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NIES Annual Report 2007

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National Institute for Environmental Studies
http://www.nies.go.jp/

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Foreword

This annual report is an official record of research activities at the National Institute for Environmental Studies (NIES) for the 2006 fiscal year (April 2006 to March 2007), which was the first year of our second five-year research plan as an independent administrative institution.

From the first to the second five-year plan, our research units were reorganized to further help resolve serious environmental problems and to strengthen our research capabilities; this was done under the mottoes of "selection and concentration" for the former and "continuity and challenge" for the latter. Four themes selected for priority programs were climate change, sustainable material cycles, environmental risk, and the Asian environment. About half of the NIES researchers have been involved in these programs, while the other half have carried out fundamental and pioneer studies in the six research divisions — Social and Environmental Systems, Environmental Chemistry, Environmental Health Sciences, Atmospheric Environment, Water and Soil Environment, and Environmental Biology — and the Laboratory of Intellectual Fundamentals for Environmental Studies.

Our administrative units were also reorganized. The Planning Division, which was newly established, has played central roles in the management and support of research activities and in the development of public and international relations, in cooperation with the General Affairs Division and all research units.

Throughout the year we have endeavored to make advances in our research, which has covered a wide range of environmental issues at the local, national, regional, and global levels; we have also collaborated with many researchers from Japan and abroad. Our research activities, as well as outreach activities such as the issue of press releases on our research findings, the dissemination of environmental information through our home page, and the holding of public symposia and open campus days, helped to give us an A grade in the External Committee's evaluation.

It is my sincere hope that the readers of this report will maintain an interest in NIES and will offer comments and suggestions on our activities; such input is invaluable to the continuous upgrading of our work.

Ryutaro Ohtsuka, D.Sc.
President,
National Institute for Environmental Studies

Contents

During the 1950s and 1960s, Japan experienced serious environmental pollution problems that accompanied rapid economic growth. In 1971, the Environment Agency was established within the Japanese government to develop measures to counteract serious environmental pollution problems such as Minamata disease, caused by poisoning from organic mercury in factory wastewater, and chronic bronchitis and asthma, caused by sulfur oxides emitted from factories in large industrial complexes. In 1974, based on the understanding that research on environmental sciences was necessary and that it had the potential to address public needs, the Environment Agency established the National Institute for Environmental Studies (NIES) in Tsukuba Science City, about 50 km north of Tokyo. NIES is now the primary national institute for comprehensive research in environmental science in Japan.

During the two decades following the establishment of NIES, rapid technological progress, structural changes in industry, and lifestyle changes created additional issues for environmental science to confront. Moreover, global environmental problems such as climate change, the depletion of the stratospheric ozone layer, acid deposition, destruction of tropical rain forests, and desertification became a more prominent concern worldwide.

NIES underwent a major reorganization in 1990 to enable it to conduct more intensive research on conservation of the natural environment and global environmental changes and their effects. The new structure included two research project divisions, six fundamental research divisions, and the Center for Global Environmental Research. In addition, the Environmental Information Center was given the task of providing access to research publications and environment-related databases.

In January 2001, the Environment Agency became the Ministry of the Environment as a part of structural changes within the Japanese government. At the same time, NIES established a Waste Management Research Division.

In April 2001, NIES became an independent administrative institution, giving it a degree of independence from the national government. The change from government institute to independent status allowed more flexibility in operations, thus enabling the institute to respond with more agility to the demands of society. At the same time, NIES prepared a five-year (2001–2005) plan that corresponded to the objectives of the Ministry of the Environment.

In 2006, NIES embarked on its second five-year (2006–2010) plan and reorganized its research system to focus its resources on four priority research areas: climate change, sustainable material cycles, environmental risk, and the Asian environment. At the same time, NIES renewed its resolve to engage in fundamental research in order to respond to emerging and potential environmental issues. In collaboration with many institutions in Japan and abroad, it continues to engage in scientific research on environmental issues.

Researchers at NIES are skilled in various fields, such as physics, chemistry, biology, health sciences, engineering, agricultural and fisheries sciences, law, and economics. Interdisciplinary studies are also carried out, particularly in the context of our priority research projects. NIES has various types of experimental facilities and remote

research stations such as the Lake Kasumigaura Water Research Laboratory, Fuji Hokuroku Flux Observation Site, and the Global Environmental Monitoring Stations in Hateruma and Cape Ochi-ishi.

As of April 1, 2007, the total number of NIES regular permanent staff was 254 (including 5 foreign researchers). There were also 584 non-permanent researchers, including 64 foreign researchers, as of March 31, 2007. The total budget for FY 2006 was 14 100 million yen.

Table 1 Number of permanent staff (as of April 1, 2007)

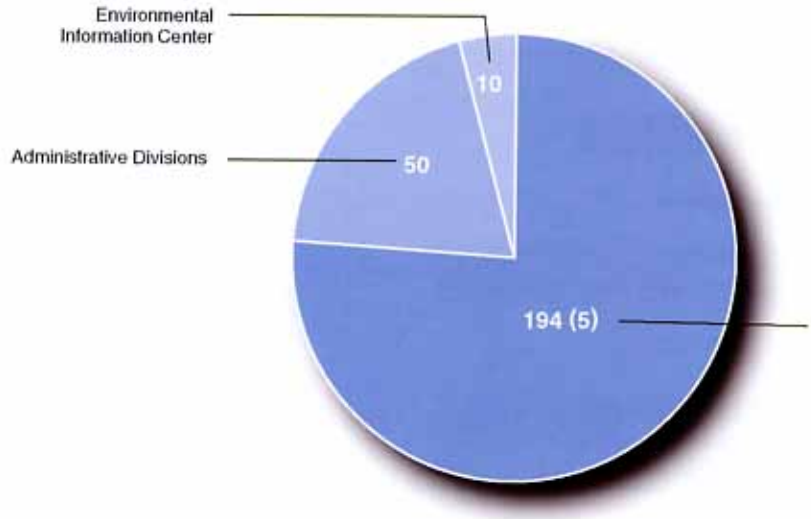
Researchers	194	76.4%
Administrative & management	50	19.7%
Environmental Information Center	10	3.9%
Total	254	100%

Table 2 Budget for the second five-year plan of NIES (in millions of yen)

	Category	2006–2010 budget (5 years)	Fiscal 2006 budget
Revenues	Grant for operating costs	48 196	9 616
	Subsidies for facilities	2 420	415
	Commissioned work	20 275	4 055
	Others	70	14
	Total	70 961	14 100
Expenditures	Project costs	30 898	6 169
	Facility improvements	2 420	415
	Expenses for commissioned work	20 275	4 055
	Personnel expenses	14 795	2 919
	General administrative expenses	2 573	542
	Total	70 961	14 100

Note: The budget for each annual work plan will be requested and decided each fiscal year, based on the second five-year plan.

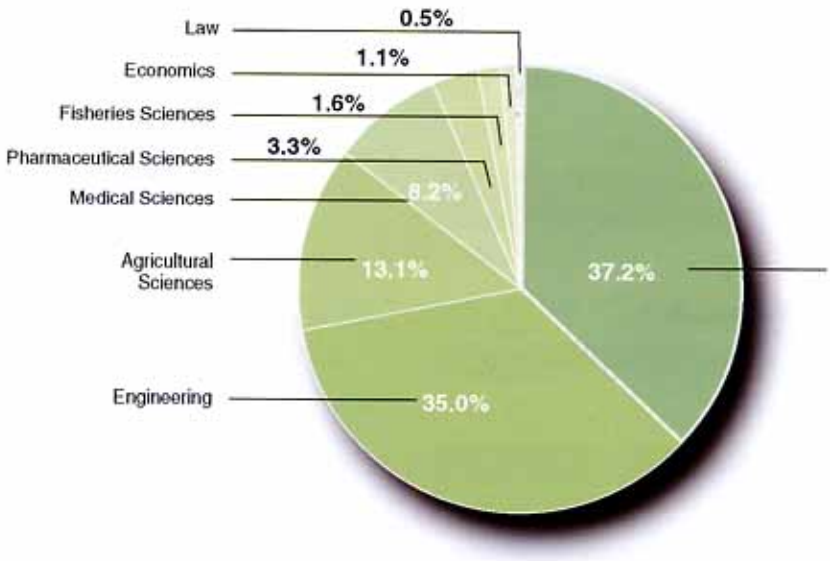
Human Resources



Number of Permanent Staff

254 (5)

Notes : 1. Data is as of April 1, 2007.
2. Figures in parentheses indicate number of foreign researchers.

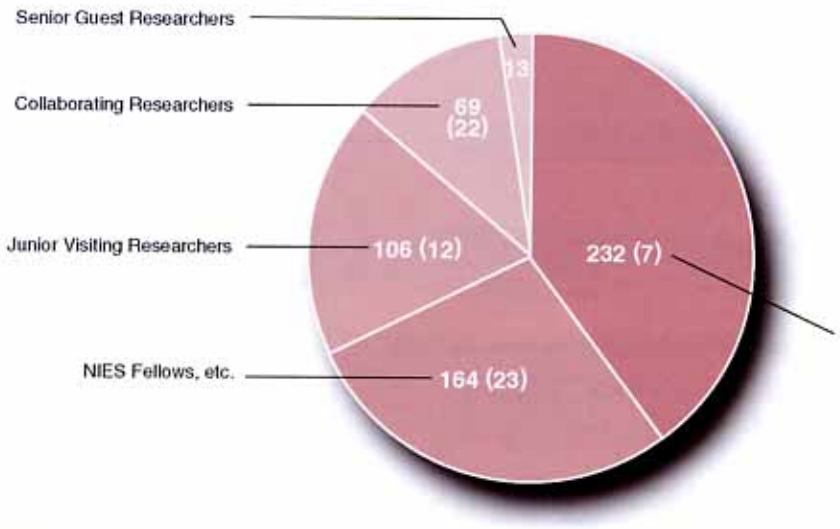


Fields of Expertise

Researchers holding doctorates

93.4%

Note : Data is as of April 1, 2007.

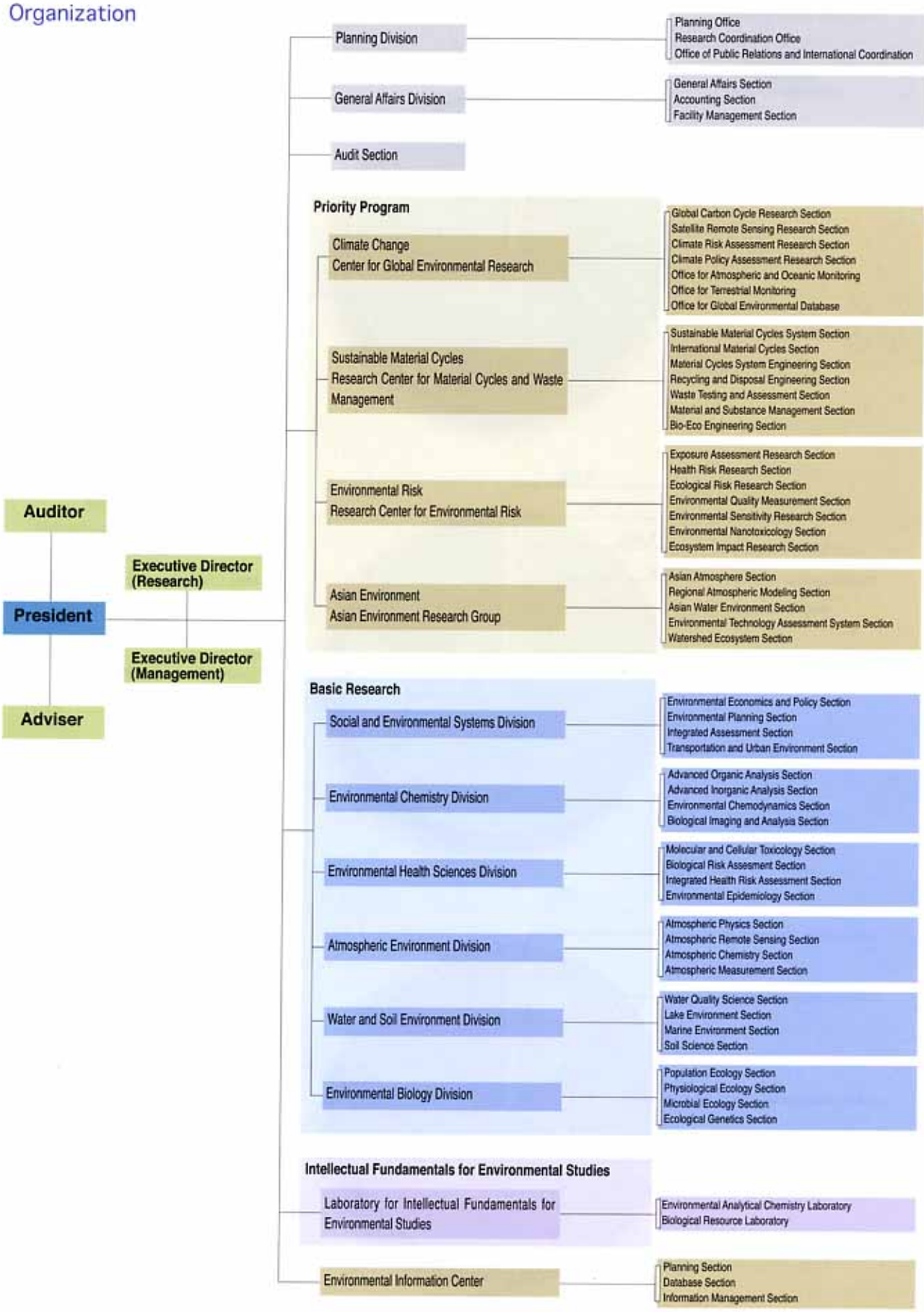


Number of Visiting Researchers

584 (64)

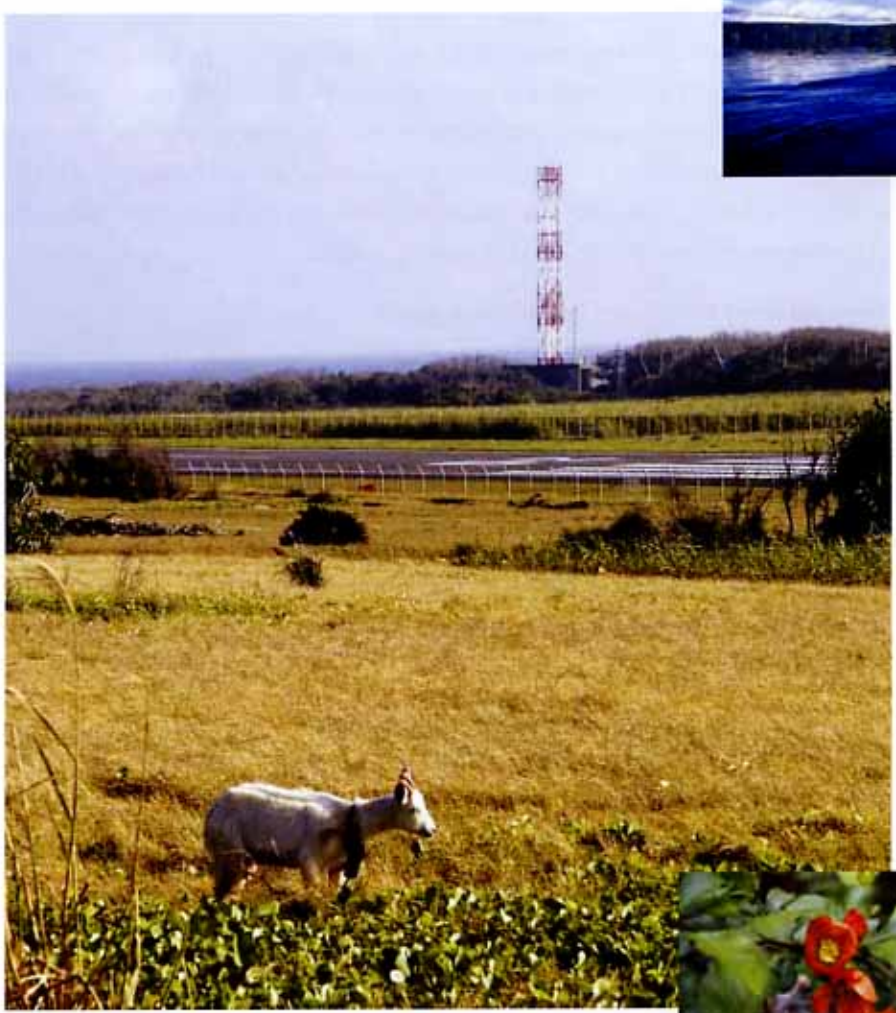
Notes : 1. Data for 'NIES fellows, etc' is as of April 1, 2007. Data for the rest are as of March 31, 2007.
2. Figures in parentheses indicate number of foreign researchers.

Organization



Center for Global Environmental Research

Above: Fieldwork at Lake Mashu.



Above: Goat grazing near Hateruma Global Environment Monitoring Station.

Below: *Chaenomeles japonica* (Japanese quince) near Fuji Hokuroku Flux Observation Site.

The Center for Global Environmental Research (CGER) was established in 1990 as a focal point for Japan's contribution to global environmental research. Since then, it has been working to clarify scientifically the effects that humanity has on the environment to create a foundation for targeted measures for environmental preservation.

As the core organization for research on climate change at NIES, CGER carries out research ranging from greenhouse gas (GHG) observations to climate change predictions, risk assessment, and future scenario studies targeting a low-carbon society. This research forms the basis of the Climate Change Research Program, which is composed of the following four research projects.

Project 1: Long-term variation mechanisms of greenhouse gas concentrations and their regional characteristics

Project 2: Greenhouse gas observations from space and use of the observations to estimate global carbon flux distribution

Project 3: Assessment of climate risk based on integrated climate, impact, and land-use models

Project 4: Developing visions of a low carbon society and integrated analysis of climate policies

In addition to climate change research, CGER contributes to the effective implementation of research at the national and international levels and the creation of a network of researchers through strategic monitoring, the creation of a global environmental database, and integration and support of global environmental research. Furthermore, the results of these activities are made available not only to other researchers and related organizations, but also to the general public.

Observational studies on greenhouse gases

Concentrations of GHGs in the atmosphere are controlled by their emission source fluxes and sinks. To clarify budgets of GHGs in the atmosphere, we measure GHG concentrations and fluxes in the Asia–Oceania region. GHGs are monitored from airplanes, cargo ships, and monitoring stations (in Hateruma and Ochi-ishi). Vertical CO_2 profile observations by commercial airplanes at various sites (Figure 1) commenced

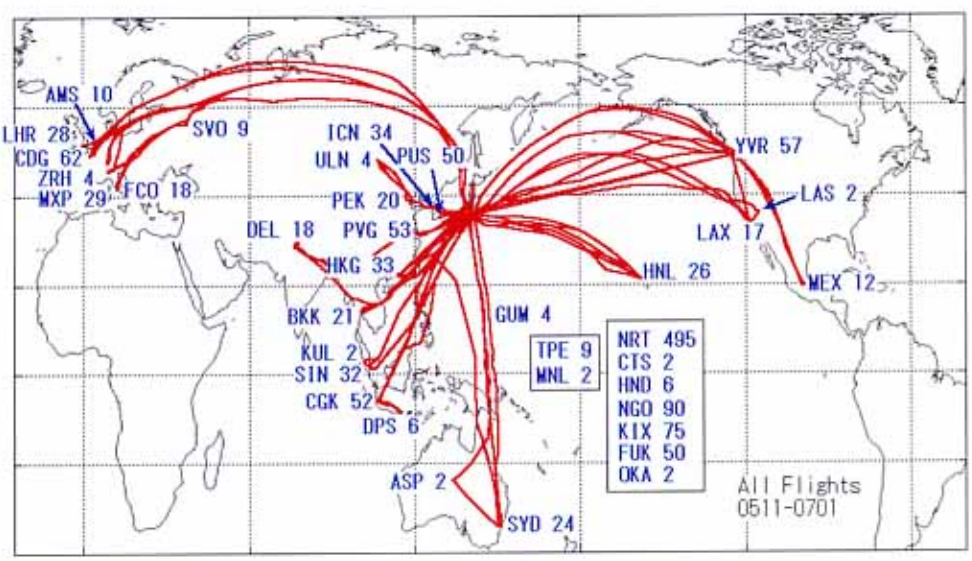


Fig. 1 Air routes and numbers of trials of vertical profile observations over various airports worldwide.

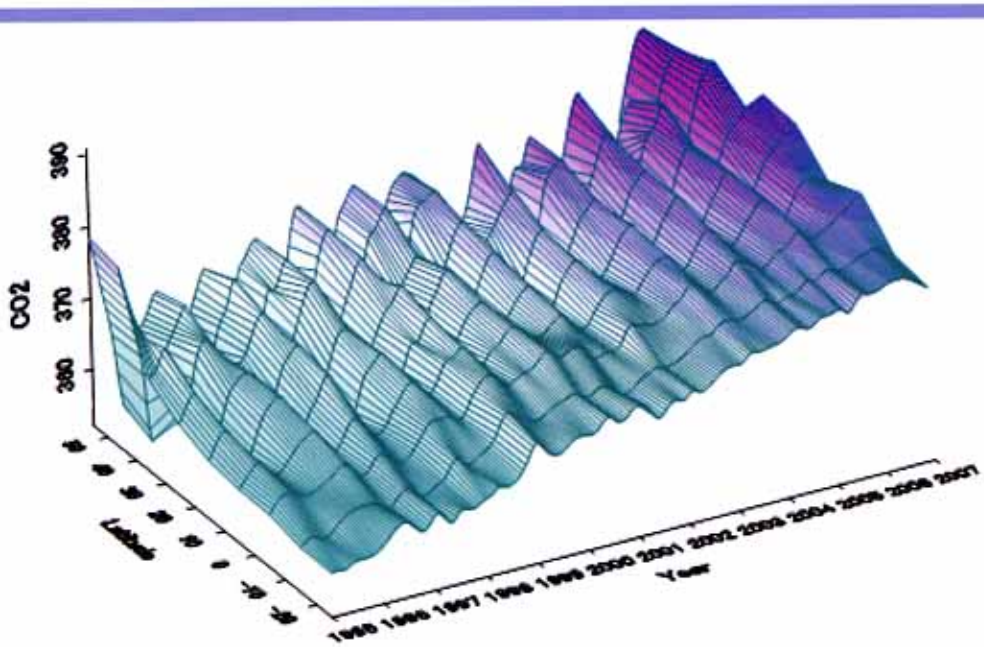


Fig. 2 Latitudinal long-term variations in CO_2, as observed from cargo ships in the Pacific.

last year with the cooperation of Japan Airlines (JAL). These profile observations are useful for investigating regional surface CO_2 flux and air-mixing mechanisms.

We have been observing CO_2, oxygen, and isotopes for several years at the monitoring stations and over the Pacific using cargo ships (owned by Toyofuji Shipping Company) that operate between Japan and Oceania, and Japan and the Americas. Such long-term observations provide a global view of GHG concentrations (Figure 2) and information on CO_2 budgets in the atmosphere. From these observations, the Pacific Ocean was estimated to be a stable sink of CO_2 at about 1.8–2.1 Pg-C/y from 1995–2005.

Regional CO_2 flux in Siberia was modeled with CO_2 data obtained from several tower observation sites in West Siberia. We found that inverse modeling using such new data sets for inland areas gave flux estimates that were consistent with outputs from biological models such as SIM-Cycle.

Greenhouse gas observation from space

Plans have been made to launch the Greenhouse Gases Observing Satellite (GOSAT) in 2008. We are currently conducting research to derive precise column concentrations of CO_2 and CH_4 from the GOSAT observations.

A field experiment in which a GOSAT bread-board model (BBM) was placed on the top of Mt. Tsukuba was conducted in December 2006 with in-situ (continuous direct air-sampling) measurements of CO_2, and the obtained spectra were analyzed. A compact in-situ CO_2 monitor was placed aboard a Cessna aircraft, and measurements were taken along the shoulder of the mountain, near the measurement ray path of the BBM. Sky-radiometers and sky-cameras were also placed at the top of the mountain and near the ground in the region of the solar reflection target to monitor temporal variations in aerosols and clouds. The column amounts of CO_2 retrieved from the BBM agreed with those from the in-situ data, within about 2%. When aerosol effects were considered in the BBM data retrieval by using data from the sky-radiometers, the difference decreased to approximately 0.2% to 0.4%. This field experiment assured us that the GOSAT data retrieval algorithm being developed works well in the field.

Climate risk assessment

This project covers climate risk assessment based on predictions of future changes in natural and social systems. One of the focal points of this research is to assess the range of uncertainty in future predictions due to the randomness of climate variability and the incompleteness of our knowledge of natural and social systems.

As a quantitative assessment of the robustness and uncertainty of climate predictions, we conducted a study to examine whether human contributions to changes in extreme temperature indices have larger amplitudes than uncertainty due to natural variability in near-future (up to 2030) climate prediction. We performed 10 runs of the initial-condition perturbed ensemble of a coupled atmosphere-ocean general circulation model under the anthropogenic greenhouse gas and aerosol emission scenario of the International Panel on Climate Change (IPCC) Special Report on Emissions Scenarios (SRES) A1B (business-as-usual). All 10 runs predicted that in the near future over most land areas there would be more frequent occurrences of warm nights and warm days, and less frequent cold nights and cold days, suggesting that human influences will have become larger than natural variability (Fig. 3 for warm nights). The fraction of areas where all runs agreed on the direction of changes over land was insensitive to ensemble size (for warm nights, 96% and 93% for 4 and 10 runs, respectively). These results suggest that policymakers should not discount the possibility of changes in temperature extremes in the near future, even if the influence of natural variability is taken into account. Uncertainties in models and emission scenarios and the potential influence of natural external forcings (changes in the solar cycle and large amounts of volcanic activity) in the near future are reserved for future work.

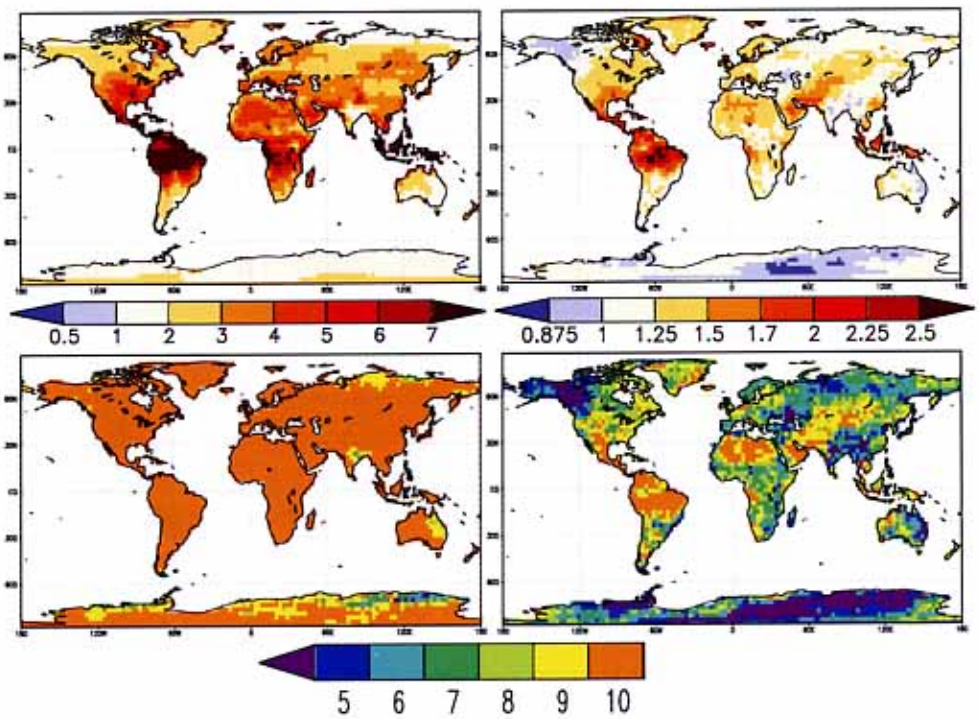


Fig. 3 Predictions of the frequency of warm nights. Warm nights are defined as days in summer (June to August for the Northern Hemisphere and December to February for the Southern Hemisphere) in which the daily minimum temperature is higher than the 95th percentile value of the summers in 1951–1970. The top panels show the 10-run means of the relative change in frequency of warm nights in 2011–2030 (left) and 1981–2000 (right) with respect to 1951–1970 (values larger than 1 denote increases). Bottom panels indicate the number of runs that predicted more frequent warm nights for 2011–2030 (left) and for 1981–2000 (right) than for 1951–1970 (10 denotes unanimity).

Climate policy assessment

We perform integrated assessments of climate change mitigation strategies by identifying strategies and envisioning scenarios for meeting medium- and long-term goals for reducing GHG emissions, analyzing international policies, and assessing the cost-effectiveness of countermeasures. By setting goals for 2050, including the required technological and social innovations (such as improvements in urban development) that need to be in place by then, we showed that it will be possible to achieve a high-quality, low-carbon society that continues to meet required service demands while still achieving a 70% reduction in CO_2 emission levels (compared with 1990 levels) in Japan.

We provide training workshops and manuals for Asian researchers to learn how to use the models developed by our research team. Our partner researchers throughout Asia use these models to analyze the effectiveness of climate change mitigation strategies in their countries. For example, we analyzed the target, proposed by the Chinese Government, of improving energy intensity (i.e. energy consumption per GDP) by 20% between 2005 and 2010. Through our research, we found that if the GDP growth rate remains high, even if highly energy efficient technologies are introduced, China will be able to achieve only a 12.3% improvement by 2010, so it will be necessary to develop new technologies or adopt new policy combinations to meet the target.

Long-term monitoring of greenhouse gases and other air pollutants

We monitor GHGs (e.g., CO_2, CH_4, and N_2O) and other chemical species (CO, NO_x, and SO_x) from several platforms. We have two remote stations: Hateruma Island, over 1000 km southwest of the Japanese mainland, and Cape Ochi-ishi, in northeastern Hokkaido. We also use airplanes that fly over Siberia and commercial ships that traverse the Pacific to measure GHGs and collect air samples.

At both monitoring stations, GHGs are continuously monitored and related species are measured with the aim of furthering our understanding of global warming and atmospheric transport processes. Most species are measured automatically, and the data are transferred to NIES at Tsukuba by dedicated network lines. Bottle samplings are also performed to measure some species, such as halocarbons, oxygen/nitrogen ratios, and isotope ratios in CO_2. Over the last 13 years, the average CO_2 concentration measured at both stations has increased from about 360 ppm to 385 ppm, with a recent growth rate of over 2 ppm/year.

Routine measurements of atmospheric GHGs and oceanic pCO_2 in the Pacific have been conducted from the Voluntary Observing Ship *M/S Fujitrans Future 5* since July 2006. The *M/S Pyxis* collects air samples and measures oceanic pCO_2 along shipping routes between Japan and the USA. For sampling at latitudes higher than 40°N, the *M/S Skaubryn* is used. Latitudinal distributions and long-term trends in GHGs are observed, together with trends in oxygen/nitrogen ratios and CO_2 isotopes. We analyzed long-term pCO_2 records and revealed the climatology of the ΔpCO_2 (the difference in pCO_2 of the ocean and atmosphere) distribution over 12 years (1995–2006) in the North Pacific. The increase rate of the North Pacific Ocean pCO_2 was nearly the same as that of the atmosphere from 1995 to 2006.

Carbon dioxide flux monitoring in terrestrial ecosystems

We monitor carbon exchange between the atmosphere and the terrestrial ecosystem at two remote stations in larch forests. To gain a better understanding of the mechanisms behind CO_2 balance, we are carrying out integrated observations using not only basic micrometeorological methods, but also a physioecological approach.

In 2006, we established the Fuji Hokuroku Flux Observation Site in the foothills of Mt. Fuji to elaborate on the results of measurements of carbon balance. At the new site, we are able to perform integrated research involving measurement methods that draw upon expertise from several disciplines. For example, by using airborne laser altimetry and digitizing the results, we have succeeded in developing a methodology for estimating the history of larch forest growth, including the distribution and transition in height of trees over the past four decades.

At the Teshio Carbon Cycle and Larch Growth (CC-LaG) Experimental Site (Fig. 4), which was established in 2001 in a catchment in Hokkaido, we are focusing on the transition of carbon flow during the arboreal growing period. After the felling of a natural forest, we planted larch saplings in 2003 and are now using standard forestry practices to manage them. Before the felling, the gross primary production (GPP) was nearly balanced with the total ecosystem respiration (Re) in the forest, and the net ecosystem exchange of CO_2 (NEE) was small. The clear-felling of trees further decreased the sequestration capacity of this ecosystem. Sasa bamboo, which is the main vegetation of the forest floor, has a large biomass, and the NEE was negative in the daytime during its full growing period. However, because of the large respiration rate of the sasa bamboo at night, the mean NEE remained positive (because of carbon release) even after the clear-felling of the surrounding forest. After strip-cutting the sasa bamboos and planting larch saplings in autumn 2003, CO_2 emissions from the forest gradually decreased with the increase in larch growth.

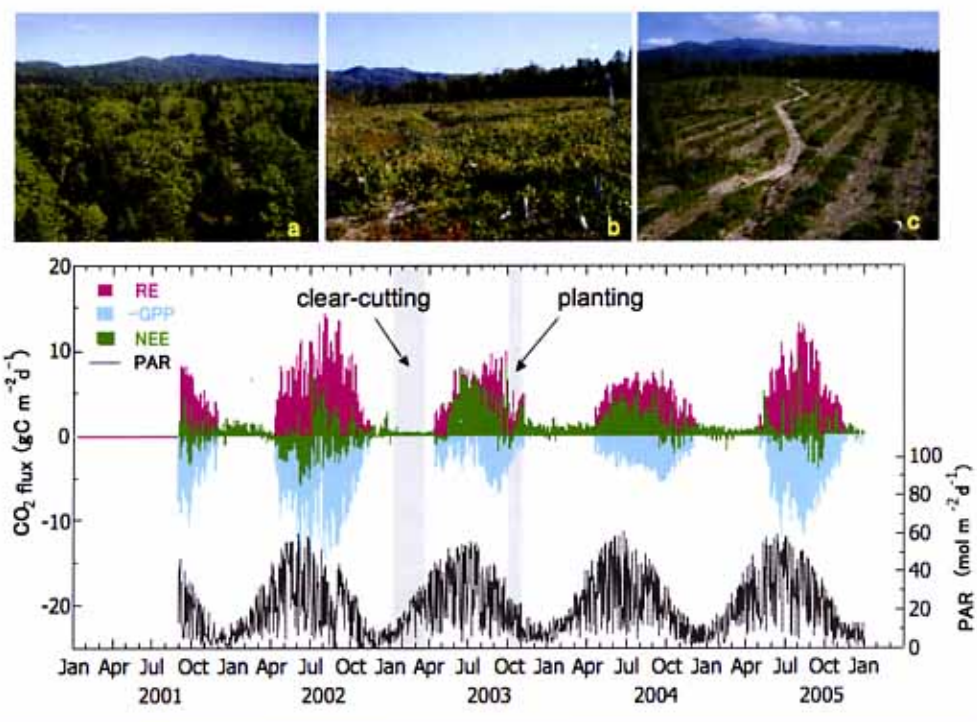
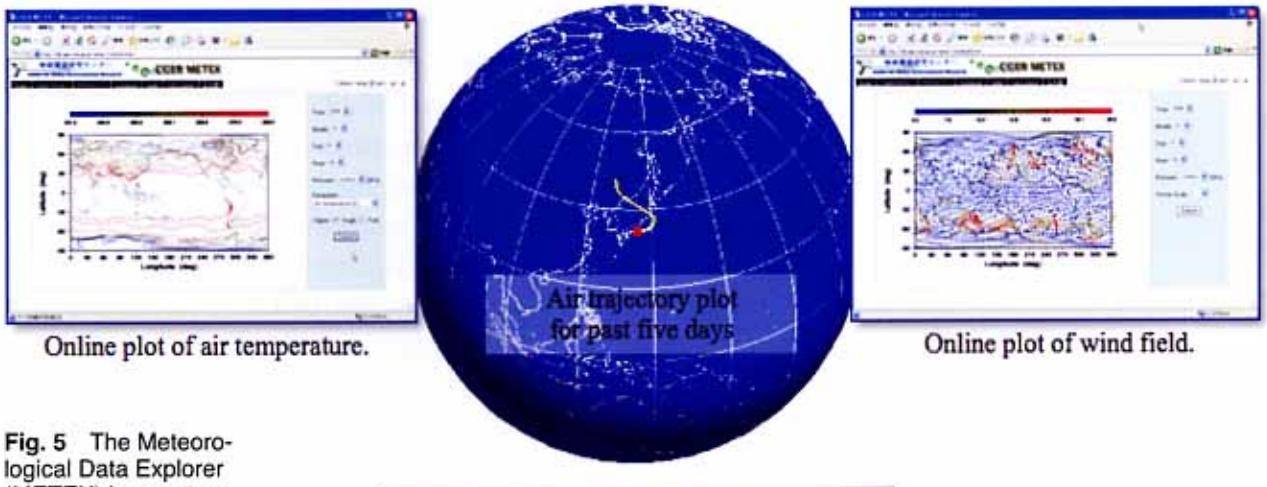
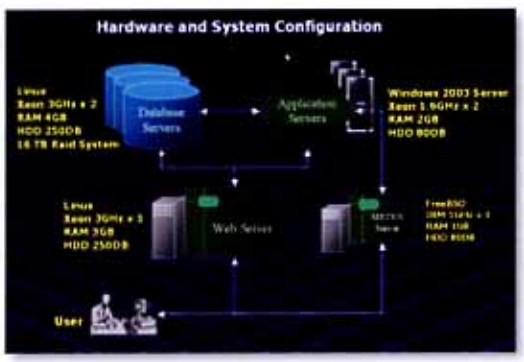


Fig. 4 Effect of clear-cutting and planting on carbon balance in forest ecosystem at Teshio Carbon Cycle and Larch Growth Experiment Site. Photos show forest before and after clear-cutting and planting: a, before clear-cutting, August 2001; b, after clear-cutting, September 2003; c, after planting, June 2004.





New server system in FY2006

Fig. 5 The Meteorological Data Explorer (METEX) is a system developed to use meteorological data for assisting in the analysis of GHG monitoring results. The new server system provides powerful services for online air trajectory calculation and visualization of various meteorological data. It also provides data to users around the world for use in offline trajectory calculations.

Global Environmental Database

CGER develops and manages various databases, websites, and data analysis tools for global environmental research and makes them available to the public. The following five databases and related tools were developed or updated at CGER: Global Environmental Monitoring, Terrestrial Carbon Sink Modeling, Greenhouse Gas Emission Scenarios, Greenhouse Gas Emissions, and Carbon Flows.

The Meteorological Data Explorer (METEX) is an application suite for analysis and visualization of the dynamics and material transport of the atmosphere using wind vectors and other data calculated by numerical meteorological models (Fig. 5). A new version of METEX that works on our new server system was developed in 2006 and publicly released in April 2007 (see http://db.cger.nies.go.jp/metex/). This version has enhanced the online capability of METEX, and most of the functions of the previous version of METEX have been replaced with new web applications.

The Greenhouse Gas Emission Scenario Database contains emission scenarios developed by various countries and organizations. In 2006, the structure of the database was reorganized, and we improved the database's ability to compare and analyze scenarios from many perspectives. The results of the scenario analyses using this new capability were reflected in the newly released *Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (IPCC AR4).

Office for Coordination of Climate Change Observation

The "Earth Observation Promotion Strategy" of the Council for Science and Technology Policy proposed the establishment of a national Earth observation alliance to enhance cooperation among organizations and ministries. As climate change is one of the most important issues facing the global environment, the Japanese Alliance for Climate Change Observation (JACCO) was launched by the Ministry of the Environment (MOE) and the Japan Meteorological Agency (JMA) in April 2006. The Office for Coordination of Climate Change Observation (OCCCO), located in CGER at NIES, supports the activities of JACCO. The goal of JACCO is to develop a comprehensive and integrated climate change observation system that takes user needs into consideration. OCCCO held a kick-off ceremony and seminar on September 19, 2006 in Tsukuba, Japan.

Global Carbon Project (GCP) Tsukuba International Office

The Global Carbon Project (GCP) Tsukuba International Office (Japan) contributes to the integration of the human dimension into the earth system science of the global carbon cycle by advancing research and scientific networking on carbon management. A high priority for the Japan office is to develop and coordinate its new flagship program entitled "Urban and Regional Carbon Management" (URCM), which focuses on a comparative and historical approach to urban and regional carbon footprints, as well as their determinants and trajectories, future scenarios, and opportunities for management. In 2006, the GCP Tsukuba office organized a major international conference in Mexico, a side event at the United Nations Framework Convention on Climate Change (UNFCCC) Conference of the Parties (COP-12) in Nairobi, and two workshops (in Indonesia and Japan), in partnership with a number of international scientific networks and institutions.

Research Center for Material Cycles and Waste Management

Core research project: Design and evaluate material cycle systems, policy, and management techniques for the near future

Since its foundation in 2001, the Research Center for Material Cycles and Waste Management has aimed to foster a society with desirable material cycles and reduced utilization of natural resources, reduced generation of waste, increased recycling of materials, and appropriate waste management. In the second five-year plan at NIES (covering 2006–2010), the center is playing a main role in promoting a research program named "Sustainable Material Cycles", which is one of four priority programs at NIES. The program comprises four core research projects and other research activities aimed at ensuring appropriate waste management.

1. Designing and evaluating material cycle systems and policy/management techniques for the near future (Core research project 1)

A future vision for achieving an effective material-cycling society is needed at various government levels as well as at the levels of the public, administrative authorities, and industry. This research project envisages technology and socioeconomic systems in a society thus equipped 10 to 20 years in the future and will develop transition scenarios and specific plans to reach strategic targets set based on forecasting and backcasting approaches. The following results were obtained in the first year of the project.

"Eco-velocity" (Fig. 1) was proposed as a simple indicator, associated with a concept of sustainable consumption, representing the balance between the rate of growth in product consumption and the rate of progress in the environmental efficiency of technologies related to the lifecycle of the product. It can be estimated with an economic input–output model that integrates material flows and environmental loads such as GHG emissions.

We selected recyclable mineral resources (construction materials, metals, etc.) and biomass resources (food wastes, sewage sludge, etc.) as research targets, and designed preliminary resource circulation systems applicable to the near future. We designed not

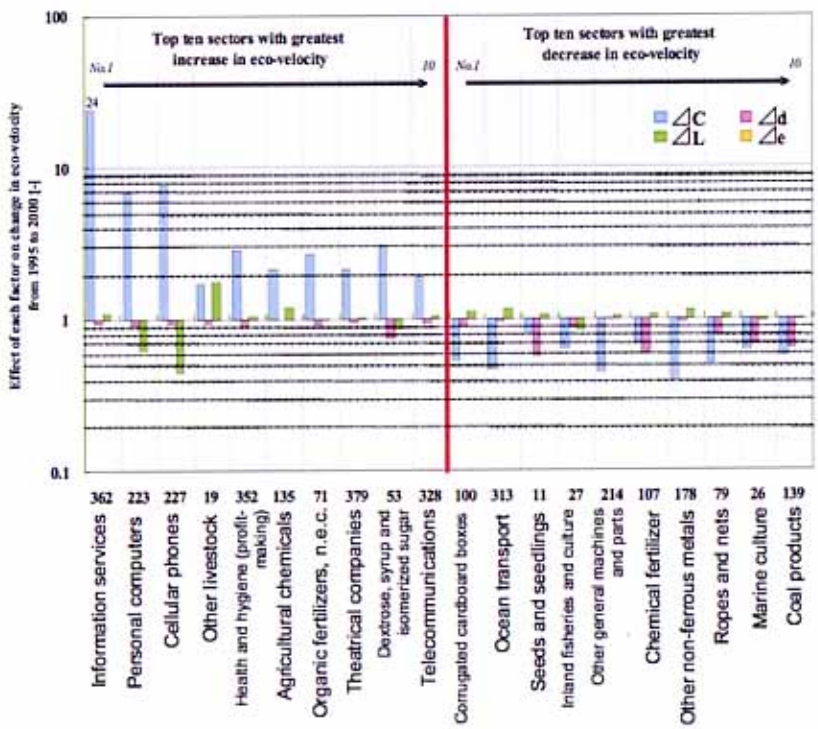


Fig. 1 Changes in eco-velocity from 1995 to 2000 by sector. Listed are the top 10 sectors for which the eco-velocities increased or decreased the most in terms of the following four factors: C (consumption volume), L (product supply chain), d (unit CO_2 emission in production phase), and e (unit CO_2 emission in use phase).

only an integrated system comprising material production and waste processing for mineral resources, but also a system that combines an existing MSW (municipal solid waste) incineration facility with a biogas production facility for biomass resources.

A benchmarking approach was proposed as a technique for improving the MSW management system of each local government and comparing the MSW management performances of different governments. We proposed "Waste-Environmental Accounting" as a way of clarifying both the effects of various environmental management activities and their necessary costs. We applied this approach to management activities under the Container and Packaging Recycling Law and to MSW management.

2. Management of hazardous and valuable substances in the life cycles of materials and products (Core research project 2)

Behavior and control of brominated flame-retardants and related chemicals at an electronics recycling plant

Air monitoring for brominated flame retardants (BFRs) and polybrominated dibenzo-*p*-dioxins/dibenzofurans (PBDD/DFs) was conducted at a TV-set dismantling plant in Japan. During the investigation, technical countermeasures to reduce the amount of particle dust were introduced into the process, and the concentrations and patterns of BFRs and PBDD/DFs in air samples before and after the measures had been taken were compared. After the technical improvements had been made, the total amounts of both polybromodiphenyl ethers (PBDEs) and PBDD/DFs in the air were reduced by one order of magnitude. The patterns and concentrations of PBDEs in the airborne dust were similar to those of the dust inside the TVs, suggesting that the airborne dust was derived from the dust inside the TVs. This finding suggests the importance of removing the dust from inside TVs before separating out the various components, in order to decrease the exposure of workers at the plant.

Measures for managing recycling and disposal of valuable and hazardous metals

Emissions of the hazardous metal mercury to the air in Japan were estimated. Annual release was estimated as 24 to 35 t/year (see Fig. 2, which depicts the main sources and amounts). The amount of mercury recycled (approximately 80 t/year) exceeded domestic demand (10–20 t/year).

We proposed a method for the analysis of hazardous and valuable metals in products such as e-wastes. This method includes precise disassembly, determination of the metal contents of sorted items and materials, a leaching test, and a combustion test for residual mixtures. As a case study of e-wastes, the total contents of metals in one waste personal computer were determined, as were the potential of recyclable metals and the environmental impact of inappropriate disposal of the residues from metals recycling.

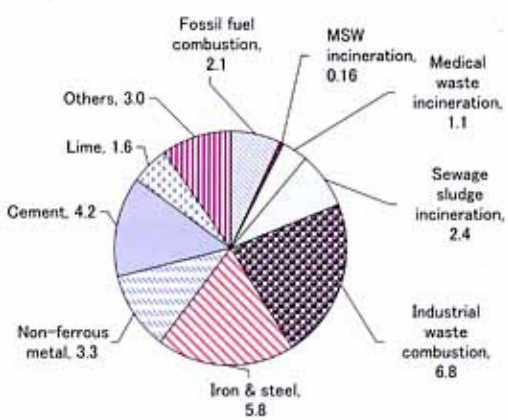


Fig. 2 Mercury emission inventory for Japan, 2003 (units: t/year).

Methodology for environmental safety quality control of recycled products

The prototype of a hierarchical framework for evaluation of recycled products used at construction sites was proposed, focusing on risks of soil and groundwater pollution. A broad range of shapes and reuse environments of recycled products was evaluated by using combinations of different test methods consisting of exposure tests and leaching tests. Inter-laboratory validation of the environmental availability test, which is one of the leaching tests developed in this study, was carried out in cooperation with 19 laboratories. A model which depicts contaminant-transfer from the recycled products to soil and groundwater was developed to estimate impacts on the environment.

3. Developing a win-win resource-recycling technology for waste biomass (Core research project 3)

Project 3 aims to recover energy and materials from biomass and develop organized applications for them. In the process tested, waste woody biomass was gasified and reformed at around 1123 K without the use of a reforming catalyst. Efficient production of biofuel gas with more than 4200 kJ was accomplished (Figs. 3 and 4).

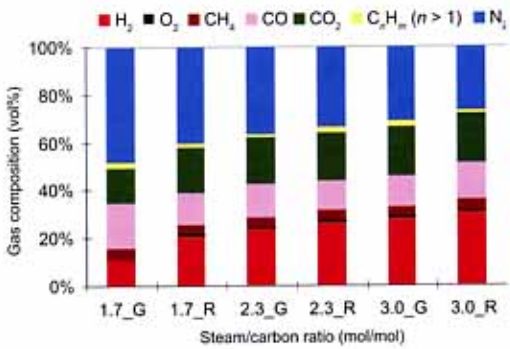


Fig. 3 (L) Composition of gas obtained from gasification–reforming of waste woody biomass (G: gasified gas, R: reformed gas).

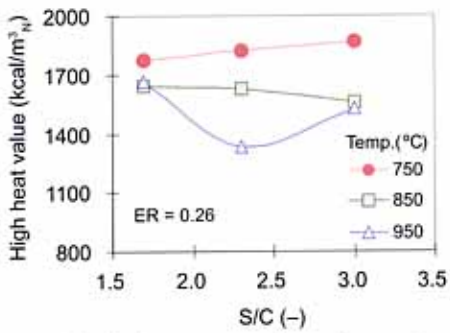


Fig. 4 (R) Gas heat values under different temperature conditions, shown for three steam-to-carbon (S/C) ratios.

We also evaluated the potential to produce biogases by hydrogen–methane fermentation of wet waste such as kitchen garbage. Effective biogas production from bench-scale fermentation systems could be achieved. Furthermore, we investigated the use of a magnesium ammonium phosphate (MAP) – anaerobic ammonium oxidation (ANAMMOX) denitrification system to remove the ammonium that disturbs practical biological methanation.

As the first step toward optimizing the conventional biodiesel fuel (BDF) production process, the phase equilibria required for the design of BDF separation and purification processes were measured, and the model most useful for the process design was determined from various kinds of Universal Quasi-Chemical Functional-group Activity Coefficients (UNIFAC) models.

A series of batch lactate fermentations of food wastes were carried out. We developed a zero-emission–type fermentation system that simultaneously produces lactate and animal feed. The system discharges no wastewater or solid residue.

We also constructed a pilot-scale phosphorus adsorption/desorption processes for centralized wastewater treatment. We also developed a system of phosphorus removal by the use of iron electrolysis and investigated suitable operational conditions. These processes were combined with a sludge-reduction system, and basic parameters for optimum operation were preliminarily established.

Finally, to develop and evaluate material cycle systems that integrate raw materials and waste processing, a cement-production process was designed and evaluated. The system combines a pre-treatment process to change sewage sludge into solid fuel and a cement-production process. Comparison of the new system and conventional ones (such as incineration) and technical findings revealed that the system reduced CO_2 production because of the replacement of charcoal by the biomass fuel.

4. Establishing appropriate management networks and technology systems to support sound international material cycles (core research project 4)

To help promote appropriate material cycles in Asia, we examined current methods of recycling and waste management in each country. In addition, for developing countries we designed, applied, and evaluated waste-management technologies and systems that achieve both appropriate disposal and global warming mitigation.

We analyzed material flows of internationally traded recyclable resources such as e-wastes and plastics (Fig. 5). Domestic e-waste generation in Asia and the volume of second-hand electronic equipment exported from Japan are increasing. The costs of schemes for the recycling of waste home appliances were compared. To properly recognize both the resource and hazardous potentials of recyclable resources, we listed and organized the factors which affect both potentials. The case study of personal computers revealed the importance of the efficient recovery of minor elements.

The occurrence of persistent organic pollutants (POPs) and heavy metals was reviewed in relation to material recycling and waste disposal in Asia. A lab experiment and field survey were started to obtain the emission factors for the emission of these compounds from specific processes such as thermal treatment and dumping disposal.

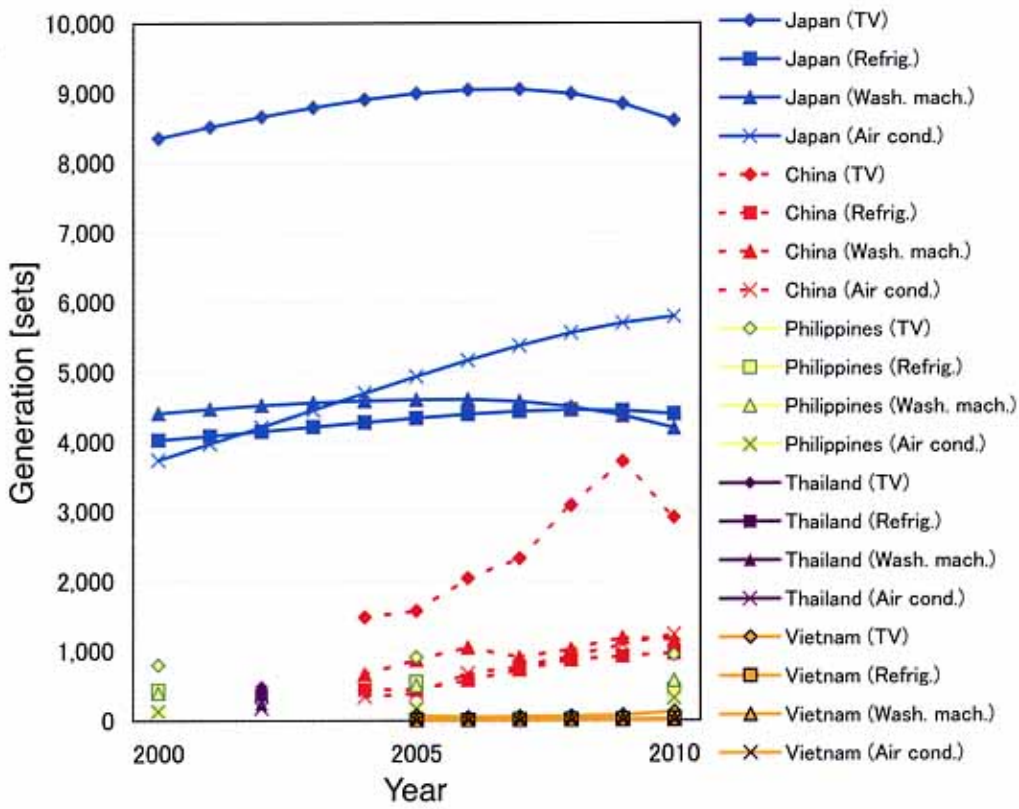


Fig. 5 Estimated e-waste generation in selected Asian countries.

To design a waste-management technology and system for developing countries, factors affecting the adoption of existing technologies were extracted from Asian waste-management systems through a comparative study. A laser methane detector – static chamber method was developed for measuring whole-surface GHG flux from solid waste disposal sites.

The regional characteristics of liquid wastes were investigated with the aim of introducing effective bio-eco–engineering systems into developing countries. Some affordable technologies for liquid waste treatments were investigated, and basic parameters for optimum operational conditions were preliminarily established.

5. Research to ensure appropriate waste-management practices

To support the formation of a sound material-cycling society it is indispensable to establish safe and reassuring technologies for appropriate waste treatment and disposal, as well as testing, assessment, and monitoring procedures to confirm the security of the facilities. This fiscal year we dealt with the following problems.

We devised intermediate treatment scenarios: maintaining the status quo and converting to incineration or separation to recover resources and thus control the quality of wastes going to landfill. The latter scenario was based on an assessment of the separation performance of existing intermediate process technologies through the evaluation of amounts going to landfill and the organic and heavy metal content.

Underdrainage or horizontal plate-layer drainage were proposed and analyzed as measures to counteract delays in the stabilization of offshore landfill sites. We expect that the results of the analysis will form a useful scientific base for the closure and aftercare maintenance of landfill sites in Japan.

Continuous monitoring data on organic halogenated compounds in flue gases were collected at an incineration plant, and useful relationships between the monitoring data and dioxin concentrations and operational parameters of the plant were obtained.

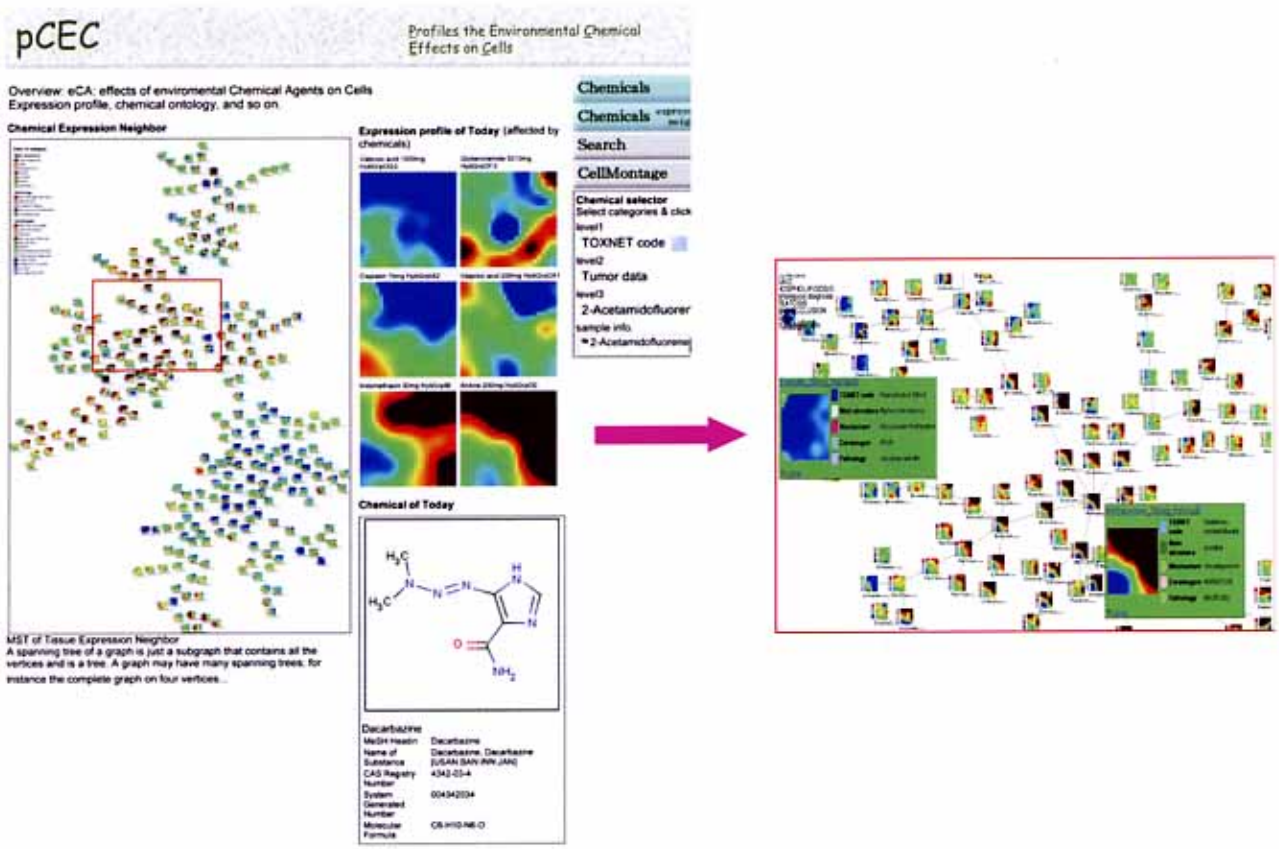
Evaluation of maintaining an advanced on-site household domestic wastewater treatment process with iron electrolysis on the removal of organic compounds, nitrogen, and phosphorus suggested that high treatment capacity could be obtained by appropriate maintenance and that the target effluent water quality could be achieved.

6. Promotion of fundamental research

We estimated the amounts of generation and landfilling of waste asbestos from the past to the present and examined how to find or discriminate waste asbestos at landfill sites. For treated (vitrified) waste asbestos, we developed a new testing method that uses transmission electron microscopy (TEM) and satisfies three requirements: observation of small and thin fibers, crystallographic identification of minerals, and determination of chemical composition. By applying the TEM method we observed thermally treated crysotile and crocidolite fibers, counted their numbers, and confirmed their transformation into other crystalline structures.

In addition, we have been developing databases that interrelate material cycling and waste disposal processes, the conversion of material flows that include recycling and disposal, and the chemical composition of organic materials.

Research Center for Environmental Risk



By using genomics and toxicity data to predict potential toxicity, our pCEC (profiles of Chemical Effects on Cells) system displays classifications of chemical effects on rodents and on human health.

In accordance with the second five-year Plan (2006–2010) of the National Institute for Environmental Studies (NIES), the Research Center for Environmental Risk (RCER) is conducting an Environmental Risk Priority Program. In this program, we perform comprehensive research on how to assess environmental risks, such as the effects of chemical substances, invasive species, and nanoparticles, on human health and the ecosystem.

The Environmental Risk Priority Program includes the following four Core Research Projects:

1. Integrated exposure assessment analysis of the complex factors involved in chemical exposure.

2. Development of methods for the health risk assessment of environmental chemicals that induce sensitivity reactions.

3. Assessment of the health risks associated with the disposition of environmental nanoparticles.

4. Development of environmental risk assessment methods that take into account biodiversity and ecosystem functioning.

We are also conducting the following research activities with a view to their future application to environmental decision-making:

- Fundamental research to improve environmental risk assessment methodologies.
- Collection and dissemination of information on environmental risks.
- Development of environmental risk assessment practices for regulatory objectives.

1. Integrated exposure assessment analysis of the complex factors involved in chemical exposure

We aim to establish an exposure assessment process that effectively and comprehensively considers the complex nature of exposure to chemicals. The project will integrate a number of exposure variables, including chemical composition and spatial and temporal scales, to provide a more comprehensive view of exposure status for future integrated exposure assessment. The project consists of three main topics: (1) development of methods of hierarchical exposure analysis based on GIS from the regional to the global scale (Fig. 1); (2) exposure measurement based on *in vitro* and

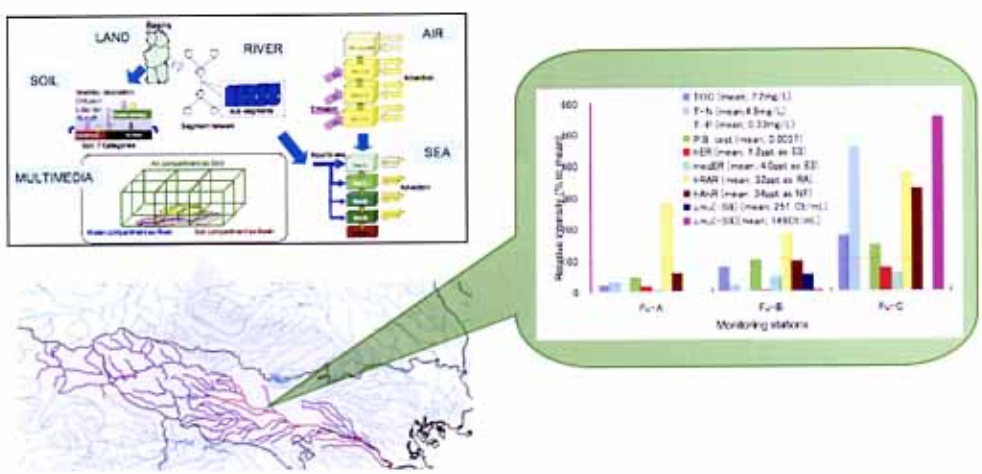


Fig. 1 General concept of the integration of hierarchical modeling outputs and exposure monitoring by bioassays and exhaustive monitoring

in vivo bioassays; and (3) exhaustive development of integrated exposure analysis, as described below.

Development of hierarchical exposure analyses as part of topic 1) will help us to understand the multiple factors involved in the interaction between natural environmental dynamics and chemical exposure. This year, we validated a regional-scale GIS fate model, expanded it to a global fate model, and performed a case study of the global fate of PCBs. We also studied the sediment–water dynamics of selected hydrophobic chemicals on the basis of field surveys and laboratory experiments, and we used monitoring data to study statistical methods of exposure analysis.

To analyze the complex causes of exposure we are applying bioassays and exhaustive chemical analyses to environmental samples. We have used various bioassays and analyses to perform a preliminary field survey of selected river waters; developed both new analytical and test methods for airborne mutagenic compounds and *in vivo* test methodologies for aquatic organisms; and performed related basic studies on both *in vitro* and *in vivo* bioassays.

We aim to present the methods and results of our integration of the complex components of exposure and to be able to analyze various types of data (e.g. socioeconomic) in order to develop effective measures for exposure reduction and control. We are developing new methods of risk assessment that involve both the integrated analysis of sociological data and the use of conventional assessment methods. This year, we have begun the collection, compilation, and conversion of socioeconomic and other data for their incorporation into the GIS database system.

2. Development of methods for the health risk assessment of environmental chemicals that cause sensitivity

To understand the triggering of chemical sensitivity reactions in individuals, we analyzed the effects of environmental chemicals on higher biological functions such as genetics, development, reproduction, immunity, and neurobehavior systems. Our aim is to establish experimental models that can be used to assess the health risks posed by low-dose environmental chemicals in susceptible individuals.

Establishing a new experimental model to identify and assess harmful effects on nervous and immune system functions following exposure to low-dose environmental chemicals

We have developed a system for evaluating the olfactory detection threshold of volatile organic compounds (VOC) gases in mice. In this ongoing study, we have found that the detection threshold of toluene gas in mice is under 5 ppb—at least 99% lower than that reported previously in humans.

During 6 weeks of low-level exposure of BALB/c mice to toluene, body weight decreased dose-dependently with or without ovalbumin (OVA) immunization. In contrast, after OVA immunization of C3H mice, the increase of body weight was observed until 50 ppm toluene exposure but not in 500 ppm. The tendency of shift to Th2 type appeared in unimmunized C3H mice.

Low-level exposure of C3H mice to toluene increased the expression of genes encoding

dopamine receptors, transcriptional factor, and tumor necrosis factor (TNF)-α in the hippocampus. However, in BALB/c mice, decreased expression of the gene encoding transcriptional factor,and increased expression of the gene encoding capsaicin receptor occurred in the hippocampus.

Selecting reliable and feasible methods of investigating the effects of environmental chemicals on experimental animals in various developmental stages (fetal, newborn, adult)

In the absence of toluene exposure, male fetuses had higher levels of testosterone and estradiol than female fetuses. However, toluene exposure significantly decreased testosterone and estradiol levels in male fetuses but not in female fetuses, thus reducing the sex differences in these steroid levels. These results suggest that toluene exposure during development affects brain sexual differentiation, targeting male offspring.

The respiratory stimulant peptidoglycan (PGN) elevated the expression levels of the gene encoding toll-like receptor (TLR) 2 in the lungs of weanling mice. However, it did not lead to Th1 type functional development or allergic suppression in an allergic mouse model.

Administration of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) to mice on postnatal day (PND) 7 downregulated the mRNA expression of both calbindin D and the Na^+/Ca^{2+} exchanger NCX-1, which are involved in transcellular Ca^{2+} transport in the early stages of renal development. Furthermore, exposure to TCDD on PNDs 14 and 21 induced high-level expression of the mRNA of 25-hydroxyvitamin D_3 1α-hydroxylase (CYP27B1). These findings indicated that TCDD disrupts vitamin D metabolism and Ca^{2+} transport in the developing mouse kidney.

The vulnerability of the developing brain is considered to depend particularly on the period of exposure to environmental chemicals. Exposure of 5-day-old rats to bisphenol A caused hyperactivity in the rats as juveniles (age 4 weeks) but not as young adults (age 8 weeks) (Fig. 2). However, denervation of dopaminergic neurons by bisphenol A was still observed in adult rats pathologically. We therefore need to assess the potential risks of such chemicals throughout life.

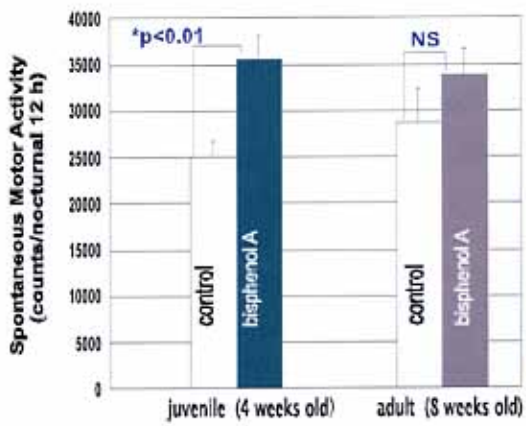


Fig. 2 Exposure of 5-day-old rats to bisphenol A caused hyperactivity in juveniles, but not in adults, although the pathological features of neurodegeneration were still observable in the adults.

Microinjection of bisphenol A into the substantia nigra of adult rats impaired immunoreactivity to tyrosine hydroxylase in the ipsilateral striatum (*arrow*).

Screening system to assess complex sensitivity factors revealed when exposure to environmental chemicals aggravates health disorders (e.g. allergic diseases)

We investigated the effects of environmental chemicals, including mono-ethylhexyl phthalate, diisononyl phthalate, diisononyl adipate, tris(2-ethylhexyl)trimellitate, and bisphenol A, on atopic-dermatitis–like skin lesions induced in NC/Nga mice by house dust mite allergen. Exposure to diisononyl phthalate and bisphenol A at some doses exacerbated atopic dermatitis in mice.

3. Assessment of the health risks associated with the disposition of environmental nanoparticles

We have been investigating the biological impacts of ultrafine particulate matter and environmental nanoparticles and determining how these materials behave in the body. Our final goal is to establish health risk assessment methods that are geared to these kinds of particles rather than to regular chemicals (Fig. 3).

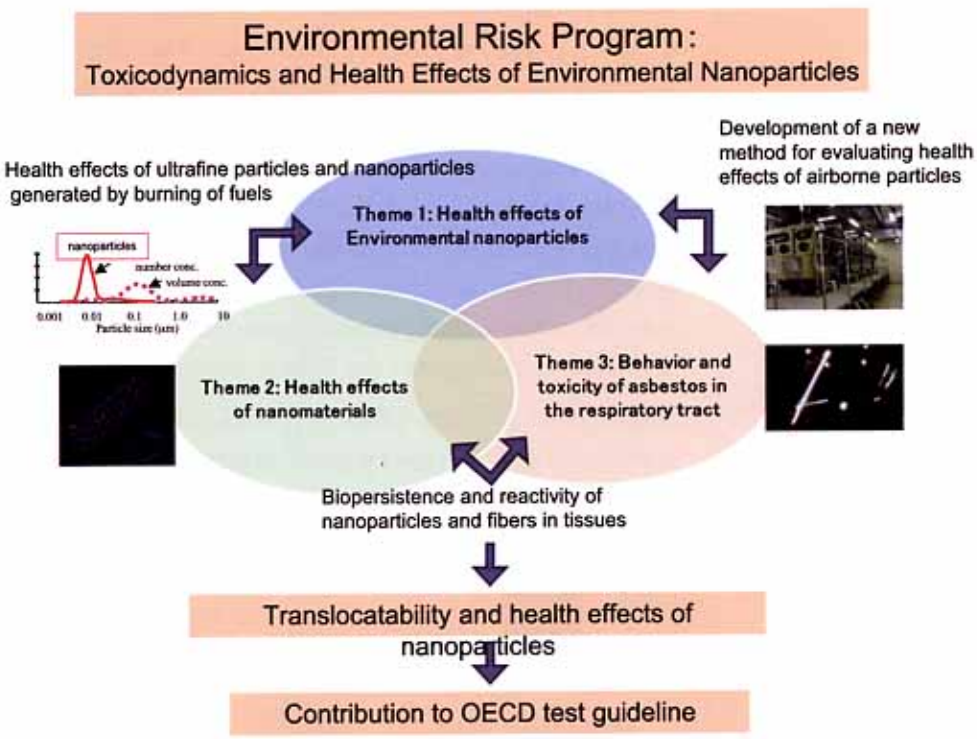


Fig. 3 Environmental risk program: toxicodynamics and the health effects of environmental nanoparticles

Nanoparticle-enriched diesel exhaust was generated from a diesel engine. Chemical analyses indicated that 55% of nanoparticles generated originated from unburned diesel fuel and consisted of organic carbon. We have been exposing rats and mice to nanoparticle-enriched diesel exhaust in four inhalation chambers (control, low, medium, and high [ca. 100 $\mu g/m^3$] nanoparticle concentrations). Exposure increased the mRNA levels of the genes encoding heme oxygenase-1 and other antioxidant enzymes, exacerbated bacterial-toxin–induced lung inflammation, and had adverse effects on the cardiovascular system. We have also studied the cellular uptake of nanosize gold and fluorescent polystyrene particles. We found that the cells used MARCO (macrophage receptor with collagenous structure) to recognize and phagocytose the nanoparticles. Also, after intratracheal injection of nano gold particles into mice, we found particles of 20 nm diameter on the endothelial surface by electron microscopy.

We investigated the interaction of multi-walled carbon nanotubes (MWCNTs) with macrophages and found that dispersed MWCNTs were highly reactive with the plasma membrane. Electron microscopic analyses indicated that the plasma membrane was injured directly by MWCNTs.

The toxicity of heat-treated chrysotile and crocidolite asbestos was determined by using macrophages and lung epithelial and mesothelial cells. The cytotoxicity of the asbestos samples appeared to change with the surface activity of the asbestos.

4. Development of environmental risk assessment methods that take into account biodiversity and ecosystem functioning

Bottom-trawl surveys were performed seasonally to collect fishes, molluscs, crustaceans, and echinoderms at 20 sampling stations in Tokyo Bay. The samples were used to analyze spatiotemporal changes in abundance, biomass, and species composition. Samples of surface and bottom seawater and of bottom sediments were collected to measure temperature, dissolved oxygen concentration, salinity, nutrients, chlorophyll-*a*, heavy metals, and organic chemicals. The relationships between environmental parameters and biological responses at the population and community levels are to be evaluated. This will include evaluations of inter-species relations (e.g. by the food web) in demersal/benthic communities and the involvement of commercial fishing pressure on population decline. Detailed field studies were also conducted to elucidate the life-history traits of marbled flounder, dragonet, and mantis shrimp and the possible impacts of environmental stressors such as hypoxia and harmful chemical substances. Preliminary results showed that hypoxia might have restricted the spatial distributions of dragonet and mantis shrimp in Tokyo Bay (Fig. 4).

Macrophytes and dragonflies were studied in relation to environmental variables and spatial scales in 55 irrigation ponds in Hyogo Prefecture, western Japan. By combining

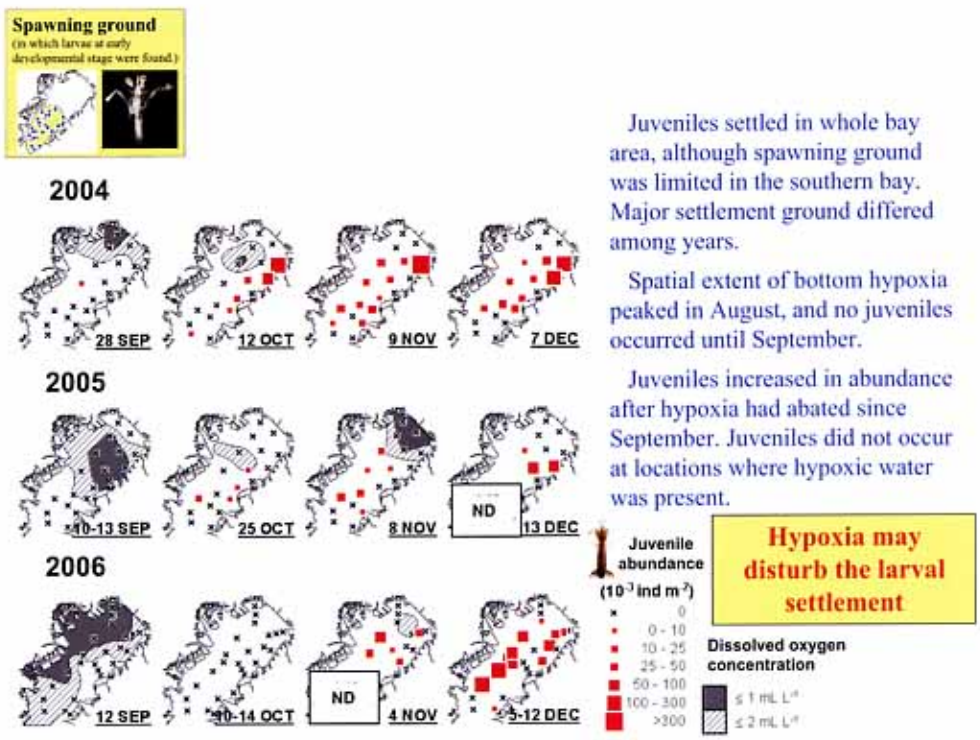


Fig. 4 Spatial distribution of juvenile mantis shrimp and bottom hypoxia in Tokyo Bay

GIS with predictive modeling, we analyzed data to identify important variables that explain the species richness of each taxon, and to document the optimal spatial scales for conservation. We have done a preliminary analysis of the relationships between the richness of macrophyte and adult dragonfly populations and the proportion of surrounding freshwater areas, the water depth, the pond surface area, the proportions of surrounding farmland areas, and the proportion of developed areas.

To develop a method of comprehensive risk estimation that will enable us to compare various adverse influences on ecosystems (e.g. habitat destruction, nutrient loading, chemical pollution, and invasion by exotic species), we are employing ecological modeling of populations and community dynamics. We used population dynamic modeling, which is based on stage- and size-structured models, to analyze the vulnerability of a benthic macroinvertebrate population in Tokyo Bay. We also constructed community-level models to track species compositional changes on the basis of trait distribution in a community in response to environmental changes. Such trait-based community models can be extended to link the environmental changes resulting from human disruption with the community responses that accompany the subsequent changes in ecosystem functioning.

We investigated two alien insect species, the European bumblebee, *Bombus terrestris*, imported for pollination of tomato crops, and the exotic stag beetle *Dorcus titanus*, imported as a pet. We performed cross experiments to assess the risks of crosses between exotic and native populations. The results revealed that the male of *B. terrestris* can mate with the native species and inseminate the eggs, but the eggs cannot hatch. A field survey indicated that such crosses actually occur in the wild. There was little reproductive isolation between the South East Asian and Japanese strains of *D. titanus*, even though DNA data suggested that there has been over 1.5 million years' isolation between them. We found many species of mites attached to commercial beetles. Examination of the phylogenic associations of the host beetles and the parasitic mites suggested that the mites diverged into strains specific to their host strains.

5. Development of systems for predicting the effects of chemical exposure on human health by using informatics techniques

Great concern has been raised that exposure to low doses of environmental chemicals during fetal and newborn development may result in a predisposition to various disorders such as cancer, learning disabilities, and allergies later in life. The way in which chemicals with such potential effects are identified is thought to be one of the most important issues in human health risk management. To solve this problem, genomic analysis using multiple types of information, such as toxicity, epidemiological, and clinical information, is necessary. The development of prediction systems is already being pursued. We are also trying to develop a system that can be used to predict the effects of chemicals at early stages of contamination.

The system we are constructing has three components. The first is the ChemToxGen system, a data-acquisition system that can handle large quantities of data; it is capable of extracting multiple types of information on the basis of the chemical's name or CAS (Chemical Abstracts Service) number from the toxic information database

TOXNET/PubMed and the gene expression database Gene Expression Omnibus (National Center for Biotechnology Information, USA). The second component is a system called pCEC (profiles of Chemical Effects on Cells) that uses gene-expression and toxicological information to categorize chemicals on the basis of their effects (see illustration at the start of this section). This system stores and handles gene expression profiling information and categorizations of toxicity data, and can separate chemicals into a variety of groups by their types of influence. The gene expression profiling was achieved by the SOM (self-organizing maps) technique, and the toxicity data are shown by using MST (minimum spanning tree) algorithms. To give an example of the system's effectiveness, we demonstrated that it can categorize 102 Johnson & Johnson hepatotoxicants on the basis of their molecular mechanisms, toxicological data, and microarray data. The third component is a system for the multi-profiling of chemicals. This year, while constructing ChemToxGen and pCEC, we studied the framework of our comprehensive system, as well as the system's process of categorization and classification of toxic influences and their relationship with molecular mechanisms.

6. Invasive species database

To help us take the proper measures to prevent the entry of or control invasive alien species, we are constructing a database of invasive alien species in Japan. The schema of the database will conform to that of the invasive alien species database of the Global Invasive Species Program (GISP) in the International Union for Conservation of Nature and Natural Resources (IUCN). We are also developing invasiveness criteria in order to set up systematic information on invasive alien species.

To construct the database, we selected those invasive alien species in Japan that needed to be listed because of their invasiveness, then compiled data on these species. A special focus is being placed on providing core background information on the ecology of invasive alien species, as well as on their ecological and economic damage, any legislative controls, and control and eradication techniques. Species information includes biology, ecology, distribution maps, management information, references, and images.

As at 18 May 2007, the database contained information on 337 species. Each species is classified by taxonomic group and according to whether it has been introduced internally (within the country) or internationally (from abroad). All taxonomic groups of non-native species and organisms may be included in the database.

The 337 species currently in the database are regarded as the most invasive ones. For each of them, the database provides datasets by searchable fields, including Japanese name, scientific name, English common name, morphological description, native and alien geographical ranges, invasion pathway, local dispersal methods, management regime, and scientific references in Japanese. Additionally, images and distribution maps are provided for some of the species.

Our database structures and query interface are formulated by a software design that can be adapted to personal computers. However, we should soon be able to provide a web-based query system suitable for national- and international-scale systems for the early detection, tracking, and management of invasive alien species in Japan.

Asian Environment Research Group

Scenery of
Mekong River Basin

Japan is closely connected to Asia both geographically and economically, and rapid future development is expected in the region. Therefore, preservation of the environment and creation of a society in good harmony with nature is crucial in considering environmental security and international contributions and the need to realize a sustainable society throughout the whole of Asia. Therefore, we conduct research on air quality, long-range transboundary air pollution, sustainable management of the water environments in the terrestrial, coastal, and oceanic areas, and ecosystem management and conservation in catchments such as those of large rivers.

The Asian Environment Research Group, which has five research sections, an independent senior research scientist, and two collaborative research sections, has been carrying out three core projects in the Asian Environment Priority Program. These projects will promote Asian environmental management; they will also help to establish scientific knowledge and the foundations of policy recommendations to create a society in good harmony with nature through international cooperation.

Core Project 1: Developing methods for evaluating the atmospheric environment of East Asia

The regional air quality (e.g. ozone, anthropogenic aerosols, mineral dust) of East Asia is investigated through comprehensive field monitoring, the development of an emission inventory, and transport modeling. The final goal of this project is to develop an integrated method based on observation and modeling in order to understand the current status of the air quality of East Asia and predict future changes in the atmospheric environment.

Sub-project 1-1: Study of regional-scale air quality in East Asia

The Asian Atmosphere Section has carried out continuous and comprehensive observations of the chemical, physical, and radiative properties of aerosols and gases at Cape Hedo Aerosol and Atmosphere Monitoring Station (CHAAMS, Fig. 1) by using equipment such as an aerosol mass spectrometer, carbon monitor, nitrate monitor, lidar, sky-radiometer, pyrheliometer, and microwave radiometer. We planned an intensive campaign in spring and carried out aerial observations in China and ground-based observations at CHAAMS, Okinawa, Fukue, Nagasaki, and Qingdao, China, in collaboration with several institutions in China, Korea, and Japan. The effect of dust storms in 2006 was larger than that in previous years, since the calcium ion concentration, which is one of the major dust storm indicator, measured in China was higher in 2006. High concentrations of sulfate, nitrate, and organics were associated with the movement of cold fronts and high pressure systems. A large-scale Asian dust storm (*kosa*) was also observed at Fukue and CHAAMS, where the chemical compositions

Fig. 1 Cape Hedo Aerosol and Atmosphere Monitoring Station (CHAAMS)

measured were very different: the organics-to-sulfate mass ratio was greater than unity at Fukue, but less than unity at CHAAMS, which reflects the progress of oxidation reaction. Air mass history largely affects the chemical properties of regional aerosols. We extended CHAAMS by constructing a new 4-m × 8-m building and a transformer substation for a high-voltage electric power supply in order to provide enough space and electricity for additional monitoring systems. This extension is highly appreciated by both Japanese and foreign researchers.

Sub-project 1-2: Evaluation and future projection of atmospheric environment in East Asia

The Regional Atmospheric Modeling Section conducted long-term simulations of surface ozone over East Asia during 1980–2003 by using a regional-scale chemical transport model (CMAQ) and the newly developed year-by-year Regional Emission Inventory in Asia (REAS). REAS includes the emissions for 1980–2003 with 0.5° × 0.5° resolution. Total energy consumption in Asia more than doubled between 1980 and 2003, causing a rapid growth in Asian emissions, by 28% for black (elemental) carbon (BC), 30% for organic carbon (OC), 64% for carbon monoxide (CO), 108% for non-methane volatile organic compounds (NMVOCs), 119% for SO_2, and 176% for NO_x. In particular, Chinese NO_x emissions showed a marked increase of 280% over 1980 levels, and growth in emissions since 2000 has been extremely high. These increases in China were caused mainly by increases in coal combustion in the power plant and industrial sectors. The CMAQ with the REAS data could reproduce the spatial and seasonal variations in observed surface ozone concentrations around Japan. The historical simulation from 1980 to 2003 demonstrated that the annual average concentration of surface ozone over central-east China and Japan increased by about 12 ppb (1% y^{-1}) and by 5 ppb (0.4% y^{-1}), respectively, during the quarter-century. This simulated trend in Japan generally agrees with the observed trend measured at monitoring stations and is correlated with the trend in Chinese NO_x emissions.

Sub-project 1-3: Application of dust and sandstorm data measured by the lidar observation network in East Asia

The Collaborative Research Sections investigated mineral dust in the atmosphere, which has huge effects on the global environment. The mineral dust generated from arid areas in the interior of China and Mongolia is known as *kosa* (dust and sandstorm, DSS) aerosol. Our research objectives were: (1) to develop quality assurance and quality control methods and a real-time data-processing system for the lidar dust-monitoring network; (2) to establish a useful forecasting system through a feasibility study of the development of a four-dimensional variational assimilation system for regional dust modeling based on the lidar network monitoring data; and (3) to study the three-dimensional movement of DSS by using the quality-assured network data. A network dataset from the lidar system was made for the data assimilation experiment. Real-time data processing was applied to the data in 2006. The results of lidar network monitoring were also provided as part of the *kosa* information in a trial web service offered by the Ministry of the Environment.

Core Project 2: Development of systems for evaluating regional water and material cycles in East Asia

The comprehensive tools needed for sustainable management of the aquatic environment and water resources in East Asia are developed by gathering scientific knowledge and information through strategic international collaborative research. This core project has been developing a system for the observation and evaluation of water and material cycles in catchment ecosystems by coupling satellite monitoring with a lumped catchment model. The aim is to investigate the influence of river water on the oceanic environmental ecosystem and to develop an evaluation system that will provide a technology inventory, a countermeasure policy inventory, and socioenvironmental indicators on the basis of a distributed catchment eco-hydrology model.

Sub-project 2-1: Development of a system for the observation and evaluation of water and material cycles in a catchment ecosystem

The Asian Water Environment Section has developed a system for the observation and evaluation of water and material cycles in a catchment ecosystem of East Asia. In 2006, an automatic observation system was designed to measure river water quality. A field survey was conducted along the Hanjiang River, China, to choose a suitable place for the observations. At the same time, the structure, items, format, and framework of the database were developed from satellite, GIS, and observation data from the basins of East Asian rivers, such as the Changjiang, Hanjiang, and Huaihe, China. Some of the data, such as climatic factors, geographical features, and land-cover maps, have been collected and input to the database.

To develop an integrated assessment model for the evaluation of water and material cycles, both an ecosystem model (Biome-BGC) and a catchment hydrological model (SWAT) have been investigated. Meanwhile, the correlations among complex impact factors such as wide-area climate, landforms, and terrestrial cover have been analyzed.

To make further progress in research on the evaluation of water and material cycles in the Changjiang basin, we have signed a joint research agreement for "Cooperative Research on Water Environment Management and Countermeasure Technology" with the Changjiang Water Resources Commission (CWRC). Under the agreement, the First Sino–Japan River Basin Water Environment Workshop was held in Wuhan, China, in June 2006. Scientists from both countries discussed their common interests in research issues and exchanged opinions, information, and research results.

Sub-project 2-2: Investigation of the influence of river water on the oceanic environment and ecosystem

The Asian Water Environment Section has also investigated the influence of Changjiang water on the oceanic environment and ecosystem. For this purpose, an investigative cruise was held in the East China Sea in May 2006. We are now analyzing algal primary production in response to the presence of macronutrients transported with the Changjiang-diluted water mass.

To foster academic exchanges and investigations, a collaborative research network with related Chinese institutions, including Zhejiang Marine University and Shanghai Fisheries University, has been established.

Sub-project 2-3: Development of a technology and countermeasure policy inventory and a system for its evaluation

The Environmental Technology Assessment System Section has started to develop a technology inventory system and socioenvironmental indicators for assessing sustainable urban–industrial systems. This system provides for the strategic design and evaluation of appropriate technological alternatives and countermeasure policy programs for local and regional stakeholders.

An urban-scale model for simulating water, matter, and energy cycles has been developed on the basis of the NICE model.

To develop the technology inventory and socioenvironmental indicators, we held an international workshop with related Chinese institutions, including Dalian University of Technology, Wuhan University, and Nankai University.

Core Project 3: Developing methods for the environmental impact assessment of watershed ecosystems in Southeast Asia and Japan

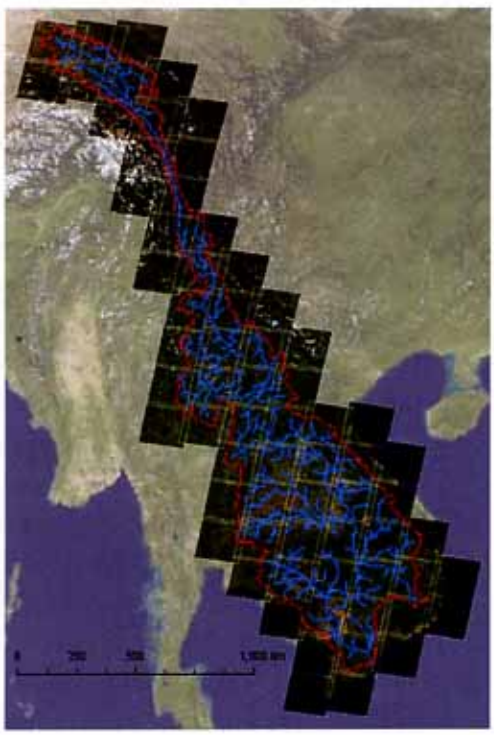


Fig. 2 Satellite image of surface-water flows (blue lines) in the Mekong basin (red line)

The Watershed Ecosystem Section is developing methods for the environmental impact assessment of Asian watershed ecosystems in Southeast Asia and Japan. We are building an international network in the Mekong River watershed area (Fig. 2). We provide the scientific knowledge to support the sustainable development of watersheds through international joint research. We are clarifying the current status of freshwater fish species in the Mekong River. By understanding the environmental dynamics of watersheds, we can assess the ecological impact of dams and other facilities.

Sub-project 3-1: Satellite monitoring of spatiotemporal changes in surface-water regimes and riparian environments over the entire Mekong basin

One of the goals of this study is to develop a geographic database that will enable us to determine the causal relationship between human activities in water resource management and the changes in riparian environments over the entire Mekong basin in the past 20 years. The geographic data collected included satellite monitoring information (SPOT-VEGETATION, Landsat TM, Landsat TM, Landsat ETM, JERS-1 SAR), surface-water regime data (SRTM DEM, HydroSHEDS, Global Drainage Basin Database), the CRU-TS Climate Database, a GIS dataset (Early Warning Information System, Thailand on a Disk), and topographic maps of the Mekong basin.

Sub-project 3-2: Predicting fish distributions in the Mekong River

Identifying the distributions of fish species in large river systems such as the Mekong is a formidable challenge. Lack of existing fish data, among other things, is a major cause of this difficulty. Modern statistical modeling techniques have recently been developed and applied to predictions of the distributions of various organisms at such geographic spatial scales. In this modeling, fish distributions that are typically represented as the presence or absence of individual fish species at survey sites are considered to be a function of both environmental and anthropogenic factors such as latitude, altitude, channel gradient, land cover, water temperature, rainfall, and dam construction.

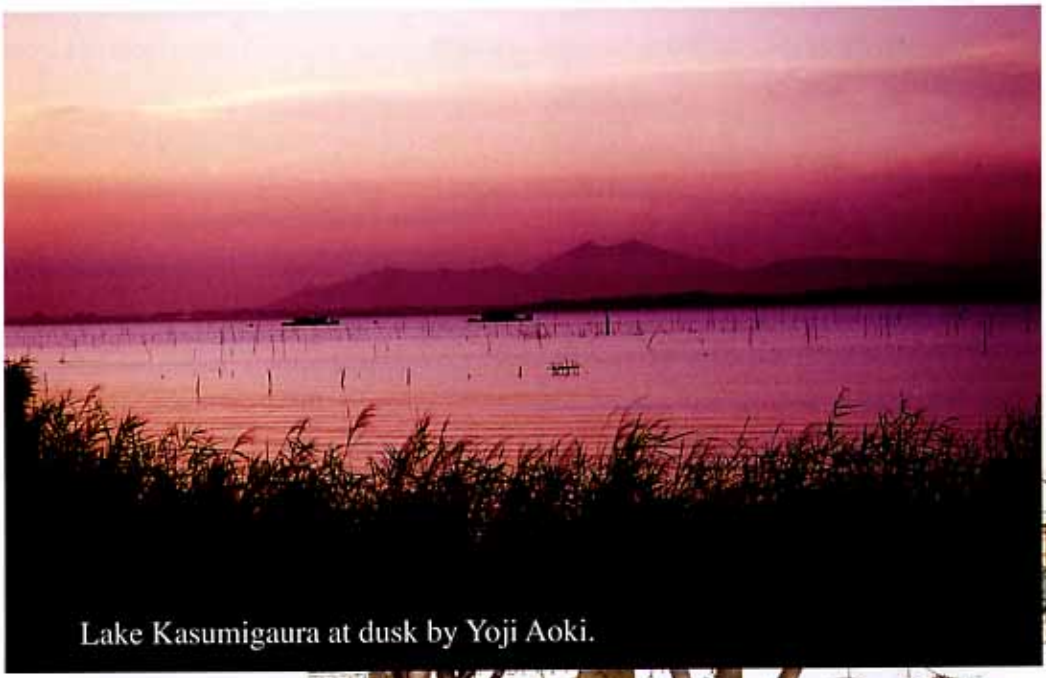
In early March 2007, we recorded about 60 species of freshwater fishes at four sites in the Mekong River and 16 sites in the Mun River, which is one of the largest tributaries of the Mekong in northeast Thailand. Tissue and otolith samples of 171 individual fish were collected for stable isotope analysis and chemical analysis. A fish image database and GIS database of these fishes were also developed. Hypothetical data on fish presence/absence were modeled with various predictor variables, including altitude, annual mean temperature and rainfall, and years when habitats were lost owing to damming of the rivers.

Sub-project 3-3: Developing methods to assess environmental impacts on Mekong River watershed environments

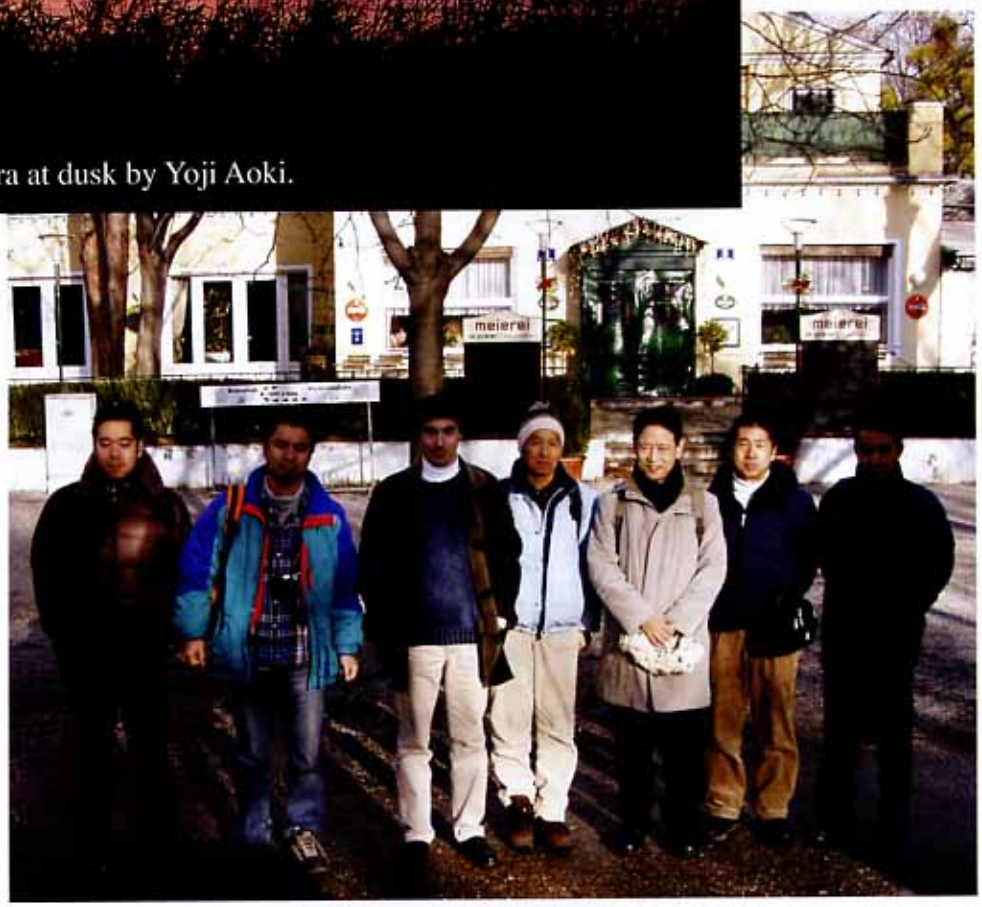
The Se San River, which flows across the border of Vietnam and Cambodia, is one of the largest tributaries of the Mekong River. Since the 1993 construction of Vietnam's Yali Falls Dam, which lies 80 km upstream of Cambodia's border, the Se San River's ecosystem has not been the same. Villagers of Cambodia have identified daily problems that they face, such as skin problems and diarrhea from using and drinking river water, difficulties in coping with the now unpredictable flooding and fluctuations in water level, and drastic decreases in the fish catch in recent years, which are affecting the food security of many of the village households. In August 2006, we visited the Se San River to observe the river conditions, including the surface water, riverbed, speed of water flow, river depth, vegetation, and erosion of the banks by directly sampling and measuring the river water, and by observation from a boat. We concluded from our data that the river water is not contaminated by metals at high levels, but we did find contamination with silicic acid. Arsenic contamination levels were low.

Chiang Kong or Chiang Saen, along the upper Mekong River in northern Thailand, is a suitable place for examining the various negative impacts caused by the Chinese dams that have been built in, or are planned for, the mainstream of the Mekong. We visited northern Thailand to better evaluate the local activities related to the Mekong River ecosystem and exchange experiences with the villagers. We visited affected places where we could see the impact of development projects and we discussed the issues with local villagers. We also collected *kai* (an alga) and other river plants living in the polluted water in places affected by development.

Social and Environmental Systems Division



Lake Kasumigaura at dusk by Yoji Aoki.



On-site survey of Prater Park in Vienna by the members of Japan–Austria joint research.

This Division targets the linkages between human activities and the natural environment in order to clarify the relationships between socioeconomic systems and environmental issues. The work of the Division results in proposals for environmental policies. It covers a broad area, from global environmental issues such as global warming to local issues like recycling and lifestyle. There are four research sections:

The Environmental Economics and Policy Section conducts studies relating to the economic and policy-related aspects of environmental conservation. It analyses the economic and political effectiveness of environmental policies.

The Environmental Planning Section is working on planning and evaluation techniques and applications relating to environmental conservation, including local goal-setting of environmental policies, and on the prediction and assessment of global warming impacts.

The Integrated Assessment Section develops a set of environment–economy integrated models for environmental policy assessment, such as those of global warming mitigation and sustainable development policies in the Asia–Pacific region.

The Transportation and Urban Environment Section analyzes urban environmental issues such as air pollution caused by automobiles and the urban heat-island effects caused by mass consumption of fossil fuels in urban areas.

The major research results obtained by our section in the first year of the second mid-term research plan of NIES are described below.

Environmental Economics and Policy Section

To investigate a wide range of environmental issues we are studying the interaction between current social and environmental systems by using social sciences, natural sciences, and systems approaches. In addition, we are analyzing the economical impact of environmental policies such as carbon taxes and emissions trading. We are also analyzing the environmental policy decision-making processes in use by various countries and investigating the possibility of international cooperation on global environmental conservation.

Study of the environmental Kuznets hypothesis

The environmental Kuznets curve (EKC) hypothesis proposes that indicators of environmental degradation first rise and then fall with increasing income per capita and thus with increasing demand for a good environment (Fig. 1). Because this hypothesis was presented as evidence against growth limitation, it attracted wide attention, and many empirical studies emerged in the early 1990s. However, recently some controversial studies have questioned the robustness of this earlier research.

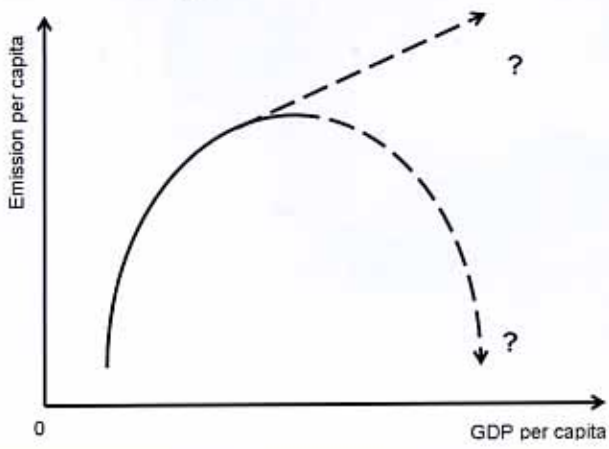


Fig. 1 The Kuznetz curve hypothesis

We therefore reexamined the validity of this hypothesis more robustly by applying both a parametric approach to estimation of the instrumental variables and seemingly unrelated regressions, and a nonparametric approach. Specifically, we used panel datasets of two environmental indicators, SO_2 and CO_2, for over 90 countries, including data on many developing countries from 1960 to 2000. The results of the parametric approach showed that the EKC hypothesis was applicable to SO_2 and CO_2, whereas those from the nonparametric approach gave the opposite result. Therefore, our findings show that the evidence supporting the EKC hypothesis is weak.

Study of the roles of legal principles governing the climate regime beyond 2012

This study focused on which legal principles would function in adaptation policy in a climate regime beyond 2012. The polluter-pays principle can be applied directly to the issue of adaptation. In this case, the greatest difficulty in a legal sense is in avoiding the need to demonstrate a causal relationship between greenhouse gas emissions and impacts. With respect to an instance in which a developing country is responsible for an environmental burden, the proposal does not make it clear whether (i) industrialized countries should assume liability; or (ii) the affected countries should bear the cost; or (iii) developing countries should be allowed to defer payment until their income reaches a certain level. Under the inference of state responsibility, the polluter will be held ultimately responsible for the damage (choice iii). However, an emphasis on the perspective of ability to pay and the common but differentiated responsibility principle may lead to the view that some developing countries can be exonerated. In this case, the choice will be either (i) or (ii).

Environmental Planning Section

We are conducting research into the development and assessment of regional plans and basic environmental plans for environmental conservation. In practice, we are investigating environmental indicators for use as regional environmental targets and against which to monitor the progress of environmental policies. We are also developing new methods of understanding and assessing regional environments by using geographical information systems (GIS).

Theory and effects of voluntary environmental actions by citizens and enterprises

To analyze why companies choose to adopt ISO 14001 and examine the effects of this standard on environmental emissions by small and medium-sized firms (SMFs), among which the adoption of ISO 14001 is not yet widespread, we performed a national survey. We statistically analyzed the data collected on differences in motives for ISO 14001 adoption and in emission-reduction targets between firms of different sizes. Opportunities for EU trade (for large firms) and the perceptions of top management (for SMFs) were distinctively important motivators. Perception of environmental issues by top management was more important for SMFs in adopting ISO 14001 and improving emissions controls than for large firms.

Mechanism of thermal mitigation by large-scale restoration of an inner-city river

To promote sustainable urban design in Asia, we analyzed data related to thermal environments in Seoul and Chongqing and described their spatial and temporal

Fig. 2 Before (left) and after (right) the restoration of the Cheong-Gye Stream in Seoul

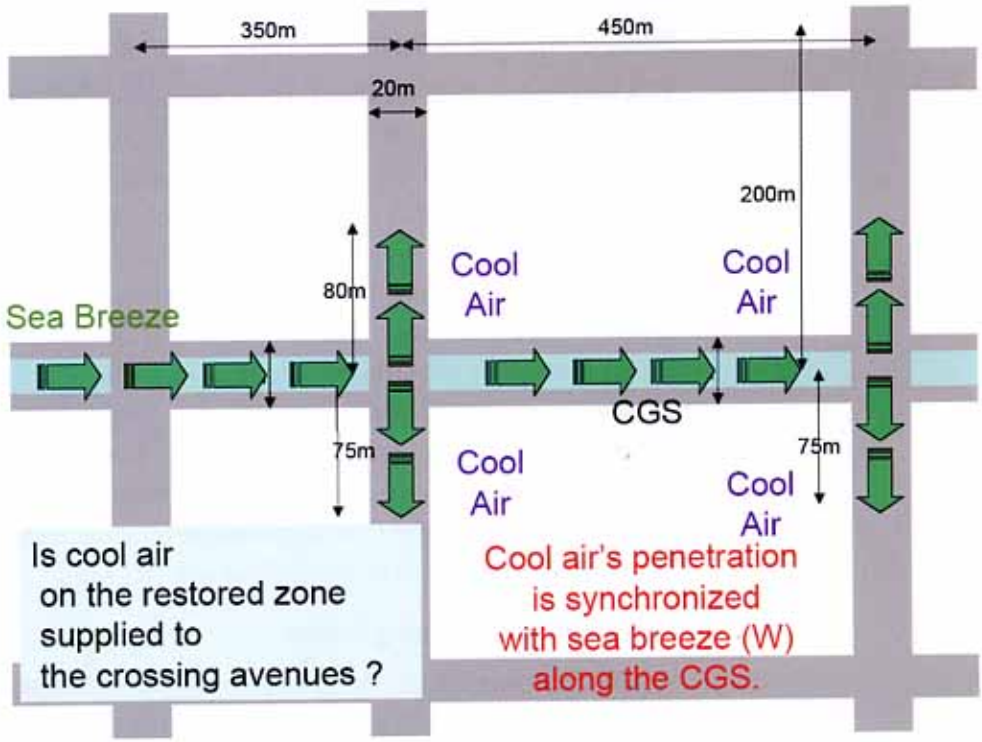


Fig. 3 Penetration of cool air into the Cheong-Gye Stream (CGS) study area after restoration of the stream

characteristics from the viewpoint of urban structure. We then made specific recommendations for urban planning. In particular, we used before-and-after monitoring to demonstrate the mechanism of atmospheric and thermal mitigation by a project that restored the Cheong-Gye Stream, a large inner-city river in Seoul (Figs. 2 and 3). Additionally, we compiled and summarized warming data for the last 100 years in each target city in Asia and mapped the hours of exposure to high temperatures. These analyses revealed that the current countermeasures for urban heat islands need to be revised. These processes, along with past natural and urban environmental recoveries, give us ideas for proposals for the future direction of cities by indicators of subsurface environment in which was easy to remain influences from anthropogenic activity.

Integrated Assessment Section

Development of an integrated assessment model for long-term scenario development

"Integrated assessment" is a framework for linking the scientific knowledge from a wide range of disciplines and the policymaking process. The core tool of integrated assessment is the integrated assessment model, which evaluates the policy options for solving various environmental problems. We developed and modified the Asia–Pacific

Integrated Model (AIM) to assess climate policy. The model also takes into account the fact that in developing Asian countries local environmental problems are more severe than global environmental issues such as climate change. We are expanding the AIM to include not only climate problems, but also the other environmental issues related to sustainable development. The following four topics were the main activities in 2006:

(1) By using AIM's computable general equilibrium model, we quantified the impacts of carbon tax policy on CO_2 emission reduction and economic activity in Japan. We found that the shorter the time period until the first commitment period, the higher the carbon tax needed to achieve the Kyoto target became.

(2) We have been developing the AIM/Impact [Policy] model to assess long-term climate policies, taking into account climate change impacts. This model can provide the necessary greenhouse gas emission-reduction pathways corresponding to the various future climate targets. We have updated the values of parameters in the AIM/Impact [Policy] model on the basis of the latest scientific knowledge from the IPCC's fourth assessment report.

(3) We are discussing the development of an integrated water resources model. The model consists of a land-surface hydrology sub-model, a river sub-model, an agriculture sub-model, and a reservoir operation sub-model. We have improved some of these sub-models and have begun to couple the main model with the NIES global climate model to simultaneously project future climates and assess the impact of climate change on water resources.

(4) We developed an economic model for use in discussing the long-term environmental visions of Japan. This model covers greenhouse gas and air pollutant emissions and their reduction, material cycles, water demand, and land-use change. We analyzed the relationship between socioeconomic activity and the environment in 2050, and we presented pathways that could be used to realize a sustainable society in Japan.

Transportation and Urban Environment Section

This section pursues studies relating to transportation and urban environmental problems. We evaluate the environmental impacts of motor vehicles by using our vehicle emission test facility and on-board emission measurement devices. We also formulate and evaluate environmental improvement scenarios for transportation and urban systems.

In FY 2006, we examined the environmental suitability of diesel vehicles equipped with exhaust after-treatment systems. We also evaluated bio-diesel fuels and an electric city commuter vehicle.

A GIS-based tool combined with the on-board devices was developed to show the positions of the emissions from vehicles and to precisely estimate the emission intensity along each road section through the aggregation of data (Fig. 4). An ecodriving test-ride event using vehicles equipped with the on-board devices was conducted to promote ecodriving and to enable scientific analysis of the driving data. The relationship between driving style and fuel consumption (as indicated by CO_2 emission) was analyzed. As the transport section team of the Japan Low Carbon Society's Toward-

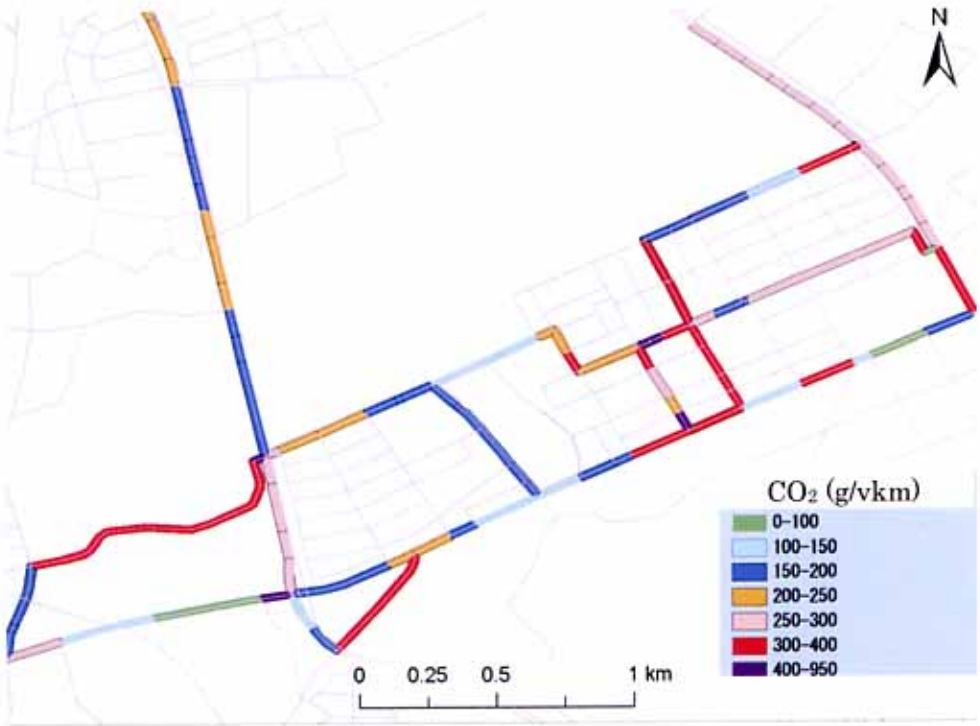


Fig. 4 Average CO_2 emission intensity along each road section near NIES. Narrow back roads and sections connecting to crossings with traffic signals have higher CO_2 emissions.

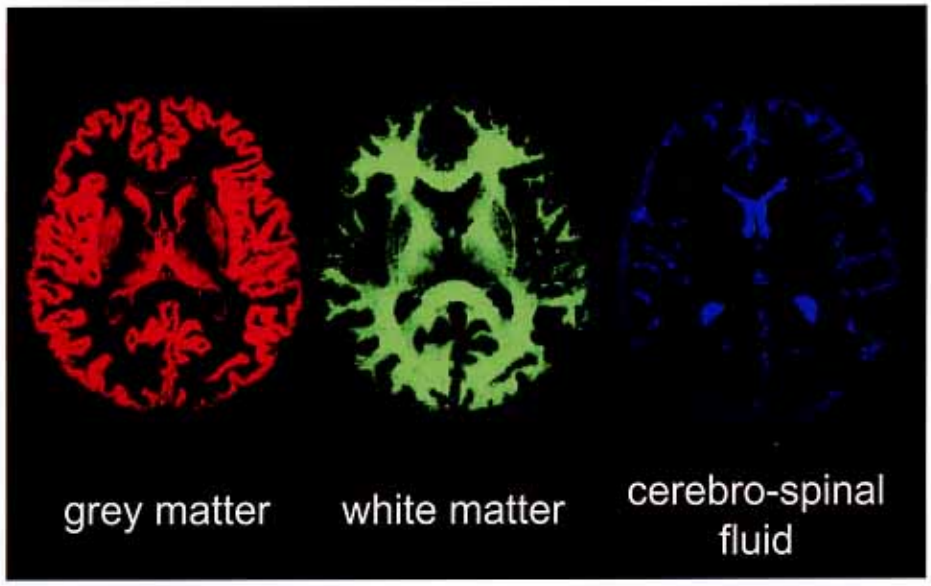
2050 Project, we revised the EST (environmentally sustainable transport) scenarios for 2020, which were focused on the market penetration of hybrid electric vehicles. EST 2050 scenarios and policy implications were drafted as a combination of countermeasures fitted to suit regional characteristics.

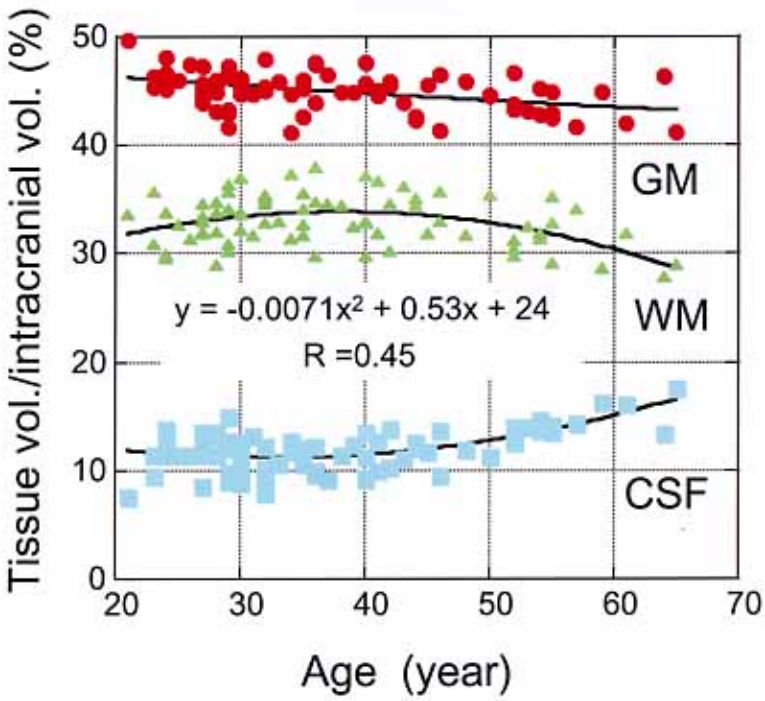
Japan and Austria cooperative research

Environmental impacts are not the same over the various climatic conditions and cultural backgrounds, because these impacts depend greatly on human activities in open spaces. We are testing various measurement techniques in order to develop a way of measuring human activities during outdoor recreation. Japan and Austria have different climates, and we are now testing a method of measurement suitable for use in both countries. This will be available for the comparison of outdoor activities in different climates and cultural spheres. We are now testing the visitor number data obtained up until 2006.

Environmental Chemistry Division

Tissue segmentation in the human brain based on the high-resolution 3-dimensional image obtained with 4.7T MRI. Gray matter, white matter, and cerebrospinal fluid can be clearly distinguished and used for further quantitative analyses. See figure below and text for more details.





Quadratic regression analyses of normalized brain volumes of gray matter (GM), white (WM), and cerebrospinal fluid (CSF) (shown in the figure above) in 75 male and female brains. WM peaks at about age 40 years, suggesting maturation of cerebral myelination in WM.

The Environmental Chemistry Division has been working on the development of various methods for the analysis of organic chemicals and elements or isotopes and the monitoring of their environmental and biological fates and behaviors, and on the analysis of biological responses to pollutant exposure. Various kinds of studies have been conducted, including studies of global environmental change; the presence and transport of elements or chemicals on global, regional, and local scales; long-term environmental monitoring and specimen-banking; the identification and apportionment of major sources of pollutants; the development of new analytical methods such as nano-particle analyses and magnetic resonance imaging (MRI) of the central nervous system; and behavioral and biochemical responses to chemicals.

The **Advanced Organic Analysis Section** has developed advanced methods for the analysis of organic pollutants such as persistent organic pollutants (POPs) in the environment and their application to environmental monitoring.

The Special Research entitled "Development of analytical methods using multi-dimensional separation for POPs" has been started. We have successfully separated out polychlorinated dibenzo-*p*-dioxins/furans (TCDDs/Fs) and polychlorinated biphenyls (PCBs) by using two-dimensional gas chromatography (2D-GC). Every congener of TCDDs/Fs, which is assigned a toxicity equivalent factor, was separated from the other congeners by 2D-GC using 5% phenylmethylsiloxane in the first column (length 50 m; i.d. 0.25 mm; thickness 0.1 μm) and 50% phenylmethylsiloxane in the second column (length 1.5 m; i.d. 0.1 mm; thickness 0.075 μm). Under various clean-up procedures, extracts of flue gases and fly ash were analyzed by 2D-GC with quadrupole mass spectrometry (QMS) and/or high-resolution time-of-flight mass spectrometry

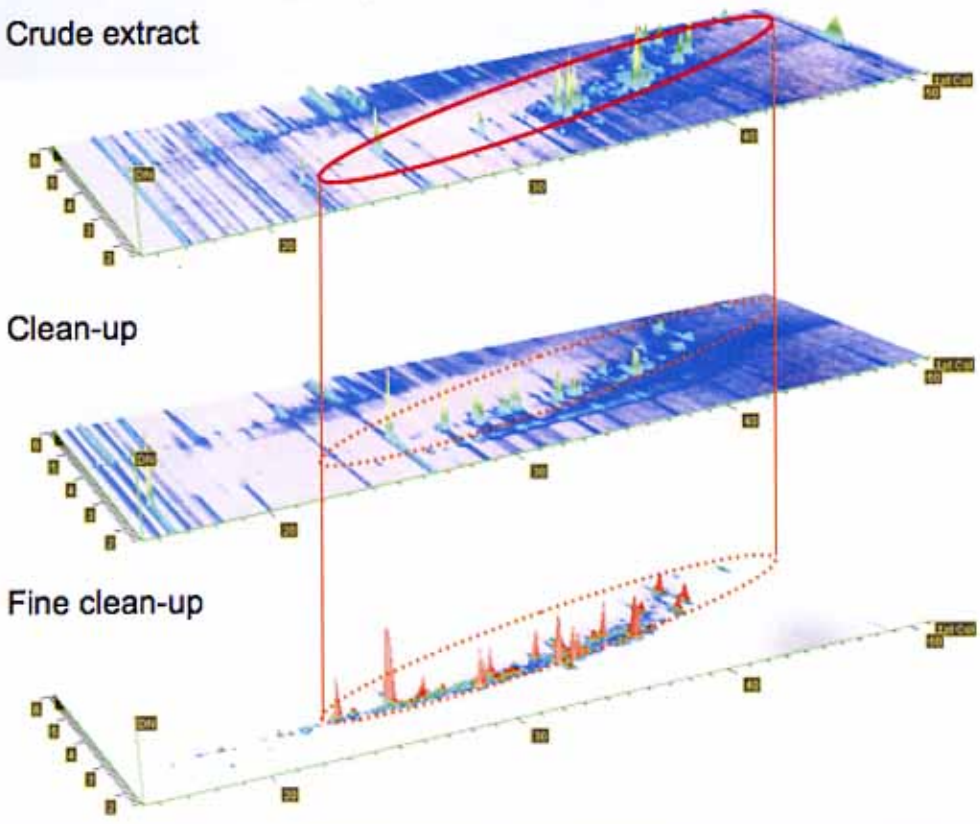


Fig. 1 2D-GC-total ion chromatograms of extracts of fly ash with and without clean-up. Clean-up: the extract was cleaned up with only sulfuric acid – silica gel chromatography. Fine clean-up: the extract was cleaned up with sulfuric acid – silica gel and activated carbon column chromatography. The peaks of PCDDs/Fs were expected to be observed within the ellipses.

(HR-TOFMS). The peaks of the major congeners of TCDDs/Fs in the extracts were detected irrespective of the clean-up procedure, indicating the possibility of rapid analysis of TCDDs/Fs without the need for complicated sample pretreatments (Fig. 1). A quantification program was developed for 2D-GC–HR-TOFMS, as one of various expected improvements and developments of the instrument.

Ultratrace analysis of semi-volatile organics in atmospheric nanoparticles was investigated by thermal desorption (TD) 2D-GC–QMS. By using an automated NIST library search, we found various chemical classes—e.g. alkanes, alkenes, cycloalkanes, long-chain carboxylic acids, aldehydes, ketones, substituted aromatics, polycyclic aromatic hydrocarbons (PAHs) and oxygenated PAHs, and heterocyclic compounds—in the 2D chromatogram. Trial measurements of per- and polyfluorinated alkyl compounds (PFCs) released from textile goods were performed. Various PFCs, such as perfluorooctanoic acid (PFOA), perfluorooctane sulfonamidoethanol (PFOSAE), and fluorotelomer alcohols (FTOHs), were widely detected from extracts of the samples by GC-MS and/or liquid chromatography (LC) MS-MS. Release of PFOSAE and FTOHs to the air from a waterproof jacket was found by TD-GC-MS at 60 °C.

As a part of a project on the "Development of simultaneous detection methods of chemical compounds and compositions in nano-particles", the performance of the laser ionization (LI)-TOFMS instrument that we developed was tested through application to diesel exhaust gas provided by an engine fitted with a dynamometer and a dilution tunnel. Size-resolved particle samples of the exhaust gas were also analyzed by a trace analytical method using TD-GC/MS and the results were compared with those obtained by LI-TOFMS.

Several investigations were performed in the "Study on environmental monitoring methods and quality control in environmental monitoring: (2) Quality control in measurement of polychlorinated dibenzodioxins and related compounds". Samples of water, algae, aquatic insects, and fish were collected from several rivers, and their PCDDs/F contents were determined by high-resolution gas chromatography – high-resolution mass spectrometry (HRGC-HRMS). The origins of the PCDDs/Fs were estimated from the PCDDs/F concentrations and congener profiles in each sample. We also investigated the passive sampling of indoor PCBs by woolen yarn. A conversion equation or factor to calculate the concentration in air from the amount collected was derived on the basis of parallel sampling by the conventional active method. Woolen yarn gave a shorter equilibration time than did other adsorbents such as activated carbon fibers and polyurethane foams; the yarn especially tended to adsorb PCBs of high molecular weight.

The **Advanced Inorganic Analysis Section** has been measuring the stable-isotopic abundance of elements with precision by multi-collector – inductively coupled plasma mass spectrometry (MC-ICPMS). Investigation of the analytical figures for chelate resin separation of lead and other elements from various types of biological and geological samples was initiated with the aim of achieving efficient and precise isotope analysis. The sensitivity of lead detection was enhanced by using a combination of MC-ICPMS and a desolvating nebulizing system attached to a PFA microflow nebulizer. We have been also investigating the application of surface analytical

methods, such as secondary ion mass spectrometry (SIMS) and X-ray photoelectron spectroscopy (XPS), to environmental samples.

The accelerator mass spectrometry (AMS) facility, NIES-TERRA, conducted about 1700 radiocarbon measurements this fiscal year, including measurements of airborne particles, ancient tree rings, and atmospheric CO_2. The AMS has been updated to generate more stable and higher acceleration voltages for more sensitive analyses. Micro-scale radiocarbon measurement is a unique and important trial by NIES-TERRA that has made it possible to estimate the contribution of fossil fuels to specific chemical components in environmental samples. Methodologies for the radiocarbon analysis of acetaldehyde in indoor air were studied for source apportionment. A large-volume DNPH (2 4-dinitrophenylhydrazine) sampler for indoor air sampling was devised. A preparative methodology involving both liquid and gas chromatography was established to separate and purify acetaldehyde in indoor air. The $^{14}C/^{12}C$ ratio of acetaldehyde in indoor air was successfully measured.

House dust samples were collected from households in the Kanto area for chemical characterization. House dust was fractioned by particle size, and X-ray fluorescence (XRF) and X-ray diffraction (XRD) analyses were applied to the particles. A list of constituents of house dust was made, and a substance containing Pb in the house dust was found.

Biogenic manganese oxide coatings on the pebbles in a river system draining strongly acidified water from tea plantations were analyzed. Micrographs, X-ray spectra, and elemental maps of cross-sections of the pebbles (Fig. 2) showed that the manganese oxide layer was 5 to 20 μm thick. The binding energy of the X-ray photoelectron spectrum of Mn $2p_{3/2}$ suggested the formation of MnO_2 on the pebble surface. The powder X-ray diffraction pattern of the MnO_2 coatings was typical of phyllomanganate with a 10-Å d-spacing (poorly crystallized buserite).

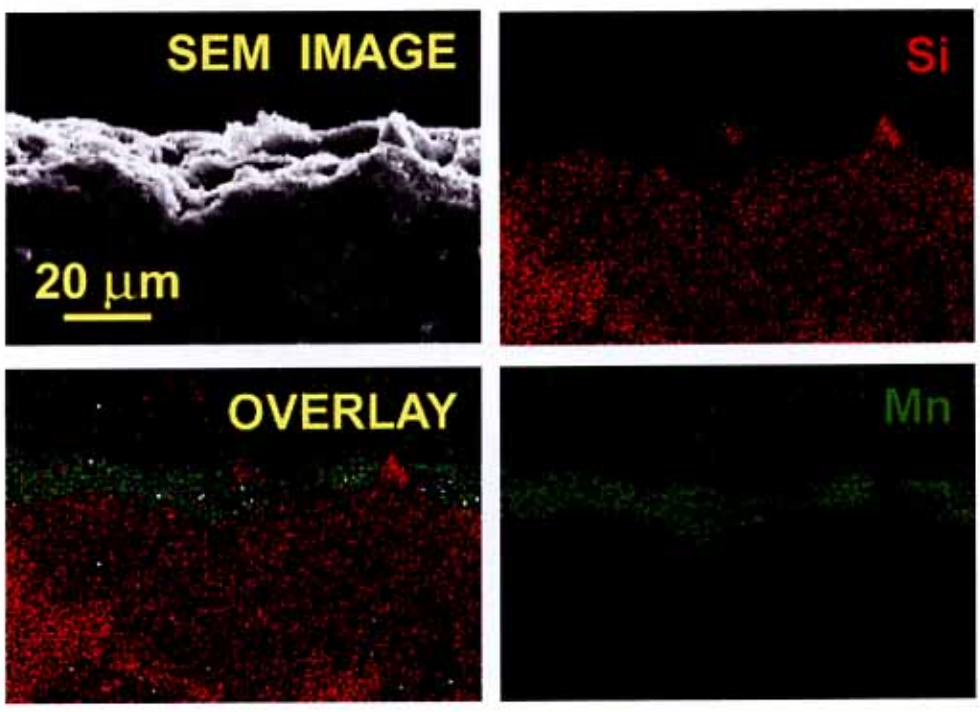


Fig. 2 Scanning electron micrograph and X-ray maps (Si, Mn, and overlay) of a cross-section of a pebble sample covered with biogenic manganese oxides.

We have been developing a portable device for measuring aerosol concentrations by an electron transmission method and analyzing their chemical compositions by XRF analysis. For the XRF measurement, we have made a prototype of a compact X-ray tube with a field electron emitter of graphite-nanocraters (GRANC) and are now subjecting it to long-term stability testing. For the aerosol concentration measurement we fabricated a silicon electron transmissive window 2 μm thick by a combination of micromachining and ion beam etching.

In the **Environmental Chemodynamics Section** we are studying the chemodynamics of natural and anthropogenic volatile organic compounds and hazardous chemicals, as well as carbon cycles in the ocean. At the ground station on Hateruma Island we have done high-frequency monitoring of HFCs, PFC, HCFCs and some other halocarbons. The observations have revealed rapid annual increases in atmospheric concentrations of HFCs and HCFCs (e.g. 12% for HFC-134a, 22% for HFC-152a, 30% for HFC-32, and 4% for HCFC-22 from autumn 2005 to autumn 2006). Some pollution events have suggested that among those halocarbon greenhouse gases emitted by China, HFC-23 was probably the largest contributor to global warming. We also studied CH_3Cl-emitting plants in a tropical forest in Malaysia. As part of the SOLAS (Surface Ocean – Lower Atmosphere Study) project, we have been experimenting with a new membrane tube equilibrator for VOCs in seawater. For hazardous chemicals, we developed a continuous-extraction sampling system and installed it on international merchant vessels. In the surface seawater samples collected from the South China Sea in June 2006, we found that the concentration of β-HCH was always higher than that of any other isomer and was in the range of 16 to 57 pg/L. The concentrations of α-HCH and γ-HCH ranged from 2.0 to 25 pg/L and from 1.6 to 17 pg/L, respectively. We have also started a joint study with the Japan Atomic Energy Agency ("Measurement of radiocarbon and its application to studies of the carbon cycle in the ocean") and have obtained data on the spatial variations of radiocarbons in the Japan Sea.

The **Biological Imaging and Analysis Section** has been developing a methodology and instruments for detecting and analyzing the responses of biological systems *in vivo* to various environmental factors. The long-term objective of this section is to establish methods for monitoring human health and the soundness of the ecosystem in noninvasive and nondestructive ways.

In a human study we focused our efforts on the brain. An ultra-high-field magnetic resonance imaging (MRI) spectrometer equipped with a 4.7-T superconductive magnet was installed to directly monitor the human brain. We are using three different approaches: anatomical structure analysis, local metabolic analysis, and functional mapping. For the anatomical structure analysis we have collected fine-spatial-resolution brain images from about 100 volunteer subjects. For volumetric evaluation of the images obtained we are developing quantitative methods that will enable us to evaluate sex differences and age-dependent changes in voxel-based morphology (see cover page figures). For the local metabolic analysis of the brain we have developed two methods of localized spectroscopy. One is a one-dimensional multinuclear spectroscopy method that enables us to observe 14 metabolites, including neuronal and glial markers, ATP, and phosphocreatine. The other is a two-dimensional cor-

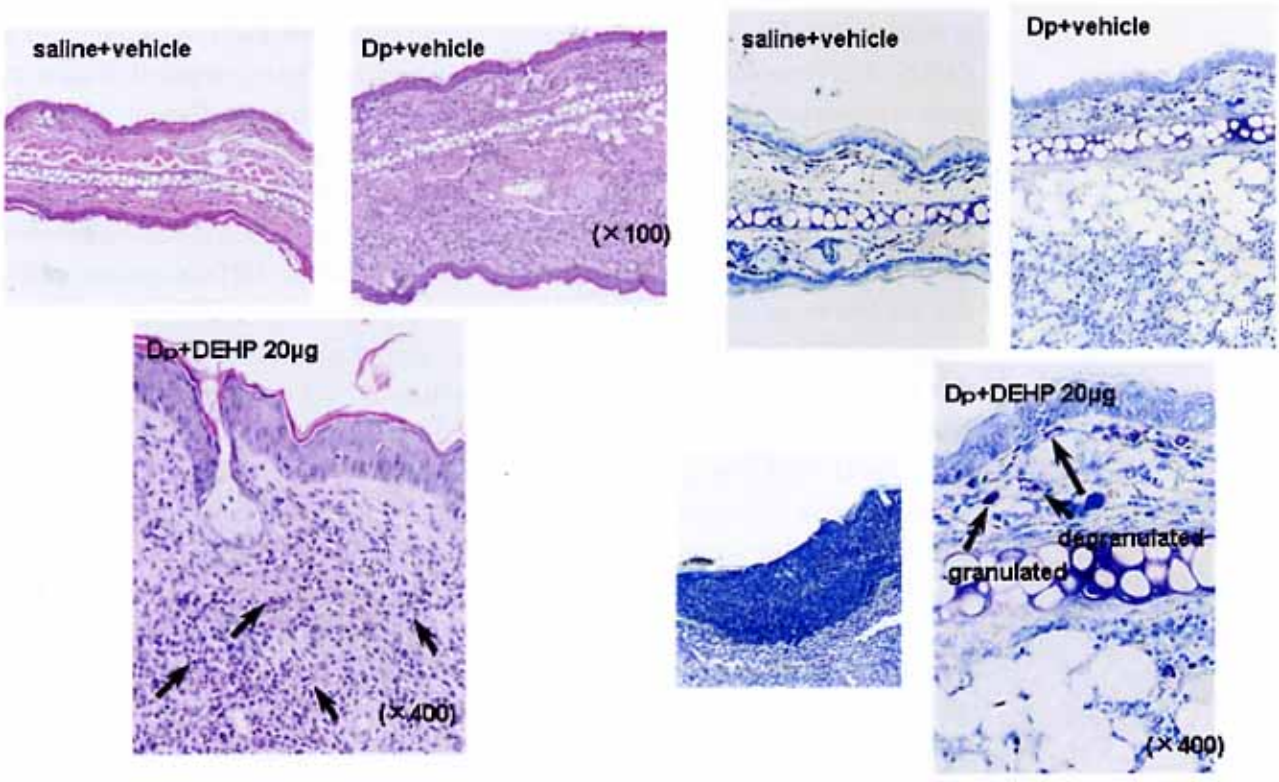
relation spectroscopy (COSY) method enabling observation of γ-aminobutyric acid, a representative inhibitory neurotransmitter that is difficult to observe by the one-dimensional method. For the functional mapping of the brain we developed a visual indication/stimulation apparatus usable in a very high field (4.7 T).

Behavioral test methods were also applied to experimental animals to examine the effects of various chemical reagents on the brain. We examined the effects of perinatal exposure to diphenylarsenic acid (DPAA) on behavior in mice. DPAA was observed in the brains of DPAA-exposed mice at weaning, at which time the DPAA exposure was terminated. After the exposure, the animals were bred under standard conditions. Behavioral tests were started when the animals reached the age of 5 weeks. DPAA exposure did not affect ambulatory activity or RotaRod performance. On the other hand, DPAA increased the number of entries to the open and closed arms in the elevated plus-maze. In addition, DPAA decreased response latency at the retention trial in the passive avoidance test, suggesting that perinatal DPAA exposure may impair learning and memory.

To monitor various kinds of microbial cells in natural ecosystems we are developing new micro-device systems that will rapidly measure the activities of microorganisms. The new micro-devices will be very useful for evaluating polluted environments at the microorganism level and for isolating many kinds of microorganisms effective at degrading various kinds of chemical pollutants. Initially we studied highly sensitive micro-sensors, single-cell manipulation systems, and microfluidic systems as important elements of the micro-device systems. Micro-electrochemical sensors in a micro-scale chamber were developed for the highly sensitive detection of oxygen to measure microbial respiration and photosynthesis. For single-cell manipulation, microbial cells were loaded into the micro-scale chamber by electrophoresis . We tested this micro-device to measure the photosynthetic activity of toxic cyanobacteria of *Microcystis* sp. We could detect the single-cell photosynthetic activity of the cyanobacteria and were able to estimate the single-cell respiration rate.

Environmental Health Sciences Division

Evaluation of histological changes



Exposure to 20 μg diethylhexylphthalate (DEHP) in the presence of allergen enhanced the infiltration of eosinophils (arrow) into skin lesions caused by atopic dermatitis. This trend was paralleled by increasing severity of mast cell degranulation (arrow).

The mission of the Environmental Health Sciences Division is to study the possible effects of environmental chemicals (e.g. dioxins, arsenite, phthalates, plasticizers, metals, air pollutants) and physical agents (e.g. heat stress, UV radiation) on human health. We aim to use the information obtained as a scientific basis for the risk assessment of these agents, alone or in combination. In this Division, we perform both epidemiological and experimental studies. In the latter, we use laboratory animals as experimental models for humans, and organs and cells to elucidate the mechanisms underlying their toxicity. In particular, we are interested in hypersensitive populations who are susceptible to the harmful effects of environmental stress, especially subjects with allergic disorders. Below, we highlight our progress in several study areas.

The **Director** researched the effects of environmental chemicals on several cardinal features of allergic diseases and clarified the mechanisms of action of these chemicals. He has demonstrated that systemic exposure to di-(2-ethylhexyl) phthalate can enhance atopic-dermatitis–like skin lesions. Furthermore, he examined the effects of nano-sized particles and materials on health—especially of the respiratory, cardiovascular, and immunological systems—and on the skin.

In the **Molecular and Cellular Toxicology Section**, we have been using a toxicogenomics approach to clarify the biological pathways and mechanisms of effects of a variety of environmental pollutants on immune function. We investigated changes in gene expression in thymuses exposed to thymic-atrophy–causing pollutants, including triphenyltin (TPT), tributyltin (TBT), methyldithiocarbamate, and diethylhexylphthalate (DEHP). The analyses revealed that TPT, TBT, and methyldithiocarbamate downregulated a group of genes that are involved in cell-cycle progression and were shown in our previous study to be downregulated by sodium arsenite. TPT upregulated genes that are known targets of the transcription factor peroxisome proliferator-activated receptor γ (PPARγ). Because PPARγ is implicated in apoptosis, our results suggest that TPT induces thymic atrophy through both cell-cycle arrest and apoptosis. We also studied the mechanism of species-specific toxicity of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD). The toxicity of TCDD is mediated by the activation and nuclear-translocation of a transcription factor, the arylhydrocarbon receptor (AhR). Although the species-specific activity of the AhR is primarily attributable to the species-specific affinity of the AhR to ligands such as dioxins, the precise mechanism has not been clarified. We investigated the mechanisms by which AhR function is modulated in Hepa1c1c7 and HepG2 hepatoma cells derived respectively from C57BL/6 mice, which express high-affinity AhR, and humans, who express low-affinity AhR. Our results shoed differences between the two cell lines in the kinetics of both the amount of nuclear-translocated AhR and the binding of histone deacetylase (HDAC) to the target gene promoter. We suggest that these factors are involved in the species-specific modulation of AhR function.

In the **Research for Health Effects Section**, we used animal models to examine the effects of environmental pollutants on subjects with pre-existing disorders, such as bronchial asthma, atopic dermatitis, and lung inflammation related to bacterial endotoxin. In 2006, we acquired data on the effects of particles on models of infectious lung injury. We reported the following:

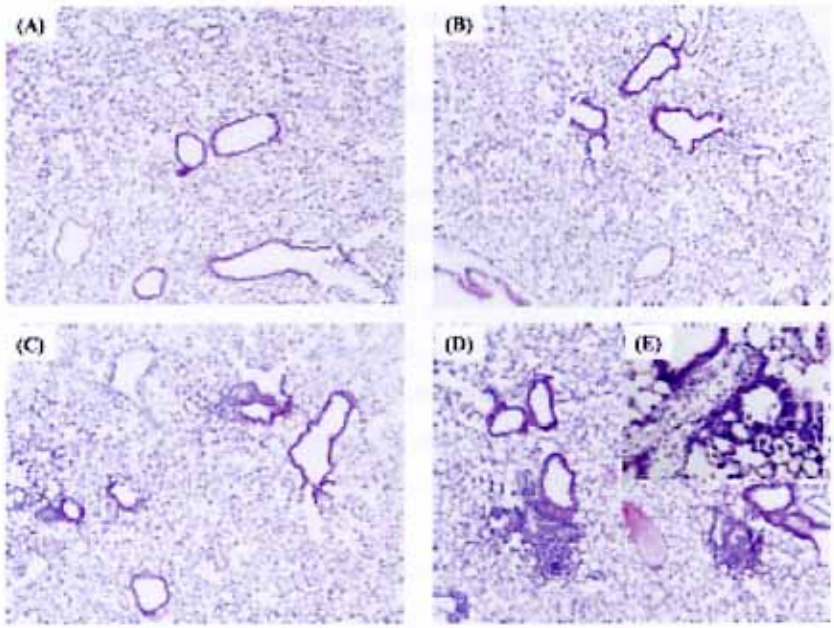


Fig. 1 Histological changes in the murine lung 24 h after intratracheal instillation of various substances. The sections were stained with hematoxylin and eosin. (A); Vehicle instillation; (B); instillation of Asian sand dust particles (ASDP)-F; C): kaolin instillation; (D, E): ASDP instillation. Original magnification; ×100 or ×400.

1. The organic chemicals contained in diesel exhaust particles (DEP), rather than the residual carbonaceous nuclei of the DEP, exaggerate allergic airway inflammation, as shown by the infiltration of inflammatory cells into the lung and the expression of inflammatory molecules in the lung.
2. Exposure to Asian sand dust particles (ASDP, i.e. *Kosa*) causes pulmonary inflammation via the expression of proinflammatory molecules in response to lipopolysaccharide and β-glucan absorbed by the ASDP.This inflammation was shown by gene expression using DNA microarray analysis, protein expression in the lung using ELISA, and histological changes (Fig. 1).
3. Diesel exhaust inhalation does not exacerbate acute lung injury related to bacterial endotoxin.
4. Pulmonary exposure to carbon nanoparticles enhances acute lung injury as shown by lung epithelial damage with inflammatory cell infiltration and amplified cytokine expression) associated with bacterial endotoxin.
5. When inhaled, diesel engine-derived nanoparticles dose-dependently enhance acute lung injury (as shown by lung epithelial damage with inflammatory cell infiltration) related tobacterial endotoxin.
6. Naphthoquinone, a chemical compound extractable from diesel exhaust particles, can aggravate allergic airway inflammation with allergen-specific immunoglobulin production *in vivo*.

The **Integrated Health Impact Assessment Section** conducted epidemiological and experimental research with the financial support of the MOE and the New Energy and Industrial Technology Development Organization (NEDO). One study assessed health impacts related to heat and air pollution in the future under global warming. The other assessed the development of novel culture substrata for tissue and embryonic stem cells that grow and differentiate on basement membrane (BM) *in vivo*. We focused on BM formation by several kinds of animal and human epithelial cells *in*

vitro, and on processing the BM extracellular matrices to culture substrata by removing only the covering epithelial cells without impairing the lamina densa underneath the cells. The novel substrata could induce to differentiate airway epithelial basal cells to ciliated cells.

We conducted field research with personal $PM_{2.5}$ samplers, personal PM monitors, and handheld condensation particle counters to assess roadside exposure to fine and ultrafine particulate matter (PM) near congested trunk roads in Tokyo. We confirmed brief but high-concentration exposure of pedestrians walking by the roadside. We also started an assessment of exposure to air pollutants, in particular $PM_{2.5}$ and polycyclic aromatic hydrocarbons, in the cities of Shenyang and Shanghai, China.

We established a monitoring system by which patients with heat-related disorders were monitored by an emergency transportation network covering 14 major cities in Japan.

We also engaged in research conducted by MOE on short-term morbidity/mortality and an epidemiological study of traffic-related air pollution exposure and respiratory health; the latter study was launched by the MOE with the cooperation of the Environmental Epidemiology Section.

The **Environmental Epidemiology Section** is investigating the relationship between exposure to environmental factors (especially air pollution) and their health effects. We are developing methods to assess exposure and to evaluate health effects.

We are now engaged in a prospective cohort study and in short-term morbidity/mortality studies conducted by the Ministry of the Environment (MOE). We analyzed vital statistics in various regions, looking for statistical correlations between airborne particulate matter (PM) exposure and mortality rate. We analyzed the mortality rates in Japanese cities to investigate the short-term effects of PM on mortality. Our results suggest that there is a positive relationship between PM concentration and daily mortality in Japan, in agreement with the results of many reports in the USA and Europe.

We also conducted an epidemiological study, launched by the MOE, of traffic-related air pollution exposure and respiratory health. In fall 2005, we enrolled in the study 57 primary schools and 16,300 schoolchildren (grades 1–3) from three metropolitan areas of Japan (Kanto, Chukyo, and Kansai). Forty-nine of the schools were selected from districts with heavy traffic density; the other schools were some distance from major roads. Parents of children were asked to participate in a baseline study that included a questionnaire and blood sampling (measurements of serum total IgE, mite-specific IgE, and Japanese cedar pollen-specific IgE). The questionnaire will be conducted annually through to 2009. We intend to characterize the long-term average exposure of each participant to traffic air pollutants (elemental carbon and nitrogen oxides) by model-based estimates at both the participants' residences and their schools. We will use dispersion models that incorporate traffic volumes, vehicle emission rates, meteorological conditions, types of road construction, and distance to roadways.

Atmospheric Environment Division

Taking ozone sonde measurements at Showa Station in Antarctica

This Division is conducting research with the aim of understanding and solving atmospheric environmental problems ranging from urban air pollution to global and trans-boundary atmosphere-related issues. The Division consists of four sections: the Atmospheric Physics Section, which conducts research on numerical modeling and data analysis of atmospheric dynamics and climate systems; the Atmospheric Chemistry Section, which conducts research on trans-boundary air pollutants and chemical processes taking place in the atmosphere; the Atmospheric Remote Sensing Section, which studies the atmospheric environment by using remote sensing techniques such as lidar (laser radar); and the Atmospheric Measurement Section, which conducts field research on natural and anthropogenic trace species. The observation of ozone-depleting species and polar stratospheric cloud over Antarctica is being tackled independently as an activity of the current Antarctic expedition team. Many of the members of this Division also work for Priority Research Programs such as the Climate Change and Asian Environment programs.

Following are brief accounts of some of the important results of our research in 2006.

Future ozone layer prediction by the CCSR/NIES chemical climate model with T42 horizontal resolution

One of the defects of the previous version of the CCSR–NIES chemical climate model (CCM; see Nagashima et al: *Geophys. Res. Lett.*, **29**, 2002) is that the model's Antarctic ozone hole occurs in November, about 1 month later than the observed hole, and it has insufficient ozone depletion in October. To improve this defect in ozone hole prediction we made several improvements to the model. The horizontal resolution of the model improved from T21-level (5.6° × 5.6°) to T42-level (2.8° × 2.8°) and new chemical schemes, such as bromine chemistry and heterogeneous reactions involving polar stratospheric clouds (PSCs) of Super-cooled Ternary Solution, were included. We also included the process of radiation of Schumann–Runge bands, the effects of atmospheric sphericity on solar radiation, non-orographic gravity wave effects, and sedimentation velocity corresponding to PSC radius. The model was run under a future greenhouse gas and halogen projection from the IPCC A1B scenario and the Ab scenario of the Beijing Amendments. The results were analyzed and investigated in terms of the recovery of the ozone hole in the future atmosphere.

Figure 1 is a time series of the ozone hole area, as defined by the area south of 40°S in which the total amount of ozone is less than 220 Dobson Units. Total ozone mapping spectrometer (TOMS) observation shows the appearance of an ozone hole at the beginning of the 1980s, followed by rapid growth in the 1980s, slower growth in the 1990s, and a peak in about 2000. The CCM result simulates past changes in the ozone hole well. In particular, the appearance of the ozone hole at the beginning of the 1980s and the peak in about 2000 are reproduced well. CCM modeling of Antarctic ozone in the future atmosphere shows that: (i) the ozone hole will remain large until 2020; (ii) a clear decrease in the size of the ozone hole will begin in the 2020s; and (iii) there were be a marked reduction in the size of the hole by the middle of this century, although by about 2050 the hole will not have totally disappeared because of the year-to-year variation in the condition of the Antarctic polar vortex. Figure 2 shows the evolution over time of minimum total ozone south of 40°S. A pattern opposite to that seen with

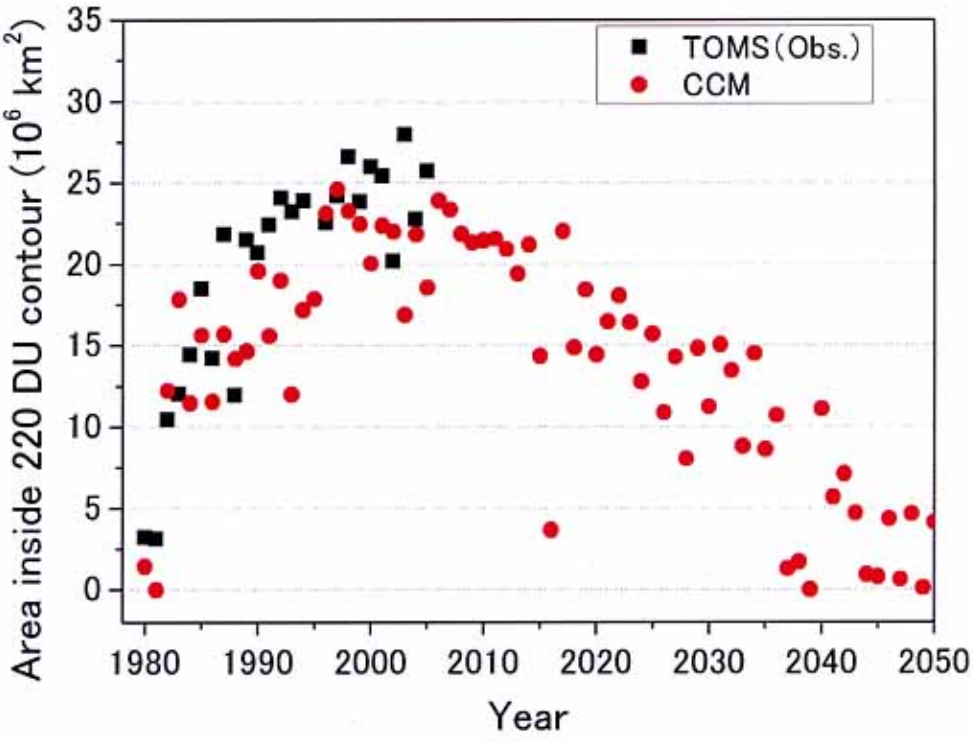


Fig. 1 Time evolution of the area of the ozone hole. Black squares represent observations by TOMS instrument and red circles represent the results of CCM calculations. DU = Dobson Units.

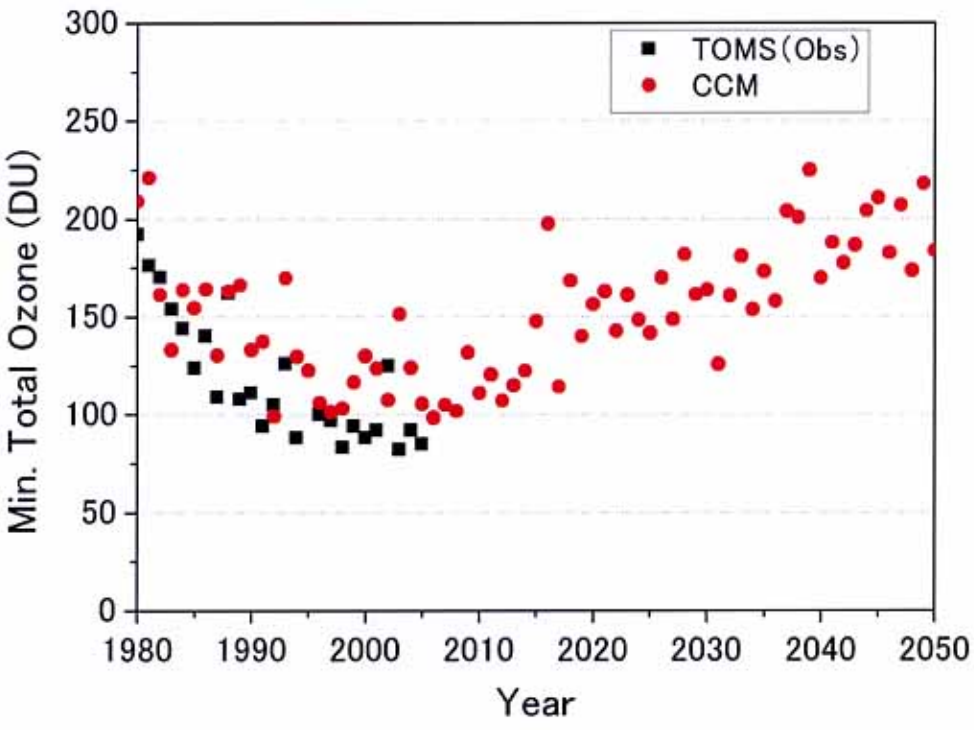


Fig. 2 Time evolution of total ozone minimum south of 40°S. Black squares and red circles are the same as in Fig. 1.

the ozone hole area in Figure 1 is apparent. The minimum total ozone concentration decreases rapidly in the 1980s and more slowly in the 1990s, reaches a minimum in about 2000, and then increases, recovering by the middle of this century.

Observations of Asian dust, sea-salt, and anthropogenic aerosols over the Pacific Ocean by ship-borne lidar

Ship-borne measurements with an automated dual-wavelength polarization lidar have been conducted in the Pacific Ocean since 1999, in collaboration with the Japanese Maritime Science and Technology Center. These ship-borne data are the world's only lidar data measured over the wide region of the Pacific Ocean and over a long period of time. Many researchers have used the ship-borne lidar data to validate numerical models and satellite data and to gain an understanding of the vertical structures of aerosols, clouds, and planetary boundary layers in maritime environments.

A new type of aerosol retrieval algorithm was developed to analyze the ship-borne lidar data. Distinct from the algorithms developed to date, our algorithm can classify aerosol components and estimate the vertical profiles of extinction coefficients of three types of aerosol components, i.e., water-soluble, sea-salt or dust. "Water-soluble" is defined as a mixture of sulfate, nitrate and organic carbon aerosols. This algorithm provides a quantitative understanding of the vertical structures of the major aerosol components in maritime environments. The algorithm is applicable not only to the ship-borne lidar data, but also to satellite-borne lidar data and the NIES lidar network data measured over the wide region of East Asia.

The algorithm was applied to ship-borne lidar data measured over the western Pacific Ocean near Japan in May 2001. The results showed that naturally occurring water-soluble and sea-salt aerosols co-existed in the planetary boundary layer forming below 1 km. In addition, Asian dust and anthropogenic water-soluble plumes were found over the planetary boundary layer. Comparisons with a numerical model revealed that the water-soluble and dust plumes originated on the seaboard of China and in the Gobi Desert, respectively. The data on the properties of aerosols were used to validate a global aerosol transport model.

Atmospheric fate of leaf aldehyde in the daytime

Leaf aldehyde, (z)-3-hexenal, is one of the biogenic C_6 aldehydes emitted from wounded leaves and stems. Leaf aldehyde has an aldehyde functional group and a C=C double-bond structure. Therefore, leaf aldehyde emitted into the atmosphere is thought to be removed by photolysis as well as by reactions with OH radicals and ozone. However, the removal processes have not yet been studied.

We measured the absorption cross-section and effective photodissociation quantum yield of leaf aldehyde, thus enabling us to estimate the photodissociation lifetime. We also measured the rate coefficients for the reactions with OH radicals and ozone at ambient temperature and pressure. Most of the experiments were conducted in a photochemical reaction chamber.

The photodissociation rate coefficient of leaf aldehyde was measured in a solar simulator in the presence of an excess amount of CO to depress the additional losses by OH-radical reaction and was determined to be $(5.8 \pm 0.8) \times 10^{-3}$ relative to the photodissociation rate coefficient of NO_2. This gives an effective quantum yield of photolysis in the UV region of 0.4 ± 0.1.

The rate coefficient of the reaction of leaf aldehyde with OH-radical was measured by the relative rate method in the presence of an excess amount of NO and determined to be $(6.1 \pm 0.7) \times 10^{-11}$ cm^3 molecule^{-1} s^{-1}. The rate coefficient of the reaction of leaf aldehyde with ozone was measured in the presence and in the absence of an excess amount of CO, an OH-radical scavenger. The rate coefficient and the OH yield in the leaf aldehyde + O_3 reaction were obtained by fitting the observed decay profiles of leaf aldehyde and ozone and were determined to be $(3.5 \pm 0.6) \times 10^{-17}$ cm^3 molecule^{-1} s^{-1} and 0.4 ± 0.1, respectively.

By using the rate coefficients determined in this work, the atmospheric lifetime of leaf aldehyde in the daytime was estimated to be a few hours.

Preparation of gravimetric CO_2 standards by one-step dilution method

The concentrations of atmospheric CO_2 need to be measured with an uncertainty of ±0.1 μmol mol^{-1} in order to combine the measurements made by different laboratories into an international database and to accurately evaluate the global carbon budget (sources and sinks) by using the combined CO_2 data and atmospheric transport models. Therefore, highly accurate CO_2 standards are required. Jointly with the Chemicals Evaluation and Research Institute (CERI) and Japan Fine Products Corporation (JFP), we developed a method to prepare gravimetric CO_2-in-air standard gases in 10-L aluminum cylinders with one-step dilution. The masses of the purified CO_2 (about 0.7 g) and the clean-up air (CO_2-free air, about 1.2 kg) are determined by a precise electric balance with a precision of <50 μg and a precise analytical balance with a precision of <3 mg, respectively. We prepared 30 CO_2 standards (15 for CERI and 15 for JFP) and measured their CO_2 mole fractions by nondispersive infrared (NDIR) analyzer against the NIES CO_2 standard scale. The differences in the CO_2 mole fraction between the gravimetric and analyzed values (gravimetric – analyzed value) are plotted against the individual mole fractions in Figure 3. The averages and standard deviations (1σ)

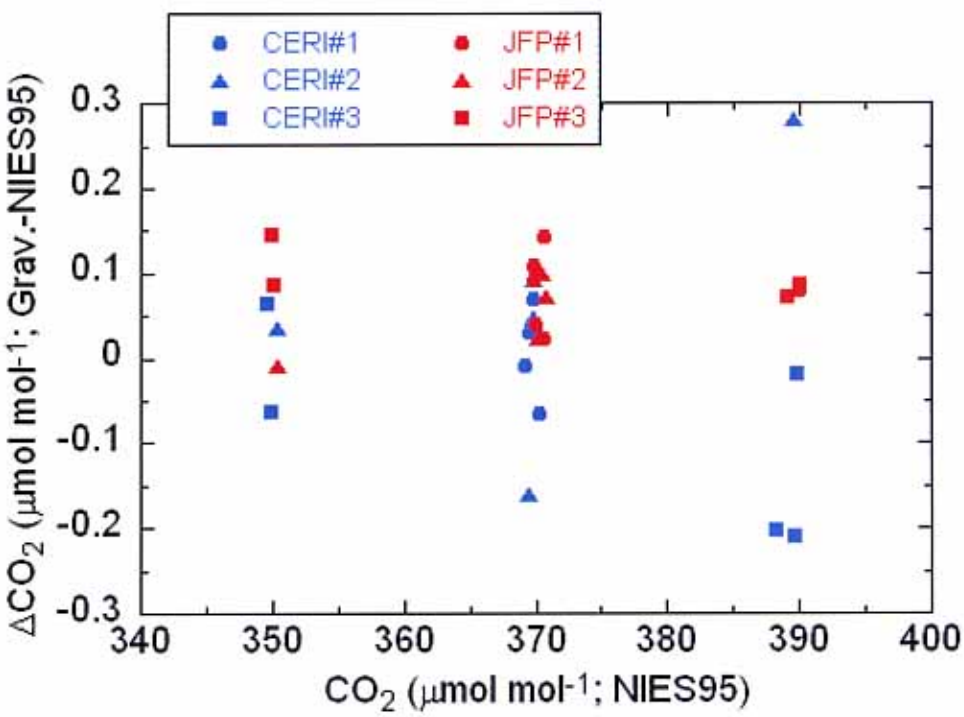


Fig. 3 Differences in CO_2 mole fraction between gravimetric values and NDIR measurements for the 30 gravimetric CO_2 standards. Each difference is plotted against its CO_2 mole fraction, which is determined by NDIR with respect to the NIES-95 scale.

of the differences between the gravimetric and NDIR values (gravimetric – NDIR) were –0.00 ± 0.13 μmol mol^{-1} for CERI and 0.08 ± 0.04 μmol mol^{-1} for JFP. These results suggest that the one-step dilution method is capable of preparing CO_2 standards within an uncertainty of about ± 0.1 μmol mol^{-1}.

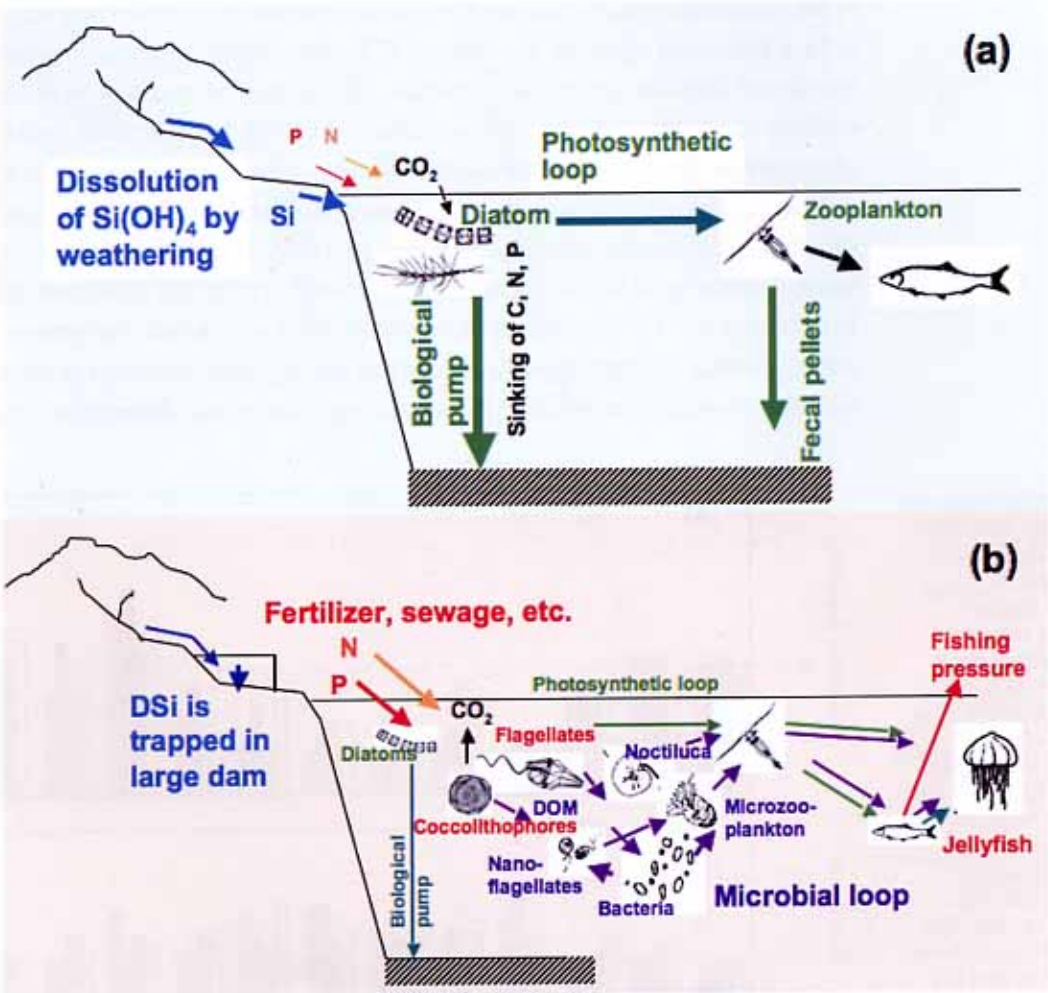
Development of a personal monitoring sensor for air pollutants

We are developing portable sensors for air pollutants, such as aerosols, ozone, and NO_2, to estimate the levels of exposure of individuals. The sensors need to be sufficiently lightweight and small to be carried by anyone at all times. They are also required to be sensitive enough to enable comparison of the data they generate with values observed at air pollutant monitoring stations.

The aerosol sensor utilizes light-scattering detection. The change in resistance induced by the adsorption of ozone onto a semiconductor is applied to the ozone sensor. NO_2 is detected by the Saltzman reaction.

A detection sensitivity of 5 ppbv was achieved for ozone and NO_2. It was confirmed that the aerosol sensor could detect particles with diameters of 0.3 to 2.5 μm.

Water and Soil Environment Division



Schematic diagram of biogeochemical fluxes of elements in coastal seas (a) with few anthropogenic effects and (b) with human perturbation in terms of land-based input of nitrogen (N), phosphorus (P), and silicon (Si).

Water—in precipitation, rivers, lakes, seas, and soil—is vital for our lives. Once the environment has been polluted, the time and cost needed for its restoration are enormous. Our Division undertakes research from a variety of approaches on the environmental pollution and ecological changes that occur via the media of water and soil.

Decomposition kinetics of TCE in the presence of several washing chemicals

We investigated the effects of coexisting surfactants and high-molecular-weight organic compounds on the reductive dechlorination of trichloroethylene (TCE) by metallic zerovalent iron (ZVI) powder, which is commonly used as a permeable reactive barrier for the treatment of chlorinated organic solvents, to determine whether these additives had utility as washing reagents (WRs) for remediation of soil and groundwater pollution. During the dechlorination reaction, the amount of TCE decreased, and *cis*-1,2-dichloroethylene formed. The rate of TCE decomposition by ZVI was proportional to the concentrations of TCE and ZVI; in the absence of additives this was concluded to be a first-order reaction. The rate of TCE decomposition in the presence of WRs was lower than the rate in their absence: taking the rate constant in the absence of additive as 1.0, that with the cationic surfactant CTAB was 0.7; those with the anionic surfactants sodium *n*-dodecylbenzenesulfonate, sodium *n*-dodecylsulfate, and sodium *n*-dodecanesulfonate or with the high-molecular-weight organic compounds soluble starch, β-cyclodextrin, and polyethyleneglycol 6000 were 0.5; and those with sodium laurate and the nonionic surfactants Triton X-100, Tween 20, Tween 60, Brij 35, and Brij 58 were 0.2. Comparison of the concentrations of nonionic surfactants with their critical micellar concentrations indicated that the rate-reducing effect of these additives was due to solubilization of TCE into the micellar phase. Adsorption of TCE onto

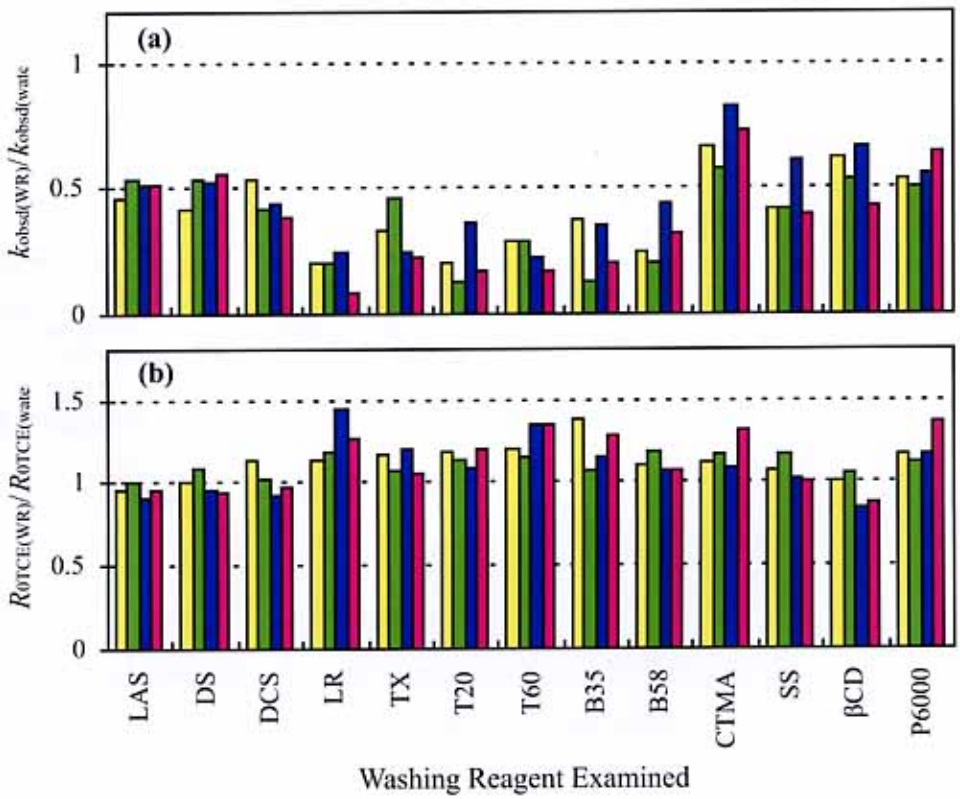


Fig. 1 Ratios of (a) rate constants for decomposition of TCE by ZVI in the presence ($k_{obsd(WR)}$) of washing reagent (WR) to the rate constants in the absence ($k_{obsd(water)}$) of WR; (b) remaining TCE (R_{0TCE} = ([TCE]$_{initial}$ – [TCE]$_{adsorbed}$) / [TCE]$_{initial}$) in the aqueous phase just after the start of the reaction in the presence ($R_{0TCE(WR)}$) of WR to remaining TCE in the absence ($R_{0TCE(water)}$) of WR. The experimental conditions are; 0.4 g ZVI and 0.1 g L^{-1} WR (yellow), 0.4 g ZVI and 1.0 g L^{-1} WR (green), 1.0 g ZVI and 0.1 g L^{-1} WR (blue), and 1.0 g ZVI and 1.0 g L^{-1} WR (pink).

the ZVI surface was also affected by the presence of the additives, being decreased with the formation of micelles and being increased with the formation of admicelles. Thus, the changes in the rate of decomposition of TCE were determined by several factors (Fig. 1). The observed deceleration effect on the decomposition rate of TCE suggests that some surfactants are not suitable for the use as WR.

Trace metals in bulk precipitation and throughfall in suburban area of Japan

To evaluate the sources of metals in rainfall and their enrichment through canopy processes, we analyzed the concentrations of dissolved aluminum (Al), manganese (Mn), iron (Fe), copper (Cu), zinc (Zn), silver (Ag), indium (In), tin (Sn), antimony (Sb), and bismuth (Bi) in bulk precipitation collected over bare land and in throughfall collected under four tree species: Japanese cedar (*Cryptomeria japonica*), Japanese red pine (*Pinus densiflora*), Japanese cypress (*Chamaecyparis obtusa*), and bamboo-leaf oak (*Quercus myrsinaefolia*).

The metal concentrations were higher in the throughfall (especially that of *C. japonica*) than in the bulk precipitation. Enrichment ratios (ER: ratio of metal concentration in throughfall to that in bulk precipitation) ranged from 2.5 (Zn) to 5.3 (Ag) (mean 3.9), and ERs for slightly soluble metals were generally higher than those for easily soluble metals. Mn, Fe, Cu, and Zn accounted for 99% of the total concentration of heavy metals in rainwater, whereas those of rare metals such as Ag, In, Sn, and Bi totaled <0.23%. Average concentrations of rare metals in bulk precipitation and throughfall were 0.002 and 0.010 $\mu g\ L^{-1}$ for Ag, 0.001 and 0.005 $\mu g\ L^{-1}$ for In, 0.062 and 0.21 $\mu g\ L^{-1}$ for Sn, and 0.006 and 0.023 $\mu g\ L^{-1}$ for Bi. The metal concentrations in rainwater were negatively correlated with the volume of rainwater, indicating that washout is the main mechanism that incorporates metals into rainwater.

To classify sources of metal as either natural or anthropogenic, we used enrichment factors (EFs) calculated as $EF = (X/Al)_{rain}/(X/Al)_{crust}$, where $(X/Al)_{rain}$ and $(X/Al)_{crust}$ refer to the ratio of the concentration of metal X to that of Al in rainwater and in the

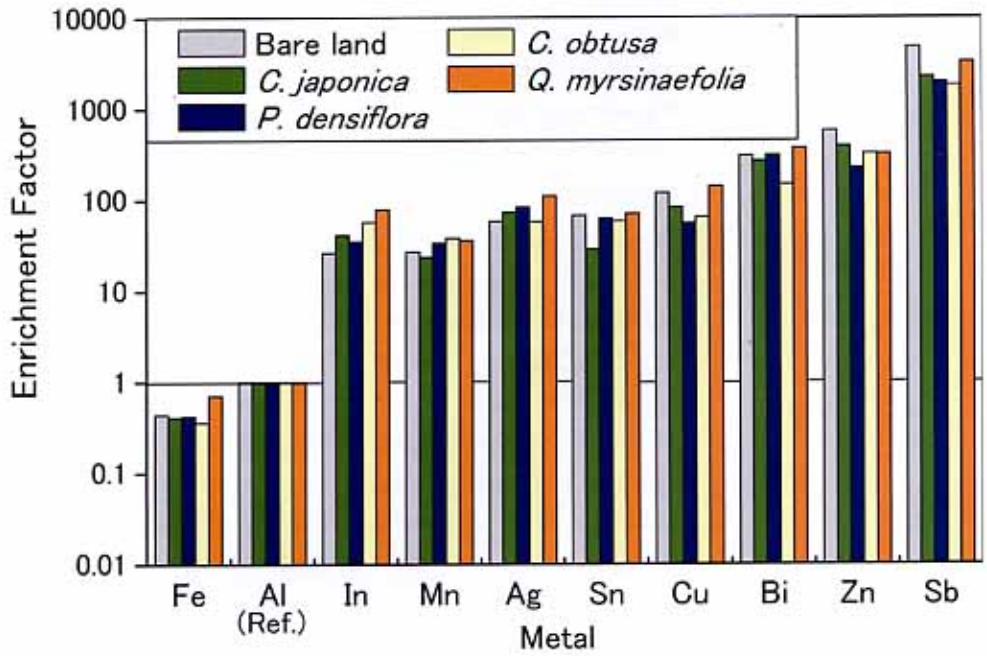


Fig. 2 Enrichment factors of metals, i.e. $(M/Al)_{rain}/(M/Al)_{crust}$, in bulk precipitation collected over bare land and in throughfall collected under four tree species. Metals are arranged from left to right in order of increasing EF in bulk precipitation.

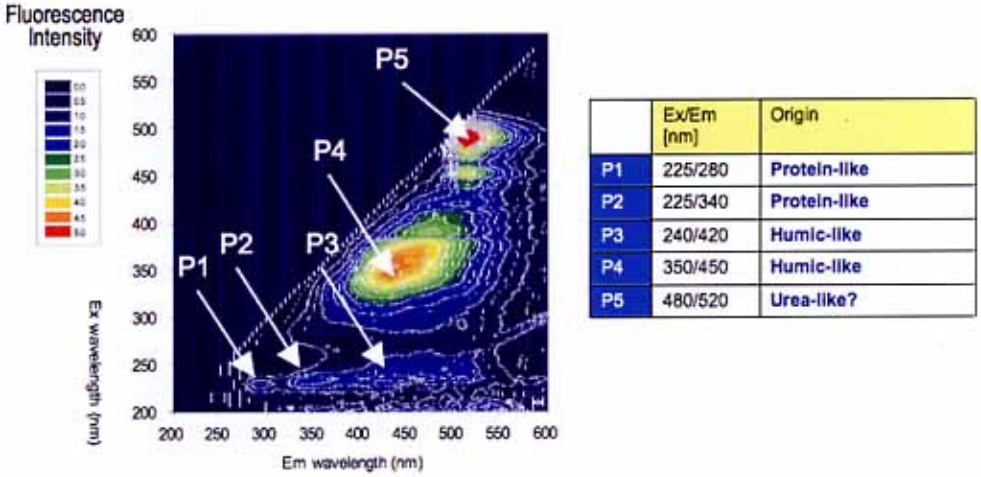
Earth's crust, respectively. In this equation, Al is hypothesized to originate exclusively from crustal materials. Therefore, EFs close to 1 indicate that the metal originates from weathering of Earth's crust, and EFs between 1 and 10 suggest the influence of the chemical composition of local soil. Those between 10 and 500 denote moderate enrichment, indicating sources in addition to crustal materials, and those greater than 500 are clear evidence of extreme enrichment, indicating severe contamination due to human activities. The EFs differed slightly among the five sites, but the orders of the metals when arranged according to their EFs were almost the same regardless of site (Fig. 2). Metals other than Fe were more enriched in rainwater than in Earth's crust. The concentrations of Mn in rainwater were correlated with those of Al ($r > 0.80$, $P < 0.001$), and the EFs of Mn were almost equivalent to the ratio of $(Mn/Al)_{river}/(Mn/Al)_{crust}$ (≈ 12), where $_{river}$ denotes common river water. Therefore, Mn enrichment might have occurred mainly by leaching of Mn preceding Al from crustal materials (soil dust). Other metals enriched in rainwater, i.e. Cu, Ag, In, Sn, and Bi (EFs: 10–500), and Zn and Sb (EFs: ≥ 500), are likely to be of anthropogenic origin, because all had larger EFs in rainwater than in river water (data not shown), and their concentrations in rainwater were mostly correlated with each other ($r > 0.45$, $P < 0.001$).

Characterization of recalcitrant dissolved organic matter in lake water

A steady increase in recalcitrant dissolved organic matter (DOM) has been observed in several lakes in Japan and may represent a new type of lake water pollution. The accumulation of recalcitrant DOM in lake water—a phenomenon that has not been considered before—will clearly influence the way in which lakes must be managed for environmental protection. It also presents a serious challenge for drinking water management, because recalcitrant DOM could be a major precursor of the trihalomethane produced during chlorination in water treatment. Therefore, detailed evaluation of the characteristics of DOM in lake water is urgently needed.

Three-dimensional excitation emission matrix (EEM) fluorescence spectroscopy has recently come into more common use for evaluating the characteristics of DOM in aquatic environments. The EEM is constructed by sequential and simultaneous determination of three fluorescence parameters: excitation wavelength, emission wavelength, and intensity of fluorescence. We applied this EEM spectroscopy to the characterization of DOMs derived from Lake Kasumigaura, its main inflowing rivers, and several types of sewage treatment plant effluents.

We observed substantial differences in the peak profile of EEM among the DOM samples. Five peaks were found in the EEM of the sewage treatment plant effluent (Excitation wavelength/Emission wavelength [nm/nm], Ex/Em = 225/280, 225/340, 240/420, 350/450, and 480/520 (Fig. 3). Peak 1 at 225/280 nm and Peak 2 at 225/340 nm have respectively been assigned as protein-like (tyrosine-like) and protein-like (tryptophan-like) fluorophores. Both Peak 3 and Peak 4 have been categorized as humic-like fluorophores. Peak 5, at 480/520 nm, has not been reported in natural water samples and thus was characteristic of the sewage treatment plant: both the influent and effluent at the sewage treatment plant displayed a substantial intensity of Peak 5. Only Peaks 3 and 4 were observed in the EEMs of the lake and river water samples, with Peak 4 predominating.



	Ex/Em (nm)	Origin
P1	225/280	Protein-like
P2	225/340	Protein-like
P3	240/420	Humic-like
P4	350/450	Humic-like
P5	480/520	Urea-like?

Fig. 3 Excitation emission matrix contour plot of sewage treatment plant effluent. The dimension used for fluorescence intensity is RU (Raman units)·nm^{-1}·L·[mg C]$^{-1}$. At right are the peak positions of the fluorophores and their fluorescence types.

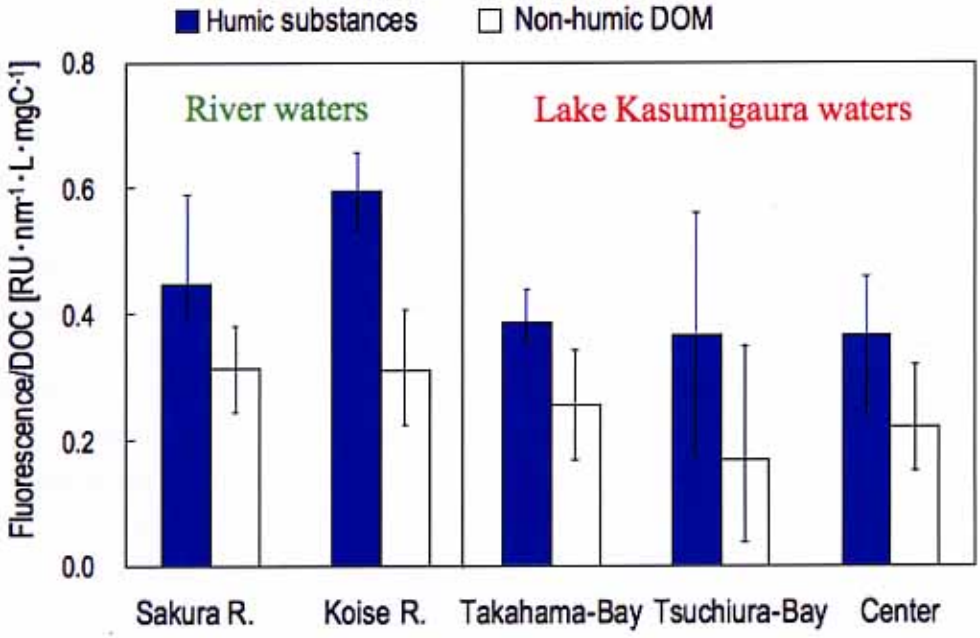


Fig. 4 Fluorescence intensities over DOC ratios of Peak 4 for the humic (aquatic humic substances) and non-humic (hydrophilic) fractions of DOM in Lake Kasumigaura and its inflowing rivers. Four samples were collected for each river and 12 samples were from each site in the lake. The Sakura River enters Lake Kasumigaura at Tsuchiura Bay, and the Koise River empties into Takahama Bay. Error bars represent ± 1 SD of the mean.

No study to date has ever described "humic-like" fluorescence (Peaks 3 and 4) as being derived from aquatic humic substances in DOM. Moreover, no work has confirmed that there is no substantial intensity of "humic-like" fluorescence in the EEM of the non-humic fractions of DOM. Hence, virtually nothing is known in regard to whether or not the "humic-like" Peaks 3 and 4 in the DOM are derived only from aquatic humic substances. To clarify this ambiguity, we fractionated DOM samples from the lake and river waters into humic and non-humic fractions by adsorption chromatography with XAD-8 resin. We then determined the fluorescence intensity in the EEMs of the humic and non-humic fractions. Peak 4 (350/450 nm) was found in both the humic and non-humic fractions of all samples. The non-humic fraction contributed greatly to the fluorescence of DOM Peak 4, accounting for 30% to 50% of its intensity. Our results clearly suggest that Peak 4 at Ex/Em = 350/450 is not appropriate as an indicator of the presence of "humic-like" groups in DOM (Fig. 4).

Evaluating the effects of anthropogenic change in the discharge of land-based N, P, and Si to the coastal marine ecosystem

Ecological deterioration in the form of outbreaks of harmful algal blooms or jellyfish swarms has become a concern in Asia's marginal seas and has been attributed to eutrophication, climate change, and overfishing. Other changes in element cycling may also contribute. Whereas loadings of nitrogen (N) and phosphorus (P) are enhanced by human activity, dissolved silicate (DSi) supplied by natural weathering tends to be trapped in reservoirs, the numbers of which are also increasing globally because of increased damming. The consequent change in the N:P:Si stoichiometric ratio of the river waters flowing into coastal seas may be advantageous to flagellates (nonsiliceous and potentially harmful) but not to diatoms (siliceous and mostly benign). This is the "silica deficiency hypothesis". We are trying to develop it further into an extended hypothesis, as follows. Although diatoms effectively draw down substances from the upper layer by sinking after the spring bloom ("biological pump"), other algae do not. This failure to sink causes the retention of surplus nutrients and dissolved organic matter (DOM) in the upper layer and allows non-siliceous algae (flagellates, coccolithophores, etc.) and heterotrophic organisms (bacteria, nanoflagellates, microzooplankton, *Noctilucas*, jellyfish, etc.) to proliferate in summer (cover page). To verify this hypothesis, we performed a study consisting of three components.

First, as this hypothesis is highly interdisciplinary and involves scientific uncertainties, we extensively reviewed the related scientific literature, weighting the results in the same way as IPCC Reports weight the results of reports related to global warming.

Second, we used a ferryboat as a platform to perform a time-series observation of biogeochemical components. We found that the biomass of heterotrophic microorganisms was higher in summer (after most diatoms had sunk after the spring bloom), implying that the material feeding the microbial loop of the food web remained in the upper layer in summer.

Third, we constructed a 1-box, time-dependent marine ecosystem model named the Marine Stoichiometric and Functional Type (MSFT) Model to represent the upper layer of the model estuary in consideration of N:P:Si stoichiometry and the two types of algae: diatoms (silicifiers and fast sinkers) and flagellates (non-silicifiers and slow sinkers). The computed results showed that the case in which we considered a particular sinking response of diatoms as proposed from the culture experiment by Bienfang et al. (1982) (i.e. diatoms sink faster when their nutrients, particularly DSi, are depleted) better explained the results observed in the Seto Inland Sea, where flagellate-induced red tides prevail in summer and diatom-induced blooms prevail in spring. This result implied that not only the nutrient stoichiometry but also the sinking characteristics of diatoms, which are strongly dependent on the ballast-like function of their silicified frustules, is important in the maintenance of coastal marine ecosystems.

These three results, although they are in the still preliminary phase, are consistent with our extended silica deficiency hypothesis.

Bienfang, P. K. *et al.* (1982): Sinking rate response to depletion of nitrate, phosphate and silicate in four marine diatoms, Mar. Biol. 67, 295-302.

Environmental Biology Division

Seasonal changes of Watarase wetland. Left: mid-April, a month after burning. Middle: early July, when tall grasses exceed 4 m in height. Right: December, when aboveground parts of grasses are dead.

An aerial view of northeastern part of Watarase wetland.

Swertia diluta, an endangered species growing in Watarase wetland.

The mission of the Environmental Biology Division is to help conserve biodiversity and ecosystem functions. In the pursuit of this mission, our activities include ecological, physiological, and molecular genetic studies. The division consists of four sections: Population Ecology, Physiological Ecology, Microbial Ecology, and Ecological Genetics.

Studies of the conservation of threatened species

We surveyed vegetation in the Watarase Wetland (see cover page), the largest wetland on the main island of Japan, to develop methods of predicting the distribution of endangered plants from information obtained from aerial photographs. In this wetland, standing dead plants are all burned by controlled fire in March every year. Plant height (Fig. 1), obtained as the difference in surface heights between April and August, was effective in discriminating *Imperata cylindrica* grassland, in which endangered species such as *Inula britannica* and *Swertia diluta* occur. Analysis of the vegetation cover in May indicated the presence of early-leafing plants. The presence of those plant species is also effective in discriminating different vegetation types.

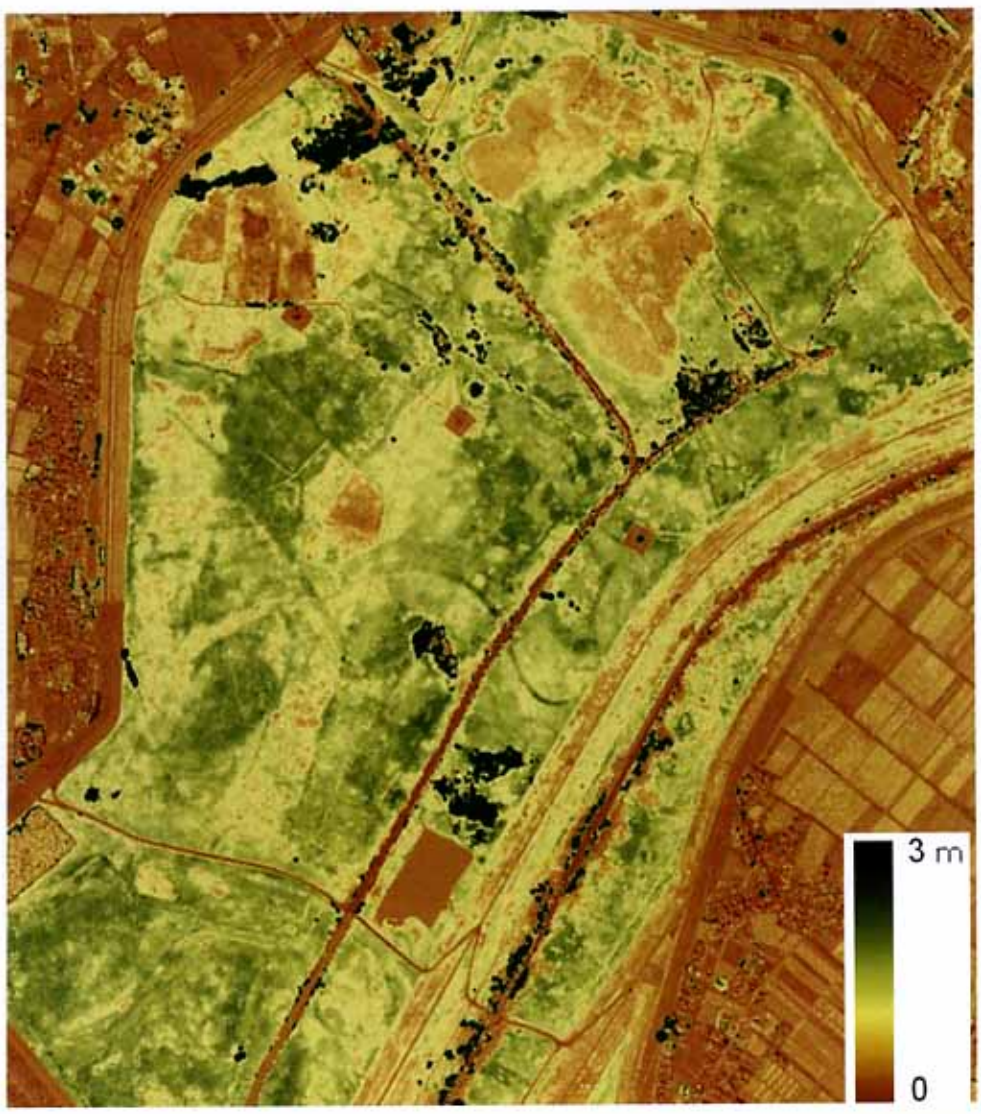


Fig. 1 Distribution of the height of vegetation cover in the Watarase wetland, estimated from aerial photographs.

Fig. 2 Larvae of *Cricotopus ogasaseptimus*, a chironomid species endemic to the Bonin Islands. Chironomid larvae live mainly in fresh water and can be an indicator of the status of water environment. Vertical bar = 1 mm.

The chironomids are a large group of small insects of the Diptera. Chironomid larvae live mainly in fresh water and are thought to indicate the status of freshwater ecosystems. In 2006, we examined the habitats of endemic chironomids in the Bonin Islands, an archipelago in the Pacific Ocean. Little is known about the ecology of freshwater animals in the Bonin Islands. We collected larvae from various habitats and confirmed the habitats of several species. Our collection of *Glyptotendipes* species on Hahajima Island was the first record of this genus in the Oceania region. We also studied in detail the morphologies of the larvae and pupae of endemic chironomids (Fig. 2).

Studies of invasive alien species and genetically modified organisms

Millions of tonnes of genetically modified (GM) or "transgenic" agricultural products have been generated, of which about one-fifth is oilseed rape (*Brassica napus* L.) seed. It has been estimated that about half of such imports into Japan are resistant to one of the two herbicides glyphosate and glufosinate, and it is probable that some of these imported seeds are dispersed during their transport in Japan. Propagation of escaped GM oilseed rape was confirmed along a road on the Kanto Plain. Among them were plants that were resistant to both types of herbicide. This indicates that two types of escaped GM plant had crossbred and produced viable seeds.

To assess the impact of GM soybean on the natural environment, we grew herbicide-tolerant GM soybean, wild soybean, and their F_1 hybrid in a closed greenhouse and recorded flowering time, plant height, stem diameter, stem length, and seed production (Fig. 3). The characteristics of the F_1 hybrid were similar to those of either parent or intermediate between them. No specific effect of the introduced gene was recognized.

Fig. 3 Experiment to measure the growth of herbicide-tolerant GM soybean, wild soybean, and their hybrids. The plants were grown in a closed greenhouse to prevent their seeds and pollen from being released into the environment.

Fig. 4 *Stenomelania boninensis* (left), a snail species endemic to the Bonin Islands, is suspected of being threatened by the alien snail species *Melanoides tuberculata* (right), which has invaded Chichi-jima, one of the Bonin Islands.

In a survey of freshwater and brackish water macroinvertebrate fauna in the Bonin Islands, the alien thiarid snail *Melanoides tuberculata* was found for the first time on Chichi-jima (Fig. 4). As this species is known to be invasive and reproduces by parthenogenesis, it is a great threat to *Stenomelania boninensis*, a native thiarid snail endemic to the Bonin Islands.

Studies of the effects of environmental stresses and climate change

Monitoring of the effects of climate warming on natural ecosystems was continued in the alpine region of central Japan and on the Qinghai-Tibetan plateau. In the latter area, two monitoring sites were established, at Dongxiong and Haibei (Fig. 5). Observations of meteorological data and ecosystem structure and function were started. In addition, ecosystem biomass, carbon balance, and species diversity were investigated along a road covering 1200 km of the central Plateau.

Fig. 5 A set of climate-monitoring devices installed at 5200 m a.s.l. on the Qinghai-Tibetan plateau. A series of such monitoring points has been installed along an altitudinal gradient to detect climate change.

We tried to identify and characterize the genes related to the responses of plants to environmental stress factors. We studied the physiological characteristics of an ozone-sensitive mutant of the model plant species *Arabidopsis thaliana*. The apertures of the stomata (small openings in the surfaces of leaves for gas exchange) were larger in the ozone-sensitive mutant than in the wild type. This suggests that an increase in ozone absorption through the wider stomata is the cause of the ozone sensitivity of this mutant.

By sampling leaves of cultivated *Ipomoea nil* (morning glory) plants when ozone concentrations were high, we detected the expression of two defense-related genes, *PAL* and *GST*, by molecular genetic techniques. This result suggests that the detection of ozone-induced stress from the expression of ozone-responsive genes is promising. Development of a simple system for detecting the expression of these stress-induced genes is the next task.

Chattonella is a well-known genus of poisonous phytoplankton that cause red tides, resulting in mass mortalities of fish. We developed genetic markers specific to four *Chattonella* species, *C. antiqua*, *C. marina*, *C. ovata*, and *C. marina* (Fig. 6). The genetic markers will be valuable tools in studies of *Chattonella* species, e.g., in biogeographic studies of the distribution history of natural populations.

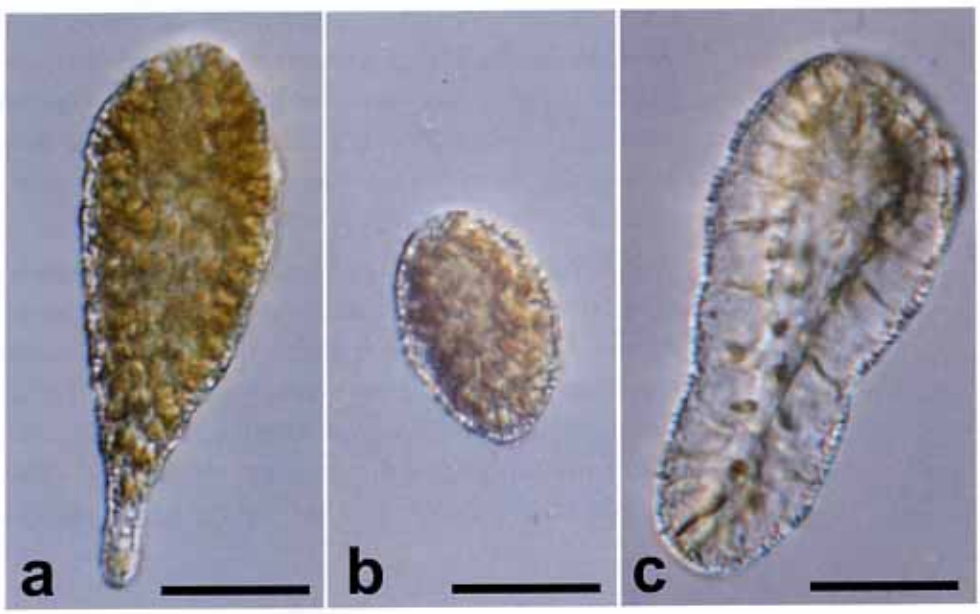


Fig. 6 Three poisonous phytoplankton: (a) *Chattonella antiqua*, (b) *C. marina*, and (c) *C. ovata*. We developed genetic markers of these species to distinguish populations of different origin. Bars = 5 μm.

Studies of the structure and function of ecosystems

Yatsu Tidal Flat in the Kanto district is in the Ramsar List of Wetlands of International Importance. One of the concerns about this tidal flat is the green tide formed by *Ulva* spp. algae. In our investigations of various environmental factors and the components of the ecosystem (Fig. 7), we have found evidence of a recent expansion of the area of sandy sediment on the tidal flat and a decrease in the muddy area. This change in physical conditions has been associated with changes in the biological components of the tidal flat ecosystem, such as in the macrobenthos.

Fig. 7 Field survey on Yatsu Tidal Flat. In this area, frequent occurrences of green tides of *Ulva* spp. have been observed. We suspect that these tides are due to the recent development of a sewerage system, which has reduced freshwater inflow and, as a consequence, increased water salinity.

The vulnerability of ecosystems to biological invasion was investigated with a computer simulation. A model ecosystem evolved without the invasion of alien species, as would be the case in an ecosystem on an oceanic island, showed a high animal species to plant species ratio. Such a system was highly vulnerable to plant invasion. This result agrees with the available data from real insular ecosystems. The vulnerability increased as the model ecosystem developed. The system was constantly vulnerable to the invasion of competitive omnivores.

The trophic position of higher-order consumer animals in an ecosystem can be estimated from the stable isotope composition of the ecosystem. In a study of fish populations, we found that the trophic position of fish upstream was lower in a river with weirs than in a river without weirs. We also found that the genetic distances among fish populations within a river were larger when the river had weirs. This indicates that there is limited gene flow within rivers with weirs. Thus, obstacles in a river affect both the structure of the food web and the genetic structure of fish populations.

Laboratory of Intellectual Fundamentals for Environmental Studies

A: The Kureko Dori: an endangered domestic fowl breed in the Kureko region of Kumamoto Prefecture in Kyushu, Japan. With strict screening criteria, the Kureko Dori was designated a prefectural natural treasure in 1965.

B: Environmental Specimen Bank: after excision of stingray liver *in situ*, coarse and fine crushing, bottling, and cryo-preservation in cold vapor of N_2 (< –150 °C) over liquid N_2.

C: Environmental Certified Reference Materials (CRMs) produced at NIES. Information on NIES-CRMs can be found at <http://www.nies.go.jp/labo/crm-e/index.html>.

The Laboratory of Intellectual Fundamentals for Environmental Studies (LIFES) consists of two research laboratories: the Environmental Analytical Chemistry Laboratory (ACLab) and the Biological Resource Laboratory (BRLab). The aim of LIFES is to promote environmental research, not only in NIES but all over the world, through the provision of environmental Certified Reference Materials, cell strains of microbes, and experimental animals for environmental risk evaluation, and the development of information databases related to environmental biology. In addition to the major topics summarized below, both laboratories conduct research activities that have both fundamental and frontier themes.

ACLab has been studying on evaluation of the quality assurance and quality control (QA/QC) of environmental monitoring; developing new environmental analysis methods; and comparing monitoring methods for regulating atmospheric substances. Recently, comparison of monitoring methods for various atmospheric particles (i.e. correlation between beta-ray absorption methods and a tapered element oscillating microbalance method; Fig. 1). A part of the results is useful to the monitoring and presurmise of Asian dust storms (*kosa*). We have also developed imprinted polymers with molecular-specific adsorption, which led us to discover four antifungal peptides from a Thai strain of the cyanobacterium *Calothrix* sp.

Fig. 1 Parallel comparison test for atmospheric particle monitoring instruments – beta-ray absorption monitors (middle), tapered-element oscillating microbalance instruments (rear), low-volume samplers (front).

BRLab has been working on several topics based on biotechnology. With the aim of developing new technologies in the field of bioscience, we are studying germline stem cells (primordial germ cells) in the Amniota (mainly in the Aves). We have made germline chimeras by the transplantation of primordial germ cells, and have obtained offspring originating from the introduced primordial germ cells by backcross analysis. We are now trying to put this method to practical use for the proliferation of threatened bird species. Our techniques should be useful in cleaning up infections transmitted via eggs and in the recovery of populations from inbreeding depression by the transplantation of primordial germ cells in the early embryonic stages (Fig. 2). In September and October we conducted a short training course on avian cell culture for foreign researchers. The purpose of the course was to disseminate information on techniques for avian cell culture and the cryopreservation of living avian cells. The participants came from Russia, Korea, and China, and a total of eight researchers participated (Fig. 3).

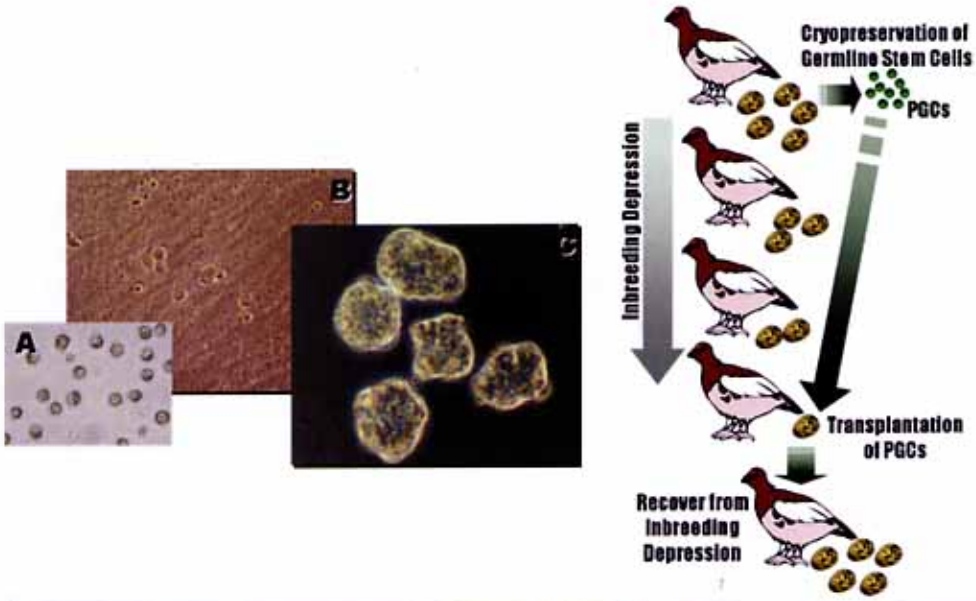


Fig. 2 Left: *In vitro* long-term culture of chick primodial germ cells (PGCs).
A: Isolated PGCs at the early embryonic stage.
B: Initial phase of PGC cultivation on feeder cells.
C: PGC clusters after 2 weeks' incubation.

Right: Utilization of frozen germline cells.

Fig. 3 Russian participants in a training course on techniques of avian cell culture and cryopreservation of living avian cells.

LIFES functions as a reference laboratory for environmental research in Japan through improving methods of ensuring analytical quality control and cross-checking of analytical techniques; and improving methods of classifying and culturing microalgae and other laboratory organisms, and preserving and supplying those organisms to provide standards for classification, standard strains for bioassay tests, and strains with special functions.

Management and operation of key analytical equipment

The ACLab has been working to improve the sensitivity and accuracy of analysis of environmental specimens at NIES and has been managing and operating commonly used key analytical equipment. An on-demand analysis service has been established and is operated by personnel technically trained in the use of 10 instruments. Over 50 researchers made requests for analyses on about 30 research themes, and we provided them with useful data derived under a high level of quality control.

Preparation of environmental Certified Reference Materials

Environmental Certified Reference Materials (CRMs) are utilized for the evaluation of new analytical methods and for accuracy control of pretreatment and instrumental analyses. We have been preparing and distributing environmental and biological CRMs since 1980 (see half-title page). Over 180 CRMs were distributed to researchers worldwide this financial year; the "rice flour, unpolished" CRM was the one most often delivered. Preparation of a new urban aerosol CRM was completed, and the next step of determining certified values for over 15 elements in the aerosol was started.

Long-term storage of environmental samples (environmental specimen bank)

We continued to collect and prepare environmental samples for long-term, low-temperature storage as part of our expanded program to make samples available for retrospective analysis of pollutants. Our environmental specimen time capsule facility accommodates various items of equipment for low-temperature preparation of environmental specimens for long-term storage. The facility can store such specimens for 50 years under an atmosphere of liquid nitrogen vapor at about –150 °C. About 300 samples were added to storage this year; the total number of time-capsule samples registered is now about 1200 (Fig. 4).

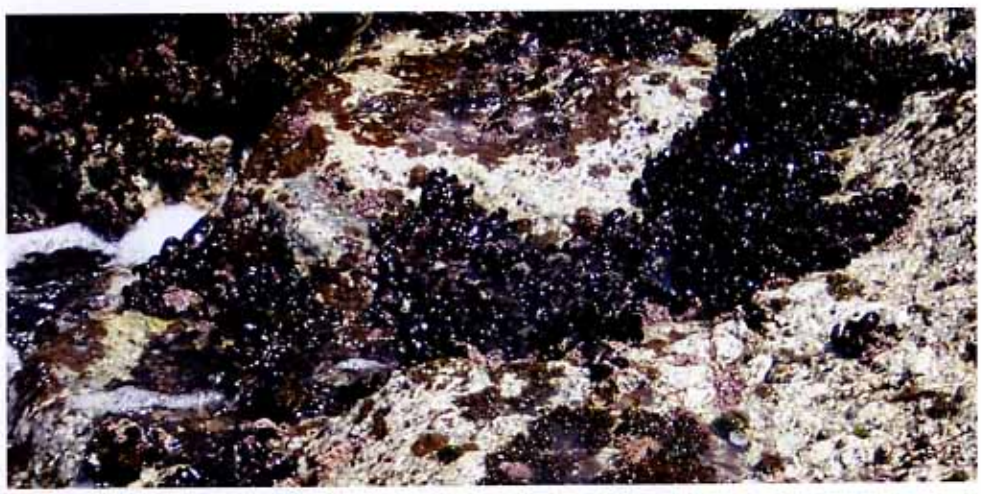


Fig. 4 The black mussel, *Septifer virgatus*, a filter-feeding bivalve on intertidal rocks, was collected for cryopreservation.

Preservation of cells and gene resources of threatened wildlife species

(1) Threatened wild animals

In the hope of making future contributions to the conservation of threatened wild animals, we cryopreserve the cells (including germline cells) and tissues of such animals for genetic analysis, with the support of the National Time Capsule Program for the Environment and Threatened Wildlife. Six hundred and forty-five kinds of samples (tissues, cultured cells, and sperm) had been cryopreserved up until March 2006. From April 2006 to March 2007, we accepted 180 individual threatened wild animals (mammalian species: 12 individuals; avian species: 168 individuals) and cryopreserved tissues and cultured cells. During this period, 466 kinds of samples (tissues and cultured cells) were cryopreserved. The newly cryopreserved species are as follows: Ussuri whiskered bat (*Myotis mystacinus gracilis*), Ussuri Daubenton's bat (*Myotis daubentonii ussuriensis*), Japanese long-eared bat (*Plecotus auritus sac-*

rimontis), Japanese lesser tube-nose bat (*Murina ussuriensis silvatica*), short-tailed albatross (*Diomedea albatrus*), Latham's snipe (*Gallinago hardwickii*), black woodpecker (*Dryocopus martius martius*), little tern (*Sterna albifrons sinensis*), Canada goose (*Branta canadensis leucopareia*), black-winged stilt (*Himantopus himantopus*), intermediate egret (*Egretta intermedia intermedia*), shelduck (*Tadorna tadorna*), peregrine falcon (*Falco peregrinus japonensis*), bean goose (*Anser fabalis serrirostris*), white-naped crane (*Grus vipio*), and osprey (*Pandion haliaetus haliaetus*). In total, 1111 kinds of samples have been cryopreserved since the National Time Capsule Program was started in 2004 (Fig. 5).

Fig. 5 The Okinawa rail (*Gallirallus okinawae*), a threatened Japanese endemic species.

(2) Threatened algae

We have been surveying the status of threatened algal species in Japan since 1995. During FY 2006 we surveyed 40 potential habitats (agricultural reservoirs) of the Charales in Kagawa Prefecture. Members of the Charales grew at 27 of the sites. We found one to three species at 23 sites, and four, five, six, and seven species at one site each. Most reservoirs were located in hilly places (Fig. 6), habitats different from those reported during 1940 to 1960. Now, 60 strains of the Charales and 200 strains

Fig. 6 Three species of *Chara* were reported from this reservoir in the 1980s. In 2006, however, those species could not been found, and two species of *Nitella* were found instead. Left: the natural shore of the reservoir. Right: colonies of *Nitella* on the shore.

of freshwater red algae are maintained in the Biological Resource Collection at NIES. Ten of the strains of the Charales are unialgal. Sixty-two of the strains of red algae are preserved in liquid nitrogen.

Investigation, collection, and storage of microbes useful for environmental conservation and development of laboratory organisms

At the Microbial Culture Collection (MCC-NIES), we:

- received 174 strains of microbes from scientists inside and outside NIES
- received about 350 strains from the IAM Collection at the University of Tokyo as a result of its closure
- transferred 29 strains of cyanobacteria and green algae from maintenance by subculture to freezing (they are now entirely preserved in liquid nitrogen)
- distributed 780 algal strains to researchers and technicians
- continued to renew the MCC database system.

We now maintain a total of more than 2000 strains, of which more than 1700 are available as NIES strains. These activities are conducted in collaboration with five institutes as a part of the National Bio-Resource Project.

Environmental Information Center

The Environmental Information Center provides the public with various kinds of environmental information through web sites.

The Environmental Information Center provides information technology (IT) support for research and related activities at NIES; carries out public relations activities for NIES, including the publication of NIES research reports; collects and processes environmental information and disseminates it to the general public; performs tasks commissioned by the Ministry of the Environment; and acts as the national focal point of UNEP-Infoterra. To implement these tasks more efficiently, the Center was reorganized in April 2003.

1. IT support for research and related activities at NIES

The Center manages and operates the computers and related systems at NIES, uses IT to improve the work efficiency of NIES, and runs a library service.

a. Management and operation of computers and related systems

A new computer and network system started operation in March 2007. The UNIX-based computing environment consists of a supercomputer system and various subsystems, including a scalar-computing server, a front-end server, storage devices, and application servers. Our vector supercomputer (NEC SX-8R/128M16), equipped with a FORTRAN compiler with high-level debugging capability and high-efficiency optimization, executes the large-scale programs needed to model global environmental problems.

A LAN called NIESNET was established at NIES in 1992. File transport was upgraded in March 2007. The network configuration was restructured, and the large-scale file transport performance was improved at the same time. Registered users outside NIES can use the supercomputer system through the Tsukuba WAN via the Science Information Network (SINET) connection to the Internet.

b. Use of IT to improve work efficiency

The Center gives IT support to the management sector of NIES, with the aim of increasing work efficiency. It also provides NIES researchers with processed research data and helps them to disseminate their data through the NIES homepage. In FY 2006, the Center supported the following activities:

- development of an electronic application and registration system at NIES
- operation of a thin-client PC management system for the administrative section
- use of XML to modify an automatic typesetting system for issuing the NIES research program and annual report
- modification and operation of a database of basic information on each member of staff at the Institute
- modification of a registration system for a research theme database
- development and modification of a database for information disclosure
- installation and operation of a directory services system
- support for modifications to a processing system for budget and settlement of accounts and a salary payment processing system.

c. Library service

As of March 2007, the NIES library held 51,262 books, 395 technical and scientific serials, 9,688 maps, 119,289 microfiches, and various other reports and reference materials.

In addition to these materials, researchers at NIES can access documentary information through commercial databases such as Web of Science, Science Direct, JDreamII, STN, G-Search, and the British Library Inside Web.

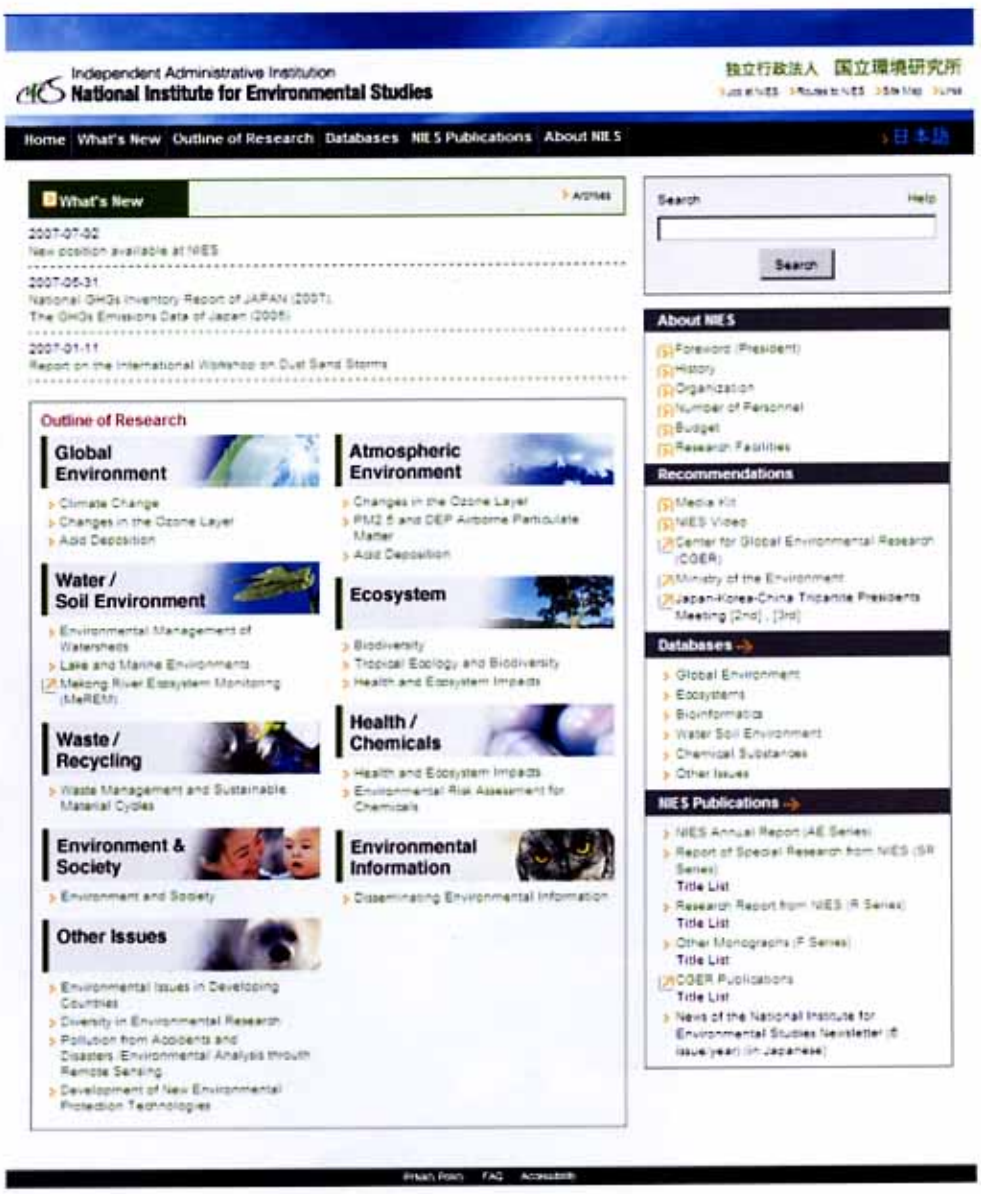
Library facilities include separate rooms for reading books, journals, indexes and abstracts, reports, maps, and microfiches.

2. NIES public relations activities

The Center manages the NIES Worldwide Web (WWW) Internet site, and edits and publishes NIES reports such as research reports and this *Annual Report*.

a. Management of NIES WWW

NIES began to provide public information on its research activities and results via the Internet (http://www.nies.go.jp/) in March 1996. The website was completely renewed and improved in accordance with the restructuring of NIES in April 2001 as an independent administrative institution. Because NIES starts the second stage of its medium-term plan in April 2006, a newly designed website has been prepared in accordance with the new organization and activities. The new site has been designed to have improved usability, including improved accessibility for people with disabilities.



b. Editing and publication of NIES reports

Reports of NIES research activities and results, such as the NIES *Annual Report* and research reports, official newsletters (*NIES News*, in Japanese), and NIES research booklets (*Kankyo-gi*, in Japanese) are edited, published and distributed by the Center.

3. Other activities

In addition to the activities mentioned above, the Center collects, processes, and disseminates environmental information for the general public; conducts tasks commissioned by the Ministry of the Environment; and acts as the national focal point of UNEP-Infoterra.

a. Collection, processing, and dissemination of environmental information

NIES is required to carry out "the collection, processing, and dissemination of environmental information" as one of its major tasks. The Center provides various kinds of environmental information to the public through websites, processes and manages environmental information databases, and provides environmental information via GIS (geographic information systems).

(a-1) EIC Net and Environmental Technology Information Network

The EIC Net (Environmental Information and Communication Network, http://www.eic.or.jp/) provides various kinds of environmental information, such as news and topics on the environment, and a chronology of environmental issues in Japan. This fiscal year, environmental issues in Asia were newly added. The site was updated regularly. The Center opened the Environmental Technology Information Network (ETIN, http://e-tech.eic.or.jp/) in August 2003. The ETIN contains pages of environmental technology news on ministries and companies, research reports and review papers by

environmental specialists, and information on seminars and events in environmental technology. In FY 2004 we improved the homepage of the ETIN and added more menus for easier operation.

At present, these sites are available only in Japanese.

(a-2) Processing and management of environmental information databases

Various environmental data are needed for research, policy decisions, and policy enforcement. The Center compiles and processes air quality and water quality data as monitored by local governments and reported to the Ministry of the Environment. These processed data can be accessed through the database on the NIES WWW. Duplication and lending services are also available.

(a-3) Provision of environmental information via GIS

The Center, with the cooperation of the Ministry of the Environment, has been using GIS to develop an environmental data provision system. This system helps users to easily understand the status of the environment by showing data on environmental quality and other information on maps. The system has been publicly available through the Internet since September 2002.

b. Tasks commissioned by the Ministry of the Environment

In FY 2006 the Center performed the following six tasks commissioned by the Ministry of the Environment:

- Development of an information system for the total management of aquatic environments.
- Management of display systems for wide-area air pollutant surveillance and for pollen observation.
- Maintenance of an information management system for noise, vibration, and offensive odors.
- Analysis of the results of a national survey of aquatic animals.
- Use of GIS to maintain and manage a system for the exhibition of traffic noise survey data.
- Development of a database for investigations of dioxins in all parts of the environment.

c. National focal point of UNEP-Infoterra

UNEP-Infoterra is the global environmental information exchange network of the United Nations Environment Program. The network operates through a system of government-designated national focal points. The Center has been the designated Japanese national focal point since 1975. These focal points provide a wide range of environmental information, including directories of information sources.

One of our staff participated in the international meeting held by UNEP from 13 to 16 April 2004 at Geneva and discussed plans for future activities.

14th International Meeting of the Network for the Detection of Atmospheric Composition Change/ InfraRed Working Group

May 8–10, 2006
Tsukuba International Congress Center
Tsukuba, Japan

This annual meeting focuses on the latest findings and scientific analyses on atmospheric trace constituents, such as ozone, nitric acid, nitrous oxide, carbon dioxide, or methane using infrared remote-sensing technology. More than 30 scientists specializing in fields such as atmospheric physics, chemistry, optics, and spectroscopy from Japan, the USA, Canada, Australia, New Zealand, and Europe met at Tsukuba International Congress Center (Epochal Tsukuba). The latest information on Fourier-transform spectroscopic measurements and data retrievals were discussed. Also, a state-of-the-art technique for retrieving CO_2 mixing ratios precisely from ground-based FTIR was introduced. The next annual meeting will be held in Canary Islands, Spain in May 2007.

3rd Tripartite Presidents Meeting (TPM) among NIES, NIER, and CRAES

May 16–18, 2006
Seogwipo KAL Hotel
Jeju, Korea

This meeting worked to expedite joint efforts in environmental research among Japan, Korea, and China, while seeking further cooperation on issues of common interest. At TPM3, the partnership to improve the environmental quality of Northeast Asia through research cooperation was given particular emphasis. The three institutes reached an agreement to exchange information including annual reports and lists and overviews of major research projects. It can be considered a major breakthrough that the three institutes agreed upon initiating a joint research project to deal with the problem of "yellow sand storms", the degree and extent of which are ever intensifying, threatening the environmental qualities in the region. The three presidents are expecting a feasible plan for the cooperation to be developed at the expert meeting in the autumn of 2006 in China. The next TPM4 will be hosted by CRAES in the spring of 2007.

Asia–Pacific Initiative Toward a Sustainable and Environmentally-Sound Society

May 23, 2006
Hotel Maritim
Bonn, Germany

Countries in the Asia-Pacific region are working to address climate change while undergoing rapid economic growth. At this conference, participants: (1) explored a new model of sustainable development through multi-dimensional discussion on regional policy development, GHG inventory activity, APN cooperation, and the 2050 vision research (2) introduced distinguishing cases of regional activities focusing on different aspects of climate change issues such as policy, inventory of greenhouse gases, scientific research programs, and future scenarios; and (3) identified the best-practices and challenges of regional activities in the Asia-Pacific region.

Tsukuba Workshop on the Application of Multimedia Models for the Identification of Persistent Organic Pollutants in East Asian Countries

June 27–28, 2006
Tsukuba International Congress Center
Tsukuba, Japan

The purpose of the workshop was to provide information and training on the application of multimedia models for identification of persistent organic pollutants (POPs) in the East Asian region and to provide opportunities for training on and discussion of the "OECD P_{ov} and LRTP Screening Tool" software which was developed by the OECD Expert Group on Multimedia Models for screening level assessments of chemicals. The workshop had around 40 participants and it was a agreed that the training and discussions at the workshop were useful regarding the use of a multimedia fate model for the screening assessment of chemicals in terms of P_{ov} and LRTP.

First International Conference on Carbon Management at Urban and Regional Levels

September 4–8, 2006
Metropolitan Autonomous University
Mexico City, Mexico

The conference developed a comprehensive analysis of city/regional net emissions trajectories and their underlying drivers and explored possible management strategies and the best timing for implementation to foster the development of less carbon intense pathways of regional/urban development. The conference was attended by total of 114 experts working in this field and was successful in forming a community that can work together to develop urban and regional carbon management (URCM) further. The conference outlined a road-map to be pursued by the URCM scientific community over the next three to four years.

Symposium on 10th Anniversary of the Accelerator Mass Spectrometry Facility at NIES (NIES-TERRA)

Oct 19, 2006
NIES
Tsukuba, Japan

A one-day symposium was held in commemoration of the first decade of research activities involving the Accelerator Mass Spectrometry (AMS) Facility at NIES-TERRA. Following the opening speech by Dr. Ohtsuka, President of NIES, participants heard presentations on AMS activities at NIES-TERRA over the first 10 years, the detection of radio-nuclides from the Sun, and the latest AMS system developments. A poster presentation was also held, with 21 posters on display.

Commemorative Symposium on the Conclusion of a Comprehensive Partnership Agreement between the National Institute for Environmental Studies and Yokohama National University

Impacts of Socioeconomic Development on Ecosystems: Harmonization of Nature and Millennium Ecosystem Assessment

October 23, 2006
Tokyo International Forum
Tokyo, Japan

This symposium was held to commemorate the comprehensive partnership agreement made between the National Institute for Environmental Studies and Yokohama National University and the publication of the "Ecosystems and Human Well-Being" report by the United Nations. The symposium advocated the further development of research on ecosystems and risk management in Japan and progress in research on Asian environmental issues.

Global Challenges toward Low Carbon Society (LCS) through Sustainable Development (SD)

NIES/MoEJ/DEFRA COP12 & COP/MOP2 Side Event

November 8, 2006
Acacia in the World Agroforestry Center (ICRAF), UN Office at Nairobi (UNON)
Nairobi, Kenya

This side event offered an opportunity to discuss strategies with a particular emphasis on policy packages for the transition to a Low-Carbon Society (LCS). Researchers engaged in LCS studies from China, Germany, India, South Africa, the UK and Japan discussed how to align climate change and sustainable development action, tools and methods to delineate options for cost-effective transition to an LCS, cooperation for LCS including a long-term policy-framework. The outcome of the Japan-UK joint research project, "Developing Visions for a Low-Carbon Society through Sustainable Development", was presented in the event.

Co-benefits of Greenhouse Gas and Air Pollution Management

UNFCCC COP-12 Side Event

November 15, 2006
Acacia in the World Agroforestry Center (ICRAF), UN Office at Nairobi (UNON)
Nairobi, Kenya

This session, as a side event of UNFCCC COP12, explored opportunities of co-benefits and CDM in the context of climate change and air pollution management. The session concluded with the idea that there is a need to scale-down global actions which are usually tailored to the greenhouse gas reduction community, and at the same time there is a need to scale-up the actions which are locally tailored by the urban management community that deals with urban planning, air pollution control, and transport management.

NIES Commemorative Lectures by the Blue Planet Prize Winners

November 17, 2006
NIES
Tsukuba, Japan

Dr. Akira Miyawaki and Dr. Emil Salim, winners of the 15th Blue Planet Prize who made outstanding contributions to providing solutions to global environmental problems, gave special lectures to NIES Researchers and local residents of Tsukuba.

Workshop on Material Flows and Environmental Impacts Associated with Massive Consumption of Natural Resources and Products

November 17, 2006
Tsukuba International Congress Center
Tsukuba, Japan

This workshop was held to share information on the latest policy and institutional actions for sustainable use of natural resources and material flow analysis in the international context and to discuss the research results on material flow analysis. There were ten presentations including six invited foreign experts and around 200 participants. The participants reconfirmed that, in exploring sustainable natural resources use, it is significant to exchange information and knowledge between exporting and importing countries. They also reconfirmed of the usefulness of the "cradle to grave" approach in the management of material flow.

The 3rd NIES Workshop on E-waste

November 17–18, 2006
Tsukuba International Congress Center (Epochal Tsukuba)
Tsukuba, Japan

This workshop was held in order to understand the current regional and global issues of E-waste and to seek appropriate 3R policies in light of latest information. Nineteen speeches were given by nine invited speakers from Asia and Europe, and by representatives of NIES and other institutions in Japan. Participants discussed several important aspects of E-waste such as toxic and resource potentials, inventories, reuse and Extended Producer Responsibility (EPR).

International Workshop on Regional Ecology and its Environmental Effect: Dust Sand Storm, its Impact and Mitigation Countermeasure

December 3–5, 2006
Diaoyutai Hotel & Beijing Capital Xindadu Hotel
Beijing, China

This workshop was organized by the Chinese Research Academy of Environmental Sciences (CREAS) with the National Institute for Environmental Studies (NIES) of Japan and the National Institute of Environmental Research (NIER) of Korea. It was held as a side event of the Eighth Tripartite Environment Ministers Meeting (TEMM8). Three environmental ministers and three presidents of environmental research institutes in China, Japan and Korea were present at the workshop, and confirmed that dust sand storms (DSS), which have the potential to cause great damage in the northeast Asian region, should be identified as an issue for cooperation among the three countries. Approximately 100 people from Japan, China, Korea, and Mongolia participated in the workshop. Research presentations and debates focused on a wide range of issues including evolvement, transportation and monitoring of DSS, simulation modeling and prediction/warning, physical and chemical characteristics and transformation, the impact of regional ecosystem changes on the occurrence of DSS, the environmental impact of DSS, and preventative measures and technologies. The expert meeting for cooperation related to DSS was held following the workshop.

International Workshop on Institutional Dimensions of Carbon Management at the Urban and Regional Levels

December 5–7, 2006
Grand Hyatt Bali Hotel
Bali, Indonesia

This one day workshop explored the theoretical framework of fit, scale and interplay applied in the contexts of urban and regional carbon management and clarified the practical dimensions of institutional challenges related to carbon management. The workshop discussed city case studies from Europe, USA, China, and Latin America and explored urban carbon management opportunities from a development perspective. The workshop identified research gaps, new research directions and ideas in institutional dimensions of carbon management to be further pursued.

Quantifying Energy Scenarios of a Low Carbon Society – The Annual Energy Modelling Conference (AEMC) of the UK Energy Research Centre

December 5–7, 2006
Oxford University
United Kingdom

The 2006 Annual Energy Modelling Conference (AEMC) of the UK Energy Research Centre (UKERC) focused on *Quantifying Scenarios of a Low Carbon Society*. It was a technical workshop on modeling low carbon scenarios. A particular emphasis was put on participation from developing countries. The workshop defined common modeling runs which is a direct research output to the 2 nd UK-Japan workshop on low carbon societies (LCS) in June 2007. These events represent a core part of the Japan–UK Joint Research Project: Developing Visions for a Low-Carbon Society (LCS) through Sustainable Development.

2nd Asian Water Cycle Symposium

January 9–10, 2007
Koshiba Hall, University of Tokyo
Tokyo, Japan

The 2nd Asian Water Cycle Symposium discussed the activities of the Asian Water Cycle Initiative (AWCI), and the possibilities of effective collaboration among local/national water resources management and meteorological authorities and institutions, international organizations, and space agencies, which is essential for implementation of the demonstration projects. Furthermore, this symposium explored respective proposals for the demonstration projects on nominated river basins in individual countries.

GEOSS Symposium on Integrated Observation for Sustainable Development in the Asia–Pacific Region

January 11–12, 2007
Dai-ichi Hotel Seafort
Tokyo, Japan

The goals of this symposium were (1) to present information on the progress of GEOSS implementation to a wide audience of government officials, experts, scientists, and the public and press from Asia–Pacific countries, (2) to summarize the current situation regarding in-situ networks, satellite capabilities, model predictability, and data integration, and (3) to discuss future plans for filling the observational gaps, avoiding duplication, and creating socio-economic benefits. Participants concluded the symposium with a renewed understanding of the importance of applying observational systems and models to the earth system model and integrating data management systems. Furthermore, the participants stressed the necessity of combining these data with socio-economic data, visualization, and the functions of simulation and communication.

1st Workshop on the Improvement of Solid Waste Management and the Reduction of GHG Emissions in Asia (SWGA)

January 18–19, 2007
Yokohama Symposia
Yokohama, Kanagawa, Japan

In order to exchange knowledge and experiences and to show methods for achieving sustainable solid waste management in Asia, researchers and experts on solid waste management and GHG reduction activities from China, Korea, Thailand, Indonesia, Mongolia and Vietnam discussed the characteristics of solid waste management in Asia and the applicability of the IPCC guidelines to Asian landfills. One of the conclusions was that there is still a need for more precise quantity data on specific waste streams in Asian countries. It was also agreed that the topic of the next workshop will be technologies for improving waste management and reducing GHG emissions.

Environmental Nanotechnology International Workshop

February 9–10, 2007
The National Museum of Emerging Science and Innovation (Miraikan)
Tokyo, Japan

The R&D Project for Environmental Nanotechnology was consigned to the National Institute for Environmental Studies by the Ministry of the Environment in 2003. The research is focused on the beneficial application of nanotechnology in environmental issues, an area that is not well-recognized nor well understood. The purpose of the workshop was to improve comprehension of this issue among researchers in companies and universities, and also to emphasize the possible opportunities to improve the current environmental situation.

International Workshop on Carbon Dynamics and Global Warming on the Qinghai–Tibetan Plateau

March 2–3, 2007
NIES
Tsukuba, Japan

This workshop aimed at identifying the contribution of the alpine grassland of the Qinghai–Tibetan Plateau to the terrestrial carbon cycle and global warming. The workshop represented studies carried out over the last 6 years. The workshop also discussed the current on-going studies regarding global warming monitoring on the plateau.

International Workshop on Urbanization, Development Pathways, and Carbon Implications

March 28–30, 2007
NIES
Tsukuba, Japan

This workshop helped to clarify the status quo of urbanization phenomena and their drivers in relation to carbon management. The workshop gathered people from key institutions working on global scale analyses of the urbanization phenomenon involving both the integrated assessment community and urban energy and urban dynamics analyses. The workshop assessed how urbanization is treated in integrated assessment models and discussed the insights that can be gained from different approaches. The workshop was successful in developing a preliminary network of scholars interested in the analysis and modeling of urban and regional development pathways and scenarios and their carbon consequences.

COUNTRY
No. Title
Collaborating Institution
NIES Partner (as of latest review meeting)

CANADA

1. Elucidation of the cycling and transformation of chemical substances in the North Pacific Ocean
   Dept. Chemistry, University of British Columbia
   Environmental Chemistry Division
2. Monitoring of the atmosphere–ocean carbon dioxide exchange rate
   Center for Ocean Climate Chemistry, Institute of Ocean Sciences
   Global Environment Division

CHINA

1. Advanced wastewater treatment processes for China
   Research Institute for Environmental Engineering/Dept. Environmental Engineering, Tsinghua University
   Research Center for Material Cycles and Waste Management
2. Advanced sewage treatment processes by soil system applicable to China
   Institute of Applied Ecology, Chinese Academy of Sciences
   Research Center for Material Cycles and Waste Management
3. Development of wastewater and water resources treatment processes applicable to China
   Chinese Research Academy of Environmental Sciences
   Research Center for Material Cycles and Waste Management
4. Research on the development of water pollution control techniques for the Taihu Lake in China by bio-eco engineering
   Chinese Research Academy of Environmental Sciences
   Research Center for Material Cycles and Waste Management
5. Dioxin analysis and survey of dioxin sources in China
   Sino–Japan Friendship Center for Environmental Protection
   Environmental Chemistry Division
6. Development of eco-engineering technologies for the control of eutrophication in the drainage area of Hongfeng Lake and Baihua Lake in Guizhou, China
   Guizhou Provincial Environmental Protection Bureau
   Research Center for Material Cycles and Waste Management
7. Study on transport mechanism of *kosa* aerosol to Japan by way of Beijing
   Sino–Japan Friendship Center for Environmental Protection
   Environmental Chemistry Division
8. Research on development of suitable technologies to control greenhouse gas emissions during the treatment of domestic wastewater using bio-eco engineering system
   Shanghai Jiao Tong University
   Research Center for Material Cycles and Waste Management
9. Molecular epidemiological studies on the health effects of arsenic
   Institution of Environmental Health and Engineering, Chinese Academy of Preventive Medicine
   Environmental Health Sciences Division
10. Research on VOCs and ammonia emissions in China
    Chinese Research Academy of Environmental Science
    Atmospheric Environment Division
11. Studies on techniques to control emission of acid precursors in East Asia and evaluation of impact of their application on the environment
    State Environmental Protection Administration
    Atmospheric Environment Division

CZECH REPUBLIC

1. Biogeochemical studies on acid deposition and pollution
   Institute of Landscape Ecology, Czech Academy of Sciences
   Atmospheric Environment Division
2. Perception of landscape: from landscape appreciation to landscape planning
   Institute of Landscape Ecology, Czech Academy of Sciences
   Social and Environmental Systems Division

FRANCE

1. A molecular biological study of mechanisms of environmental adaptation in plants
   University of Picardie
   Environmental Biology Division
2. Biodiversity of microalgae obtained from the Atlantic and Pacific Oceans
   University of Caën
   Environmental Biology Division

KOREA

1. Aircraft- and ground-based observations of acidic and oxidative pollution in East Asia
   Environment Research Center, Korean Institute of Science and Technology
   Atmospheric Environment Division
2. Cross-cultural comparison of landscape evaluation between Japanese and Korean people
   Kyung Pook University
   Social and Environmental Systems Division
3. Study on the monitoring of harmful algal blooms and effects of nitrogen and phosphorus
   National Institute of Environmental Research
   Research Center for Material Cycles and Waste Management
4. Study on marine pollution using ships-of-opportunity
   Korea Ocean Research and Development Institute
   Water and Soil Environment Division
5. Research on the prevention and management of environmental disease
   National Institute of Environmental Research
   Environmental Health Sciences Division

POLAND

1. Molecular mechanisms of plant adaptation to atmospheric stresses
   Plant Breeding and Acclimatization Institute
   Biodiversity Conservation Research Project

RUSSIA

1. Airborne measurement of greenhouse gases over Siberia
   Central Aerological Observatory
   Center for Global Environmental Research
2. Modeling of methane emission rates from natural wetlands
   Institute of Microbiology
   Center for Global Environmental Research
3. Measurement of methane emission rates from permafrost areas
   Permafrost Institute
   Center for Global Environmental Research
4. Greenhouse gases budget of land ecosystems in Siberia
   Institute of Microbiology, Russian Academy of Sciences
   Center for Global Environmental Research
5. Greenhouse gas monitoring to estimate sink and source distribution in West Siberia
   Institute of Atmospheric Optics
   Center for Global Environmental Research
6. Conservation of genetic resources in wild animals in Khabarovsk region
   Russian Federation, Ministry of Natural Resources, Bolonski State Natural Reserve Laboratory
   Laboratory of Intellectual Fundamentals for Environmental Studies

SWEDEN

1. Measurement of pCO_2 in the surface water of the Arctic Ocean
   Göteborg University
   Climate Change Research Project
2. Health risk assessment of heavy metal exposure: effects of increase in human activity
   Karolinska Institute
   Environmental Health Sciences Division

UK

1. Cooperation on the development and application of coupled chromatography – accelerator mass spectrometry techniques
   University of Oxford
   Environmental Chemistry Division

USA

1. Joint implementation of ocean surface CO_2 observation in the Pacific Ocean to understand the oceanic sink of CO_2
   Pacific Marine Environmental Laboratory, NOAA
   Climate Change Research Project
2. Collaboration on greenhouse gas observation from space
   Jet Propulsion Laboratory
   Center for Global Environmental Research
3. Joint implementation of CO_2 flux observations for the identification of carbon fixation ability of forests and the prediction of its fluctuation
   DOE
   Center for Global Environmental Research
4. Comparative, standardized and complementary measurement of atmospheric constituents for the evaluation of terrestrial/oceanic sources and sinks of carbon, other non-CO_2 greenhouse gases and aerosols
   Climate Monitoring and Diagnostics Laboratory, NOAA
   Center for Global Environmental Research

CANADA	Agreement between the National Institute for Environmental Studies and the Institute of Ocean Sciences (1995).
CHINA	Memorandum of Understanding (MoU) between the Changjiang Water Resources Commission, Ministry of Water Resources, People's Republic of China, and the NIES for collaborative research on developments of monitoring systems and mathematical management model for environments in river catchments (1997).
	MoU between the NIES and the Chinese Research Academy of Environmental Sciences (CRAES), People's Republic of China, for collaborative research on advanced treatment of domestic wastewater (1997).
	MoU between Northwest Plateau Institute of Biology (NPIB), Chinese Academy of Sciences, P. R. China, and NIES for collaborative research on global warming effects and carbon budget in alpine grassland ecosystems (2001).
CHINA & KOREA	Third Tripartite Presidents' Meeting among NIES, National Institute of Environmental Research (NIER), Korea, and CRAES joint communique (2006).
INDIA	MoU between Anna University, Chennai, India, and the NIES for collaborative research on atmospheric science (2006).
INDONESIA	MoU between the Research and Development Center for Biology, Indonesian Institute of Sciences (RDCP-LIPI), Bogor, Indonesia, and the NIES concerning scientific and technical cooperation on biodiversity and forest fires (2001).
KOREA	Agreement between the NIES and the NIER to establish a cooperative framework regarding endocrine-disrupting chemicals research (1999).
MALAYSIA	MoU between the Forest Research Institute Malaysia (FRIM), the Universiti Pertanian Malaysia (UPM), and the NIES for collaborative research on tropical forests and biodiversity (amended in 2003).
RUSSIA	Agreement on a joint geochemical research program—Impact of Climatic Change on Siberian Permafrost Ecosystems—between the Permafrost Institute Siberian Branch, Russian Academy of Sciences, Russia, and the NIES (1992).
	Agreement on cooperative research project between the Central Aerological Observatory, Committee for Hydrometeorology and Monitoring of Environment, Ministry of Ecology and Natural Resources, Russian Federation, and the NIES (1992).
	Agreement on cooperative research projects between the NIES, Ministry of the Environment and the Institute of Atmospheric Optics, Russian Academy of Sciences (1997).
	Agreement on cooperative research project between the Institute of Solar–Terrestrial Physics (ISTP), Siberian Branch, Russian Academy of Science, and the NIES.
UN	MoU referring to the establishment and operation of a GRID-compatible center in Japan (1991).

Host Division

Researcher, COUNTRY, Research Period
Research Subject (Host Researcher)

Center for Global Environmental Research

Shukla, Priyadarsh R., INDIA, 2006.7.03–2007.3.31
Development of AIM/India for analyzing countermeasures to climate change (Kainuma, M.)

Research Center for Material Cycles and Waste Management

Choi, Ki-In, KOREA, 2006.4.25–2006.10.31
Studies on assessment methodology for environmental safety of secondary products (Osako, M.)

Fan, Bin, CHINA, 2006.4.01–2007.3.31
Informal landfill's remediation and groundwater contamination control (Inoue, Y.)

Kim, Juhyun, CHINA, 2006.4.03–2007.3.31
Development of nitrogen, phosphorus removal, recovery system for stock farm wastewater treatment (Inamori, Y.)

Kong, Hainan, CHINA, 2006.12.11–2007.3.31
Development of bio-eco engineering for advanced treatment and energy recovery from liquid waste such as domestic wastewater (Inamori, Y.)

Li, Yu-You, CHINA, 2006.10.11–2007.3.31
Development of hydrogen–methane fermentation system for waste biomass (Inamori, Y.)

Wang, Yanhua, CHINA, 2006.5.12–2007.3.31
Development of clean energy recovery processes based on hydrogen fermentation of biomass (Inamori, Y.)

Zhang, Jixiang, CHINA, 2006.12.6–2007.3.31
Modeling and evaluation of plant–soil purification processes as eco-engineering (Inamori, Y.)

Research Center for Environmental Risk

Alissara, Reungsang, THAILAND, 2006.4.01–2007.3.31
Bioassay of river sediments and comparative study with high resolution GC-MS (Suzuki, N.)

Cho, Hongbin, CHINA, 2006.8.01–2007.3.31
Research on the relation between geographical distribution of human exposure and environmental levels for dioxins (Suzuki, N.)

Ha, Kyong, KOREA, 2006.4.01–2006.10.20
Prey–predator interaction focused on cyanobacterial toxin production (Takamura, N.)

Jang, Min-Ho, KOREA, 2006.4.01–2006.9.03
Changes in toxin production by cyanobacteria exposed to food-web components (Takamura, N.)

Lee, Jeong Hoon, KOREA, 2006.5.12–2007.3.31
Responses of fishes caused by marine environmental stressors at population/community levels (Horiguchi, T.)

Li, Chunmei, CHINA, 2006.6.06–2007.3.31
Studies on the endocrine disrupter chemicals isolated from diesel exhaust particles (DEP) (Suzuki, A.)

Manila, Sedqyar, AFGANISTAN, 2006.6.06–2007.3.31
Study of endocrine control of the gonad in Japanese quail (Suzuki, A.)

Prasetiati, Maria Angela Novi, INDONESIA, 2006.4.01–2007.3.31
Bioassay of river sediments and comparative study with high resolution GC–MS (Suzuki, N.)

Asian Environment Research Group

Lun, Xiaoxiu, CHINA, 2006.4.01–2007.3.31
Studies on organic aerosols transported from East Asia (Hatakeyama, S.)

Qiu, Guoyu, CHINA, 2006.6.12–2007.3.31
Response of garden bryophytes and lichens to global warming and its monitoring with thermal image (Shimizu, H.)

Social and Environmental Systems Division

Arnberger, Arne, AUSTRIA, 2006.4.01–2006.4.19
Development of a measuring system to estimate the crowding by photo montage (Aoki, Y.)

Lee, Lyong-Tae, CHINA, 2006.4.01–2006.9.30
Mitigation of thermal stress by large restoration of inner-city river (the Cheong-Gye Stream in Seoul) (Ichinose, T.)

Sha, Weiming, CHINA, 2006.4.01–2007.3.31
Development of non-hydrostatic numerical models for the geophysical fluid dynamics of the global and regional atmosphere (Ichinose, T.)

Shu, Jiong, CHINA, 2006.9.25–2007.3.22
Research and comparisons on urban heat island in Shanghai and Tokyo (Ichinose, T.)

Yang, Yufang, CHINA, 2006.4.01–2007.3.31
Establishment of long-term monitoring on ecosystem in an international river in Asia (Ichinose, T.)

Zhang, Xiaoxi, CHINA, 2006.7.12–2007.3.31
Assessment of environmental protection countermeasures in Shenyang City, China (Masui, T.)

Environmental Health Sciences Division

Chen, Xueqing, USA, 2006.5.22–2006.7.20
Speciation of arsenic metabolites in biological fluids (Hirano, S.)

Tin-Tin-Win-Shwe, MYANMAR, 2006.4.01–2007.3.31
Analysis of the effect of nanoparticles on the neuron–immune axis by using a push–pull perfusion technique (Kobayashi, T.)

Atmospheric Environment Division

Griesfeller, Alexandra, GERMANY, 2006.4.01–2007.3.31
Studies of stratospheric trace species by comparison of ILAS-II and ground-based FTIR measurements (Nakajima, H.)

Griesfeller, Jan Juergen, GERMANY, 2006.4.01–2007.3.31
A research on stratospheric minor constituents by using ground-based Fourier-transform spectrometer data (Nakajima, H.)

Schutgens, Nicolaas Alexander Johannes, GERMANY, 2006.7.3–2007.3.31
A study of aerosol and cloud properties using GOSAT/CAI (Higurashi, A.)

Vaidyanathan, Venkatesan, INDIA, 2006.6.01–2007.3.31
Spectroscopic studies of the formation of secondary organic aerosol compounds (Imamura, T.)

Zhou, Libo, CHINA, 2006.4.01–2007.3.31
A study on ozone trend in the northern hemisphere using a chemical climate model (Akiyoshi, E.)

Water and Soil Environment Division

Ayoub, Sameh Reyad, EGYPT, 2006.4.01–2007.3.31
Study on remediation techniques of soil and groundwater pollution with hazardous chemicals (Inaba, K.)

Guo, Hong, CHINA, 2006.5.08–2007.3.31
Characterization of dissolved organic matter in lake (Imai, A.)

Yoochatchaval, Wilasinee, THAILAND, 2006.5.08–2007.3.31
Study on methane fermentation technology for low strength wastewater treatment (Shutsubo, K.)

Environmental Biology Division

An, Ping, CHINA, 2006.4.01–2007.3.31
A pilot study in North East Asia for developing desertification assessment and constructing an early warning system – land vulnerability assessment by soil/vegetation/hydrological analysis (Shimizu, H.)

Chen, Jin, CHINA, 2006.10.1–2007.2.28
A study on the instantaneous and large-scale estimation of carbon absorption on the Qinghai–Tibetan plateau (Tang, Y.)

Cho, Kyoungwon, KOREA, 2007.2.20–2007.3.31
Proteomics and genomics of ozone induced changes in a cereal crop genome model, the rice cultivar Nipponbare (Kubo, A.)

Li, Cui, CHINA, 2006.7.03–2007.3.31
Genetic diversity of *Potentilla fruticosa* in relation to elevation change on the Qinghai–Tibetan Plateau (Tang, Y.)

Li, Renhui, CHINA, 2006.1.10–2007.3.10
Taxonomic and phylogenetic studies on toxic waterbloom-forming cyanobacteria (Kasai, F.)

Luo, Tianxiang, CHINA, 2006.11.10–2007.2.10
A modeling study on the effects of global warming on the soil carbon storage on the Qinghai–Tibetan Plateau (Tang, Y.)

Rakwal, Randeep, INDIA, 2006.7.10–2007.3.31
Systematic analysis of molecular responses of plants to air pollutants (Kubo, A.)

Laboratory of Intellectual Fundamentals for Environmental Studies

Lee, Christina Slimming, ENGLAND, 2006.4.01–2006.6.30
Determination of fundamental properties of the NIES Certified Reference Materials (Nishikawa, M.)

Adachi T., Satoh M., Pramanik R., Kuroda S., Ishido M., Imoto M., 2007, Region-dependent differences and alterations of protective thiol compound levels in cultured astrocytes and brain tissues, Biol. Pharm. Bull., 29(7), 1466–1469.

Ahmed S., Tin-Tin-Win-Shwe, Yamamoto S., Tsukahara S., Kunugita N., Arashidani K., Fujimaki H., 2007, Increased hippocampal mRNA expression of neuronal synaptic plasticity related genes in mice chronically exposed to toluene at a low-level human occupational-exposure, Neurotoxicology, 28, 168–174.

Aikawa M., Hiraki T., Tamaki M., Kasahara M., Kondo A., Uno I., Mukai H., Shimizu A., Murano K., 2006, Field survey of trans-boundary air pollution with high time resolution at coastal sites on the Sea of Japan during winter in Japan, Environ. Monit. Assess., 122, 61–79.

Akimoto H., Ohara T., Kurokawa J., Horii N., 2006, Verification of energy consumption in China during 1996–2003 by using satellite observational data, Atmos. Environ., 40, 7663–7667.

Akiyoshi H., Sugata S., Yoshiki M., Sugita T., 2006, Ozone decrease outside Arctic polar vortex due to polar vortex processing in 1997, J. Geophys. Res., 111, D22311.

Alexandrov G. A., Yamagata Y., 2006, A peaked function for modeling temperature dependence of plant productivity, Ecol. Modell., 200(1/2), 189–192.

Andersen S. B., Weatherhead E. C., Stevermer A., Austin J., Bruhl C., Fleming E. L., Grandpre de J., Grewe V., Isaksen I., Nagashima T. et al., 2006, Comparison of recent modeled and observed trends in total column ozone, J. Geophys. Res., 111, D02303.

Aoki T., Yokota T., Inoue G., Nobuta K., Kotani A., 2007, Information and disturbances contained in the reflected solar radiation spectra measured with space-borne Fourier transform spectrometer for greenhouse gas mapping, Proc. SPIE, 6405, 640506.

Aoki Y., 2006, Different effects of the people's attributes on the preference and perceived naturalness of diverse vegetation in the South Japan Alps, J. Environ. Inf. Sci., 34(5), 81–85.

Aoki Y., 2006, A historical review on landscape studies in team of psychological evaluation, Landscape planning for Russia: results and prospects 2006, 37–46.

Aono M., Wakiyama S., Nagatsu M., Nakajima N., Tamaoki M., Kubo A., Saji H., 2006, Detection of feral transgenic oilseed rape with multiple-herbicide resistance in Japan, Environ. Biosafety Res., 5(2), 77–87.

Arao K., Ishizaka I., Sugimoto N., Matsui I., Shimizu A., Mori I., Nishikawa M., Aoki K., Uchiyama A., Yamazaki A., Togowa H., Asano J., 2006, Yellow sand dust event on 13 April 2003 over Western Kyusyu, Japan, SOLA, 2, 100–103.

Arao K., Nishikawa M., Hatakeyama S., Takami A., Matsuyama S., Hayasaka T., 2006, Atmospheric turbid conditions due to fine particles in recent years at Nagasaki, Japan, J. Environ. Stud., Nagasaki Univ., 9(1), 23–30.

Arimoto T., Inoue K., Yanagisawa R., Mason R. P., Takano H., 2006, Diesel exhaust particles synergistically enhance lung injury and oxidative stress induced by bacterial endotoxin, J. Clin. Biochem. Nutr., 38, 133–137.

Becker P. R., Gunter E. W., Schluter C., Shibata Y., Wise S. A., 2006, Environmental specimen banking, J. Environ. Monit., 8, 776–778.

Cai Y., Ng P. K. L., Shokita S., Satake K., 2006, On the species of Japanese atyid shrimps (Decapoda: Caridea) described by William Stimpson (1860), J. Crustacean Biol., 26(3), 392–419.

Chen P.-J., Linden K. G., Hinton D. E., Kashiwada S., Rosenfeldt E. J., Kullman S. W., 2006, Biological assessment of bisphenol A degradation in water following direct photolysis and UV advanced oxidation, Chemosphere, 65, 1094–1102.

Choi K.-I., Lee D.-H., Osako M., Kim S.-C., 2007, The prediction of PCDD/DF levels in wet scrubbers associated with waste incinerators, Chemosphere, 66, 1131–1137.

Cui X., Wakai T., Shirai Y., Hatakeyama K., Hirano S., 2006, Chronic oral exposure to inorganic arsenate interferes with methylation status of p16INK4a and RASSF1A and induces lung cancer in A/J mice, Toxicol. Sci., 91(2), 372–381.

Cui X., Wakai T., Shirai Y., Yokoyama N., Hatakeyama K., Hirano S., 2006, Arsenic trioxide inhibits DNA methyltransferase and restores methylation-silenced genes in human liver cancer cells, Human Pathol., 37, 298–311.

Deguchi Y., Toyoizumi T., Masuda S. Yasuhara A., Mohri S., Yamada M., Inoue Y., Kinae N., 2007, Evaluation of mutagenic activities of leachates in landfill sites by micronucleus test and comet assay using goldfish, Mutat. Res., 627, 178–185.

Dewanti L., Watanabe C., Sulistiawati, Ohtsuka R., 2006, Unexpected changes in blood pressure and hematological parameters among fasting and nonfasting workers during Ramadan in Indonesia, Eur. J. Clin. Nutr., (60), 877–881.

Dirmeyer P. A., Gao X., Zhao M., Guo Z., Oki T., Hanasaki N., 2006, GSWP2 multimodel analysis and implications for our perception of the land surface, Bull. Am. Meteorol. Soc., 87(10), 1381–1397.

Doi T., Sato S., Sato J., 2007, Atmospheric concentration of ^{210}Pb in East Asia and its contribution to Japanese islands by long-range transport, Radioisotopes, 56(3), 115–130.

Eguchi N., Kodera K., 2007, Impact of the 2002, Southern Hemisphere, stratospheric warming on the tropical cirrus clouds and convective activity, Geophys. Res. Lett., 34(5), L05817.

Ejiri M. K., Terao Y., Sugita T., Nakajima H., Yokota T., Toon G. C., Sen B., Wetzel G., Tabaka T., Machida T. et al., 2006, Validation of the Improved Limb Atmospheric Spectrometer-II (ILAS-II) Version 1.4 nitrous oxide and methane profiles, J. Geophys. Res., 111, D22S90.

Emori S., 2006, The reliability of future climate change projectiom by high-resolution climate models, Global Environ. Res., 10(2), 143–149.

Eyring V., Butchart N., Waugh D. W., Akiyoshi H., Austin J. et al., 2006, Assessment of temperature, trace species, and ozone in chemistry-climate model simulations of the recent past, J. Geophys. Res., 111, D22308.

Eyring V., Harris N. R. P., Rex M., Shepherd T. G., Fahey D. W., Amanatidis G. T., Austin J., Chipperfield M. P., Dameris M., Nagashima T. et al., 2005, A strategy for process-oriented validation of coupled chemistry-climate models, Am. Meteorol. Soc., 86, 1117–1133.

Falandysz J., Nose K., Ishikawa Y., Lukaszewicz E., Yamashita N., Noma Y., 2006, HRGC/HRMS analysis of chloronaphthalenes in several batches of halowax 1000, 1001, 1013, 1014 and 1099, J. Environ. Sci. Health A, 41(10), 2237–2255.

Fang J., Brown S., Tang Y., Nabuurs G-J., Wang X., Shen H., 2006, Overestimated biomass carbon pools of the Northern mid-and high latitude forests, Clim. Change, 74, 355–368.

Feng H., Yamaki K., Takano H., Inoue K., Yanagisawa R., Yoshino S., 2006, Suppression of Th1 and Th2 immune responses in mice by sinomenine, an alkaloid extracted from the Chinese medicinal plant Sinomenium acutum, Planta Medica, 72, 1383–1388.

Fine T., Leskinen P., Isobe T., Shiraishi H., Morita M., Marks R. S., Virta M., 2006, Luminescent yeast cells entrapped in hydrogels for estrogenicendocrine disrupting chemical biodetection, Biosensors Bioelectron, 21, 2263–2269.

Flandysz J., Nose K., Ishikawa Y., Lukaazewicz E., Yamashita N., Noma Y., 2006, Chloronaphthalenes composition of several batches of halowax 1051, J. Environ. Sci. Health A, 41(3), 291–301.

Fransson A., Chierici M., Nojiri Y., 2006, Increased net CO_2 outgassing in the upwelling region of the southern Bering Sea in a period of variable marine climate between 1995 and 2001, J. Geophys. Res., 111, C08008.

Fujibe T., Saji H., Watahiki W. K., Yamamoto K. T., 2006, Overexpression of the radical-induced cell death1 (RCD1) gene of Arabidopsis causes weak rcd1 phenotype with compromised oxidative-stress responses, Biosci. Biotechnol. Biochem., 70, 1827–1831.

Fujimaki H., Kurokawa Y., Yamamoto S., Satoh M., 2006, Distinct requirements for interleukin-6 in airway inflammation induced by diesel exhaust in mice, Immunopharmacol. Immunotoxicol., 28, 703–714.

Fujimaki H., Yamamoto S., Tin-Tin-Win-Shwe, Hojo R., Sato F., Kunugita N., Arashidani K., 2007, Effect of long-term exposure to low-level toluene on airway inflammatory response in mice, Toxicol. Lett., 168, 132–139.

Fujino J., Nair R., Kainuma M., Masui T., Matsuoka Y., 2006, Multi-gas mitigation analysis on stabilization scenarios using aim global model, Energy J., 343–353.

Fujita H., Samejima H., Kitagawa N., Mitsuhashi T., Washio T., Yonemoto J., Tomita M., Takahashi T., Kosaki K., 2006, Genomic-wide screening of dioxin-responsive genes in fetal brain: bioinfomatic and experimental approaches, Cong. Anom., 46, 135–143.

Fujitani Y., Hasegawa S., Fushimi A., Kondo Y., Tanabe K., Kobayashi S., Kobayashi T., 2006, Collection characteristics of low-pressure impactors with various impaction substrate materials, Atmos. Environ., 40, 3221–3229.

Fujitani Y., Ideno Y., Fushimi A., Tanabe K., Kobayashi S., Kobayashi T., 2007, Generation of nanoparticles of lubricating motor oil for inhalation studies, Aerosol Sci. Technol., 41(1), 14–23.

Furukawa K., Hoshino T., Tsuneda S., Inamori Y., 2006, Comprehensive analysis of cell wall-permeabilizing conditions for highly sensitive fluorescence in situ hybridization, Microbes Environ., 21(4), 227–234.

Furukawa K., Noda N., Tsuneda S., Saitou T., Itayama T., Inamori Y., 2006, Highly sensitive real-time PCR assay for quantification of toxic cyanobacteria based on microcystin synthetase A gene, J. Biosci. Bioeng., 102(2), 90–96.

Furusawa T., Ohtsuka R., 2006, Inter-household variations in subsistence strategies within a rural society of Roviana, Solomon Islands: An analysis of agricultural production and cash income in relation to socio-demographic factors, Tropics, 15(1), 29–37.

Griesfeller A., Griesfeller J., Hase F., Kramer I., Loes P., Mikuteit S., Raffalski U., Blumenstock T., Nakajima H., 2006, Comparison of ILAS-II and ground-based FTIR measurements of O_3, HNO_3, N_2O, and CH_4 over Kiruna, Sweden, J. Geophys. Res., 111, D11S07.

Hanaoka T., Kainuma M., Kawase R., Matsuoka Y., 2006, Emissions scenarios database and regional mitigation analysis: a review of post-TAR mitigation scenarios, Environ. Econ. Policy Stud., 7(3), 367–389.

Hanasaki N., Kanae S., Oki T., 2006, A global river discharge simulation taking into account water withdrawal and reservoir operations, J. Hydrosci. Hydraul. Eng., 24(2), 53–63.

Harada N., Ahagon N., Sakamoto T., Uchida M, Ikehara M., Shibata Y., 2006, Rapid fluctuation of alkenone temperature in the southwestern Okhotsk Sea during the past 120 ky, Global Planet. Change, 53, 29–46.

Hasegawa A., Emori S., 2007, Effect of air-sea coupling in the assessment of CO_2-induced intensification of tropical cyclone activity, Geophys. Res. Lett., 34, L05701.

Hasegawa S., Wakamatsu S., Ohara T., Itano Y., Saitoh K., Hayasaki M., Kobayashi S., 2006, Vertical profiles of ultrafine to supermicron particles measured by aircraft over Osaka metropolitan area in Japan, Atmos. Environ., 41(4), 717–729.

Hashimoto A. H., Amanuma K., Hiyoshi K., Takano H., Masumura K-i., Nohmi T., Aoki Y., 2006, In vivo mutagenesis in the lungs of gpt-delta transgenic mice treated intratracheally With 1, 6-Dinitropyrene, Environ. Mol. Mutagen., 47, 277–283.

Hayasaki M., Sugata S., Tanaka H. L., 2006, Interannual variation of cold frontal activity in spring in Mongolia, J. Meteorol. Soc. Jpn, 84(3), 463–475.

Higa A., Kasai F., Kawachi M., Kumano S., Sakayama H., Miyashita M., Watanabe M. M., 2007, Seasonality of gametophyte occurrence, maturation and fertilization of the freshwater red alga *Thorea okadae* (Thoreales, Rhodophyta) in the Kikuchi River, Japan, Phycologia, 46, 160–167.

Hirai N., Nanba A., Koshio M., Kondo T., Morita M., Tatarazako N., 2006, Feminization of Japanese medaka (*Oryzias latipes*) exposed to 17β-estradiol: Formation of testis-ova and sex-transformation during early-ontogeny, Aquatic Toxicol., 77, 78–86.

Hirai N., Nanba A., Koshio M., Kondo T., Morita M., Tatarazako N., 2006, Feminization of Japanese medaka (*Oryzias latipes*) exposed to 17β-estradiol: Effect of exposure period on spawning performance in sex-transformed females, Aquatic Toxicol., 79, 288–295.

Hirano S., Kobayashi Y., 2006, Cytotoxic effects of S-(dimethylarsino)-glutathione: A putative intermediate metabolite of inorganic arsenicals, Toxicology, 227, 45–52.

Hirata R., Hirano T., Mogami J-i., Fujinuma Y., Inukai K., Saigusa N., Yamamoto S., 2005, CO_2 flux measured by an open-path system over a larch forest during snow-covered season, Phyton (Austria), 45, 347–351.

Hirata R., Hirano T., Okada K., Fujinuma Y., Inukai K., Saigusa N., Yamamoto S., 2005, Effects of wind speed and direction on eddy fluxes over a larch plantation, J. Agric. Meteorol., 60(5), 741–744.

Hirobe M., Goda Y., Okayasu Y., Tomita J., Takigami H., Ike M., Tanaka H., 2006, The use of enzyme-linked immunosorbent assays (ELISA) for the determination of pollutants in environmental and industrial wastes, Water Sci. Technol., 54(11/12), 1–9.

Hirota M., Tang Y., Hu Q., Hirata S., Kato T., Mo W., Cao G.,

Mariko S., 2006, Carbon dioxide dynamics and controls in a deep-water wetland on the Qinghai-Tibetan Plateau, Ecosystems, 9, 673–688.

Hiwatari T., Shinotsuka Y., Kohata K., Watanabe M., 2006, Exotic hard clam in Tokyo Bay identified as Mercenaria mercenaria by genetic analysis, Fish. Sci., 72, 578–584.

Horiguchi T., 2006, Masculinization of female gastropod mollusks induced by organotion compounds, focusing on mechanism of actions of tributyltin and triphenyltin for development of imposex, Environ. Sci., 13(2), 77–87.

Horiguchi T., Kojima M., Hamada F., Kajikawa A., Shiraishi H., Morita M., Shimizu M., 2006, Impact of tributyltin and triphenyltin on ivory shell (*Babylonia japonica*) populations, Environ. Health Perspect., 114, 13–19.

Hoshino T., Terahara T., Yamada K., Okuda H., Suzuki I., Tsuneda S., Hirata A., Inamori Y., 2006, Long-term monitoring of the succession of a microbial community in activated sludge from a circulation flush toilet as a closed system, FEMS Microbiol. Ecol., 55, 459–470.

Hosokawa T., Betsuyaku T., Nishimura M., Furuyama A., Katagiri K., Mochitate K., 2007, Differentiation of tracheal basal cells to ciliated cells and tissue reconstruction on the synthesized basement membrane substratum in vitro, Connect. Tissue Res., 48(1), 9–18.

Ichinose T., Sadakane K., Takano H., Yanagisawa R., Nishikawa M., Mori I., Kawazato H., Yasuda A., Hiyoshi K., Shibamoto T., 2006, Enhancement of mite allergen-induced eosinophil infiltration in the murine airway and local cytokine/chemokine expression by Asian sand dust., J. Toxicol. Environ. Health A, 69, 1571–1585.

Ieda T., Kitamori Y., Mochida M., Hirata R., Hirano T., Inukai K., Fujinuma Y., Kawamura K., 2006, Diurnal variations and vertical gradients of biogenic volatile and semi-volatile organic compounds at the Tomakomai larch forest station in Japan, Tellus, 58B(3), 177–186.

Imaizumi Y., Suzuki N., Shiraishi H., 2006, Bootstrap methods for confidence intervals of percentiles from dataset containing nondetected observations using lognormal distribution, J. Chemometrics, 20(1/2), 68–75.

Inaba K., Doi T., Isobe N., Yamamoto T., 2006, Formation of bromo-substituted triclosan during chlorination by chlorine in the presence of trace levels of bromide, Water Res., 40, 2931–2937.

Inamori R., Xu K-Q., Gui P., Ebie Y., Inamori Y., Matsumura M., 2006, Characteristic analysis of the organic substance and nutrient removal and the green house gas emission in the soil treatment systems with aquatic plants, Jpn. J. Water Treat. Biol., 42(4), 185–197.

Inoue K., Takano H., Hiyoshi K., Ichinose T., Sadakane K., Yanagisawa R., Tomura S., Kumagai Y., 2007, Naphthoquinone enhances antigen-related airway inflammation in mice, Eur. Respir. J., 29(2), 259–267.

Inoue K., Takano H., Sakurai M., Oda T., Tamura H., Yanagisawa R, Shimada A., Yoshikawa T., 2006, Pulmonary exposure to diesel exhaust particles enhances coagulatory disturbance with endothelial damage and systemic inflammation related to lung inflammation, Exp. Biol. Med., 231, 1626–1632.

Inoue K., Takano H., Shimada A., Wada E., Yanagisawa R., Sakurai M., Satoh M., Yoshikawa T., 2006, Role of metallothionein in coagulatory disturbance and systemic inflammation induced by lipopolysaccharide mice, FASEB J., 20(3), 533–535.

Inoue K., Takano H., Yanagisawa R, Hirano S., Sakurai M., Shimada A., Yoshikawa T., 2006, Effects of airway exposure to nanoparticles on lung inflammation induced by bacterial endotoxin in mice, Environ. Health Perspect., 114(9), 1325–1330.

Inoue K., Takano H., Yanagisawa R., Hirano S., Ichinose T., Shimada A., Yoshikawa T., 2006, The role of toll-like receptor 4 in airway inflammation induced by diesel exhaust particles, Arch. Toxicol., 80, 275–279.

Inoue K., Takano H., Yanagisawa R., Hirano S., Kobayashi T., Ichinose T., Yoshikawa T., 2006, Effects of organic chemicals derived from ambient particulate matter on lung inflammation related to lipopolysaccharide, Arch. Toxicol., 80, 833–838.

Inoue K., Takano H., Yanagisawa R., Ichinose T., Sakurai M., Yoshikawa T., 2006, Effects of nano particles on cytokine expression in murine lung in the absence or presence of allergen, Arch. Toxicol., 80, 614–619.

Inoue K., Takano H., Yanagisawa R., Sakurai M., Ueki N., Yoshikawa T. (Kyoto Pref. Univ. Med.), 2007, Effects of diesel exhaust particles on cytokine production by splenocytes stimulated with lipopolysaccharide, J. Appl. Toxicol., 27, 95–100.

Irie H., Sugita T., Nakajima H., Yokota T., Oelhaf H., Wetzel G., Saitoh N., Ejiri M. K., Tanaka T., Sasano Y. et al.), 2006, Validation of stratospheric nitric acid profiles observed by Improved Limb Atmospheric Spectrometer (ILAS)-II, J. Geophys. Res., 111, D11S03.

Ishido M., 2007, Melatonin inhibits maneb-induced aggregation of alpha-synuclein in rat pheochromocytoma cells, J. Pineal Res., 42, 125–130.

Ishihama F., Ueno S., Tsumura Y., Washitani I., 2006, Effects of density and floral morph on pollen flow and seed reproduction of an endangered heterostylous herb, Primula sieboldii, J. Ecol., 94, 846–855.

Ishihara I., Ikushima M., Horikawa J., Haraga M., Kawamoto R., Murase C., Tashiro T., Tsutsui Y., Kawashima M., Kasai H., Yamazaki S., Majima Y., Kurokawa Y., 2005, A very low level of magnetic field exposure does not affect a participant's mental fatigue and stress as much as VDT work, J. UOEH, 27(1), 25–40.

Ishimura R., Kawakami T., Ohsako S., Nohara K., Tohyama C., 2006, Suppressive effect of 2,3,7,8-tetrachlorodibenzo-p-dioxin on vascular remodeling that takes place in the normal labyrinth zone of rat placenta during late gestation, Toxicol. Sci., 91(1), 265–274.

Ishizawa M., Chan D., Higuchi K., Maksyutov S., Yuen C., Chen J., Worthy D., 2006, Rectifier effect in an atmospheric model with daily biospheric fluxes: impact on inversion calculation, Tellus, 58B, 447–462.

Isobe T., Serizawa S., Horiguchi T., Shibata Y., Managaki S., Takada H., Morita M., Shiraishi H., 2006, Horizontal distribution of steroid estrogens in surface sediments in Tokyo Bay, Environ. Pollut., 144, 632–638.

Itayama T., Kiji M., Suetsugu A., Tanaka N., Saito T., Iwami N., Mizuochi M., Inamor Y., 2006, On site experiments of the slanted soil treatment systems for domestic gray water, Water Sci. Technol., 53(9), 193–201.

Ito A., 2006, Simulation of glibal terrestrial carbon cycle using the JRA-25 reanalysis as forcing data, SOLA, 2, 148–151.

Ito A., Sasai T., 2006, A comparison of simulation results from two terrestrial carbon cycle models using three climate data sets,

Tellus, 58B, 513–522.
Iwao K., Nishida K., Kinoshita T., Yamagata Y., 2006, Validating land cover maps with Degree Confluence Project information, Geophys. Res. Lett., 33, L23404.
Izumi Y., Tatsuta H., Akimoto S-i., 2006, Isolation of six microsatellite markers from apterous grasshopper *Podisma kanoi* (Orthoptera: Podisminae), Mol. Ecol. Notes, 6, 1067–1069.
Jang M.-H., Ha K., Jung J.-M., Lee Y.-J., Takamura N., 2006, Increased microcystin production of microcystis aeruginosa by indirect exposure of nontoxic cyanobacteria: Potential role in the development of microcystis bloom, Environ. Contam. Toxicol., 76, 957–962.
Jiang H. W., Umezaki M., Ohtsuka R., 2006, Inter-household variation in adoption of cash cropping and its effects on labor and dietary patterns: a study in a Li hamlet in Hainan island, China, Anthropol. Sci., 114, 165–173.
Kabuto M., Nitta H., Yamamoto S., Yamaguchi N., Akiba S., Honda Y., Hagihara J., Isaka K., Saito T., Ojima T. et al., 2006, Childhood leukemia and magnetic fields in Japan: A case-control study ofchildhood leukemia and residential power-frequency magnetic fields in Japan, Int. J. Cancer, 119(3), 643–650.
Kagawa S., Tasaki T., Moriguchi Y., 2006, The environmental and economic consequences of product lifetime extension: empirical analysis for automobile use, Ecol. Econ., 58, 108–118.
Kanda I., Uehara K., Yamao Y., Yoshikawa Y., Morikawa T., 2006, A wind-tunnel study on exhaust gas dispersion from road vehicles—Part 1: Velocity and concentration fields behind single vehicles, J. Wind Eng. Ind. Aerodyn., 94, 639–658.
Kasamatsu J., Shima M., Yamazaki S., Tamura K., Sun G., 2006, Effects of winter air pollution on pulmonary function of school children in Shenyang, China, Int. J. Hyg. Environ. Health, 209, 435–444.
Kashiwada S., Kameshiro M., Tatsuta H., Sugaya Y., Kullman S. W., Hinton D. E., Goka K., 2007, Estrogenic modulation of CYP3A38, CYP3A40, and CYP19 in mature male medaka (*Oryzias latipes*), Comp. Biochem. Physiol. C, 145(3), 370–378.
Kato T., Tang Y., Gu S., Hirota M., Du M., Li Y., Zhao X., 2006, Temperature and biomass influences on interannual changes in CO_2 exchange in an alpine meadow on the Qinghai-Tibetan Plateau, Global Change Biol., 12, 1285–1298.
Kawada H., Tatsuta H., Arikawa K., Takagi M., 2006, Comparative study on the relationship between photoperiodic host-seeking behavioral patterns and the eye parameters of mosquitoes, J. Insect Physiol., 52(1), 67–75.
Kawakami T., Ishimura R., Nohara K., Takeda K., Tohyama C., Ohsako S., 2006, Differential susceptibilities of Holtzman and Sprague-Dawley rats to fetal death and placental dysfunction induced by 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) despite the identical primary structure of the aryl hydrocarbon receptor, Toxicol. Appl. Pharmacol., 212, 224–236.
Kawamoto K., Park K. A., 2006, Calculation of environmental concentration and comparison of output for existing chemicals using regional multimedia modeling, Chemosphere, 63, 1154–1164.
Kawamoto K., Urashima K., 2006, Restration and recovery technologies for illegal dumping of waste pollution, Sci. Technol. Trends Q. Rev., (21), 42–58.
Kawamoto K., Hayasaka T., Uno I., Ohara T., 2006, A correlative study on the relationship between modeled anthropogenic aerosol concentration and satellite-observed cloud properties over East Asia, J. Geophys. Res., 111, D19201.
Kawase R., Matsuoka Y., Fujino J., 2006, Decomposition analysis of CO_2 emission in long-term climate stabilization scenarios, Energy Policy, 2113–2122.
Kaya K., Morrison L. F., Codd G. A., Metcalf J. S., Sano T., Takagi H., Kubo T., 2006, A novel biosurfactant, 2-acyloxyethylphosphonate, isolated from waterblooms of Aphanizomenon flos-aquae, Molecules, 11, 539–548.
Khosrawi F., Muller R., Proffitt M. H., Nakajima H., 2006, Monthly averages of nitrous oxide and ozone for the Northern and Southern Hemisphere high latitudes: A "1-year climatology" derived from ILAS/ILAS-II observations, J. Geophys. Res., 111, D11S11.
Kim Y., Choi W., Lee K.-M., Park J. H., Massie S. T., Sasano Y., Nakajima H., Yokota T., 2006, Polar stratospheric clouds observed by the ILAS-II in the Antarctic region: Dual compositions and variation of compositions during June to August of 2003, J. Geophys. Res., 111, D13S90.
Kimoto M., Yasutomi N., Yokoyama C., Emori S., 2005, Projected changes in precipitation characteristics around Japan under the global warning, SOLA, 1, 85–88.
Kobayashi Y., Hayakawa T., Hirano S., 2007, Expression and activity of arsenic methyltransferase Cyt19 in rat tissues, Environ. Toxicol. Pharmacol., 23, 115–120.
Kobayasi Y., Hayakawa T., Cui X., Hirano S., 2006, The role of glutathione in the metabolism and detoxification of trivalent arsenicals, Biomed. Res. Trace Elements, 17(4), 365–372.
Kodama K., Shiraishi H., Morita M., Horiguchi T., 2006, Verification of lipofuscin-based crustacean ageing: seasonality of lipofuscin accumulation in the stomatopod Oratosquilla oratoria in relation to water temperature, Mar. Biol., 150, 131–140.
Komatsu E., Fukushima T., Shiraishi H., 2006, Modeling of P-dynamics and algal growth in a stratified reservoir-mechanisms of P-cycle in water and interaction between overlying water and sediment, Ecol. Modell., 197, 331–349.
Kondo T., Ebie Y., Noda N., Iwami N., Tsuneda S., Inamori Y., 2006, Evaluation of polyphosphate-accumulating organisms indicators in the Start-Up phase in enhanced biological phosphorus removal process using conventional methods and Microautoradiography-FISH, Jpn. J. Water Treat. Biol., 43(1), 19–29.
Kondo T., Ebie Y., Tsuneda S., Inamori Y., 2007, Characterization of the High-Density bacteria in biological phosphorus removal process by using buoyant density separation, Jpn. J. Water Treat. Biol., 43(1), 51–62.
Koshikawa H., Xu K-Q., Liu Z. L., Kohata K., Kawachi M., Maki H., Zhu M. Y., Watanabe M., 2007, Effect of the water-soluble fraction of diesel oil on bacterial and primary production and the trophic transfer to mesozooplankton through a microbial food web in Yangtze estuary, China, Estuar., Coast. Shelf Sci., 71, 68–80.
Koshikawa-K. M., Takamatsu T., Takada J., Zhu M., Xu B., Chen Z., Murakami S., Xu K-Q., Watanabe M., 2007, Distribution of dissolved and particulate elements in the Yangtze estuary in 1997–2002: Background data before the closure of the Three Gorges Dam, Estuar., Coast. Shelf Sci., 71, 26–36.
Kubo T., Nomachi M., Nemoto K., Sano T., Hosoya K., Tanaka

N., Kaya K., 2006, Chromatographic separation for domoic acid using a fragment imprinted polymer, Anal. Chim. Acta, 577, 1–7.

Kumata H., Uchida M., Sakuma E, Uchida T, Fujiwara K., Tsuzuki M., Yoneda M., Shibata Y., 2006, Compound class specific ^{14}C analysis of polycyclic aromatic hydrocarbons associated with PM_{10} and $PM_{1.1}$ aerosols from residential areas of Suburban Tokyo, Environ. Sci. Technol., 40(11), 3474–3480.

Kume G., Horiguchi T., Gto A., Shiraishi H., Shibata Y., Morita M., Shimizu M., 2006, Seasonal distribution, age, growth, and reproductive biology of marbled sole Pleuronectes yokohamae in Tokyo Bay, Japan, Fish. Sci., 72(2), 289–298.

Kuramochi H., Kawamoto K., 2006, Modification of UNIFAC parameter table Revision 5 for representation of aqueous solubility and 1-octanol/water partition coefficient for POPs, Chemosphere, 63, 698–706.

Kuramochi H., Maeda K., Kawamoto K., 2007, Physicochemical properties of selected polybrominated diphenyl ethers and extension of the UNIFAC model to brominated aromatic compounds, Chemosphere, 67(9), 1858–1865.

Kuramochi H., Nakajima D., Goto S., Kawamoto K., Maeda K., 2007, Water solubility of solid solution of phenanthrene and anthracene mixture, Polycycl. Aromat. Compd., 26, 299–312.

Kurokawa Y., Nitta H., Kabuto M., 2004, Evaluation of residential exposure to intermediate frequency magnetic fields, Arch. Environ. Health, 59(12), 693–699.

Kuroyanagi A., Kawahata H., Narita H., Ohkushi K., Aramaki T., 2006, Reconstruction of paleoenvironmental changes based on the planktonic forminiferal assemblages off Shimokita (Japan) in the northwestern North Pacific, Global Planet. Change, 53, 92–107.

Li C., Takahashi S., Taneda S., Furuta C., Watanabe G., Suzuki A. K., Taya K., 2006, Impairment of testicular function in adult male Japanese quail (*Coturnix japonica*) after a single administration of 3-methyl-4-nitrophenol in diesel exhaust particles, J. Endocrinol., 189, 555–564.

Li C., Taneda S., Suzuki A. K., Furuta C., Watanabe G., Taya K., 2006, Anti-androgenic activity of 3-methyl-4-nitrophenol in diesel exhaust particles, Eur. J. Pharmacol., 543, 194–199.

Li C., Taneda S., Suzuki A. K., Furuta C., Watanabe G., Taya K., 2006, Estrogenic and anti-androgenic activities of 4-nitrophenol in diesel exhaust particles, Toxicol. Appl. Pharmacol., 217, 1–6.

Li M., Xu K-Q., Watanabe M., Chen Z., 2007, Long-term variations in dissolved silicate, nitrogen, and phosphorus flux from the Yangtze River into the East China Sea and impacts on estuarine ecosystem, Estuar., Coast. Shelf Sci., 71(1/2), 3–12.

Lin J.-L., Kiladis G. N., Mapes B. E., Weickmann K. M., Sperber K. R., Lin W., Wheeler M. C., Schubert S. D., Genio A. Del, Emori S. et al., 2006, Tropical intraseasonal variability in 14 IPCC AR4 climate models. Part I: Convective signals, J. Clim., 19, 2665–2690.

Liu Y., Ono M., Yu D., Wang Y., Yu J., 2006, Individual solar-UV doses of pupils and undergraduates in China, J. Exposure Sci. Environ. Epidemiol., 16, 531–537.

Managaki S., Takada H., Kim D.-M., Horiguchi T., Shiraishi H., 2006, Three-dimensional distributions of sewage markers in Tokyo Bay water—fluorescent whitening agents (FWAs), Marine Pollut. Bull., 52, 281–292.

Maruyama W., Aoki Y., 2006, Estimated cancer risk of dioxins to humans using a bioassay and physiologically based pharmacokinetic model, Toxicol. Appl. Pharmacol., 214, 188–198.

Maruyama W., Hirano S., Kobayashi T., Aoki Y., 2006, Quantitative risk analysis of particulate matter in the Air: Interspecies extrapolation with bioassay and mathematical models, Inhal. Toxicol., 18, 1013–1023.

Masui T., Hanaoka T., Hikita S., Kainuma M., 2006, Assessment of CO_2 reductions and economic impacts considering energy-saving investments, Energy J., Special Issue, 175–190.

Matsui T., Tsuchiya T., 2006, Root aerobic respiration and growth characteristics of three Typha species in response to hypoxia, Ecol. Res., 21(3), 470–475.

Matsumoto J., Takahashi K., Matsumi Y., Yabushita A., Shimizu A., Matsui I., Sugimoto N., 2006, Scavenging of pollutant acid substances by Asian mineral dust particles, Geophys. Res. Lett., 33, L07816.

Matsuzaki M., Kubota K., Satoh T., Kunugi M., Ban S. Imura S., 2006, Dimethyl sulfoxide-respring bacteria in Suribati Ike, a hypersaline lake, in Antarctica and the marine environment, Polar Biosci., (20), 73–81.

Matsuzaki S-i. S., Usio N., Takamura N., Washitani I., 2007, Effects of common carp on nutrient dynamics and littoral community composition: roles of excretion and bioturbation, Fundam. Appl. Limnol. /Arch. fur Hydrobiol., 168(1), 27–38.

Mera N., Iwasaki K., 2006, Use of Plate-Wash samples to evaluate nbcterial population dynamics in mercury-and trichloroethylene-contaminated soils, J. Environ. Biotechnol., 6(2), 115–122.

Miner D., Allinson G., Salzman S., Nishikawa M., Turoczy N., 2006, Trace metal concentrations in the Balmain bug (*Ibacus peronii* Leach, 1815) from Southwest Victoria, Australia, Bull. Environ. Contam. Toxicol., 76, 1007–1013.

Mitsumori F., Watanabe H., Takaya N., Garwood M., 2006, T2 measurements in the human brain at 4.7T using an adiabatic multi-echo sequence—Correlation between T2 and the tissue iron content, Proc. Int. Soc. Magn. Reson. Med., 14, 2508.

Miyawaki H., Sudirman I. L., Simbolon H., Nakanishi M., Yamaguchi T., Shimizu H., 2006, Effects of forest fires on some lichen species in East Kalimantan, Indonesia, Phyton (Austria), 45, 569–574.

Mogami J-i., Hirano T., Hirata R., Kitaoka S, Koike T., Fujinuma Y., 2005, Variation in photosynthetic photon flux density on a larch forest floor, J. Agric. Meteorol., 60(6), 1161–1163.

Murayama R., Goto S., Nakajima D., Fujimaki H., Watanabe I., Arashidani K., Uchiyama I., 2006, Measurements of exposure concentrations of benzene, toluene and xylene and amounts of respiratory uptake, J. UOEH, 28, 173–183.

Nagai T., Imai A., Matsushige K., Fukushima T., 2006, Effect of iron complexation with dissolved organic matter on the growth of cyanobacteria in a eutrophic lake, Aquat. Microb. Ecol., 44, 231–239.

Nagashima T., Shiogama H., Yokohata T., Takemura T., Crooks S. A., Nozawa T., 2006, Effect of carbonaceous aerosols on surface temperature in the mid twentieth century, Geophys. Res. Lett., 33, L04702.

Nagata H., 2006, Reevaluation of the prevalence of blood parasites in Japanese Paseerines by using PCR based molecular diagnostics, Ornithological Sci., 5(1), 105–112.

Nakajima D., Asada S., Kageyama S., Yamamoto T., Kuramochi H., Tanaka N., Takeda K., Goto S., 2006, Activity related to

carcinogenicity of plastic additives in the benzophenone group. J. UOEH, 28(2), 143–156.

Nakajima D., Ishii R., Kageyama S., Onji Y., Mineki S., Morooka N., Takatori K., Goto S., 2006, Genotoxicity of microbial volatile organic compounds, J. Health Sci., 52, 148–153.

Nakajima D., Tin-Tin-Win-Shwe, Kakeyama M., Fujimaki H., Goto S., 2006, Determination of toluene in brain of freely moving mice using solid-phase microextraction technique, Neurotoxicology, 27, 615–618.

Nakajima H., Sugita T., Irie H., Saitoh N., Kanzawa H., Oelhaf H., Wetzel G., Toon G. C., Yokota T., Sasano Y. et al., 2006, Measurements of $ClONO_2$ by the improved limb atmospheric spectrometer (ILAS) in high-latitude stratosphere: New products using version 6.1 data processing algorithm, J. Geophys. Res., 111, D11S09.

Nakajima H., Sugita T., Yokota T., Ishigaki T., Mogi Y., Kuze A., Tanii J., Kawasaki H., Kobayashi H., Sasano Y. et al., 2006, Characteristics and performance of the Improved Limb Atmospheric Spectrometer-II (ILAS-II) on board the ADEOS-II satellite, J. Geophys. Res., 111, D11S01.

Nakamura H., Shiozawa T., Terao Y., Shiraishi F., Fukazawa H., 2006, By-products produced by the reaction of estrogens with hypochlorous acid and their estrogen activities, J. Health Sci., 52(2), 124–131.

Nakamura Y., Hirata A., 2006, Plankton community structure and trophic interactions in a shallow and eutrophic estuarine system, Ariake Sound, Japan, Aquat. Microb. Ecol., 44, 45–57.

Nakayama K., Harihara S., Ishida T., Soemantri A., Jin F., Dashnyam B., Ohtsuka R., Duanchang P., Isa M. N., Settheetham-Ishida W., 2006, Identification of novel functional variants of the melanocortin 1 receptor gene originated from Asians, Hum. Genet., 119, 322–330.

Nakayama T., Edmonds J. S., Shibata Y., Morita M., 2006, The rate of oxidation of dimethylarsinous acid to dimethylarsinic acid is pH dependent: implications for the analysis and toxicology of arsenic metabolites in urine, J. Chem. Res., 2006(3), 185–187.

Nakayama T., Watanabe M., Tanji K., Morioka T., 2007, Effect of underground urban structures on eutrophic coastal environment, Sci. Total Environ., 373, 270–288.

Nakayama T., Watanabe M., 2006, Simulation of spring snowmelt runoff by considering micro-topography and phase changes in soil layer, Hydrol. Earth Syst. Sci. Discuss., 3, 2101–2144.

Nakayama T., Yang Y., Watanabe M., Zhang X., 2006, Simulation of groundwater dynamics in North China Plain by coupled hydrology and agricultural models, Hydrol. Process., 20(16), 3441–3466.

Nakicenovic N., Kolp P., Riahi K., Kainuma M., Hanaoka T., 2006, Assessment of emissions scenarios revisited, Environ. Econ. Policy Stud., 7(3), 137–173.

Nansai K., Kagawa S., Moriguchi Y., 2007, Proposal of a simple indicator for sustainable consumption: classifying goods and services into three types focusing on their optimal consumption levels, J. Cleaner Prod., 15(10), 879–885.

Nansai K., Kagawa S., Suh S., Inaba R., Moriguchi Y., 2007, Simple indicator to identify the environmental soundness of growth of consumption and technology: "Eco-velocity of consumption", Environ. Sci. Technol., 41(4), 1465–1472.

Nishimura N., Yonemoto J., Nishimura H., Tohyama C., 2006, Localization of cytochrome P450 1A1 in a specific region of hydronephrotic kidney of rat neonates lactationally exposed to 2,3,7,8-tetrachlorodibenzo-p-dioxin, Toxicology, 227(1/2), 117–126.

Nitta H., 2006, Prospects for measures against pollinosis in Japan, Sci. Technol. Trends Q. Rev., (20), 48–58.

Nohara K., Ao K., Miyamoto Y., Ito T., Suzuki T., Toyoshiba H., Tohyama C., 2006, Comparison of the 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)-induced CYP1A1 gene expression profile in lymphocytes from mice, rats, and humans: Most potent induction in humans, Toxicology, 225, 204–213.

Obersteiner M., Alexandrov G. A., Benitez P. C., McCallum I., Kraxner F., Riahi K., Rokityanskiy D., Yamagata Y., 2006, Global supply of biomass for energy and carbon sequestration from Afforestation/Reforestation activities, Mitigation Adap. Strategies Global Change, 11(5/6), 1003–1021.

Oda S., Tatarazako N., Watanabe H., Morita M., Iguchi T., 2006, Genetic differences in the production of male neonates in Daphnia magna exposed to juvenile hormone analogs, Chemosphere, 63, 1477–1484.

Ogura T., Abe-Ouchi A., Hasumi H., 2004, Effects of sea ice dynamics on the Antarctic sea ice distribution in a coupled ocean atmosphere model, J. Geophys. Res., 109, C04025.

Ohashi J., Naka I., Kimura R., Tokunaga K., Nakazaki M., Ataka Y., Ohtsuka R., Inaoka T., Matsumura Y., 2006, HLA-DRB1 polymorphism on Ha'ano island of the Kingdom of Tonga, Anthropol. Sci., 114, 193–198.

Ohashi J., Naka I., Kimura R., Tokunaga K., Yamauchi T., Furusawa T., Yamamoto R., Ishida T., Natsuhara K., Nakazawa M., Ohtsuka R., 2006, Polymorphisms in the ABO blood gene in three populations in the New Georgia group of the Solomon Islands, J. Hum. Genet., 51, 407–411.

Ohba S., Tatsuta H., Sasaki M., 2006, Raptorial legs and claws are not influenced by food condition in nymphal stages of *Lethocerus deyrolli* (Heteroptera: Belostomatidae), Ann. Entomol. Soc. Am., 99(1), 151–156.

Ohkouchi Y., Inoue Y., 2006, Direct production of L(+)-lactic acid from starch and food wastes using Lactobacillus manihotivorans LMG18011, Bioresour. Technol., 97(13), 1554–1562.

Ohmura Y., Kawachi M., Kasai F., Watanabe M. M., Takeshita S., 2006, Genetic combinations of symbionts in a vegetatively reproducing lichen, Parmotrema tinctorum, based on ITS rDNA sequences, Bryologist, 109(1), 43–59.

Oka M., Arai T., Shibata Y., Miyazaki N., 2006, Reproductive transfer of organochlorines in viviparous surfperch, Ditrema temmincki, Environ. Pollut, 142, 383–387.

Okadera T., Watanabe M., Xu K., 2006, Analysis of water demand and water pollutant discharge using a regional input-output table: An application to the city of chongqing, upstream of the three gorges dam in China, Ecol. Econ., 57(2), 221–237.

Okayama Y., Kuwahara M., Suzuki A. K., Tsubone H., 2006, Role of reactive oxygen species on diesel exhaust particle-induced cytotoxicity in rat cardiac myocytes, J. Toxicol. Environ. Health A., 69(18), 1699–1710.

Oki K., Awadu T., Oguma H., Omasa K., 2005, Spatial assessment of the alder tree in Kushiro Mire, Japan using remotely sensed imagery—Effects of the surrounding land use on Kushiro Mire, Environ. Monit. Assess., 109(1/3), 243–253.

Ono M., Omori T., Nitta H., 2006, Is the midnight-to-midnight average concentration of pollutants anappropriate exposure index for a daily mortality study?, J. Exposure Sci. Environ. Epidemiol, 1–4.

Onodera S., Hayashi T., Fujiyama T., Oh-i T., Mori Y., Kuwahara

M., Ezoe Y., Nakajima D., Goto S., 2006, TLC fractionation and characterization of Ames mutagenic substances in chlorine-treated 4-methyphenol solution in the presence of bromide ion, J. Environ. Chem., 16(2), 229–237.

Ooba M., Hirano T., Mogami J-I., Hirata R., Fujinuma Y., 2006, Comparisons of gap-filling methods for carbon flux dataset: A combination of a genetic algorithm and an artificial neural network, Ecol. Modell., 198(3/4), 473–486.

Osaki K., Kashiwada S., Tatarazako N., Ono Y., 2006, Toxicity testing of leachate from waste landfills using medaka (*Oryzias latipes*) for monitoring environmental safety, Environ. Monit. Assess., 117, 73–84.

Oshchepkov S., Bril A., Yokota T., Inoue G., 2007, Application of the equivalence theorem to simulate GOSAT observation data under cirrus-present condition, Proc. SPIE, 6405, 640509.

Oshchepkov S., Sasano Y., Yokota T., Nakajima H., Uemura N., Saitoh N., Sugita T., Matsuda H., 2006, ILAS data processing for stratospheric gas and aerosol retrievals with aerosol physical modeling: Methodology and validation of gas retrievals, J. Geophys. Res., 111, D02307.

Park C. B., Nakane H., Sugimoto N., Matui I., Sasano Y., Fujinuma Y., Ikeuchi I., Kurokawa J.-I., Furuhashi N., 2006, Algorithm improvement and validation of National Institute for Environmental Studies ozone differential absorption lidar at the Tukuba Network for Detection of Stratospheric Change complementary station, Appl. Opt., 45(15), 3561–3576.

Patra P. K., Gurney K. R., Denning A. S., Maksyutov S., Nakazawa T., Baker D., Bousquet P., Bruhwiler L., Chen Y. H., Ciais P. et al., 2006, Sensitivity of inverse estimation of annual mean CO_2 sources and sinks to ocean-only sites versus all-sites observational networks, Geophys. Res. Lett., 33, L05814.

Qi B., Sato K., Imamura T., Takami A., Hatakeyama S., Ma Y., 2006, Production of the radicals in the ozonolysis of ethene: A chamber study by FT-IR and PERCA, Chem. Phys. Lett., 427, 461–465.

Rex M., Salawitch R. J., Deckelmann H., Gathen P. von der, Harris N. R. P., Chipperfield M. P., Naujokat B., Reimer E., Allaart M., Nakane H. et al., 2006, Arctic winter 2005: Implications for stratospheric ozone loss and climate change, Geophys. Res. Lett., 33(23), L23808.

Sadakane K., Ichinose T., Takano H., Abe M., Sera N., Yanagisawa R., Ochi H., Fujioka K., Lee K.-G., Shibamoto T., 2006, Murine strain differences in 8-hydroxy-deoxyguanosine formation in hepatic DNA induced by oxidized lard and dietary oils, Food Chem. Toxicol., 44, 1372–1376.

Safaeefar P., Ang H. M., Kuramochi H., Asakuma Y., Maeda K., Tabe M. O., Fukui K., 2006, Measurement and correlation of the solubility of $MnSO_4 \cdot H_2O$ in ethanol + water + $MgSO_4 \cdot 7H_2O$ solutions, Fluid Phase Equilibria, 250(1/2), 64–69.

Saito T., Yokouchi Y., 2006, Diurnal variation in methyl halide emission rates from tropical ferns, Atmos. Environ., 40, 2806–2811.

Saito T., Yokouchi Y., Aoki S., Nakazawa T., Fujii Y., Watanabe O., 2006, A method for determination of methyl chloride concentration in air trapped in ice cores, Chemosphere, 63, 1209–1213.

Saito T., Yokouchi Y., Aoki S., Nakazawa T., Fujii Y., Watanabe O., 2007, Ice-core record of methyl chloride over the last glacial-Holocene climate change, Geophys. Res. Lett., 34, L03801.

Saitoh N., Hayashida S., Sugita T., Nakajima H., Yokota T., Sasano Y., 2006, Variation in PSC occurrence observed with ILAS-II over the Antarctic in 2003, SOLA, 2, 72–75.

Saitoh N., Hayashida S., Sugita T., Nakajima H., Yokota T., Hayashi M., Shiraishi K., Kanzawa H., Ejiri M. K., Sasano Y. et al., 2006, Intercomparison of ILAS-II version 1.4 aerosol extinction coefficient at 780 nm with SAGE II, SAGE III, and POAM III, J. Geophys. Res., 111, D11S05.

Saitoh N., Ota Y., Taguchi S., Imasu R., 2007, Assessment of uncertainty in CO_2 concentrations retrieved from thermal infrared spectra of GOSAT satellite, Proc. SPIE, 6405, 640508.

Sakai S., Yamamoto T., Noma Y., Giraud R., 2006, Formation and control of toxic polychlorinated compounds during incineration of wastes containing polychlorinated naphthalenes, Environ. Sci. Technol., 40(7), 2247–2253.

Sakaki T., Kato T., Saji H., 2007, Lipid acyl-hydrolase in leaves of different kidney bean (*Phaseolus vulgaris* L.) cultivars: Purification and characterization of a kidney bean lipid acyl-hydrolase, and foliar lipid changes in the cultivars with ozone exposure, Plant Sci., 172, 462–472.

Sakanakura H., 2007, Formation and durability of dithiocarbamic metals in stabilized air pollution control residue from municipal solid waste incineration and melting processes, Environ. Sci. Technol., 41, 1717–1722.

Sakurai T., Kojima C., Kobayashi Y., Hirano S., Sakurai M. H., Waalkes M. P., Himeno S., 2006, Toxicity of a trivalent organic arsenic compound, dimethylarsinous glutathione in a rat liver cell line (TRL 1215), Br. J. Pharmacol., 149, 888–897.

Sarma V. V. S. S., Saino T., Sasaoka K., Nojiri Y., Ono T., Ishii M., Inoue H. Y., Matsumoto K., 2006, Basin-scale pCO_2 distribution using satellite sea surface temperature, Chl a, and climatological salinity in the North Pacific in spring and summer, Global Biogeochem. Cycles, 20, GB3005.

Scheringer M., Fiedler H., Suzuki N., Holoubek I., Zetzsch C., Bergman A., 2006, Initiative for an International Panel on Chemical Pollution (IPCP), Environ. Sci. Pollut. Res. Int., 13(6), 432–434.

Shen H., Tang Y., Washitani I., 2006, Morphological plasticity of Primula nutans to hummock-and-hollow microsites in an alpine wetland, J. Plant Res., 119, 257–264.

Shi Z., Arai K. Y., Jin W., Weng Q., Watanabe G., Suzuki A. K., Taya K., 2006, Expression of nerve growth factor and its receptore NTRK1 and TNFRSFB is regulated by estrogen and progesterone in the uteri of golden hamsters, Biol. Reprod., 74, 850–856.

Shima H., Koike E., Shinohara R., Kobayashi T., 2006, Oxidative ability and toxicity of n-Hexane insoluble fraction of diesel exhaust particles, Toxicol. Sci., 91(1), 218–226.

Shiogama H., Christidis N., Caesar J., Yokohata T., Nozawa T., Emori S., 2006, Detection of greenhouse gas and aerosol influences on changes in temperature extremes, SOLA, 2, 152–155.

Shiogama H., Nagashima T., Yokohata T., Crooks S. A., Nozawa T., 2006, Influence of volcanic activity and changes in solar irradiance on surface air temperatures in the early twentieth century, Geophys. Res. Lett., 33, L09702.

Shirasuna H., Fukushima T., Matsushige K., Imai A., Ozaki N., 2006, Runoff and loads of nutrients and heavy metals from an urbanized area, Water Sci. Technol., 53(2), 203–213.

Stajner I., Wargan K., Chang L.-P., Hayashi H., Pawson S., Nakajima H., 2006, Assimilation of ozone profiles from the Improved Limb Atmospheric Spectrometer-II: Study of

Antarctic ozone, J. Geophys. Res., 111, D11S14.
Streibel M., Rex M., Gathen P. von der, Lehmann R., Harris N. R. P., Braathen G. O., Reimer E., Deckelmann H., Chipperfield M., Nakane H. et al., 2006, Chemical ozone loss in the Arctic winter 2002/2003 determined with Match, Atmos. Chem. Phys., 6, 2783–2792.
Sudo N., Ohtsuka R., 2006, Effects of morning- and evening-shift work on the sleep, dietary intake, and psycho-physiological health conditions of Japanese female workers, J. Health Human Ecol., 72(5), 177–190.
Sudo N., Sekiyama M., Maharjan M., Ohtsuka R., 2006, Gender differences in dietary intake among adults of Hindu communities in lowland Nepal: assessment of portion sizes and food consumption frequencies, Eur. J. Clin. Nutr., (60), 469–477.
Sueyoshi S., Al-Khozahe H. O. Ohtsuka R., 2006, Effects of reproduction norms on contraception practice among Muslim women in Amman, Jordan, Eur. J. Contracept. Reprod. Health Care June 2006, 11(2), 138–145.
Suga S., 2006, Numerical schemes obtained from lattice boltzmann equations for advection diffusion equations, Int. J. Mod. Phys. C, 17(11), 1563–1577.
Sugamata M., Ihara T., Takano H., Oshio S., Takeda K., 2006, Maternal diesel exhaust exposure damages newborn murine brains, J. Health Sci., 52(1), 82–84.
Sugimoto N., Lee C. H., 2006, Charecteristics of dust aerosols inferred from lidar depolarization measurements at two wavelengths, Appl. Opt., 45(28), 7468–7474.
Sugita T., Yokota T., Nakajima H., Kobayashi H., Saitoh N., Kawasaki H., Usami M., Saeki H., Horikawa M., Sasano Y., 2004, A comparative study of stratospheric temperatures between ILAS-II and other data, Proc. SPIE, 5652, 279–289.
Sugiura N., Okano K., Burns B. P., Utsumi M., Inamori Y., Nishimura O., Sudo R., 2006, Adsorption and biodegradation characteristics of musty odorous compounds, 2-methylisoborneol and geosmin, Jpn. J. Water Treat. Biol., 42(2), 85–91.
Suzuki G., Takigami H., Nose K., Takahashi S., Asari M., Sakai S-I., 2007, Dioxin-like and transthyretin-binding compounds in indoor dusts collected from Japan: Average daily dose and possible implications for children, Environ. Sci. Technol., 41(4), 1487–1493.
Suzuki T., Takayabu Y. N., Emori S, 2006, Coupling mechanisms between equatorial waves and cumulus convection in an AGCM, Dyn. Atmos. Oceans, 42, 81–106.
Takami A., Wang W., Tang D., Hatakeyama S., 2006, Measurements of gas and aerosol for two weeks in northern China during the winter-spring period of 2000, 2001 and 2002, Atmos. Res., 82, 688–697.
Takano H., Yanagisawa R., Inoue K., Ichinose T., Sadakane K., Yoshikawa T., 2006, Di-(2-ethylhexyl) phthalate enhances atopic dermatitis-like skin lesions in mice, Environ. Health Perspect., 114(8), 1266–1269.
Takaoka M., Yoshinaga J., Tanaka A., 2006, Influence of paint chips on lead concentration in the soil of public playgrounds in Tokyo, J. Environ. Monit., 8, 393–398.
Takaya N., Watanabe H., Mitsumori F., 2006, The size of Corpus Callosum normalized by the intracranial or brain parenchymal volume exhibits a significant difference between male and female brain, Proc. Int. Soc. Magn. Reson. Med., 14, 1606.
Takigami H., Behnisch P. A., Shiozaki K., Ohno M., Sakai S., 2006, Bioassay monitoring of waste PCB samples during chemical destruction treatments, Water Sci. Technol., 53(11), 43–50.
Tamaoki M., Imai H., Toda Y., Niwa Y., Nakajima N., Kubo A., Aono M., Saji H., 2006, Development of visual markers for transgenic plants and their availability for environmental risk assessment, Z. Naturforsch. C, 61c, 377–386.
Tanaka T., Fukabori M., Sugita T., Nakajima H., Yokota T., Watanabe T., Sasano Y., 2006, Spectral line parameters for CO_2 bands in the 4.8- to 5.3-μm region, J. Mol. Spectrosc., 239, 1–10.
Tanaka Y., Sano T., Tamaoki M., Nakajima N., Kondo N., Hasezawa S., 2006, Cytokinin and auxin inhibit abscisic acid-induced stomatal closure by enhancing ethylene production in Arabidopsis, J. Exp. Bot., 57(10), 2259–2266.
Tasaki T., Hashimoto S., Moriguchi Y., 2006, A quantitative method to evaluate the level of material use in Lease/reuse systems of electrical and electronic equipment, J. Cleaner Prod., 14(17), 1519–1528.
Tasaki T., Kawahata T., Osako M., Matsui Y., Takagishi S., Morita A., Akishima S., 2006, A GIS-based zoning of illegal dumping potential for efficient surveillance, Waste Manag., 27, 256–267.
Tatarazako N., Oda S., 2007, The water flea *Daphnia magna* (Crustacea, Cladocera) as a test species for screening and evaluation of chemicals with endocrine disrupting effects on crustaceans, Ecotoxicology, 16, 197–203.
Tatsuta H., Hoshizaki S., Bugrov A., Warchalowska-Sliwa E., Tatsuki S., Akimoto S-i., 2006, Origin of chromosomal rearrangement: Phylogenetic relationship between X0/XX and XY/XX chromosomal races in the brachypterous grasshopper *Podisma sapporensis* (Orthoptera: Acrididae), Ann. Entomol. Soc. Am., 99(3), 457–462.
Tatsuta H., Takano-Shimizu T., 2006, Genetic architecture of variation in sex-comb tooth number in Drosophila simulans, Genet. Res. Cambridge, 87(2), 93–107.
Terasaki M., Kazama T., Shiraishi F., Makino M., 2006, Identification and estrogenic characterization of impurities in commercial bisphenol A diglycidyl ether (BADGE), Chemosphere, 65, 873–880.
Terazono A., Murakami S., Abe N., Inanc B., Moriguchi Y., Sakai S., Kojima M., Yoshida A., Li J., Yang J. et al., 2006, Current status and research on E-waste issues in Asia, J. Mater. Cycles Waste Manag., 8(1), 1–12.
Tilmes S., Muller R., Grooss J.-U., Spang R., Sugita T., Nakajima H., Sasano Y.), 2006, Chemical ozone loss and related processes in the Antarctic winter 2003 based on Improved Limb Atmospheric Spectrometer (ILAS)-II observations, J. Geophys. Res., 111, D11S12.
Tilmes S., Mueller R., Groob J.-U., Nakajima H., Sasano Y., 2006, Development of tracer relations and chemical ozone loss during the setup phase of the polar vortex, J. Geophys. Res., 111, D24S90.
Tin-Tin-Win-Shwe, Mitsushima D., Nakajima D., Ahmed S., Yamamoto S., Tsukahara S., Kakeyama M., Goto S., Fujimaki H., 2007, Toluene induces rapid and reversible rise of hippocampal glutamate and taurine neurotransmitter levels in mice, Toxicol. Lett., 168, 75–82.
Tin-Tin-Win-Shwe, Yamamoto S., Ahmed S., Kakeyama M., Kobayashi T., Fujimaki H., 2006, Brain cytokine and chemokine mRNA expression in mice induced by intranasal instillation with ultrafine carbon black, Toxicol. Lett., 163, 153–160.

Tomita M., Totsuka K., Ikari H., Ohara K., Mimura H., Watanabe H., Kume H., Matsumoto T., 2006, Observation of whispering gallery modesin cathode luminescence in TiO_2:Eu($^{3+}$) microspheres, Appl. Phys. Lett., 89, 061126.

Tsukahara S., 2007, Increased Fos immunoreactivity in suprachiasmatic nucleus before luteinizing hormone surge in estrogen-treated ovariectomized female rats, Neuroendocrinology, 83(5/6), 303–312.

Tsukahara S., Kakeyama M., Toyofuku Y., 2006, Sex differences in the level of Bcl-2 family proteins and caspase-3 activation in the sexually dimorphic nuclei of the preoptic area in postnatal rats, J. Neurobiol., 66(13), 1411–1419.

Tsukahara S., Yamamoto S., Tin-Tin-Win-Shwe, Ahmed S., Kunugita N., Arashidani K., Fujimaki H., 2006, Inhalation of low-level formaldehyde increases the Bcl-2/Bax expression ratio in the hippocampus of immunologically sensitized mice, Neuroimmunomodulation, 13(2), 63–68.

Tsukino H., Hanaoka T., Sasaki H., Motoyama H., Hiroshima M., Tanaka T., Kabuto M., Turner W., Patterson D. G., Jr., Needham L., Tsugane S., 2006, Fish intake and serum levels of organochlorines among Japanese women, Sci. Total Environ., 359, 90–100.

Tsunekawa A., Ito T. Y., Shinoda M., Nemoto M., Suhama T., Ju H., Shimizu H., 2006, Methodology for assessment of desertification based on vegetation degradation using net primary productivity (NPP) as a key indicator, Phyton (Austria), 45, 185–192.

Tsushima Y., Emori S., Ogura T., Kimoto M., Webb M. J., Williams K. D., Ringer M. A., Soden B. J., Li B., Andronova N., 2006, Importance of the mixed-phase cloud distribution in the control climate for assessing the response of clouds to carbon dioxide increase: a multi-model study, Clim. Dyn., 27, 113–126.

Umemiya C., 2006, Improving GHG inventories by regional information exchange: a report from Asia, Carbon Balance Manag., 1(9), 1–7.

Umezu T., Nagano K., Ito H., Kosaka K., Sakaniwa M., Morita M., 2006, Anticonflict effects of lavender oil and identification of its active constituents, Pharmacol., Biochem. Behav., 85, 713–721.

Uno I., Wang Z., Chiba M., Chun Y. S., Gong S. L., Hara Y., Jung E., Lee S. S., Liu M., Sugimoto N. et al., 2006, Dust model intercomparison (DMIP) study over Asia: Overview, J. Geophys. Res., 111, D12213.

Usio N., 2007, Endangered crayfish in northern Japan: distribution, abundance and microhabitat specificity in relation to stream and riparian environment, Biol. Conserv., 134(4), 517–526.

Usio N., Suzuki K., Konishi M., Nakano S., 2006, Alien vs. endemic crayfish: roles of species identity in ecosystem functioning, Arch. Hydrobiol., 166(1), 1–21.

Wama R., Utiyama M., Miura N., 2006, Highly sensitive NO_2 sensor based on stabilized-zirconia tube and nitrite-based auxiliary sensing-electrode, Electrochemistry, 74, 145–148.

Wang D. Y., Hoepfner M., Tsidu G. M., Stiller G. P., Clarmann T. von, Fischer H., Blumenstock T., Glatthor N., Nakajima H., Sugita T. et al., 2006, Validation of nitric acid retrieved by the IMK-IAA processor from MIPAS/ENVISAT measurements, Atmos. Chem. Phys. Discuss., 6, 9723–9764.

Wang D. Y., Hoepfner M., Tsidu G. M., Stiller G. P., Clarmann T. von, Fischer H., Blumenstock T., Glatthor N., Nakajima H., Sugita T. et al., 2007, Validation of nitric acid retrieved by the IMK-IAA processor from MIPAS/ENVISAT measurements, Atmos. Chem. Phys., 7, 721–738.

Wang Z., Li L., Chen D., Xu K-Q., Wei T., Gao J., Zhao Y., Chen Z., Watanabe M., 2007, Plume front and suspended sediment dispersal off the Yangtze (Changjiang) River mouth, China during non-flood season, Estuar., Coast. Shelf Sci., 70(1/2), 60–67.

Warita K., Sugawara T., Yue Z-P., Tsukahara S., Mutoh K., Hasegawa Y., Kitagawa H., Mori C., Hoshi N., 2006, Progression of the dose-related effects of estrogenic endocrine disruptors, an important factor in declining fertility, differs between the hypothalamo-pituitary axis and reproductive organs of male mice, J. Vet. Med. Sci., 68(12), 1257–1267.

Watanabe H., Kume H., Mizuochi N., Yamasaki S., Kanno S., Okushi H., 2006, Nitrogen incorporation in homoepitaxial diamond thin film, Diam. Rela. Mater., 15, 554–558.

Watanabe M., Takamatsu T., Koshikawa-K. M., Sakamoto K., Inubushi K., 2006, Atmospheric acidic pollutants at Mt. Tsukuba, Japan, determined using a portable filter pack sampler, Bull. Chem. Soc. Jpn., 79, 1407–1409.

Watanabe S., Nagashima T., Emori S., 2005, Impact of global warming on gravity wave momentum flux in the lower stratosphere, SOLA, 1, 189–192.

Wetzel G., Oelhaf H., Friedl-Vallon F., Kleinert A., Lengel A., Maucher G., Nakajima H., Sasano Y., Sugita T., Yokota T. et al.), 2006, Intercomparison and validation of ILAS-II version 1.4 target parameters with MIPAS-B measurements, J. Geophys. Res., 111, D11S06.

Wu W., Kawamoto K., Kuramochi H., 2006, Hydrogen-rich synthesis gas production from waste wood via gasification and reforming technology for fuel cell application, J. Mater. Cycles Waste Manag., (8), 70–77.

Yamagata Y., 2006, Terrestrial carbon budget and ecosystem modelling in Asia, Global Change Newsl., (67), 6–7.

Yamaguchi M., Inomata S., Washida N., 2006, Multireference configuration interaction calculation of the B2A-X2A transition of halogen- and methyl-substituted vinoxy radicals, J. Phys. Chem. A, 110(45), 12419–12426.

Yamaguchi M., Mitsumori F., Takaya N., Watanabe H., Minami M., 2006, Visualization of seminiferous tubles by high resolution MR imaging in rat testes: the usefulness in the evaluation of spermatogenic activities, Proc. Int. Soc. Magn. Reson. Med., 14, 2118.

Yamaguchi M., Mitsumori F., Watanabe H., Takaya N., Minami M., 2006, In vivo localized ^{1}H MR spectroscopy of rat testes: Stimulated echo acquisition mode (STEAM) combined with short TI inversion recovery (STIR) improves the detection of metabolite signals, Magn. Reson. Med., 55, 749–754.

Yamaguchi T., Nakajima D., Ezoe Y., Fujimaki H., Shimada Y., Kozawa K., Arashidani K., Goto S., 2006, Measurement of volatile organic compounds (VOCs) in new residential buildings and VOCs behavior over time, J. UOEH, 28, 13–27.

Yamaji K., Ohara T., Uno I., Tanimoto H., Kurokawa J-i., Akimoto H., 2006, Analysis of the seasonal variation of ozone in the boundary layer in East Asia using the Community Multi-scale Air Quality model: What controls surface ozone levels over Japan?, Atmos. Environ., 40(10), 1856–1868.

Yamamori M., Kagawa A., Kasai Y., Mizutani K., Murayama Y., Sugita T., Irie H., Nakajima H., 2006, Validation of ILAS-II version 1.4 O_3, HNO_3, and temperature data through comparison with ozonesonde, ground-based FTS, and lidar

measurements in Alaska, J. Geophys. Res., 111, D11S08.
Yamamoto N., Takahashi Y., Yoshinaga J., Tanaka A., Shibata Y., 2006, Size distributions of soil particles adhered to Children's hands, Arch. Environ. Contam. Toxicol., 51, 157–163.
Yamamoto S., Tin-Tin-Win-Shwe, Ahmed S., Kobayashi T., Fujimaki H., 2006, Effect of ultrafine carbon black particles on lipoteichoic acid-induced early pulmonary inflammation in BALB/c mice, Toxicol. Appl. Pharmacol., 213, 256–266.
Yamamoto Y., Ohtaka A., Hayashi T., Fukuhara H., Nohara S., Ochiai M., 2006, Spring red snow phenomenon caused by iron accumulated around algal spores in alpine mires in Japan, Verh. Internat. Verein. Limnol., 29, 1947–1950.
Yamano H., Shimazaki H., Matsunaga T., Ishoda A., McClennen C., Yokoki H., Fujita K., Osawa Y., Kayanne H., 2006, Evaluation of various satellite sensors for waterline extraction in a coral reef environment: Majuro Atoll, Marshall Islands, Geomorphology, 82, 398–411.
Yamaoka Y., Carmona M. L., Oclarit J. M., Jin K., Shibata Y., 2006, Characterization of water-soluble organoarsenic compounds in marine sponges, Appl. Organometal. Chem., 20, 545–548.
Yan X., Ohara T., Akimoto H., 2006, Bottom-up estimates of biomass burning in mainland China, Atmos. Environ., 40, 5262–5273.
Yanagisawa R., Takano H., Inoue K., Ichinose T., Sadakane K., Yoshino S., Yamaki K., Yoshikawa T., Hayakawa K., 2006, Components of diesel exhaust particles differentially affect Th1/Th2 response in a murine model of allergic airway inflammation, Clin. Exp. Allergy, 36, 386–395.
Yasunaga K., Yoneyama K., Kubota H., Okamoto H., Shimizu A., Kumagai H., Katsumata M., Sugimoto N., Matsui I., 2006, Melting layer cloud observed during R/V mirai cruise MR01-K05, J. Atmos. Sci., 63, 3020–3032.
Yokohata T., Emori S., Nozawa T., Ogura T., Okada N., Suzuki T., Tsushima Y., Kawamiya M., Abe-Ouchi A., Hasumi H., et al., 2007, Different transient climate responses of two versions of an atmosphere-ocean coupled general circulation model, Geophys. Res. Lett., 34, L02707.
Yokohata T., Emori S., Nozawa T., Tsushima Y., Ogura T., Kimoto M., 2005, A simple scheme for climate feedback analysis, Geophys. Res. Lett., 32, L19703.
Yokouchi Y., Taguchi S., Saito T., Tohjima H., Tanimoto H., Mukai H., 2006, High frequency measurements of HFCs at a remote site in East Asia and their implications for Chinese emissions, Geophys. Res. Lett., 33, L21814.
Yoshida K., 2006, Intra-clade predation facilitates the evolution of larger body size, Ecol. Modell., 196, 533–539.
Yoshida K., 2006, Effect of the intensity of stochastic disturbance on temporal diversity patterns—a simulation study in evolutionary time scale, Ecol. Modell., 196, 103–115.
Yoshida K., 2006, Ecosystem models on the evolutionary time scale: a review and perspective, Paleontol. Res., 10(4), 375–385.
Yoshida S., Tamaoki M., Shikano T., Nakajima N., Ogawa D., Ioki M., Aono M., Kubo A., Kamada H., Inoue, Y., Saji H., 2006, Cytosolic dehydroascorbate reductase is important for ozone tolerance in Arabidopsis thaliana, Plant Cell Physiol., 47(2), 304–308.
Yoshida S, Ono N., Tsukue N, Oshio S., Umeda T., Takano H., Takeda K., 2006, In utero exposure to diesel exhaust increased accessory reproductive gland weight and serum testosterone concentration in male mice, Environ. Sci., 13(3), 139–147.
Yoshida Y., 2006, Development of air conditioning technologies to reduce CO_2 emissions in the commercial sector, Carbon Balance Manag., 1(12), 1–20.
Yoshikane M., Kay W. R., Shibata Y., Inoue M., Yanai T., Kamata R., Edmonds J. S., Morita M., 2006, Very high concentrations of DDE and toxaphene residues in crocodiles from the Ord River, Western Australia: an investigation into possible endocrine disruption, J. Environ. Monit., 8, 649–661.
Zhang J., Xu K-Q., Yang Y., Hayashi S., Watanabe M., 2006, Measuring water storage fluctuations in lake dongtin, China, by TOPEX/POSEIDON satellite altimetry, Environ. Monit. Assess., 115(1/3), 23–27.
Zhang Y. Q., Tang Y., Jiang J., Yang Y., 2007, Characterizing the dynamics of soil organic carbon in grasslands on the Qinghai-Tibetan Plateau, Sci. China Ser. D-Earth Sci., 50(1), 113–120.
Zheng Y. R., Xie Z. X., Jiang L. H., Shimizu H., Drake S., 2006, Changes in Holdridge Life Zone diversity in the Xinjiang Uygur Autonomous Region (XUAR) of China over the past 40 years, J. Arid Environ., 66, 113–126.
Zheng Y. R., Xie Z. X., Jiang L. H., Shimizu H., Rimmington G. M., Zhou G. S., 2006, Vegetation responses along environmental gradients on the Ordos plateau, China, Ecol. Res., 21, 396–404.
Zheng Y. R., Xie Z. X., Jiang L. H., Wu Y. Z., Shimizu H., 2006, Model simulation and comparison of the ecological characteristics of three degraded grassland types in China, Belg. J. Bot., 138(2), 109–118.
Zhou H., Watanabe C., Ohtsuka R., 2007, Impacts of dietary intake and helminth infection on diversity in growth among schoolchildren in rural south China: A four-year longitudinal study, Am. J. Human Biol., (19), 96–106.

Clerbaux C., Cunnold D. M., Anderson J., Engel A., Fraser P. J., Mahieu E., Manning A., Miller J., Montzka S. A., Yokouchi Y. et al., 2007, Chapter 1. Long-Lived Compounds, Scientific Assessment of Ozone Depletion: 2006 (WMO Global Ozone Research & Monitoring Project-Report No. 50) (WMO, 572p.), 1. 1–1. 63.

Denison M. S., Takigami H., 2006, Dioxin 2006 Session summary: Analysis-biological methods, 26th Int. Symp. Halogenat. Persistent Org. Pollut. (Thomsen C., Becher G. eds., 118p.), 36–38.

Hamada T., Ichinose T. (Toshiaki), Tanaka H., Mikami T., 2006, Effect of mountain wind on urban heat island in Nagano, Japan, Prepr. 6th Int. Conf. Urban Clim. (Int. Assoc. Urban Clim., WMO, Göteborg Univ. eds., Göteborg Univ., 897p.), 743–746.

Ichinose T. (Toshiaki), Bai Y., Nam J-C., Kim Y-H., 2006, Mitigation of thermal stress by a large restoration of inner-city river (Cheong-Gye Stream in Seoul), Prepr. 6th Int. Conf. Urban Clim. (Int. Assoc. Urban Clim., WMO, Göteborg Univ. eds., Göteborg Univ., 897p.), 358–361.

Ichinose T. (Toshiaki), Niitsu K., Onozuka T., Jinno M., 2006, Mitigation of thermal environment by a special paving material, Katsuren Travertine, Prepr. 6th Int. Conf. Urban Clim. (Int. Assoc. Urban Clim., WMO, Göteborg Univ. eds., Göteborg Univ., 897p.), 681–684.

Irving W., Nakane H., Ramon T., Villarin J., 2006, Chapter 5. Time series consistency, 2006 IPCC Guidelines for National Greenhouse Gas Inventories Vol. 1 General Guidance & Reporting (Eggleston H. S. et al., IGES, 309p.), 5. 1–5. 16.

Kameyama S., Fukushima M., Han M., Amemiya M., Kaneko M., 2006, The estimation of habitat potential for freshwater fish and its spatio-temporal change—A nationwide study in Japan, Int. Symp. Wetland Restoration 2006 (Proceedings) (Organ. Comm. Symp. Wetland Restration 2006 ed., 404p.), 298–301.

Miyawaki K., Omori Y., Hibiki A., 2006, Bayesian estimation of demand functions under block rate pricing, Discussion Paper, CIRJE (Miyawaki K., Omori Y., Hibiki A. eds., Univ. Tokyo, 27p.), F-424.

Sei K., Ike M., Fujita M., Inanc B., Inoue Y., Matsufuji Y., Tanaka A., Maeda S., Mitsui K., Suzuki M., Oba T., 2004, Evaluation of accelerated stabilization of landfill by monitoring functional microbes, Proc. 5th Gen. Seminar Core Univ. Program, 259–264.

Shimizu H., 2006, Eco-physiological characteristics of key-plant species: essential information for rehabilitating the desertificated land in arid/semi-arid region, Workshop on Ecological Conservation in Northwest China (OECC, 156p.), 122–133.

Shiraki Y., Harada I., Kuze H., Ichinose T. (Toshiaki), Bai Y., 2005, Experimental study on the effect of Cheong-gye stream restoration on urban environment (Long-path measurement of atmospheric pollutant species with an obstruction flashlight), Proc. CEReS Int. Symp. Remote Sensing (Tetuko S. S. J., Ishiyama T., Tateishi R. eds., Chiba Univ., 251p.), 169–173.

Yokouchi Y., Saito T., Okuda T., Phillip E., 2006, A preliminary study of volatile organic compounds emitted from tropical plants, Annu. Rep. NIES/FRIM/UPM Jt. Res. Proj. Tropical Ecology & Biodiversity 2005 (Okuda T., Kondo T. eds., 117p.), 37–43.

Aoyagi-Usui M., 2006, Consumers' trust in information sources, Partnership for Sustainable Development: Perspectives from the Asia-Pacific Region (Welford R., Hills P. Young W. eds., Univ. Hong Kong, 363p.), 156–164.

Arimura T. H., Hibiki A., Johnstone N., 2007, An empirical study of environmental R&D: what encourages facilities to be environmentally innovative?, Environmental Policy and Corporate Behaviour (Johnstone N. ed., Edward Elgar Publ., 278p.), 142–173.

Ataka Y., Ohtsuka R., 2006, Migration and fertility of a small island population in Manus: a long-term analysis of its sedentes and migrants, Population, Reproduction and Fertility in Melanesia (Ulijaszek S. J. ed., Berghahn Books), 90–109.

Hatakeyama S., 2006, Long-range transport of air-pollutants in the East Asian Pacific Rim Region, Effects of Pollutants on Atmospheric Environment (Ishizaka Y., Kitada T. eds., HyARC Nagoya Univ, UNESCO, 290p.), 55–81.

Higashi H., 2007, 7 Influences of climate change on the frequencies of storm rainfalls and flood disasters, Water-Related Disasters, Climate Variability and Change: Results of Tropical Storms in East Asia (Matsuura T., Kawamura R. eds., Transworld Research Network, 170p.), 125–143.

Ichinose T. (Toshiaki), 2005, Recent counteractions for urban heat island in regional autonomies in Japan, Urban Dimensions of Environmental Change: Science, Exposures, Policies and Technologies (Feng H., Yu L., Solecki W. eds., Science Press, 324p.), 161–167.

Ichinose T. (Toshiaki), Yasui I., 2004, Future scenarios: Predicting our environmental future, Encyclopedia of Life Support Systems (Web) (UNESCO, Eolss Publishers)

Idip D., Jr., Kayanne H., Yamano H., Matsunaga T., Shimazaki H.,, 2007, Chapter 18. Coastal Habitat Map of Palau, Coral Reefs of Palau (Kayanne H. et al. eds., Palau Int. Coral Reef Cent., 231p.), 170–202.

Inanaga S., Eneji A. E., An P., Shimizu H., 2005, A recipe for sustainable agriculture in drylands, Plant Responses to Air Pollution and Global Change (Omasa K., Nouchi I., De Kok L. J. eds., Springer, 300p.), 285–293.

Ishido M., 2006, Chapter 51. Interactions of melatonin with environmental factors, Melatonin (Pandi-Perumal S. R., Cardinali P. eds., Nova Sci. Publ.)

Ishido M., 2006, Prevention by melatonin of maneb-induced mitochondrial dysfunction in rat pheochromocytoma cells, Antioxidants (Panglossi H. V. ed., Nova Sci. Publ., 207p.), 149–157.

Kada Y., Tanaka S., Aoyagi-Usui M., Arakaki T., Watanabe S., Hoffman S., 2006, From Kogai to Kankyo Mondai: Nature, development, and social conflictin Japan, Forging Environmentalism: Justice, Livelihood, and Contested Environments (Bauer J. ed., M. E. Sharp, N. Y., 427p.), 103–183.

Kim Y., Park J. H., Choi W., Lee K-M., Massie S. T., Yokota T., Nakajima H., Sasano Y., 2006, Intra-seasonal variation of PSC compositions retrieved from ILAS-II data, IRS 2004 Current Problems in Atmospheric Radiation (Fischer H., Sohn B-J. eds., A. Deepak Publishing, 476p.), 207–210.

Seyama H., Soma M., Theng B. K. G., 2006, X-Ray photoelectron spectroscopy, Handbook of Clay Science (Developments in Clay Science 1) (Bergaya F., Theng B. K. G., Lagaly G. eds., Elsevier, 1224p.), 865–878.

Shi P. J., Shimizu H., Wang J. A., Liu L. Y., Li X. Y., Fan Y. D., Yu Y. J., Jia H. K., Zhao Y., Wang L., Song Y.), 2005, Land degradation and blown-sand disaster in China, Plant Responses to Air Pollution and Global Change (Omasa K., Nouchi I., De Kok L. J. eds., Springer, 300p.), 261–269.

Shu J., Ichinose T. (Toshiaki), Yang X., Jiang T., Zhang C., 2005, Monitoring and numerical simulation of urban heat island in Shanghai, China, Urban Dimensions of Environmental Change: Science, Exposures, Policies and Technologies (Feng H., Yu L., Solecki W. eds., Science Press, 324p.), 67–78.

Sugimoto N., 2006, Observation of aerosol particle in the east asia using lidars, Effects of Pollutants on Atmospheric Environment (Ishizaka Y., Kitada T. eds., HyARC Nagoya Univ, UNESCO, 290p.), 83–101.

Tian J., Liu P., Shimizu H., Inanaga S., 2005, A case study on combating desertification at a small watershed in the hills–gully area of loess plateau, China, Plant Responses to Air Pollution and Global Change (Omasa K., Nouchi I., De Kok L. J. eds., Springer, 300p.), 277–284.

Totsuka T., Sase H., Shimizu H., 2005, Major activities of acid deposition monitoring network in East Asia (EANET) and related studies, Plant Responses to Air Pollution and Global Change (Omasa K., Nouchi I., De Kok L. J. eds., Springer, 300p.), 251–259.

Welch E. W., Rana A., Mori Y., 2006, The promises and pitfalls of ISO 14001 for competitiveness and sustainability: A comparison of Japan and the United States, Managing the Business Case for Sustainability (Schaltegger S., Wagner M. ed., Greenleaf Publishing, 625p.), 569–588.

Akazawa Y., Numaguti A., Emori S., 2005, Regional characteristics of the change in snow amount in the course of the global warming—comparison between model and observational data, J. Jpn. Soc. Hydrol. Water Resour., 18 (5), 510–520.

Aoyagi-Usui M., Kabuto M., 2006, Precautionary framework and societal governance of EMF issue, Environ. Sci., 19 (2), 167–175.

Fujii M., Kawahata T., Hashimoto S., Murakami S., Nansai K., Osako M., Moriguchi Y., 2007, Net transportation for measuring transportation efficiency, J. Jpn. Soc. Waste Manage. Experts, 18 (1), 77–85.

Fujii M., Murakami S., Nansai K., Hashimoto S., Moriguchi Y., Koshikawa T., Saito A., 2006, Model for evaluation sorted collection and transportation of household plastic packaging, J. Jpn. Soc. Waste Manage. Experts, 17 (5), 331–341.

Fujimaki K., Yoshinaga J., Watanabe C., Serizawa S., Shiraishi H., Mizumoto Y., 2006, Estimation of intake level of Di (2-ethyhexyl) phthalate (DEHP) ofJapanese pregnant woman based onmeasurement of concentrations of three urinary metabolites, Jpn. J. Hyg., 61 (3), 340–347.

Fujitani Y., Hirano S., Kobayashi S., Tanabe K., Suzuki A., Furuyama A., Kobayashi T., 2007, National Institute for Environmental Studies nanoparticle health effect laboratory, Engine Technol., 8 (6), 34–39.

Fukuhara H., Ohtaka A., Kimura N., Kikuchi Y., Yamamoto Y., Ochiai M., Fukui M., Nohara S., 2006, Reseraches on red snow, Jpn. J. Limnol., 67 (2), 81–93.

Hashimoto S., Moriguchi Y., Tasaki T., Yagishita M., 2006, Comparative analysis on images of cycle-oriented society, J. Jpn. Soc. Waste Manage. Experts, 17 (3), 204–218.

Hatakeyama S., Takami A., Miyoshi T., Wang W., 2006, Relationship among major ionic species in aerosols transported from China via the East China Sea to Okinawa, J. Aerosol Res., 21 (2), 147–152.

Hayashi N., Kuwabara T., Inamori R., Inamori Y., Sudo R., 2006, Role of midge for water purification on pond with aquatic plants, J. Jpn. Soc. Shimanto Policy Integrated River Basin Manage., 5 (2), 35–42.

Higashi H., Kohata K., 2007, Changes in characteristics of Red-Tide in Tokyo Bay, Annu. J. Hydraul. Eng., JSE, 51, 1303–1308.

Higashi H., Matsuura T., 2006, Relationship between occurrence frequency of large precipitation in Japan and sea surface temperature in the El nino region, J. Hydraul. Coastal Environ. Eng., 62 (3), 251–257.

Hijioka Y., Takahashi K., Kubota I., 2006, Country-specific impact assessment of potential productivity changes of rice and wheat under greenhouse gas stabilization targets utilizing integrated assessment model, Environ. Inf. Sci., 20, 19–24.

Hioki T., Nakanishi S., Mukai H., Murano K., 2006, Analysis of long-range transport of aerosols with water-soluble ionic species and trace metal components, collected continuously with particle size segregation in the coastal area of the Sea of Japan—Focusing on the kosa event in spring 2002, J. Aerosol Res., 21 (2), 160–175.

Hirano Y., Ichinose T. (Toshiaki), 2006, Observation and characterization of the surface heat budget on a rooftop planted with sedum, Environ. Eng. Res., 43, 661–672.

Ichinose T. (Toshiaki), Harada I., EE Mongshan, Otsubo K., 2006, Estimation map of groundwater resource demand in the Yellow River basin, China: for numerical simulation of grandwater level, Proc. Annu. Meet. Environ. Syst. Res., 34, 201–205.

Ichinose T. (Toshiaki), Harada I., Kataoka K., Lee L-T., 2006, Mitigation on atmospheric environment by a large restoration of inner-cty river (Cheong-gye stream in Seoul), Proc. Annu. Meet. Environ. Syst. Res., 34, 317–323.

Imai T., Takiguchi N., Horiguchi T., 2006, The estimating decline factor of the abalone catch in Jyogashima, Annu. Rep. Kanagawa Pref. Fish. Technol. Cent. NO. 1 (Kanagawa Pref. Fish. Technol. Cent., 113p.)

Iwao K., Nishida K., Yamagata Y., 2006, Validation method for land cover maps using degree confluence points information, J. Jpn. Soc. Photogramm. Remote Sensing, 45 (4), 35–46.

Kageyama S., Nakajima D., Yamamoto T., Mineki S., Endo O., Takagi Y., Kohzaki K., Goto S., 2006, Investigation of mutagenicity of vegetable soil amendents, J. Environ. Chem., 16 (1), 43–49.

Kashiwagi N., Yoshizawa T., Ibaraki T., Kato K., Hashimoto S., Sasaki Y., 2006, Estimation of contribution of unidentified sources to environmental contamination, Proc. Inst. Stat. Math., 54 (1), 123–146.

Kawamoto K., 2006, Development of incineration technology for municipal solid waste, Environ. Res. Q., (143), 80–89.

Kobayashi S., Hasegawa S., Takahashi K., Fushimi A., Kondo Y., Tanabe K., 2006, Emission characteristics of ultrafine particles in diesel exhaust gases and their behavior in roadside atmosphere, J. Aerosol Res., 21 (4), 305–311.

Kobayashi S., Fujiwara T., Harashima A., 2007, Seasonal and inter-annual variation of dissolved inorganic nitrogen in the Seto inland sea, Bull. Coastal Oceanog., 44 (2), 165–175.

Kunugi M., 2006, Global-scale marine pollution with hazardous chemicals, J. Jpn. Soc. Eng., 45 (6), 390–398.

Kunugi M., Fjimori K., Nakano T., 2006, Development of observation systems for global-scale marine pollution with persistent organic pollutants deployed on voluntary observation ships, Bunseki Kagaku, 55 (11), 835–845.

Matsuhashi K., 2006, A vision for sustainable transport and city planning, Environ. Res. Q., (141), 22–28.

Matsumoto M., Aoki Y., 2006, Quantitative estimate of carcinogenic risk from inhalation exposure of 1, 2-dichloroethane with benchmark dose approach, J. Jpn. Soc. Atmos. Environ., 41 (4), 196–208.

Matsumoto M., Kawahara K., Sugaya Y., Ema M.., 2006, OECD high production volume chemicals programme—Summary of 20th SIDS initial assessment meeting, ChemBio Intergrated Manag., 2 (1), 135–146.

Mochitate K., Furuyama A., Hosokawa T., 2006, Construction of artificial tissues on the basement membrane substratum, Regenerative Med., 5 (3), 57–63.

Mori Y., Kikegawa Y., Uchida H., 2006, A model for detailed evaluation of fossil-energy saving by utilizing unused but possible energy sources on a city scale, Energy Resour., 27 (3), 44–50.

Moriguchi Y., Matsuhashi K., 2007, A long-term perspective of the social condition surrounding Japanese automobiles, J. Soc. Automot. Eng. Jpn., 61 (3), 31–36.

Munesue Y., Masui T., 2006, Projections of global dietary energy requirements from the IPCC special report on emissions scenarios (SRES), Environ. Sci., 19 (6), 477–493.

Nakajima T., Fujiwara Y., Wakabayashi M., Yamazaki K., 2007, Metal concentrations in Tokyo Bay water, J. Jpn. Soc. Water Environ., 30 (1), 45–47.

Nakanishi R., Kosugi Y., Ohkubo S., Nishida K., Oguma H., Takanashi S., Tani M., 2006, Seasonal changes of a spectral reflectance index, PRI (Photochemical Reflectance Index) in a temperate Japanese cypress forest, J. Jpn. Soc. Hydrol. Water Resour., 19 (6), 475–482.

Nishimura N., Yonemoto J., Nishimura H., Matsumura F., Tohyama C., 2006, Toxic mechanism on the induction of hydronephrosis in the pips lactationally exposed to dioxn, J. Toxicol. Sci., 31Suppl., S126.

Nozawa T., 2007, Detection of historical climate change signals and attribution of their causes, Environ. Res. Q., (143), 73–79.

Numai T., Nagamine K., Yasukawa T., Shiku H., Koide M., Itayama T., Suenaga T., 2005, Hermetically sealed electrochemical microwellarray chip for single cell analysis, Chem. Senos., 21, 52–54.

Oguchi M., Kameya T., Tasaki T., Tamai N., Tanikawa N., 2006, Estimation of lifetime distribution and number of 23 types of waste electrical and electronic equipment, J. Jpn. Soc. Waste Manage. Experts, 17 (1), 50–60.

Ohmori K., Nakajima D., Ezoe Y., Mori Y., Fushiwaki Y., Endo O., Takeda K., Goto S., 2006, Tumor promoting potential of suspended particlate matter collected in 13 size classis, J. Environ. Chem., 16 (1), 119–123.

Onji Y., Takeda K., Matsuura H., Haga S., Nakajima T., Takagi Y., Goto S., 2007, Gas chromatography-mass spectrometric determination of ergosterol as a chemical marker for fungal biomass of indoor and outdoor air by large-volume sample injection, J. Environ. Chem., 17 (1), 47–52.

Sakai Y., Yamamoto Y., Yoshida N., Morioka T., Moriguchi Y., Naito H., 2006, Waste input-output analysis of advanced loop-closing system by innovative production technology in steel industry, Environ. Syst. Res., 34, 285–291.

Sei K., Uchikawa Y., Nguyen S. N., Ike M., Fujita M., Ishigaki T., Inanc B., Inoue Y., Mitsui K., Maeda S-i., 2006, Demonstration test of accelerated stabilization of coastal reclamation waste disposal model reactor appling leachate circulation, Environ. Eng. Res., 43, 319–325.

Shiraki Y., Kondoh A., Ichinose T. (Toshiaki), 2006, Impactstatement on the effect of urban structure to temperature distribution using remote sensing and GIS, 5th Workshop Remote Sensing Hydrol. Processes Appl. (Kaihatsu I. et al eds., 104p.), 7–12.

Sumino H., Murota R., Ohashi A., Harada H., Syutsubo K., 2006, Treatment of low-strength wastewater by anaerobic down-flow hanging (AnDHS) reactor, Environ. Eng. Res., 43, 23–29.

Suzuki N., 2007, Assessment of environmental fate and exposure variability of organic contaminants, Yakugaku Zasshi, 127 (3), 437–447.

Suzuki T., Yamaguchi A., Ibaraki T., Ohono K., Murayama H., Shibuya N., Hashimoto S., Kashiwagi N., 2006, Study on the estimation of source contribution to PCDD/Fs using chemical mass balance method based on functional relationship analysis, J. Environ. Chem., 16 (3), 437–448.

Tada M., 2006, Ecological effects of chemicals on nature in Rachel Carson's Silent Spring and Sawako Ariyoshi's Fukugou-Osen (Multiple Pollution) from the point of view of ecotoxicology, Lit. Environ., 9, 47–53.

Takagi Y., Funada T., Kato Y., Okatani A. T., Kohzaki K., Nakajima D., Shiraishi F., Goto S., 2006, Variation of mutagenic activity of soil to depth 1m, J. Environ. Chem., 16 (4), 627–633.

Takaguchi H., Nakajima Y., Suto H., Yoshida Y., Inoue G., 2006, Development of the monitoring system of urban environment in EXPO2005, J. Archit. Build. Sci., (24), 223–227.

Takahashi M., Matsumoto M., Kawahara K., Kanno S., Sugaya Y., Hirose A., Kamata E., Ema M., 2006, Progress on OECD chemicals programme (9)-SIAM17 in Paris, 2003, ChemBio Intergrated Manage., 2 (1), 163–175.

Takahashi M., Matsumoto M., Kawahara K., Kanno S., Sugaya Y., Hirose A., Kamata E., Ema M., 2006, Progress on OECD chemicals programme (8)-SIAM16 in Paris, 2003, ChemBio Intergrated Manage., 2 (1), 147–162.

Takahashi M., Yamaguchi T., Sumino H., Araki N., Yamazaki S., Nagano A., Syutsubo K., Harada H., 2006, Development of low strength wastewater treatment under low temperature conditions by combining of UASB and DHS reactor system enhancing a sulfur-redox cycle action, Environ. Eng. Res., 43, 353–358.

Takami A., Imai T., Shimizu A., Matsui I., Sugimoto N., Hatakeyama S., 2006, Transport of anthropogenic and dust aerosol observed at Cape Hedo, Okinawa, J. Aerosol Res., 21 (4), 341–347.

Takayama N., Tanaka N., Tsuji K., Aoki Y., 2006, Genealogy and features of research on the relation between, J. Jpn. Inst. Landscape Archit., 69 (5), 741–746.

Takiguchi A., Tsuda A., Yoshikawa S., Nakajima D., Goto S., Onodera S., 2006, Reactions of antioxidants (BHA and BHT) with chlorine in aqueous solution and mutagenic assay of the reaction products, J. Environ. Chem., 16 (2), 219–228.

Tanimoto H., Mukai H., 2006, Establishing ozone standards at ambient levels and a traceability system in Japan, J. Jpn. Soc. Atmos. Environ., 41 (3), 123–134.

Tasaki T., 2006, An evaluation based on raised claims and issues for revising a law—A case study of Recycling Law for Electrical Home Appliances, Jpn. J. Eval. Stud., 6 (2), 73–84.

Tasaki T., Moriguchi Y., 2006, Decomposition analysis of factors in the generation of beverage container wastes, J. Jpn. Soc. Waste Manage. Experts, 17 (1), 31–41.

Terazono A., 2006, E-waste issues in Asia, J. Jpn. Soc. Waste Manage. Exprts, 17 (2), 69–77.

Toriyama S., Hiyoshi S., Yamazaki T., Mizukami A., Okumura H., Fujisaki S., Mizoguchi T., Kido M., Tanaka A., Nishikawa M., 2006, Development of inside stack sampler for the determination of sublimable boron compounds, J. Environ. Chem., 16 (2), 213–218.

Uehara K., Hayashi S., Yamao Y., Matsumoto Y., Wakamatsu S., 2007, Air pollution at a busy urban crossroad: estimation of annual mean NOx concentration distribution from field observations and wind-tunnel experiments, J. Jpn. Soc. Atmos. Environ., 42 (2), 93–106.

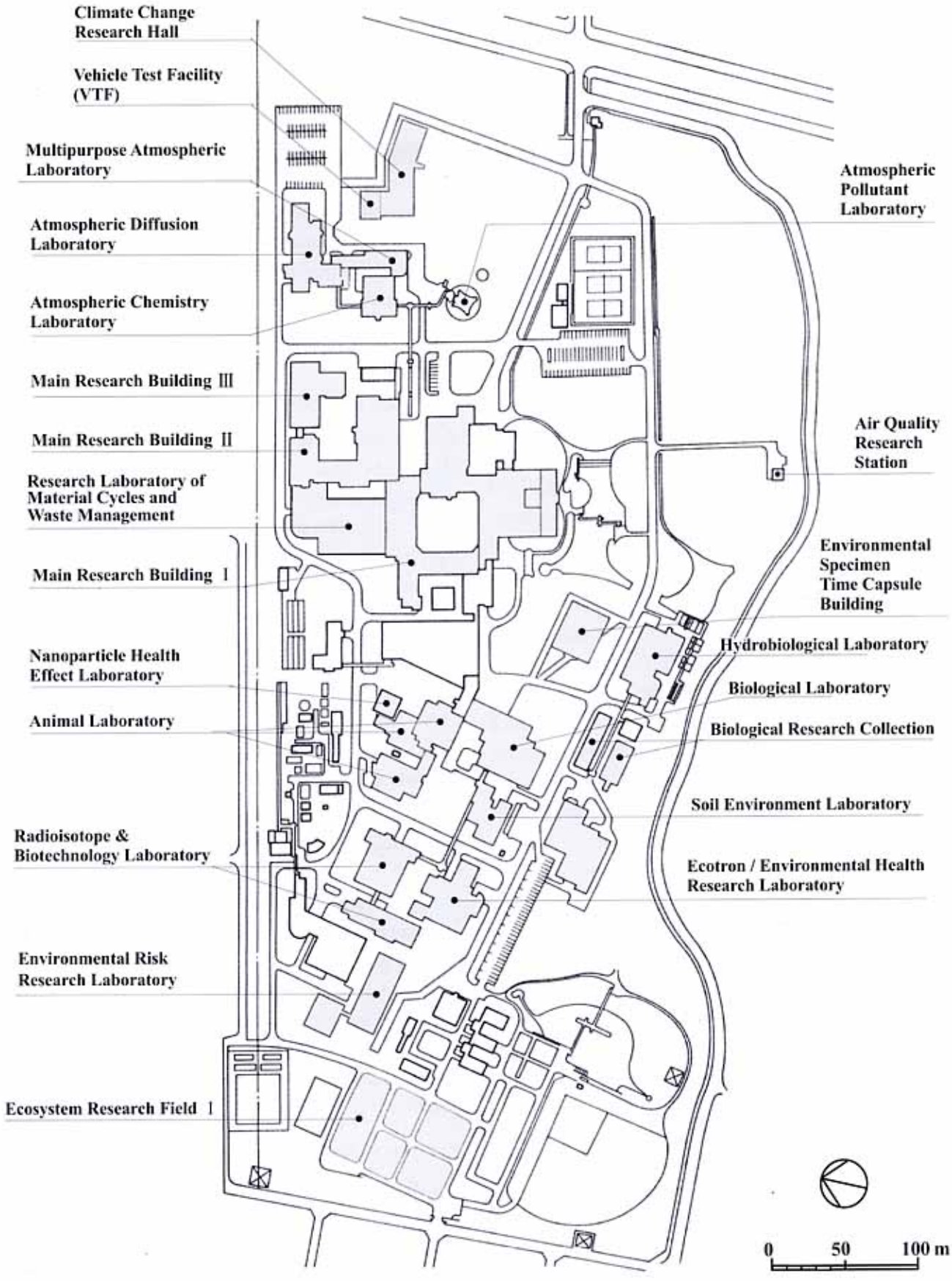
Uehara K., Wakamatsu S., Oikawa S., 2006, Wind tunnel exprements on the effects of the width of concecting streets on the concentration of roadside air pollution in a street canyon, J. Environ. Eng., AIJ, (610), 51–58.

Utiyama M., Suga S., Matsumoto Y., Fukuyama T., 2006, Aerosol dynamics in an urban area observed by multipoint measurement, J. Aerosol Res., 21, 322–327.

Watanabe T., Takamura N., 2006, The manager's awareness of conservation of the biodiversity in irrigation ponds in the southern part of East-Harima area, Hyogo Prefecture, J. Rural Planning Assoc., 25, 353–358.

Yamamoto Y., Hayashi T., Ochiai M., Fukuhara H., Ohtaka A., Nohara S., Fukui M., Kikuchi Y., Akashibo Res. Group, 2006, Reseach on red snow, Jpn. J. Limnol., 67 (3), 209–217.

NIES (2006). NIES Annual Report 2006, AE-12-2006, 135 p.
NIES (2006). Annual Report of the National Institute for Environmental Studies, A-31-2006, 505 p. (Japanese)
NIES (2006). Research Program of the National Institute for Environmental Studies, AP-6-2006, 191 p. (Japanese)
NIES (2006). Report of Special Research from NIES: International collaborative studies on a wide-area air pollution of continental scale, SR-65-2006, 54 p. (Japanese)
NIES (2006). Report of Special Research from NIES: Studies on evaluation of memory function for exposure to environmental chemicals and the development of the tool for risk evaluation in mice, SR-66-2006, 40 p. (Japanese)
NIES (2006). Report of Special Research from NIES: Study on the establishment of scientific and technical foundation for assessment of sources, development of destruction method and elucidation of pollution status of POP-like compounds especially organofluorine chemicals, SR-67-2006, 52 p. (Japanese)
NIES (2006). Report of Special Research from NIES: Studies on assessment of restoration technology of wetland ecosystem, SR-68-2006, 60 p. (Japanese)
NIES (2006). Report of Special Research from NIES: Climate Change Research Project, SR-69-2006, 120 p. (Japanese)
NIES (2006). Report of Special Research from NIES: Ozone Layer Research Project, SR-70-2006, 80 p. (Japanese)
NIES (2006). Report of Special Research from NIES: Endocrine Disrupters and Dioxin Research Project, SR-71-2006, 91 p. (Japanese)
NIES (2006). Report of Special Research from NIES: Biodiversity Conservation Research Project, SR-72-2006, 81 p. (Japanese)
NIES (2006). Report of Special Research from NIES: Watershed Environmental and Management Research Project, SR-73-2006, 94 p. (Japanese)
NIES (2006). Report of Special Research from NIES: $PM_{2.5}$ & Research Project, SR-74-2006, 84 p. (Japanese)
NIES (2006). Report of Special Research from NIES: Studies on Material Cycles and Waste Management, SR-75-2006, 161 p. (Japanese)
NIES (2006). Report of Special Research from NIES: Research on Environmental Risk by Chemical Substances, SR-76-2006, 63 p. (Japanese)
NIES (2006). Research Report from NIES: NIES Public Symposium 2006, The Asian Environment: We can't afford to ignore it, R-192-2006, 27 p. (Japanese)
Toshimasa, O. (2006). Research Report from NIES: Study on characteristics and formation mechanism of photochemical oxidants over Japan, R-193-2006, 264 p. (Japanese)
Hideaki, N. (2006. Research Report from NIES: ILAS-II Project Final Report, R-194-2006, 283 p. (Japanese)
Toshimasa, O. (2007). Research Report from NIES: Study on characteristics and formation mechanism of photochemical oxidants over Japan , R-195-2007, 256 p. (Japanese)
Center for Global Environmental Research (2006). National Greenhouse Gas Inventory Report of Japan May, 2006, CGER-I066-2006, 346 p. (Japanese)
Center for Global Environmental Research (2006). Greenhouse Gas Inventory Development in Asia—Experiences from Workshops on Greenhouse Gas Inventories in Asia, CGER-I067-2006, 137 p.
Center for Global Environmental Research (2006).National Greenhouse Gas Inventory Report of Japan August, CGER-I068-2006, 378 p. (Japanese)
Center for Global Environmental Research (2006).National Greenhouse Gas Inventory Report of Japan August, CGER-I069-2006, 434 p.
Center for Global Environmental Research (2007). CGER's Supercomputer Activity Report Vol. 14-2005, CGER-I070-2007, 154 p. (English/Japanese)
Center for Global Environmental Research (2007). Proceedings of the First Workshop of Japan–UK Joint Research Project "Developing Visions for a Low-Carbon Society through Sustainable Development", CGER-I071-2007, 98 p.
Center for Global Environmental Research (2007). Aligning climate Change and Sustainability—Scenarios, modeling and policy analysis, CGER-I072-2007, 180 p.
Center for Global Environmental Research (2007). CGER's Supercomputer Monograph Report Vol. 12, CGER-I073-2007, 79 p.
NIES (2006). News of the National Institute for Environmental Studies (Vol. 25/1–6) (Japanese)
NIES (2006). Research booklets of National Institute for Environmental Studies: Kankyo-gi (No. 20–23) (Japanese)


Climate Change Research Hall
Vehicle Test Facility (VTF)
Multipurpose Atmospheric Laboratory
Atmospheric Diffusion Laboratory
Atmospheric Chemistry Laboratory
Main Research Building III
Main Research Building II
Research Laboratory of Material Cycles and Waste Management
Main Research Building I
Nanoparticle Health Effect Laboratory
Animal Laboratory
Radioisotope & Biotechnology Laboratory
Environmental Risk Research Laboratory
Ecosystem Research Field 1
Atmospheric Pollutant Laboratory
Air Quality Research Station
Environmental Specimen Time Capsule Building
Hydrobiological Laboratory
Biological Laboratory
Biological Research Collection
Soil Environment Laboratory
Ecotron / Environmental Health Research Laboratory
0 50 100 m

Air Quality Research Station

Automatic instruments to monitor the concentrations of 7 atmospheric constituents (NO_x, SO_2, O_3, CO_2, non-methane hydrocarbons, suspended particulate matter, and gaseous Hg) are operated at this station. Wind speed, precipitation, atmospheric pressure, visible and UV radiation, earth surface (soil and air) temperature and other atmospheric characteristics are also measured for data analyses, and the results are made available to NIES researchers. The stability and accuracy of the automated measurements and factors that interfere with them are studied, as is the evaluation of new instruments developed for atmospheric monitoring.

Animal Laboratory

The animal laboratory has three facilities in which environmental conditions are controlled. Facility I has breeding rooms for specific pathogen-free laboratory animals, and has complex gas or diesel exhaust particle (DEP) exposure chambers for investigating the health effects of $PM_{2.5}$ or DEP. Facility II has a conventional laboratory animal breeding unit and has laboratories for studies on the effects of chemicals, including dioxins and heavy metals. Facility III was built in 2004 as a nanoparticle health effects research facility; it contains exposure chambers and two diesel engines for generating nanoparticles Research on the health effects of nanoparticles on experimental animals will begin in the 2005 fiscal year.

Atmospheric Chemistry Laboratory

This is a 6-m^3 stainless steel chamber, the inner surface of which is coated with Teflon. It permits studies of atmospheric photochemistry. This facility is essential to our research on the photochemistry of urban smog, mechanisms for secondary aerosol formation, and other important atmospheric phenomena.

Atmospheric Diffusion Laboratory

This wind tunnel is exceptional in that wind velocities (down to 0.2 m s^{-1}), air temperatures, and floor temperatures can be independently controlled to create stratified flow fields. Temperature and wind velocity sensors are moved through the tunnel on a computer-controlled traverse system, gathering 3- dimensional data. These features, together with the use of models of buildings or mountains in the tunnel, allow accurate simulation of air flow and pollutant transport under a variety of atmospheric conditions.

Biological Laboratory

This facility consists of controlled greenhouses and growth cabinets used to evaluate the effects of various detailed environmental scenarios on organisms. It includes experimental chambers in which light, temperature, and humidity can be precisely controlled. It also facilitates exposure of experimental plants to pollutant gases under these controlled conditions

Biological Resource Collection

Two projects are conducted in this facility. One is the Microbial Culture Collection (MCC-NIES), in which microalgae and protozoa have been maintained since 1983. About 1900 strains have now been preserved, and 600 to 800 strains are distributed to researchers inside and outside NIES each year. In 2002, MCC-NIES was made a center for the collection of algal resources in Japan. The second is ex situ conservation of endangered algae (as a part of the Environmental Specimen Time Capsule Program). About 200 strains of freshwater red algae and Charales algae are maintained.

Climate Change Research Hall

The Climate Change Research Hall (CCRH), was completed in March 2001 with 3 floors and a total area of 4900 m^2. The following major research programs are conducted in this facility: (1) development and implementation of climate change models based on various socio-economic and emissions scenarios; (2) monitoring of atmospheric constituents to evaluate ocean and terrestrial carbon sinks; and (3) assessment of forest sinks by remote sensing, forest modeling and use of statistical data. In addition, the facility includes equipment to evaluate low-emissions vehicles.

Ecosystem Research Field

The Ecosystem Research Field is composed of two fields: Main Field I is on the NIES campus and the Branch Field is located 4 km west of the campus. The facilities include experimental fields for various types of plant-dominated ecosystems, lysimeters,

greenhouses, observation towers, and laboratories. These fields are used to test the results of laboratory and outdoor studies on ecosystems; to develop remote-sensing techniques from small-scale ground truth data; and to supply plants, particularly for bioassays and mitigation studies.

Environmental Risk Research Laboratory

The Environmental Risk Research Laboratory is the core research facility of Research Center for Environmental Risk. In the Laboratory extensive research activities on ecological effects, human health effects and environmental exposure, as well as collection, analysis and dissemination of related information, are being conducted. The building is equipped with several special facilities including fresh water and marine water exposure systems for ecotoxicological research, breeding room for laboratory animals, and instruments including a liquid chromatograph -tandem mass spectrometry (LC/MS/MS) for the qualitative and quantitative analysis of environmental chemicals and a confocal laser scanning microscopy for cell biology.

Environmental Specimen Time Capsule Building

The strategic and systematic storage of environmental samples and biological specimens provides an important knowledge base and is essential for environmental research. For example, such samples and specimens are needed to study long-term trends in environmental pollutants, and to verify past conditions when new types of pollution have been identified. NIES constructed this building to provide central facilities for the preservation of environmental specimens. The facilities are used for the long-term storage of environmental specimens such as mussels and air particulates, as well as cells and genetic material of threatened species.

Forest Ecosystem Sites for Monitoring Carbon Sequestration

These monitoring facilities were established to carry out studies on the carbon balance of terrestrial ecosystems and to evaluate the methods of monitoring. All three sites are located in planted larch forests: one in Yamanashi prefecture and two in Hokkaido.

1) Fuji Hokuroku Flux Observation Site

This site was established in January 2006 and is located in a forest which is mainly comprised of planted larches at the foothills of Mt. Fuji in Yamanashi Prefecture. This site is used to investigate the magnitude of the carbon sources/sinks in terrestrial ecosystems. It also serves as the principle monitoring site of the AsiaFlux network, which is an organization that promotes co-operation and the exchange of information on carbon flux observation in Asia.

2) Teshio Carbon Cycle and Larch Growth (CC-LaG) Experimental Site

This site, which was established in 2001, is comprised of one catchment at Hokkaido University's Teshio Experimental Forest in Horonobe, Hokkaido. At this site, we focus our research on the transition of carbon flow during the arboreal growing period. After the felling of a natural forest (coniferous and broadleaf trees), in February of 2003, we planted larch saplings in October of the same year and are now using standard forestry practices to manage them and monitoring the result of carbon flux.

3) Tomakomai Flux Research Site

This site, established in August of 2000, is located in a planted larch forest on the foothills of Mt. Tarumae, Tomakomai, Hokkaido. Unfortunately, the site was destroyed by a typhoon in September 2004. Since June 2005, we have been using the restored site to study the transition of the carbon balance in the devastated forest.

Global Environmental Monitoring Stations (Hateruma and Cape Ochi-ishi)

These monitoring stations were set up mainly to monitor long-term changes in the baseline levels of greenhouse gases at remote sites in Japan. The island of Hateruma is located in Okinawa Prefecture and is the nation's southernmost inhabited island. The monitoring station was constructed on the eastern edge of Hateruma. Cape Ochi-ishi Station is located in the eastern part of Hokkaido, which is a northern district of Japan. These stations are automated systems for high-precision monitoring of greenhouse gases (e.g. CO_2,

CH_4, N_2O, O_3,) and other atmospheric species (NO_x, SO_2, SPM). Long-term monitored data are archived and distributed through the Center for Global Environmental Research (CGER) homepage and the World Data Center for Greenhouse Gases (WDCGG).

Hydrobiological Laboratory

This hydrobiological laboratory includes several related facilities. The freshwater microcosm is particularly suitable for studies of the mechanisms and dynamics of phytoplankton bloom formation. The toxicity testing system is suitable for long-term exposure studies. Other associated facilities include temperature-controlled culture rooms, axenic culture rooms, large autoclaves, and an outdoor experimental pond.

Main Research Building I

This building houses analytical instrumentation and support facilities such as clean rooms. The instruments permit accurate, highly sensitive and selective detection of harmful substances in environmental samples. Stable isotope analysis facilitates research on global warming and the origins of pollutants. Among this building's instruments, (listed below) are some that are used for research and development of new analytical methods.

Analytical instrumentation in Main Research Building I

Standard instruments (free access to institute researchers)

Gas chromatograph–mass spectrometer
Gas chromatograph with atomic emission detector
Scanning electron microscope
Transmission electron microscope
Ultraviolet–visible microscope spectrophotometer
Inductively coupled plasma emission spectrometer
Atomic absorption spectrometer
X-ray fluorescence spectrometer
X-ray photoelectron spectrometer
Stable isotope mass spectrometer (for gas samples)
Fourier transform infrared spectrometer
Nuclear magnetic resonance spectrometer
Flow cytometer
High-speed amino acid analyzer

Special instruments (restricted access)

Gas chromatograph–mass spectrometer
High-performance liquid chromatograph–mass spectrometer
Inductively coupled plasma mass spectrometer
Secondary ion mass spectrometer
High-resolution mass spectrometer
High-precision stable isotope mass spectrometer (for gas samples)
Atmospheric pressure ionization mass spectrometer
Laser Raman spectrometer
X-ray diffractometer

Main Research Building II

Preservation Laboratory

This facility includes –20°C, 5°C and 20°C temperature-controlled rooms, where various environmental substances collected by researchers at this Institute are stored temporarily, until they are put to practical use. Some samples that are recognized as valuable for study are transferred to regular storage in the time capsule building.

Main Research Building III

1) Fourier-transform mass spectrometer (FT-MS)

The FT-MS has very high mass resolution (more than 106 at m/z = 131), with a superconducting magnet rated at 3 T. Cluster ions with high mass numbers, isotopes/isobars, and reactions of radicals and ions can be measured with very high mass resolution.

2) Tandem mass spectrometer (tandem-MS)

Two double-focus-type MSs are connected serially (in tandem). The resolutions of the first and second MSs are 6.5×10^4 and 5×10^3, respectively. Ions selected by the first MS are passed through the collision cell, where the ions yield fragments, which are then analyzed by the second MS. The chemical structures of complex molecules can be determined with this instrument.

3) Accelerator mass spectrometer (AMS)

An electrostatic tandem accelerator of 5 million V (max.) terminal voltage is interfaced with two ion sources and an analytical mass spectrometer system. Isobaric atomic ions can be distinguished by the electrical charges of their nuclei. The AMS is a very sensitive

and selective method for atomic ion detection and is used for measuring long-lived radioisotopes such as ^{14}C and ^{10}Be. These radioisotopes are used as tracers and time-markers (dating agents) in environmental research.

4) Hazardous chemicals area

Experiments using highly toxic substances, such as dioxins (chlorinated dibenzodioxins), polychlorinated biphenyls (PCBs), and poly-chlorinated dibenzofurans, are conducted in this area. The air pressure inside the area is maintained below atmospheric pressure to prevent leakage of hazardous substances in the analytical laboratory. Exhaust air is treated by high-efficiency particulate air (HEPA) filters and charcoal filters; discharge water is also treated with a charcoal filter system. The Hazardous Chemicals Area contains an analytical lab with a gas chromatograph – mass spectrometer (GC-MS) and a microcosm, as well as facilities for microorganism-related research, animal exposure experiments, and measurements of the physical and chemical properties of substances.

5) Greenhouse Gases Observing Satellite Data Handling Facility

The Greenhouse Gases Observing Satellite (GOSAT) Data Handling Facility (DHF) will perform the stationary processing, including data reception, processing, reprocessing, storage, validation of the processed results, and data distribution, of the satellite data. The GOSAT DHF is primarily located at NIES. In 2006 a contractor was selected to develop the system. In addition, the Preliminary Design Review was completed and the groundwork was set for the Critical Design Review. In addition, the first procurement of hardware for the GOSAT DHF was carried out.

6) Millimeter-wave spectrometer system for observation of atmospheric ozone

The millimeter-wave spectrometer measures the emission spectra from rotational transition of ozone molecules in the stratosphere and mesosphere with extremely high resolution. Vertical profiles of ozone from 14 to 76 km are retrieved by using the dependence of the width of the emission spectra of ozone on altitude. The spectrometer was installed in 1995. Since then, ozone has been monitored continuously, except on rainy days and heavily humid days.

7) Receiving and processing facility for NOAA satellite data

The Advanced Very High Resolution Radiometer (AVHRR) instruments orbit the earth on National Oceanic and Atmospheric Administration (NOAA, USA) satellites. They monitor 5 electromagnetic radiation wavelength bands from the visible to the thermal infrared region with high temporal and relatively medium spatial resolution (ca. 1 × 1 km). The AVHRR facility of NIES was able to receive the data, which are obtained by various AVHRRs, up to March 2004. The data received up until that time are being processed and archived by the facility.

8) Information processing center for Global Resource Information Database (GRID)—Tsukuba

GRID-Tsukuba is part of the Center for Global Environmental Research (CGER). The GRID information processing system was introduced at NIES in 1994. This system, which consists of a remote-sensing image processing system and a geographic information system, is operated by NIES researchers to process GRID data and to produce original datasets. Several software packages, including ERDAS/IMAGINE, ARC/INFO, and GRASS, are installed on these workstations. Image processing is done with IDRISI on an IBM/PC.

Nanoparticle Health Effect Laboratory

This building is equipped with experimental facilities to provide new knowledge on the health effects, chemical and physical properties, behavior, and translocation of nanoparticles.

Oku-Nikko Field Research Station

The field station in Oku-Nikko, in Tochigi Prefecture, consists of an observatory and a control and management building. These facilities are used to both monitor background forest pollution levels and study the effects of pollution on the forest.

Radioisotope and Biotechnology Laboratory

This laboratory is used to develop applications of recombinant DNA technology for environmental protection and to study the fate and effects of recombinant organisms in ecosystems. The laboratory's specialized instruments, including a peptide sequencer and a DNA sequencer, are available on the first floor. The second floor is radioisotope-controlled area used to facilitate studies of the transport, accumulation, chemical conversion, and toxicity of environmental pollutants in plants, animals, soil, water, and the atmosphere.

Research Laboratory of Material Cycles and Waste Management

In April 2001, NIES established the Research Center for Material Cycles and Waste Management, as an expansion of the Waste Research Division that had been created in January of the same year in connection with the national government's administrative reforms. The Research Laboratory of Material Cycles and Waste Management supports research on resource circulation and waste management, resource recovery and recycling, and technologies for environmental risk reduction and restoration after pollution, as well as testing, evaluation and monitoring.

Research Station for the Preservation and Enhancement of the Water Environment

1) Lake Kasumigaura Water Research Laboratory

This field station, located on the shore of Lake Kasumigaura, is used as a common research facility by many NIES researchers. The station's location allows in-situ studies of pollution, water quality recovery, lake ecosystem dynamics, and elemental cycles in this heavily eutrophied lake.

2) Bio-Eco Engineering Research Laboratory

Improving water quality in enclosed water bodies is an important environmental issue in many countries around the world. If water cleaning technologies are used, it is essential that they be properly suited to the local conditions. In this laboratory, research, development, and actual field testing of new types of waste and wastewater treatment systems, such as the advanced Johkasou system and aquatic plant–soil application processes that use bio- and eco-engineering technologies, are being promoted. This laboratory will enhance research activities, including international cooperative research.

Rikubetsu Stratospheric Monitoring Station

NIES has been monitoring the stratospheric ozone layer over Hokkaido in collaboration with the Solar-Terrestrial Environment Laboratory (STEL) at Nagoya University. Monitoring is also performed in a room of the Rikubetsu Astronomical Observatory, which is run by the Rikubetsu town council. The center has been using various systems to monitor the vertical distribution of stratospheric ozone (by millimeter-wave radiometer); harmful ultraviolet rays (by Brewer spectrometer); and the vertical temperature distribution of stratospheric ozone (by laser radar). The aim is to reveal ozone depletion in the stratosphere and the effects of the Arctic ozone hole. Since parts of the polar vortex in the Arctic region sometimes arrive over Hokkaido in winter or spring, Rikubetsu is one of the sites used to study the effects of the Arctic polar delete one space vortex.

Soil Environment Laboratory

The soil laboratory contains unique small and large monolithic lysimeters in which the behaviors of pollutants such as heavy metals and synthetic organic compounds are investigated. The effects of pollutants on soil ecosystems (including the soil–organisms–plant system) are also investigated.

Vehicle Test Facility (VTF)

The VTF is equipped with an environment simulation room, an on-board measurement system, and a conventional exhaust measurement system, as well as devices originally developed by NIES, such as an exhaust gas dispersion chamber and a high-dilution-ratio tunnel, in order to measure and evaluate real-world vehicle exhaust.

Number of personnel

President	1
Executive Director	2
Auditor	2
Planning Division	8
General Affairs Division	33
Audit Section	2
Center for Global Environmental Research	26
Research Center for Material Cycles and Waste Management	21
Research Center for Environmental Risk	27
Asian Environment Research Group	22
Social and Environmental Systems Division	15
Environmental Chemistry Division	17
Environmental Health Sciences Division	12
Atmospheric Environment Division	12
Water and Soil Environment Division	16
Environmental Biology Division	20
Laboratory of Intellectual Fundamentals for Environmental Studies	9
Environmental Information Center	10
Total	255

Fields of expertise

Basic Sciences	74
Engineering	66
Agricultural Sciences	27
Medical Sciences	16
Pharmaceutical Sciences	6
Fisheries Sciences	3
Economics	2
Law	1
Total	195

Division Section/Team	Position	Staff Member
Headquarters	President	OHTSUKA, Ryutaro
	Executive Director (Research)	YASUOKA, Yoshifumi
	Exec. Director (Management)	NII, Masao
	Auditor	FUNABASHI, Motohisa
	Auditor	KOBAYASHI, Nobuyuki
Planning Division	Director	KATO, Masao
	Deputy Director	OTSUBO, Kuninori
	Deputy Director	KISHIBE, Kazumi
	Principal Res. Coordinator (*)	UEHIRO, Takashi
	Principal Res. Coordinator (*)	TANABE, Kiyoshi
	Principal Res. Coordinator (*)	FUJINUMA, Yasumi
Planning Office	Chief (*)	KISHIBE, Kazumi
	Research Coordinator	YOKOI, Michitaka
	Research Coordinator	NOMURA, Tamaki
Research Coordination Office	Chief (*)	OTSUBO, Kuninori
	Research Coordinator (*)	KONDO, Yoshinori
	Research Coordinator (*)	IWASAKI, Kazuhiro
	Research Coordinator (*)	TASAKI, Tomohiro
	Research Coordinator (*)	KUROKAWA, Yoshika
Office of Public Relation and International Coordination	Chief	SATO, Kuniko
	Research Coordinator	HIROKANE, Katsunori
General Affairs Division	Director	MURAKAWA, Masamichi
General Affairs Section	Chief	UEKI, Ken
Accounting Section	Chief	KUWATA, Nobuo
Facility Management Section	Chief	TAKEUCHI, Tadashi
Audit Section	Chief	HIRAO, Yoshinori
Center for Global Environmental Research	Director	SASANO, Yasuhiro
	Deputy Director	NOJIRI, Yukihiro
	Special Senior Researcher	MAKSYUTOV, Shamil
	Special Senior Researcher	YAMAGATA, Yoshiki

(*) Multiple roles

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		TAKAHASHI, Yoshiyuki
Satellite Remote Sensing Research Section	Chief	YOKOTA, Tatsuya
		MORINO, Isamu
		YAMANO, Hiroya
Climate Risk Assessment Research Section	Chief	EMORI, Seita
		TAKAHASHI, Kiyoshi
		OGURA, Tomoo
		ITO, Akihiko
Climate Policy Assessment Research Section	Chief	KAINUMA, Mikiko
		KAMEYAMA, Yasuko
		FUJINO, Junichi
		HANAOKA, Tatsuya
Office for Atmospheric and Oceanic Monitoring	Chief	MACHIDA, Toshinobu
		SHIRAI, Tomoko
Office for Terrestrial Monitoring	Chief	FUJINUMA, Yasumi
		OGUMA, Hiroyuki
Office for Global Environmental Database	Chief	MATSUNAGA, Tsuneo
		SHIMURA, Junko
	(*)	MORIGUCHI, Yuichi
	(*)	NAKANE, Hideaki
	(*)	YOKOUCHI, Yoko
	(*)	ONO, Masaji
	(*)	TOJIMA, Yasunori
	(*)	IMAI, Akio
	(*)	TANIMOTO, Hiroshi
	(*)	ICHINOSE, Toshiaki
	(*)	TANAKA, Atsushi
	(*)	ARAMAKI, Takahumi
	(*)	MATSUSHIGE, Kazuo
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	Deputy Director	INOUE, Yuzo
	Research Coordinator (*)	YOKOI, Michitaka

(*) Multiple roles

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International Material Cycles Section	Chief	TERAZONO, Atsushi YOSHIDA, Aya
Material Cycles System Engineering Section	Chief	OSAKO, Masahiro KURAMOCHI, Hidetoshi TASAKI, Tomohiro FUJII, Minoru
Recycling and Disposal Engineering Section	Chief	KAWAMOTO, Katsuya YAMADA, Masato ENDO, Kazuto KOBAYASHI, Jun
Waste Testing and Assessment Section	Chief	KIDA, Akiko YAMAMOTO, Takashi
Material and Substance Management Section	Chief	NOMA, Yukio TAKIGAMI, Hidetaka SAKANAKURA, Hirofumi WATANABE, Mafumi
Bio-Eco Engineering Section	Chief (*)	MORIGUCHI,Yuichi
		EBIE, Yoshitaka
	(*)	XU, Kaiqin
Research Center for Environmental Risk	Director	SHIRAISHI, Hiroaki
	Deputy Director	YONEMOTO, Junzo
	Research Coordinator	YAMAZAKI, Kunihiko
	Special Senior Researcher	HORIGUCHI, Toshihiro
	Special Senior Researcher	GOKA, Koichi
Exposure Assessment Research Section	Chief	SUZUKI, Noriyuki SAKURAI, Takeo IMAIZUMI, Yoshitaka
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(*) Multiple roles

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Database Section	Chief (*)	HIRATSUKA, Tsutomu
Information Management Section	Chief	HIRATSUKA, Tsutomu

(*) Multiple roles

4D-Var	Four-dimensional variational data assimilation
AIM	Asia–Pacific Integrated Model
AR4	Fourth Assessment Report (IPCC)
B35	Brij 35
B58	Brij 58
BBM	bread-board model
CC-LaG	Carbon Cycle and Larch Growth
CCM	Chemical Climate Model
CCSR	Center for Climate System Research, The University of Tokyo
CERI	Chemical Evaluation and Research Institute
CGER	Center for Global Environmental Research
CGS	Cheong-Gye Stream
CHAAMS	Cape Hedo Aerosol and Atmosphere Monitoring Station
CMAQ	Community Multiscale Air Quality Modeling System
COP	Conference of the Parties
CTMA	cetyltrimetylammonium bromide
CWRC	Changjiang Water Resources Commission
DCS	sodium *n*-dodecanesulfonate
DHF	Data Handling Facility
DOC	dissolved organic carbon
DOM	dissolved organic matter
DS	sodium *n*-dodecylsulfate
DSi	dissolved silicate
DSS	dust and sandstorm
EEM	excitation emission matrix
EKC	Environmental Kuznets curve
EST	environmentally sustainable transport
GCP	Global Carbon Project
GIS	geographical information system
GM	genetically modified
GOSAT	Greenhouse Gases Observing Satellite
GPP	gross primary production
HEVs	hybrid electric vehicles
IPCC	Intergovernmental Panel on Climate Change
JACCO	Japanese Alliance for Climate Change Observation
JFP	Japan Fine Products Corporation
LAN	local area network
LAS	sodium *n*-dodecylbenzenesulfonate
LR	sodium laurate
METEX	Meteorological Data Explorer
MOE	Ministry of the Environment
NDIR	nondispersive infrared
NEE	net ecosystem exchange of CO_2
NICE	NIES Integrated Catchment-based Ecohydrology
OCCCO	Office for Coordination of Climate Change Observation
P6000	polyethyleneglycol 6000
PGN	peptidoglycan
PND	postnatal day
PSC	polar stratospheric cloud
Re	respiration
REAS	Regional Emission Inventory in Asia
SMF	small and medium-sized firms
SRES	Special Report on Emissions Scenarios
SS	soluble starch
T20	Tween 20
T60	Tween 60
TCE	trichloroethylene
TLR	toll-like receptor
TOMS	Total Ozone Mapping Spectrometer
TX	polyoxyethylene(10) *t*-octylphenylether
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
URCM	Urban and Regional Carbon Management
WAN	wide area network
WR	washing reagents
WWW	Worldwide Web
ZVI	zerovalent iron
βCD	β-cyclodextrin

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