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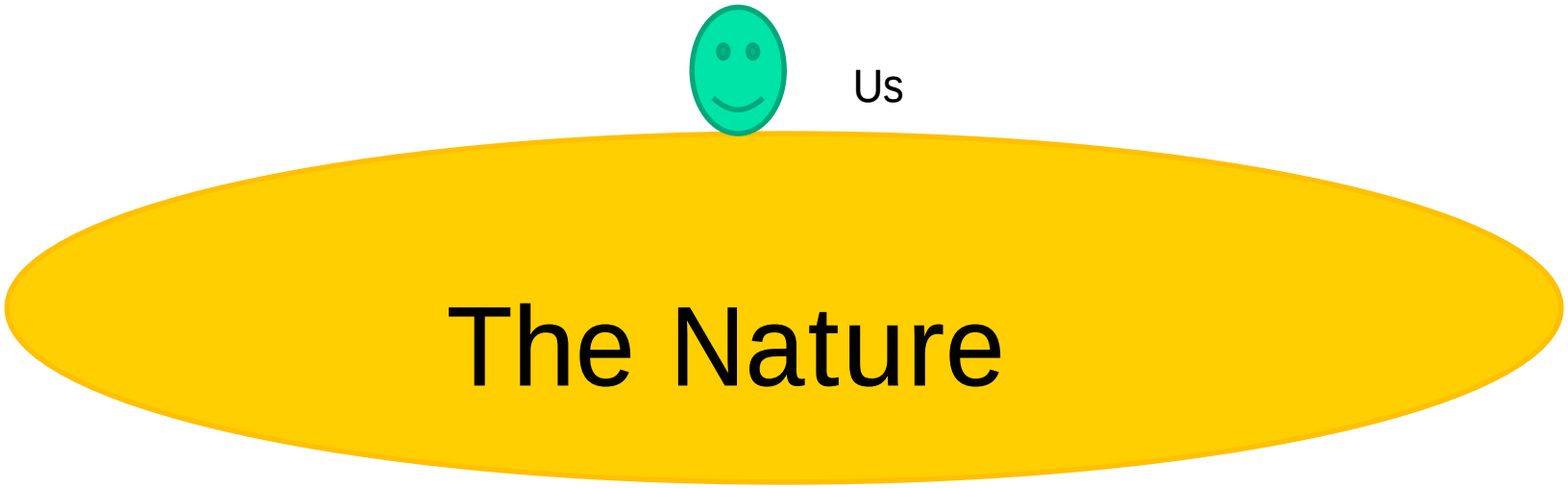
Climate Change and Future Society —Sustainability and City Resilience

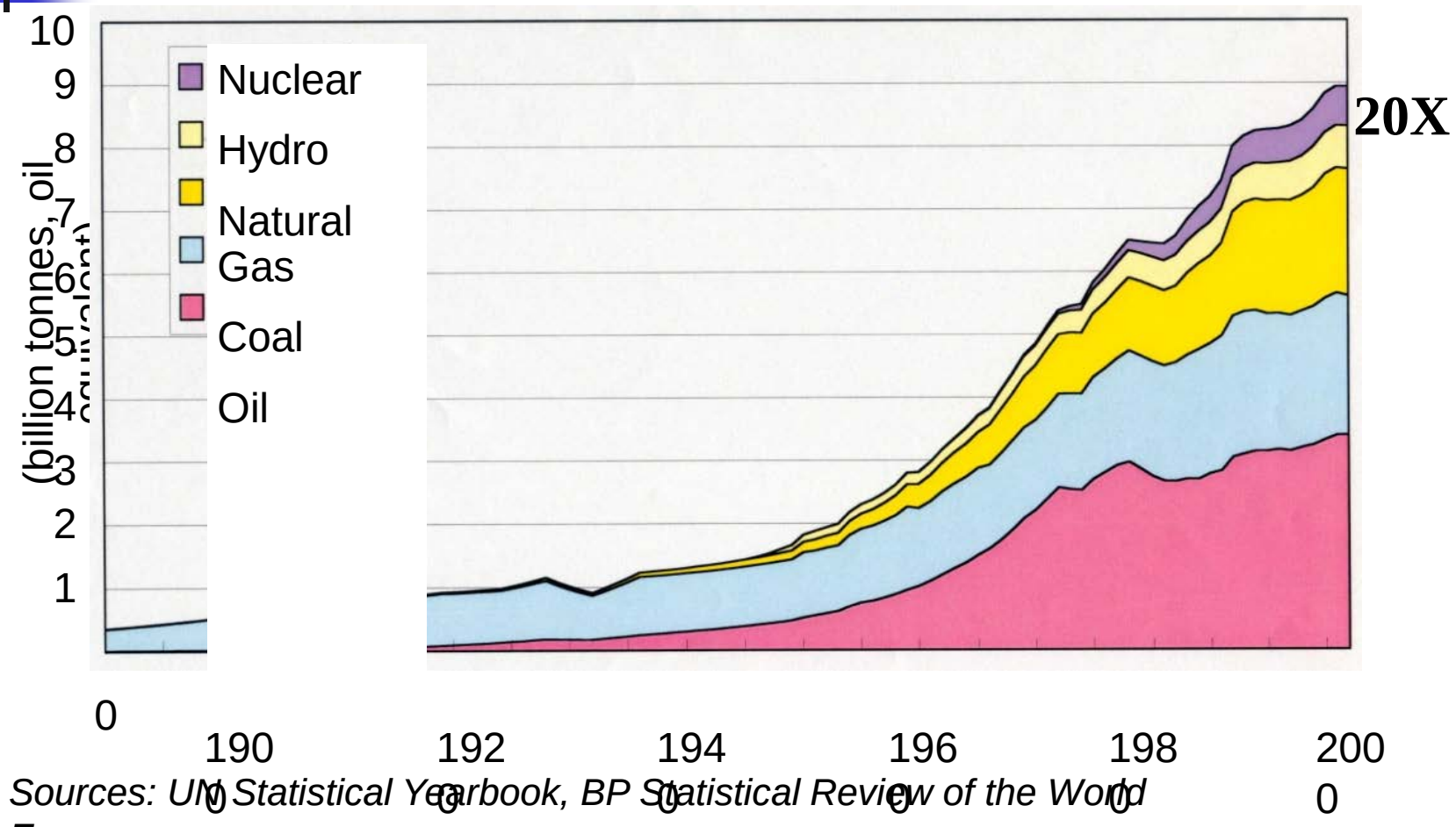
Akimasa Sumi
Prof.Emeritus
Institute for Future Initiatives
The University of Tokyo

Environmental Issues

- Relationship between the Nature and the human being
- The Natural Environment >>>Us



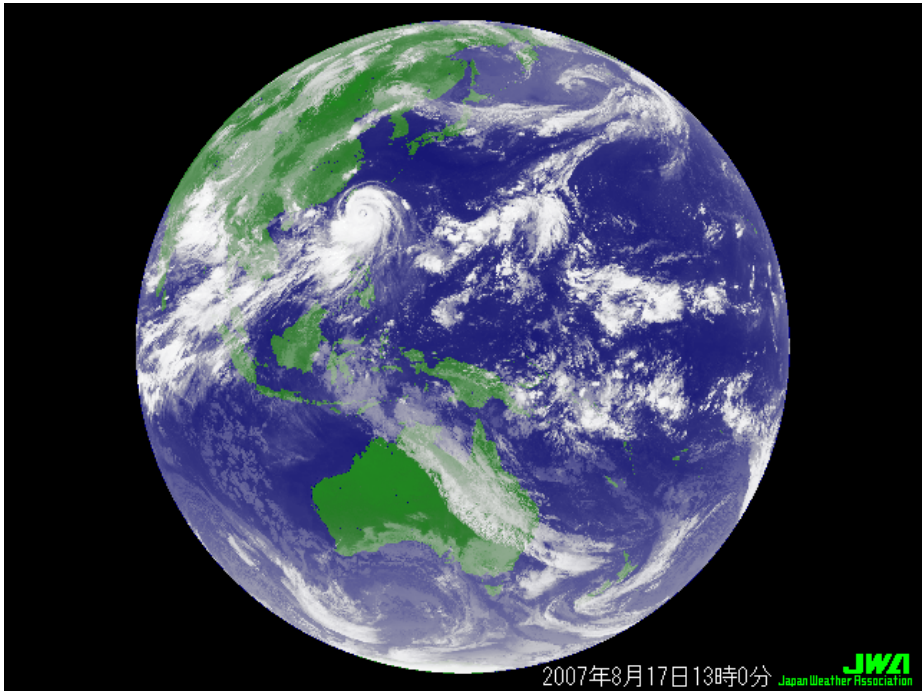
Rapid Expansion of Human Activities（Explosion!）



Sources: UN Statistical Yearbook, BP Statistical Review of the World Energy

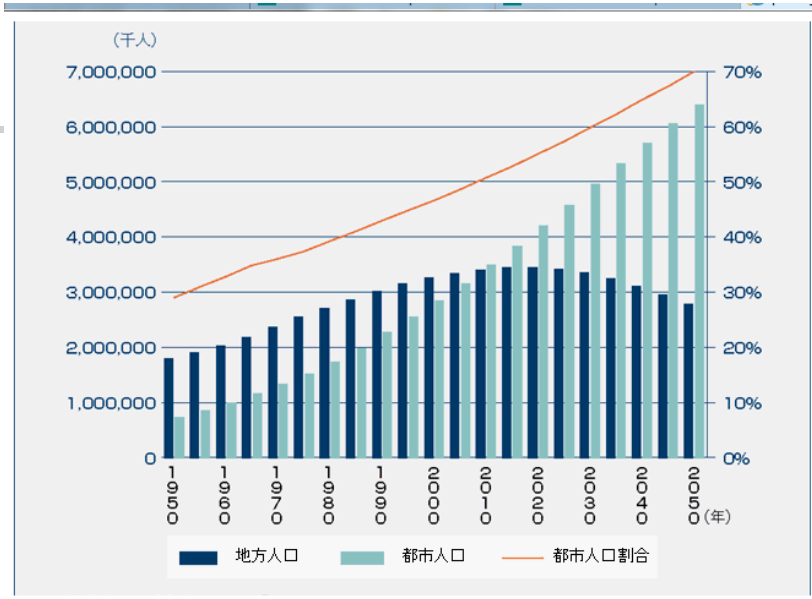
Recognition of the limit of the Earth

- Finite character of the Earth
- Limits to Growth
- Spaceship Earth



Urbanization

- Population Increase
- City Population Increase
- 2014, 54% living in City
- 1950,30%
- 2050年,66% (UN prediction)



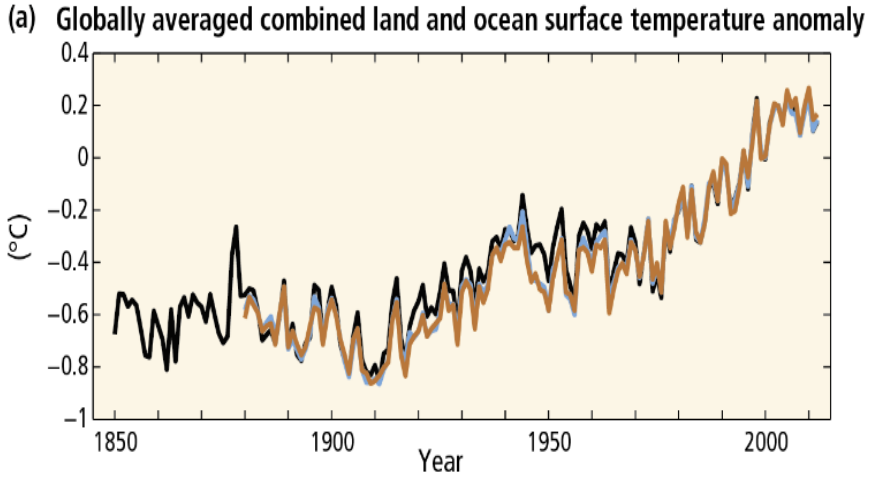
Climate Change

- Climate Change due to human activity
- Natural Climate Variability and Change
- IPCC=Intergovernmental Panel for Climate Change
- Many Assessment Reports
- AR5
- AR6 will be in 2022

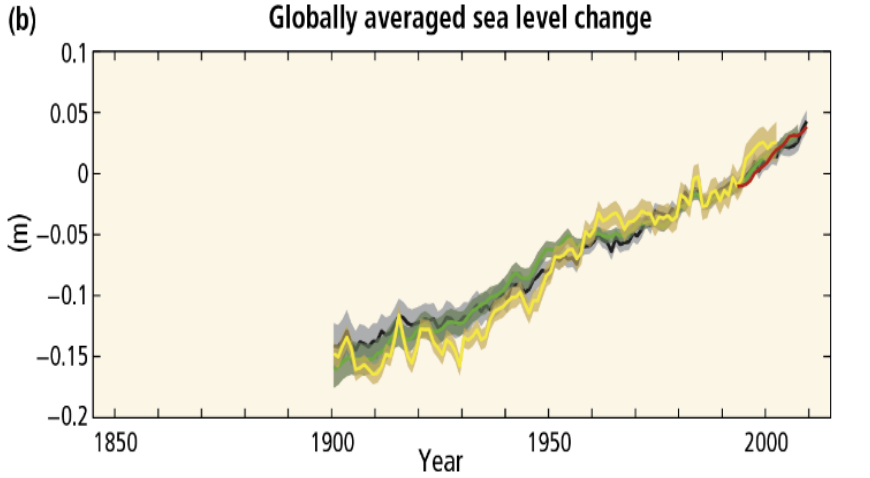
Special Reports

- Global Warming of 1.5℃
- October,2019
- The Ocean and Cryosphere in a Changing Climate
- September 2019
- Climate Change and Land
- August 2019
- Visit IPCC HP www.ipcc.ch

Observed Facts

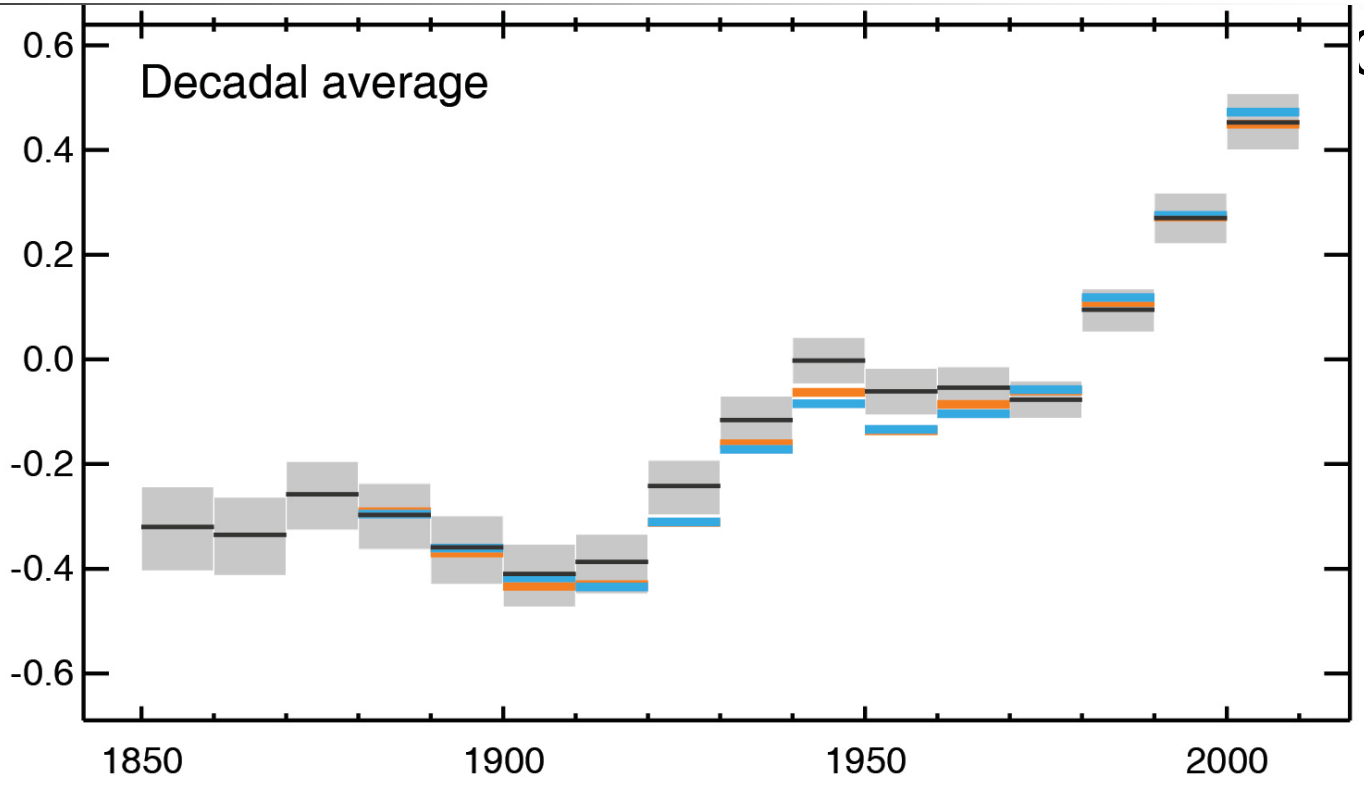


Surface Temperature

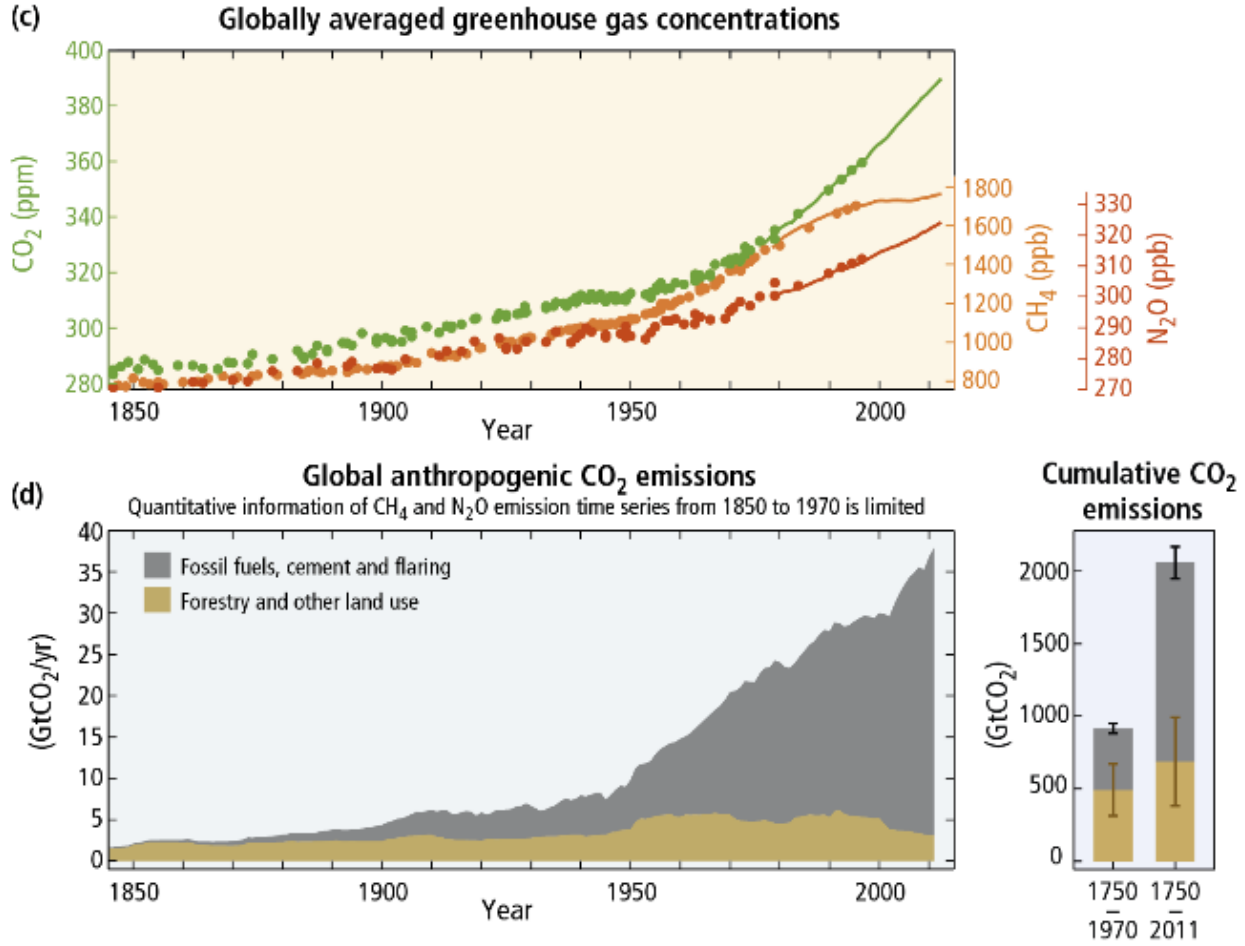


Sea Level

10year averaged globally-averaged surface temperature

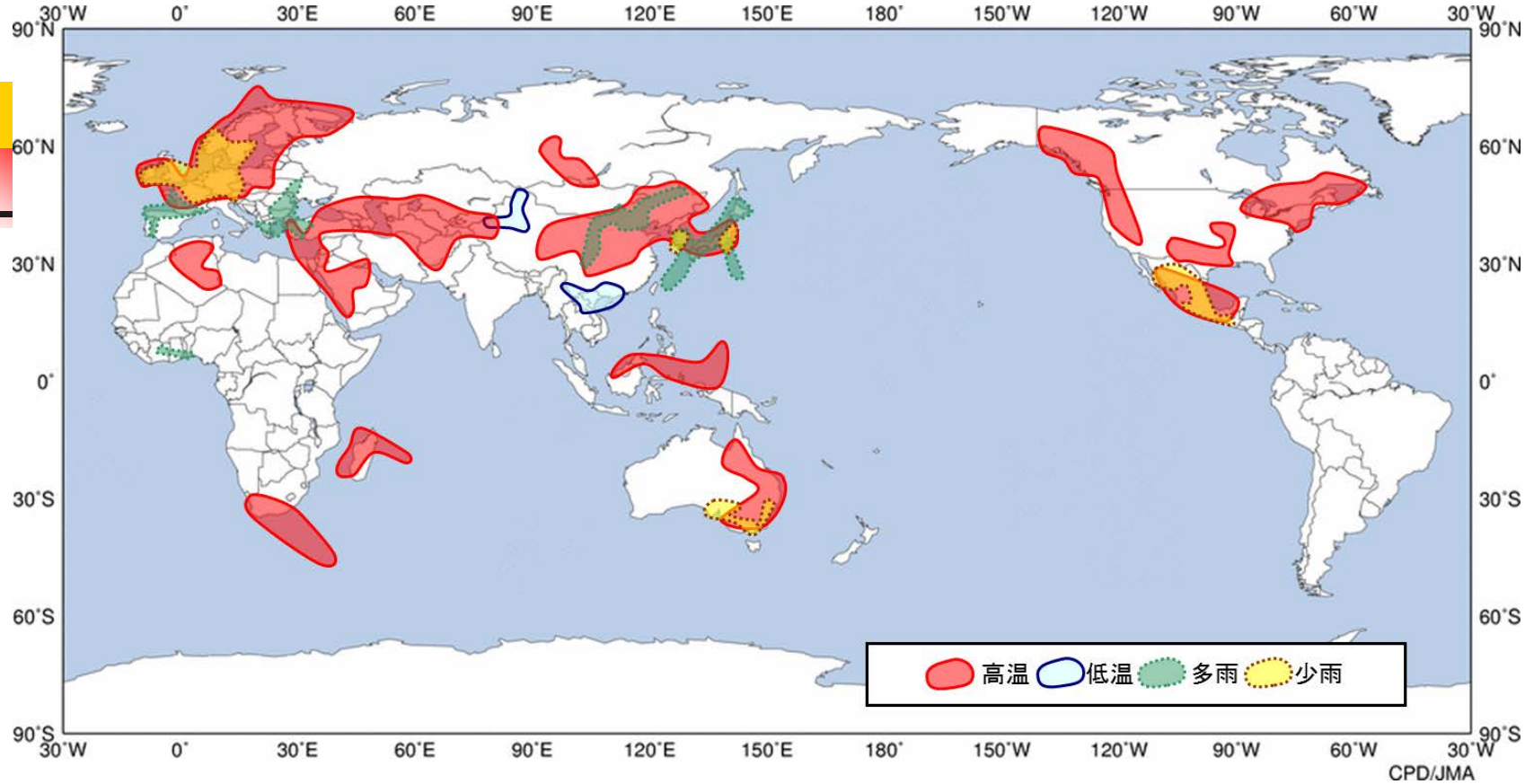


Green house Gas Concentration and CO2 emission



Flood in West of Japan(July,2018)

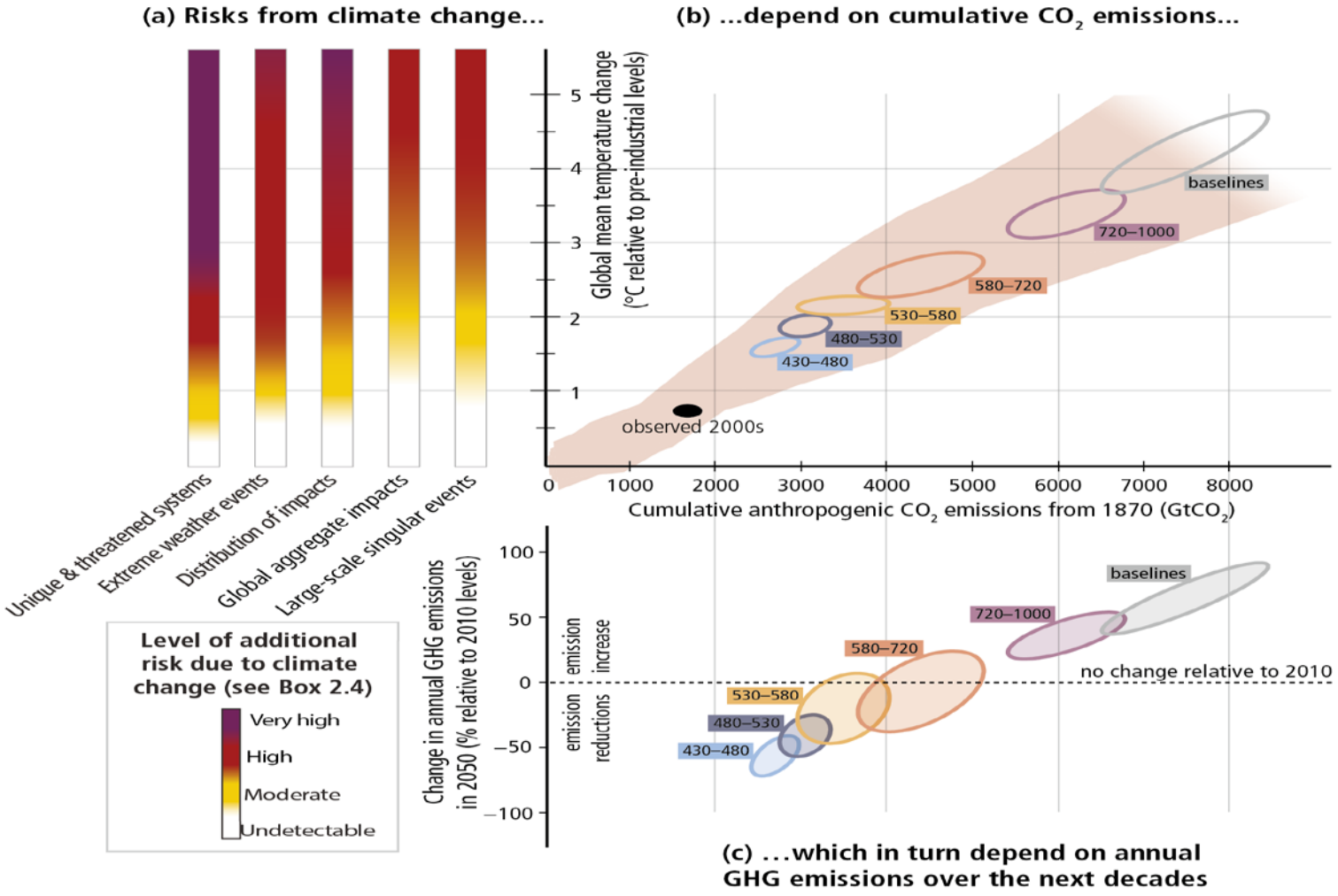
世界中で極端気象が！(2018,July)



※1: https://www.data.jma.go.jp/gmd/cpd/monitor/weekly/

※2: https://public.wmo.int/en/media/news/july-sees-extreme-weather-high-impacts

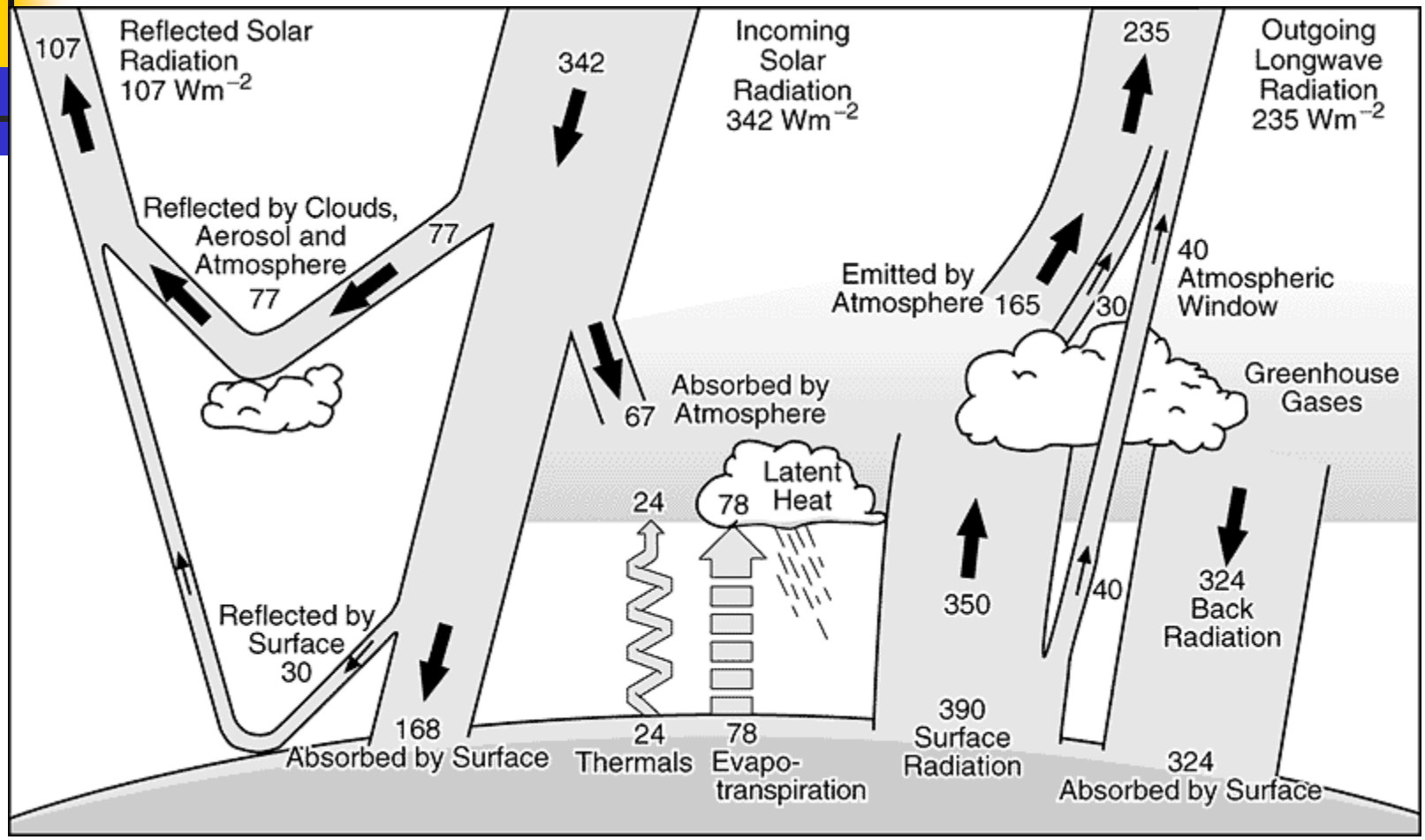
Accumulated CO2 Emission



How does climate is determined?

- Global Warming due to CO2 is correct?
- Model results are reliable?

Radiation Balance(Energy Flow)



Energy Cycle cannot be separated from Water Cycle!

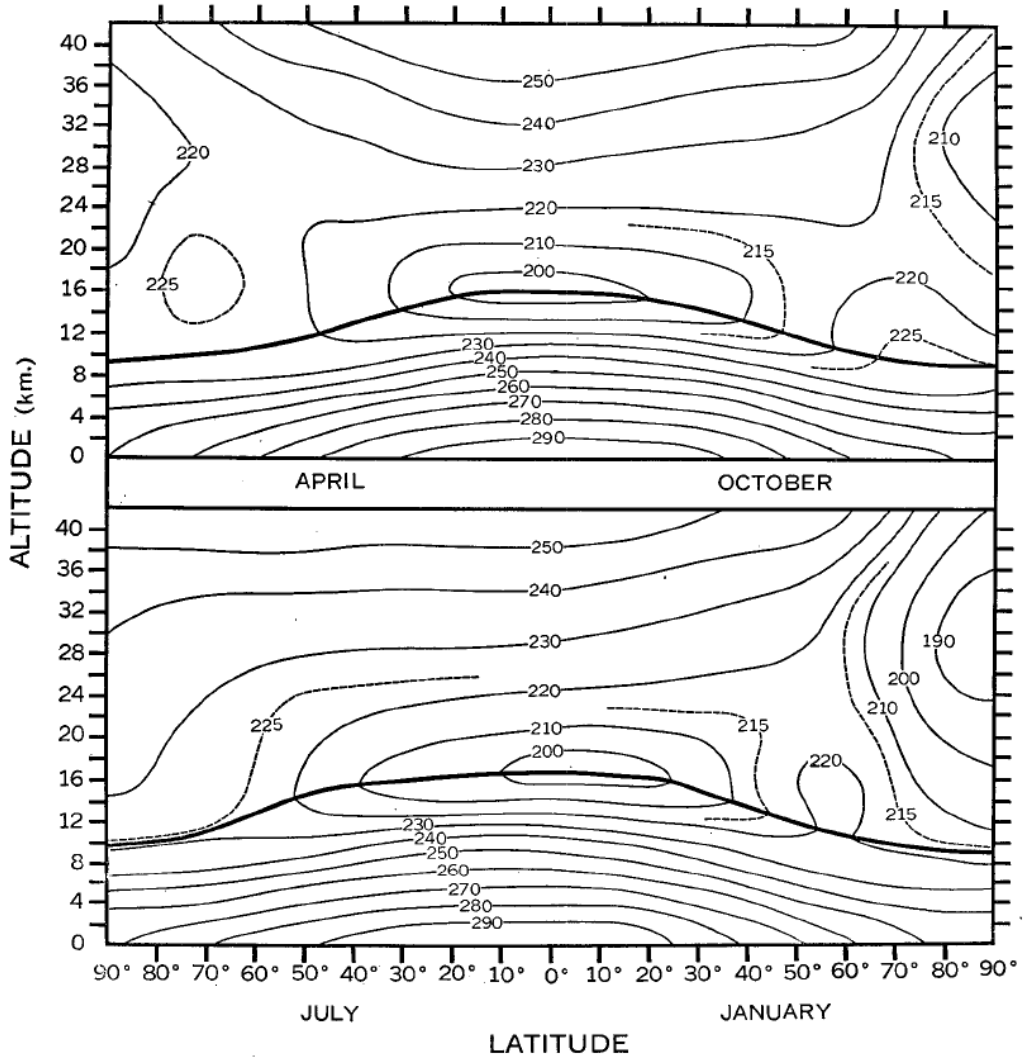


FIG. 12. Distribution of the observed temperature (deg k) in the northern hemisphere for different seasons. From J. London (1956).

Zonal mean of temperature

Following 9 figures (Manabe and Strickler(1965) Manabe and Wetherald(1967))

Radiative-Convective Equilibrium Model

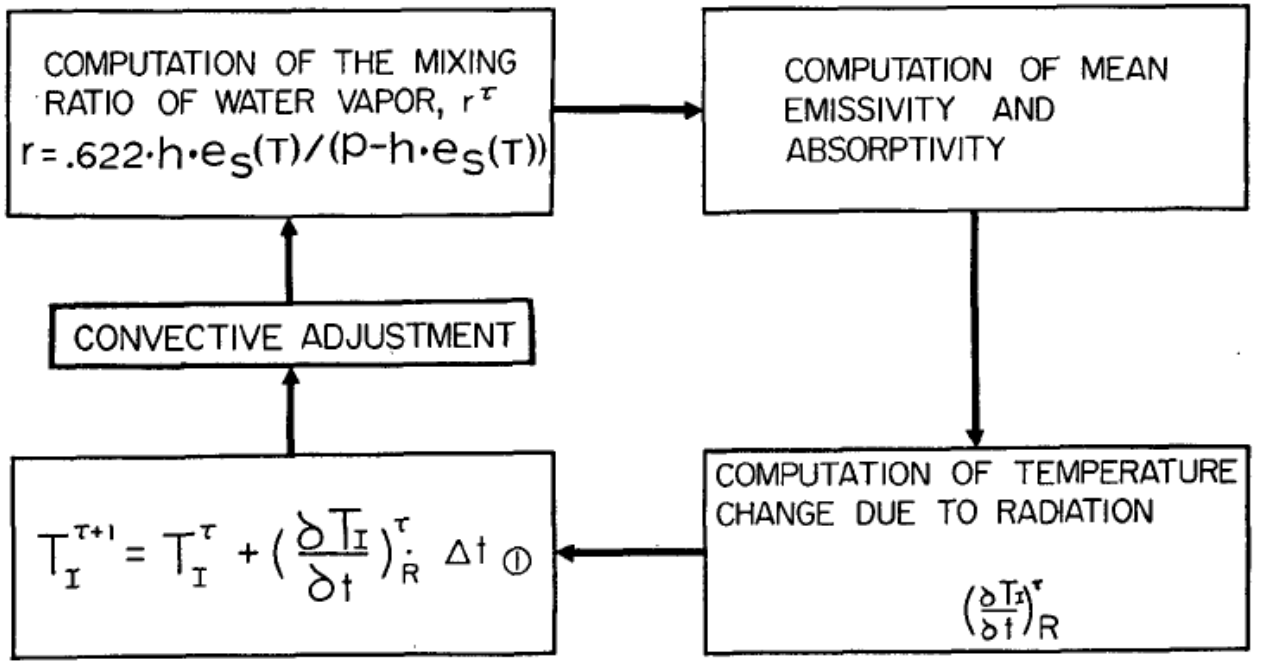


FIG. 2. Flow chart for the numerical time integration.

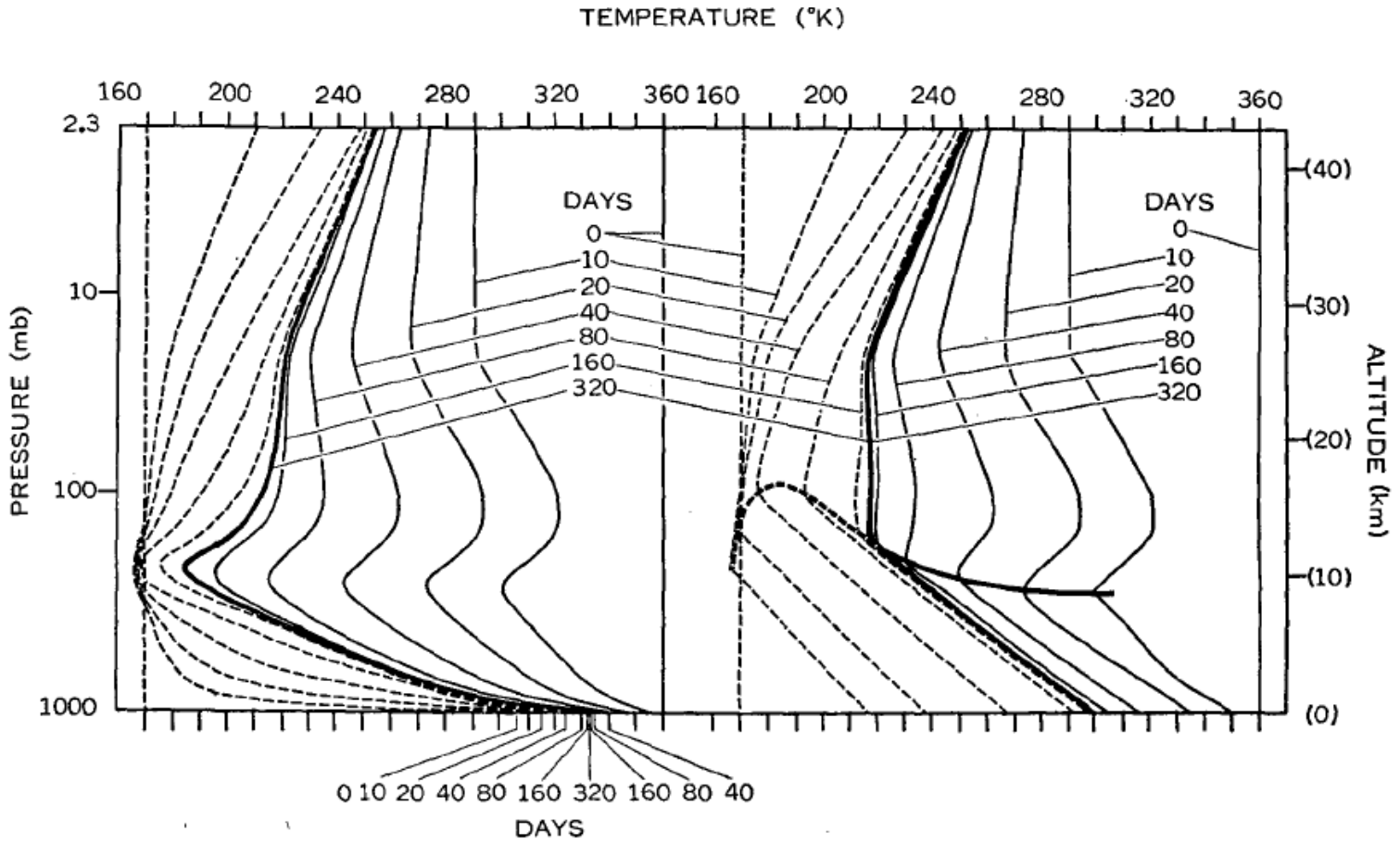


FIG. 1. The left and right hand sides of the figure, respectively, show the approach to states of pure radiative and thermal equilibrium. The solid and dashed lines show the approach from a warm and cold isothermal atmosphere.

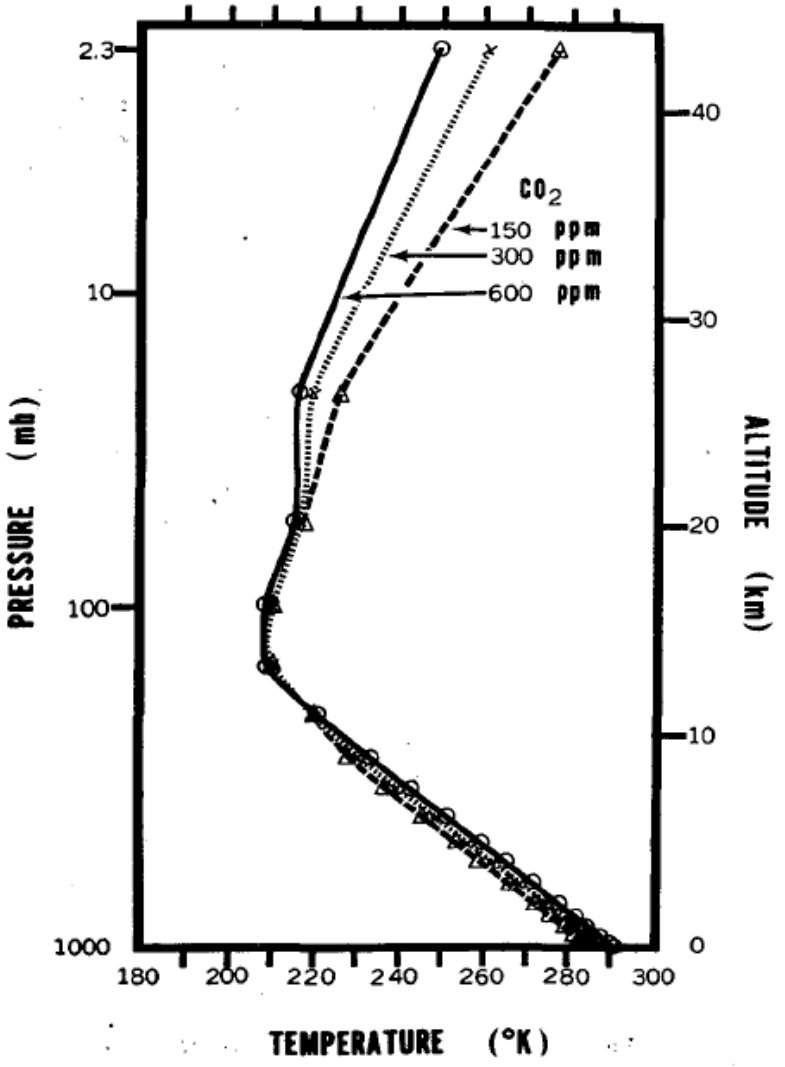
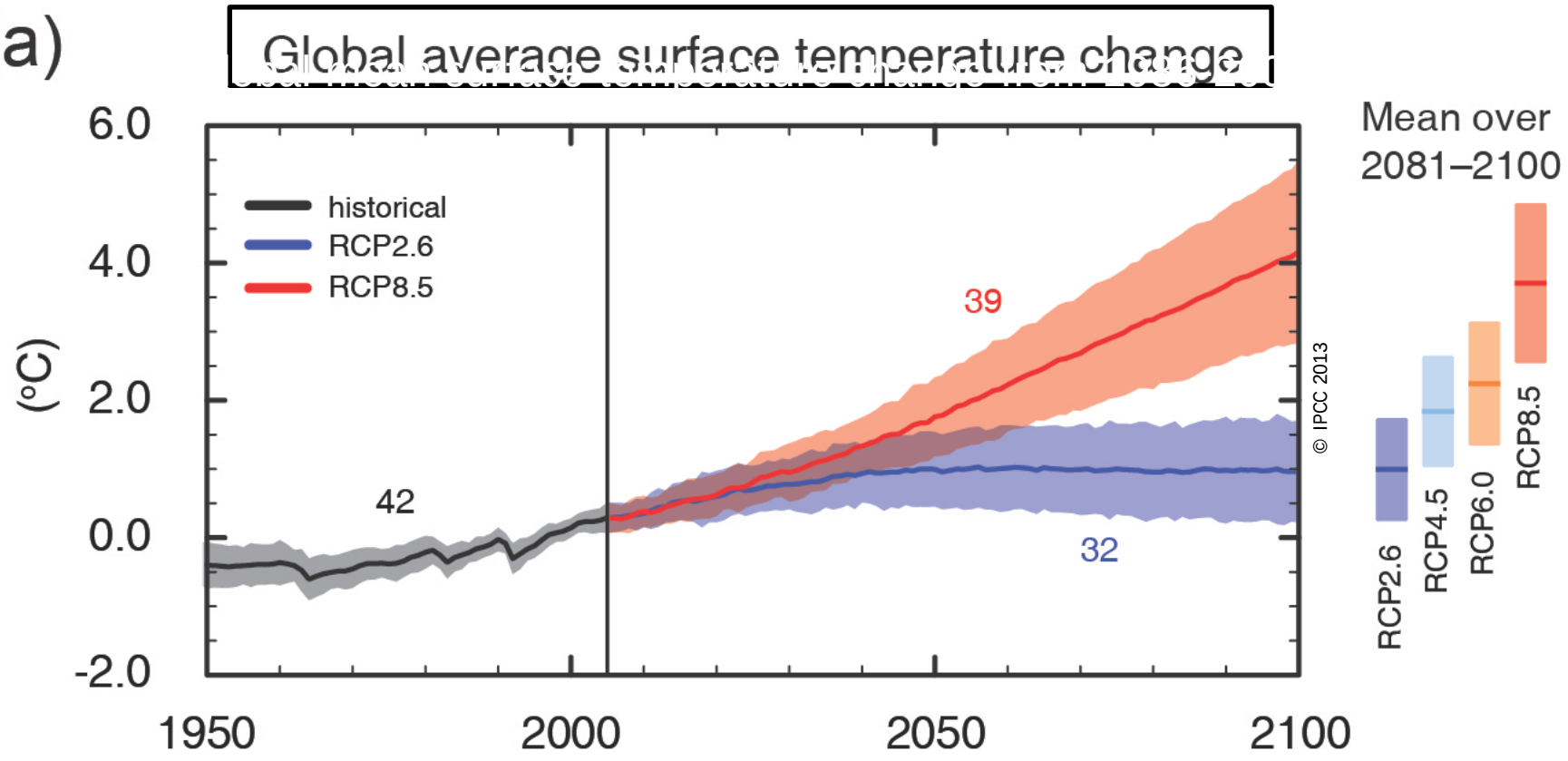


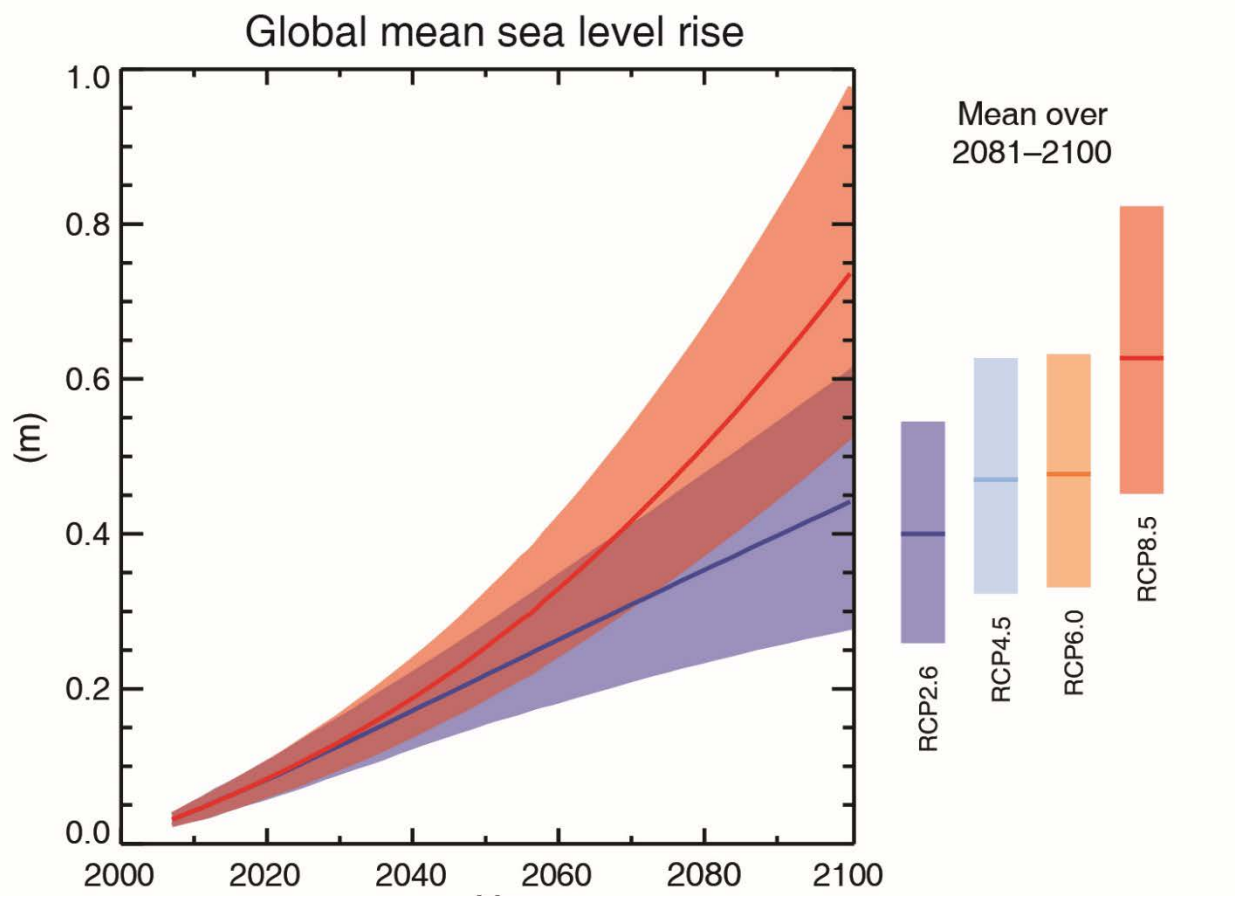
FIG. 16. Vertical distributions of temperature in radiative convective equilibrium for various values of CO_2 content.

Future Prediction

- Numerical Model's simulation
- Analogue to the past(Paleoclimate)



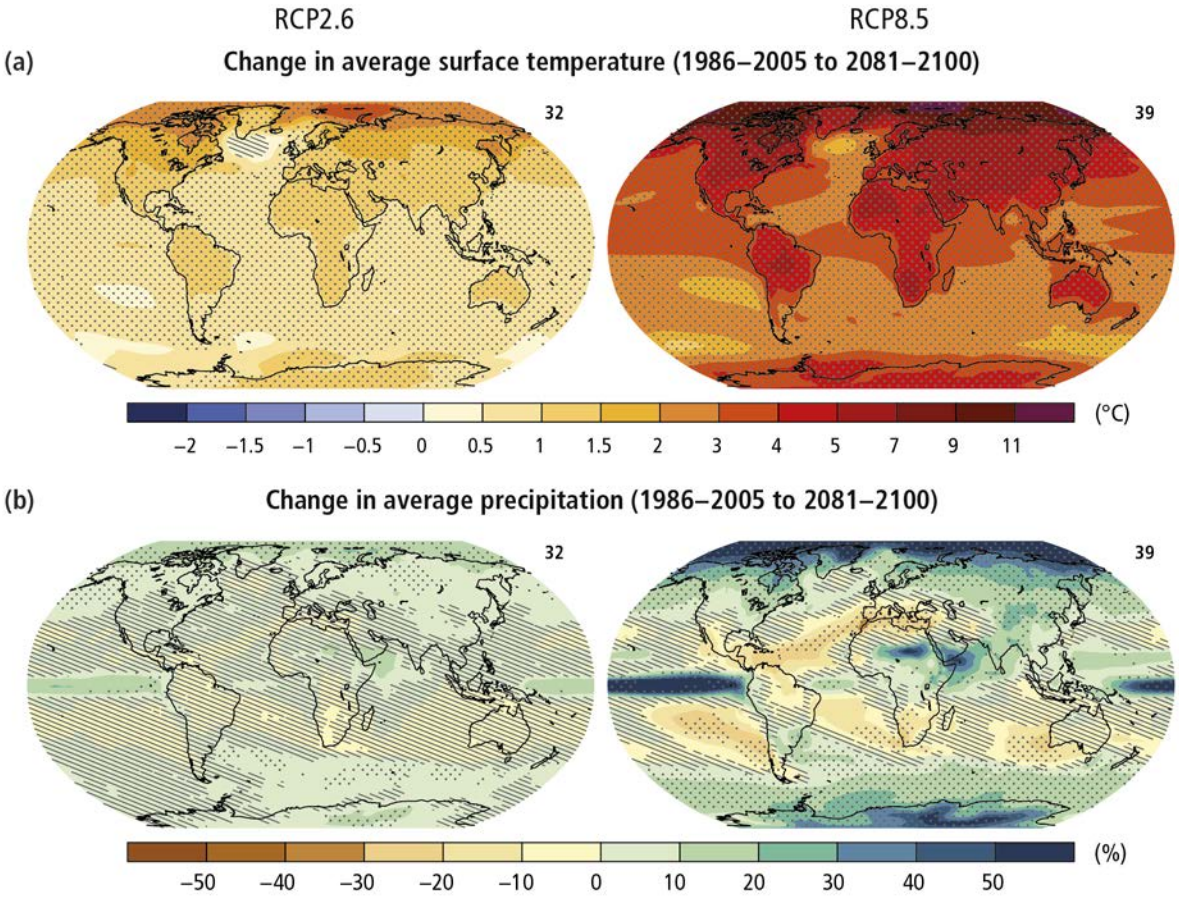
Global surface temperature change for the end of the 21st century is *likely* to exceed 1.5˚ C relative to 1850−1900 for all scenarios except RCP2.6.



RCP2.6 (2081-2100), *likely* range: **26 to 55 cm**

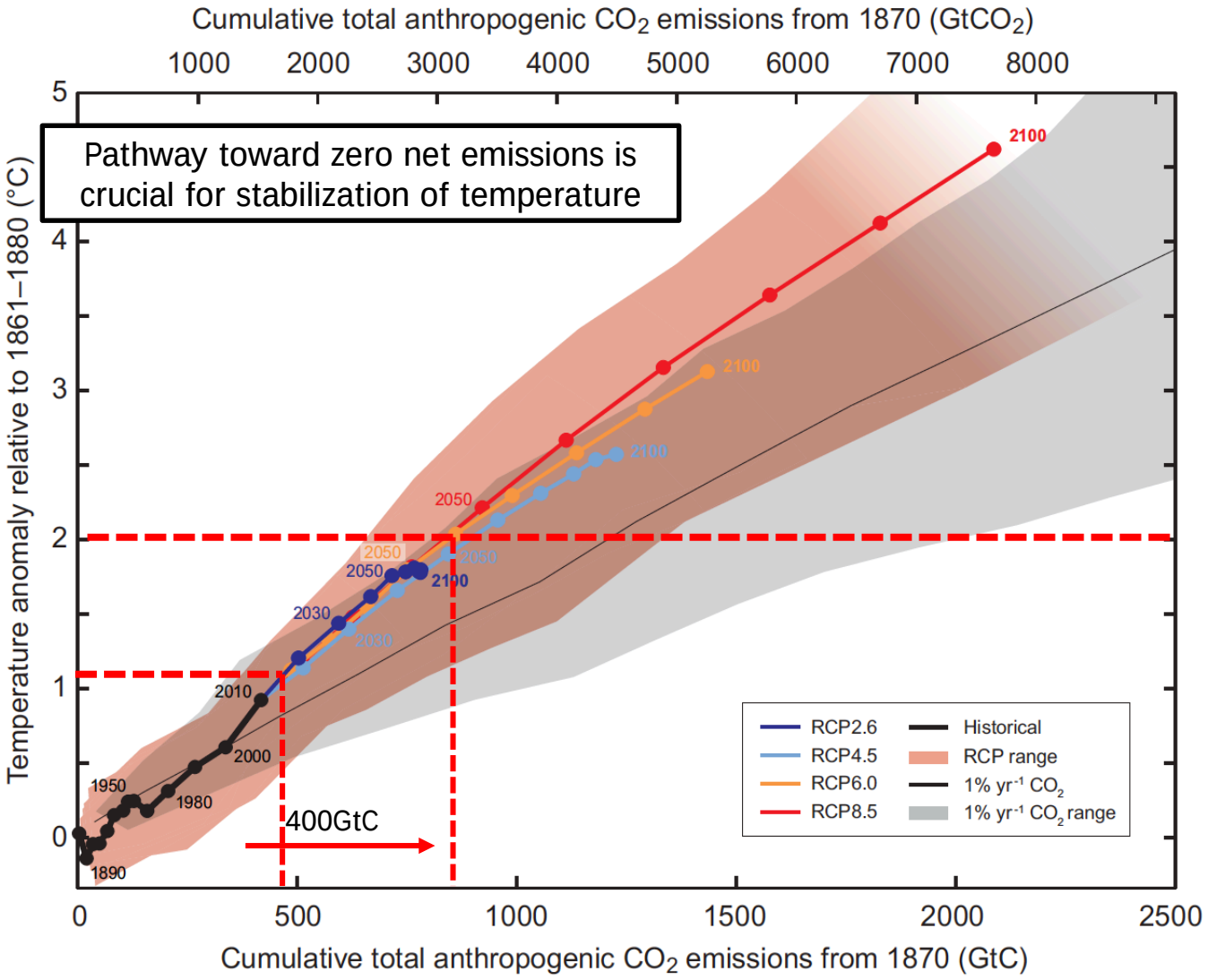
RCP8.5 (in 2100), *likely* range: **52 to 98 cm**

Temperature and Precipitation



<1st Round> Stakeholder Involvement Information Example from Science to Policy

A 400 GtC of emissions only allows to achieve 2°C



Source from Figure SPM10: http://www.climatechange2013.org/images/report/WG1AR5_SPM_FINAL.pdf

Paris Agreement（COP21)

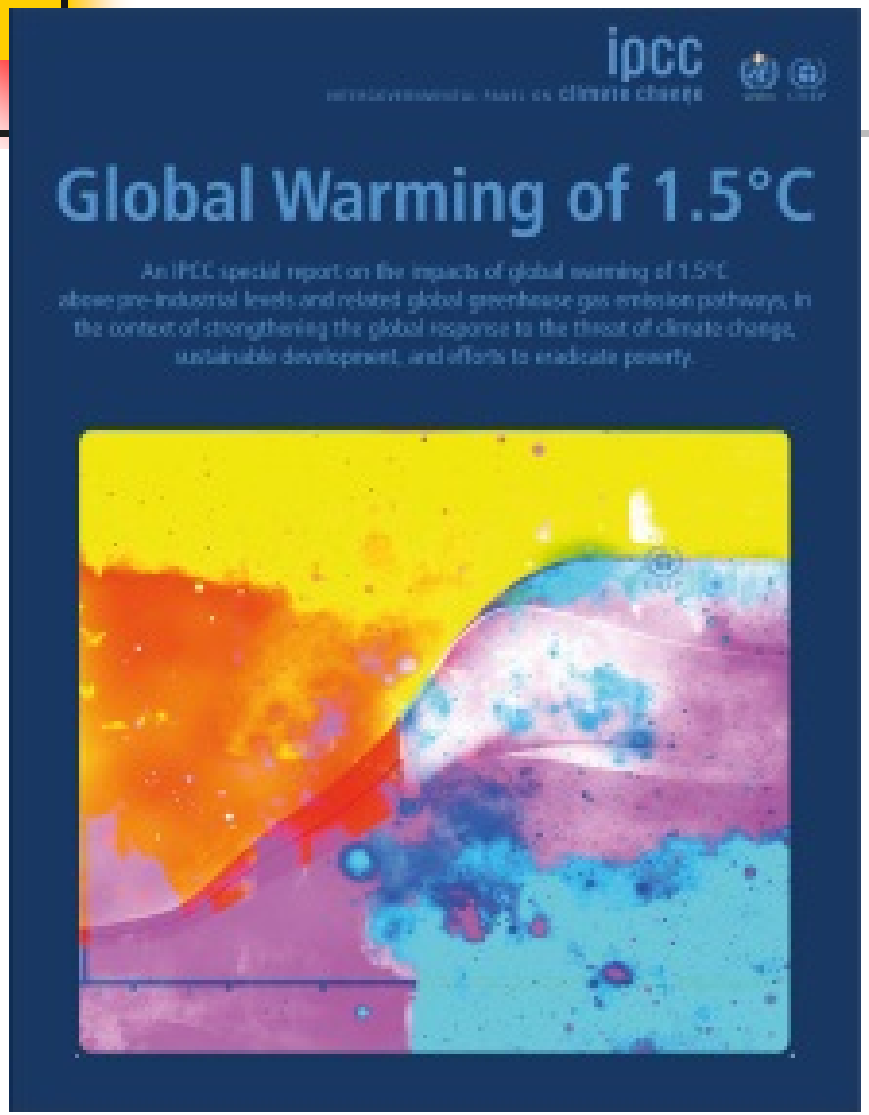
A balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases＝CCS or Biosphere(?)

Article 4

In order to achieve the long-term temperature goal set out in Article 2, Parties aim to reach global peaking of greenhouse gas emissions as soon as possible, recognizing that peaking will take longer for developing country Parties, and to undertake rapid reductions thereafter in accordance with best available science, so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century, on the basis of equity, and in the context of sustainable development and efforts to eradicate poverty

International Collaboration is critical !

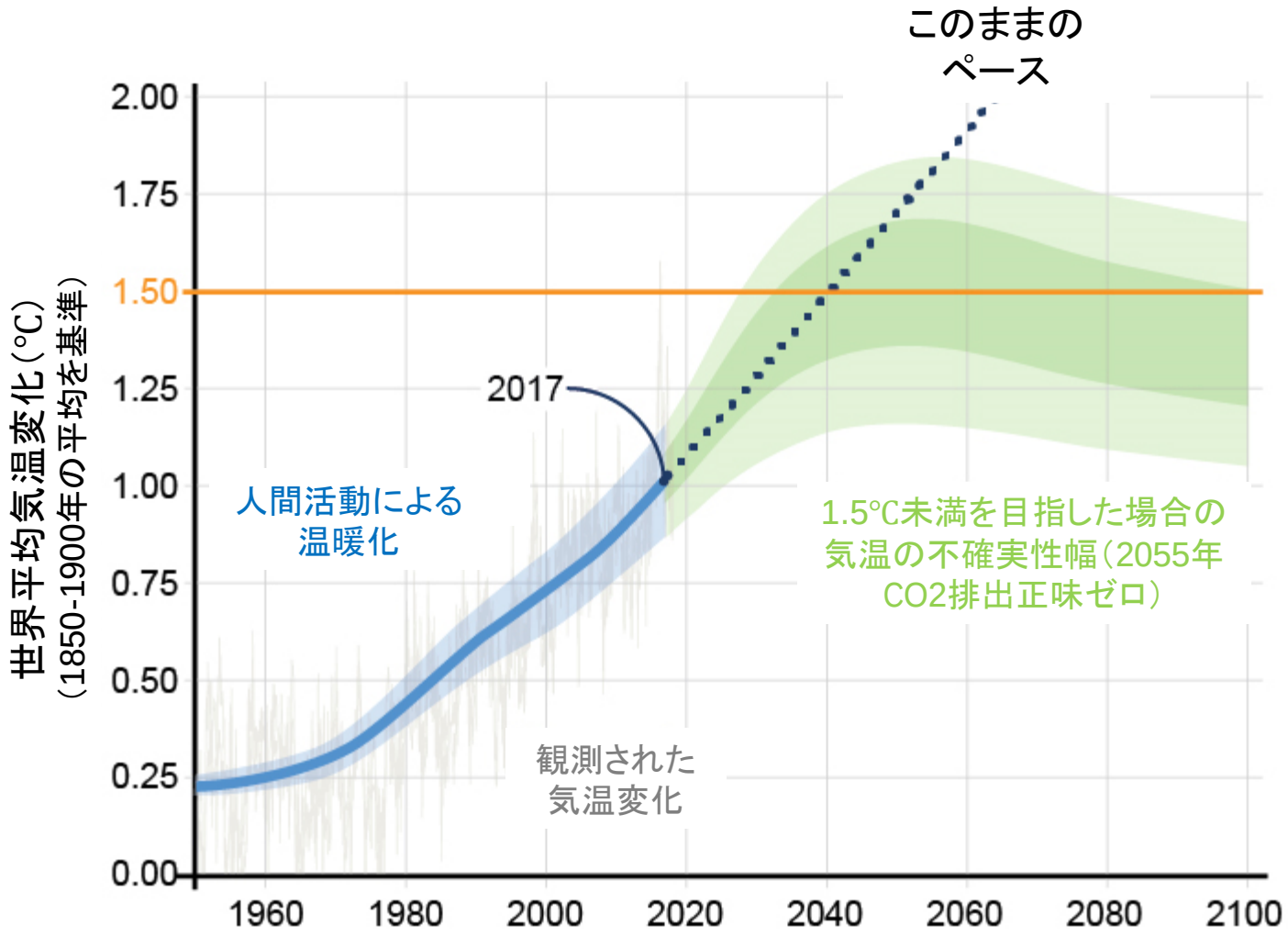
Special Report of 1.5℃



経緯：

パリ協定(2015)において、気候変動枠組条約(UNFCCC)からIPCCに、1.5℃の影響と排出経路についての評価を依頼。

2018年10月8日発表



(IPCC SR1.5 FAQ1.2より)

Situation around us has changed!

- 2015年　Big change！
- Sendai Framework（Disaster Prevention）
- Sustainable Development Goals(SGDs)
- Paris Agreement（COP21)

Sustainable Development Goals

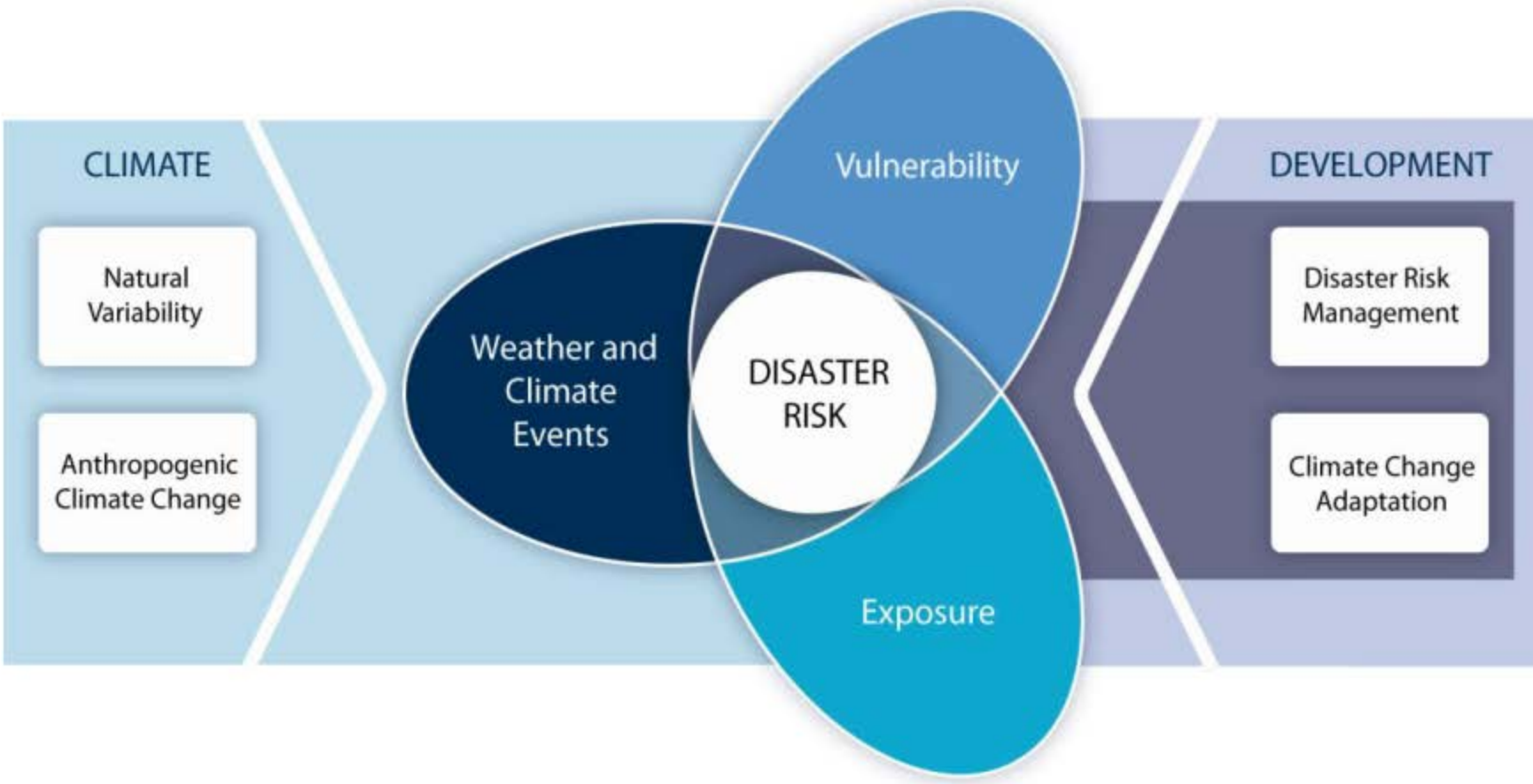
Integrated Knowledge and Action are required!

- Multiple Value System
- Diversity
- Mutual Agreement

Commonness and Diversity

- Globalization and local/regional character
- Value
- Quality of life
- Tolerance and mutual respect

Increasing vulnerability, exposure, or severity and frequency of climate events increases disaster risk



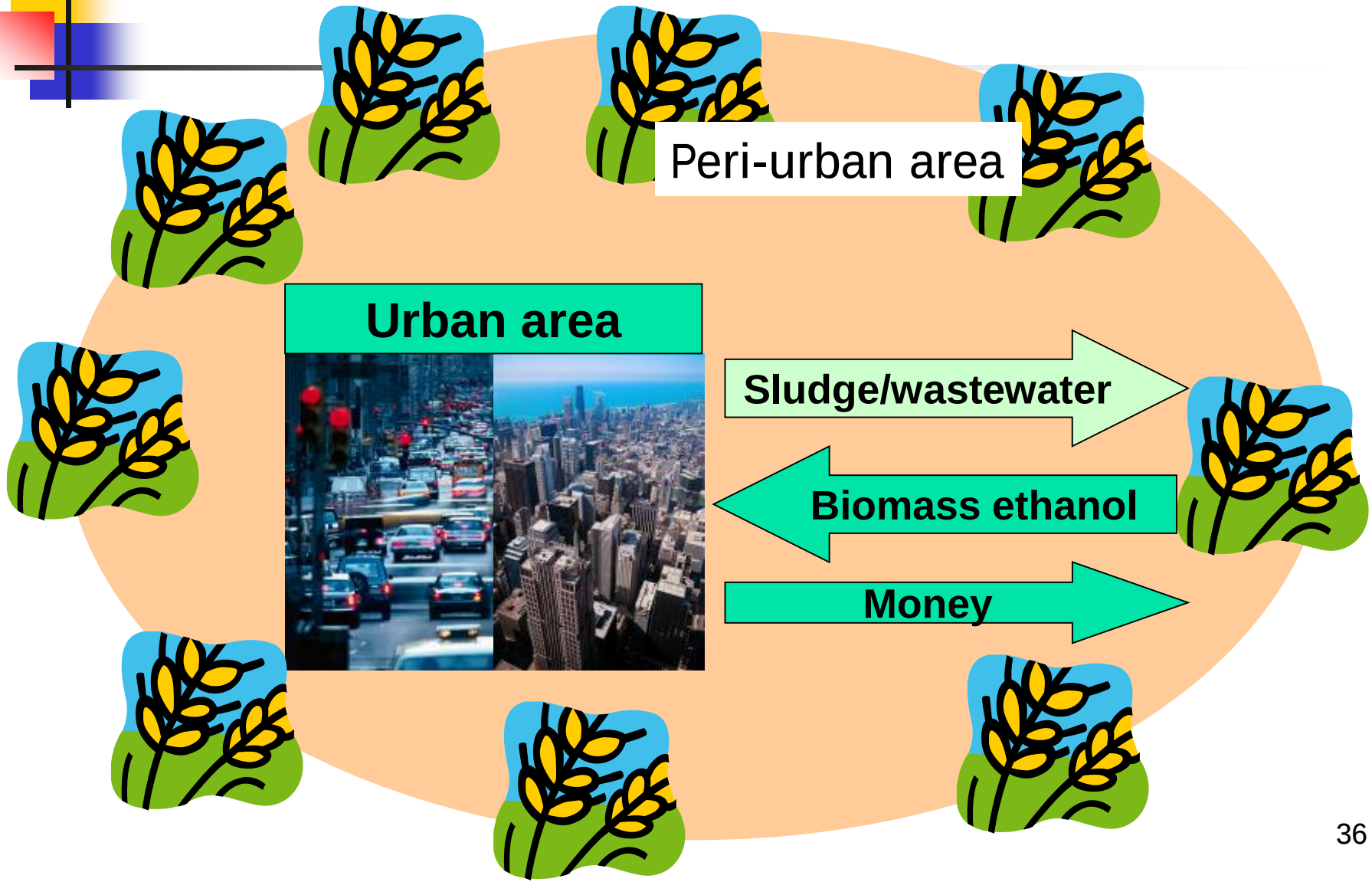
Adaptation to Climate Change

- Actions should be integrated
- Regional development
- City Issues

City Problems

- Metabolism of City
- Energy,Water,Food, Air quality etc
- Mega-City and shrinking city
- Urban-rural relationship
- City and Suburbs
- City agriculture

Urban-rural sustainability: sustainable bioethanol production



Summary

- Sustainability is a key-concept.
- Action is required.
- Urban and rural
- Many components of the issues
- Integrated Methodology
- System Approach