AGRICULTURE WG REPORT

Report presented during the 4th WGIA, 15 February 2007, Jakarta, Indonesia

Agriculture WG

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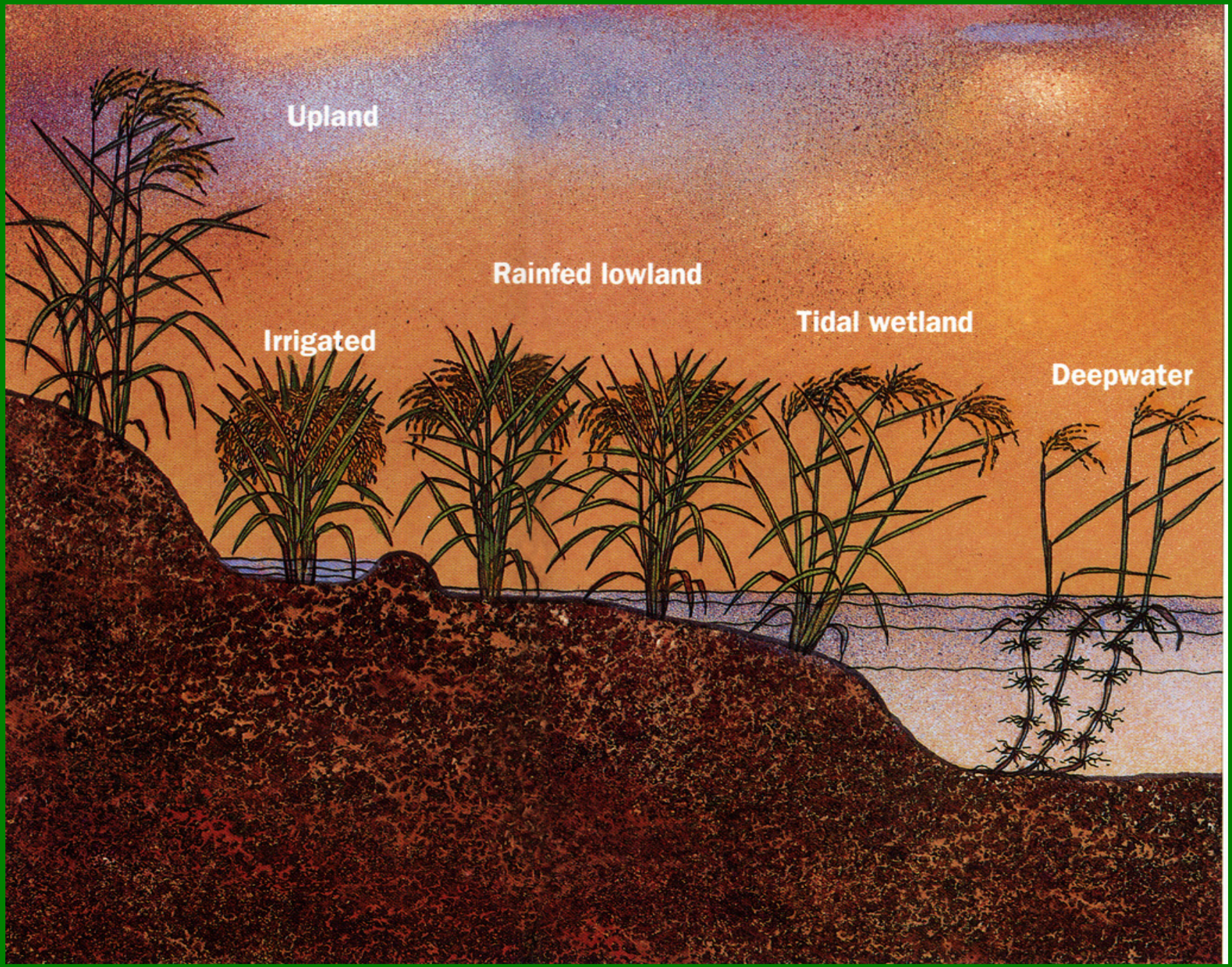
CH_4 emissions from rice ecosystems






Methane emissions from rice fields: Controlling factors:

- **Soil properties**
- **Temperature**
- **Cultural practices (water regime/drainage, fertilizer, seeding/transplanting, straw/residue management)**
- **Rice variety**

The Interregional Research Programme on Methane Emissions from Rice Fields

- International Rice Research Institute, Fraunhofer Institute for Atmospheric Environmental Research, Agricultural Research Institutes of China, India, Indonesia, Philippines and Thailand
- Funded by United Nations Development Program, Global Environmental Facility (UNDP/GEF GLO/91/G31)
- 1993-1999

Rice production and methane emissions

Management practices can be modified to reduce emissions without affecting yield

- **Intermittent drainage in irrigated systems reduces emissions and also saves water**
- **Improved crop residue management can reduce emissions**
- **Direct seeding results in less labor and water input and reduce methane emissions**
- **Plants grown under good nutrition exhibit reduced methane emissions**

Approach

- Closed chamber method

Countries with data from this approach:

IRRI project – Philippines, Indonesia, Thailand, China, India

Japan

Countries without data:
Malaysia, Cambodia, Vietnam

Rice Ecosystem Activity Data Status

Activity Data	Cam	India	Indon	Japan	Malay	Mongol	Phil	Viet
Water regime								
a. Aggregated	▲		▲		▲	▲	▲	▲
b. Disaggregated		▲		▲				
Organic Amendment								
a. Aggregated				▲	▲			
b. Disaggregated								
c. No available data	▲	▲	▲			▲	▲	▲

COUNTRY SPECIFIC CH_4 EF FROM RICE ECOSYSTEMS

- **With country-specific EF:**

- Japan
- Philippines

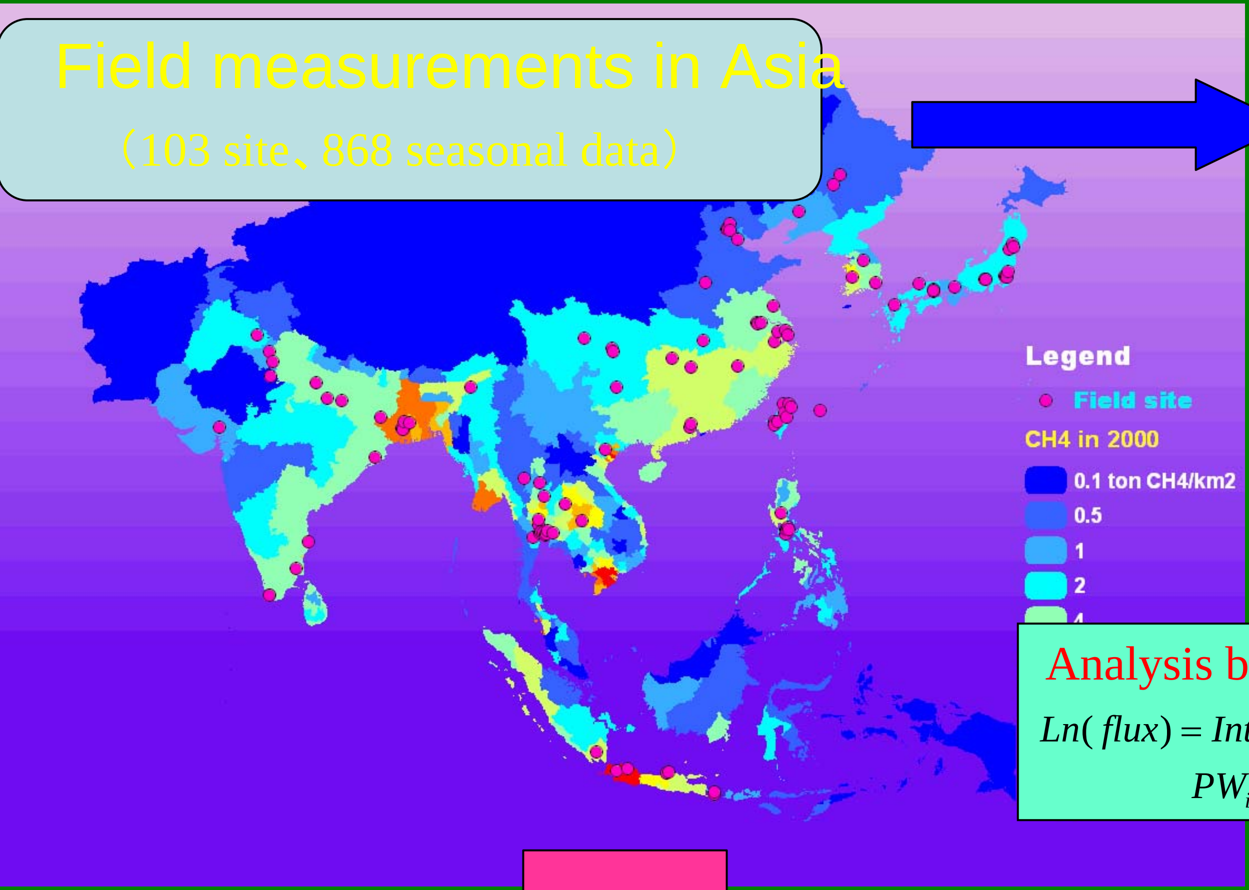
- **Without country-specific EF:**

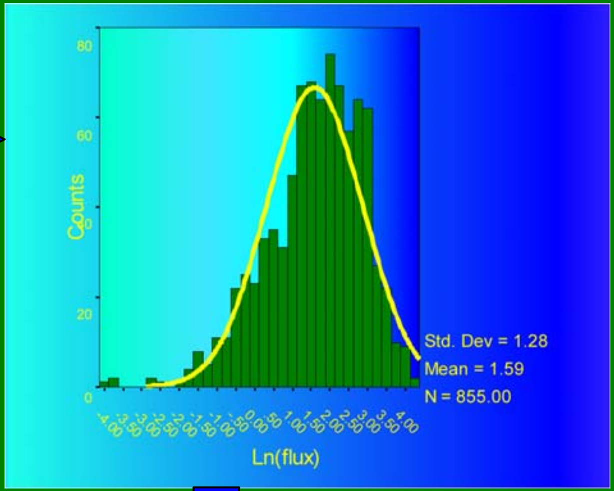
- Indonesia
- Malaysia
- Cambodia
- Vietnam

CH_4 & N_2O Source Database for Rice Fields

Field measurements in Asia

（103 site、868 seasonal data）





Analysis by a mixed linear model

$$Ln(\,flux) = Intercept + a \times \ln(OC) + b \times pH + PW_i + Water_j + Climate_k + OM_l \times \ln(1 + AOM)$$

Publishing DB at web sites

- ●CH_4 from rice → JAMSTEC web
- ●N_2O from rice → NIAES web（under const.）

- ●Baseline emission factors
- ●Various scaling factors
- ●Uncertainty analysis

National Inventory for Japan

CH_4 Emissions from Rice Cultivation

Emission Factors

Type of soil	No. of data	Straw amendment	Various compost amendment	No-amendment	Proportion of area
		[$gCH_4/m^2/year$]			%
Andosol	2	8.50	7.59	6.07	11.9
Yellow soil	4	21.4	14.6	11.7	9.4
Lowland soil	21	19.1	15.3	12.2	41.5
Gley soil	6	17.8	13.8	11.0	30.8
Peat soil	2	26.8	20.5	16.4	6.4

- Based on field monitoring campaign during 1992-1994 at 35 sites over Japan
- Measured by conventional water management with mid-season drainage followed by intermittent flooding

Methane emission factors from rice fields in the Philippines.

Ecosystem	Mean emission ($mg/m^2/day$) from Sites			Emission Factor (kg/ha/day)		% **Decrease** from IPCC
	Los Baños	Maligaya	Mean	**Derived**	IPCC default (T=27 ° C)	
Irrigated	233.1	225.5	229.3	**2.3**	5.9	61
Rainfed	40.3		40.3	**0.4**	3.54	89

2006 IPCC Guidelines

Methodology for CH_4 Emissions from Rice Cultivation

Baseline Emission Factor (EFc)

TABLE 5.11
DEFAULT CH_4 BASELINE EMISSION FACTOR ASSUMING NO FLOODING FOR LESS THAN 180 DAYS PRIOR TO RICE CULTIVATION, AND CONTINUOUSLY FLOODED DURING RICE CULTIVATION WITHOUT ORGANIC AMENDMENTS

	Emission factor	Error range
CH_4 emission (kg CH_4 ha^{-1} d^{-1})	1.30	0.80-2.20

Source: Yan et al., 2005

A baseline emission factor for:

- no flooded fields for less than 180 days prior to rice cultivation
- Continuously flooded during the rice cultivation period
- without organic amendments

EFc in the 1996 Guidelines & 2000 GPG
= 200 kg ha^{-1} $season^{-1}$

- ◆Without statistical analysis
- ◆Regardless of the length of the cultivation period

CH_4 Emission from Enteric Fermentation

- Activity Data on Number of heads of different ruminants
- – available for all countries
- - National Statistics data
- - Bureau of Animal Industry

Method for Estimation Current Methane Emission

Dividing animals into animal group

Collecting dry matter intake（DMI) of each animal group

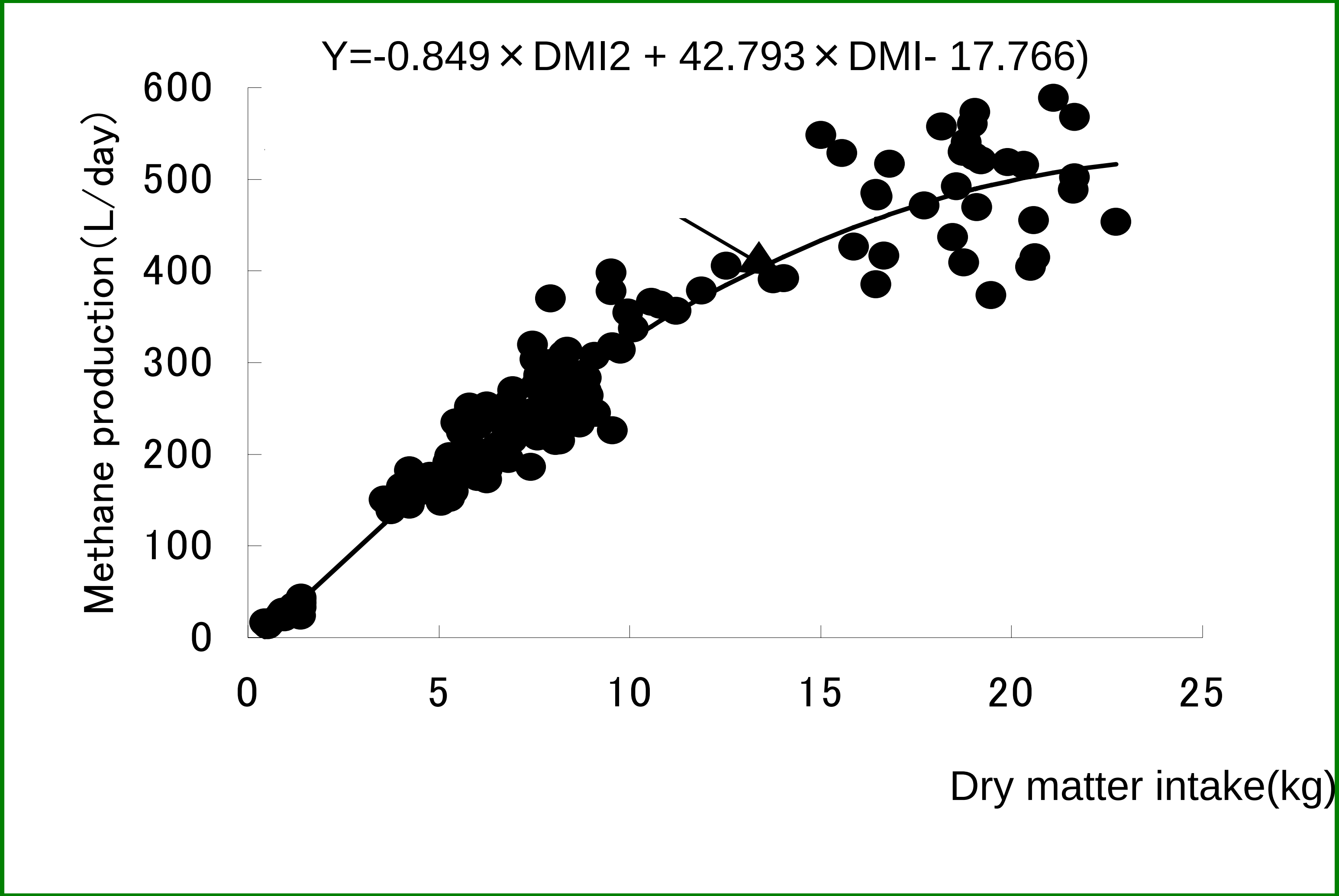
Estimate methane emission by Shibata’s equation (Methane production(L/day) = $-0.849 \times DMI^2 + 42.793 \times DMI - 17.766$)

Collecting population data

Multiplying the population by estimate methane emission for each animal group

Summing emissions across animal group

Prediction of methane emission from enteric fermentation in Japan



A trial of simple measurement technique of quantity of methane emission

Open circuit respiration chamber

Sulfur hexafluoride tracer technique(SF6)

In vitro gas production technique

Rusitec(Semi-continuous system similar to rumen)

Steps for Improvements of Activity Data in Agriculture:

- Statistical Yearbooks
- Agricultural Statistics
- Seek help for data gathering from National Ministries (Agriculture, Environment) and regional offices
- Experts' opinion
- Documentation/Archiving (sources, comments)
- Sampling to obtain data

Steps for Improvements of EF

- Develop a technology needed to estimate CH_4 emission accurately from ruminants
- For countries without country-specific EF, use EF values from other countries with similar climatic conditions and cultural practices
- Consult the EFDB
- Modeling, equations (Shibata’s eqn)

Future directions

- Organic C in soil
- N_2O emissions from N inputs (inorganic fertilizer, manure, crop residues)
- CH_4 and N_2O emissions from residue burning
- Feed type and feed composition vs CH_4 emissions from ruminants
- Proper archiving of AD and EF (sources, notes, comments)
- Listing of AD, EF, data gaps, institutionalization of data gathering and compilation of AD and EF for national GHG inventories

THANK YOU!