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GHG emission from China croplands

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Introduction

- Signatory states to the United Nations framework on Climate Change (UNFCC) are required to produce annual national inventory
- As a Party though not included in Annex I to UNFCCC, China pays great attention to global climate change

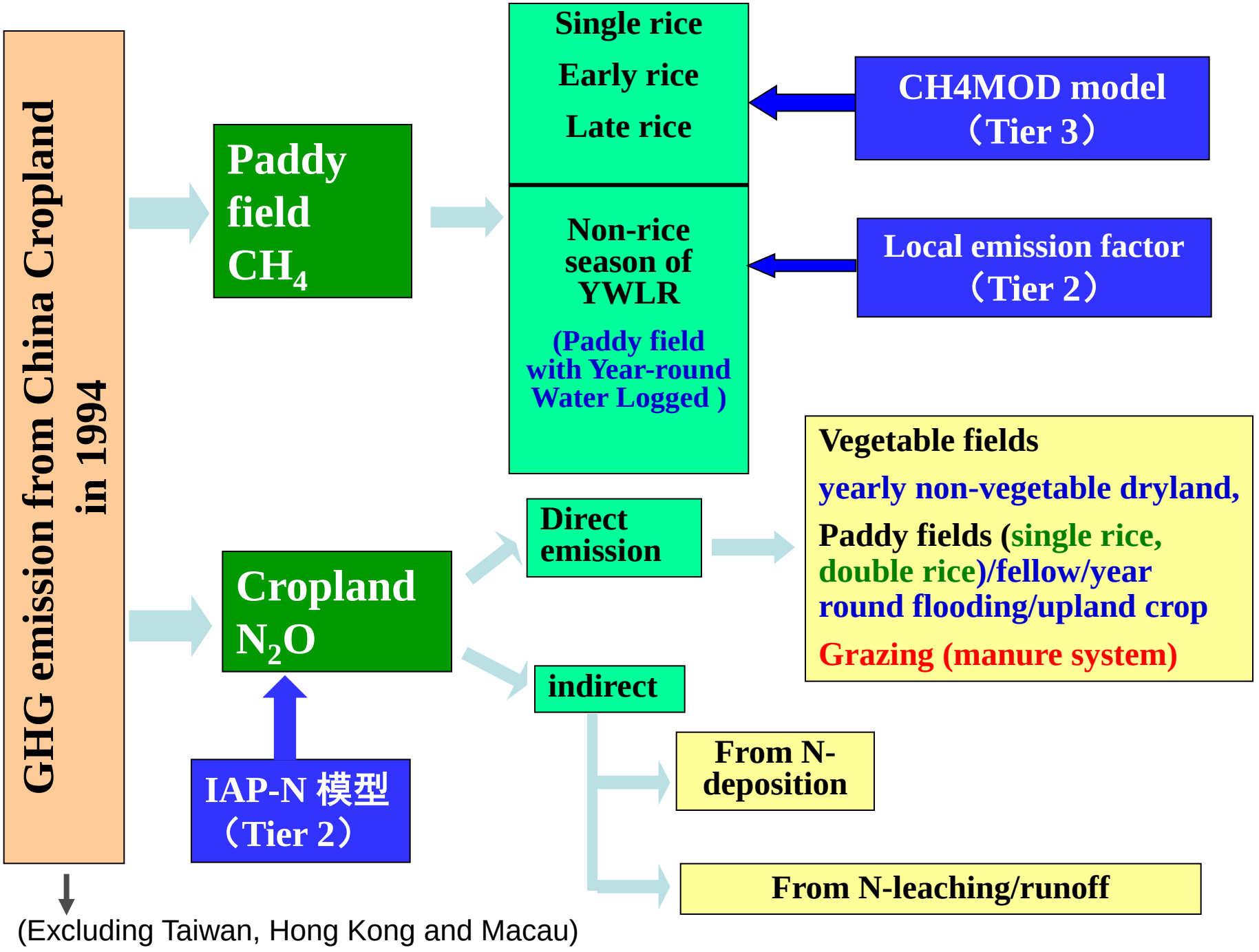
* China agrees to the principles of UNFCCC and taking into account the "common but differentiated responsibility"

* China has submitted its Initial National Communication (including China GHG inventory in 1994) to UNFCCC in December 2004,which was funded by the Global Environmental Facility (GEF)

* In 2012, China will submit its Second National Communication (including China GHG inventory in 2005) to UNFCCC.

- GHG: CO_2, CH_4, N_2O, etc.
- Agriculture is a major source of CH_4 and N_2O emissions in China in 1994:

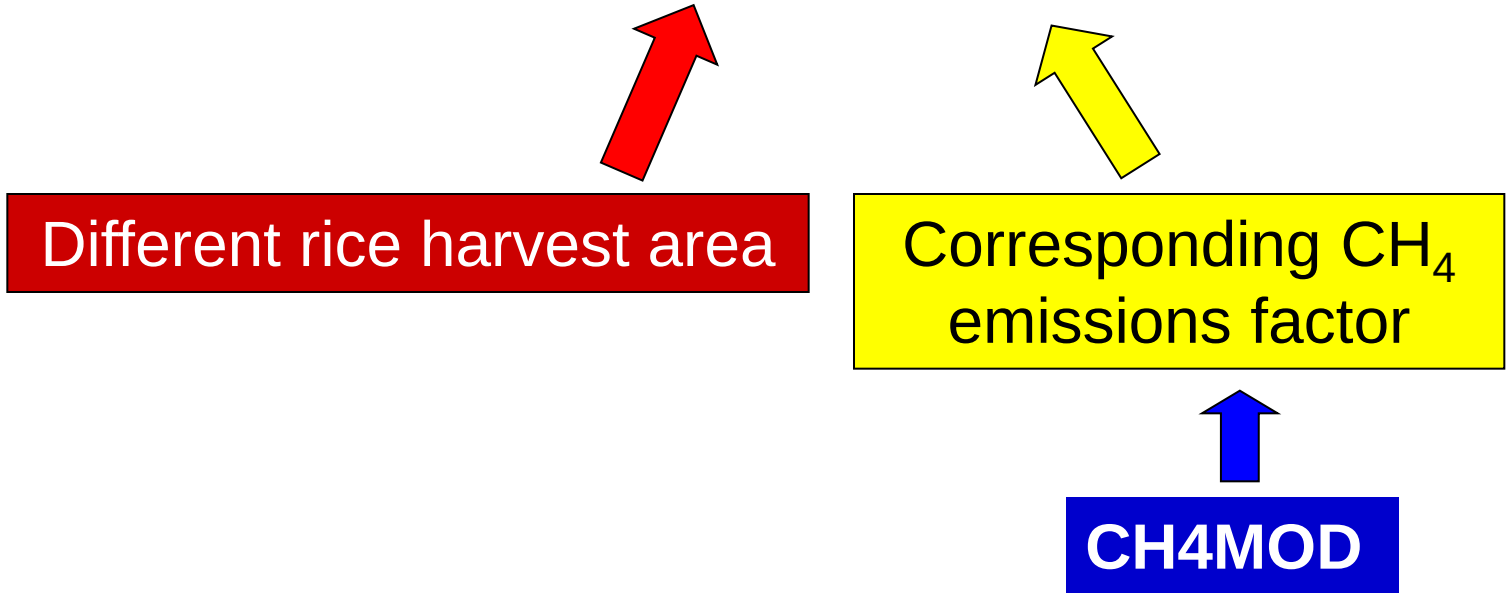
  * paddy fields accounted for 17.93% of CH_4 source, equal to 6147 Gg CH_4
  * cropland accounted for 74.22% of N_2O source, equal to 628 Gg N_2O

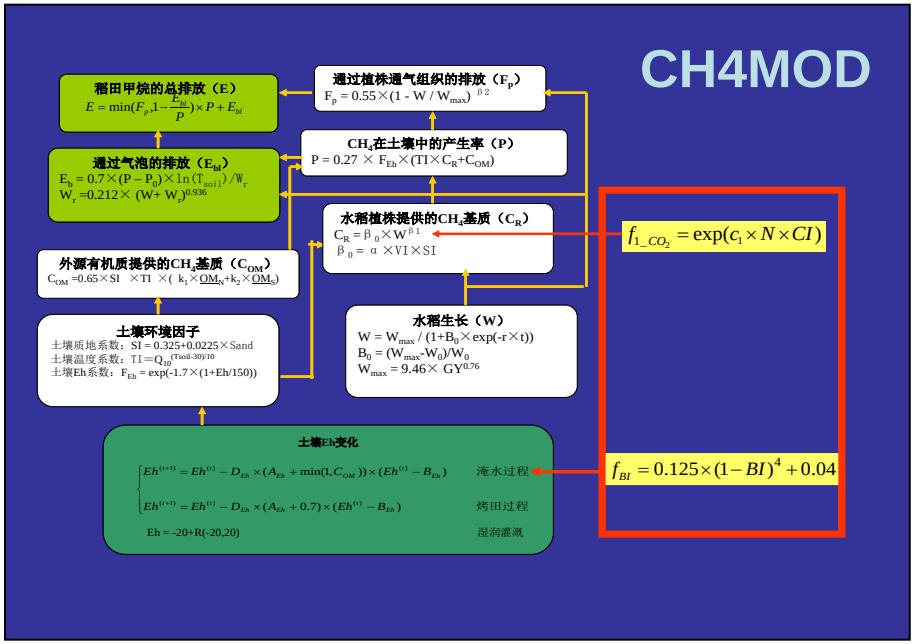

GHG emission from China Cropland in 1994
Paddy field CH_4
Single rice
Early rice
Late rice
Non-rice season of YWLR
(Paddy field with Year-round Water Logged)
CH4MOD model（Tier 3）
Local emission factor（Tier 2）
Cropland N_2O
Direct emission
indirect
Vegetable fields
yearly non-vegetable dryland,
Paddy fields (single rice, double rice)/fellow/year round flooding/upland crop
Grazing (manure system)
From N-deposition
From N-leaching/runoff
IAP-N 模型（Tier 2）
(Excluding Taiwan, Hong Kong and Macau)

CH_4 mission from paddy field

- **method** (Tier 3, IPCC, 2006)

$$CH_4 \text{ emission} = \sum (\text{Area} \times \text{EF})$$





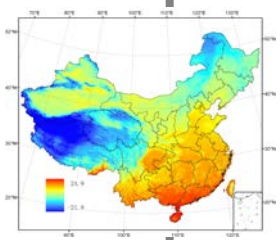
CH_4emission factor of different paddy fields:

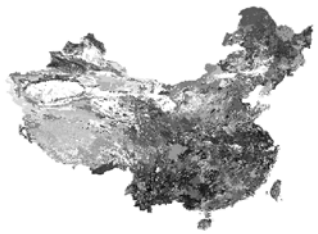
g CH_4/m^2

(Huang et al., 2004; Zhang et al., 2011)

- **Single/double Rice harvest area and production;**
- **Nitrogen fertilizer;**
- **Redsidues returning and manure application ;**
- **Climate data (T, P, daily);**
- **Time of rice transplanting and harvest;**
- **Soil data**
- **Resolution: 10km × 10km**

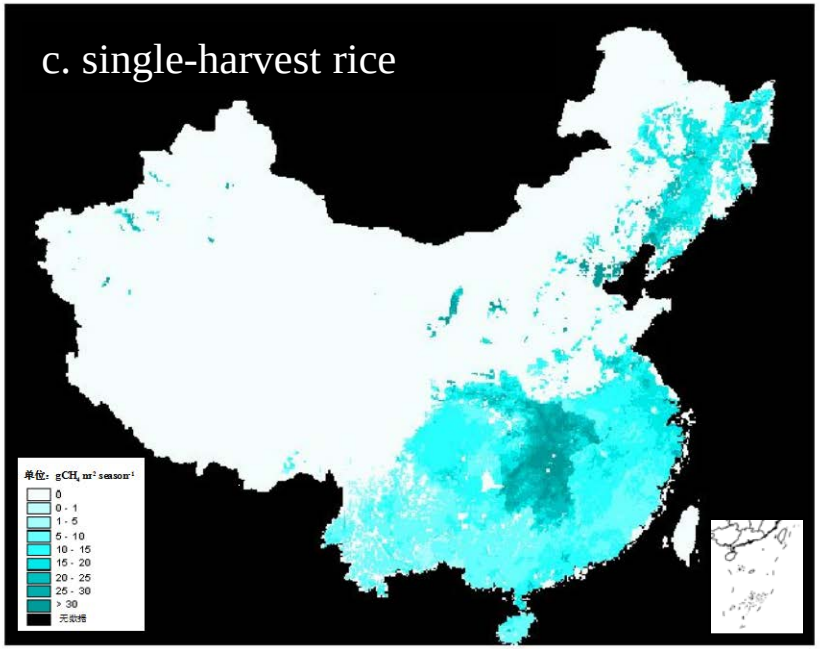
省区	秸秆还田率		省区	秸秆还田率	
	1994	2005		1994	2005
北京	0.14	0.20	湖北	0.15	0.38
天津	0.14	0.20	湖南	0.27	0.71
河北	0.14	0.47	广东	0.25	0.41
山西	0.14	0.56	广西	0.30	0.26
内蒙古	0.04	0.18	海南	0.32	0.38
辽宁	0.04	0.31	重庆	0.17	0.14
吉林	0.03	0.18	四川	0.08	0.14
黑龙江	0.33	0.35	贵州	0.24	0.15
上海	0.15	0.33	云南	0.09	0.25
江苏	0.15	0.33	西藏	0.09	0.15
浙江	0.15	0.24	陕西	0.10	0.32
安徽	0.14	0.30	甘肃	0.10	0.27
福建	0.15	0.36	青海	–	–
江西	0.27	0.65	宁夏	0.10	0.07
山东	0.14	0.24	新疆	0.10	0.13
河南	0.14	0.35			

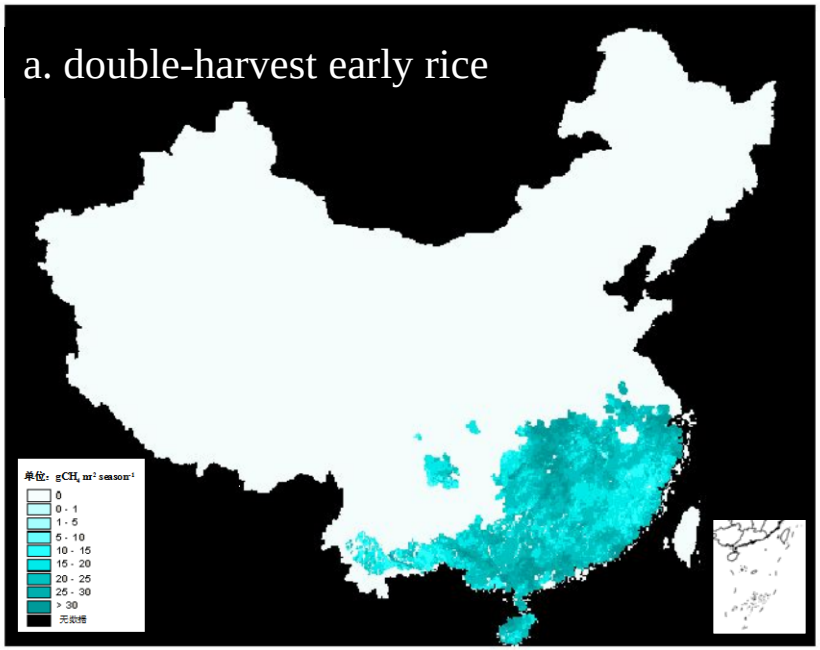


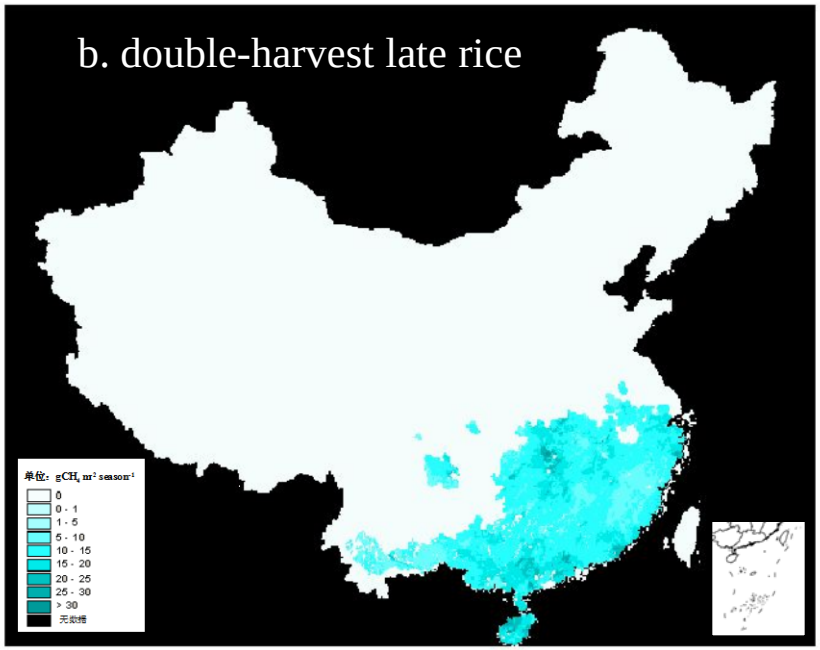


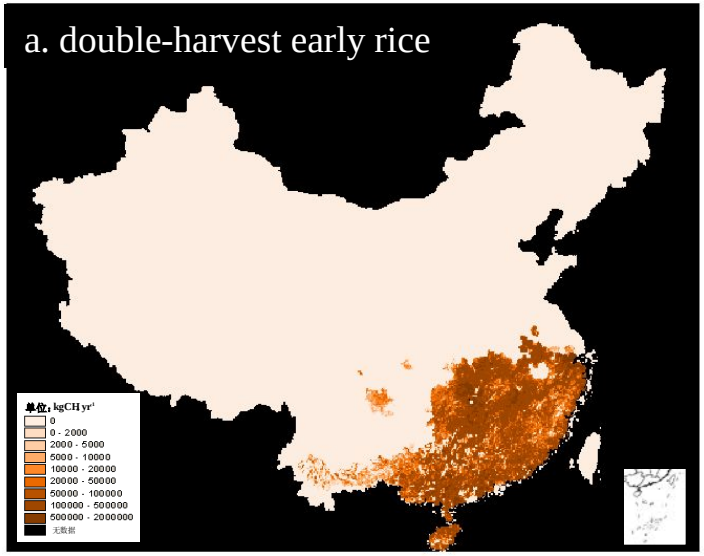
CH_4 Emission Factors

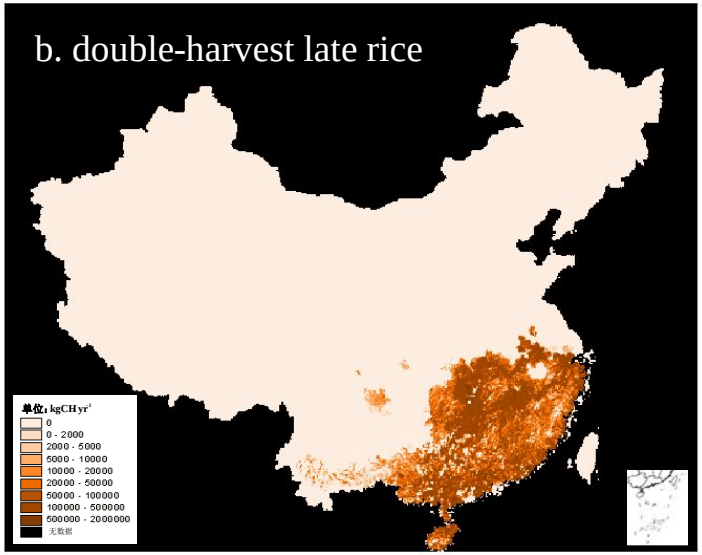
EF (g CH_4 / m^2 / season)

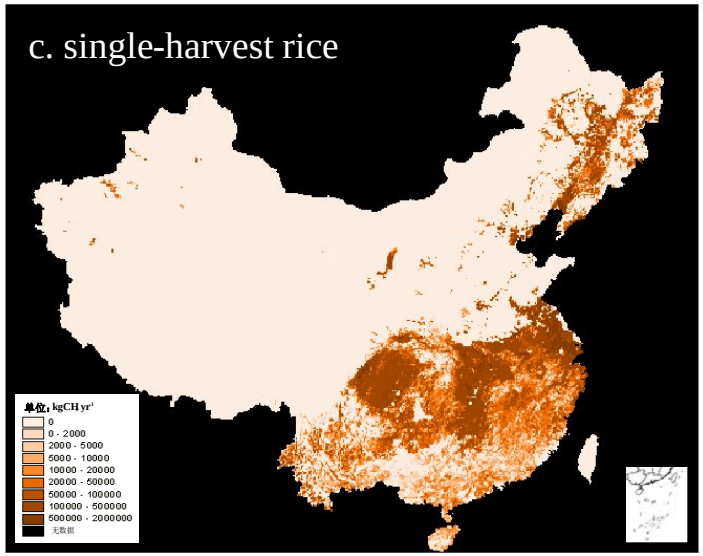


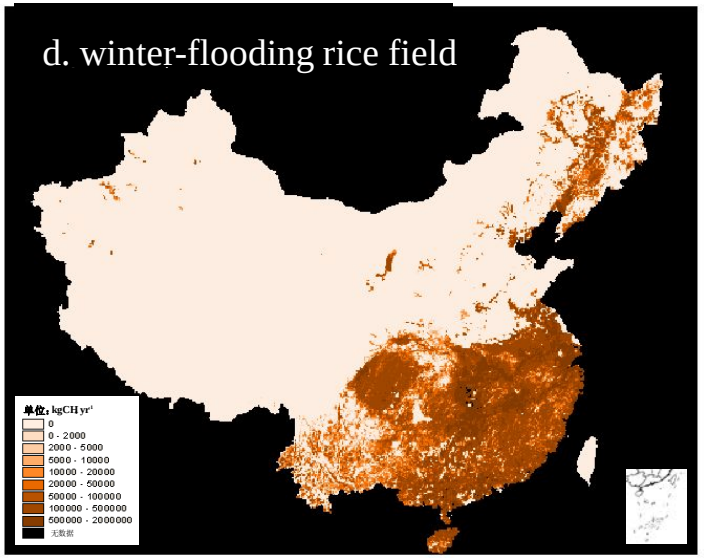












Contribution of CH_4 emission from China paddy fields ($kgCH_4/yr$)

N_2O mission from croplands

- **method** (Tier 2)

$$N_2O\ emission = \sum N_{input} \times EF$$

IAP-N

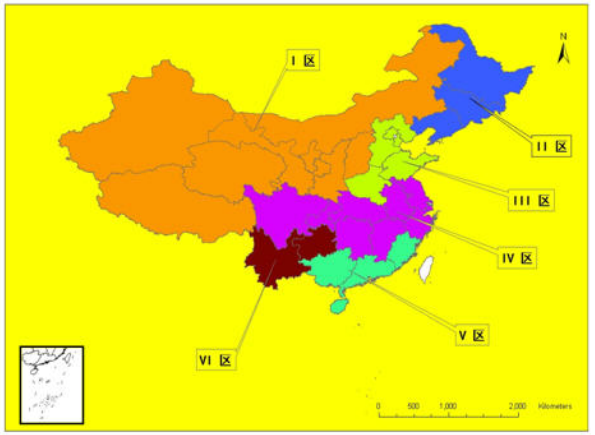
nitrogen input caused to direct / indirect N_2O emissions

Corresponding N_2O emissions factor

Field observation / IPCC

According to the character of climate belt and crop planting regime in China

- Cropland categories:

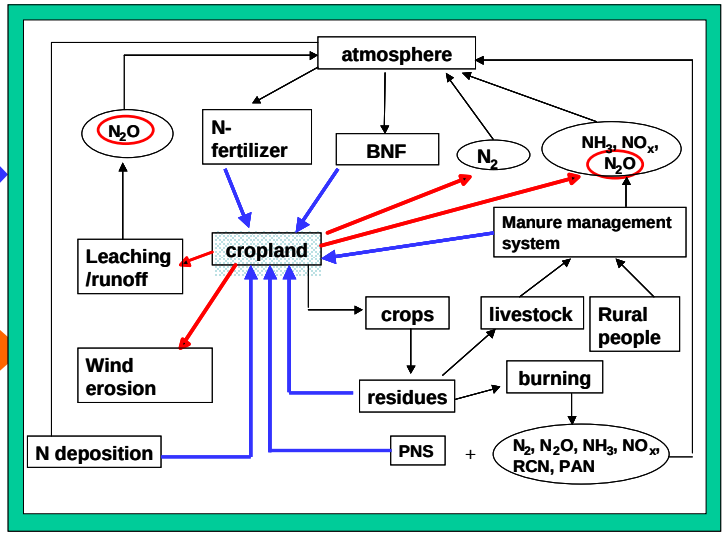


	Crop regime	Major category of cropland
Regions of I, II, III	single crop / year	Upland vegetables Year-round upland crops excluding vegetables Single paddy rice + Fallow (dry)
Region IV	double crops / year	Upland vegetables Year-round upland crops excluding vegetables Single paddy rice + Fallow (dry) (single/double)paddy+ winter-flooding Single rice -upland crop rotation Double paddy rice + Fallow (dry) or green manure
Region V	double/three crops / year	Upland vegetables Year-round upland crops excluding vegetables Single rice -upland crop rotation Double rice–upland crop rotation
Region VI	double crops / year	Upland vegetables Year-round upland crops excluding vegetables Single rice -upland crop rotation single paddy+ winter-flooding

- ✓ EF（N_2O、NH_3、NO_x、N_2）
- ✓ Parameters of crops
- ✓ parameters of livestock

Direct EF: Field observation

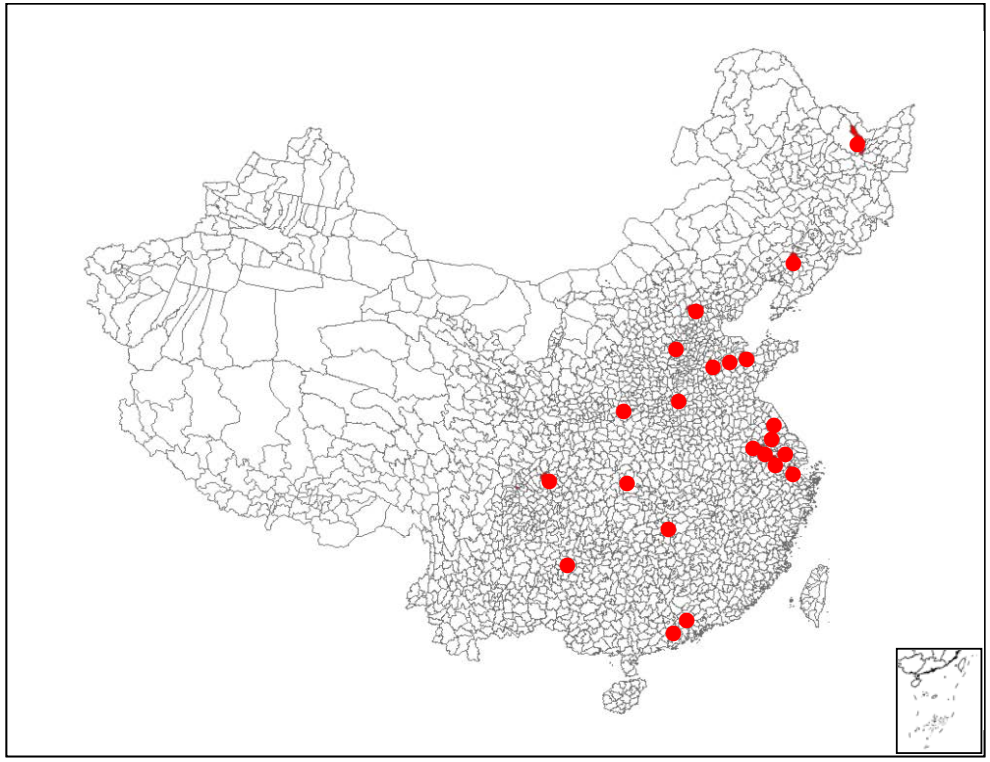
Indirect EF: IPCC



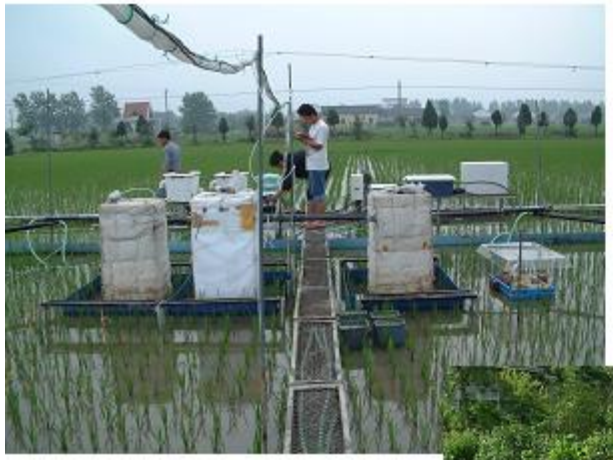
- ➢ N_input of different fields
- ➢ N-Gases emission of different fields

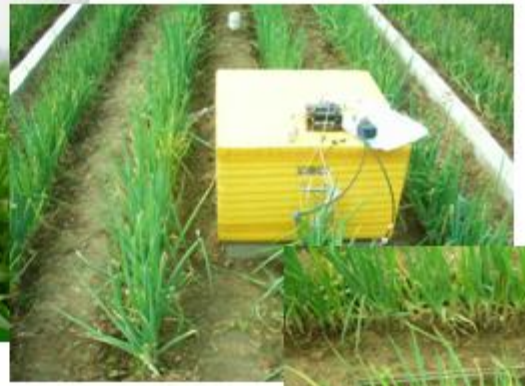
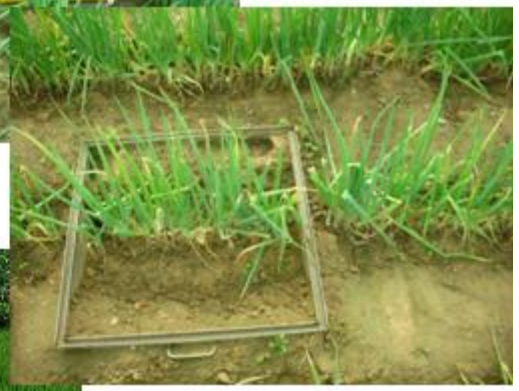
- Nireogen fertilizer
- harvest area and production of crops
- population of livestock and rural pepole
- area of administration
- arable land

(Zheng et al., 2002, 2008)



- **Different fields covering 13 provinces/city**
- **Including Beijing, Hebei, Henan, Shandong, Liaoning, Heilongjiang, Jiangsu, Zhejiang, Jiangxi, Hunan, Sichuan, Guizhou and Guangding**

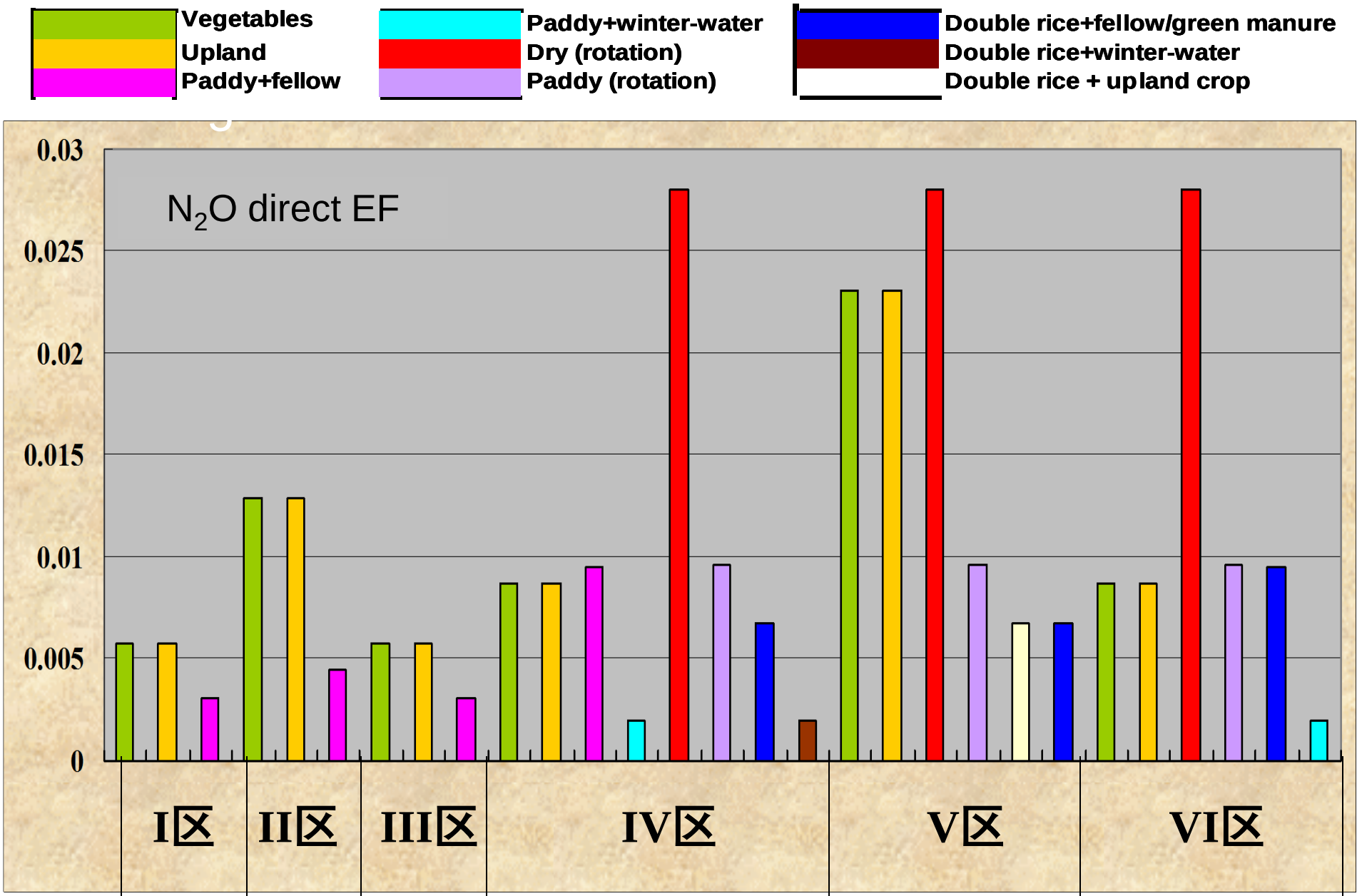


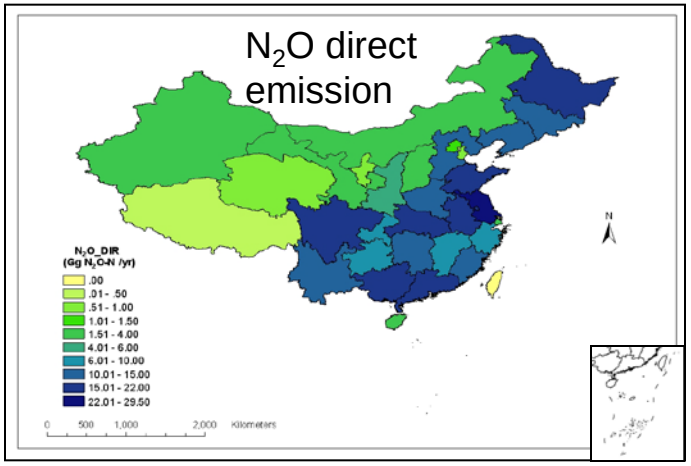


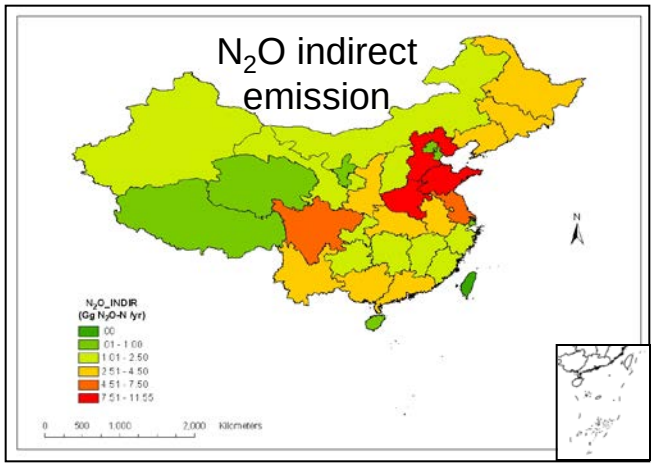

N_2O Emission Factors EF (kgN_2O-N/kgN_in) in 1994 inventory

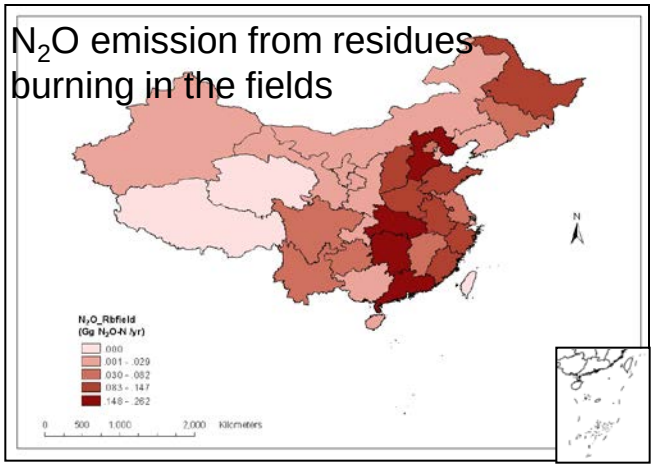
(Zheng et al., 2004)



Contribution of N_2O emission from China cropland in 1994 (GgN/yr)







Difficulties

1) Correction of N_2O observation data

N_2O anaylsis method: carry gas: N_2 (overestimated), Ar-CH_4

(Zheng et al., 2006)

Flux calculation: linear (underestimated), non-linear

A correction equation $Y_1=0.561\times X^{1.124}$ was built to correct the error caused by N_2O analysis method, where Y_1 means corrected N_2O emission for season or year, and X means the observation value of N_2O emission by analysis method with N_2 acting as carrying gas.

And then another flux correction equation $E_{NL}=1.14 \times E_L$ was built to correct the system error caused by flux calculation, where E_{NL} means N_2O flux value by the nonlinear flux calculation, and E_L means N_2O flux value by the linear flux calculation

2) Area of yearly winter-flooding rice field

- Due to high water table, the paddy field is flooded all year around
- High CH_4 emission intensity
- No statistic data for this type of paddy field

- ✓ Cooperating with local institute and local meteorology department, we get the main YWLR distribution data in Jiangxi province and Sichuan province
- ✓ Looking up for literatures

3) Residues returning data

- No statistic data
- need to do a large survey work and a large funding

4) Manure application

- No statistic data
- survey work is very very difficult because the weight and nitrogen concentration of manure is various in different region

$$N_{\_Manure} = N_{\_animal} - N_{\_grazing} - N_{\_fuel} - N_{\_volatilization} - N_{\_N2O\ mms}$$


Thank you for
Attention