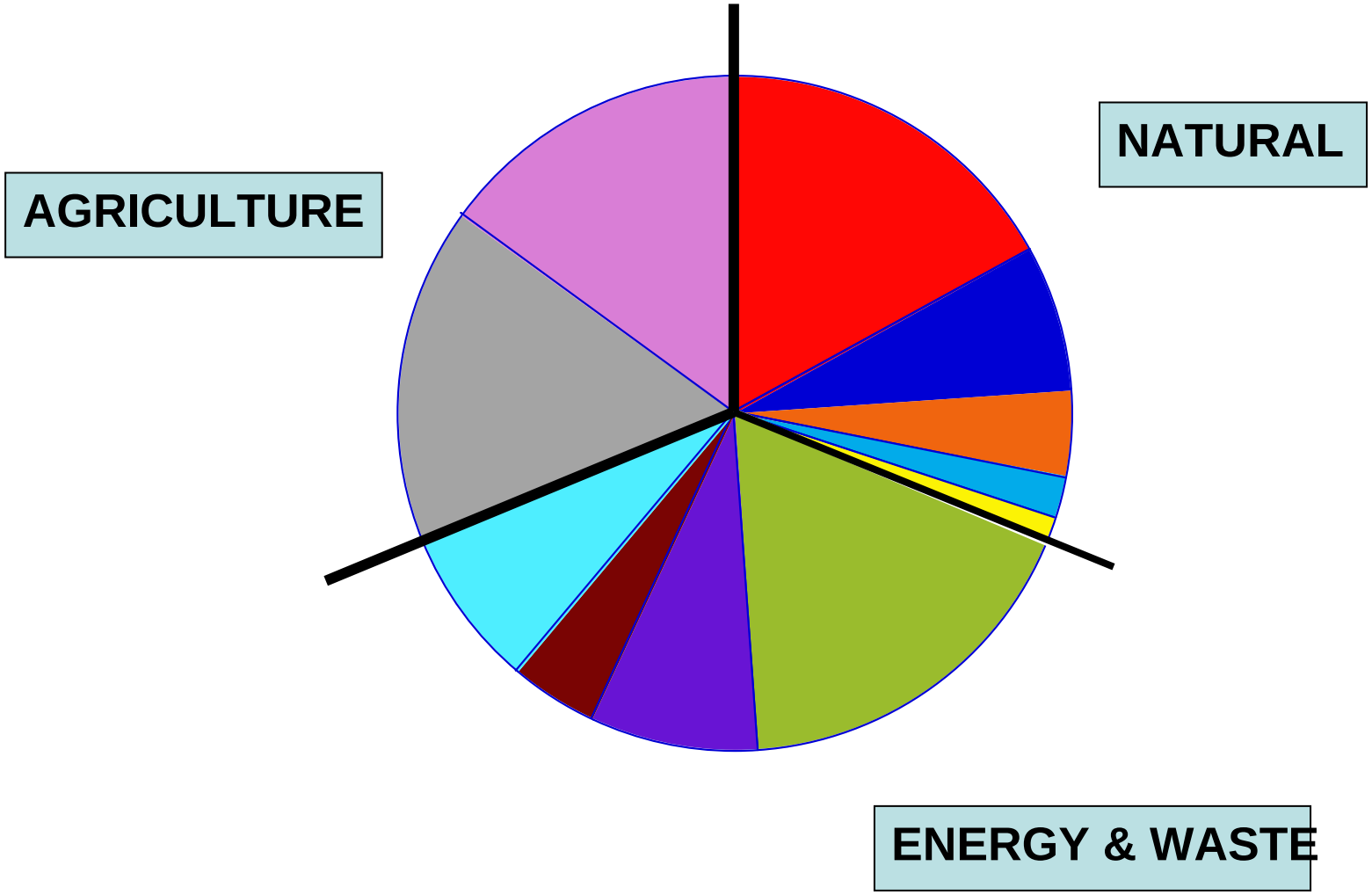
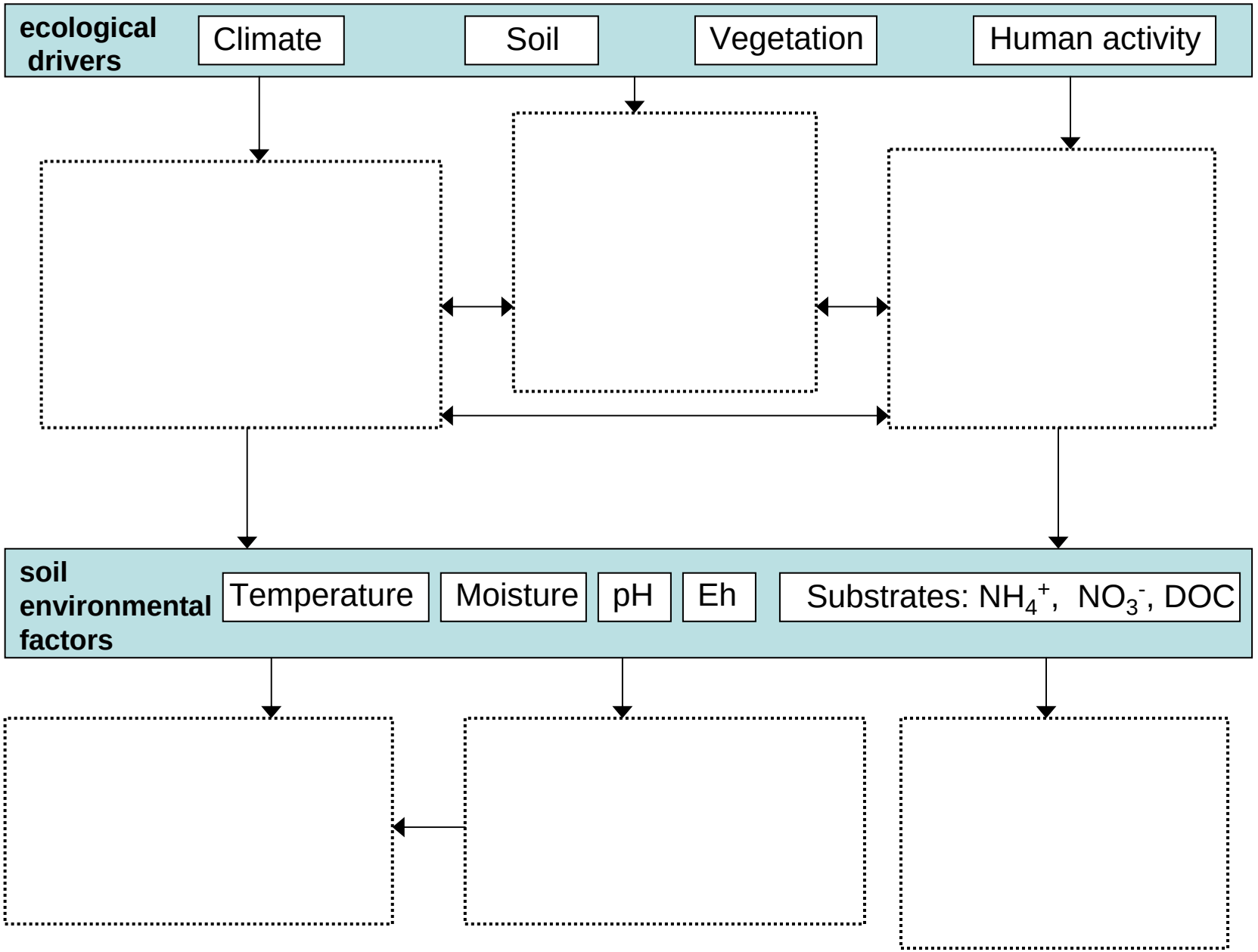

AGRICULTURE
NATURAL
ENERGY & WASTE


ecological drivers
Climate
Soil
Vegetation
Human activity
soil environmental factors
Temperature
Moisture
pH
Eh
Substrates: NH_4^+, NO_3^-, DOC

Oxygen

CH4 Modeling Natural Wetlands

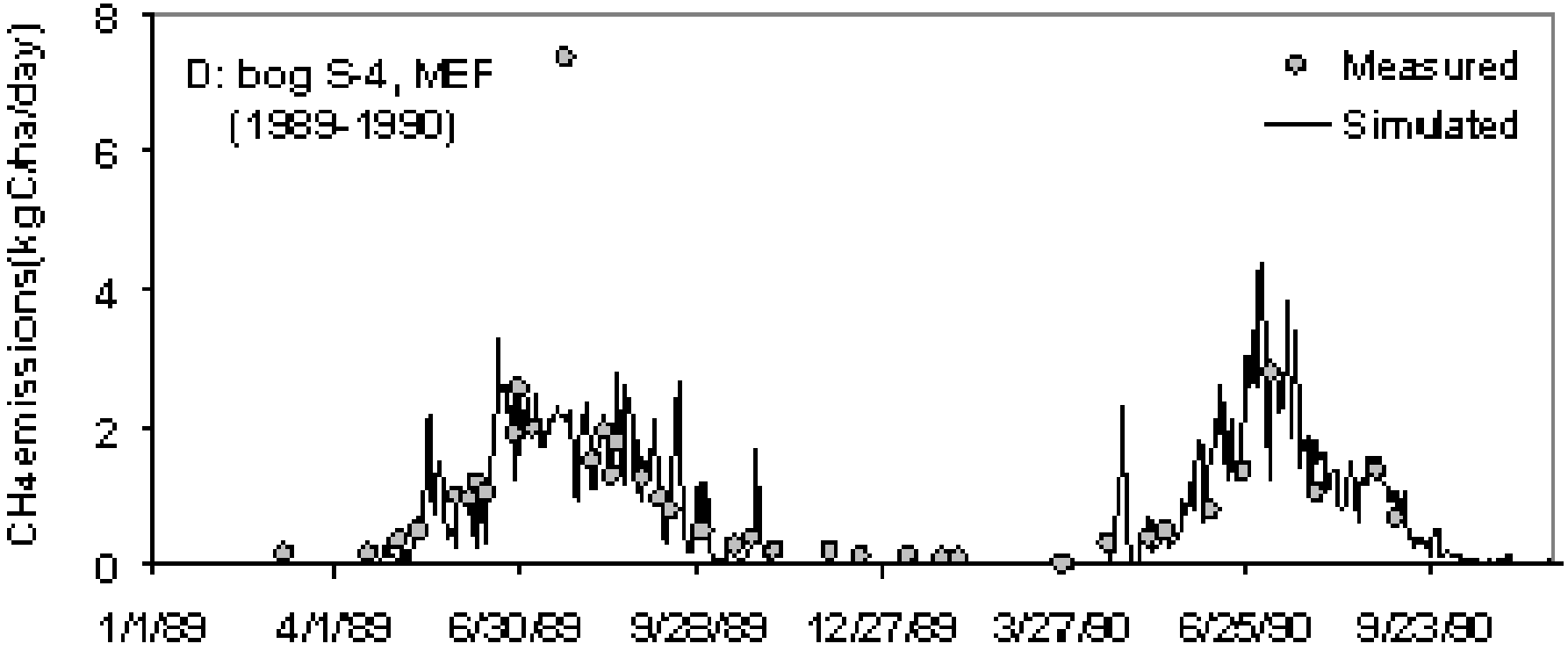
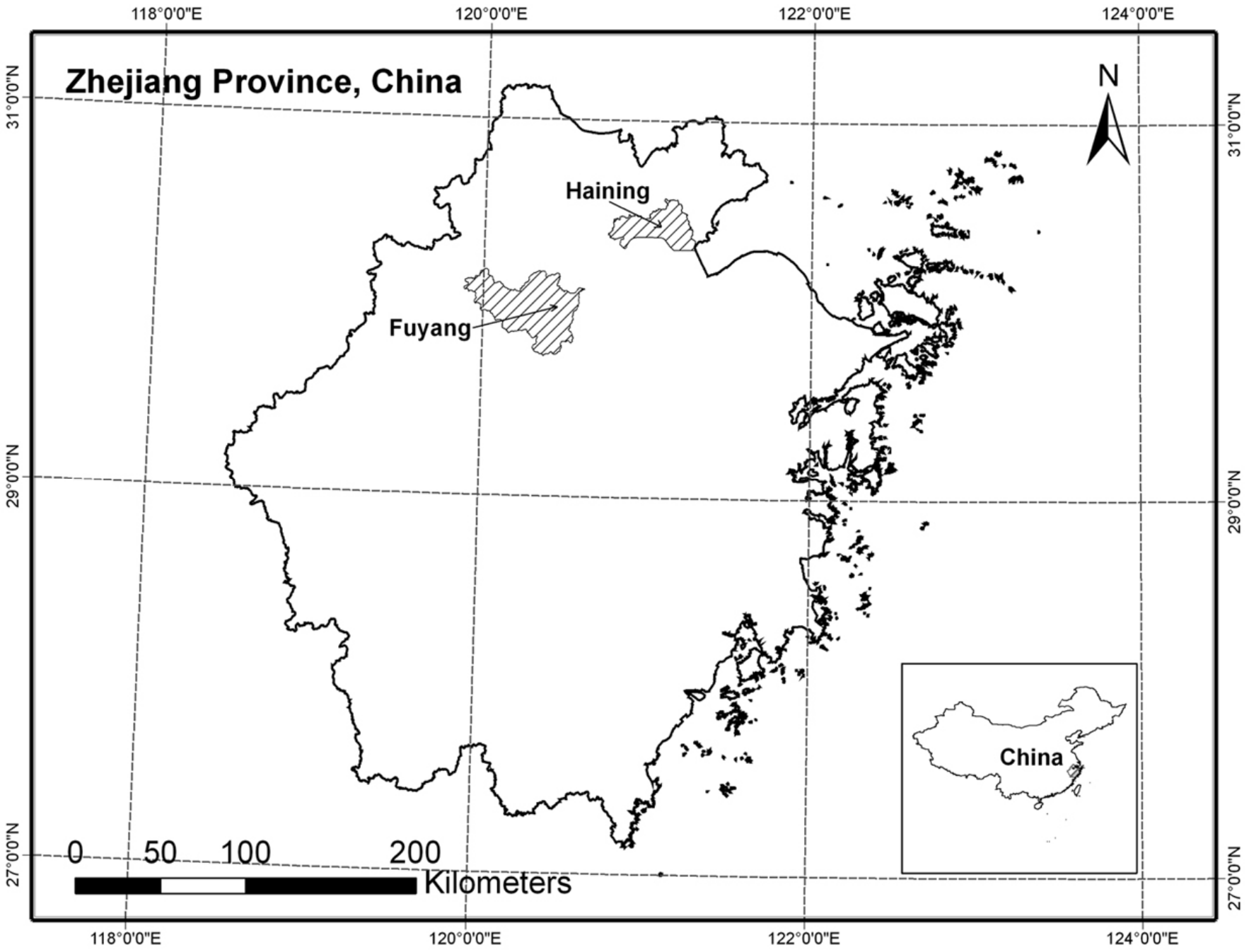


Figure 2. DNDC-modeled vs. observed CH4 fluxes from a pristine wetland in Marcell, MN (field data from Crill et al. 1988, Dise 1991, Clement et al. 1995, and Shurpali et al. 1993).

Rice studies in southeast China

- Case study 1: rice mapping in Fuyang City, Zhejiang Province (a city in China is an administrative level higher than county, which means that a city usually covers several counties)

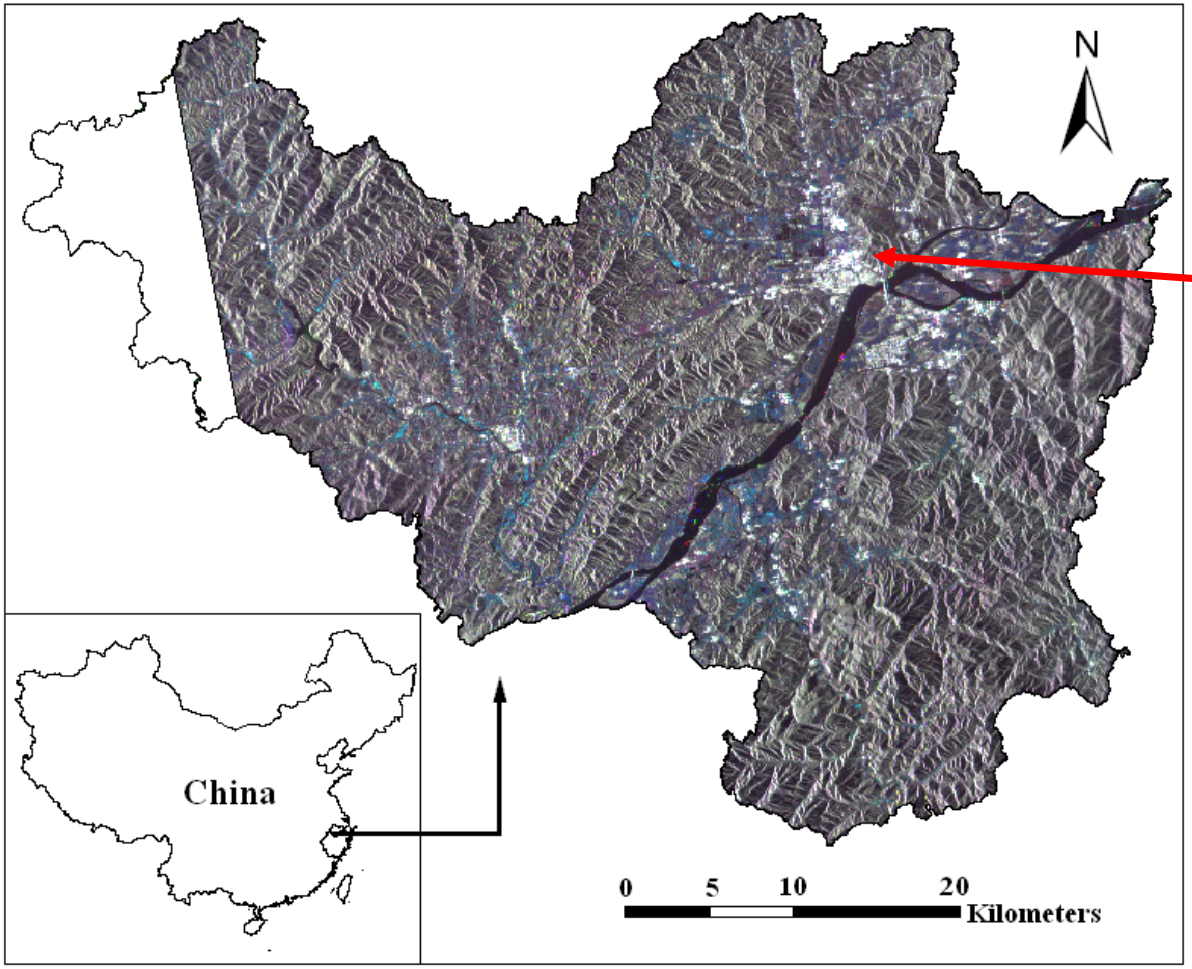
- Case study 2: rice modeling and bio-estimating in Haining County, Zhejiang Province (in-process)


Zhejiang Province, China
N
Haining
Fuyang
China
118°0'0"E
120°0'0"E
122°0'0"E
124°0'0"E
31°0'0"N
29°0'0"N
27°0'0"N
0 50 100 200
Kilometers

- Case study 1: rice mapping

- PALSAR images acquired in 2006

(HH polarization, pixel size – 6.5m)



Urban area of
Fuyang City

Image color composition:
R: June. 18 (transplanting)
G: Aug. 3 (tillering)
B: Sept. 18 (Heading)

- Study area (Fuyang City administrative area)

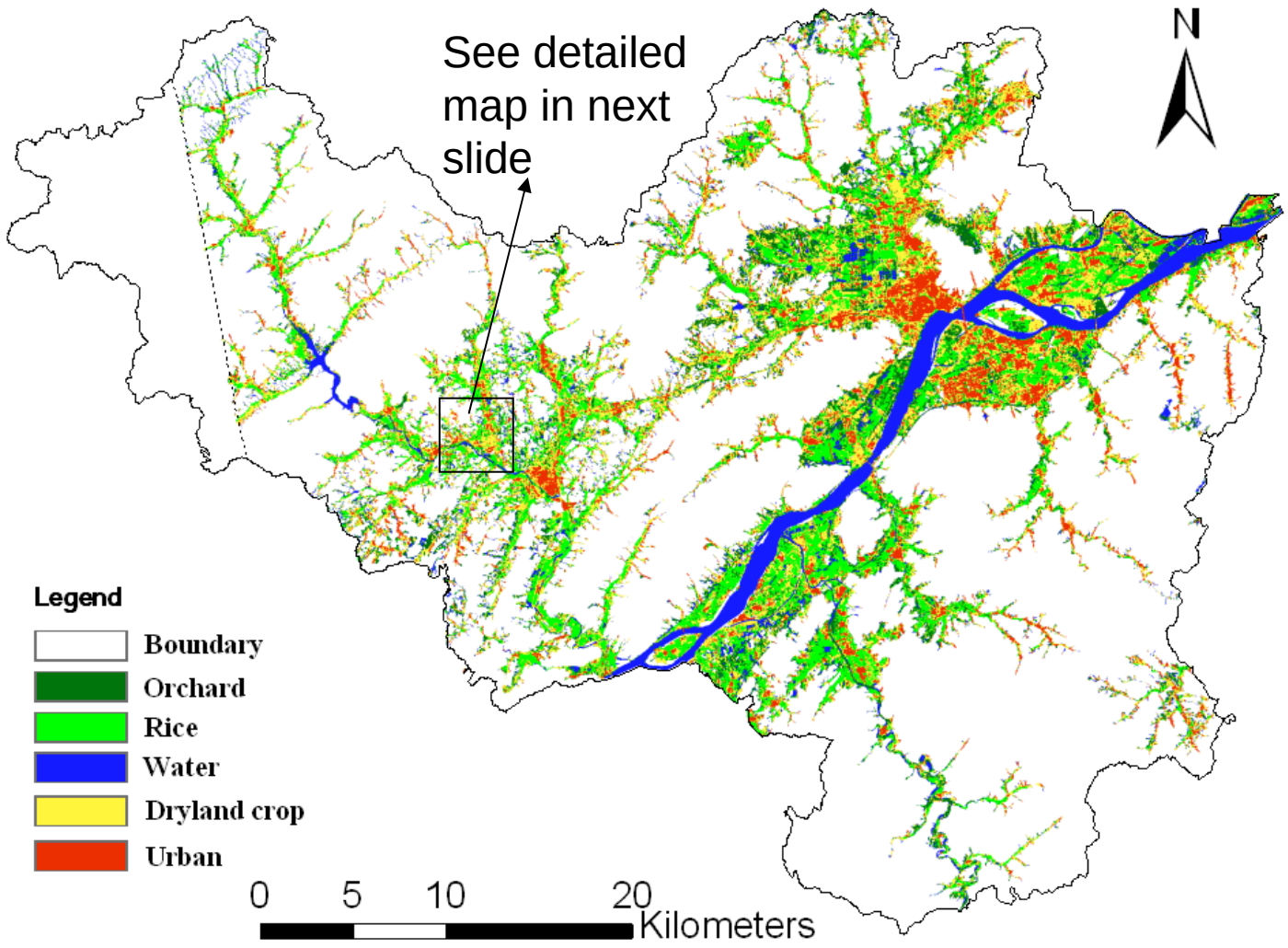
-Covering 1.8×105 hectares;

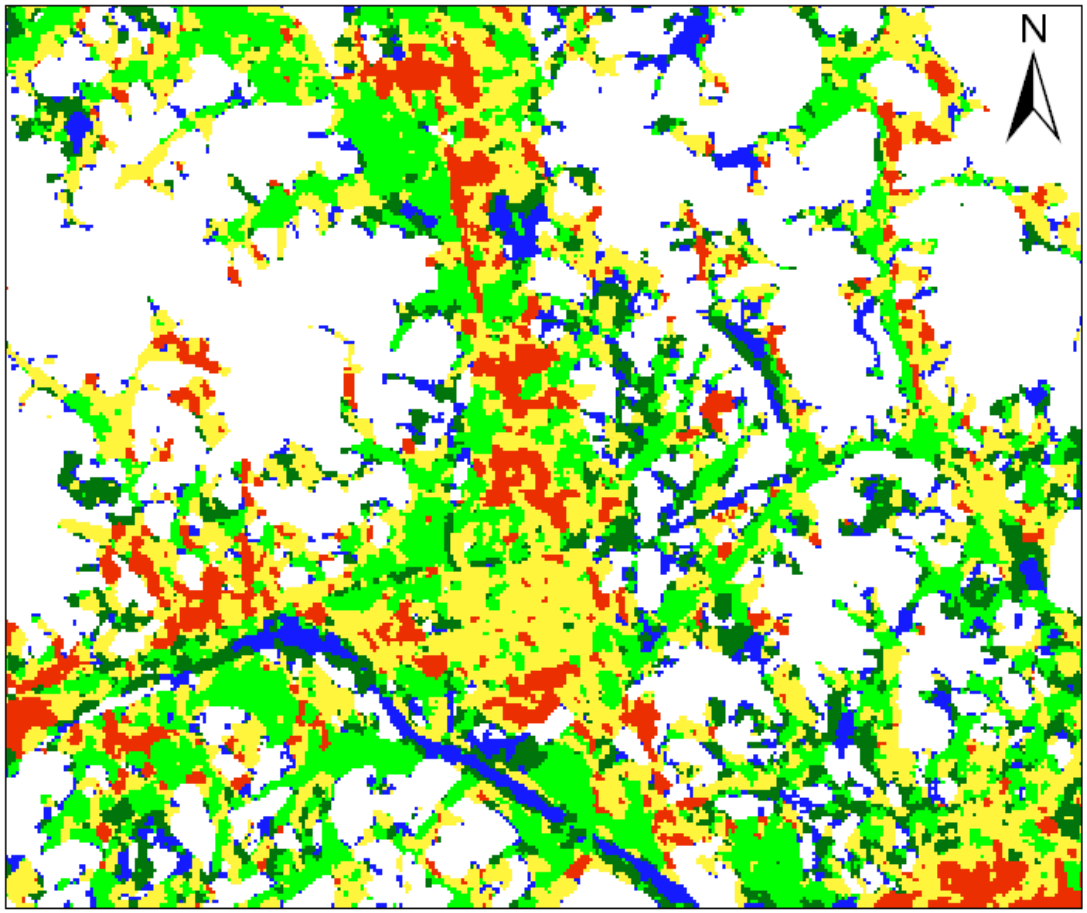
-a typical subtropical climate. Nearly half a year is rainy and cloudy;

-major LULC:
mountains (~70%), lowland plains (~20%), and water (~10%);

-Rice:
-- dominant crop in lowland plains (~50% of lowland plain);
-- single cropping
-- small fields
-- highly fragmented with urban developments, dryland crops and shrub orchards (tea, mulberry, etc)

- Image classification: ***Support vector machine (SVM)***




N
Legend
Orchard
Water
Rice
Urban
Dryland crop
0
.5
1
2
Kilometers

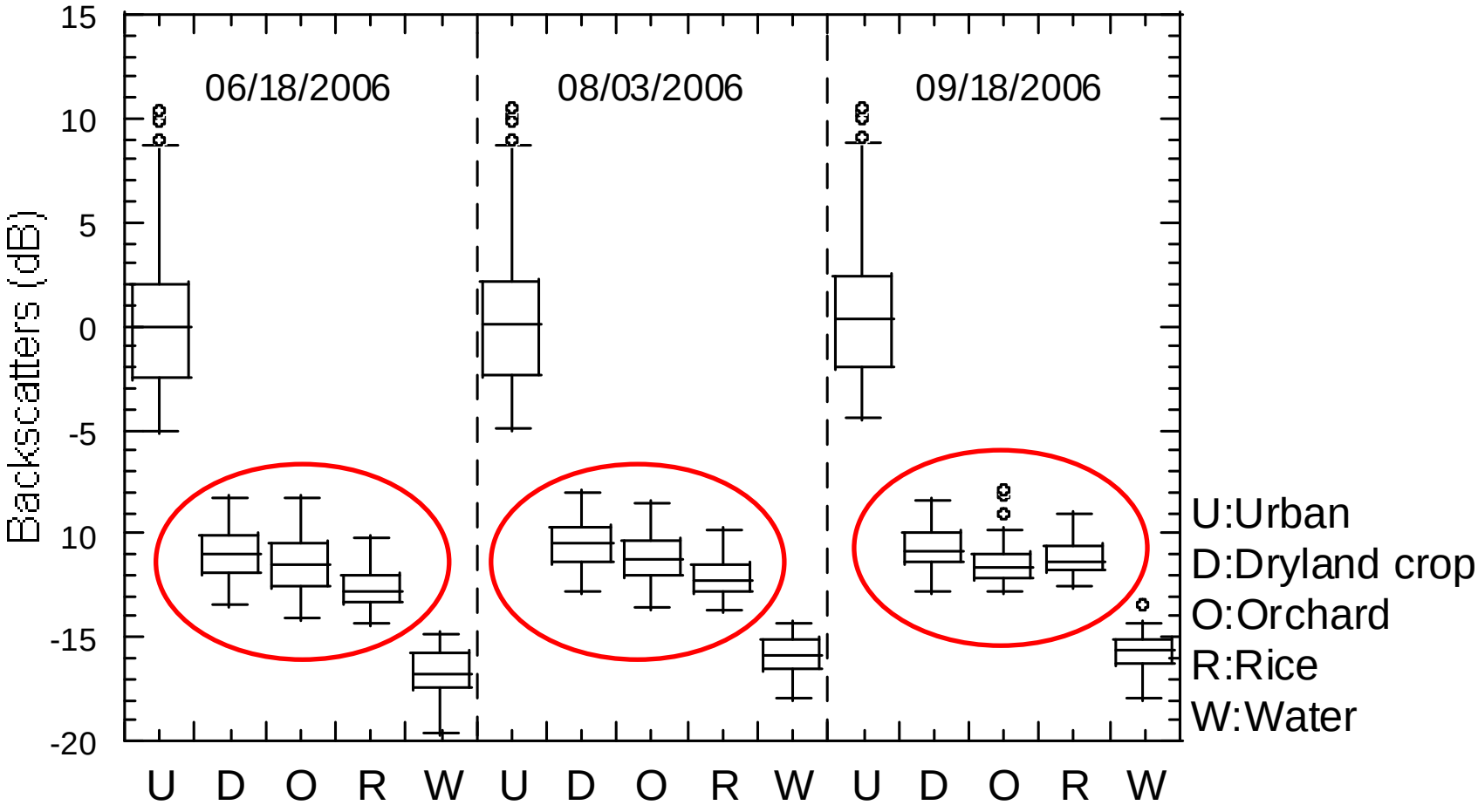
Error matrix of the PALSAR-derived class map:

		Reference data							Cond. Kappa
		W	**R**	**O**	**D**	**U**	Classified totals	User's accuracy(%)	
Classified data	**W**	**161**	21	8	5	5	200	80.50	0.7529
	R	9	**180**	9	0	2	200	**90.00**	**0.8689**
	O	34	16	**130**	8	12	200	65.00	0.5788
	D	4	19	21	**137**	19	200	68.50	0.6285
	U	3	1	1	2	**193**	200	96.50	0.9545
	Reference totals	211	237	169	152	231	1000		
	Producer's accuracy (%)	76.30	**75.95**	76.92	90.13	83.55			

W - Water; **R** - Rice; **O** - Orchard; **D** - Dryland crop; **U** - Urban.

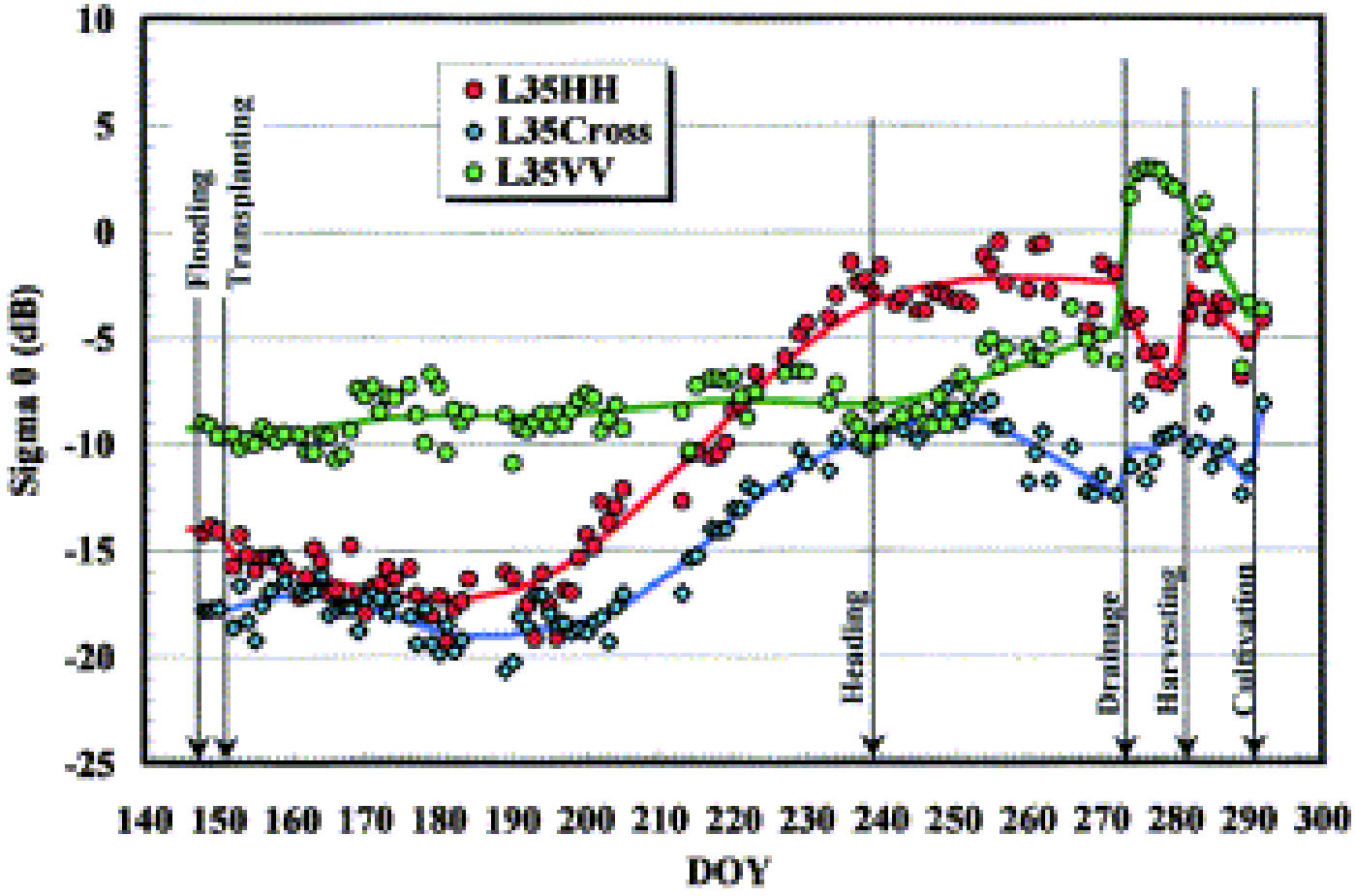
Overall Classification Accuracy = 80.10%; Overall Kappa Statistics = 0.75.

- Backscatter characteristics



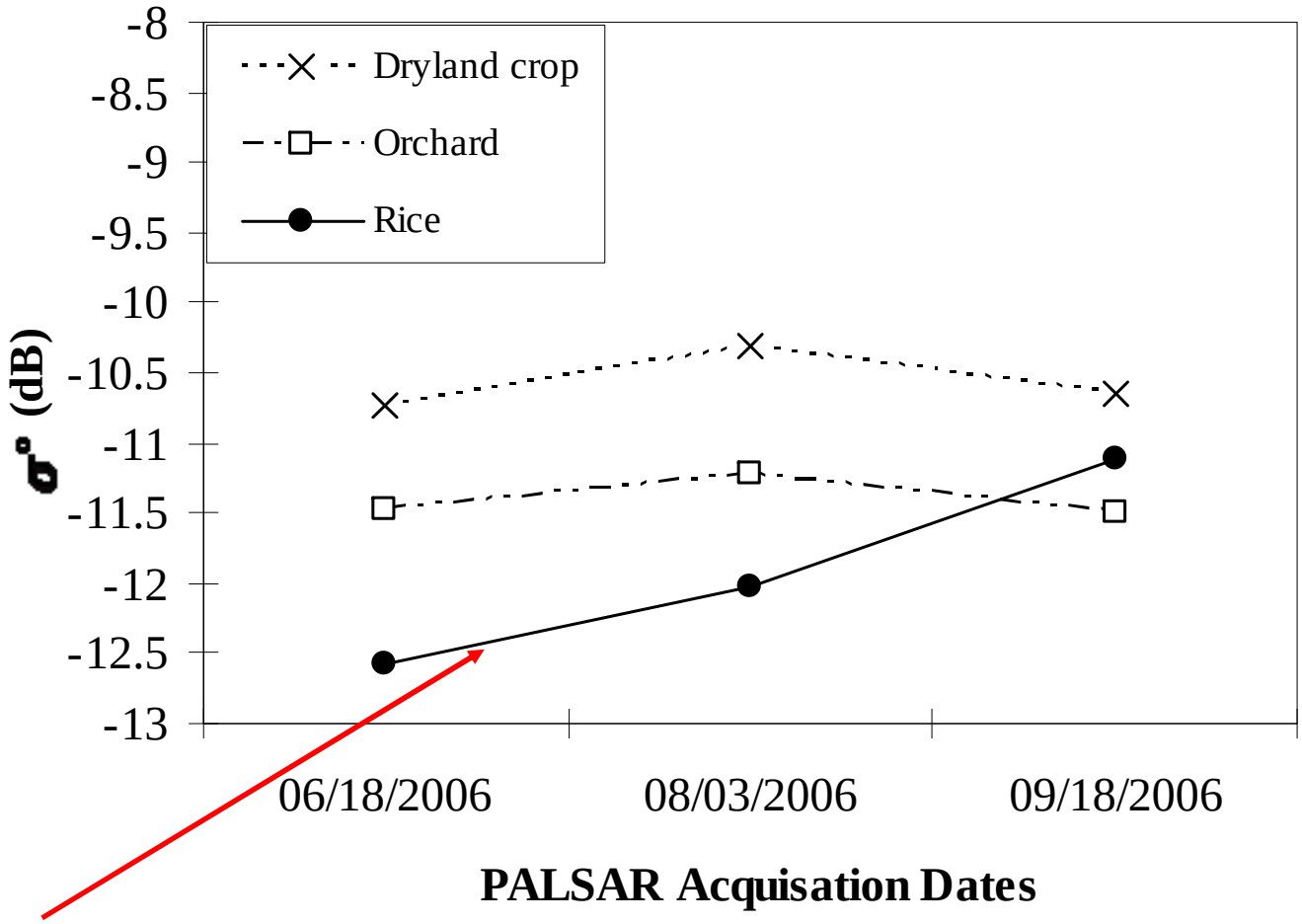
-rice turned to be confused with dryland crop and orchard in each image.

Temporal Changes in L-band Sigma 0



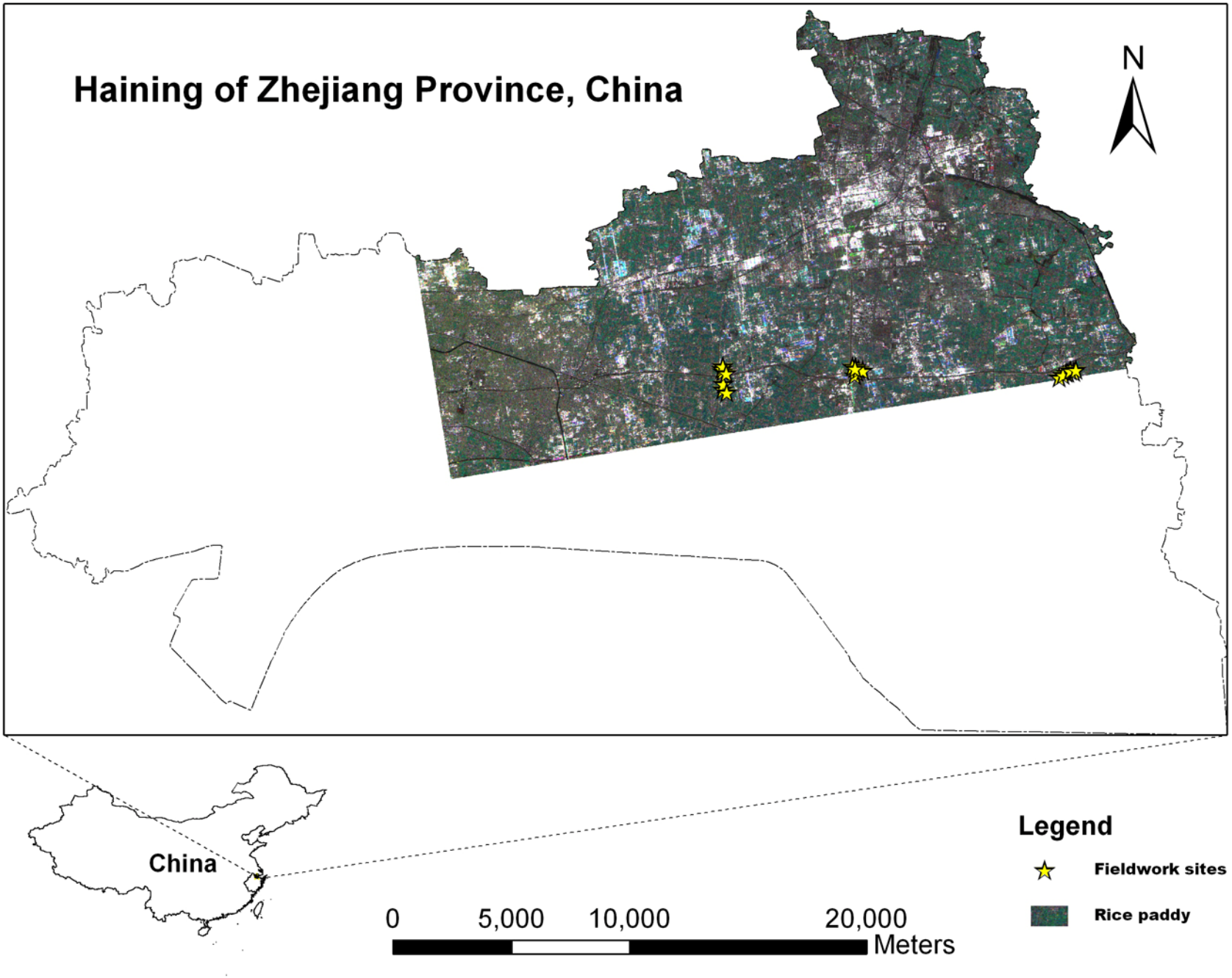
Source: Inoue et al. 2002

- Phenological variation of vegetation backscatter



-rice backscatter increased along the three growing stages. The backscatter of dryland crop and orchard did not change much.

- Case study 2: rice modeling and bio-mapping (in-process)



- Study area (Haining County)

- PALSAR FBD images: (HH&HV):

-June 28, 2007 (transplanting)

-August 13, 2007 (tillering)

-September 28, 2007 (heading)

- Field measurements (totally 44 fields):

-June 29, 2007 (4 fields)

-August 15, 2007 (19 fields)

-September 30, 2007 (21 fields)

- Measured biophysical parameters:

- plant height; plant density

- unit dry weight, unit wet weight (leaf moisture)

- leaf area index (LAI), leaf orientation angles

- Water depth

- Rice canopy scattering model

-**a 2nd-order radiative transfer function (RTF) model (based on Karam et al. 1995; Wang and Qi, in press)**

-**Rice was simulated as two-layer (leaves and short stems) continuous vegetation.**

-**Soil ground was thus simulated as a smooth continuous surface with dielectric constant of water.**

$$\sigma_{total} = \sigma_{leaf} + \sigma_{stem} + \sigma_{leaf-soil} + \sigma_{stem-soil} + \sigma_{soil}$$

Leaf volume scattering	stem volume scattering	Leaf-soil double bounce	Stem-soil double bounce	Soil surface scattering

(scattering intensity in each component is attenuated by scatterers on top of it.)

- Next steps: biophysical quantification

- Leaf density and plant height are the two major variables that control rice backscatter;

$$\sigma^0_{\mathrm{mod}el} = f(leaf\_density, plant\_height)$$

- These two variables could be retrieved via model inversion with the criteria:

$$\min(\sigma^0_{\mathrm{mod}el} - \sigma^0_{PALSAR})^2$$

- They were finally applied to all rice fields in the image to estimate field-based green biomass and rice yields in the study area.

Java Example

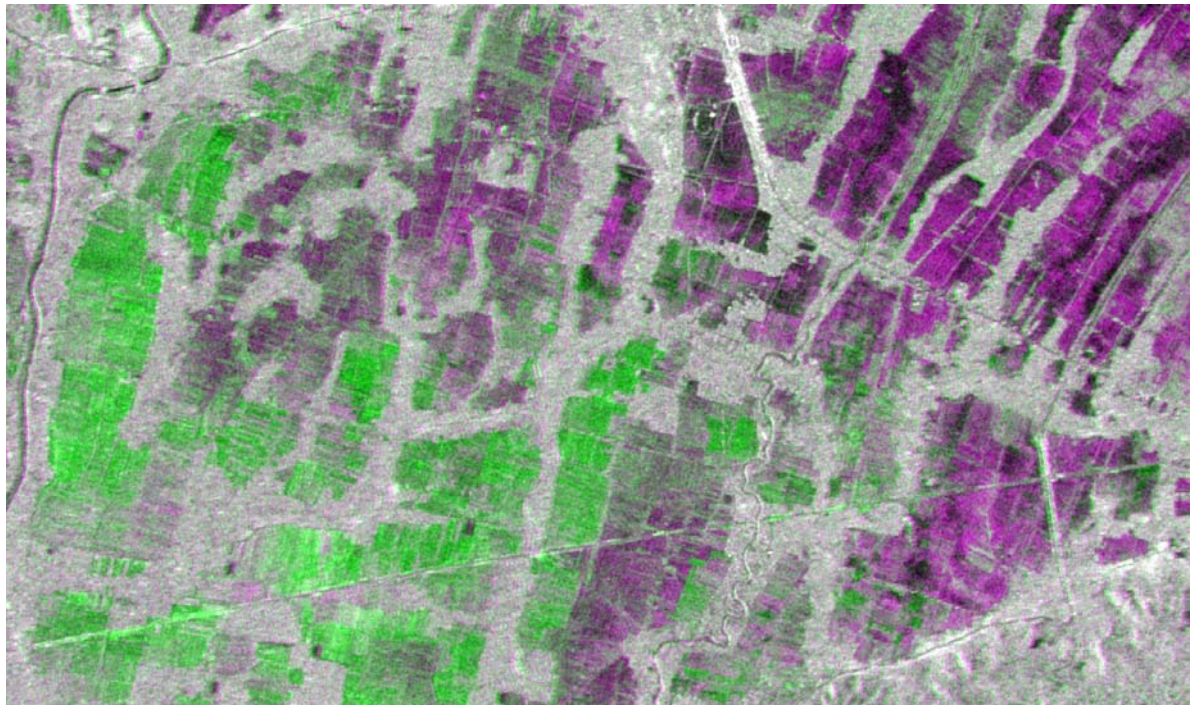


Figure 5 – Rice agriculture dynamics in Java from multiple PALSAR images collected on 6 Dec 2006 and 21 Jan 2007.
Green indicates fields planted, and pink indicates fields harvested during the interval between acquisitions.
The image is ~5 km across and has a spatial resolution of 6-m.