Land use change in the Yangtze river delta

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- Results
- Conclusion and on-going work

Introduction

- Land use and land cover change (LUCC) have impacts on radiative forcing and climate locally and globally through changing surface biophysical (albedo and evapotranspiration) and biochemical (sink and source of GHGs) properties.

- The purpose of this study:
  - (1) To analyze the LUCC in Anhui, Jiangsu, Zhejiang province and Shanghai from 2003 to 2013 based on MODIS images.
  - (2) To monitoring the vegetation dynamics by MODIS NDVI products.

Dataset and Methods

2.1 Dateset

- The NDVI is obtained from red(R) and near-infrared (NIR)reflectance,

$$\mathbf{NDVI = (Band_{NIR} - Band_R) / (Band_{NIR} + Band_R)} \quad (1)$$

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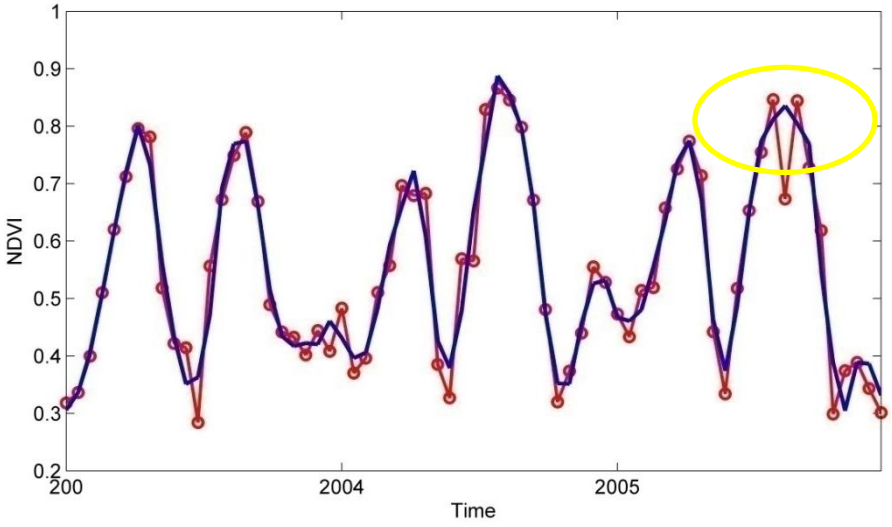
Dateset	MOD13A2
temporal resolution	1km
Spatial Resolution	16d
time span	2003～2013

2.2 Filtering

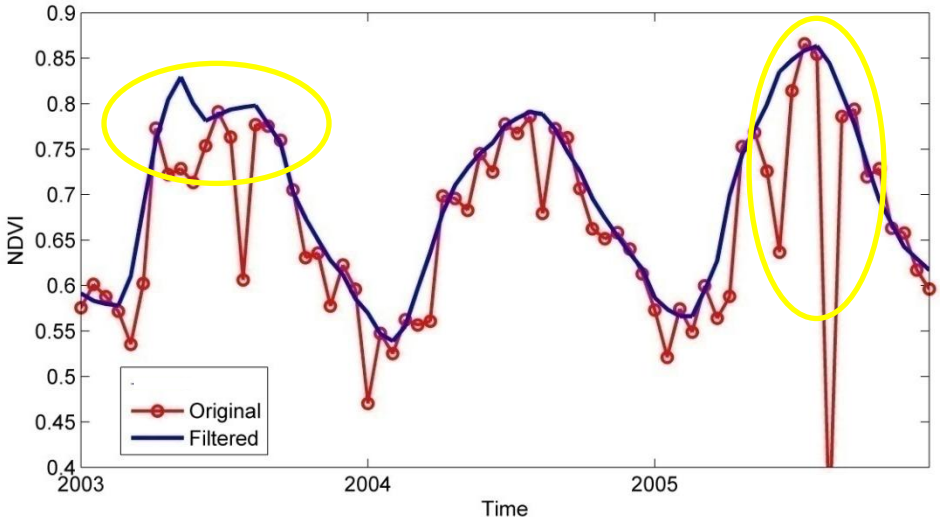
TIMESAT package is used for filtering(S-G) DNVI to eliminate part of the noise impact.

$$\mathrm{NDVI}(t) = \frac{\sum_{i=-m}^{i=m} C_i \mathrm{NDVI}_{j+i}}{N}$$

N is the number of convoluting integers which is equal to the smoothing window size, and j is the running index of the original ordinate data table.



a(farmland)



b(forests)

Fig . 1 The filtering results of different vegetation (NDVI).

2.3 Feature amount extraction

Characteristic parameters :

(1) MAX_i = max($NDVI_1$,$DNVI_2$…$NDVI_{23}$)

(2) Ave_grow_i = mean($NDVI_6$,$NDVI_7$,…$NDVI_{19}$)

(3) $MEAN_i$ = mean($NDVI_1$,$DNVI_2$…$NDVI_{23}$)

(4) Fluctuation:(n=23)

$$Std_i = \left[\frac{1}{n-1} \sum_{t=1}^{n} (x_t - \bar{x})^2 \right]^{1/2} \qquad (2)$$

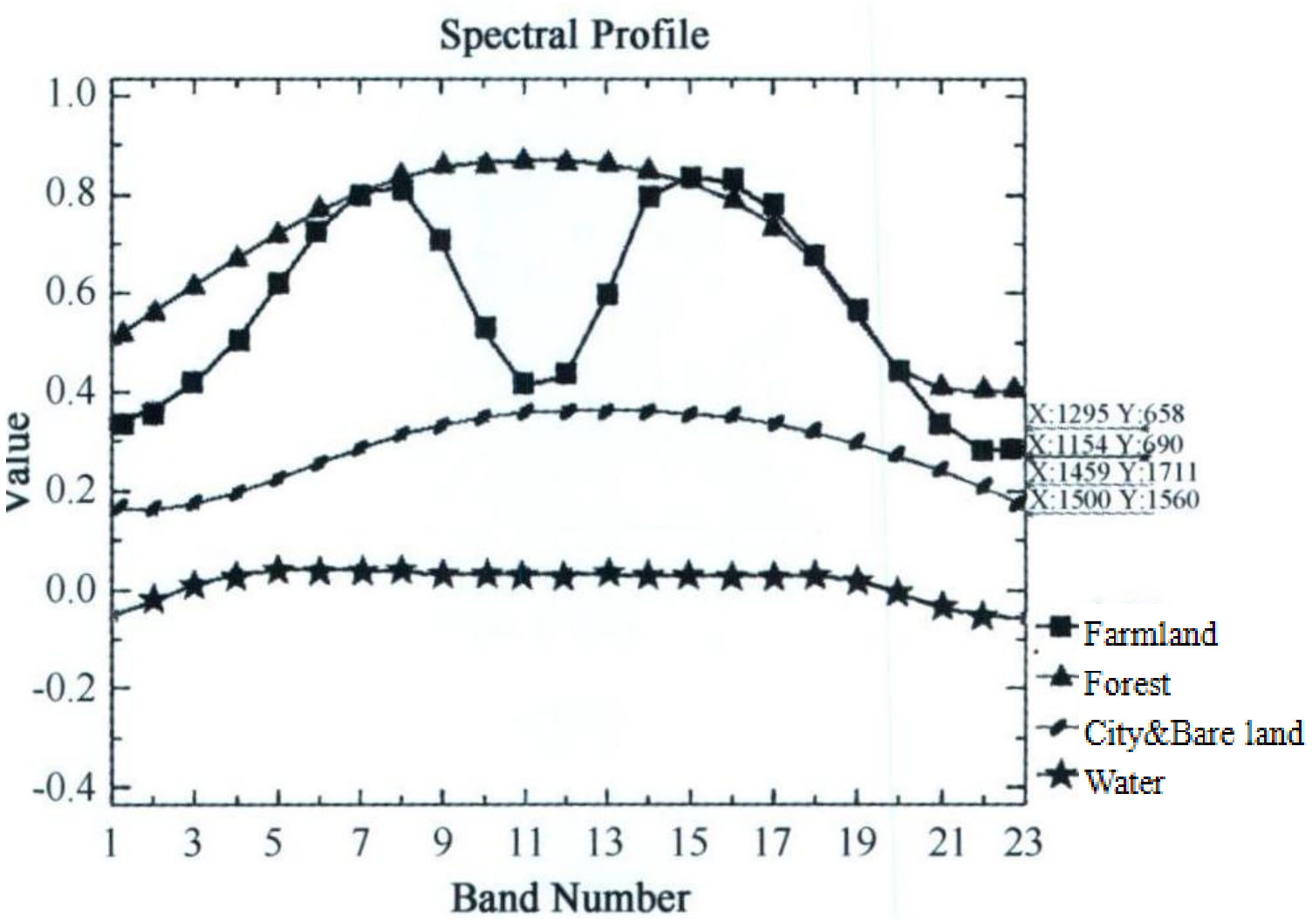


Fig.2 Temporal profile characteristic of different land cover class in the Study area.

2.4 Decision tree classification

Tillage in the Study area are mainly two seasons a year. However, crop types and sowing time are relatively large differences in different regions.

Tab.1 Target variables and classification variables in a decision tree classification

Variable	Target variable	Classification variables
Classification	Water Forest Farmland City & Bare land	**NDVI value**(MAX, MEAN, Ave_grow) **Growth cycle**(start, stop, length)

Results

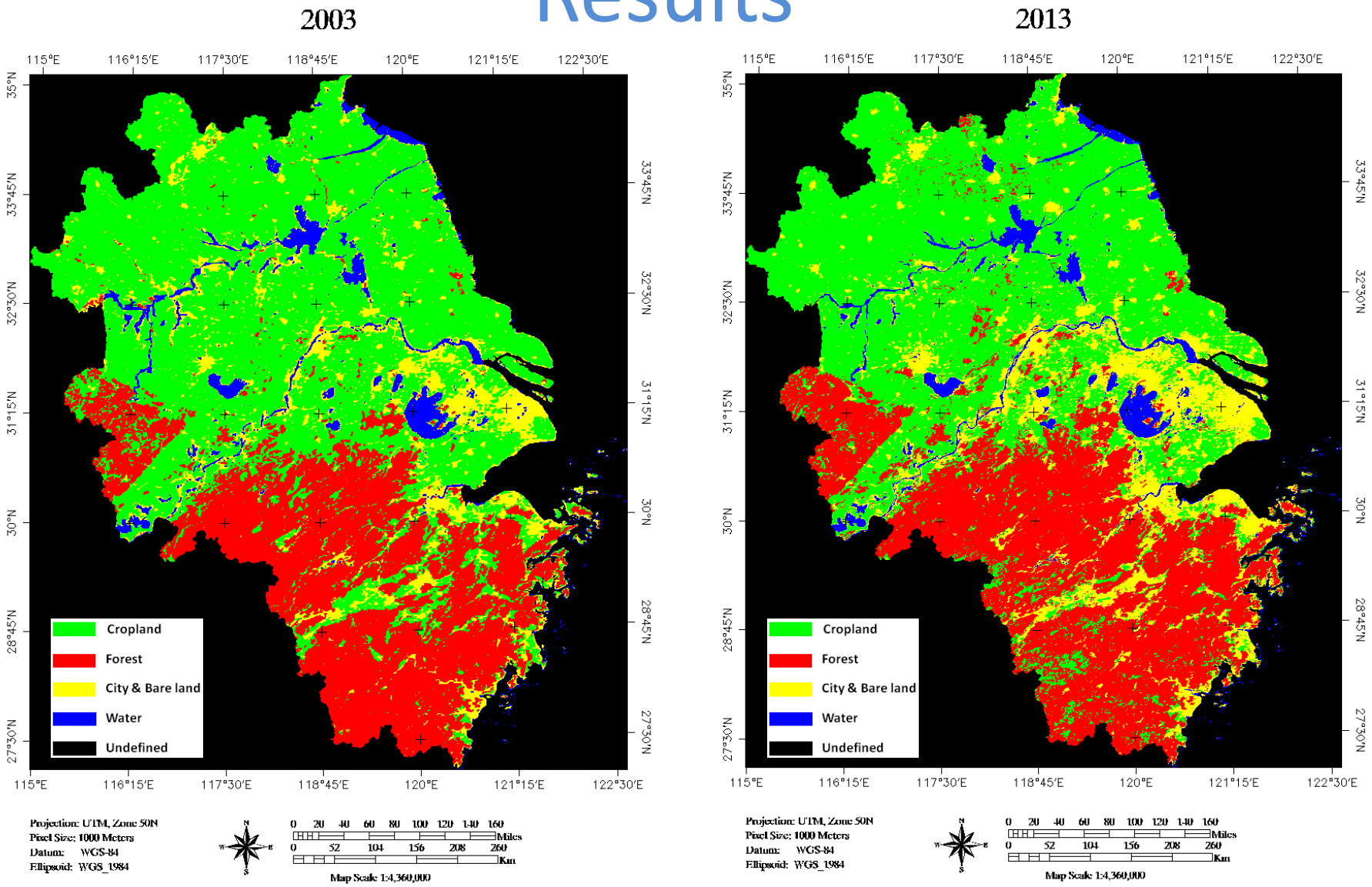


Fig. 3 Comparison between 2003 land cover map and 2013 land cover map

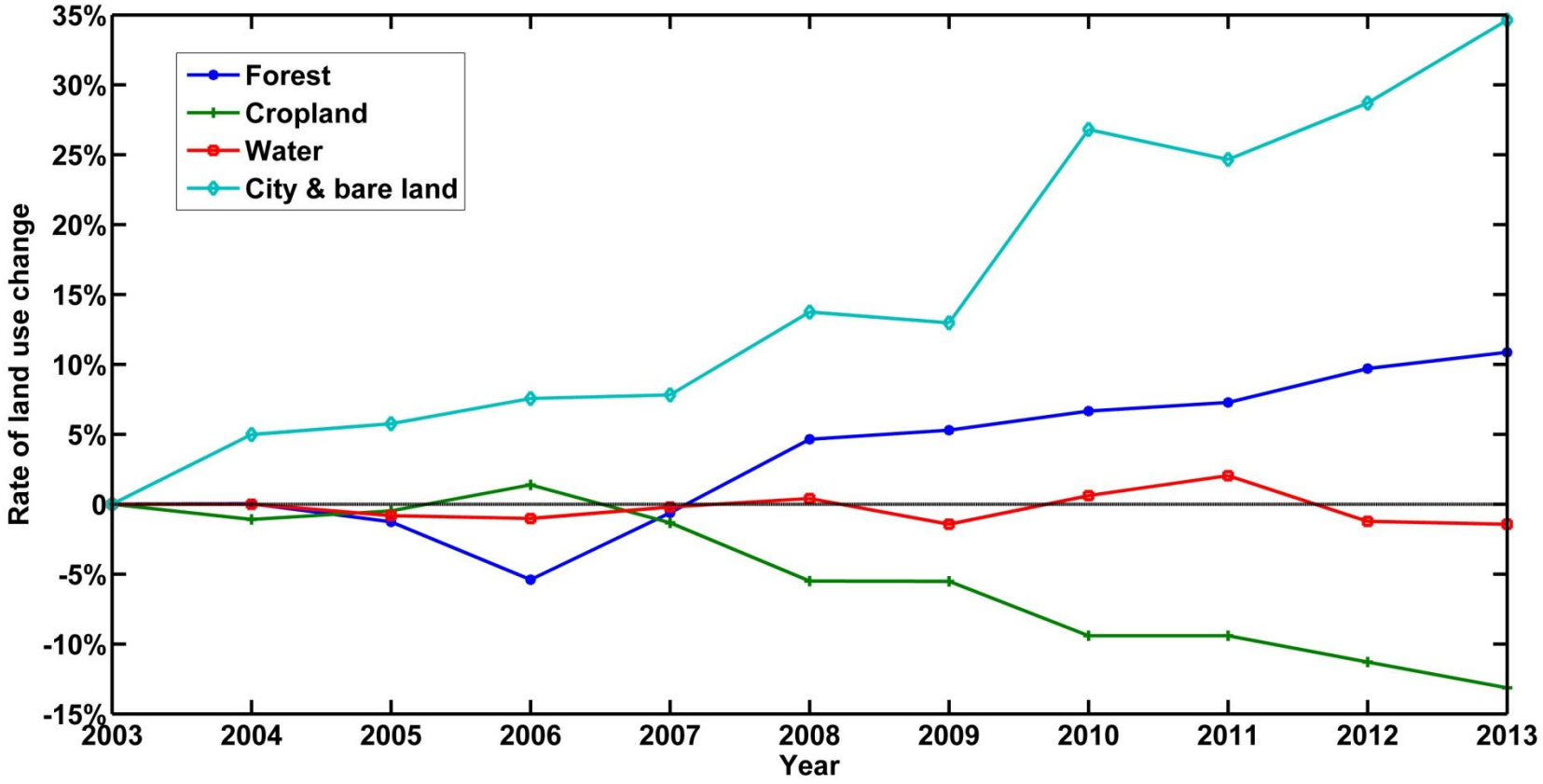


Fig. 4 The interannual changes of land use for different Underlying surface type in study area.

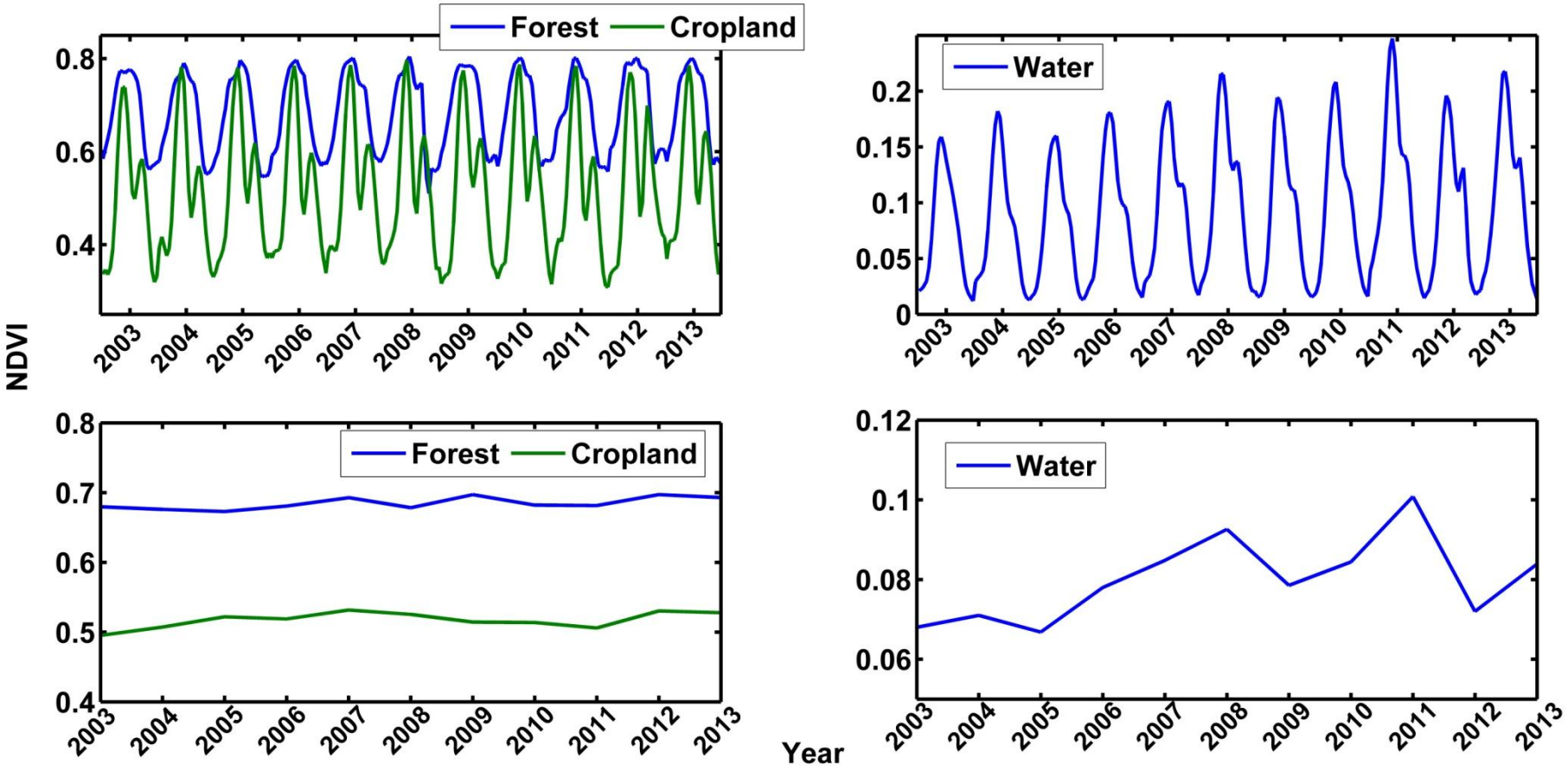


Fig. 5 The interannual and 16days changes of NDVI(mean) for different Underlying surface type in study area.

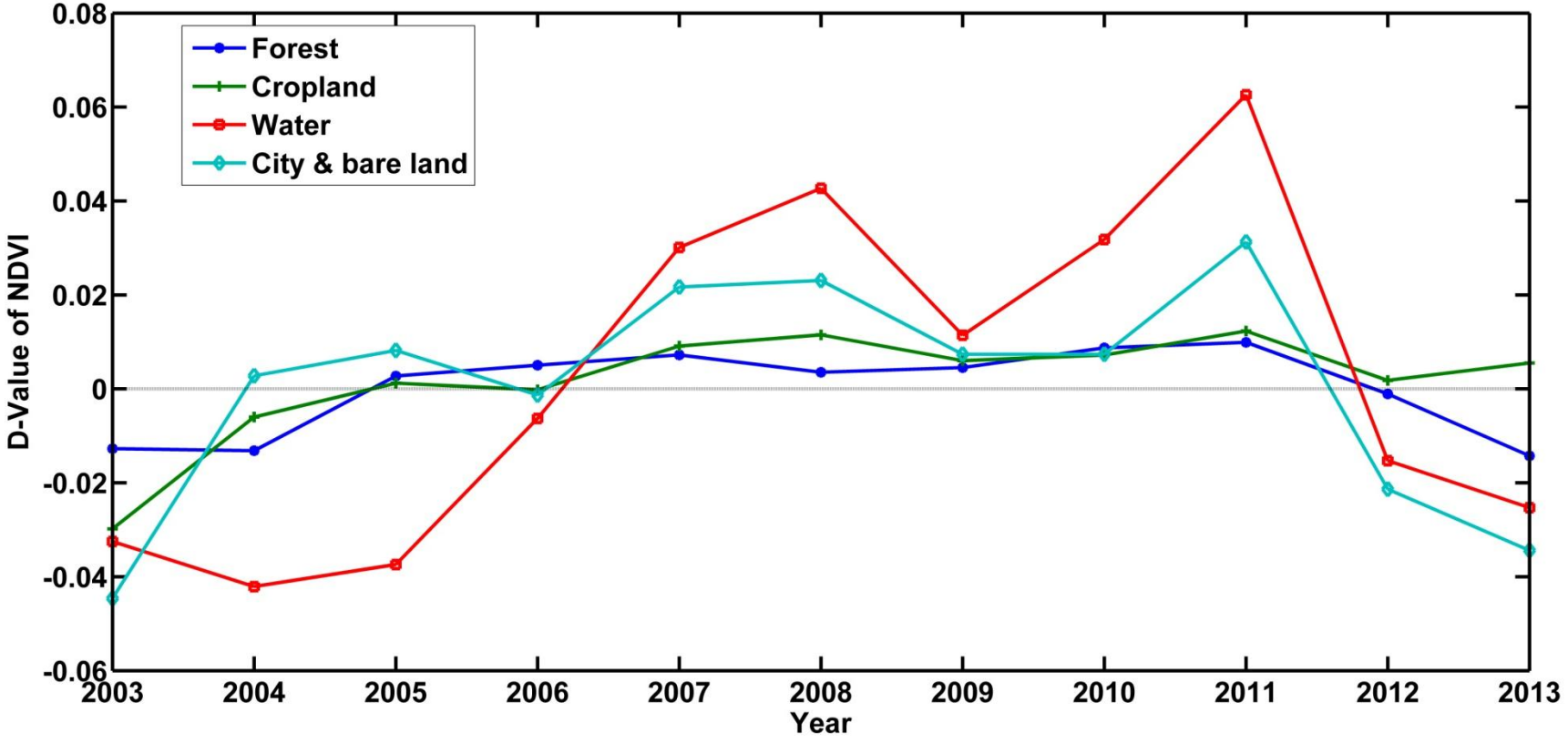


Fig. 6 The interannual changes of D-Value NDVI (mean) for different Underlying surface type in study area.

Accuracy Verification

The classification accuracy was assessed using fine-resolution Landsat ETM+ images, with an overall accuracy of 86.1% (Mapmaker accuracy is Cropland 89.6%, Forest 81.92%, Water 98.39%, City & bare land 79.27%) and kappa coefficient = 0.75.

Tab. 2 Confusion Matrix

	Ground Truth(%)			
Class	Cropland	Forest	Water	City & bare land
Cropland	89.60	17.61	0.00	19.90
Forest	4.83	81.92	0.00	0.00
Water	0.00	0.00	98.39	0.83
City & bare land	5.57	0.47	1.61	79.27
Total	100.0	100.0	100.0	100.0

Statistical data in Table 3 mainly from the literature and provincial statistical yearbook. Because the statistics are not identical in the provinces, Statistical results can only do a relative reference.

Tab. 3 Comparison of the classification results and statistical data on Annual rate of change of land use.

Annual rate of change(%)	Forest	Cropland	Construction land
Zhejiang	0.21	-1	3
Jiangsu	8.3	-1.3	2.6
Anhui	1	-0.93	6
Shanghai	0	-0.15	4.4
Total	0.63	-1.11	3.5
Total(MODIS)	0.9	-1.2	3.2

Conclusion and on-going work

1. Forest and urban area have increased by 10.8% and 35%, respectively, while cropland has decreased by 13% in the study regions from 2003 to 2013.
2. Vegetation growth peaked in 2008 and 2011.

3. The next step: Adding DEM data to improve classification accuracy of the forest; Combined with meteorological data to analyze the vegetation of the study area.


THANK
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