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Rice mapping based on multi remote sensing data

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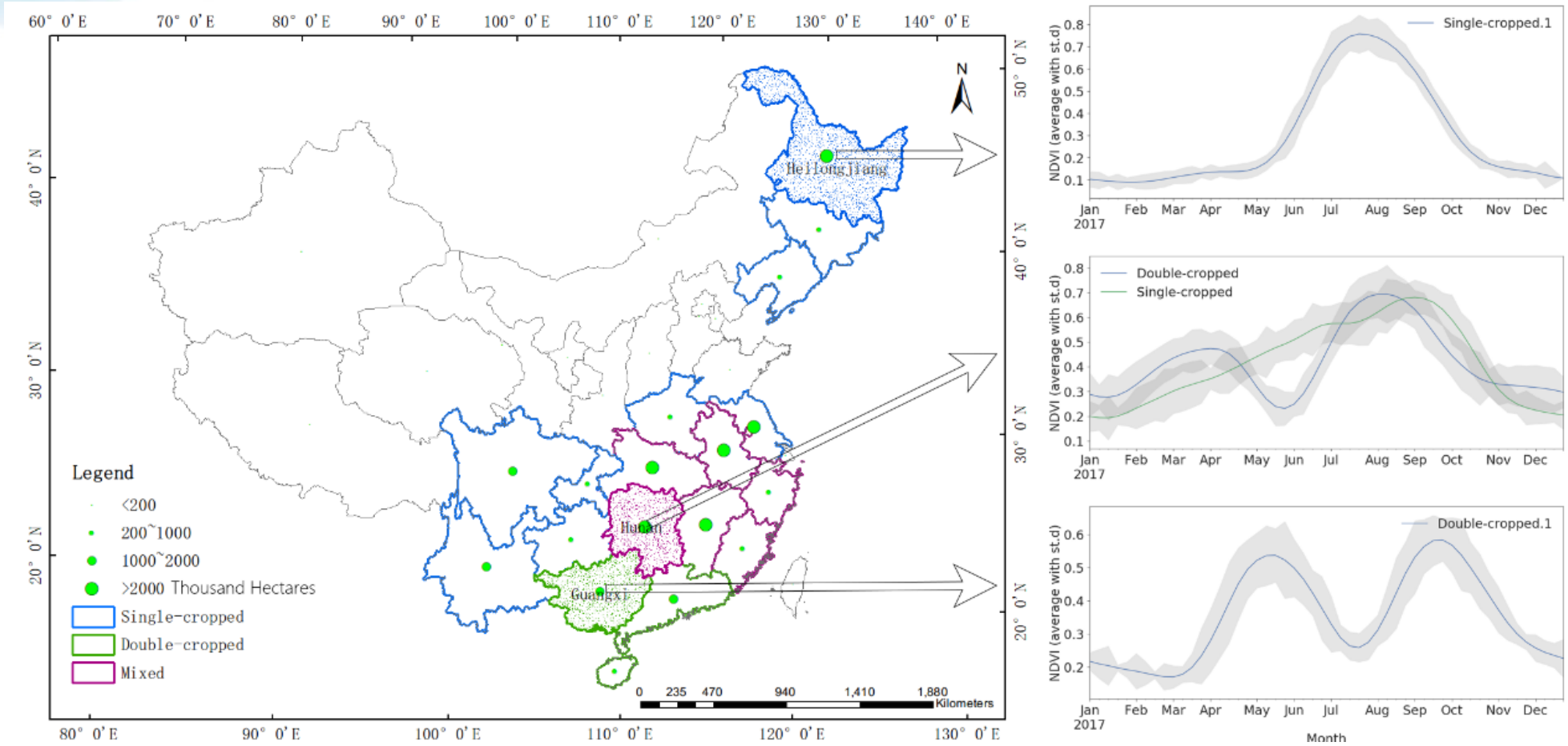
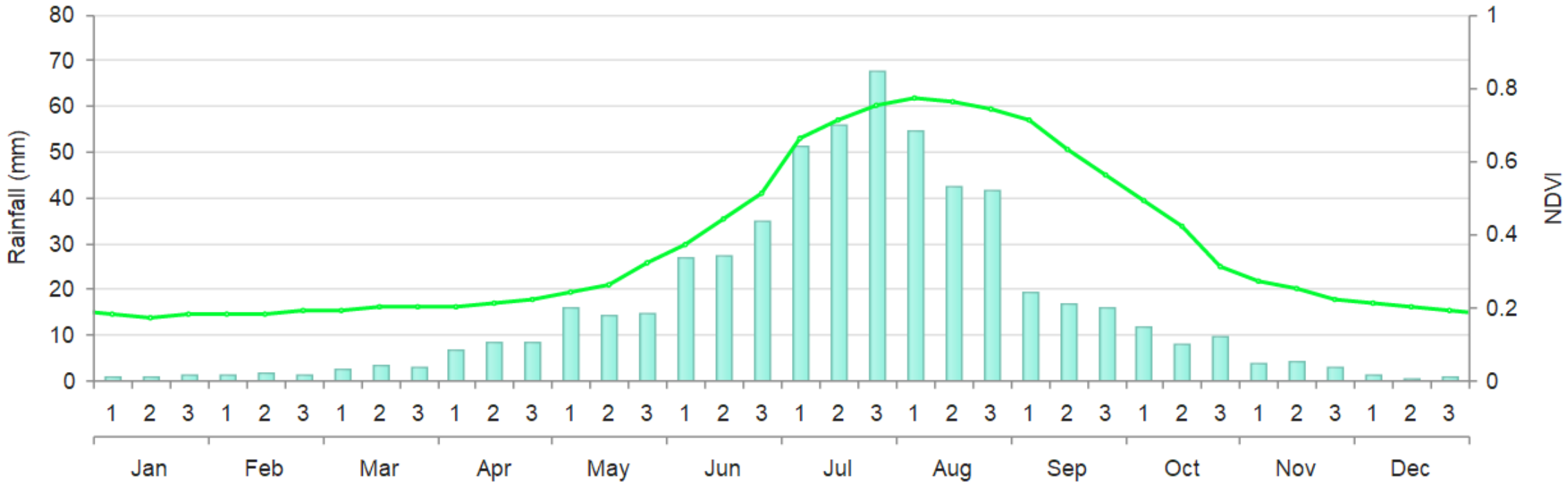
Rice major planting provinces and patterns

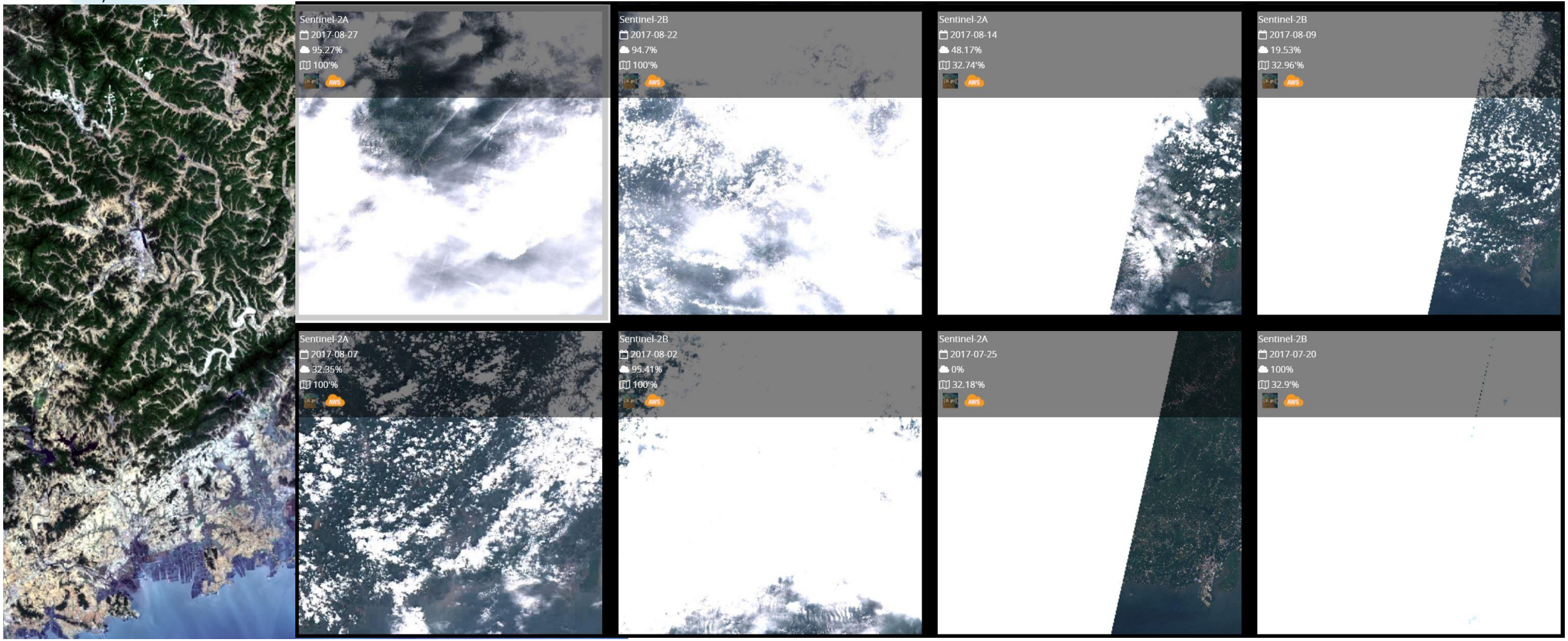


Rice growing season and rainy season



Availability of optical data

June 8, 2017



- Calendar of rice is similar to maize, soybean and other summer crops; Crop spectral feature is also similar
- But rice field is unique during planting period (covered by water); SAR data is sensitive to water body, water content, etc

Key points

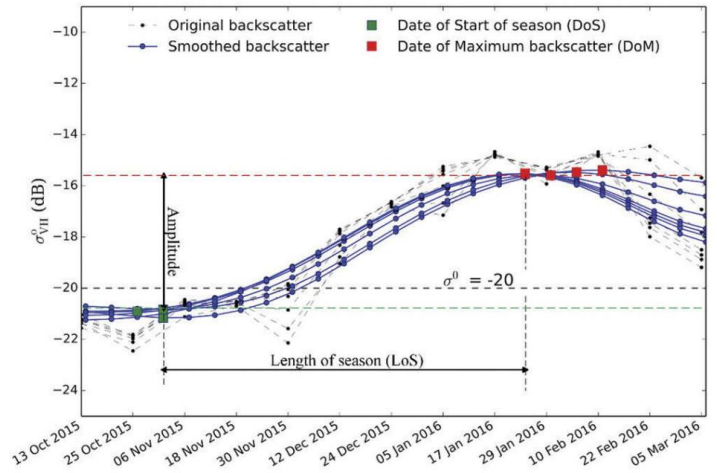


Figure 6. Rice phenological parameters and empirical threshold derivation for rice classification.

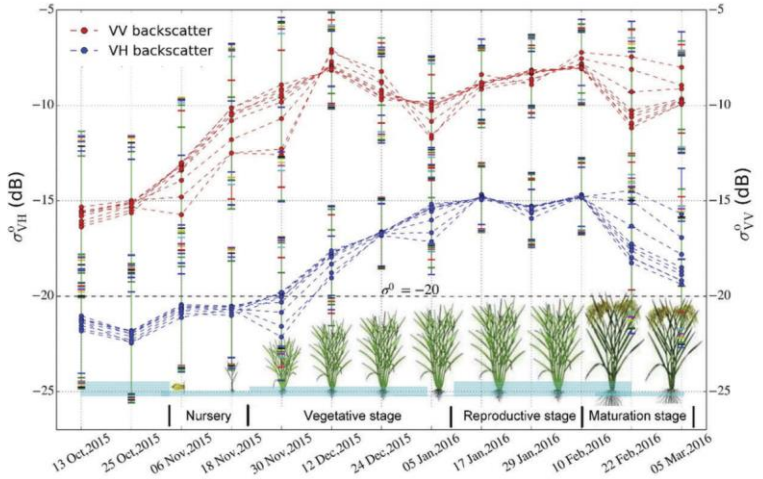
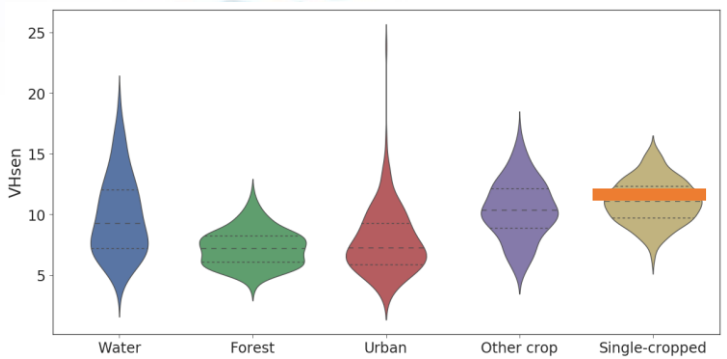
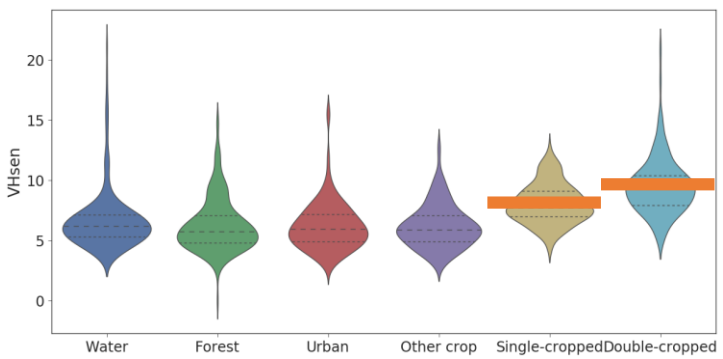


Figure 4. Temporal evolution of the VV and VH polarized backscatter over selected rice fields.

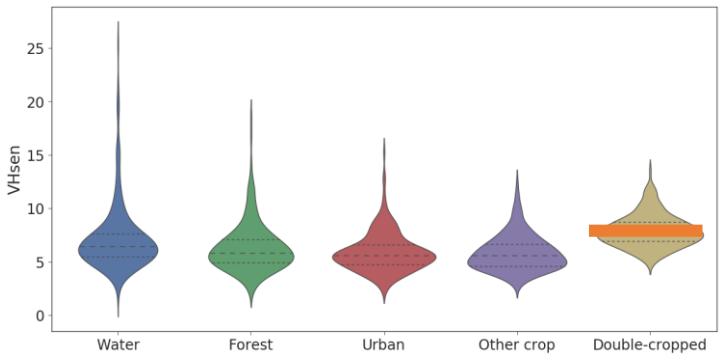
Heilongjiang



Hunan

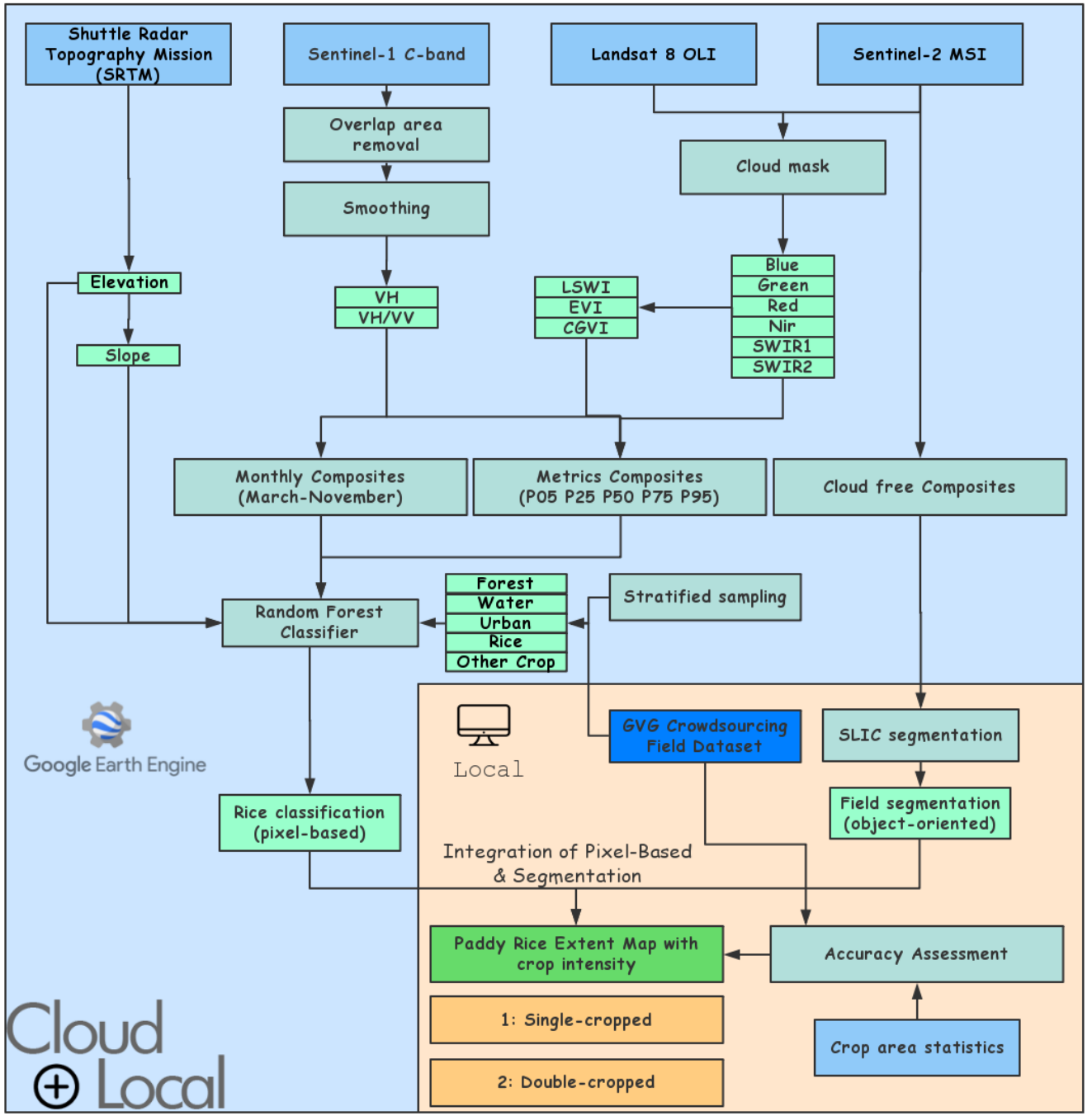


Guangxi



Statistical analysis of SAR signal

Methodology



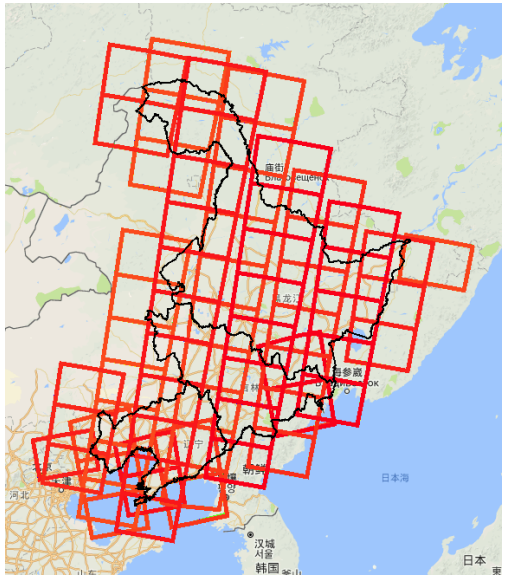
Data sources

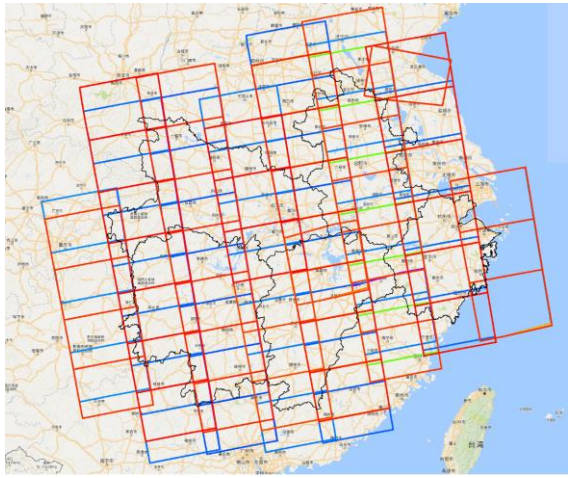
Sensors	Band	Use	Wavelength	Res	Provider
Sentinel-2 MSI	B2	Blue	490 μm	10m	ESA
	B3	Green	560 μm	10m	
	B4	Red	665 μm	10m	
	B8	Near Infrared	842 μm	10m	
	B11	Short-wave Infrared 1	1610 μm	20m	
	B12	Short-wave infrared 2	2190 μm	20m	
Landsat 8 OLI	B2	Blue	0.45 - 0.51 μm	30m	USGS
	B3	Green	0.53 - 0.59 μm	30m	
	B4	Red	0.64 - 0.67 μm	30m	
	B5	Near Infrared	0.85 - 0.88 μm	30m	
	B6	Short-wave Infrared 1	1.57 - 1.65 μm	30m	
	B7	Short-wave infrared 2	2.11 - 2.29 μm	30m	
Sentinel-1 C	VV	dual-band cross-polarization, vertical		10m	ESA
	VH	transmit/horizontal receive		10m	
SRTM	Evelation			30m	NASA/USGS
Landsat	Hansen Global Forest Change			30m	GEE
Landsat	JRC Global Surface Water Mapping			30m	GEE

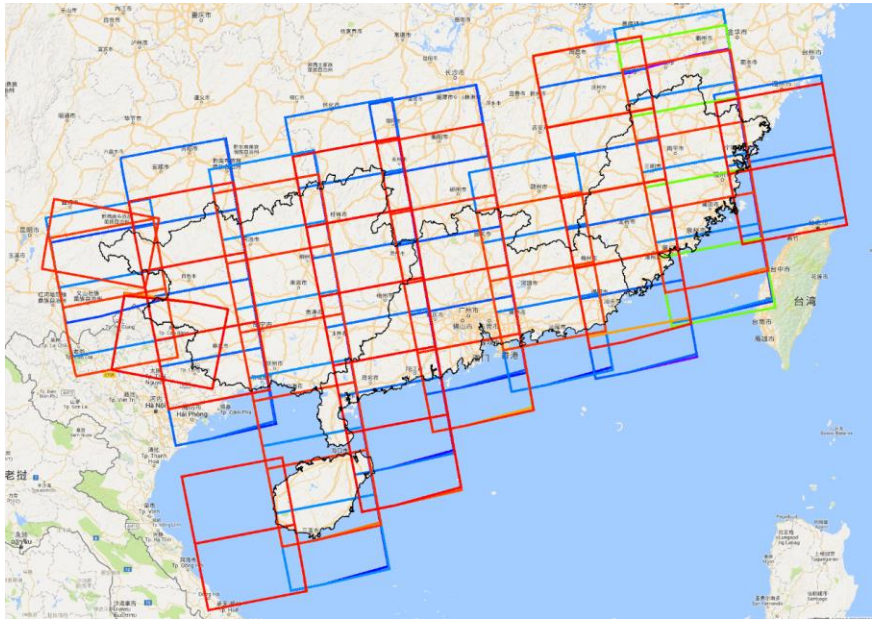
Sensors(1st March to 30th November, 2017)		Heilongjiang	Huan	Guangxi
Landsat 8 OLI	Scenes	752	187	209
	Footprints	53	21	20
Sentinel-2 MSI	Scenes	4116	1411	1580
	Footprints	86	41	48
Sentinel-1 C-band	Scenes	828	364	340
	Mode	Interferometric Wide swath (IW)		
	Orbit Properties	Descending	Ascending	Ascending

Satellite data used

- Sentinel – 1: 5532 scenes
- Sentinel – 2: 20209 scenes
- Landsat – 8: 869 scenes





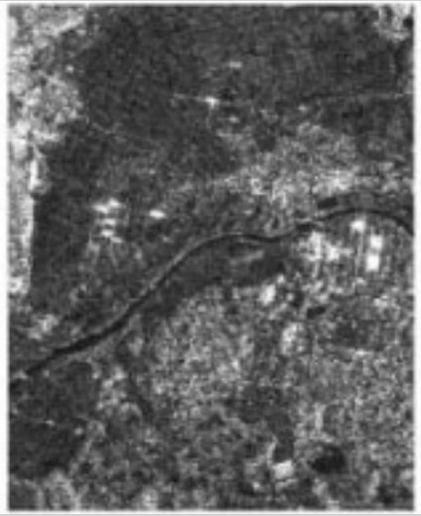


Features for classification

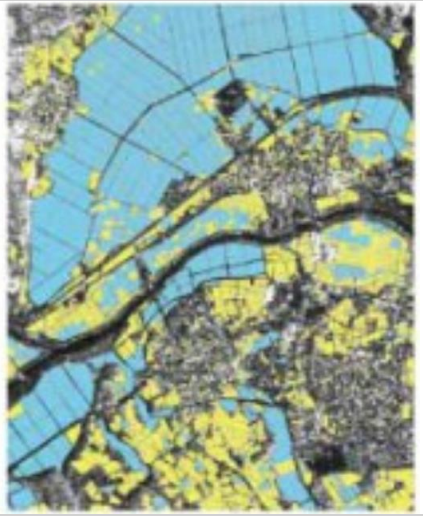
- Backscatter coefficient at different growing stage

Transplanting

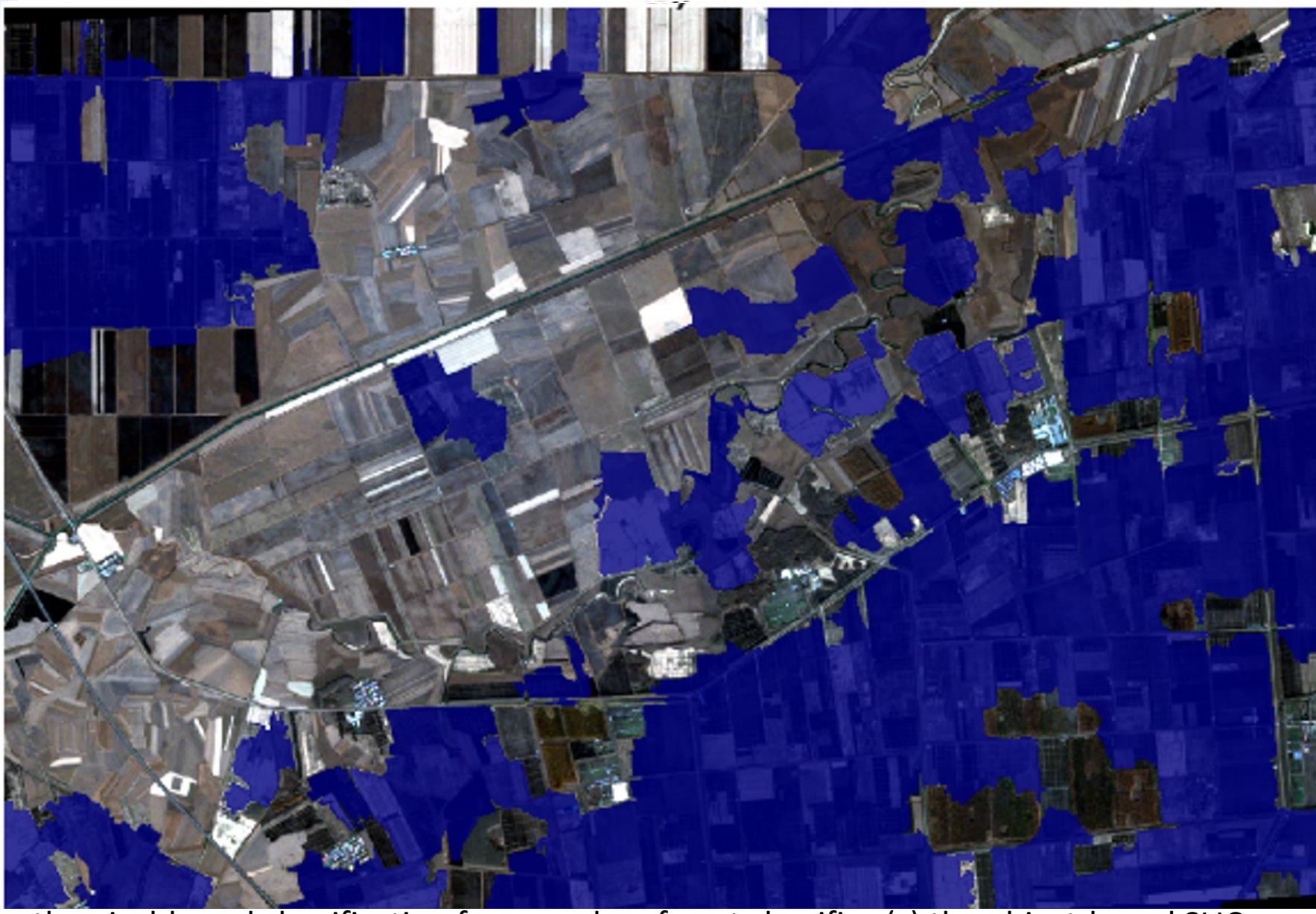
Flowering



Rice field in blue

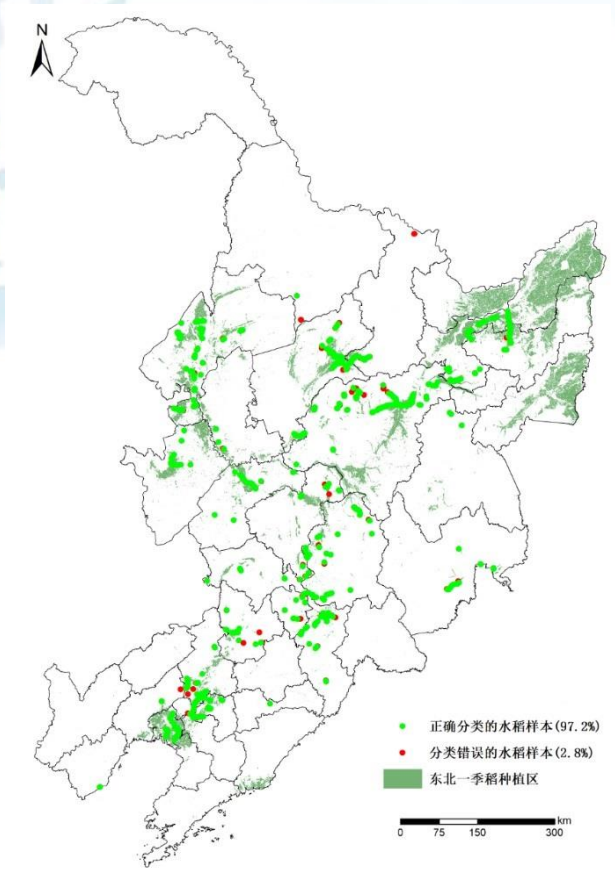


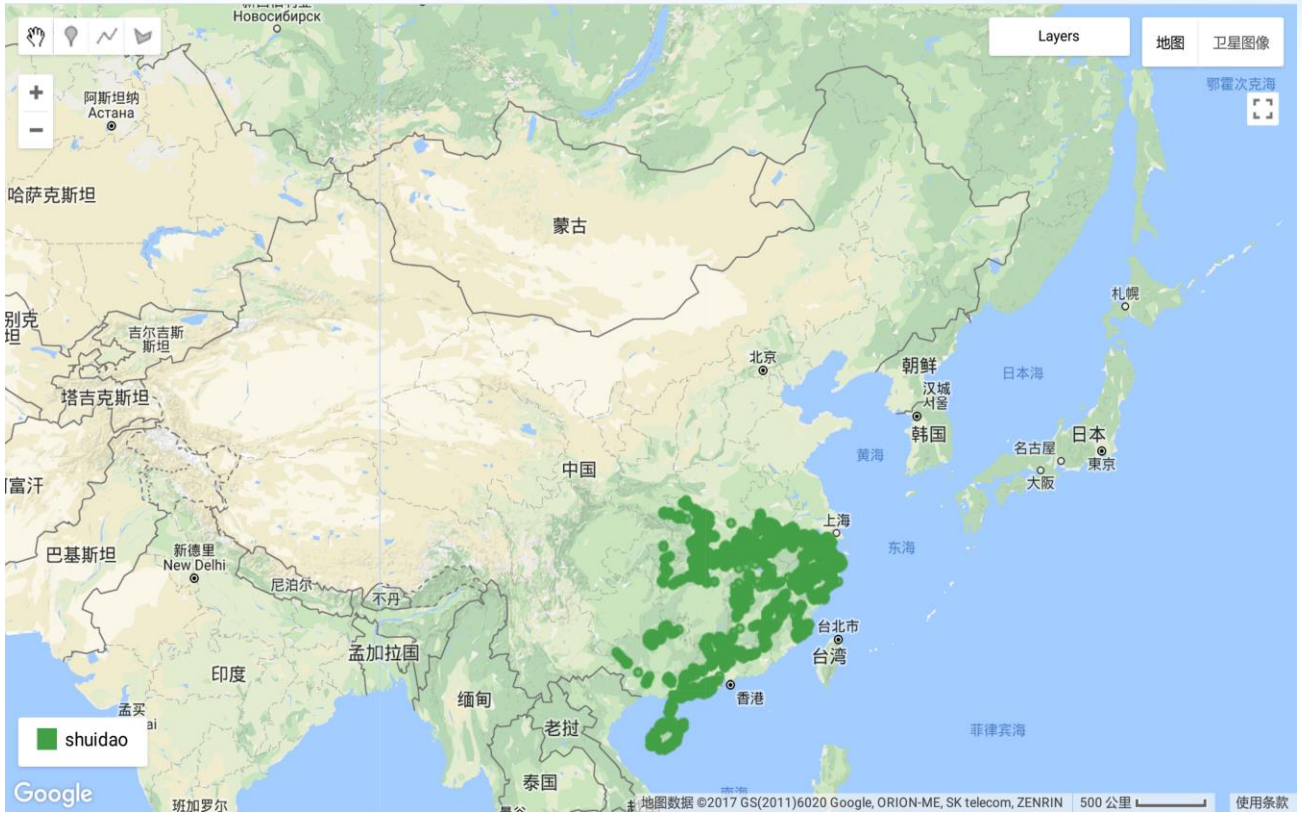
Pixel based + object based classification



$$lable = \begin{cases} mean \geq 0.6 & rice \\ mean < 0.6 & no\ rice \end{cases}$$

the pixel-based classification from random forest classifier;(c) the object-based SLIC image segmentation result and (d) the merged results with SLIC segmentation result with pixel-based Random Forest classification.





Accuracy assessment

80% of samples used for training，20% for validation

How to carry out accuracy assessment

- In situ data
- Classification result
- Overlap the two to calculate the number of samples classified correctly and wrong
- To generate confusion Metrix

$$\mathrm{OA} = \frac{S_d}{n} \times 100\%$$

$$\mathrm{UA} = \frac{X_{ij}}{X_j} \times 100\%$$

$$\mathrm{PA} = \frac{X_{ij}}{X_i} \times 100\%$$

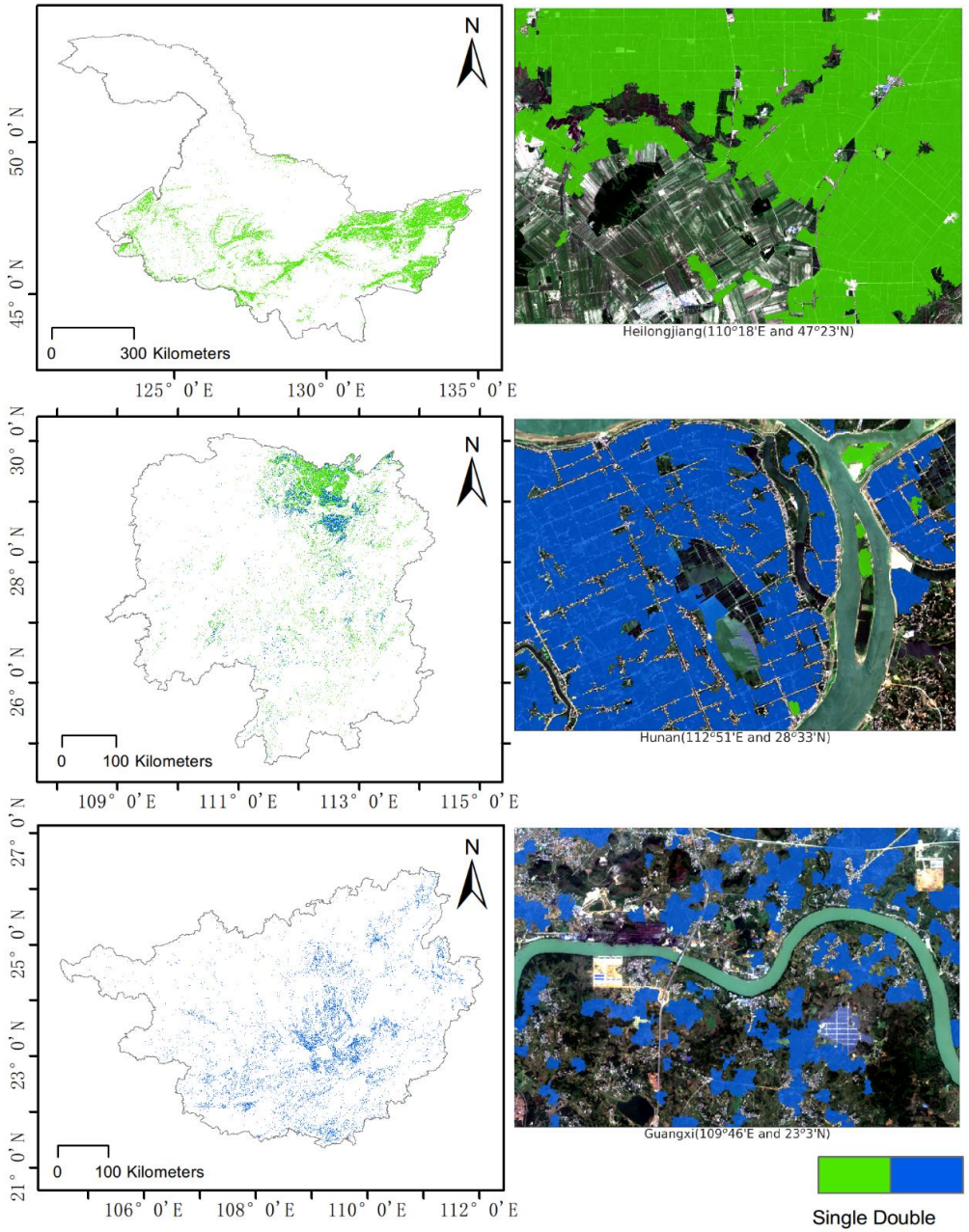
$$F_{score} = \frac{UA \times PA}{UA + PA} \times 2$$

where Sd represents the total number of correctly classified pixels, n represents the total number of validation pixels, and Xij represents an observation in row I and column j in the confusion matrix; Xi represents the marginal total of row I, and Xj represents the marginal total of column j in the confusion matrix.

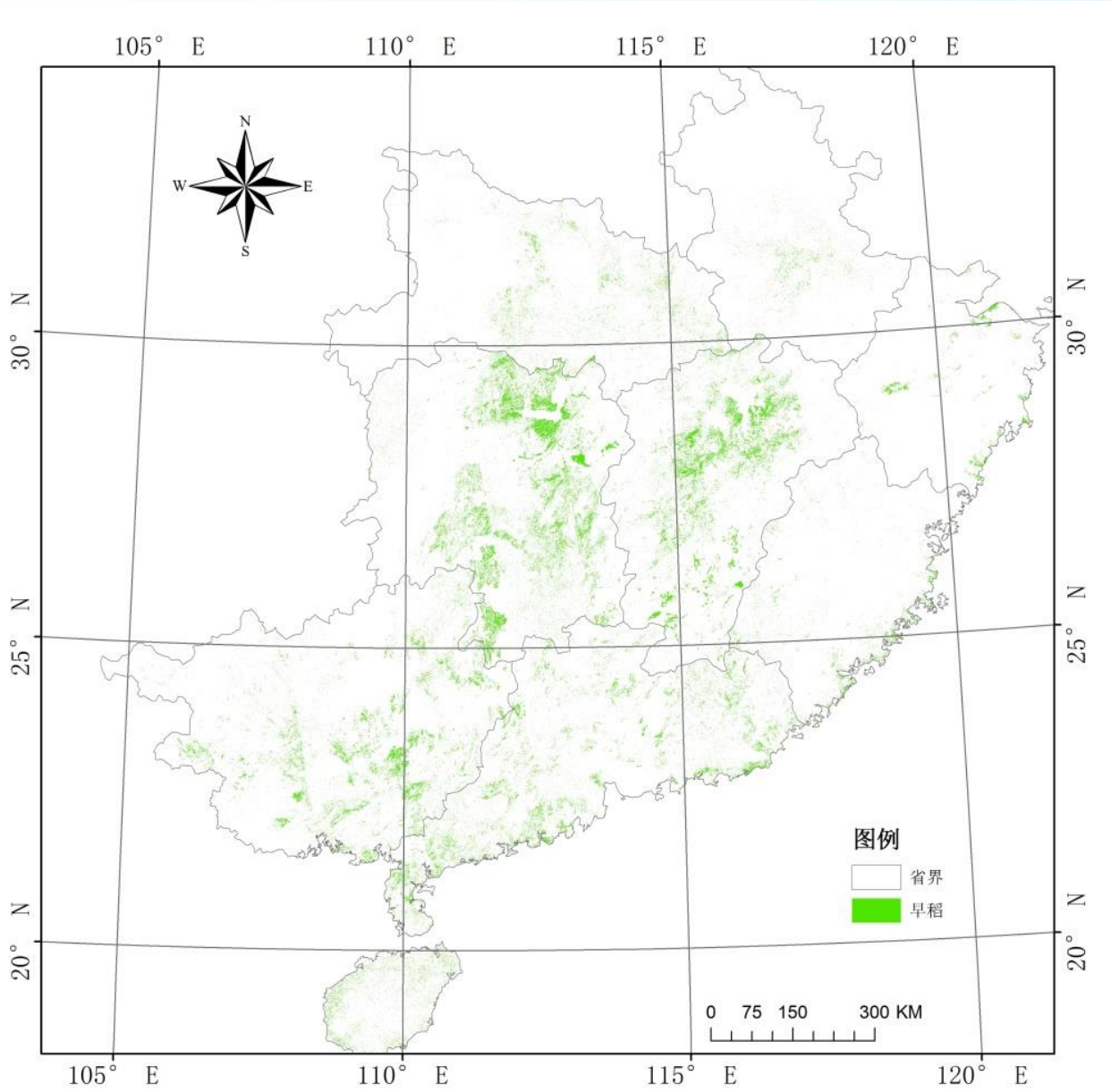
How to carry out accuracy assessment

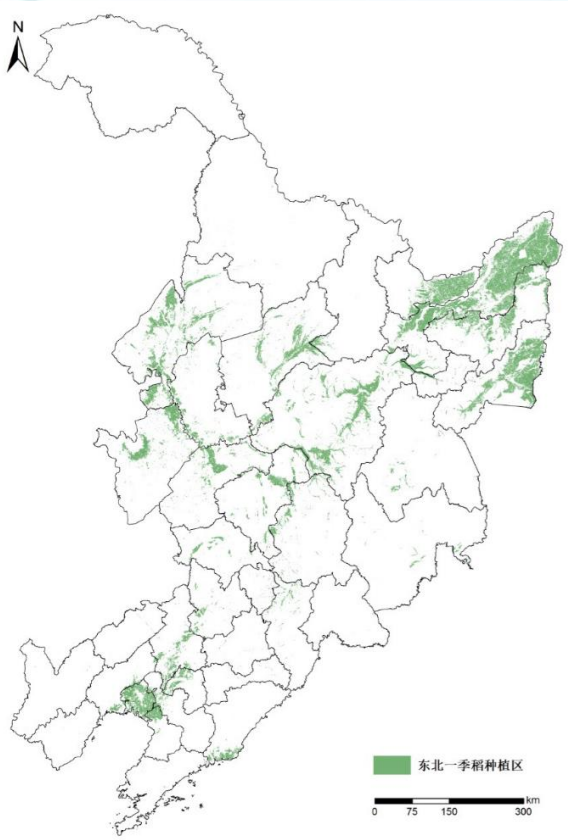
Heilongjiang		Field data			
		Other crops	Rice	Total	User Accuracy
Map data	Other crops	870	33	903	96.35%
	Rice	50	298	348	85.63%
Total		920	331	1251	
Producer Accuracy		94.57%	90.03%		
Overall Accuracy		93.37%	F score		87.78%

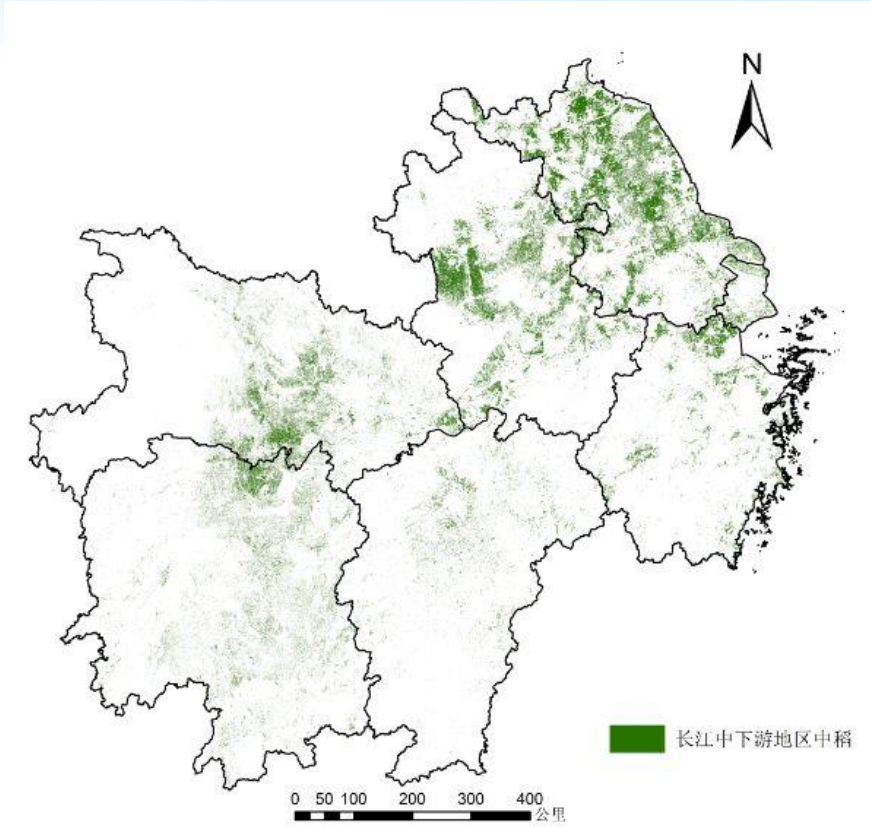
Rice mapping



Early rice

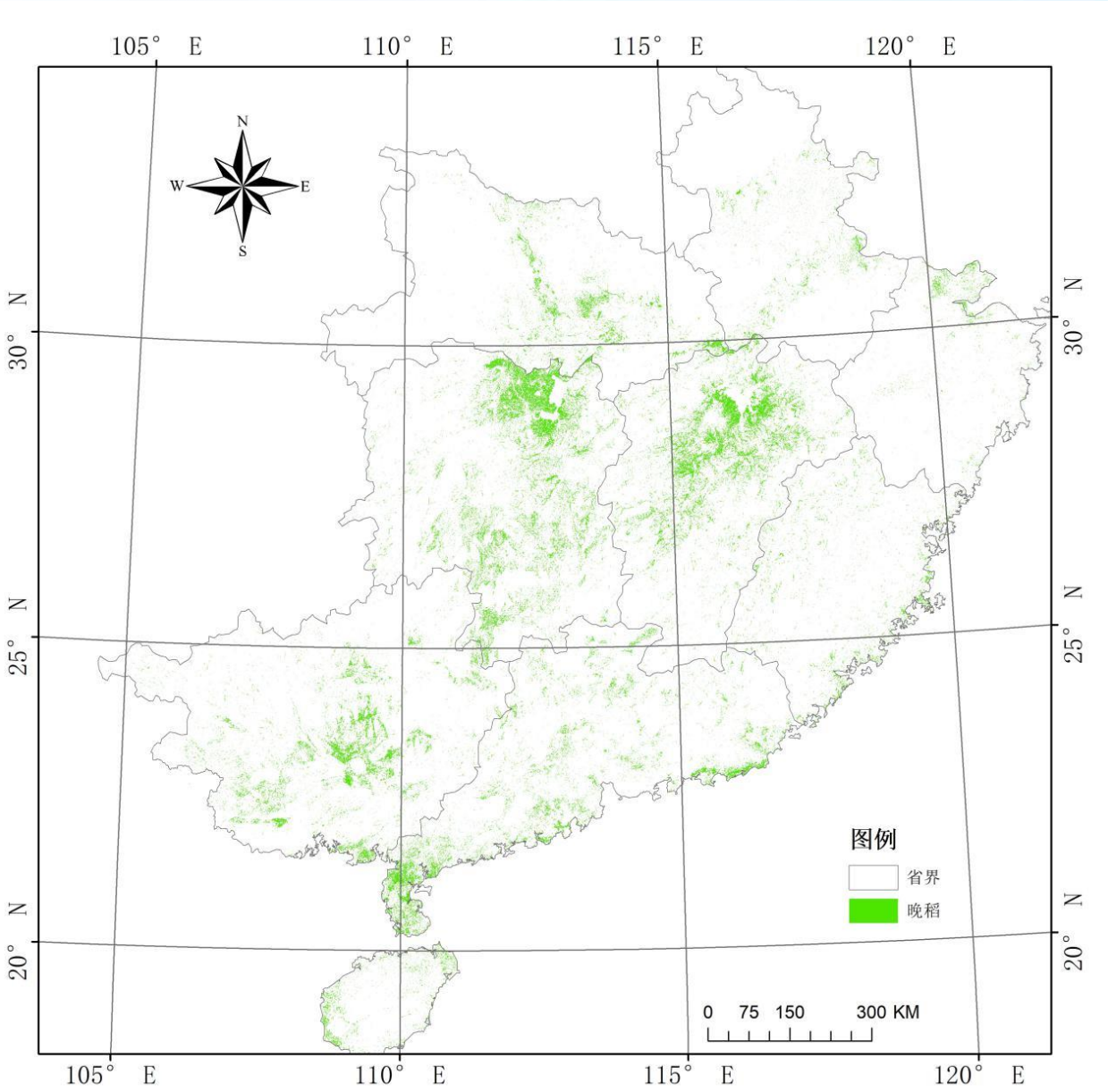






Single/Semi-late rice

Late rice



Thanks !