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中国科技部-欧洲空间局“龙计划”合作

EOWAQYWET

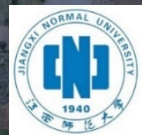
ID 32442

**New Earth Observations tools for Water resource and quality monitoring
in Yangtze wetlands and lakes**



Pr. CHEN Xiaoling, Dr. H. YESOU

Dr. Claudia KUENZER, Pr. WANG Yeqiao, Pr. S. LOISELLE, Pr. DUAN Hongtao



26-30 June 2017 | Copenhagen, Denmark

2017年6月26-30日, 丹麦 哥本哈根





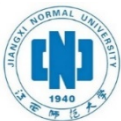
DRAGON 4 EOWAQYWET



**New Earth Observations tools for Water resource
and quality monitoring
in Yangtze wetlands and lakes**



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**1 - WaRYWeBio
Water resource behaviors in Yangtze intermediate
basin and wetlands' biodiversity**



PR WANG Yeqiao and Pr Claudia Kuenzer



**2 - BioGeoLakes
New Earth Observation tools for biogeochemical studies
of Yangtze Valley lakes**



UNIVERSITÀ
DI SIENA
1240

Pr DUAN Hongtao and Pr Steven. Loiselle

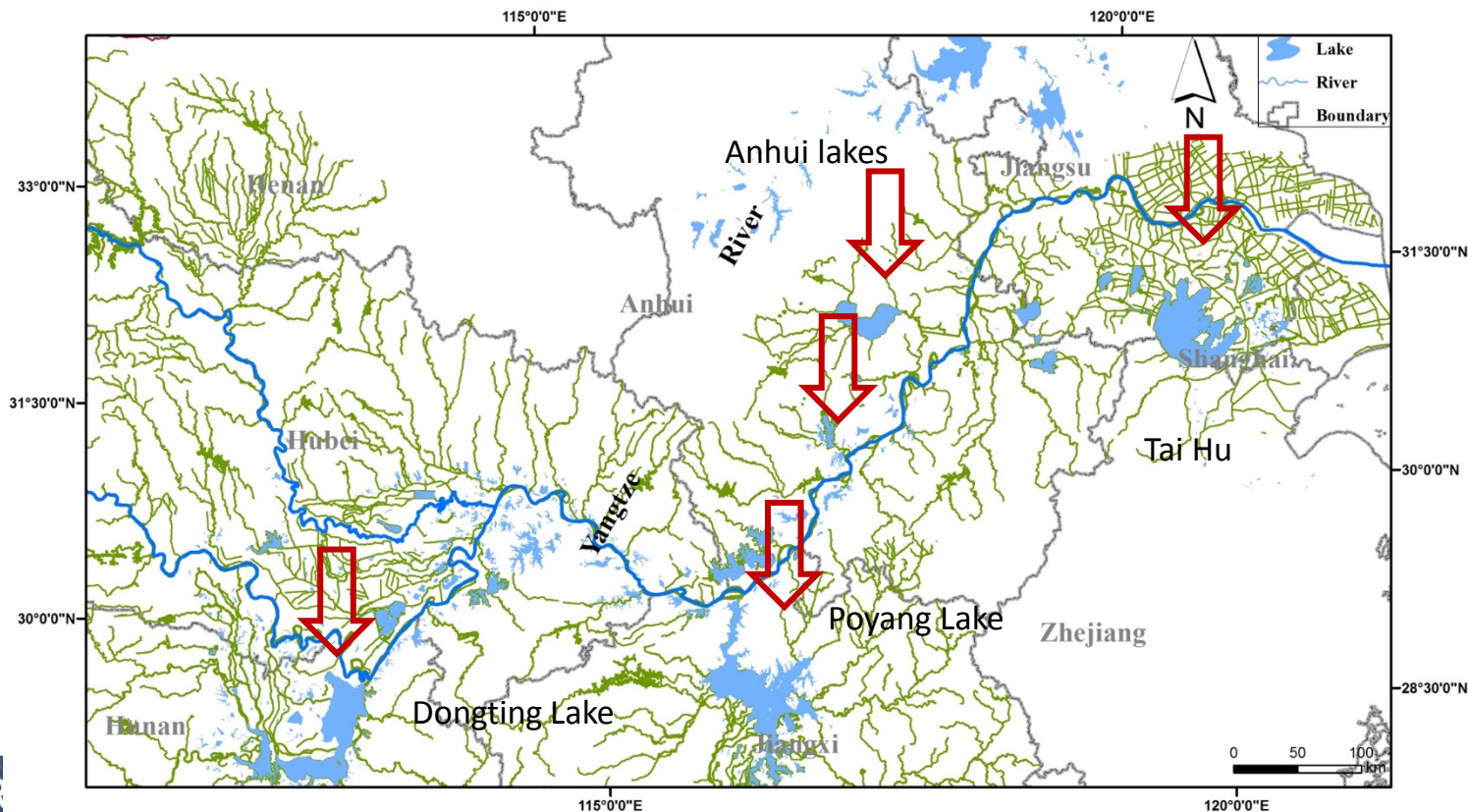
2017 DRAGON 4 SYMPOSIUM

26-30 June 2017 | Copenhagen, Denmark

2017年“龙计划”四期学术研讨会

2017年6月26-30日, 丹麦 哥本哈根

EOWAQYWET – Study areas





WaRYWeBio : Water resource behaviors in Yangtze intermediate basin and wetlands' biodiversity



Project researchers (in collaboration with BioGEOLakes)

- DLR – **Dr. Claudia KUENZER**, Juliane HUTH
- Jiangxi Normal University – **Pr Dr. WANG Yeqiao**, ZHANG Li, Pr Dr. FANG Chaoyang ..
- NIGLAS – Pr LAI Xijun
- CAS, State Key Laboratory of Urban and Regional Ecology – Pr Dr. CAO Lei
- Max Plant Institute – Pr Dr. Martin WIKELSKI, CHENG Yachang
- Wuhan University – Pr Dr. CHEN Xiaoling
- Beijing Normal University – Pr Dr. LI Jing
- RADI – Pr NIU Zhenguo, CHEN Yanfen
- ICube-SERTIT – Dr. Hervé YESOU, Claire HUBER, Mathias STUDER,
- ICube-TRIO – Dr Jerome COLIN, Dr F. NERRY
- LEGOS – Dr Jean François CRETAUX, Laurence FRUTEAU
- ICF – Dr Dorn MOORE, Dr LI Fengshan

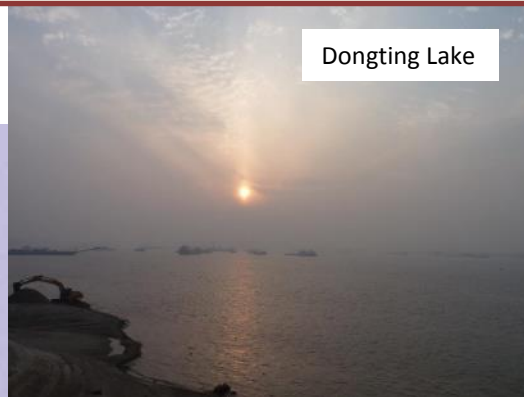
12 labs / institutes

WaRYWeBio – Workpackages

WP1: Water extent monitoring



Dongting Lake



WP2: Water height monitoring from space



Poyang Lake



Shengjin Lake



WP3: Wetland mapping and biodiversity values analysis



WP4 :Regional and global interactions



Processing of HR time series :

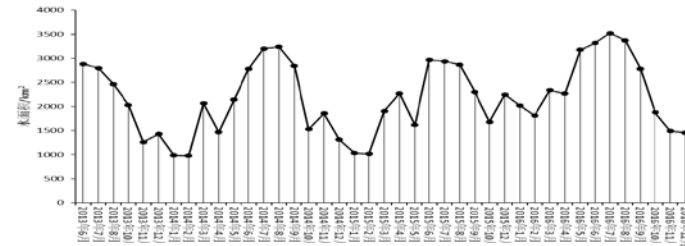
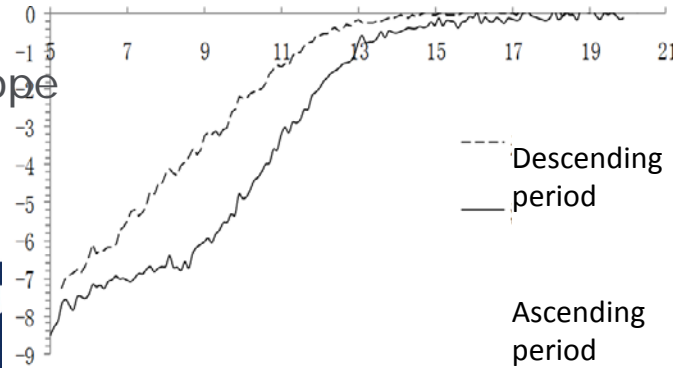
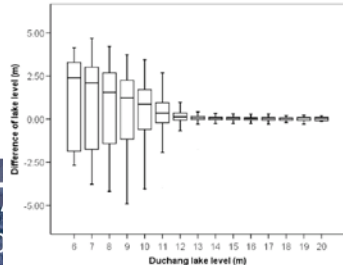
- Sentinel1
- Sentinel2
- GF 1
- + MODIS, LANDSAT

⇒ Technical improvement in term of processing

⇒ Water surfaces dynamics at different time scale and resolution

⇒ Wetlands vegetation's dynamics on a yearly/ten years basis

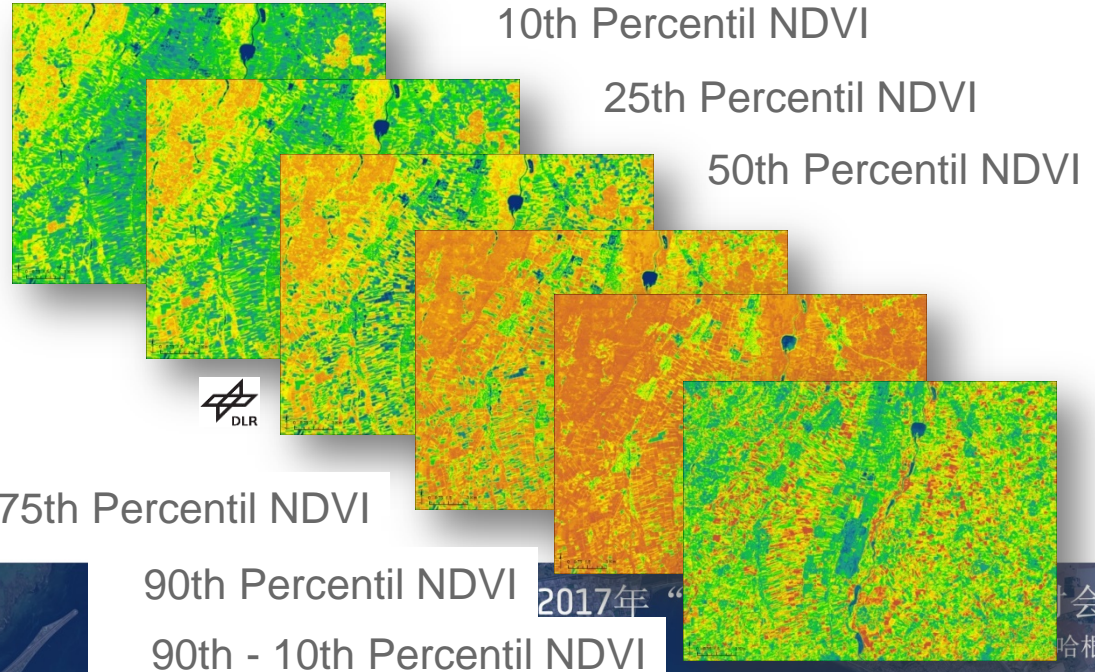
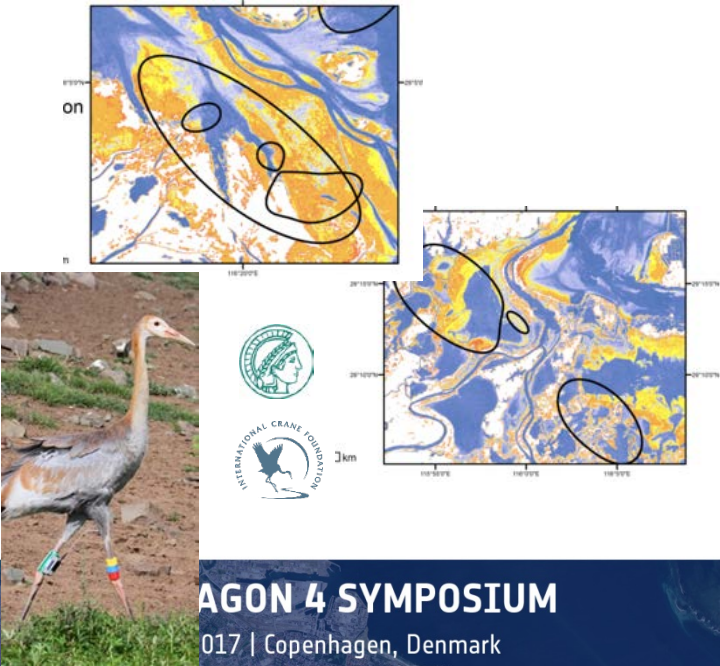
⇒ Analysis of lake slope



GF 1 2013-2016
Water extent dynamics

- ⇒ Inputs for indicators of landscape description
- ⇒ Analysis of cranes presence/ behaviors

Time series processing-Multi-temporal metrics



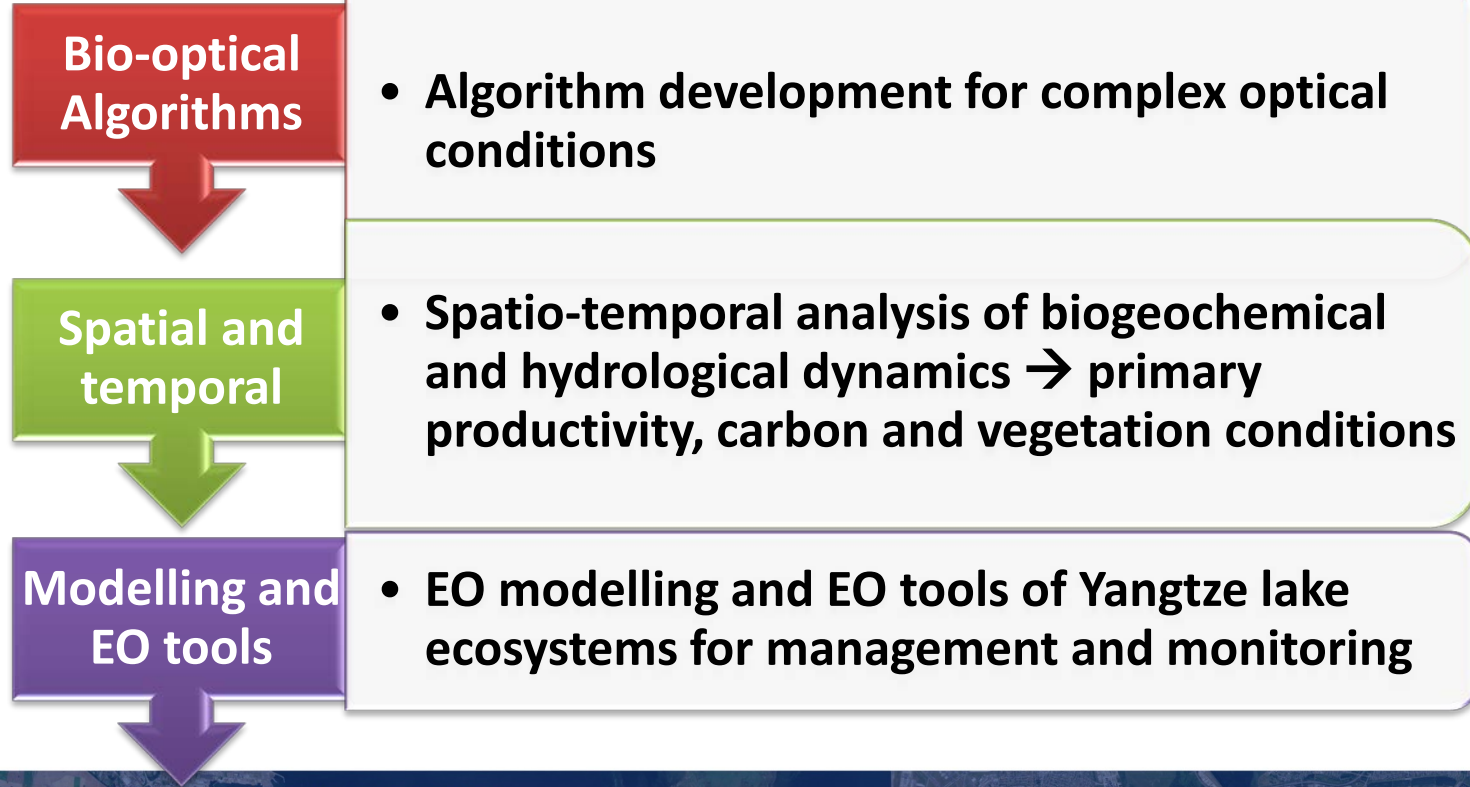
New Earth Observation tools for biogeochemical studies of Yangtze Valley lakes (BioGeoLakes)



Project researchers (in collaboration with WaRYWeBio)

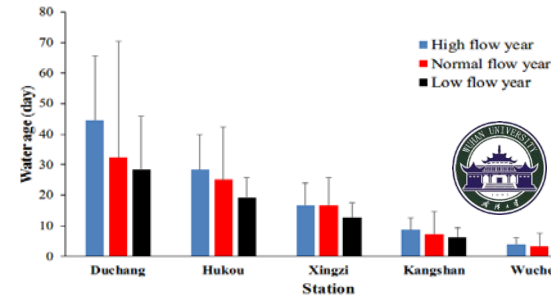
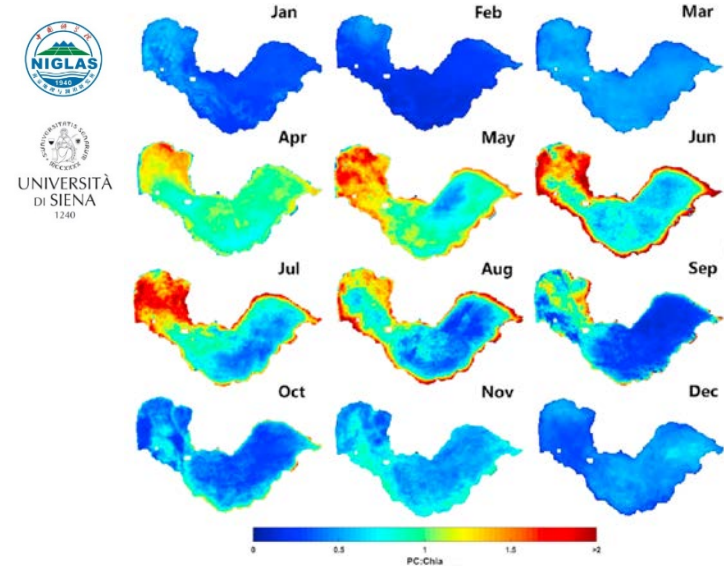
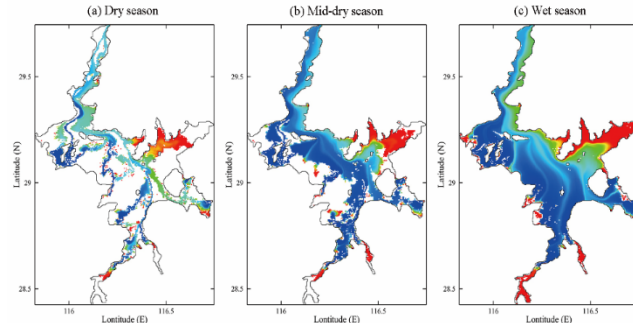
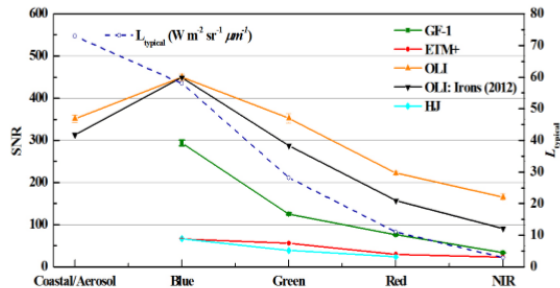
- NIGLAS– **Hongtao Duan**, Yuchao Zhang, Ronghua Ma, Juhua Luo
- Univ. Siena – **Steven Loiseau**, Claudio Rossi, Alessandro Donati
- Wuhan Univ. – Xiaoling Chen, Jianzhong Lu, Lian Feng, Jian Li, Liqiong Chen
- IREA-CNR – Paolo Villa, Mariano Bresciani
- Nanchang University - Haiming Qin
- DLR - Juliane Huth
- Jiangxi Normal University - Shuhua Qi, Li Zhang
- RADI - Junsheng Li

New Earth Observation tools for biogeochemical studies of Yangtze Valley lakes (BioGeoLakes)

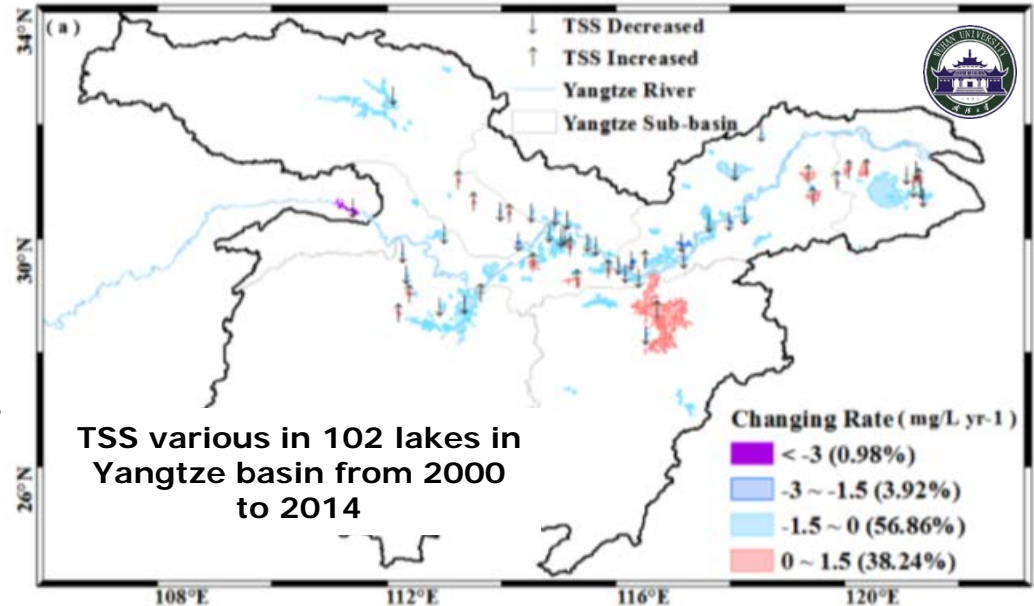
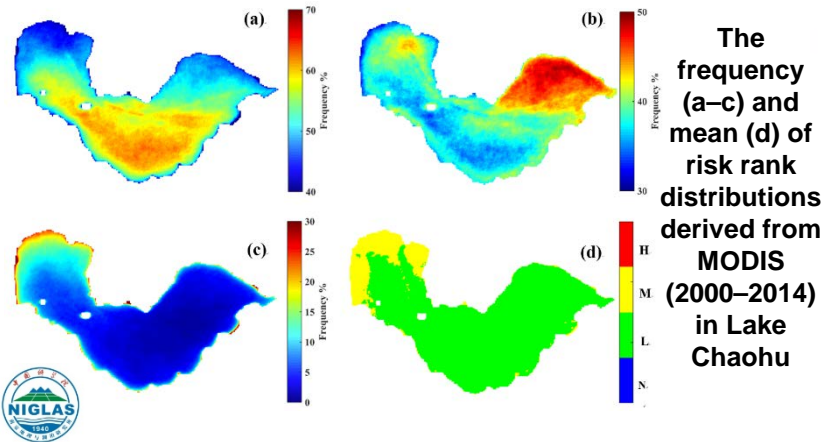


Algorithm development

- MODIS EOF-based Algorithms: Chla and PC
- Sentinel 2 Chla
- HJ and GF 1-2 series
- Age of water
- Instrument cross comparisons



- Analysis over few majors lakes (Poyang, Tai Hue, Chaohu, Honghze..)
- “global analysis” for TSS
- Risk analysis



In river-connected lakes such as Dongting Lake and the Three Gorges Reservoir TSS is decreasing
64.5% of the TSS in river non-connected lakes is decreasing.

ESA & ESA TPM DATA	Nos. scenes or inform if by FTP
ERS SAR	
ASAR	
MERIS	
AATSR	
SMOS	
CSK	
etc.Radarsat	12
TOTAL	

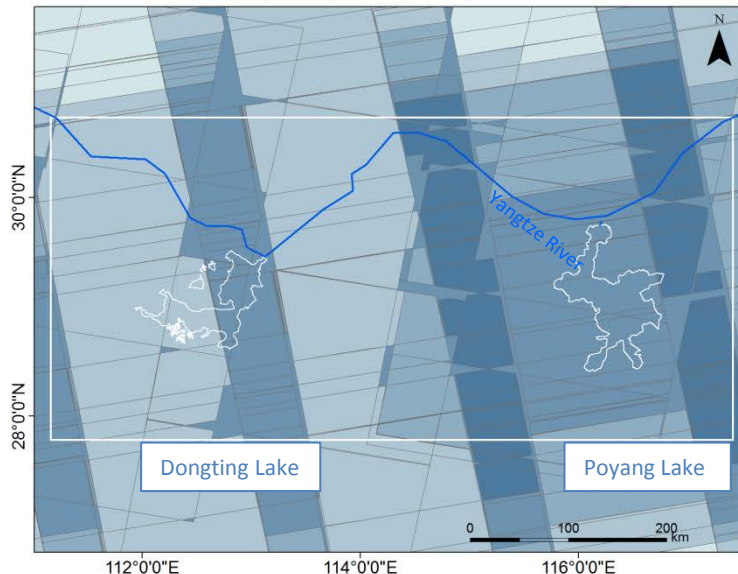
SENTINELS 1, 2 & 3 DATA	Nos. scenes
Sentinel 1-A/B SAR	300
Sentinel 2-A/B MSI	30
Sentinel 3-A OLCI	41
Sentinel 3-A SLSTR	22 L2 no yet available
Sentinel 3-A SLAR	No yet available
Etc.	
TOTAL	

CHINESE EO DATA	Nos. scenes
HJ-A/B	10
GF-1	126
GF-2	50
HY-A	
FY-1	
Etc.	
TOTAL	

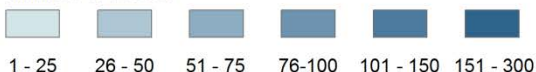
Sentinel 1/2 data availability

(acquisitions from beginning until 14.06.2017)

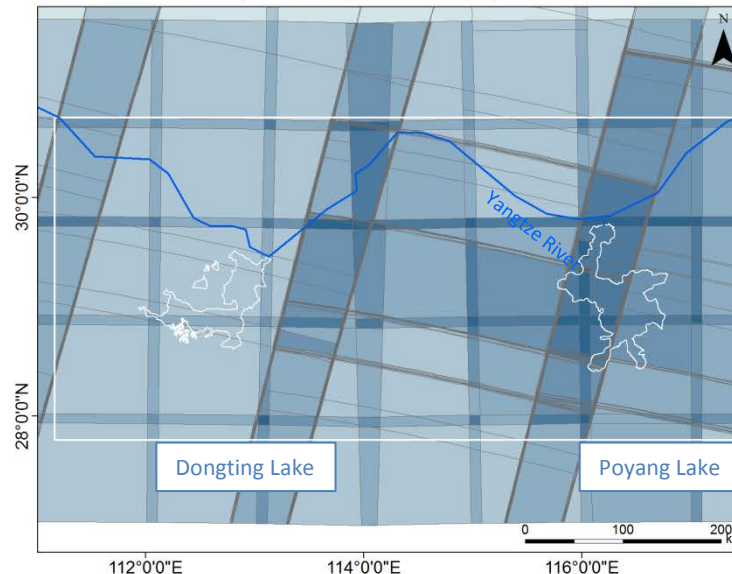
Sentinel-1A/B SAR-C, GRD, 818 Scenes, 1.2 TB data volume



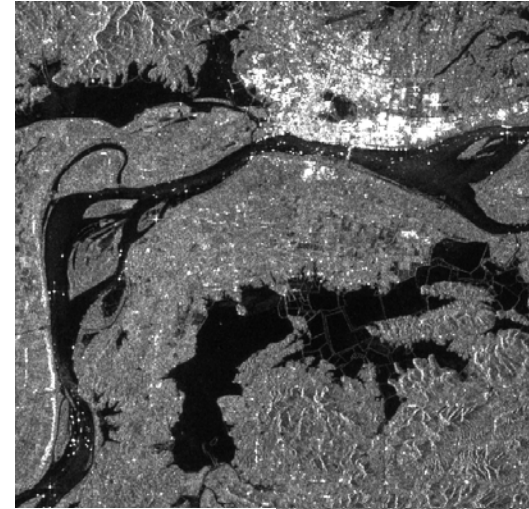
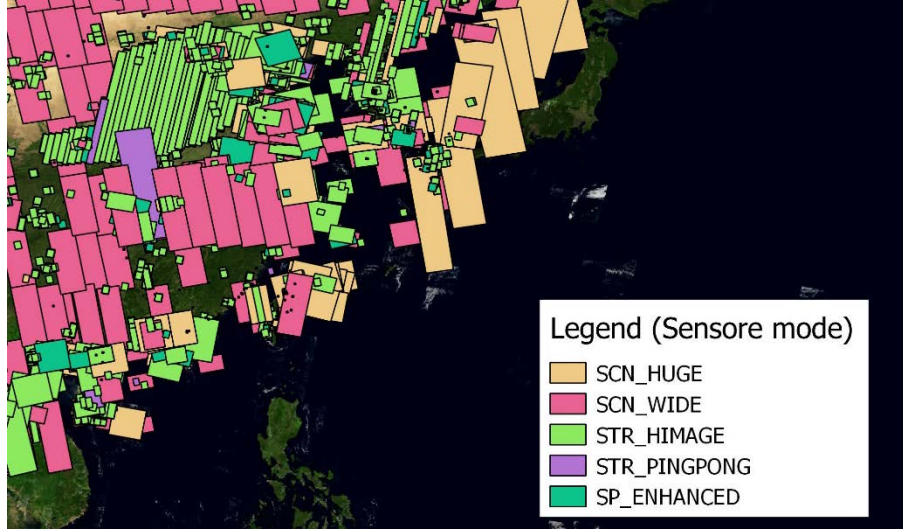
Number of scenes



Sentinel-2A/B MSI, Level 1C, 1318 Scenes, 1.3 TB data volume



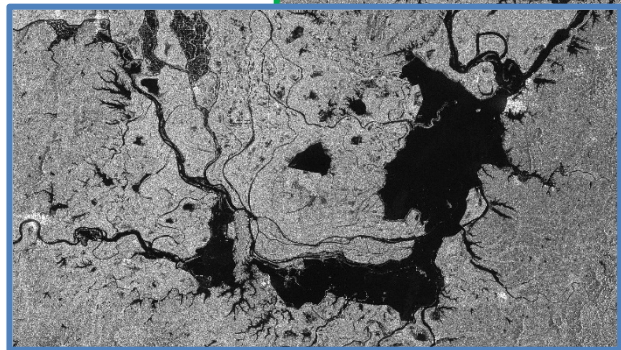
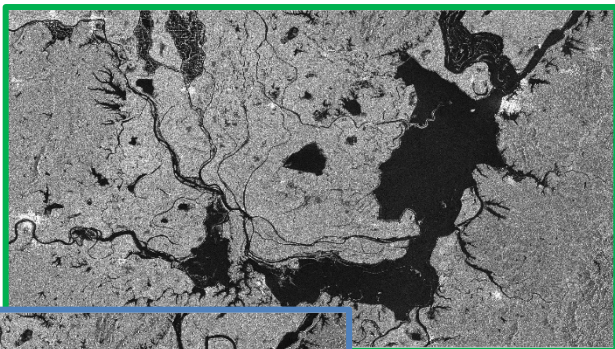
A certain default over Dongting lake in regards to the Poyang focus



Two areas targeted: historical+ new acquisitions

- Dongting (provide a better frequency of revisit)
- Anhui lakes (offering an higher resolution)

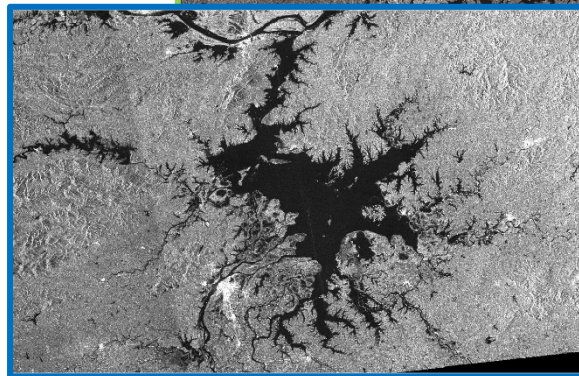
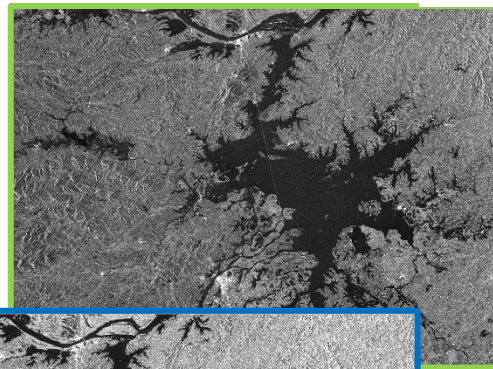
UM-SB Project Proposal id37253 (many thanks to Rafaele Rigoli to his strong support)



07-10
07-31
08-04
08-28
08-31



Dongting 1998: SCN, SCW, SGF



07-22
07-25
07-31
08-04
08-07
08-14
08-17
08-31

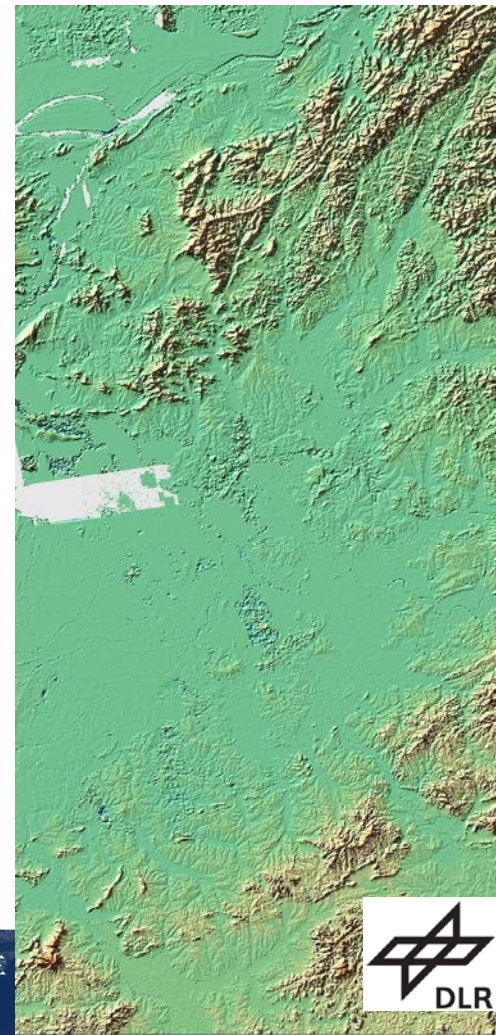
Poyang 1998: SGF, SCW,

- 30 m: credit 11 tiles, ordered : 4 tiles
- 12 m: credit de 16: 4 tiles

Thanks to DRAGON value



DEM_HYDR083 project
(many thanks Thomas Busche –DLR- to his strong support)



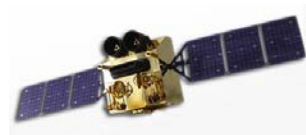


Launch July 2017:
30 months mission
10 m
12 spectral bands (VIS PIR eq S2)
Every two days
Level 1 and Level 2A Level 3



Chinese and European teams well understand the way to accessing HR time series of Sentinel1/2/3

Chinese teams well exploited the Chinese EO resources such as GF 1



European teams did not well understand the Chinese data access procedures
⇒ Help requested

⇒ Great interest on GF 3 full Pol data, great expect based on Pr LI Diren presentation ...

Does a specific channel for GF 3 data access will be set up for DRAGON 4 teams, European and Chinese ?

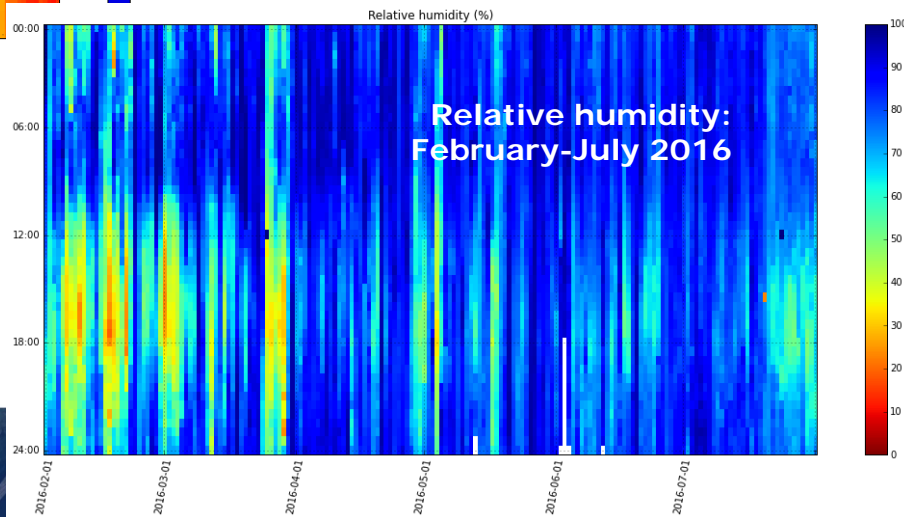
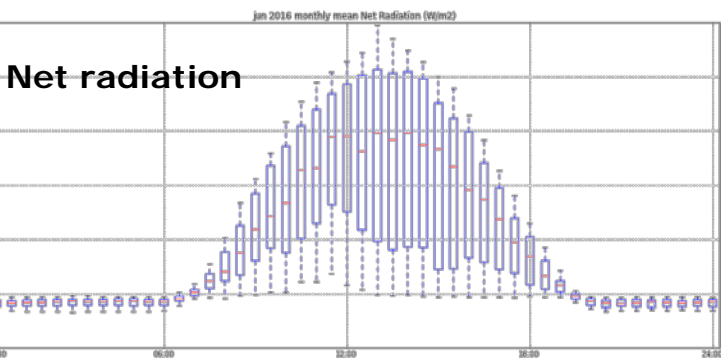
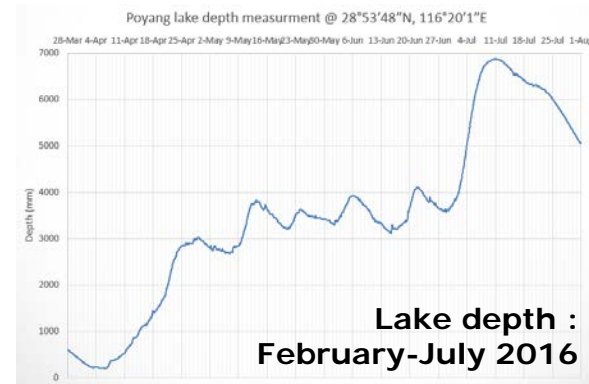
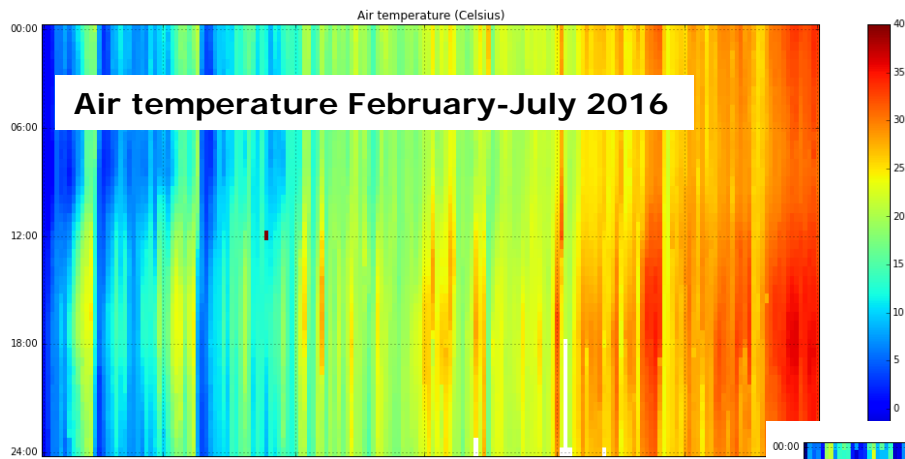
In situ Data exchange Poyang Flux measurement station

- Eddy covariance: CSAT-3
- H₂O analyzer, CO₂ analyzer : LI-7500A
- Photosynthetic active radiation sensor : LI-190SL
- Net radiation sensor: KIPP&Zonen CNR4
- Air temperature and humidity gauge: Vaisala HMP 155
- Rain gauge: TR-525USW
- Soil thermal flux sensor: Hukseflux HFP01
- Soil temperature sensor: LI-COR 7900-180
- Underground water level gauge: OnsetHOB0, U20-001-02
- Surface water level gauge: Decagon, CTD

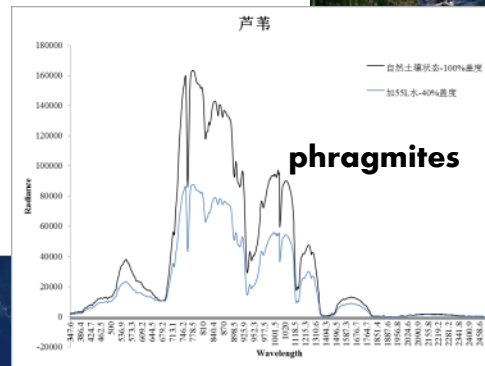
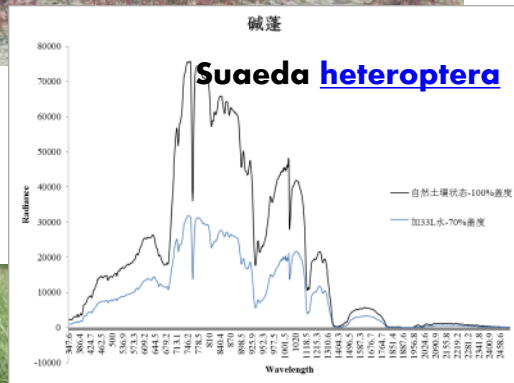


- Base altitude : 13 m .a.m.s.l.
- Eddy cor. sensors height : 17.5m





In situ Data Yancheng wetlands

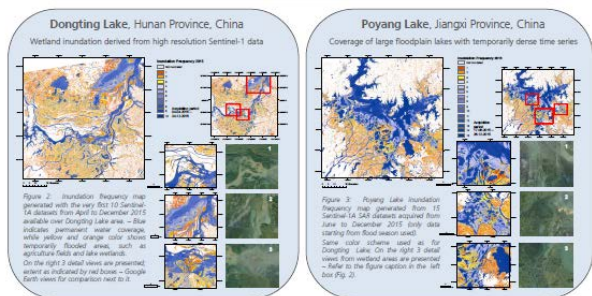
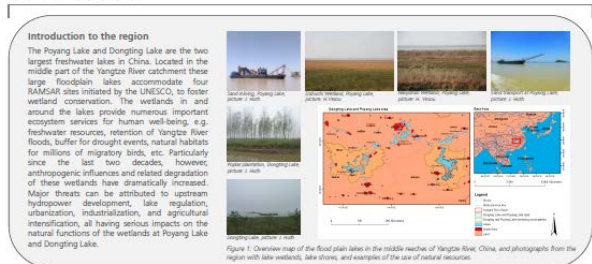


- Huth, Juliane, Wang Yeqiao, Cheng, Yachang, Clauss, Kersten, Yesou, Herve, Kuenzer, Claudia (2017) *The Potential of Sentinel-Data for the Observation of Wetland Dynamics in Poyang and Dongting Lake, China*. 37th International Symposium on the Remote Sensing of the Environment (ISRSE 37), May 8-12, 2017, Tzwane, South Africa. –
- Huth, Juliane and Kuenzer, Claudia (2016) *The Potential of Innovative Earth Observation Approaches to Assess Ecologic Dynamics in Wetlands and their Water Sheds*. Advanced International Forum on Ecological Security of Poyang Lake, Aug 27-30, 2016, Nanchang, China.
- Hervé Yésou, Claire Huber, Carlos Uribe, Sylviane Daillet, Henri Giraud, Mathias Studer, Sadri Haouet, Robin Faivre (2016) Sixteen years of over Poyang Lake monitoring exploiting satellite images applications to water resources analysis and biodiversity maintain. Advanced International Forum on Ecological Security of Poyang Lake, Aug 27-30, 2016, Nanchang, China.

The Potential of Sentinel-Data for the Observation of Wetland Dynamics in Poyang and Dongting Lake, China

J. Huth ¹, Y. Wang ², Y. Cheng ³, K. Clauss ⁴, H. Yesou ⁵, C. Kuenzer ¹

¹ German Aerospace Center (DLR), Earth Observation Center, German Remote Sensing Data Center (DFD), Land Surface Department, Oberpfaffenhofen, 82234 Weßling, Germany – ² Juliane.Huth@dlr.de; ³ Jüliang Normal University, Nanchang, China; ⁴ Max Planck Institute for Ornithology, Radolfzell, Germany; ⁵ Department of Remote Sensing, Institute of Geography and Geology, University of Würzburg; ⁶ ICube, University of Strasbourg, France.



Method
Sentinel-1 data were pre-processed using SNAP graph processing (incl. terrain correction). Detection of surface water coverage was conducted on single image basis using WATMOP (Water Mask Processor) – a watermark generation approach for earth observation-based surface water detection from radar remote sensing data developed at DLR-DFD. A combination of all derived watermaps resulted in maps which delineate water coverage depending on the frequency of water occurrence in the data.

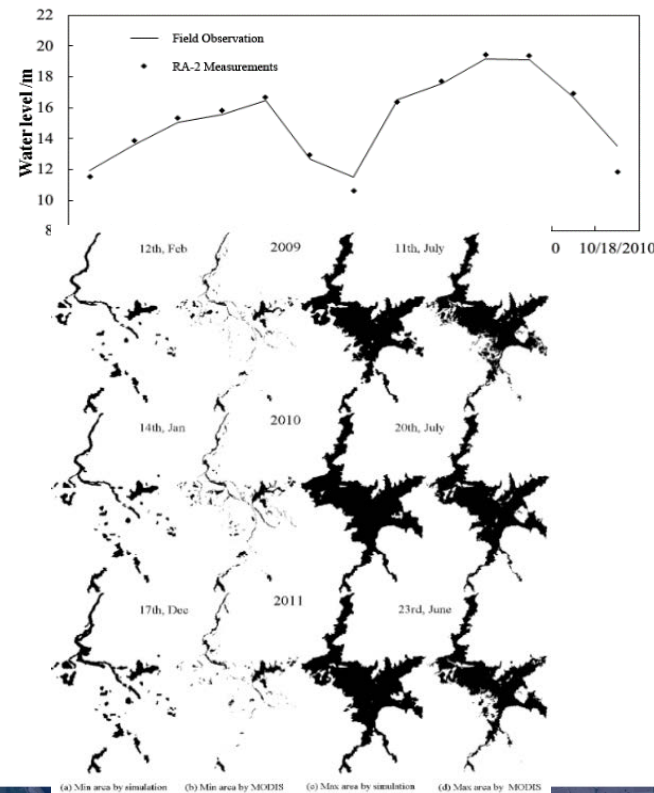
Conclusion and Outlook
Sentinel-1 SAR data proved to be highly suitable for detection of surface water dynamics, especially in cloud prone areas like Yangtze River flood plain. Future analyses of all available Sentinel-1 data will include the exploitation of the full potential for the identification of inter-annual (e.g. drought) and intra-annual phenomena – e.g. by comparing with meteorological and runoff data, the identification of specific land use patterns – e.g. irrigation, and towards monitoring of wetlands.

Deutsches Zentrum für Luft- und Raumfahrt (DLR)
German Aerospace Center
German Remote Sensing Data Center (DFD)
DLR Weßling
Germany

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www.dlr.de

Hengda Qi, Jianzhong Lu, Xiaoling Chen, Sabine Sauvage, José-Miguel Sánchez-Pérez, Water age prediction and its potential impacts on water quality using hydrodynamic model for Poyang Lake, China. *Environment Science and Pollution Research*, 2016, 23(13), 13327-13341

Jianzhong Lu, Xiaolin Cui, Xiaoling Chen, Sabine Sauvage, José-Miguel Sánchez-Pérez, Evaluation of hydrological response to climate variability using SWAT model: application to the Fuhe Basin of Poyang Lake watershed, China. *Hydrology Research*, Dec. 2016, nh2016115; DOI: 10.2166/nh.2016.115



Duan, HT, Tao, M., Loiselle S.A., Zhao W., Cao Z., Ma R., Tang X., MODIS observations of cyanobacterial risks in a eutrophic lake: implications for long-term safety evaluation in drinking-water source. *Water Research* doi.org/10.1016/j.watres.2017.06.022 (in print)

Liang, Q., Zhang, Y., Ma, R., Loiselle, S., Li, J. and Hu, M., **2017**. A MODIS-Based Novel Method to Distinguish Surface Cyanobacterial Scums and Aquatic Macrophytes in Lake Taihu. *Remote Sensing*, 9(2), p.133

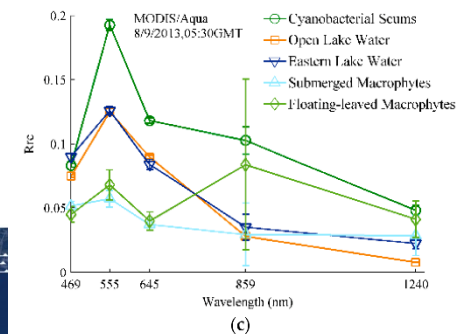
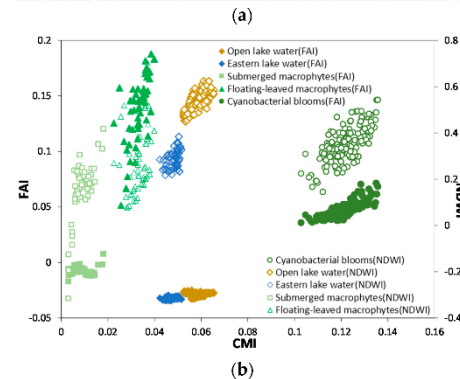
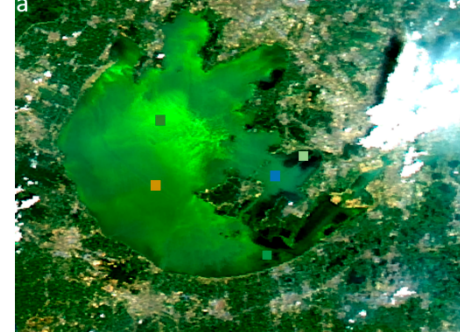
Zhang, Y., Ma, R., Duan, H., Loiselle, S., Zhang, M. and Xu, J., **2016**. A novel MODIS algorithm to estimate chlorophyll a concentration in eutrophic turbid lakes. *Ecological Indicators*, 69, pp.138-151.

Duan, H., Loiselle, S.A., Li, Z., Shen, Q., Du, Y. and Ma, R., **2016**. A new insight into black blooms: Synergies between optical and chemical factors. *Estuarine, Coastal and Shelf Science*, 175, pp.118-125.

Zhang, Y., Ma, R., Duan, H., Loiselle, S. and Xu, J., **2016**. Satellite analysis to identify changes and drivers of CyanoHABs dynamics in Lake Taihu. *Water Science and Technology: Water Supply*, p.ws2016074.

Li, J., Zhang, Y., Ma, R., Duan, H., Loiselle, S., Xue, K. and Liang, Q., **2016**. Satellite-Based Estimation of Column-Integrated Algal Biomass in Nonalgae Bloom Conditions: A Case Study of Lake Chaohu, China. *IEEE Journal of Sel Topics Applied Earth Observations and RemSen*.

Young scientists contributed to all of the above publications





Key events: WaRYWeBio August 2016



2017年“龙计划”四期学术研讨会

2017年6月26-30日, 丹麦 哥本哈根



江西师范大学
JIANGXI NORMAL UNIVERSITY

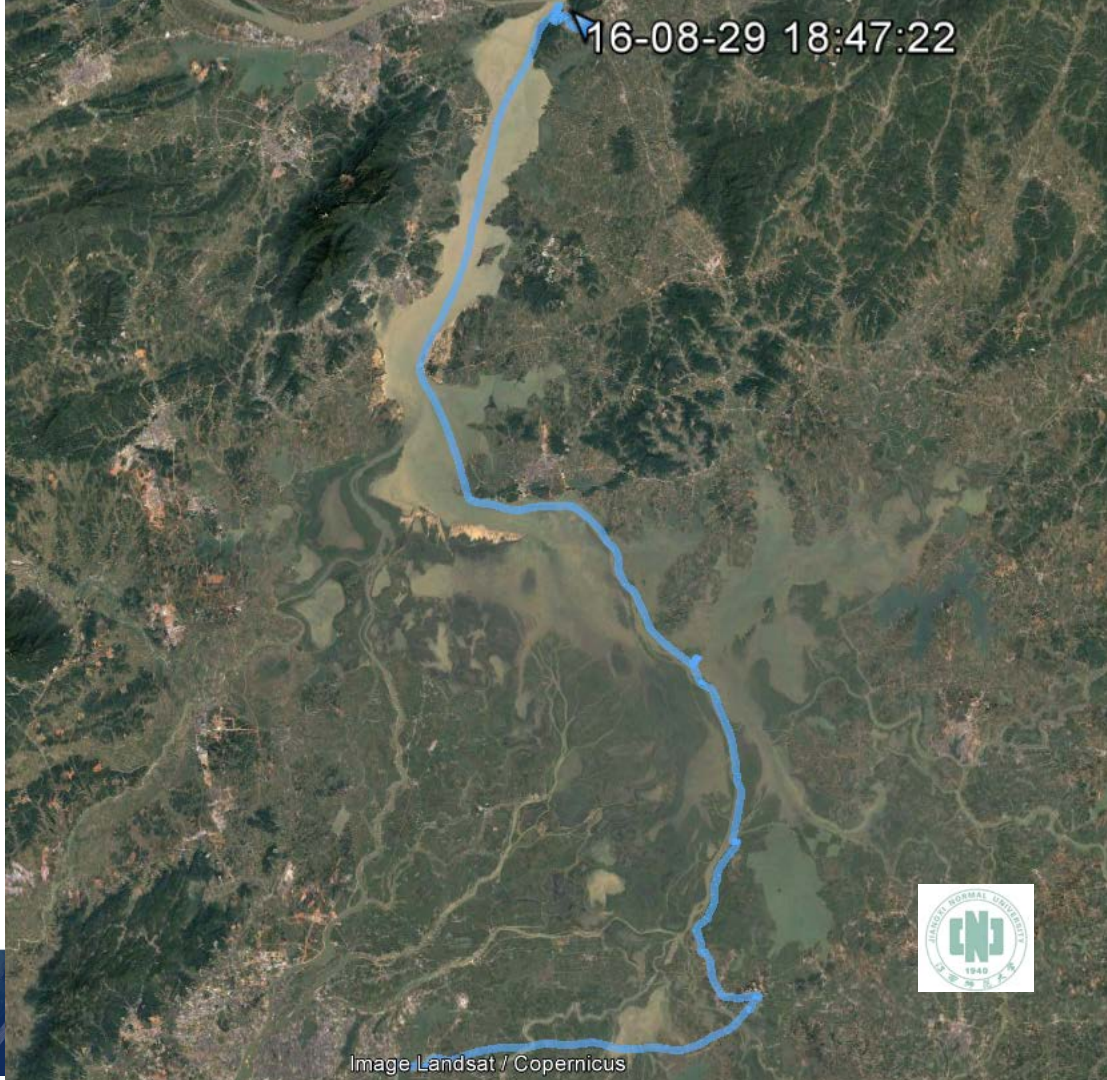


Advanced International Forum on Ecological
Security of Poyang Lake
(AIFESPYL2016)



2017 DRAGON 4 SYMPOSIUM

26-30 June 2017 | Copenhagen, Denmark



16-08-29 18:47:22



Image Landsat / Copernicus



Young scientists contribution linked to Dragon 4 – MSc and PhD involved in WaRYWeBio

- Cheng Yachang – MPI Ornithology, Radolfzell Germany
 - Finished Master thesis with the title: "Home Range and Habitat Selection of Wintering White-naped Crane *Grus vipio* Through GPS Telemetry in Poyang Lake, China."
 - Preliminary PhD topic – currently working on at MPIO and supervised by Prof. M. Wikelski – is related to „Movement Ecology of Waterbirds“.



Zhang Li ESA-ESRIN: international research fellow, 09/2015-09/2016

- Map wetland changes over the Poyang lake region by using time-series ASAR and Sentinel data.

5 Master students

4 PhD candidates

+ 4 Vice-professors /Post Doctors



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2017年“龙计划”四期学术研讨会

2017年6月26-30日, 丹麦 哥本哈根

Young scientists contribution linked to Dragon 4 – MSc and PhD involved within **BioGeoLakes**

- Zhigang Cao, Min Shen, Tianchi Qi at NIGLAS
- Two graduates students in RADI
- Chen Liqiong ESA-ESRIN: international research fellow, 03/2017-03/2018



- ✓ Analysis the relationship between algal bloom and water temperatures in inland lakes by using Sentinel 2 and 3 data.

- Chinese Visiting Scientists at DLR since summer 2016

- Dr. DU Xiaoping – topic: focus on wetlands in coastal China – CSC stipend from Sep. 2016 – Feb 2018 – home institution RADI, Beijing
- Dr. XU Di – topic: wetland monitoring in Asia – University stipend from Oct. 2016–May2017 – home institution Shanghai University



- Discussion ICUBE SERTIT and Jiangxi Normal Univ, on Post Doc, 2018-2019



- BioGeoLakes Exchanges:

number of studies initiated last year including a citizen science project in the Huangpu area, and studies on lakes Taihu and Chaohu.

1. Data Processing and Analyses – according to proposal tasks
 - Water surface monitoring for Dongting and Poyang Lake (Sentinel data) Anhui lakes (CSK)
 - Land cover (e.g. 2000 and 2016) and wetland extraction – assessment of change
 - Biodiversity – Assessment of EO potential to support habitat monitoring of birds (migratory ie cranes, geese, ducks or/and domestic)
2. In situ data collecting
3. Modelling evaporation of Poyang lake (water cycle closing)

- ✓ Continue to explore the use of Sentinel 2 and 3 for Chla, SSM etc..
- ✓ Coupling RS and hydrodynamic simulation and data assimilation
- ✓ Get a better understanding of water quality variation in Poyang Lake using Higher spatial resolution imageries
- ✓ Make a whole map of water quality in Yangtze river lakes
- ✓ More scientific visits and in deep cooperation.
- ✓ Exploring funding sources to increase collaboration and exchange
- ✓ Propose new approaches and critical areas of study