
ID° 10577

Pr HUANG Shifeng, Dr H. YESOU
Project's goals:

On the basis of the former successful flood DRAGON 1+2 projects
Four topics having water resource and behaviors monitoring as the corner stone,
1- Large and small water bodies monitoring, in terms of water extent, height & quality, on a long term analysis (more than 15 years..)
2- Wetland ecosystem understanding,
3- Focus on some water impact on public health: Epidemiology,
4- Regional interaction and global context

Long term analysis, scaling approach for a better understanding of wetland and water resource behaviors
WP reporting at DRAGON 3 symposium

WP0: Management
WP1: Water extent monitoring
WP2: Water height monitoring from space
WP3: Water quality monitoring and soil erosion
WP4: NRT actions for disaster mapping
WP5: Wetland mapping and biodiversity values analysis
WP6: EO data and Epidemiology
WP7: Regional and global interactions

H. Yésou, L. Cao, J. Burnham, S. Daillet, X. Chen, C. Huber, X. Lai, M. Studer, X. Han, Q. Jia and S. Huang
WP0: Management: partnership: Welcome new members

Pr. WANG Yeqiao Key Laboratory of Poyang Lake Wetland and Watershed Research, Jiangxi Normal University (JXNU), Ministry of Education (KLPYL)

Dr. Qi Shuhua, KL-PLWWR, JXNU, P.R. China Jiangxi Provincial Key Laboratory of Poyang Lake Comprehensive Management and Resources Exploitation, Jiangxi Normal University (JXNU)
Dragon 3 10577 test sites: focus on Yangtze watershed

DRAGON III - Biodiversity

Anhui Lakes
Poyang Lake
Napahai
WP0: Management: Data access: a crucial issue

Feasibility of Poyang monitoring based on Sentinel 1
Enlargement at Yangtze watershed

Great support from ASI, two acquisition by month over Poyang and Shenjiang

Great support from DLR: multi resolution data over Poyang lake

Access to HJ1A/B thanks to Pr CHEN Xiaoling and PhD student HAN Xinxing

New Take five Experiment: April September 2015
WP0: Management : Data access

Request to a secured resource allowing to monitoring large areas with a reduced revisiting time (10 – 15 days)

Moving from MR to HR
⇒ SPOT 4&5  TakeFive, HJ1A, preparing Sentinel 2 venue
⇒ Archive TerraSAR, New modes TerraSAR TandemX
⇒ Cosmo Skymed from ASI (supporting Envisat Gap)
⇒ Sentinel 1
Sentinel 1: High temporal revisit T0, +5, +7
7 stripes acquired from 04-04-2015 to 25-04-2015 but few appear to be missing on S1 Data Hub (11/05/15)
First Sentinel1 mosaic over Yangtze intermediate watershed

7 stripes 04-04-2015 to 25-04-2015
Poyang lake CSK time series
January to December 2014
Muti resolution approach exploiting TerraSAR New modes

Wide Scan SAR 200*200 km², 30 m
Strip Map mode : 30*50 km², 3m
SpotLight mode : 5*10 km², 1m
Staring SpotLight : 3*4 km², 25 cm
April-September: every 5 days

10 meters
First data on Theia Web server yesterday
Netx step: Sentinel 2 observation over Yantgze middle watershed.

One cycle of acquisition:
Red: Day 3,
Green: Day 6,
Blue: Day 7,
Yellow: Day 10.
WP1 Water extent monitoring: Poyang

Time series of water surfaces
Example with Sentinel-1a
Analysis of temporal variations of water surfaces from 2000 to 2014. Our core information is 15 years of surface extents with a high frequency scoring (10 days in average)
Water extent monitoring: Submersion time: residual analysis

Ten years averaged of time of submersion

Given year: 2014

Yearly Residual analysis
Water extent monitoring: Submersion time: residual analysis
WP1 Water extent monitoring: Poyang

<table>
<thead>
<tr>
<th>Date CSK</th>
<th>Surface en km²</th>
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<tbody>
<tr>
<td>19/10/2013</td>
<td>121.88</td>
</tr>
<tr>
<td>20/11/2013</td>
<td>98.14</td>
</tr>
<tr>
<td>22/12/2013</td>
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<tr>
<td>24/02/2014</td>
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<td>28/03/2014</td>
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</table>
WP1 Water extent monitoring: Poyang
WP 2: Water height monitoring from space

Exploitation of ENVISAT archive over Lakes and Yangtze River

First view of data along Yangtze River
4 virtual gauge stations
6 additional lakes

Exploitation of Altika data over Yangtze connected Lakes and Yangtze River, same tracks as Envisat

Sylviane Daillet Rochette, LEGOS, Toulouse, FR
WP 2: Water height monitoring from space

RA Envisat and Altika over Poyang lake

![Graph showing water height monitoring from space with dates and satellite names]
WP 2: Water height monitoring from space

First exploitation of Altika over Anhui lakes
A Practical Suspended sediment model in Poyang Lake using MERIS

Pr CHEN Xiaoling and PhD student HAN Xinxing
When TSS increased from 3 to 500 mg l\(^{-1}\), \(R_{N,rs}\) increased monotonically between 550 and 600 nm and decreased monotonically between 650 and 850 nm. Thus, the \(R_{N,rs}\) difference between the two spectral regions should be sensitive to TSS changes.

\[
NSSI = \left( \frac{R_{rs,560} - R_{rs,NIR}}{R_{rs,560} + R_{rs,NIR}} \right)
\]

\[
TSS = a \times e^{-b(NSSI)}
\]
When we applied those NSSI algorithms to the MERIS image, the NSSI derived with MERIS band 5 and band 11 showed the best performance than the other algorithms.

The NSSI algorithm with MERIS band 5 (560 nm) and band11 (760 nm) is recommended for TSS retrieval in Poyang Lake in this study, which can be expressed as:

\[
\text{NSSI} = \left( \frac{R_{rs,560} - R_{rs,760}}{R_{rs,560} + R_{rs,760}} \right)
\]

\[
\text{TSS} = 171.79 \times e^{-4.608 \times \text{NSSI}}
\]
High TSS was observed in the Northern part of the Poyang Lake, which is consistent with the previous MODIS observations, indicating that our NSSI algorithm is appropriate for TSS estimation in Poyang Lake.
**WP5: Wetland mapping and biodiversity values analysis**

**Background**

- Biodiversity has been threatened greatly in lakes along Yangtze River in recent years (J.Y., Fang, etc. 2006)
  - Dolphin (X. Zhang, etc. 2003)
  - Waterbirds (L. Cao, etc. 2010)
  - Fish (D.Q. Chen, etc. 2009)

- Most threats are closely related to human activities, such as:
  - Water conservancy construction (dams, levees or sluices...)
  - Pollution (domestic & industrial waste water...)
  - Fishery (aquaculture, natural fishing...)
  - Eutrophication
  - Poach
WP5: Wetland mapping and biodiversity values analysis

Field trips

Liu Yizhen, QUIN Haiming, Nanchang University

October 2014

Pr LAI Xijun, NIGLAS, Dr DAILLET, LEGOS, H. YESOU, UdS
WP5: Wetland mapping and biodiversity values analysis

Land use practices changes and biodiversity: case of the Napahai wetlands (NW Yunnan Pr)

High mountain valley wetland system with over 30 species of wetland birds
Black-necked Cranes

Currently a major ‘eco-tourism’ destination in SW China known for it’s natural and cultural attractions for national and international travelers.

James Burnham,
ICF, Wisconsin Univ.
Chi-squared goodness of fit show Black-necked Cranes disproportionately use:
- Shallow water
- Deep water
- Wetland vegetation
- Grasslands

Using post-classification rules, we combined disproportionately used classes into “habitat” and disproportionately avoided classes into “non-habitat” for 5 time steps using Landsat TMM as it was the only archive that went back far enough (1990).

We then looked at habitat loss and gain between each step and over the entire time period.
Analysis over a 20 years period

Habitat (Blue)
Non-habitat (Yellow)
Habitat loss (Pink)
Habitat gain (Green)
Napahai: all five time steps
  White = permanent Non-Habitat
  Dark Grey = permanent Habitat
  Brighter areas have more persistent Non-Habitat
  Darker areas have more persistent Habitat

Some permanent changes reflected in the habitat area:
  Construction of impoundment structures (+ Habitat)
  Expansion of impervious surfaces (− Habitat)
Preliminary conclusion over Napahai:

1) No massive loss of habitat, but lots of variability between years, most changes occur between classes within Habitat/Non-Habitat designations (e.g., agriculture to impervious)

2) Area of high variability may actually benefit cranes, as it may ensure that a productive, heterogeneous patchwork of land-cover types persist across the landscape through time

3) Not all change is equal: stabilization of the system could alter habitat/non-habitat dynamics and reduce the utility to wintering cranes.

James BurnHam
WP5: Wetland mapping and biodiversity values analysis

Poyang Lake wetland changes — Landsat observations — Over 40 years

Pr CHEN Xiaoling and PhD student HAN Xinxing
Difficult to Document the long-term changes of different wetland features using Remote Sensing

Poyang Lake Wetland
- The emerged lake bottom in the low-water stages serves as the habitat for most of the Siberian migrating cranes and the oriental storks.
- Regions covered by Carex cinerascens provide unique spawning bed sand feeding grounds for local fish.

Traditional method for wetland mapping is difficult
- Field surveys or gauge stations, are limited by either spatial or temporal coverage.
- Wetland cover types are heterogeneous across space and time.
- Sometimes vast system dimensions and the risk of infectious diseases.

Remote Sensing is a good tool
Challenge 1: Rapid inundation changes make it difficult to conduct effective field observations in Poyang Lake.

Solution: Google Earth™ was used as ground-truth for and cover classifications. More than 4000 random points were generated within the over-lapped region between the Quickbird and Landsat OLI images.
Challenge 2: Impossible to obtain concurrent reference data for images acquired several decades ago (i.e., the MSS data).

Solution: An empirical line method was introduced to adjust the differences between the atmospherically corrected surface reflectance of OLI and the other instrument (eg. MSS, TM and ETM+).
Long-term Winter Wetland Changes in Poyang Lake

From the boundary to the center of Poyang Lake, the wetlands change from vegetation to mudflat and again to water body.

Relatively large water body was changed into mudflat.

Wetland vegetation shows significant variability, with generally larger areas observed after 2002.
The inundation area rapidly decreased after 2002.

The sand areas were remained at a low level after 1984.

The wetland vegetation showed a trend spreading to the lake center (especially after 2002).
1973-1995

A large area of sand was transformed into vegetation (195.0 km\(^2\)) and mudflat (239.71 km\(^2\)) near the lake center.

Mudflat (169.2 km\(^2\)) was transitioned into wetland vegetation in the PLNNR.

1995-2013

A large area of wetland vegetation was transformed into mudflat in the center lake regions.

In the south area of Poyang Lake, the wetland changes were characterized by a transition from vegetation to mudflat.
The growth of wetland vegetation was driven by air temperature.

The sediment input of the tributaries, precipitation and water level have no significant correlation with the wetland area.

Further studies on the impact of the impounding Three-Gorges Dam (TGD).
WP7: Regional and global interactions

Analysing water resource variations and trends:

Scaling effects from regional meteorological effects, water management practice versus global meteo (Nino/Nina, Global warming)

Great interest of the Scientific community, within DRAGON wetland flood and of course others, exploiting DRAGON derived products within the DRAGON project:
Publications

International Journal of Remote Sensing

MERIS observations of chlorophyll-a dynamics in Erhai Lake between 2003 and 2009

Yingjie Han, Lian Feng, Xiaolong Chen & Herve Yesou

Published online: 04 Dec 2014.

Hydrology and Earth System Sciences

Variational assimilation of remotely sensed flood extents using a 2-D model

X. Lai, Y. Liang, H. Yesou & N. Dalcher

Accepted: 1 November 2014 – Published: 23 November 2014

Journal of Hydrology

Floods for lake decline in China

Claire Huber, Herve Yesou, Qun Huang & Jiahu Jiang

Published online: 05 September 2014 – Accepted: 05 September 2014

Journal of Applied Remote Sensing

Modification and validation of a quasi-analytical algorithm for inherent optical properties in the turbid waters of Poyang Lake, China

Jue Huang, Liping Chen, Xiaoling Chen, Lijiao Tian, Lian Feng & Herve Yesou

Contents lists available at ScienceDirect

Remote Sensing of Environment

Observations of winter wetland changes in Poyang Lake based on Landsat
Scheduled work for 4th year

WP0 Management: Preparation of DRAGON IV proposal

Data access

- Sentinel1 new monitoring scheme
- Integration of Sentinel2 (1rst data in 2015 Q4)
- Exploitation of Take 5 2015 data

From bilateral agreement with DLR

- CSk exploitation
- TerraSAR multimodes exploitation
Scheduled work for 4th year

WP1 Water extent
- Re Integrate of Sentinel 1 May 2015-may 2016
- Integration via automatisation processing of S1 and S2

WP2: Water Height
- Combine water extent and height derived from space to generate water volume variations

WP6 Regional and global interactions
- Associated the efforts from members to exploited synergistically a large set of indicators, water extent, water budget, evapotranspiration for as longer as possible times series, continue to analyze rainfall via TRMM at Yangtze and Poyang Watershed scales.
Thank for your attention

Credits: James Burnham