



ESA - MOST Dragon 2 Programme

## 2011 DRAGON 2 SYMPOSIUM



中国科技部-欧洲空间局合作“龙计划”二期

“龙计划”二期2011年学术研讨会

# 2010 a milestone year for rapid mapping and water body monitoring activities within the Flood wetland project – ID 5264

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SERTIT, University of Strasbourg, France  
IWHR, Ministry Water Resource, Beijing, China  
LEGOS/CNES Toulouse, France  
LIESMARS, University of WUHAN, China  
ICF, International Crane Foundation  
NIGLAS, Nanjing, China



## Context: Yangtze river's monsoons lakes monitoring



Health of Yangtze is a major concern for 400 000 000 of inhabitants as a fresh water resource.

- The river basin gives
  - 70% rice production
  - 40% cereal production
  - 40% industry
- Biodiversity stakes

**Additional facts: Climate fluctuation and man activities (ie Three Gorges dam) could have significant impact.**

# Wetland Flood DRAGON project Workpackages

**WP0: Management**

**WP1: Water extent monitoring**

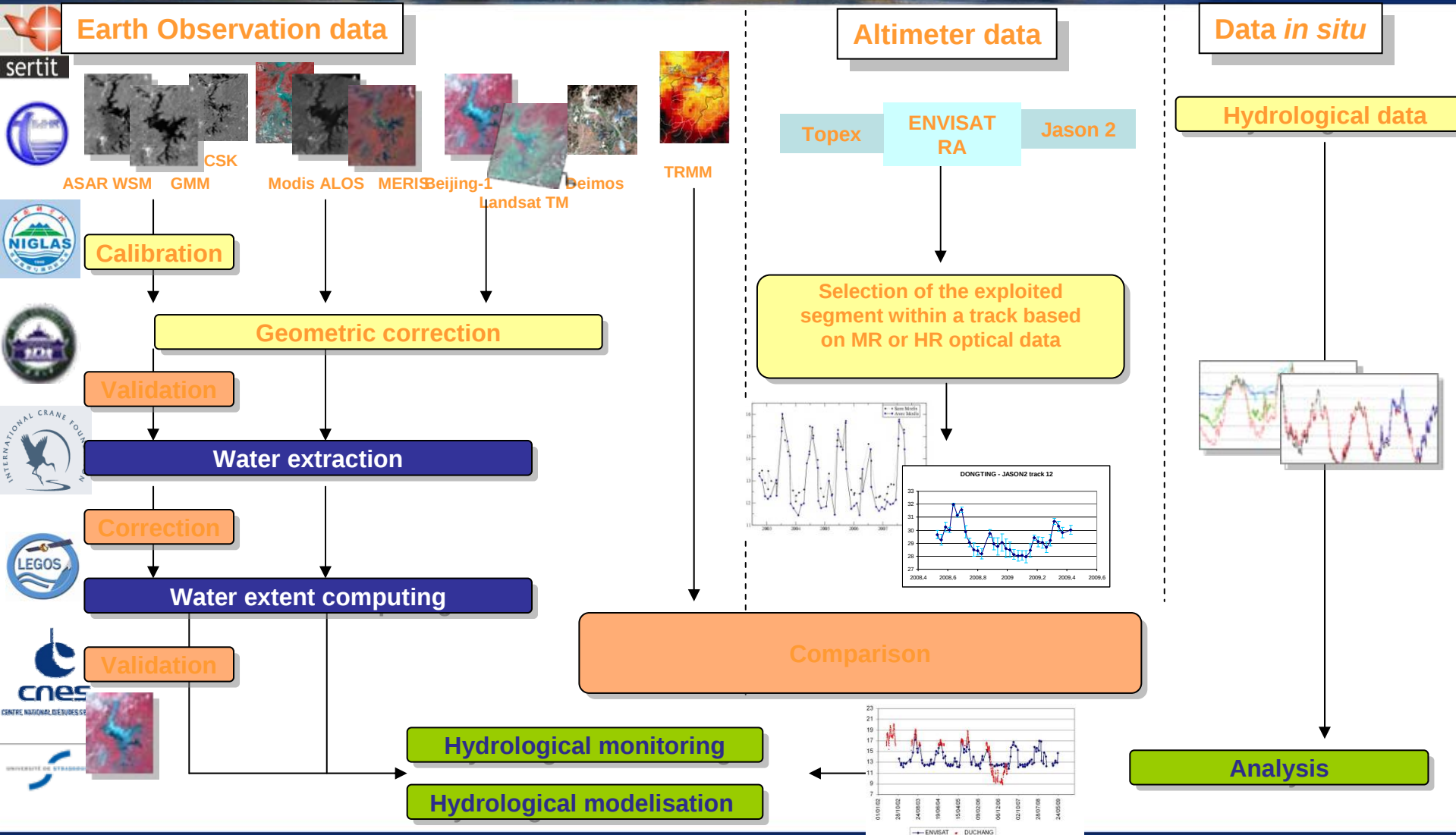
**WP2: Water height monitoring from space**

**WP3: Water quality monitoring and soil erosion**

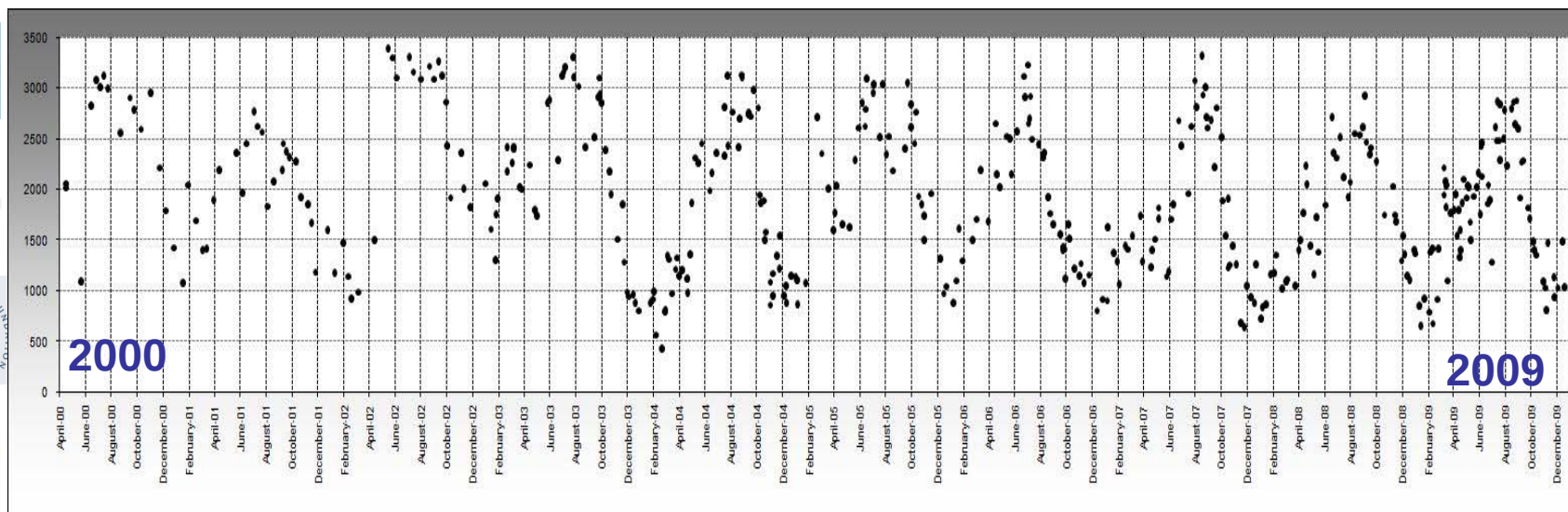
**WP4: NRT actions for disaster mapping**

**WP5: Wetland mapping and biodiversity values analysis**

**WP6: EO data and Epidemiology (Schistosomiasis + Bird Flue)**

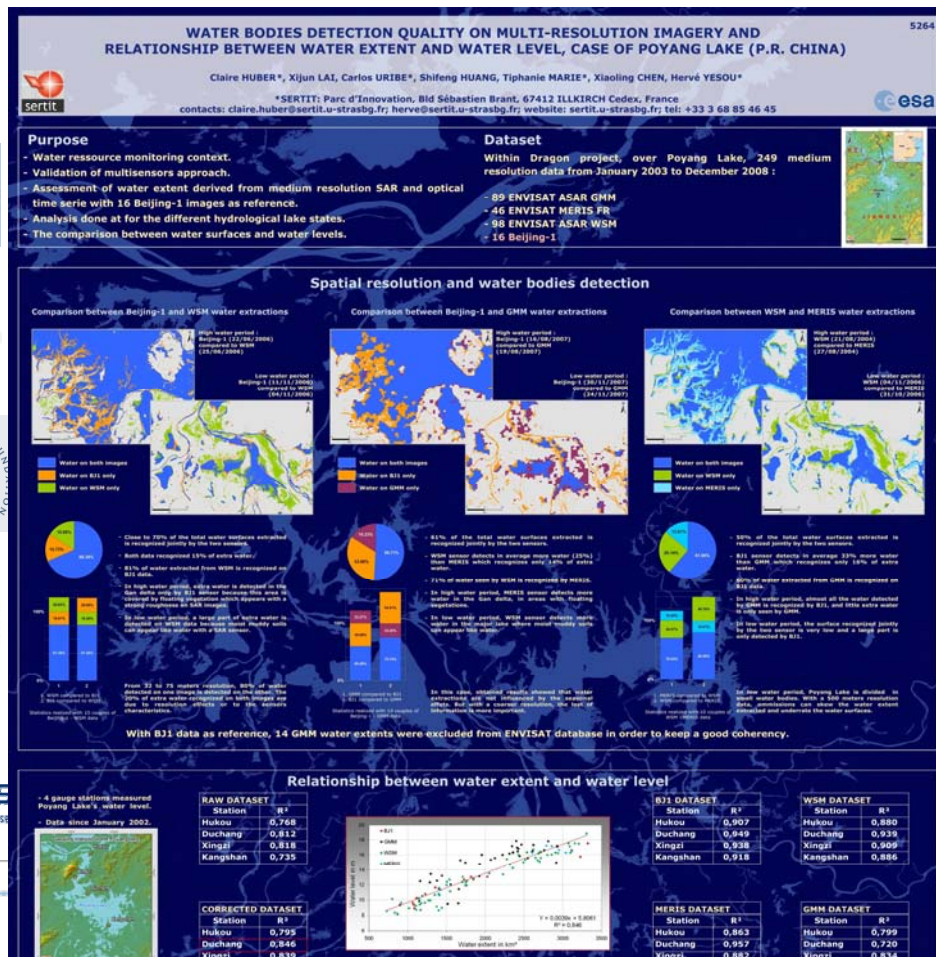


# WP1 Hydrological monitoring based on Earth observation data: global Poyang lake



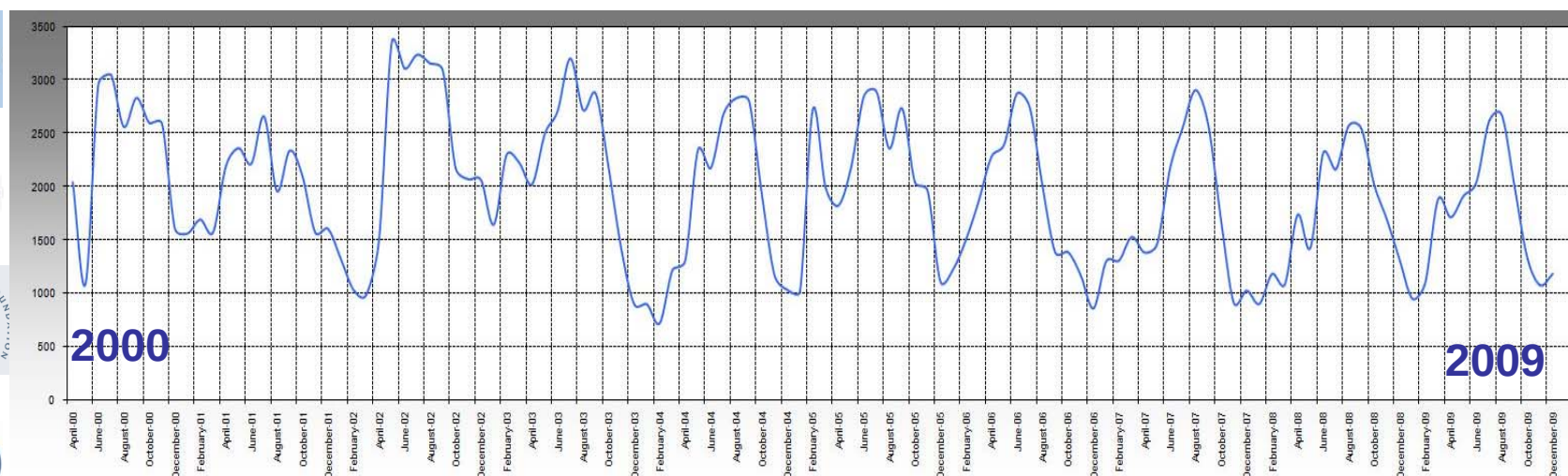
MR data=> synoptic view of the lake = water extent of entire lake  
Validation by HR times series (16 Beijing 1 and 7 Landsat TM)

# WP1: Water surface monitoring – Validation stage



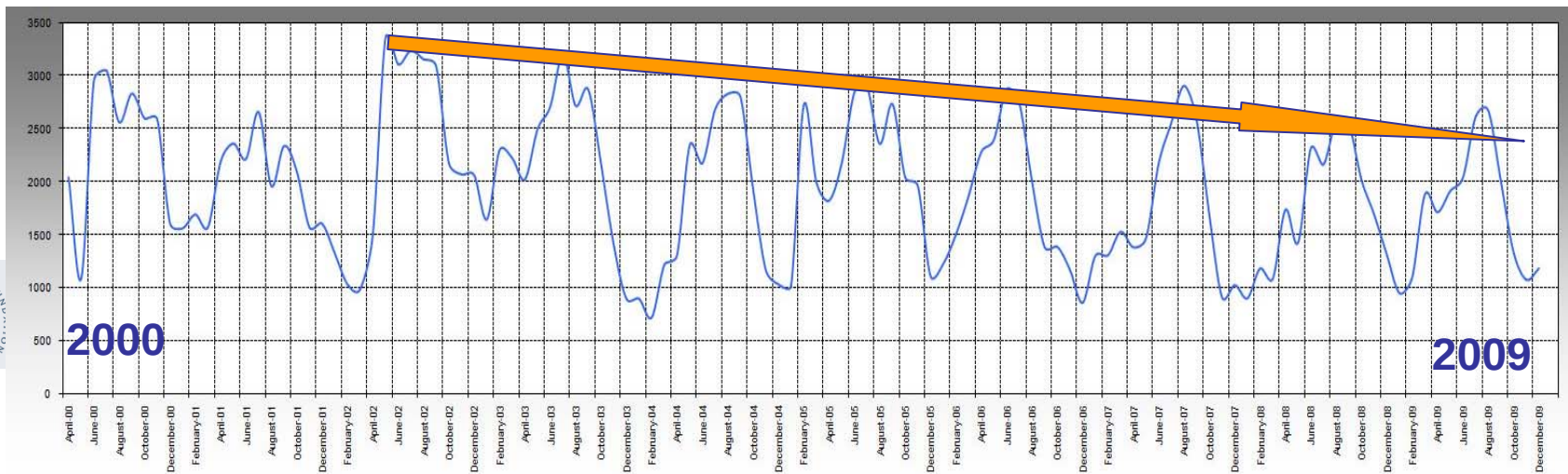
For more details and discussion see Claire HUBER at poster session

# WP1 Hydrological monitoring based on Earth observation data: global Poyang lake



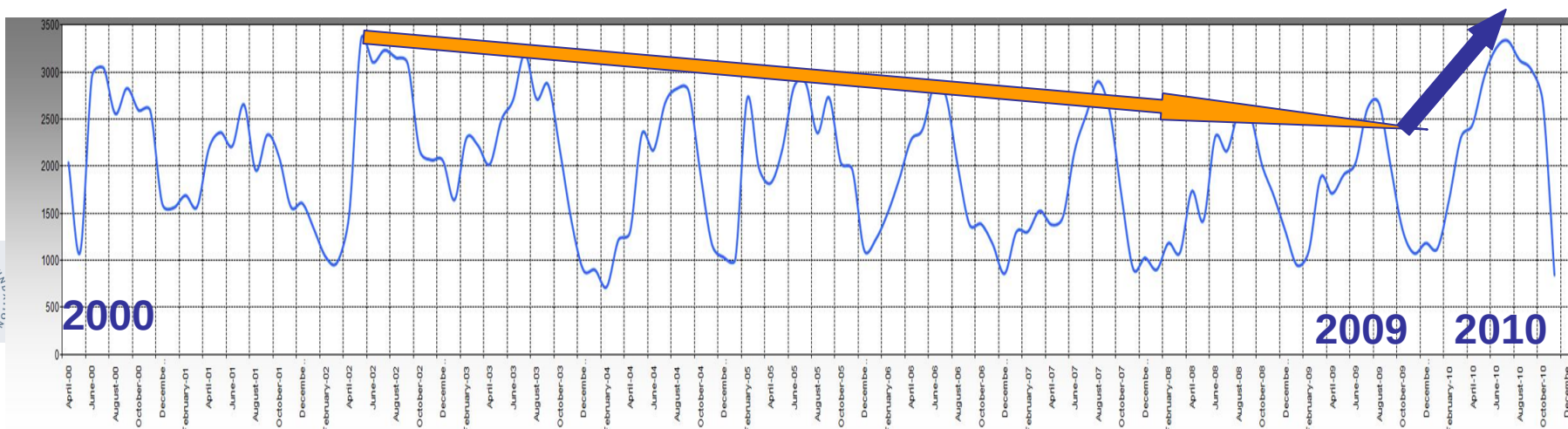
## Important intra and inter annual variations of the water surfaces of monsoon lake

# WP1 Hydrological monitoring based on Earth observation data: global Poyang lake



**Apparent decreasing trends of water surfaces from 2002 to 2009**

# WP1 Hydrological monitoring based on Earth observation data: global Poyang lake



**Apparent decreasing trends of water surfaces from 2002 to 2009**

**2009 to 2010: Increasing of water surfaces = 2002**

**=> Flooding cycle 1998, 2002, 2010....**

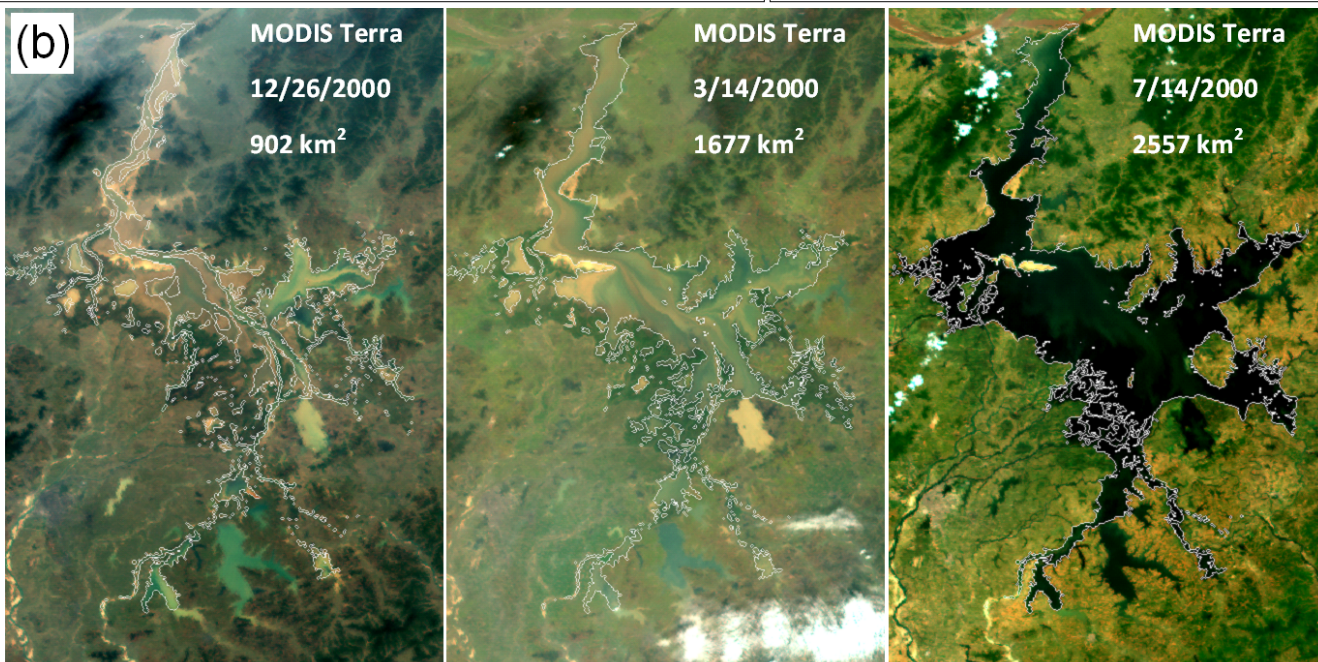
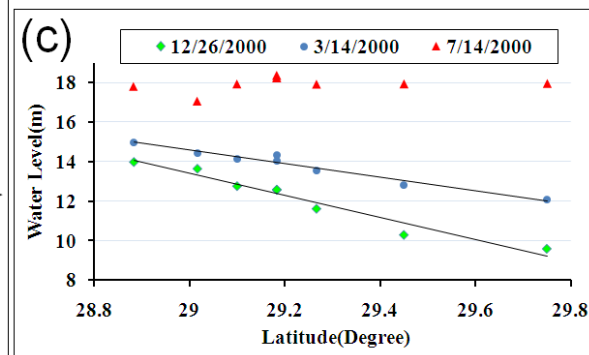
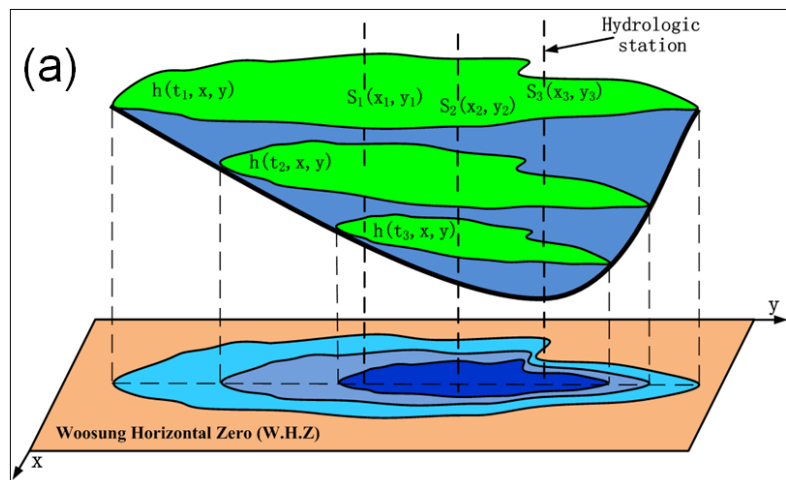
# Bottom topography of Poyang Lake derived from

## Concept:

fast-changing nature of the lake's inundation area

Water/land boundary is a topographic isobath. (after correction for water level gradients)

Topography map were generated using a interpolation over the contour lines

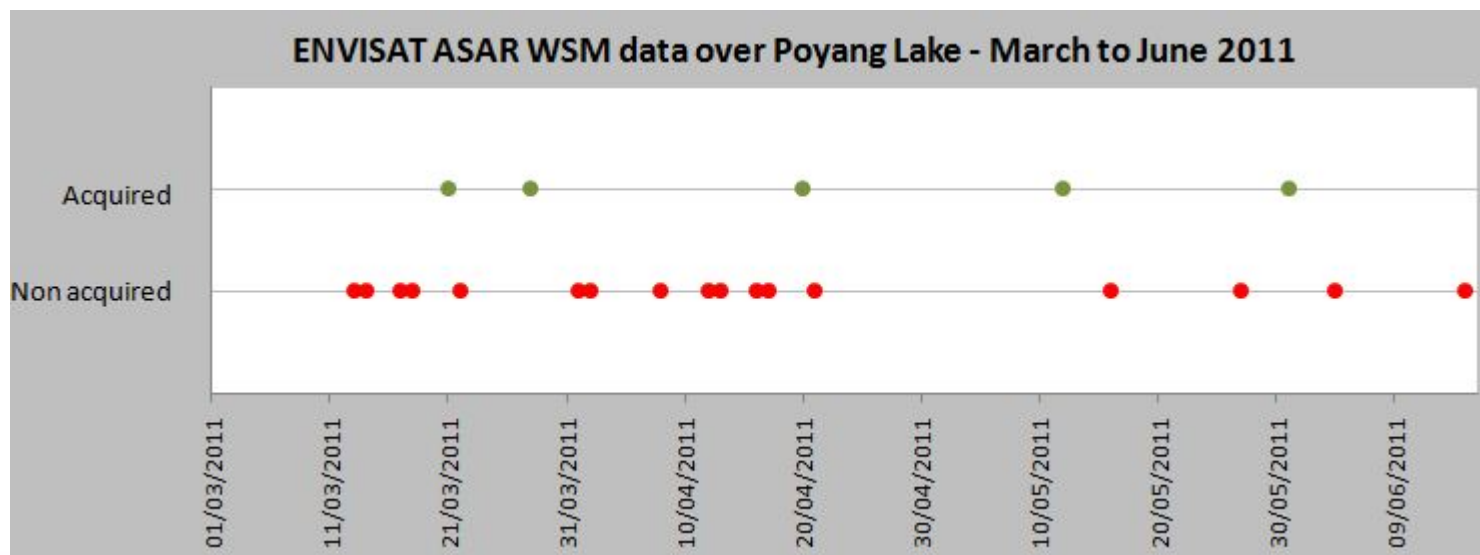


## WP1 2011 Challenge: Insure EO data resource

Since Guillin \_ May 2010:

None Chinese data has been provided to the project !!!!

Only 25% of the free conflict ENVISAT ASAR data were acquired





sertit



## WP1 2011 Challenge: Insure EO data resource

Since Guillin \_ May 2010:

None chinese data has been provided to the project !!!!

Only 25% of the free conflict ENVISAT ASAR data were acquired

Hopefully: Thanks to gained rename, the Flood Wetland project has been granted to receive recently launched EO data, such as HR optical Deimos and MR to VHR SAR Cosmo Skymed



# WP1 : Insure EO data resource: Cosmo Skymed

| Date       | Capteur       | Resolution | Level | Lieu   | Ortno | Cau | Remarque                           |
|------------|---------------|------------|-------|--------|-------|-----|------------------------------------|
| 28/11/2008 | CSK SCS W     | 30         | 1B    | Poyang |       |     | Emprise HS                         |
| 28/11/2008 | CSK SCS W     | 30         | 1B    | Poyang | ok    |     | partie centre                      |
| 28/11/2008 | CSK SCS W     | 30         | 1B    | Poyang | ok    |     | partie sud                         |
| 28/11/2008 | CSK SCS W     | 30         | 1B    | Poyang | ok    |     | partie nord                        |
| 15/12/2010 | CSK SCS W     | 30         | 1B    | Poyang | ok    |     | manque N & S                       |
| 16/12/2010 | CSK SCS W     | 30         | 1A    | Poyang |       |     | inexploitable à cause du niveau 1A |
| 18/12/2010 | CSK Stripmap  | 5          | 1B    | Poyang | ok    |     | centre - Est                       |
| 18/12/2010 | CSK SCS W     | 30         | 1A    | Poyang |       |     | inexploitable à cause du niveau 1A |
| 19/12/2010 | CSK Stripmap  | 5          | 1B    | Poyang | ok    |     | PLNR                               |
| 22/12/2010 | CSK SCS H     | 100        | 1B    | Poyang |       |     | Emprise HS                         |
| 23/12/2010 | CSK Spotlight | 1          | 1B    | Poyang |       |     | Emprise HS                         |
| 27/01/2011 | CSK SCS W     | 30         | 1A    | Poyang |       |     | inexploitable à cause du niveau 1A |
| 27/01/2011 | CSK SCS W     | 30         | 1B    | Poyang | ok    |     | moitié sud                         |
| 27/01/2011 | CSK Stripmap  | 5          | 1B    | Poyang | ok    |     | Dalianzhi                          |
| 28/01/2011 | CSK SCS W     | 30         | 1A    | Poyang |       |     | inexploitable à cause du niveau 1A |
| 28/01/2011 | CSK SCS W     | 30         | 1B    | Poyang | ok    |     | moitié nord                        |
| 29/01/2011 | CSK Stripmap  | 5          | 1B    | Poyang |       |     | Delta                              |
| 30/01/2011 | CSK SCS W     | 30         | 1B    | Poyang | ok    |     | centre - ouest                     |
| 30/01/2011 | CSK Stripmap  | 5          | 1B    | Poyang | ok    |     | image brute perdue !               |
| 30/01/2011 | CSK Spotlight | 1          | 1B    | Poyang | ok    |     | Bang hu                            |
| 01/02/2011 | CSK SCS H     | 100        | 1B    | Poyang | ok    | ok  | Poyang complet                     |
| 02/02/2011 | CSK PingPong  | 20         | 1B    | Poyang | ok    |     | PLNR                               |
| 25/05/2011 | CSK SCS H     | 100        | 1B    | Poyang | ok    | ok  | Poyang complet                     |
| 27/05/2011 | CSK Stripmap  | 5          | 1B    | Poyang |       |     | PLNR                               |
| 10/06/2011 | CSK SCS H     | 100        | 1B    | Poyang |       |     | Poyang complet                     |
| 10/06/2011 | CSK Stripmap  | 5          | 1B    | Poyang |       |     | PLNR                               |
| 12/06/2011 | CSK Stripmap  | 5          | 1B    | Poyang |       |     | Canal                              |
| 14/06/2011 | CSK Spotlight | 1          | 1B    | Poyang |       |     | Bang hu                            |
| 15/06/2011 | CSK Spotlight | 1          | 1B    | Poyang |       |     | Bang hu                            |

Received Cosmo Skymed





Poyang lake  
Cosmo Skymed Huge mode  
25 May 2011



Lake infilling not really starts  
Water extent in May 2011  
corresponds to a « normal »  
February

25 May 2011



sertit



Dongting lake

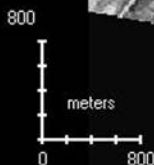
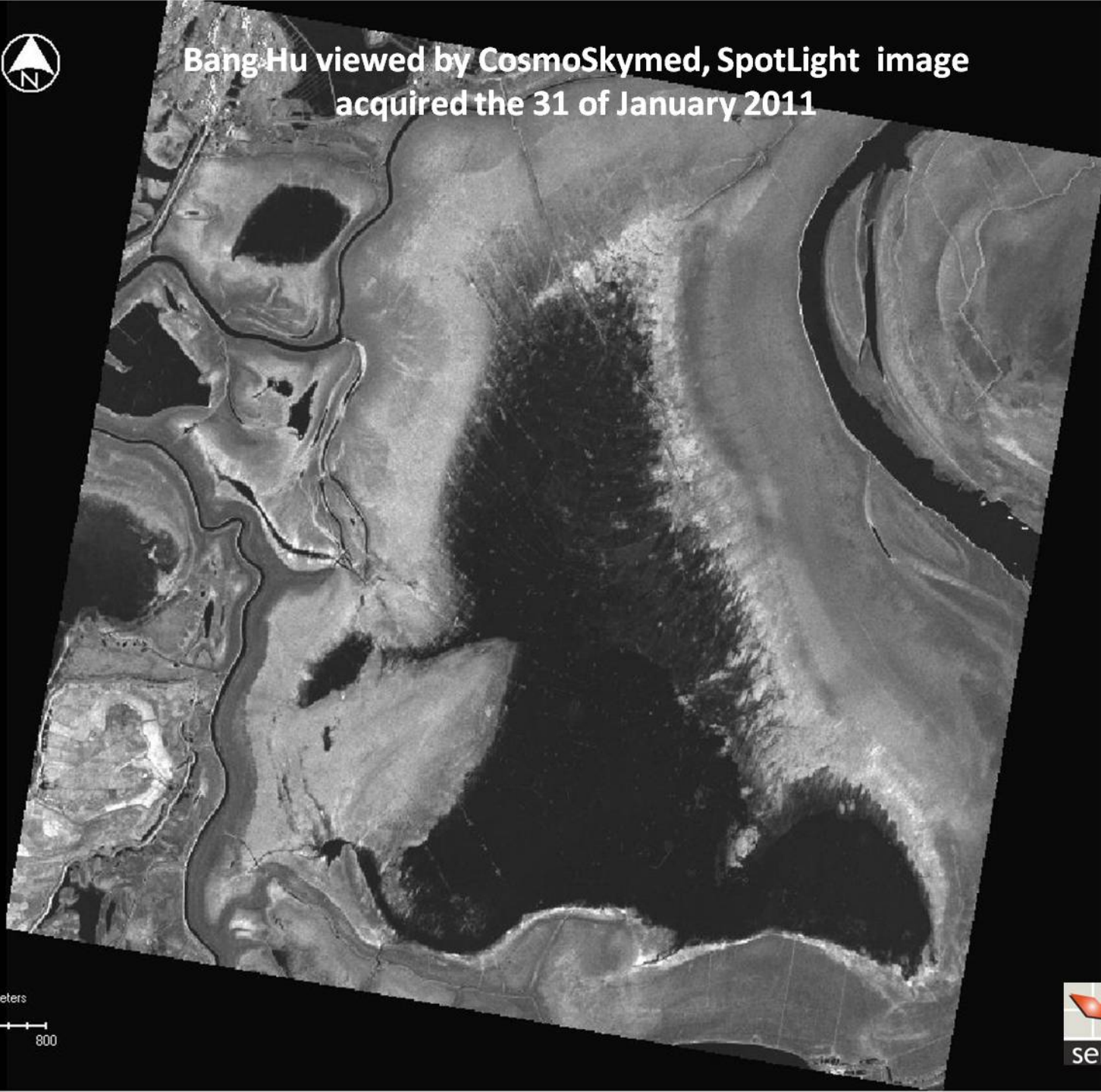
Cosmo HUGE

2011 06 16

Lake infilling starts



Bang Hu viewed by CosmoSkymed, SpotLight image  
acquired the 31 of January 2011



12 November 2010

# DEIMOS data accessed through Deimos AO launched

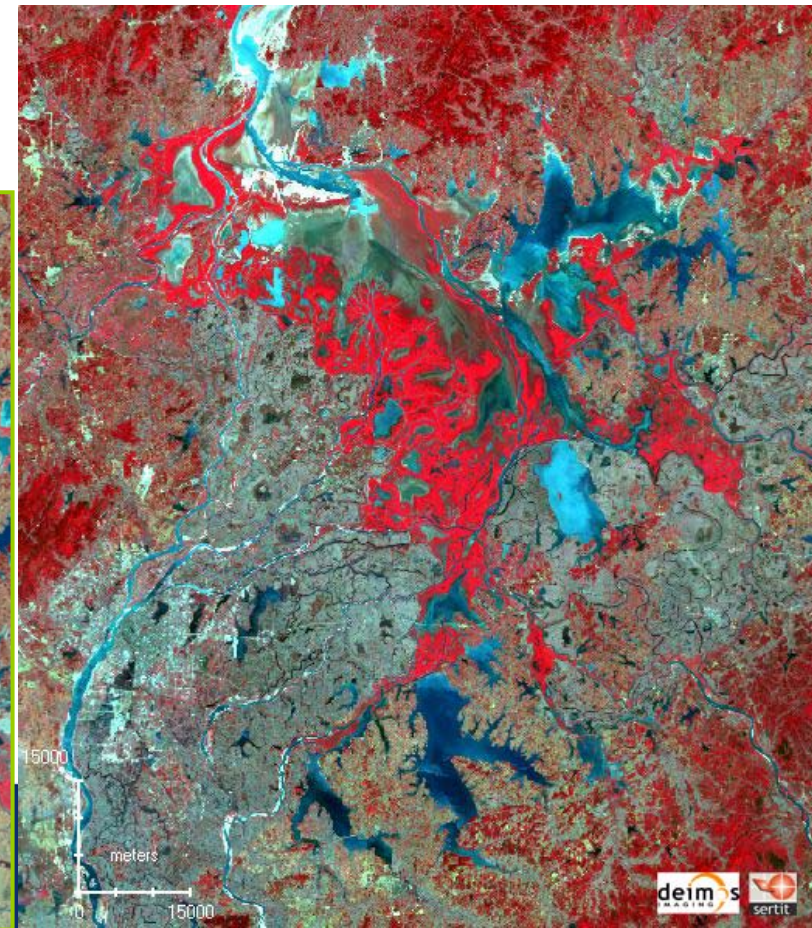
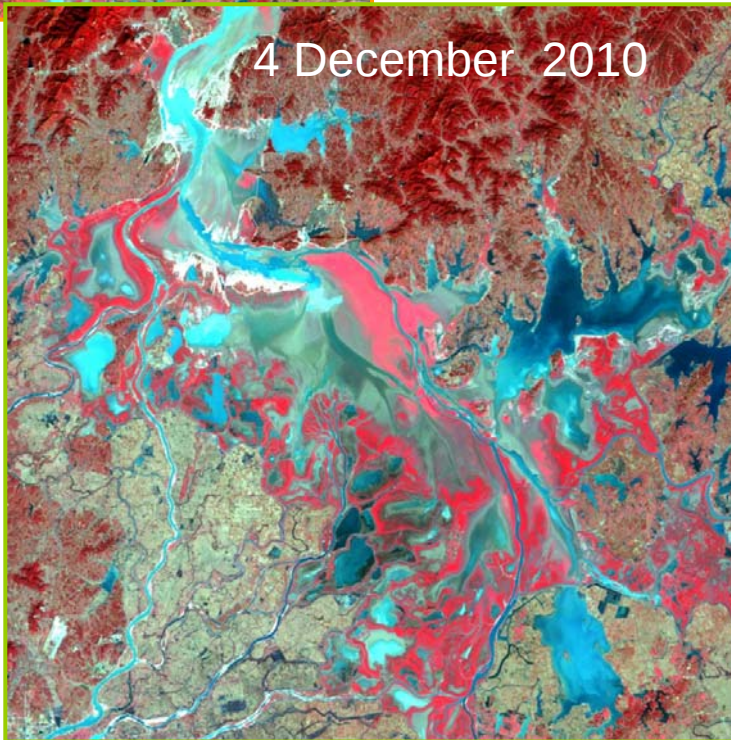
by Pr JL Casanova

Deimos data: 22 m

When DEIMOS a full part TPM ?



4 December 2010



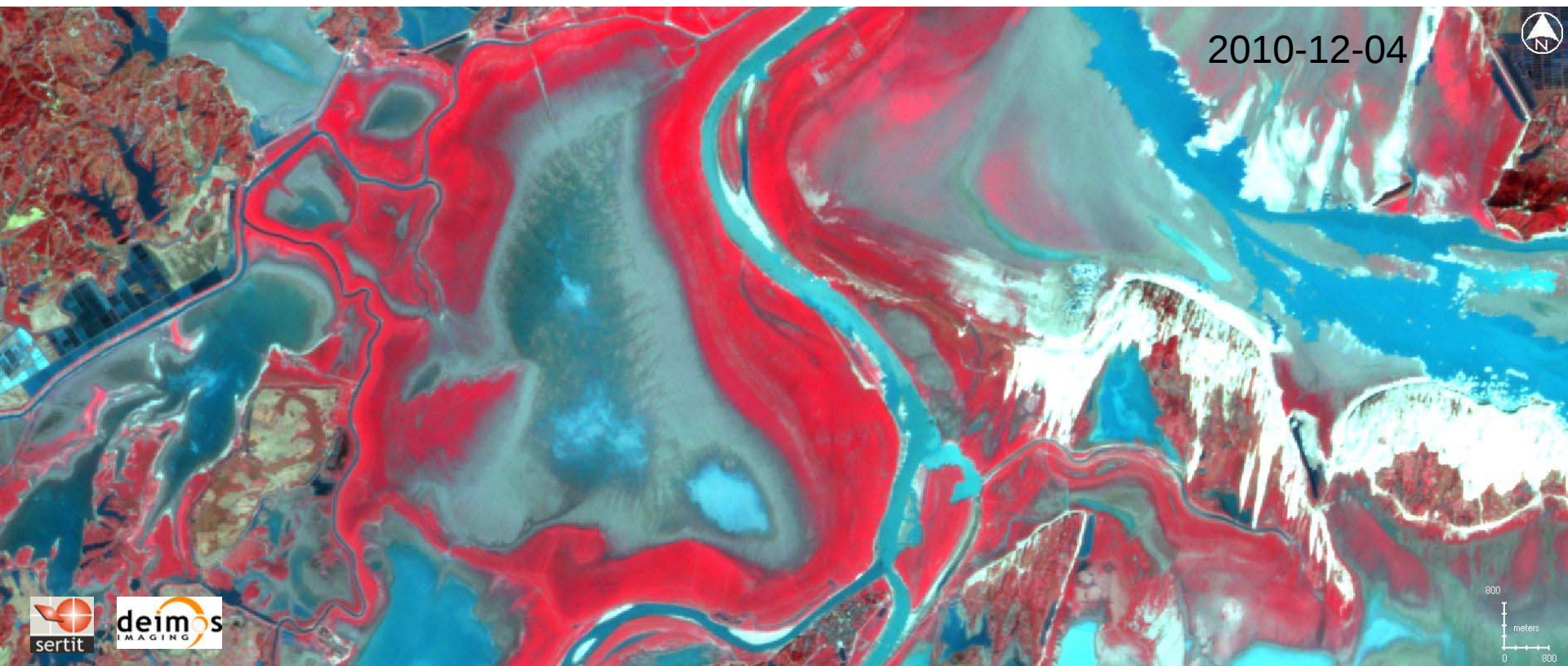
## Bang Hu : Poyang lake natural reserve

2010-11-12



## Bang Hu : Poyang lake natural reserve

2010-12-04



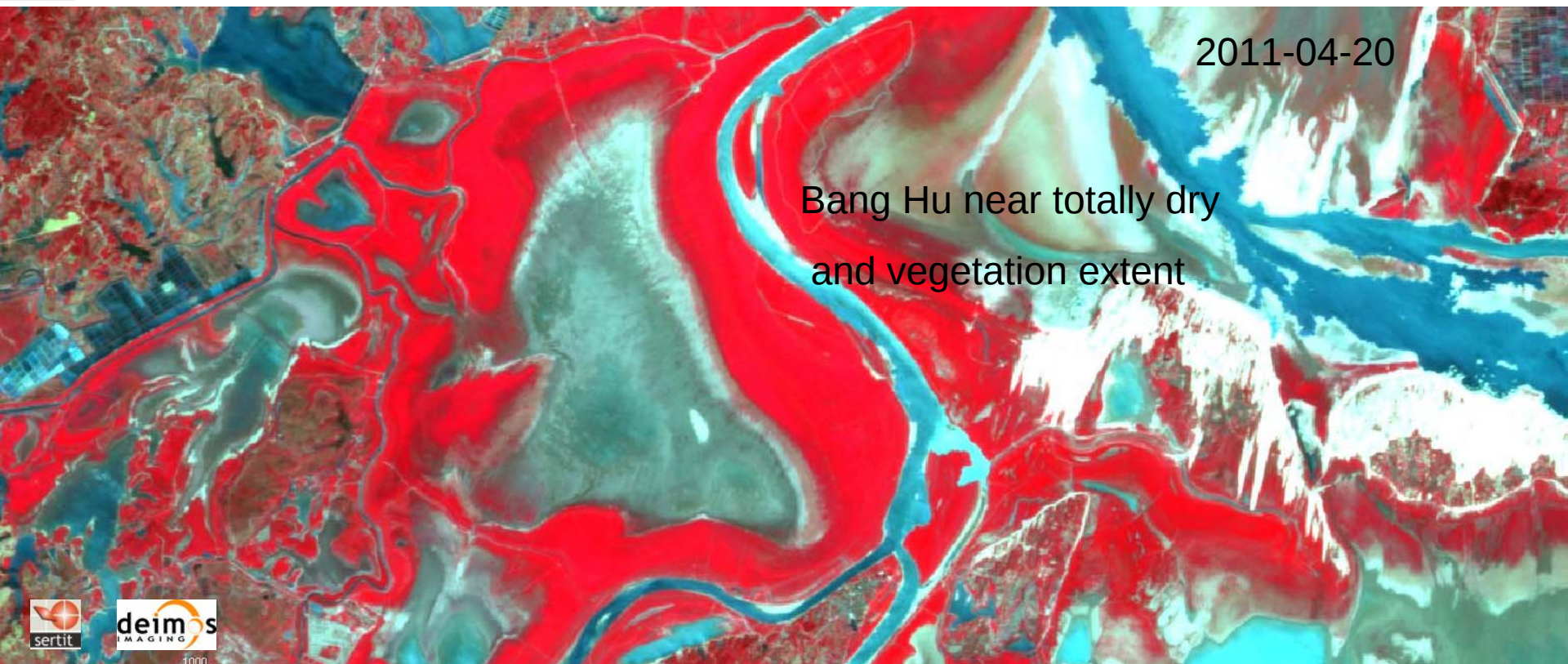
DEIMOS data accessed through Deimos AO launched by Pr JL Casanova



## Bang Hu : Poyang lake natural reserve

2011-04-20

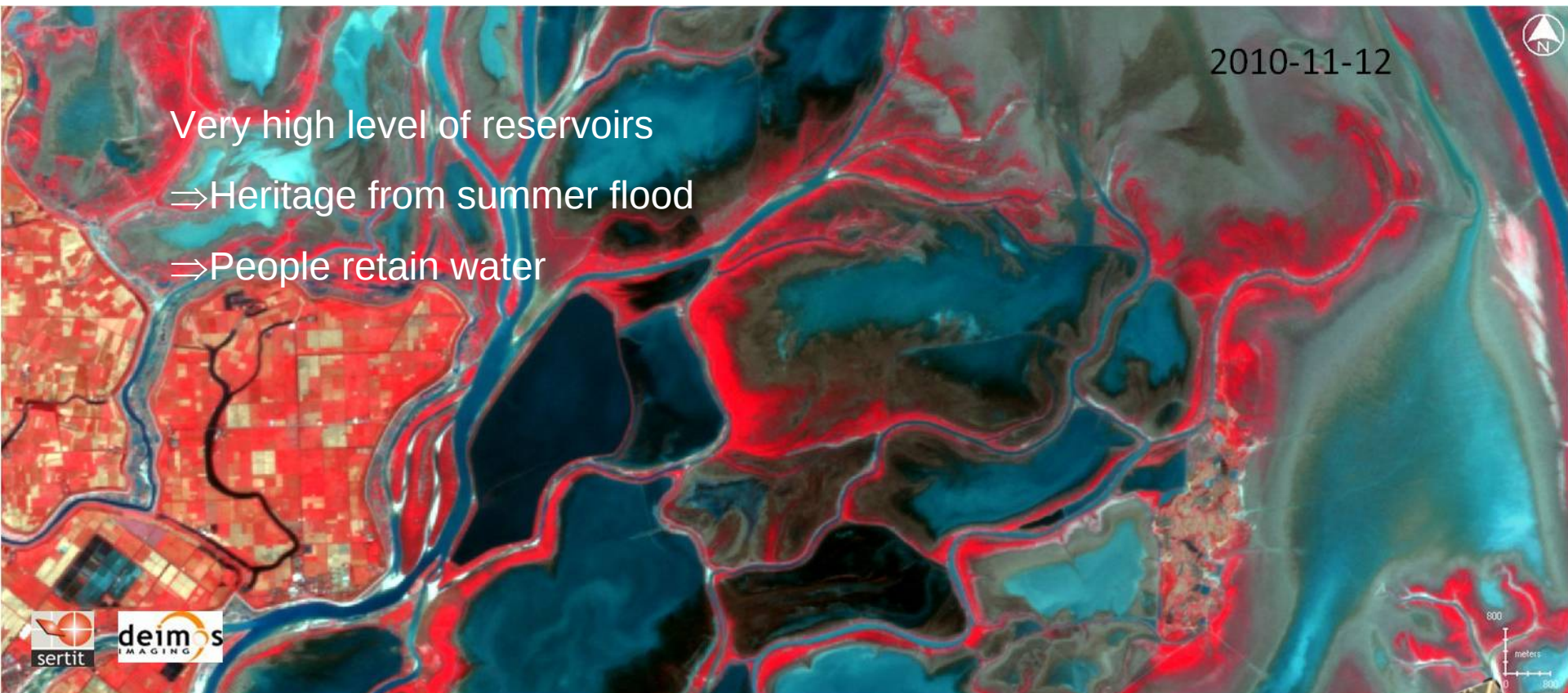
Bang Hu near totally dry  
and vegetation extent



DEIMOS data accessed through Deimos AO launched by Pr JL Casanova



## Gang Delta : Poyang lake natural reserve



DEIMOS data accessed through Deimos AO launched by Pr JL Casanova



## Gang Delta : Poyang lake natural reserve



## Gang Delta : Poyang lake natural reserve

2011-04-20



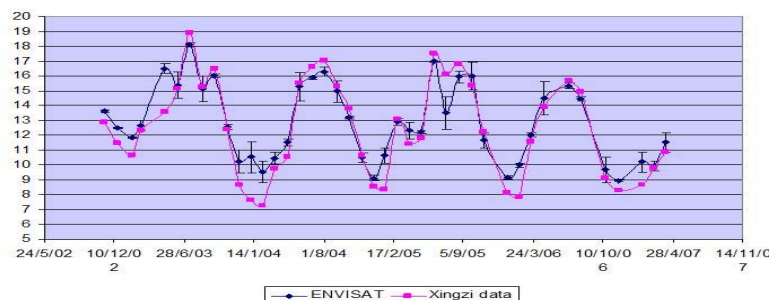
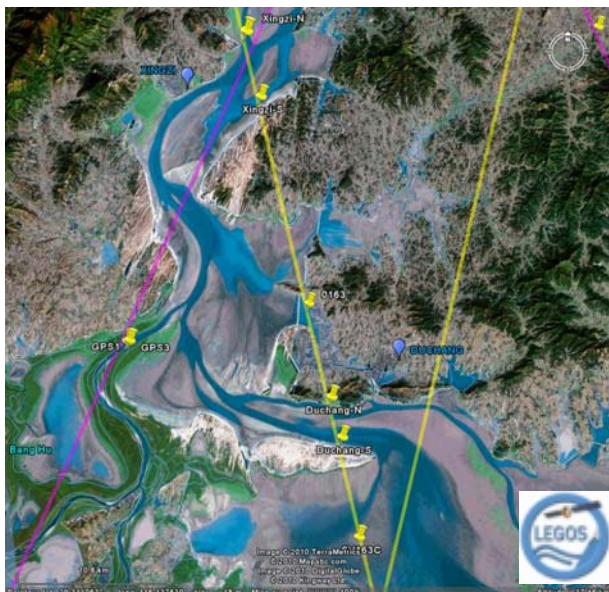
CENTRE NATIONAL DES RECHERCHES SPATIALES

DEIMOS data accessed through Deimos AO launched by Pr JL Casanova

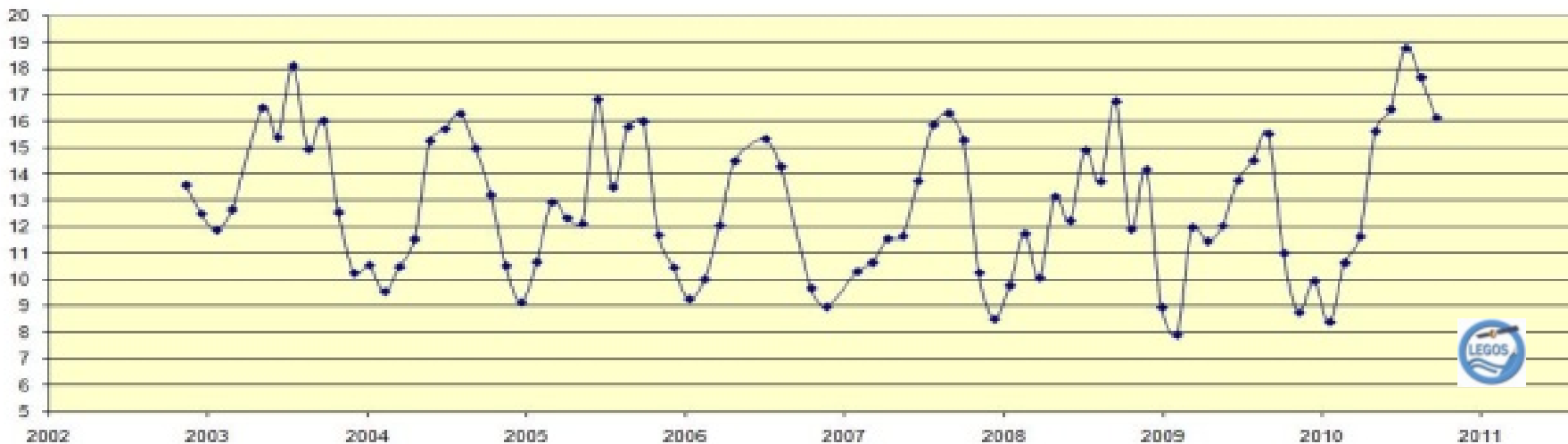


# WP2 Lakes water height monitoring from space

Exploitation of Topex and ENVISAT RA2 up to the orbit shift (Fall 2010) validation based on Xingzi gauge station

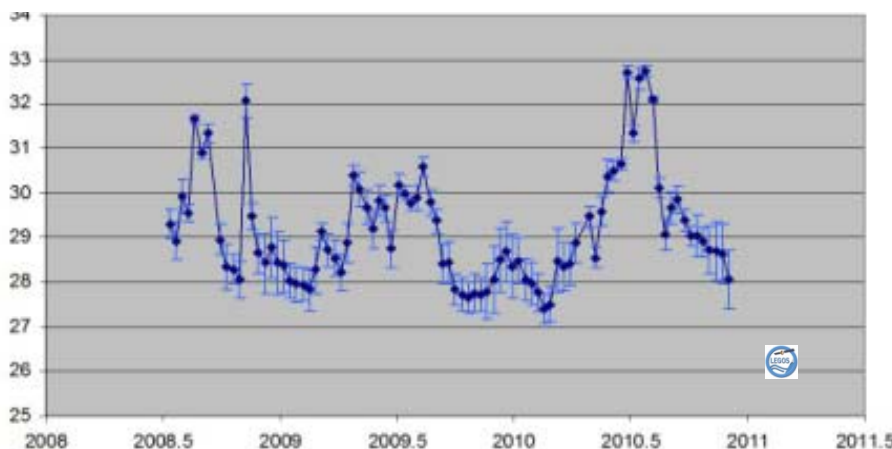
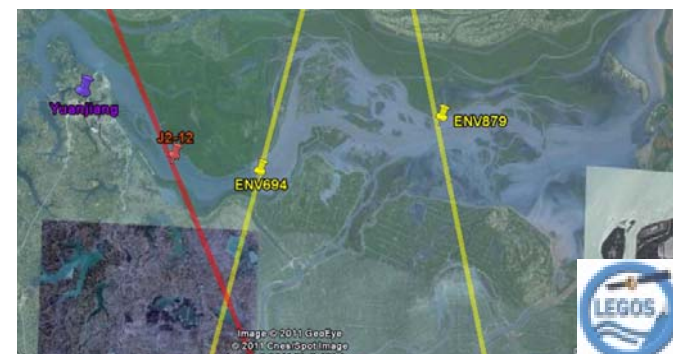


Poyang lake water height monitoring based on Envisat Altimeter from 2002 to 2010

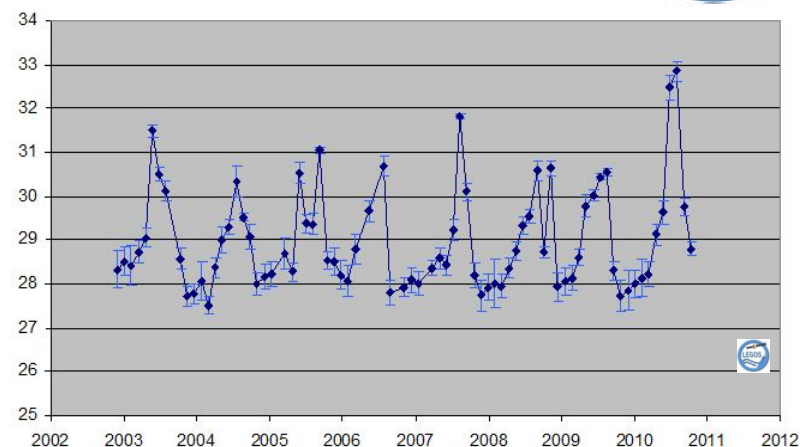


# WP2 Lakes water height monitoring from space: Dongting

Exploitation of most of the available  
historical, and actual altimetric  
missions from Topex, RA2 to Jason2

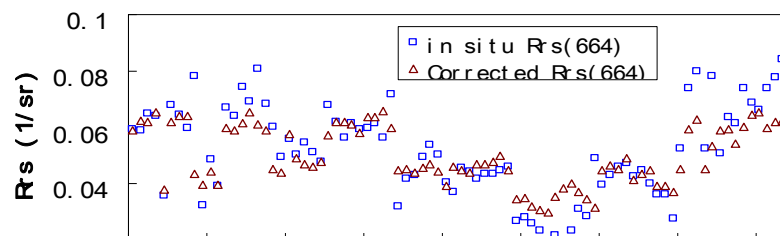
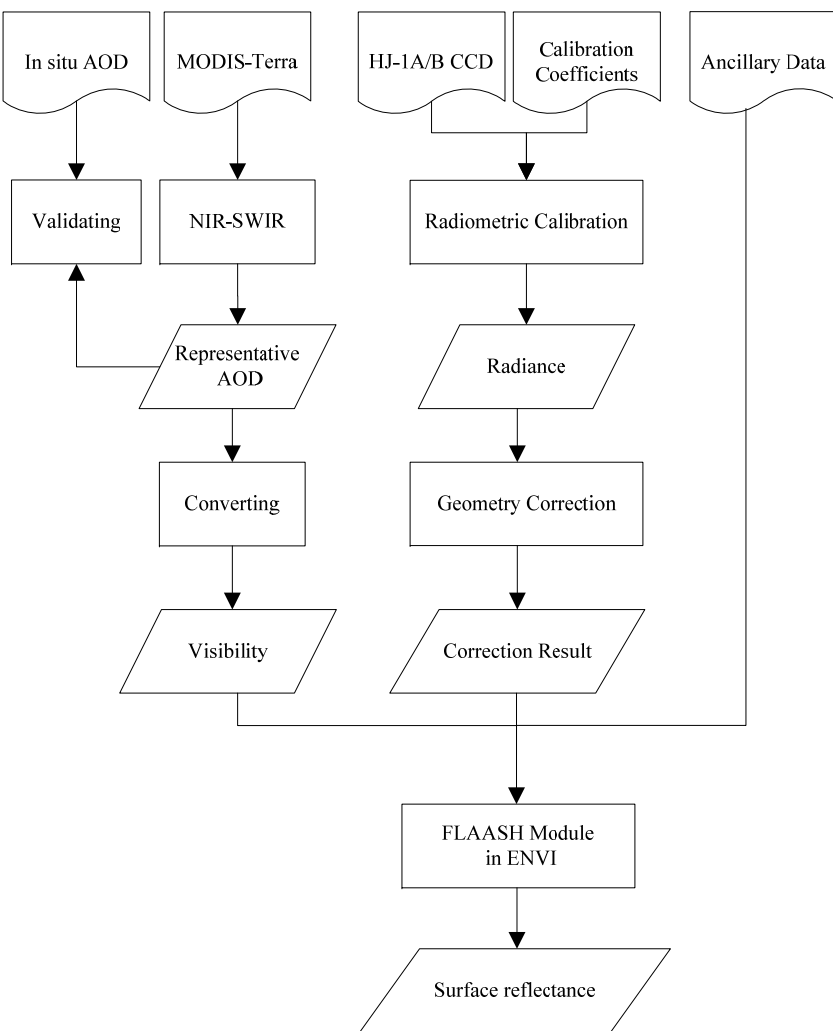


**Dongting lake water height  
monitoring based on Jason 2**

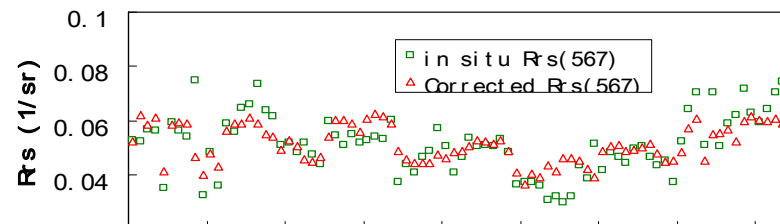


**ENVISAT trace 694  
minimum 27.8m amplitude max 5,5m**

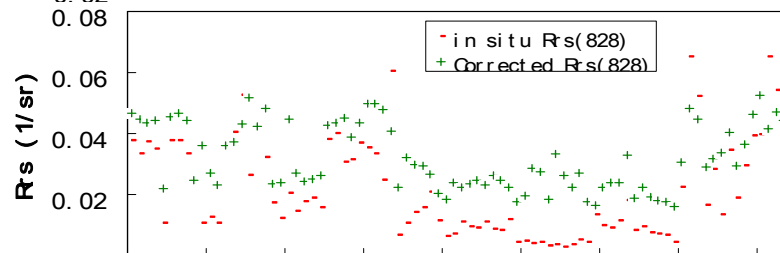
# WP3 Water quality: Assessment of total suspended sediment of Poyang Lake using HJ-1A/B CCD imagery



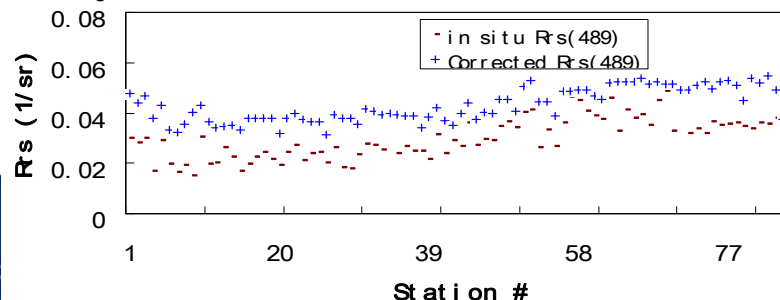
M.R.E=15.2%



M.R.E=11.3%



M.R.E=113.4%

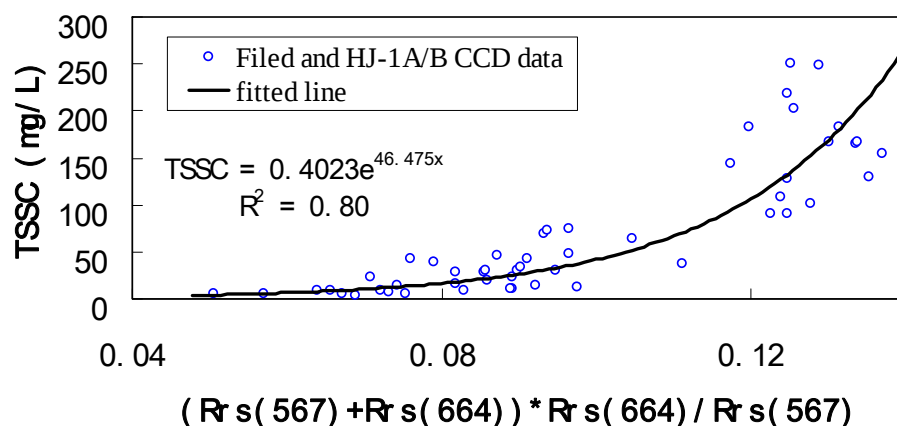


M.R.E=50.4%

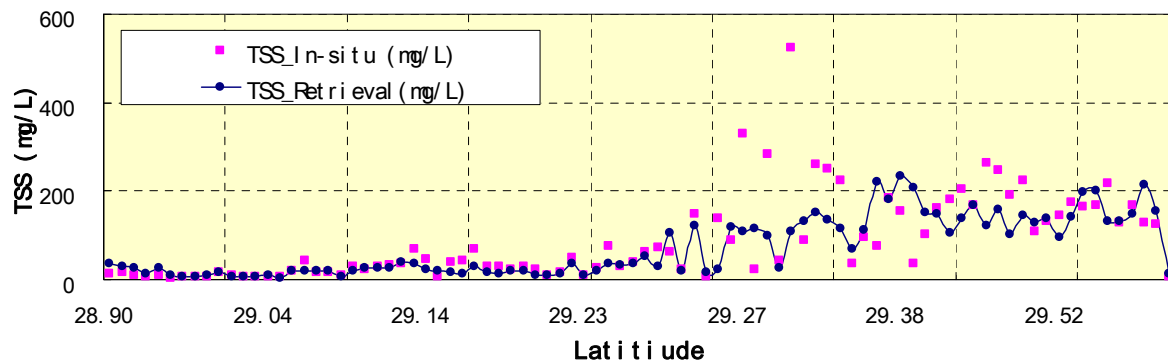
# WP3 Water quality: Assessment of total suspended sediment of Poyang Lake using HJ-1A/B CCD imagery

Retrieved TSS concentration

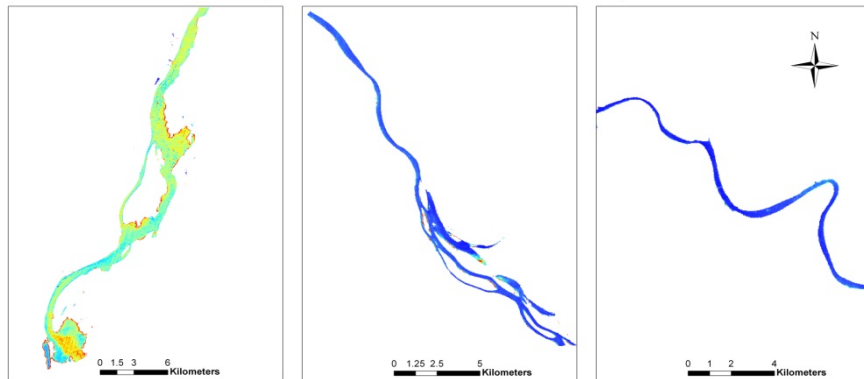
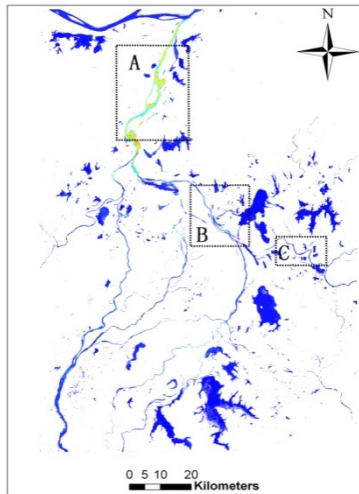
Retrieval algorithm



Result validation



## WP3 Water quality: Assessment of total suspended sediment of Poyang Lake using HJ-1A/B CCD imagery

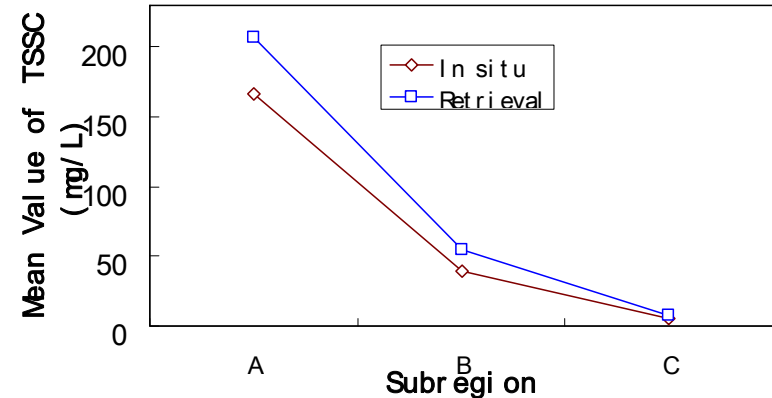


Subregion A      Subregion B      Subregion C

0      300

TSS (mg/L)

| Subregion | of TSS (mg/L)  |                  |                    |
|-----------|----------------|------------------|--------------------|
|           | <i>In situ</i> | <i>Retrieval</i> | <i>R.E. (100%)</i> |
| A         | 166.53         | 206.90           | 24.24              |
| B         | 39.77          | 54.65            | 37.42              |
| C         | 6.00           | 7.73             | 28.83              |



- The distribution trend of TSS is the same with the result of in situ data analysis.
- The mean retrieval value of TSS is a little higher than in-situ data due to the uncertain in atmospheric correction and retrieval model establishment.

## WP4 Rapid Mapping: The 2010 flood events in China

2 types of actions:

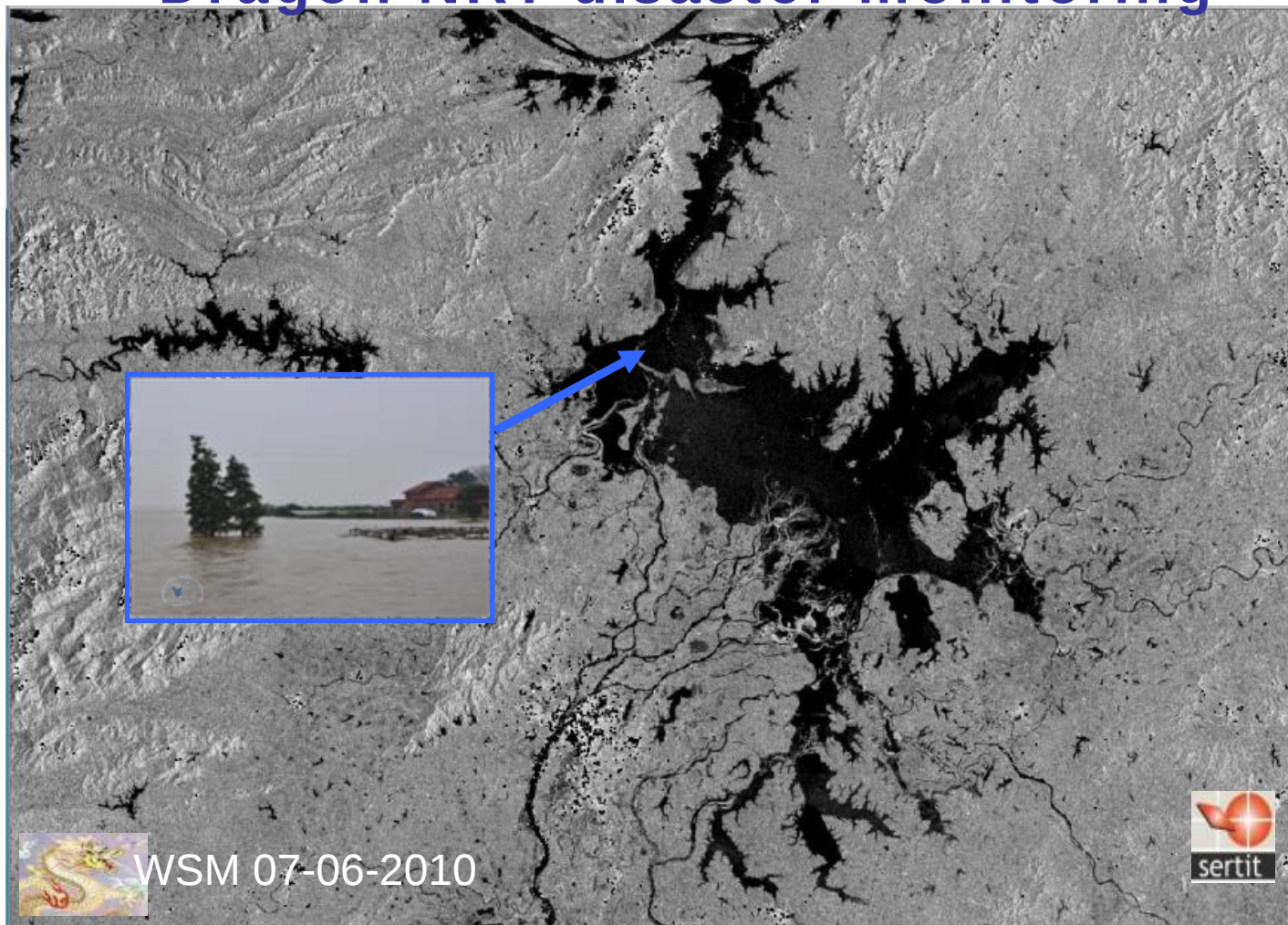
NRT punctual action on located events such as over Songhua river

NRT monitoring of Poyang Lake and at a lesser level of Dongting lake

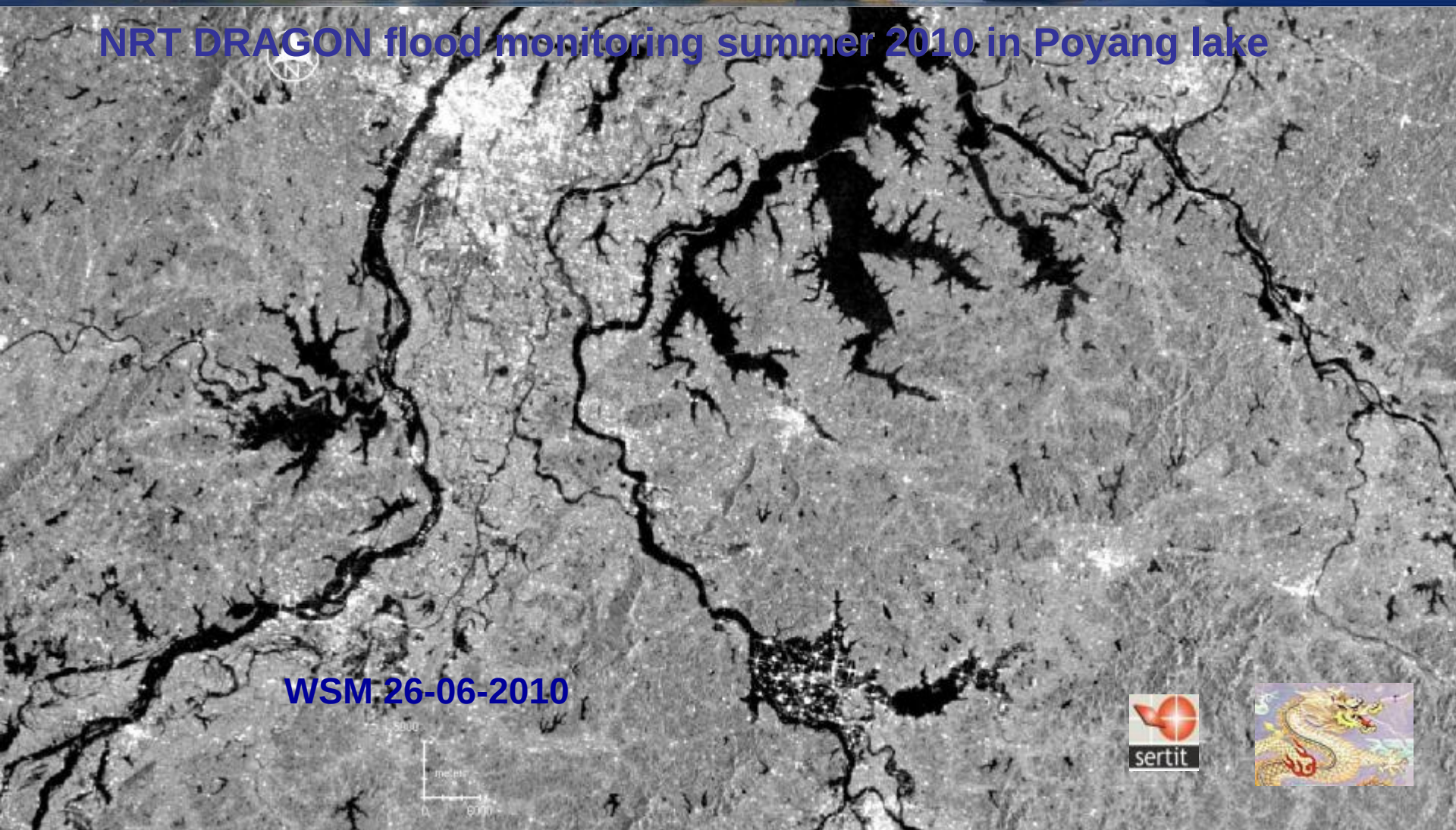
Context relatively different from the previous DRAGON as thanks to this long term monitoring a relative good knowledge of Yangtze's lakes behaviours were now characterized

Since beginning of June 2010 it appeared that the water extents were already very large, much larger than a “normal hydrological” year.

# Dragon NRT disaster monitoring



## NRT DRAGON flood monitoring summer 2010 in Poyang lake

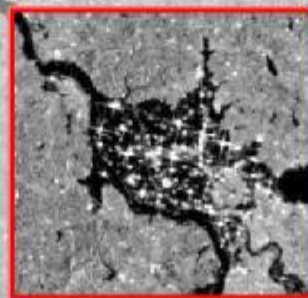


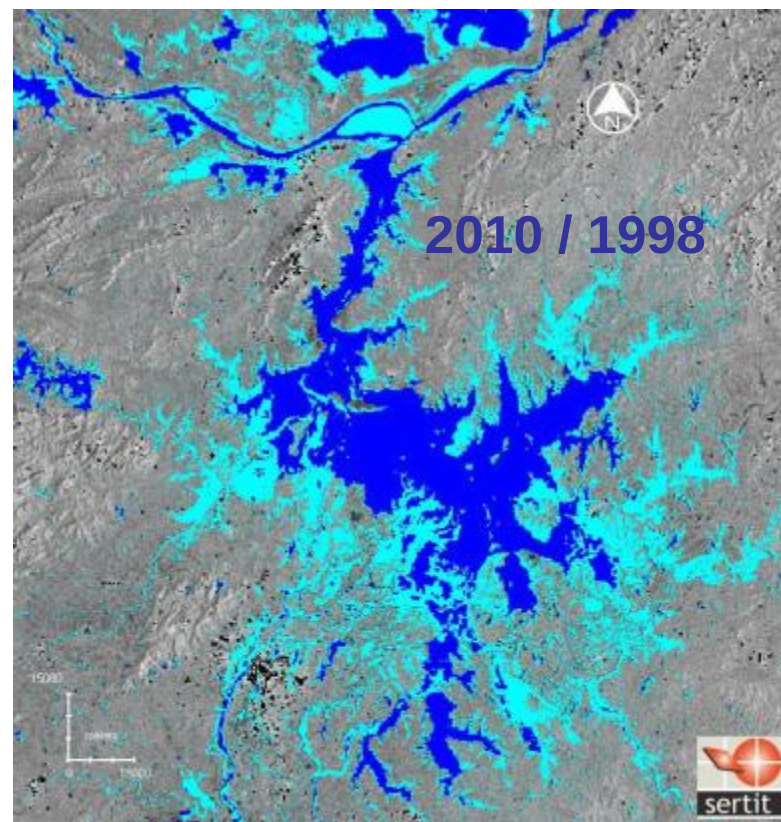
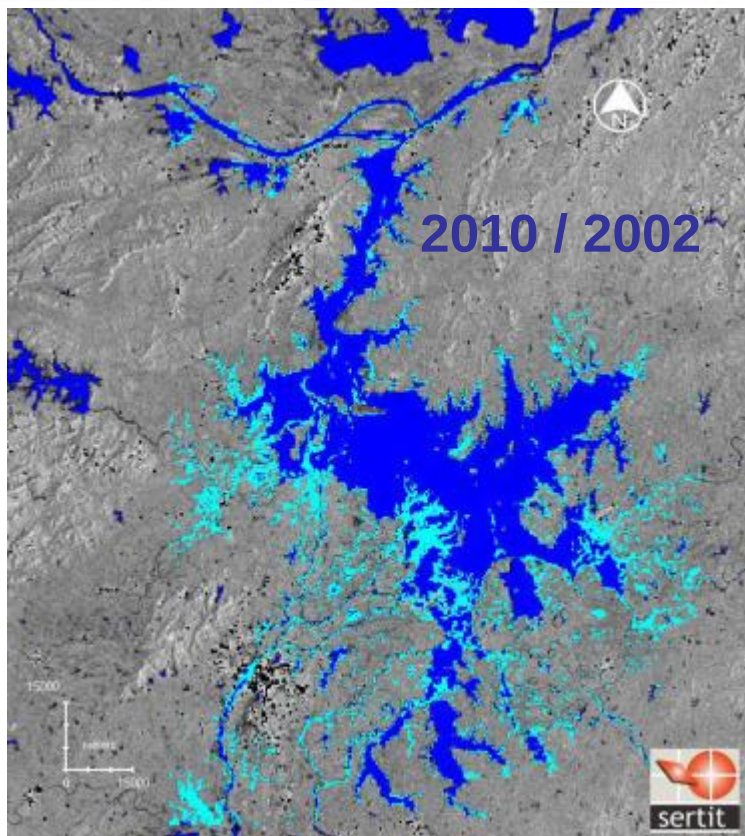
## NRT DRAGON flood monitoring summer 2010 in Poyang lake

**Breach of the Changkai dike on the Fuhe River, which burst its banks on June 21 and again on June 23, in Luozhen Township, Fuzhou City, forced 1.32 million people to evacuate**



**WSM 26-06-2010**



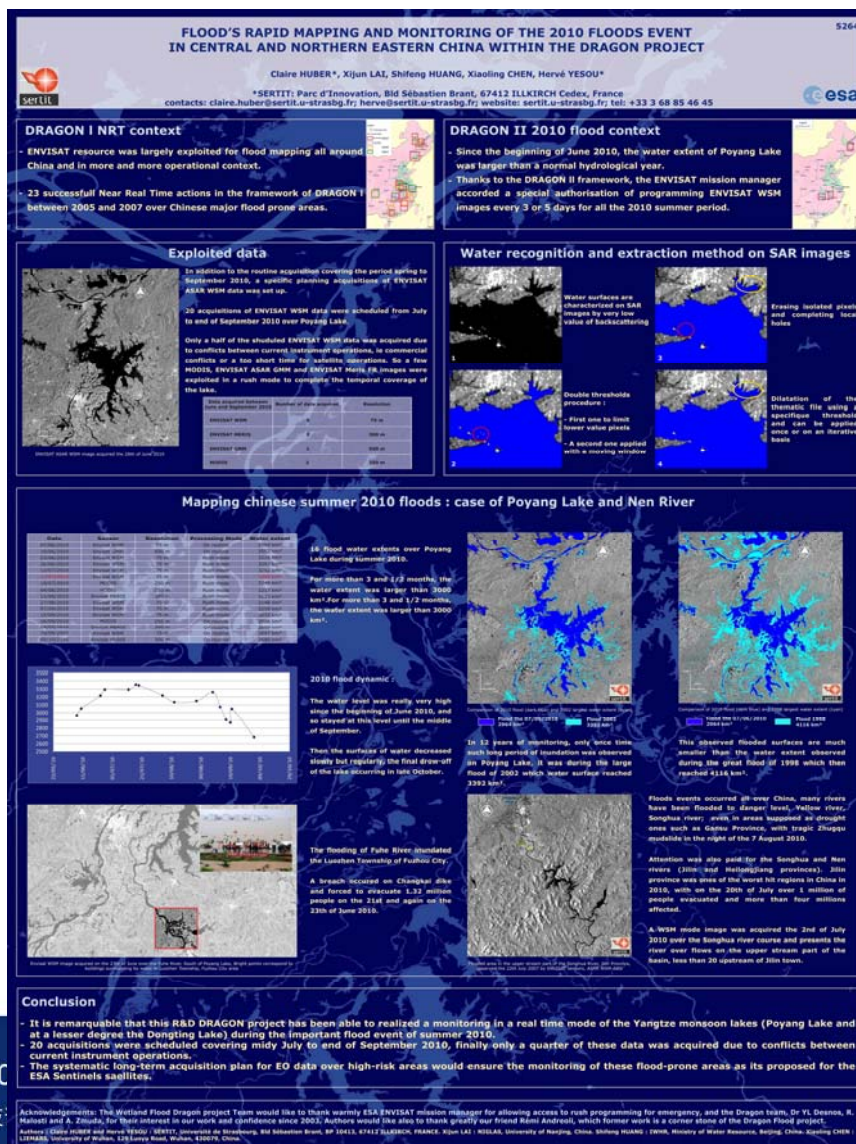


**2010 flood event is an important one in Poyang last decade history**  
**2010 extent (3354 km<sup>2</sup>) no far to the 2002 extent ( 3392 km<sup>2</sup> )**  
**2010 much smaller in term of extent than 1998 (4116 km<sup>2</sup>)**

# WP4 Rapid Mapping: 2010 summer floods in China

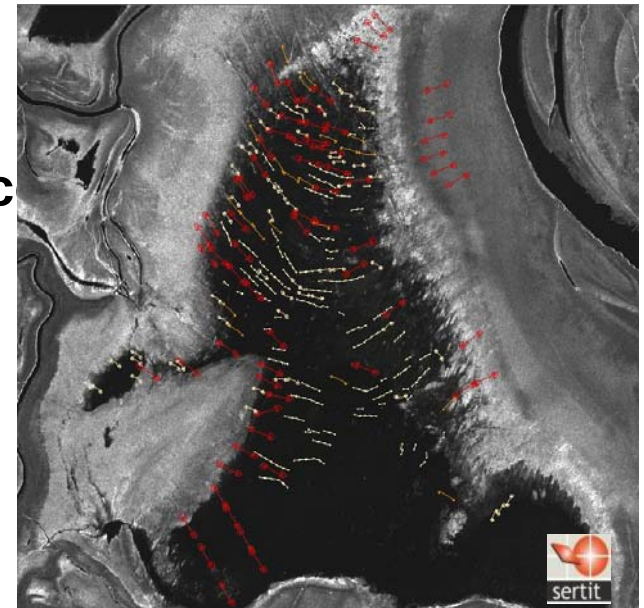


For more details and discussion see Claire HUBER at poster session



## WP5: Wetland mapping and biodiversity values analysis

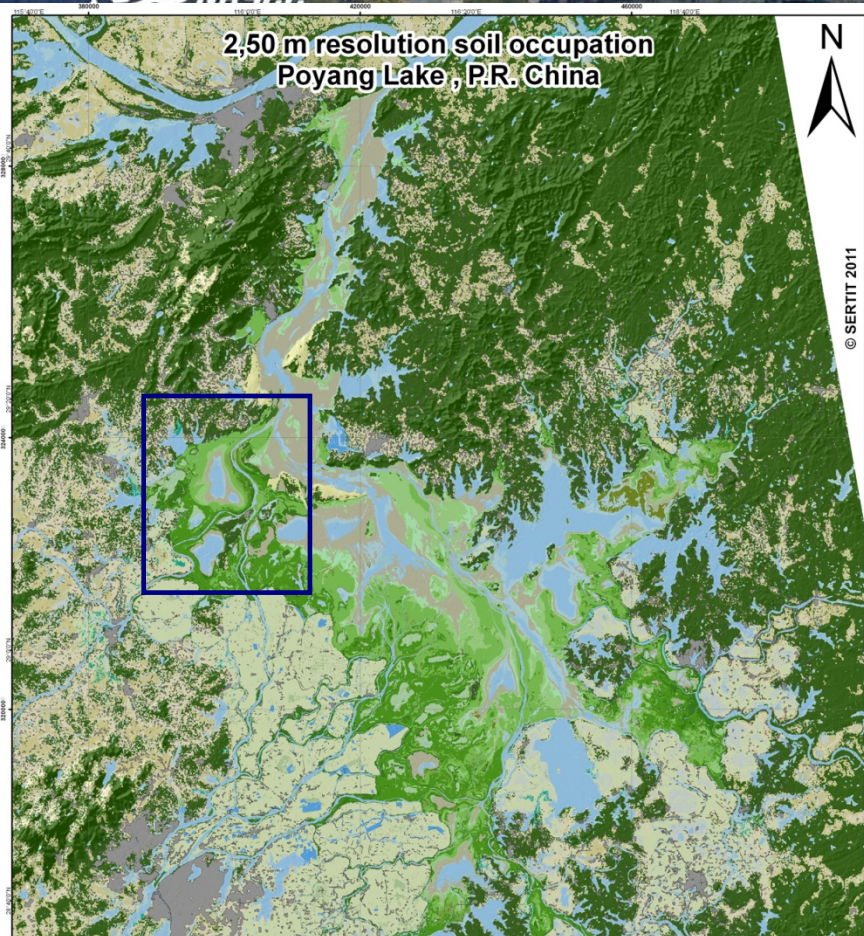
- Exploitation of Deimos data in order organized bird accounting field survey
- Exploitation of CSK VHR data to map 50km of fish traps (300m to 75m) in Bang Hu (PLNR)  
=> input for analysis of human practice and birds location
- New project delivery:
- Land use/land cover map at 20m



2,50 m resolution soil occupation  
Poyang Lake, P.R. China



© SERTIT 2011



## Land cover 21 classes



|  |                         |  |                              |  |                                         |  |                     |
|--|-------------------------|--|------------------------------|--|-----------------------------------------|--|---------------------|
|  | Water - Temporary water |  | Carex - phase 3              |  | Floating vegetation                     |  | Dry crops           |
|  | Very wet soil           |  | Grassy vegetation - Cynodon  |  | Temporary vegetation                    |  | Crops of the valley |
|  | Wet areas - Backswamp   |  | High herbaceous - Miscanthus |  | Aquacultures (mostly pearls and fishes) |  | Dunes               |
|  | Muds - Silts            |  | Vegetation on dike           |  | Very wet crops                          |  | Forest              |
|  | Carex - phase 1         |  | Marsh vegetation             |  | Wet crops                               |  | Urban               |
|  | Carex - phase 2         |  |                              |  |                                         |  |                     |

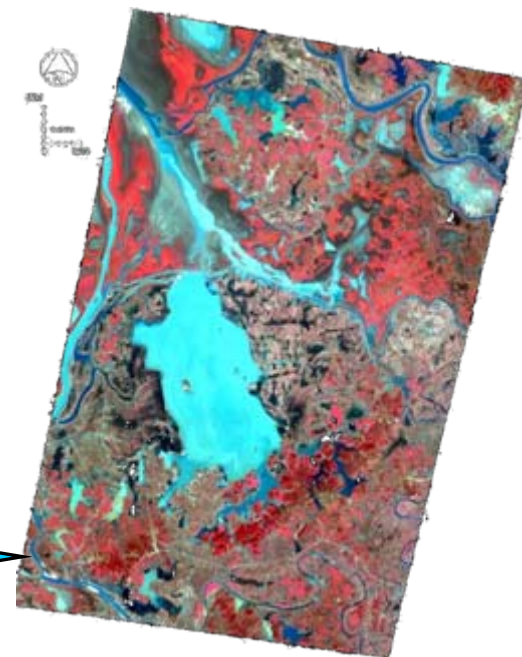
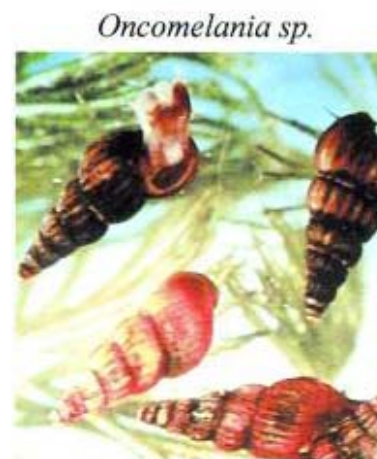
Soil occupation realized from Beijing 1, ALOS AVNIR - PRISM and ENVISAT ASAR data :

© DMC International Imaging 2007 - 2008 - all rights reserved

© JAXA 2007

© ESA 2004 - 2006

## WP6: EO data and Epidemiology (Schistosomiasis)



### Vector's habitat characterization

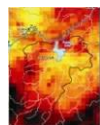
- Inundation time
- Vegetation

### Human activities and risk transmission

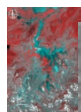
# EO data for snail habitat & risk transmission analysis

## Snail habitat

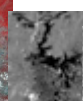
### Meteorology



TRMM



MODIS GMM



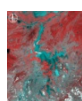
WSM MERIS



Inundation duration



Water T°



MODIS

### Vegetation



Beijing-1 Landsat TM SPOT4

## Transmission

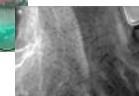
### Land Use



Alos



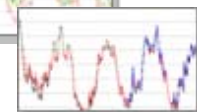
kompsat



Alos

### Human practices

### Hydrological data

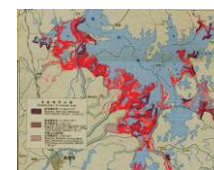


### Field survey



### Vegetation

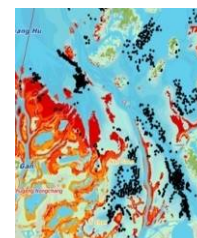
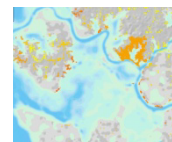
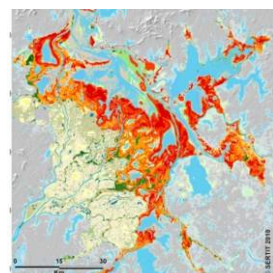
### Snail



### Validation tasks

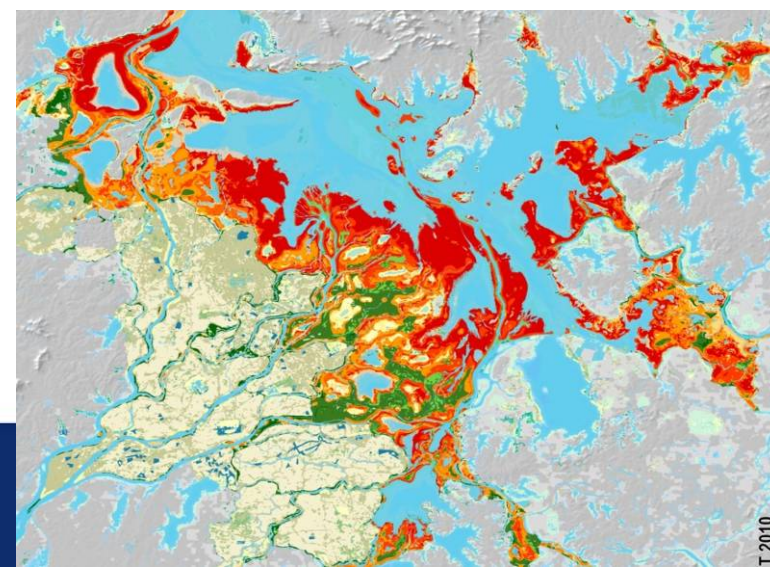
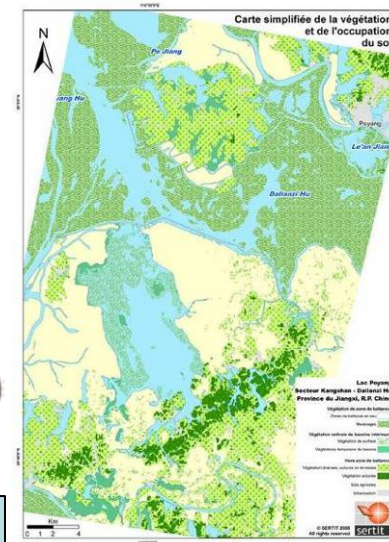
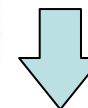
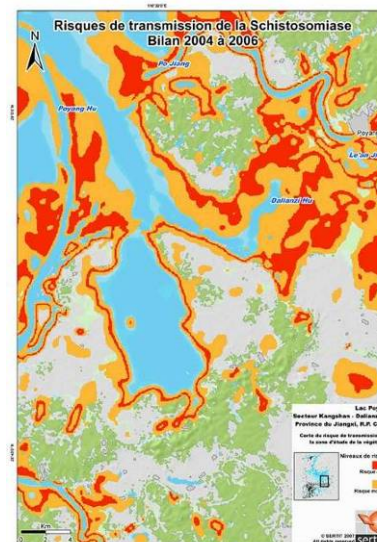
### Human activities and risk

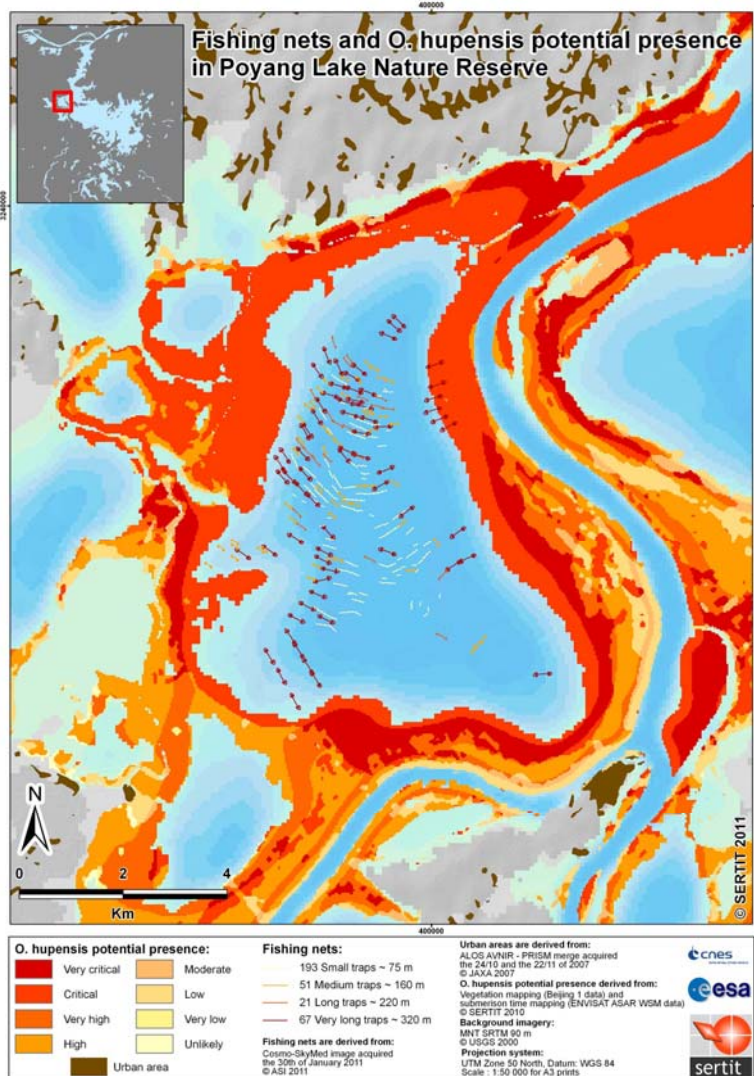
### Snail favourable habitat



# Combination of two indicators of potential presence of *Oncomelania hupensis*

| Level Submersion on time | Vegetation communities                                 | Potential <i>O. hupensis</i> presence |
|--------------------------|--------------------------------------------------------|---------------------------------------|
| High                     | <i>Carex</i> , <i>Cynodon</i>                          | Very critical                         |
| Moderate                 | <i>Carex</i> , <i>Cynodon</i>                          | Critical                              |
| High                     | <i>Miscanthus</i>                                      | Very high                             |
| Moderate                 | <i>Miscanthus</i>                                      | High                                  |
| High                     | Vegetation on dyke                                     | Moderate                              |
| Moderate                 | Vegetation on dyke                                     | Low                                   |
| High                     | Marsh, floating and temporary vegetations, crops areas | Very low                              |
| Moderate                 | Marsh, floating and temporary vegetations, crops areas | Unlikely                              |

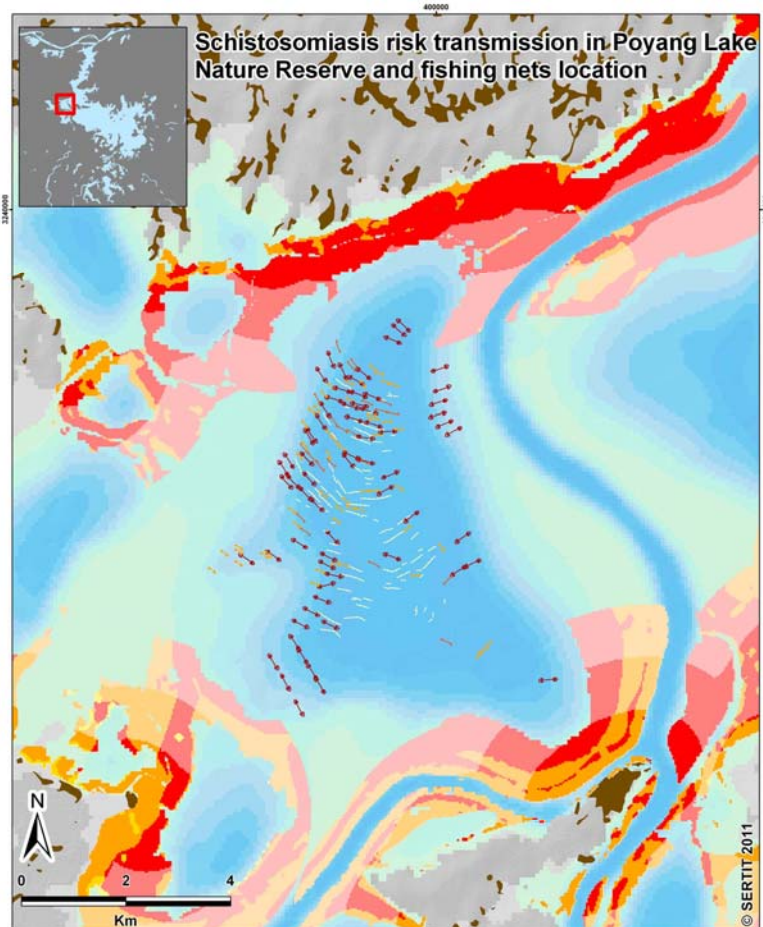




Application to Bang Hu area

Poyang Lake Natural Reserve

Potential presence of *O. Hupensis* based on vegetation type and time of inundation

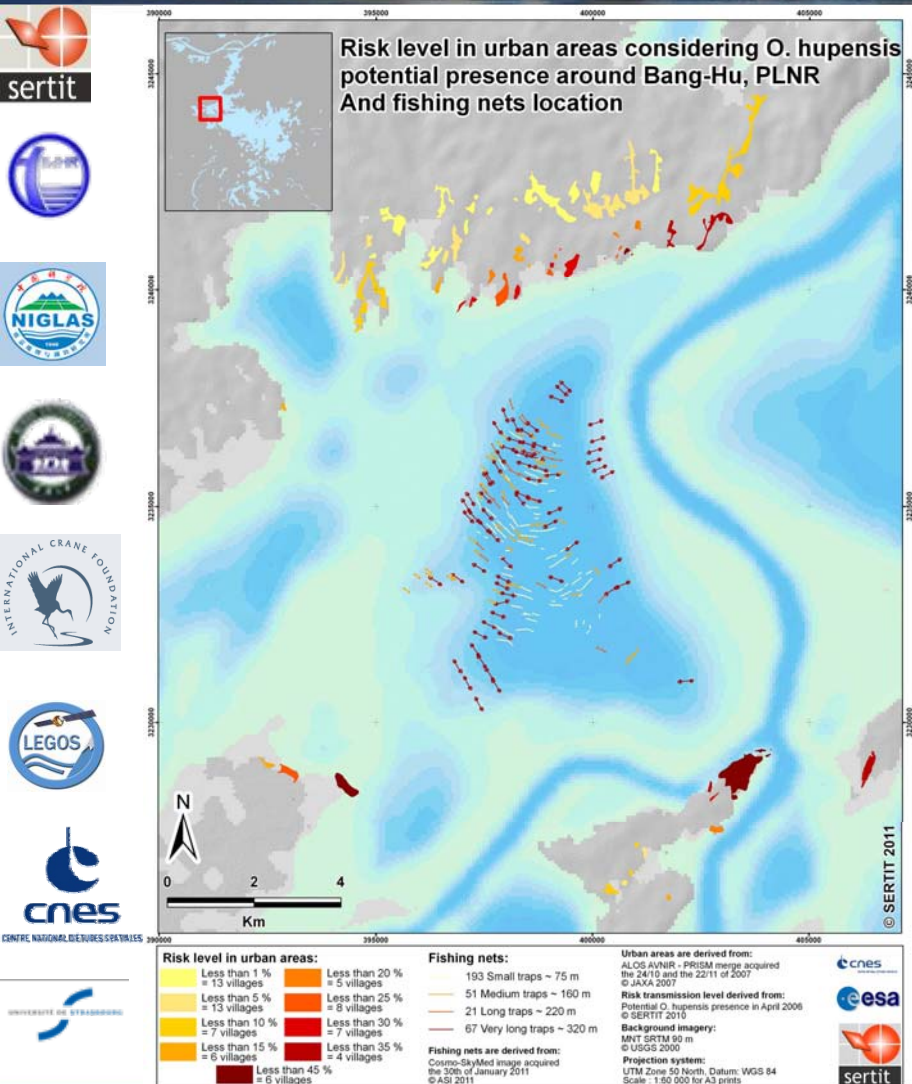


Application to Bang Hu area

Poyang Lake Natural Reserve

Identification of grassland less favorable for grassing activity



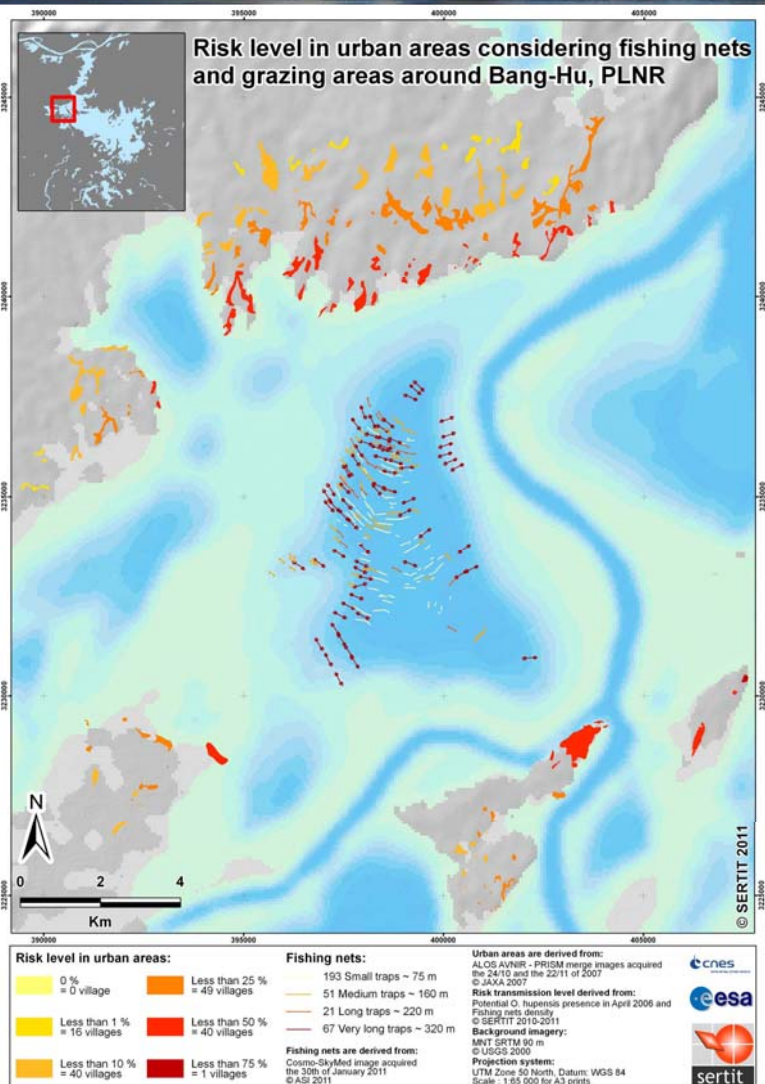


## Application to Bang Hu area

## Poyang Lake Natural Reserve

Level of risk exposure for disease transmission in regards to buffalo grassing activity





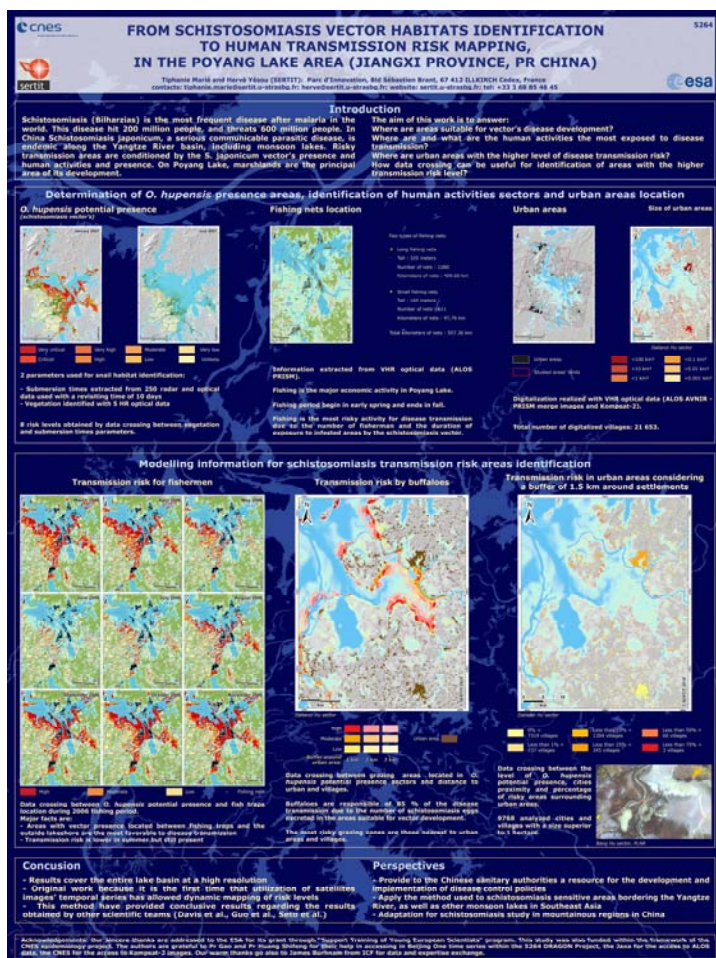
## Application to Bang Hu area

## Poyang Lake Natural Reserve

Level of risk exposure for disease transmission in regards to buffalo grassing and fishing activities



# WP6: EO data and Epidemiology (Schistosomiasis)



For more details and discussion see Tiphanie MARIE at poster session

# Publications

## Symposium

Space Appli Toulouse, June 2010

Bergen July 2010 : 3 papers

Lisboa 2011; Int sympo Altimetry

EGU, Vienna, April 2011: 2 papers

SFPT May 2011

CEOP AEGIS Annual review June 2011

Nanjing Lidar May 2011 (astonishing fail) : 2 papers

## Published - Submitted papers:

Chinese Journal of Oceanology and Limnology

Journal of Huazhong Normal University (Natural Sciences),

Rivers and lakes Journal

Rem Sens Env

Spatial Health

IEEE Transactions on Geoscience and Remote Sensing

# Conclusion

Project reach a cruise speed ⇔ Major advances

Major results for water extent and water height were achieved even if some failure in accessing EO data

For rapid mapping it is remarkable, in a R&D context, capabilities to realize a monitoring in a near real time mode of the Yangtze largest monsoon lakes

Validation of water quality approach, based on Chinese satellite HJ-1A/B , potential from Deimos

Major advances in Epidemiology - Schistosomiasis  
=> Dynamic approach (on a monthly basis) of potential presence of intermediate host

⇒ Great inter annual change due to change in hydrologic behaviors  
⇒ Assessment of risk transmission at village scale

# Thanks very much for your attention

## 谢谢 - MERCI

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