ESA-MOST Dragon Cooperation

中国科技部-欧洲空间局合作“龙计划”

DRAGON 2 FINAL RESULTS AND DRAGON 3 KO SYMPOSIUM

“龙计划”二期总结研讨会暨三期启动会

Detection of Landuse Change and its Relationship to Water Quality Features and Potential Fishing Grounds by Using Multi-Source and Multi- Scale Remote Sensing Imagery - Dr 3 project Id. 10668

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Dr. Andrew Gill, P.I. (UK); Dr Tao CHENG, Co-P.I. (UK),), Prof Sarris Apostolos, Co-I. (Greece),

Presentation contents

- Information on the project's partners and roles
- Project's objectives
- ESA, Chinese and TPM data to be investigated
- Project schedule and planning
- In-situ data measurements and requirements
- Expected field campaigns and periods in P.R. China
- Level and training of young scientists
- Expected results

Partners and roles

Institute of Remote Sensing Applications
Chinese Academy of Sciences
IRSA

浙江中科空间信息技术应用研发中心
Zhejiang-CAS Application Center for Geoinformatics

Prof. Gong Jianhua (PI- China side)

Dr. Abdoul Nasser Ibrahim (Co-I- China)

Dr. Yi Li (Co-I- China)

上海海洋大學
SHANGHAI OCEAN UNIVERSITY

Prof. Liu Qigen (Co-PI- China)

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SHANGHAI JIAO TONG UNIVERSITY

Prof Chunjiang Liu (Co-I – China)

Prof Guangrong Shen (Co-I – China)

FORTH
Institute for Mediterranean Studies

Prof.Apostolos Sarris (Co-I- Greece)

Partners and roles

Institute of Remote Sensing Applications
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浙江中科空间信息技术应用研发中心
Zhejiang-CAS Application Center for Geoinformatics

GIS & Spatial Analysis, DEM data processing, Hydrological Network modelling, Visualization RS & UAV data processing, Digital 3D Qiandao Lake modelling, Thematic & 3D mapping of watershed processes

UCL

Modeling fish ecology & fish behavior, visualization

上海交通大學
SHANGHAI JIAO TONG UNIVERSITY

Analysis of optimal fish habitat; Modeling the influence of land use on water quality and fish habitat

上海海洋大學
SHANGHAI OCEAN UNIVERSITY

Long term sampling & Lab. Analysis of Chlorophyll-a parameter; Ecological modeling of phytoplankton & fish

FORTH
Institute for Mediterranean Studies

Image proc., Change detection


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第三十五行结尾左上角
左下角81
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Data SIO, NOAA, U.S. Navy, NGA, GEBCO
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Project's objectives

- (i) To advance our scientific understanding of watershed processes and their impacts on fisheries resources in lake ecosystems through multidisciplinary case study of Qiandao Lake in Zhejiang Province of China,

- (ii) demonstrate the key importance of remote sensing in monitoring ecological processes, and inland aquatic ecosystems especially lakes and reservoirs

- (iii) Examine the accuracy and the transferability of the remote sensing prediction algorithms to other Lakes and reservoirs ecosystems with similar characteristics

Project's objectives (Con't)

- (iv) Produce thematic maps of environmental & ecological risk, qualitative & quantitative inventory of water & ecological resources, change in LU/LC and their impacts on watershed and Lake ecosystem.

- (v) develop a methodology for dynamically generating and updating those thematic maps of watershed processes, water quality features, fishing grounds, and other thematic maps of ecological risk, that will be of valuable support for any development project in the area.

ESA, Chinese and TPM data

ESA products: ENVISAT MERIS (Qiandao Lake).

- 15 spectral bands
- very suited for chlorophyll information extraction & vegetation monitoring
- However 200m spat. res., too coarse for Qiandao L, adequate for watershed

Use: Features extraction, mapping Qiandao lake basin (580Km^2), monthly map update, detecting seasonality effects over 4 years.

for land cover/land use analysis, classification and thematic mapping, with map update once a month for grasping seasonality effects over 4 years period

Qty: 10 images for model development, 48 images for subsequent monitoring and map update.

ESA, Chinese and TPM data

TPM: ALOS (10m) or QB, FORMOSAT-2 (8m), IKONOS (1m).

- **Use:** Modeling of potential fishing grounds; Generation of thematic maps of *Chlorophyll-a*, *Temperature* & *fishing grounds* extents.

- **Qty:** 3 each for initial algorithms development (1) monthly image of each over 4 years for monthly dynamic map update

ESA, Chinese and TPM data

- **TPM:** Landsat TM (30m), SPOT 5 (10m), TerraSAR-X (1m & 3m).
- **Use:** Land cover/land use classification at watershed scale; more precise reduced-scale studies of watershed processes and their impacts on water quality and fishing resources.
- **Qty:** Multidate Landsat TM 1998, 2005, and 2012; 30 SPOT 5, and 50 TerraSAR-X for initial studies, and once a year for model update. TerraSAR-X (1m) and SPOT-5 DEM data of selected locations in Xin'an watershed. UAV images will be used alongside the high resolution DEMs for very targeted studies of runoff.

ESA, Chinese (CM) and TPM data

Chinese Mission: HJ-1A (100m), HJ-1B (30m)

- **Use:** Modeling and thematic mapping of water quality features and delineation of fishing grounds. The data will also be used for Land cover/land use classification & change detection. For comparison with ESA and TPM mission data and for recommendations on the improvement of the data.

- **Qty:** (3) cloud-free images of each for initial model development and validation, and (1) image of each for dynamic update of thematic water quality and fishing grounds maps on monthly basis.
- 49 HJ-1A and 49 HJ-1B covering periods from 1998, 2005, and 2012 for change detection

ESA, Chinese and TPM data

Table: Summary of RS data to be investigated

Sensor	ALOS	TM	FORMOSAT-2	SPOT-5	TerraSAR-X	IKONOS	HJ-1A	HJ-1B
Qty	100	150	102	100	100	102	200	200

15. Final reporting

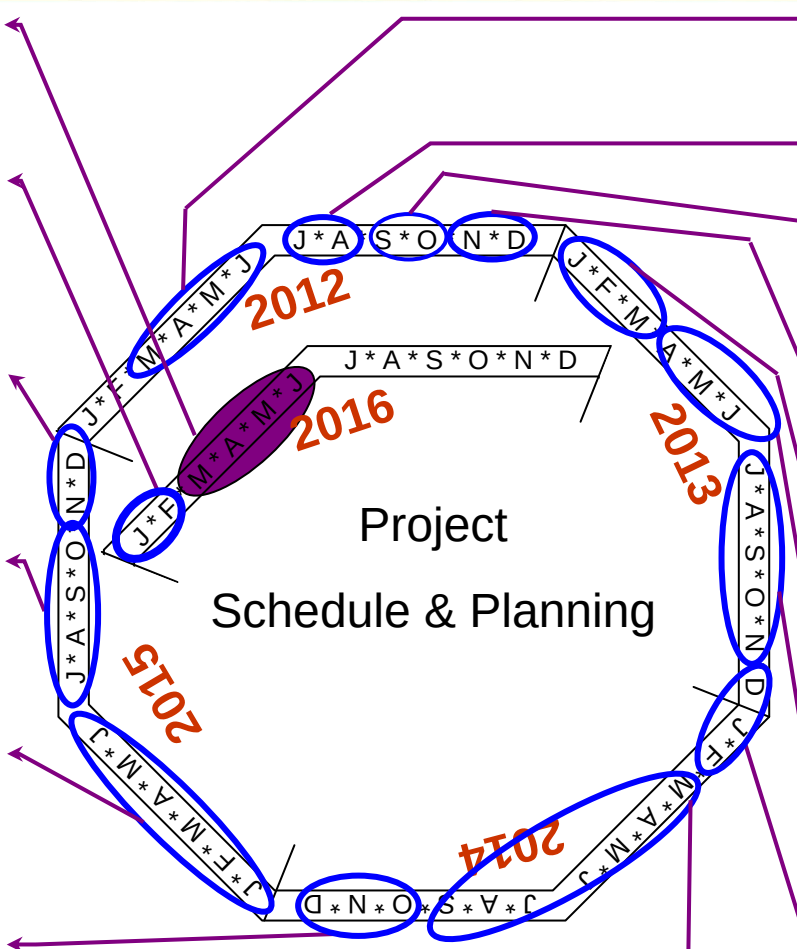
14. Dev. Of system for dynamic generation & update of thematic maps

13. Summary of algorithms, description of applicability & accuracy

12. Impact of Qiandao Lake water quality on fishing grounds

11. Impact eval. of LU/LC on Qiandao Lake water quality

10. Identification of pollution sources at watershed scale



9. LU/LC classification & change detection

1. Organizing existing documents & data

2. Start Order RS data

3. Install & Test WSN for long-term monitoring surface Temp. & Moisture

4. Database for RS & Field data management

5. *Chlorophyll-a* estimate algorithm development

6. *Wat. Temp.* estimate algorithm development

7. Fish ground initial delineation and mapping

8. Image processing for LU/LC info extraction

In-situ data measurements and requirements

- Routine water sampling and Lab analysis of field *Chlorophyll-a* & *Temperature* data (twice/month) using standard procedures (ASTM)
- Water temperature and wind speed data collection by means of wireless sensor networks placed at selected locations
- Sonar profiling of Lake bottom at selected locations based on fish potential
- Collection of UAV image data at very high resolution to help for the interpretation and accuracy improvement of LU/LC classification and change detection
- Collection of fish species data (ecological sampling)

Expected field data collection campaigns

Campaign 1 identification of sampling stations

5 to 20 sampling stations

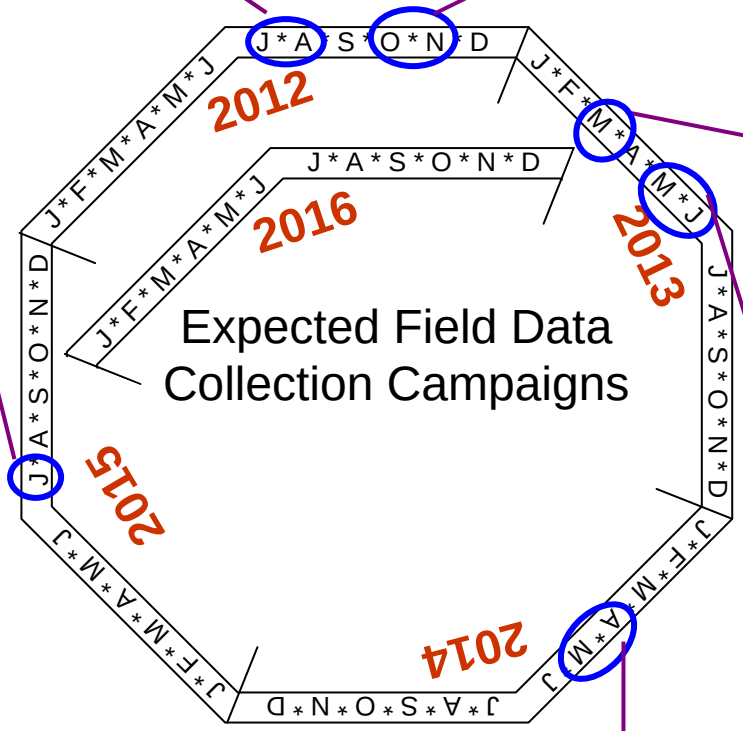
Campaign 2. Installation and testing of wireless sensor networks & GCP collection

Campaign 3. Lake bottom mapping at fish grounds locations by using sonar equipment

Campaign 4. Collect very high resolution UAV images of Qiandao lake and Xin'an river watershed at selected loc.

Campaign 5. Fish species sampling

Campaign 6. Lake water and bottom sediments sampling at 6Kmx6Km grid



Level and training of young scientists

- Dr. YI LI, PhD, (China). Training: Application of GIS and remote sensing in watershed studies; Process-Oriented Data Model for Fuzzy Spatial Objects for new land use classification methods.
- Dr. Yingsen LI, (China). Training: fisheries and environment; accuracy estimation and improvement for fishing grounds delineation and thematic mapping; impacts of watershed processes on fish habitats.
- Chuang Ma, MSc, (China). Training: Site Assessment & modeling through the application of Satellite Remote Sensing and Geographical Information Systems (G.I.S.), Satellite image processing and classification techniques.
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- Mr Berk Anbaroglu, (UK). Training: automated collection of Qiandao Lake ground truth data by wireless sensor network, spatio-temporal analysis of chlorophyll-a in Qiaodao Lake.
- Dr. Andy Chow, (UK). Training: application of satellite data to water work channel network.
- Dr. Jiaqiu Wang, (UK). Training: data organization and spatial data mining.

Expected results

Deliverable	description	Time
Operational Wireless sensor network (WSN)	Operationl system for collection and wireless transmission of Qiandao Lake water chlorophyll density (CHL-a), water surface temperature (ST), and turbidity (NTU). Capable of real-time or on-demand monitoring	M6
Database for water quality parameters of Qiandao Lake	A functional database containing water quality parameters (hourly, daily, weekly, or on demand), which will be made available to researchers, private and public institutions, and selected stakeholders interested with Qiandao Lake watershed monitoring	M12
SCI Publication	Automated system for ground data collection and processing	M12
Chlorophyll remote sensing model for Qiandao Lake	Inversion remote sensing model for retrieval of Qiandao lake water chlorophyll density (CHL-a) from multi-sensor (ALOS, HJ-1B, Landsat TM, and UAV images) and multi-resolution remote sensing data and ground Chlorophyll-a data from WSN.	M14
Temperature remote sensing model for Qiadao Lake	Inversion remote sensing model for retrieval of Qiandao lake water surface temperature (ST) from multi-sensor, multi-resolution remote sensing data (fused HJ-1A, and Landsat TM images) and ground temperature data from WSN.	M16

Expected results

Deliverable	description	Time
Turbidity remote sensing model for Qiandao Lake	Inversion remote sensing model for retrieval of Qiandao lake water turbidity (NTU) from multi-sensor, multi-resolution remote sensing data (ALOS, HJ-1B, and Landsat TM images) and ground temperature data from WSN.	M16
SCI publication	1 to 2 SCI publications	M18
Qiandao Lake Thematic map water Chlorophyll-a density	Map of Qiandao Lake Chlorophyll-a density, that is dynamically updatable daily, weekly, monthly, or on-demand	M18
Qiandao Lake Thematic map of water surface temperature	Map of Qiandao Lake water surface temperature, that is dynamically updatable daily, weekly, monthly, or on-demand	M19
Qiandao Lake Thematic map of water turbidity	Map of Qiandao Lake water turbidity, that is dynamically updatable daily, weekly, monthly, or on-demand	M20
SCI publication	1 to 2 SCI publications	M22

Expected results

Deliverable	description	Time
Qiandao Lake potential fishing grounds map	Map of Qiandao Lake fishing grounds, that is dynamically updatable daily, weekly, monthly, or on-demand	M25
SCI publication	1 to 2 SCI publications	M26
Xin'an river watershed land cover map	Map of Xin'an river watershed land cover, that is dynamically updatable yearly, or on-demand	M32
Xin'an river watershed land use map	Map of Xin'an river watershed land use, that is dynamically updatable yearly, or on-demand	M34
SCI publication	1 to 2 SCI publications	M36
Pollution risk map for Qiandao Lake	Updatable maps of risk for lake water resources pollution	M39
Fishing ground degradation risk map	Updatable map of fish habitat degradation risk	M42
SCI publication	1 to 2 SCI publications	M48

Thank you for your kind attention!

Definitions

The ecosystem is the set of species in a given area that interact among themselves, through processes such as predation, parasitism, competition and symbiosis, and with their abiotic environment to disintegrate and become part of cycles of energy and nutrients. The species of the ecosystem, including bacteria, fungi, plants and animals, are dependent on each other. The relationships between species and their environment facilitate the flow of matter and energy within the ecosystem

Ecological processes The four fundamental *ecological processes* of *ecosystems* are the water cycle, biogeochemical (or nutrient) cycling, energy flow and community dynamics, i.e. how the composition and structure of an ecosystem changes following a disturbance (succession).

Other Definitions

- Ecosystem
  - any geographic area that includes all of the organisms and nonliving parts of their physical environment.
- Biodiversity
  - Biological diversity, or biodiversity for short, refers to the variety of life forms at all levels of organization, from the molecular to the landscape level.

Ecology Definition

"Ecology is the scientific discipline that is concerned with the relationships between organisms and their past, present, and future environments."

Source: Ecological Society of America

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Image proc., Change detection