→ DRAGON 3 PROGRAMME

Brochure 2013

GEN213

THE 2013 DRAGON 3 BROCHURE

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The Dragon 3 cooperation will last 4 years and involves 51 projects to conduct land, ocean and atmospheric investigations using ESA, Third Party Missions and Chinese EO data. There are 700 scientists from 170 European/ Chinese research institutes involved in the joint research projects. The joint teams have formally kicked off their projects at the first Dragon 3 Symposium which took place from 28 and 29 June 2012, in Beijing, China.

ESA and NRSCC have organized a progress meeting in October 2012 in Beijing. At this meeting, Chinese scientists provided details about their project progress and further defined their EO data requirements. For ESA and Chinese EO data, detailed coordination of all requested acquisitions over China is being performed by ESA and NRSCC respectively.

The first Dragon 3 advanced land remote sensing training course was successfully held on 15 to 20 October 2012 hosted by the National Key Laboratory of Microwave Imaging Technology, Institute of Electronics, CAS, Beijing China. The course was attended by 70 MSc. Ph.D. and post-doctoral level trainees. The course was taught by 13 European and 9 Chinese leading Dragon 3 scientists with expertise in optical, thermal and microwave land remote sensing. The course lectures covered theory of land RS and the practical sessions introduced some applications exploiting data from ESA and China EO missions.

The next Dragon 3 annual symposium is to be held in Palermo Italy in June 2013 at which the projects' results will be presented for the 51 projects. In addition Dragon 3 young scientists will be in attendance and will take part in project team meetings and make plans to work with Chinese scientists and institutes as part of their studies.

The next steps during 2013 are the preparation for the advanced training course in ocean remote sensing that will be held at the Chinese University of Hong Kong, P.R. China in October 2013.

Finally the Dragon 3 joint website has been prepared and is the formal reporting portal and information about the programme, partners, projects' executive summaries, satellites, instruments and study areas can also be found. (see http://dragon3.esa.int)

We confirm that the Dragon 3 cooperation has got off to an excellent start and we thank all of the Sino-European investigators for their contribution to this 4 year programme.

We look forward to working with you and the results' reporting in the coming months.

Best regards,

The Dragon 3 cooperation coordinators,

ESA - **Yves-Louis Desnos**, e-mail: yves-louis.desnos@esa.int

NRSCC - **Li Zengyuan**, e-mail: zengyuan.li@caf.ac.cn

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PROGRAMME

2012 ADVANCED LAND TRAINING COURSE

- **Date** 15 to 20 October 2012
- **Hosts** ESA, NRSCC and MITL IECAS - National Key Laboratory of Microwave Imaging Technology Institute of Electronics, Chinese Academy of Sciences, Beijing, China
- **Lecturers** 22 senior scientists in optical, thermal and microwave land applications

2012 training course poster

Ph.D. students, postdoctoral and research scientists interested in land remote sensing from China and other Asian countries were invited to a 6 day training course organised within the framework of the Dragon 3 Cooperation. The course was hosted by MITL IECAS, Beijing, China. The goals were to provide theory and practical sessions on remote sensing for land applications.

There were 9 Chinese and 13 European lecturers who gave lectures on:

- Current and future European, Third Party Mission and Chinese EO satellite missions and access to EO data
- Principles of optical, thermal, active and passive microwave remote sensing for land applications
- EO data processing and products demonstration for: flood mapping and lakes monitoring; dry land crop mapping; land use change detection; forest mapping and parameter retrieval; terrain motion; water resources assessment; glacier mapping & snow parameter retrieval; the assessment of urban development
- Practical exercises with ESA software tools BEAM, NEST, and POLSARPRO

For further information including the daily programme see:

http://earth.eo.esa.int/trainingcourses/LandTrainingCourse2012

The course was attended by 70 trainees:

- Associate or assistant professors
- Senior scientists
- Post Docs.
- Ph.D. and M.Sc. students


1


2

3


4

1. SAR practical class **2.** Poster session at the Library of the Chinese Academy of Sciences **3.** trainees being awarded certificates of attendance **4.** 2012 land training course participants, lecturers and organisers, MITL IECAS, Beijing, China

ACADEMIC EXCHANGES

- **Post graduate training** — Working within the framework of the Dragon cooperation, several European universities have made agreements with universities in P.R. China to train Chinese scientists at Ph.D. level
- **Joint field visits** — A number of project teams have undertaken joint field campaigns in P.R. China to collect ground data and validate their results

European and Chinese project team members' joint field visit in China 2012

POLIMI Italy and Wuhan University, China

The long standing cooperation will continue under Dragon 3 with a programme of post-doctoral research to be undertaken at POLIMI by a Chinese researcher under the supervision of professors Fabio Rocca and Daniele Perissin. Dr. Lu Zhang went from being a young scientist in Dragon-1 to being an Assoc. Prof. in Dragon-3. The research team will focus on undertaking and supervising young scientists' research on the use of multi-frequency X, C and L-band SAR data for terrain motion studies and DEM generation with 6 test sites in China and 1 in Antarctica.

University of Twente, The Netherlands

The research undertaken and ground networks developed under the previous Dragon programmes has been expanded into a wider and more detailed study now encompassing the Third Pole Environment (TPE) and investigating Essential Climate Variables (ECV's) in relation to regional water balance and climate change. An international team of European and Chinese researchers are engaged. There will be a continuation of calibration and validation activities using ground stations on the Tibetan Plateau and Himalayan areas with associated fields campaigns with a focus on calibration of a wide range of ECVs derived from ESA, TPM and Chinese EO satellite observations.

POLSAR Group

The cooperation between MITL IECAS and IETR University Rennes-1 started in 2007 will continue in Dragon 3, with an active programme of seminars, student exchange, co-supervising of students and a research programme using both satellite and airborne Polarimetric SARs particularly with respect to forest height and biomass retrievals and new algorithms for POLSARPRO v5. In 2013, IETR will host a visiting researcher from IECAS, and 2 Ph.D. students from CAF and MITL IECAS respectively.

1. Project id. 10367: European and Chinese team members' joint field visit, Almeria, Spain Nov. 2012

2. Project id: 10609: European and Chinese project team, June 2012 meeting

3. Project id. 10649: European and Chinese team members' joint field visit, Gansu Province, China 2012

DRAGON 3 YOUNG SCIENTISTS

- Supported post graduate training for young Europeans in geo-science applications
- Master of Science, doctoral degrees and research supervised by leading EO scientists in Europe and China
- Study periods, field work, and data collection in P.R. China
- Annual reporting at Dragon Symposia

Field visit by Forest Dragon team members and young scientists, NE China

ESA has allocated resources to Dragon projects for training of young scientists. The applicable period is 2013 to 2016. ESA has placed contracts with the European Institutions participating in the Dragon projects. The types of training supported include:

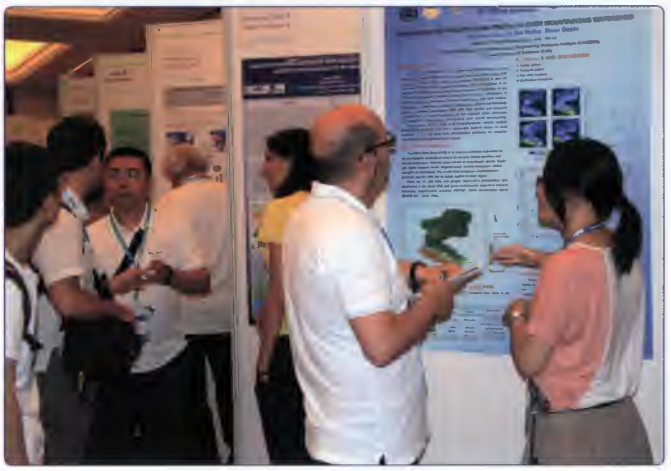
- Doctor of Philosophy (Ph.D.), 3 years duration
- Post graduate Master of Science (M.Sc.), 1 year duration for each year of the applicable period
- Post Doctoral Research (Post Doc.) 24 months with evidence of publication in leading scientific journal or conference proceedings

ESA has requested the following deliverables to set up the contracts and monitor student progress:

1. Proposal to ESA for training support using a proposal template
2. Training Report to ESA (every 6 months)
3. Presentation of progress and results at annual Dragon Symposia
4. Any software developed as a result of the training support

During 2013 to 2016, as part of their research, the young scientists will undertake study periods and field data collection campaigns in P.R. China. They will work with their Chinese counterparts. At the 2013 Symposium in Europe, they will report on their project activities and their latest results.

POLSAR Chinese young scientists and their research professors, Dragon 3 KO Symposium, Beijing

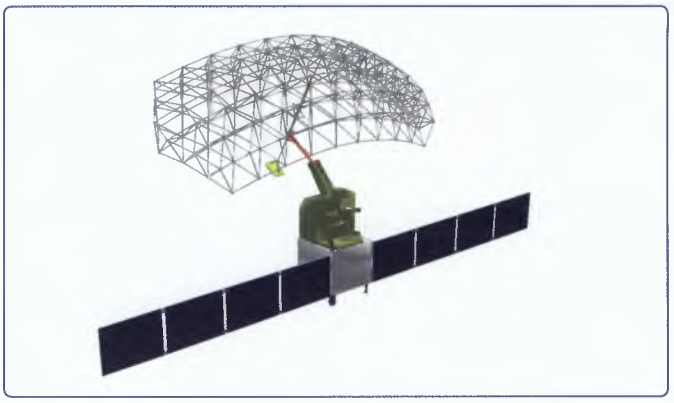


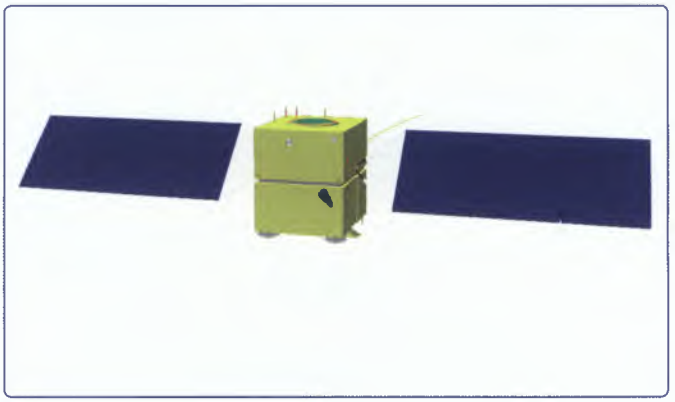
Chinese and European young scientists presenting research results at the 2012 Dragon Symposium, Beijing

- **New SAR data** China launched the HJ-1C satellite (top) successfully on 19 November 2012, which can provide continuity of S-band SAR observation, and form a constellation with HJ-1A/B satellites to provide high-temporal data for disaster and environment monitoring.
- **New optical data** China will launch the BJ-2 satellite (middle) constellation on 2014, which will be composed of 3 small satellites and load two kinds of payloads, PI and MSI, mainly serve for urban planning and natural resource monitoring. In addition, China successfully launched the ZY-1-02C satellite (bottom) in 2011.

Chinese Current EO Satellites & Instruments	
Beijing-1	PI, MSI
CBERS-01/02 or ZY-1	WFI, CCD, IMSS
HJ-1A/1B HJ-1C	CCD, HI, IMC SAR
HaiYang-1 B	COCTS, CZI
HaiYang-2	RA, SCAT, MWR
FY -1D/2C/3A/3B	Various on near polar(FY-1D/3A/3B) Various on geostationary (FY-2C)
Chinese Future EO Satellites & Instruments	
Beijing-2	PI, MSI
CBERS-03/04	CCD, WFII
TanSAT	Measurement of CO_2
CFOSAT	SWIM, SCAT

Chinese EO satellites and EO instruments

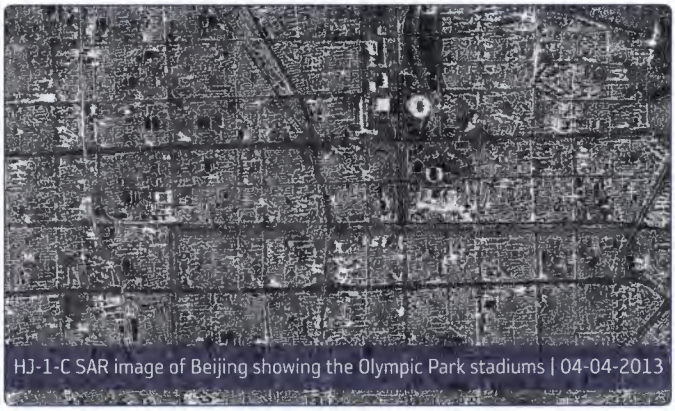




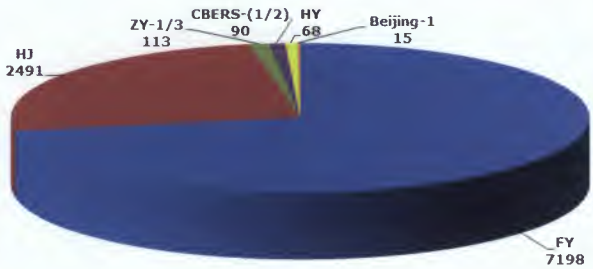
China has launch in 2012 the first of a constellation of S-band SAR satellites. There will be four satellites in the series providing high temporal re-visit capability for the China mainland and coastal areas.

CHINESE EO DATA DELIVERY

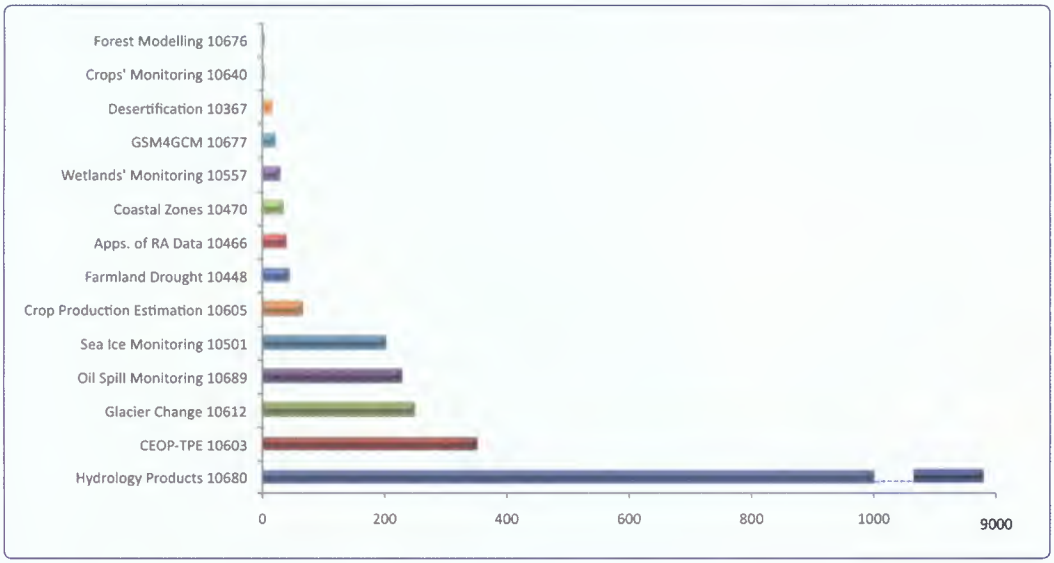
Satellite	June 2013 to April 2013
Beijing-1	15
CBERS-1/2	90
HJ	2491
ZY-1/3	113
FY	7198
HY	68
Total	**9975**



HJ-1-C SAR image of Beijing showing the Olympic Park stadiums | 04-04-2013



Chinese EO data delivery by Satellite



Delivery of Chinese EO data by project

ACCESS TO ESA, TPM AND CHINESE EO DATA

ESA & TPM EO data can be accessed using either on-line catalogues for low bit rate data or via the Earth Observation Link (EOLi) client for access to high resolution data. Users must first register to get an account.

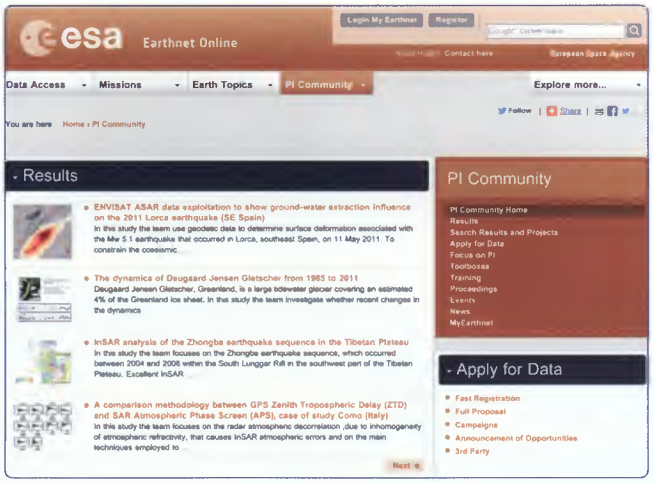
1. To access low and medium resolution ESA & TPM data & products freely available on-line

Access for registered users (with EO-SSO account)

- (A) Visit: https://earth.esa.int/web/guest/pi-community
- (B) Click on login My Earthnet

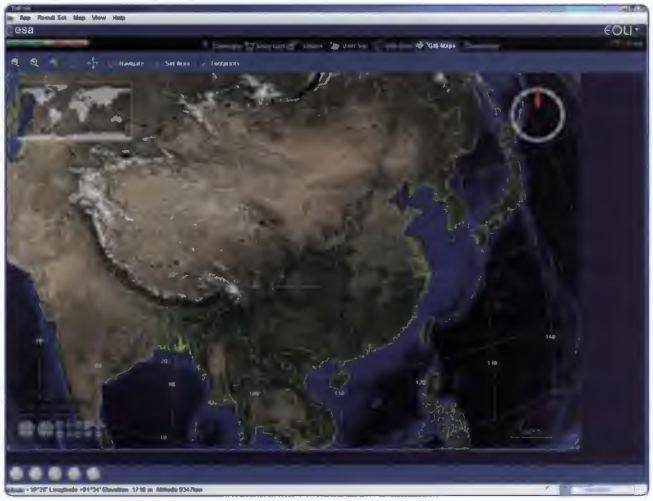
To register as a user, at the PI community website click on "Registration" and provide the requested information (if you do not already have an EO-SSO account)

Once registered, repeat steps A & B above



2. Restrained ESA & TPM data (via EOLI-SA using your dragon 3 PI account)

- Download EOLi at http://earth.esa.int/EOLi/EOLi.html
- Login to EOLi
- Identify scenes required
- Place your order



Access to Chinese EO data

1. Download by internet following registration

A. FY 2 and 3 satellite data, register at with NSMC:
www.nsmc.cma.gov.cn/NewSite/NSMC_EN/Home/Index.html

B. CBERS-01/02 and HJ-1A/1B /1C satellite data, register with CRESDA for Chinese users at:
www.cresda.com/n16/n1115/n1432/index.html

C. HY-1 B & HY-2, register NSOAS for Chinese & international users:
www.nsoas.gov.cn/NSOAS_En/index.html
www.nsoas.gov.cn/NSOAS_En/Products/index.html

2. Data ordering by NRSCC

Provide data requests to NRSCC Dragon office for ordering the following Chinese EO data (email: dragon_caf@163.com)
Beijing-1 (and 2 when operational)
TanSAT CO_2 mission (when operational)

DRAGON UPCOMING EVENTS

ADVANCED TRAINING COURSE IN OCEAN REMOTE SENSING

- **Venue** The course will be hosted by the Institute of Space and Earth Information Science, The Chinese University of Hong Kong (ISEIS, CUHK), P.R. China
- **Dates** From 21 to 26 October 2013
- **Registration**: Registration is free of charge. The course is open to Chinese and SE Asian nationals
- **Sponsors** The course is being sponsored by MOST/NRSCC, Chinese University of Hong Kong and ESA
- **Content**: The lectures and practical sessions shall cover theory and processing of ESA, TPM and Chinese EO data for ocean monitoring and parameter retrievals over China Seas

The training course programme and application form are available from the training course website:

www.iseis.cuhk.edu.hk/OceanTrainingCourse2013

Fok Ying Tung Remote Sensing Science Building, CUHK

2013 DRAGON 3 SYMPOSIUM

After 1 year's activity since the formal programme KO in June 2012, the joint teams will report on their latest results at the 2013 Dragon Symposium. The Symposium will take place from 3 to 7 June 2013 and will be held at the Piazza Borsa conference centre in Palermo, Sicily in Italy. The Symposium will be held over 3.5 days and there will be opportunities for team meetings during the week of the Symposium.

Objectives

- 1st year reporting for all of the dragon teams
- Reporting by the young scientists engaged on the projects
- Team meetings and planning for the 2nd year's research activities
- Up-date from ESA and NRSCC and EO missions and SAR data gap filling

MONITOR

European PI(s)

- ***Prof. Dimosthenis Asimakopoulos***, *Univ. of Athens, Greece*
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- ***Assoc. Prof. Constantinos Cartalis***, *Univ. of Athens, Greece*
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Chinese PI(s)

- ***Prof. Gong Huili***, *Capital Normal University, China*
  gonghl@263.net
- ***Dr. Wang Mengjie***, *Beijing Normal University, China*
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Study Areas A high latitude continental city with a dynamic planning process and environmental challenges (Beijing) and a low latitude Mediterranean city with vulnerability in microclimatic changes (Athens).

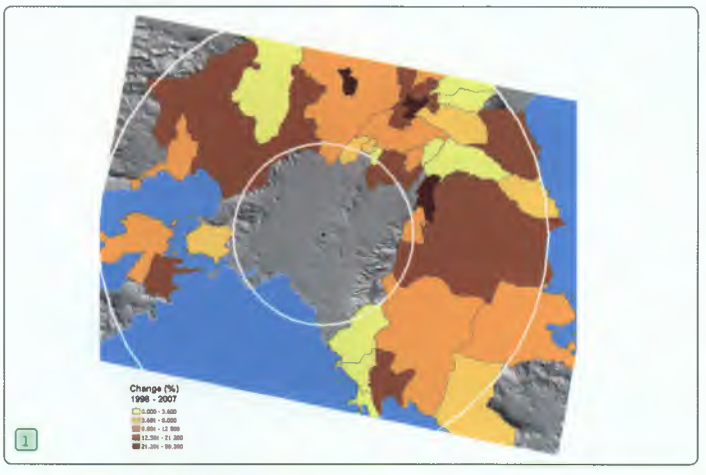
OBJECTIVES

Sustainable urban planning and management increasingly demands innovative concepts and techniques to obtain up-to-date and area-wide information on the characteristics and development of the urban system. In this project, Earth Observation (EO) and urban modeling techniques are used to monitor changes in the urban environment by means of the definition and application of four, to a significant extent interrelated, urban indicators (UI) reflecting: 1) urban fabric and sprawl 2) urban microclimate 3) urban geological hazard 4) urban flood.

PRELIMINARY RESULTS

Urban indicator 1. A time-series of EO data are used to map the dynamics of urban sprawl in the cities, based on the growth rates of the urbanized regions. The different urban land cover features are detected by implementing a machine learning classifier approach. The processing steps include: a) the geometric correction process, b) application of the brightness normalization method (Xu, 2008) so as to handle difficulties in quantifying urban composition, c) shoreline extraction d) polygon masking so as to separate land surface from water bodies, e) application of a suite of machine-learning algorithms to extract urban features and f) production of thematic maps using 4 classes: background, water body, non-urban, urban.

Urban indicator 2. Low and high resolution EO data are used for the estimation of Land Surface Temperature (LST) and subsequently the definition of Surface Urban Heat Island (SUHI) characteristics of the cities, such as development and spatial pattern (heat island or heat sink), growth and evolution (SUHI area in km2), intensity (LST difference observed between downtown and the surrounding countryside). It should be mentioned that as a continuation of the DRAGON -2 project, low resolution data are used in conjuction with downscaling techniques (Stathopoulou and Cartalis, 2009).



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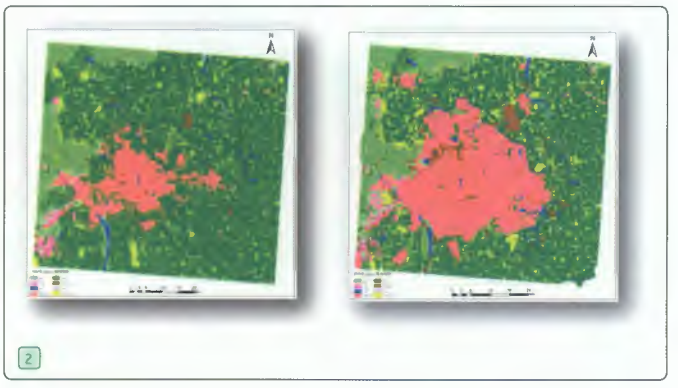

2

1. Urban expansion in Athens - composite image for the period 1998-2007.
2. Urban expansion in Beijing 1988-2009.

YOUNG SCIENTISTS

Young scientists (at postgraduate level) will be involved in urban modeling and image processing as well as in the assessment of EO data from various spectral bands (mostly visible and TIR) and temporal and spatial scales for urban applications.

LAND SUBSIDENCE MONITORING

European PI(s)

- ***Dr. Michael EINEDER***, *Deutsches Zentrum für Luft- und Raumfahrt,Germany*
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Chinese PI(s)

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- ***Dr. ZHANG Jixian***, *Chinese Academy of Surveying and Mapping, China*
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Study Areas Luanchuan, located in the west of Henan Province, China, is a mineral rich area, which has been mined since the 1970's. The topography in this region is steep, with complex landforms and some unstable slopes.

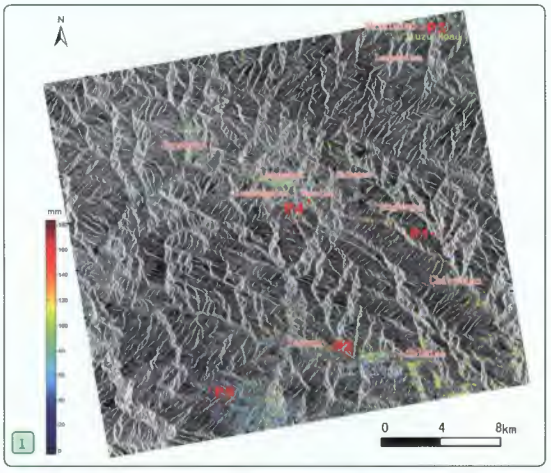
OBJECTIVES

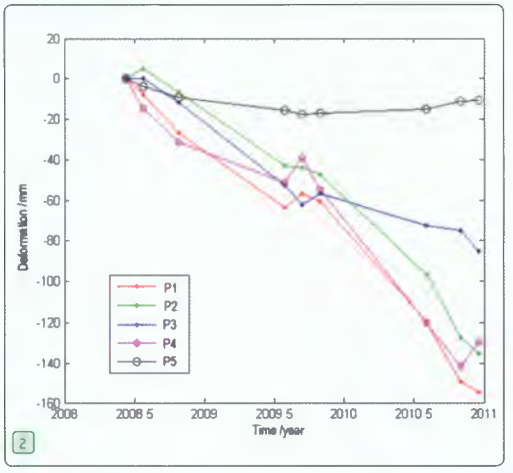
Due to long-term mining activities, severe ground subsidence has taken place in Luanchuan mining area. This region suffered the most serious geological disasters in Henan province. By 2012, geological disasters had occurred in 138 places. We used InSAR technique to map the ground deformation, and conducted a field campaign to investigate the affected area in May 2012. There are no ground measurements of subsidence before. But we found clear evidence of subsidence at places where large deformation is detected by INSAR.

PRELIMINARY RESULTS

To map the ground deformation, small baseline time-series InSAR technique was applied to a small ALOS PALSAR data stack which consists of 9 images acquired between 11 May 2008 and 17 Nov. 2010. The L-band data was chosen because C-band data presents very low coherence in this mountainous vegetation-covered area. 21 interferograms with perpendicular baselines less than 2000m are generated. 3543 high coherence point targets are selected from the average coherence image. By time-series InSAR analysis, ground deformation between May 2008 and Nov. 2010 in Luanchuan mining area is retrieved.

Figure 1 shows the accumulative deformation over coherent points during the two years. From this figure, we can see that the region from Chitudian to Shibapan has suffered the most serious deformation and the largest accumulative deformation reaches -184mm. The southwest mountain area is very stable. In order to analyze the temporal characteristics of ground deformation, 5 coherent points P1-P5 are selected. The evolutions of accumulative deformation of the 5 points are given in Fig.2. During the field investigation carried out in May 2012, many evidences of ground subsidence were found, like wall cracks, ground subsidence in the backyard of nearby residences. Besides many underground mining activities, there are several big fields of open-pit mining (Fig. 3). In conclusion, ground subsidence caused by large scale mining activities has posed substantial threat to the safety of many buildings in this area.





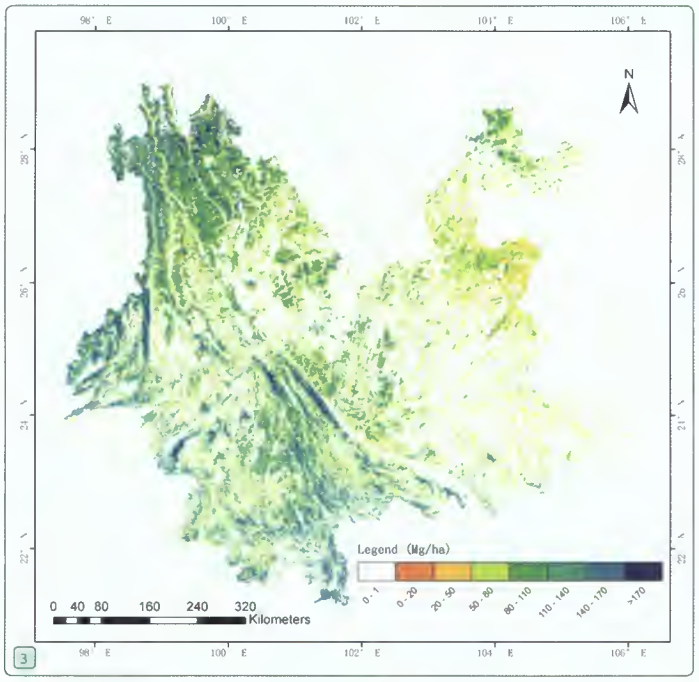
1. Accumulative deformation in Luanchuan mining area from 2008 to 2010

2. the temporal evolutions of estimated deformation on coherent points P1~P5

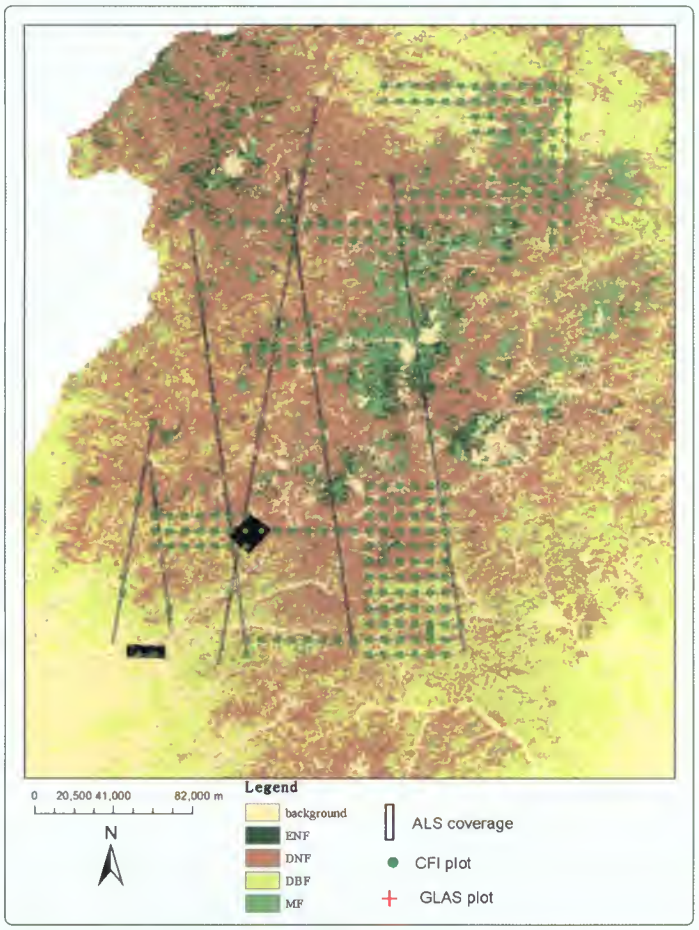
3. Field investigation photo

YOUNG SCIENTISTS

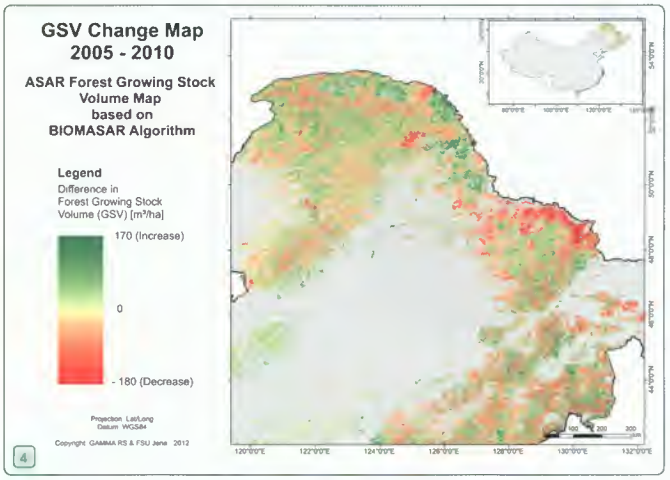
WU Hongan, Ph.D, is with CASM. His research in this project is focused on SAR interferometry and its application to ground deformation monitoring.



3. Estimated Forest AGB in Yunnan Province, China



Category	Dataset
Forest DRAGON Products	ERS-1/2 GSV map 1995 based on tandem coherence
	ASAR GSV map 2005 based on BIOMASAR algorithm
Growing Stock Volume Data	Field Campaign Data 2011
	Literature Databases
	Forest Ecosystem Database
	Provincial Data
	IIASA GSV map 2005
EO datasets, for-est-related	Forest Canopy Height 2005
	MODIS NDVI (multiple years / multiple spatial resolutions)
	MODIS Active Fire (multiple years)
	ATSR World Fire Atlas (multiple years)
	MODIS Burned Area (multiple years)
Land Cover Data	MODIS VCF Per cent Tree Cover (multiple years / multiple spatial resolutions)
	Pan arctic Vegetation Cover
	GLC2000
	MODIS Land Cover 2005
Photo Libraries	Field Campaign Photos 2011
	Confluence Points
	Field Campaign Photos (University of Oklahoma)
Other EO datasets	SRTM DEM 2000
	Landsat Surface Reflectance (multiple years)



4. GSV change map from GSV estimates obtained with the BIOMASAR algorithm using Envisat ASAR ScanSARimages acquired in 2005 and 2010 (top), ground inventory plots and coverage by airborne LIDAR, NE China (left)

YOUNG SCIENTISTS

Three young scientists from China will contribute: Dr. Guo Ying for biomass estimation algorithms development, Dr. Xu Guangcai for Lidar applications in forestry and Dr. Zhang Zhiyu for SAR application in forestry. At the University of Jena, one PhD student shall focus on multi-scale radar-optical synergies for forest monitoring, supported by MSc- and BSc-theses.

URBAN DEVELOPMENT & CLIMATE

European PI(s)

- ***Prof. Yifang Ban***, *Royal Institute of Technology, Sweden*
  yifang@kth.se

Chinese PI(s)

- ***Prof. Gong Peng***, *Tsinghua University, China*
  penggong@tsinghua.edu.cn

Study Areas The study area include nine major urban clusters in China as well as selected Megacities around the world such as Beijing, Delhi, Dhaka, L.A., London, Mexico City, Sao Paulo and Shanghai.

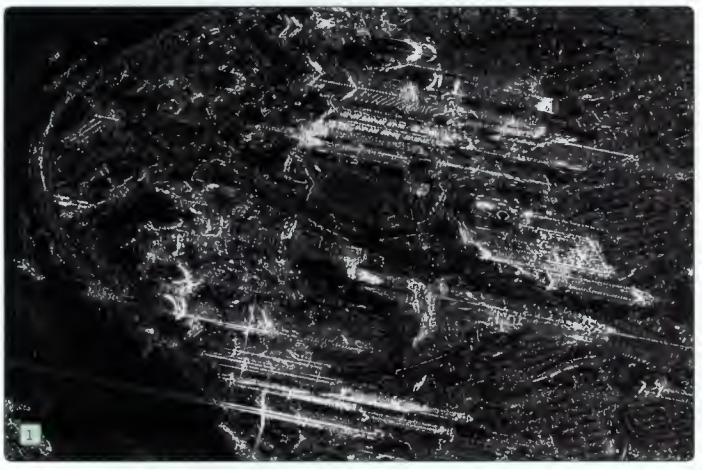
OBJECTIVES

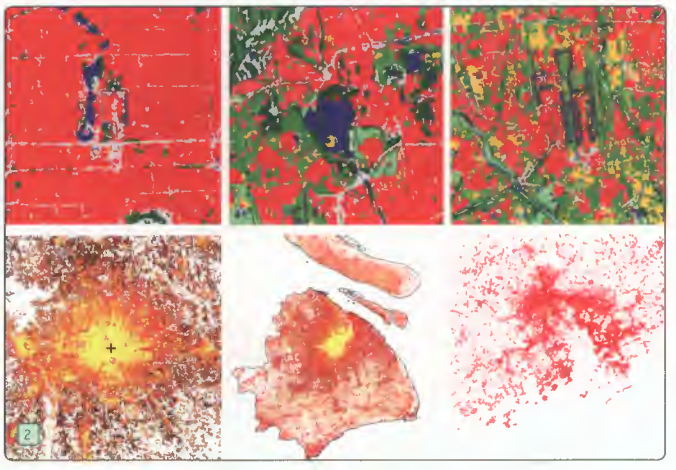
The overall objective of this research is to investigate multi-temporal, multi-scale, multisensor satellite data for analysis of urbanization and climate impact in China and around the world for sustainable urban development. The specific objectives are:

- to develop new algorithms that can rapidly detect urban clusters and land cover changes;
- to monitor urban clusters/urban agglomerations in China and globally using multitemporal multisensor data;
- to evaluate high resolution spaceborne SAR and optical data for mapping spatial configuration of selected urban landscapes;
- to assess what impact urban land cover change has on the environment and climate.

PRELIMINARY RESULTS

The KTH-SEG using an Edge Aware Region Growing and Merging algorithm (EARGM) have been developed and applied to ENVISAT ASAR and HJ-1B Data for urban land cover mapping. The results show that the performance of KTH-SEG is superior than eCognition in defining urban segments and linear features as shown in above Fig. top row (Ban and Jacob, 2013). Fast and efficient methods have also been developed for global urban extent extraction using ASAR Wide Swath Mode data. The preliminary results show that the methods are very good in mapping high-density urban classes as shown in above Fig. 2 (Gamba and Lisini, 2013). TerraSAR-X data were evaluated for monitoring of megacities using a pixel-based classification algorithm to delineate urbanized areas from other land cover types. The algorithm uses the original intensity SAR data in combination with texture information followed by an automated, threshold-based image analysis procedure. The classification algorithm detects high values in areas with a comparatively high texture measure caused by vertical man-made structures, as shown in Fig. 1 (Taubenböck et al., 2012). Change detection methods are being developed for monitoring urbanization using multitemporal SAR data. A non-local means despeckle algorithm and Markov random field are being adapted to improve urban change detection using multitemporal SAR data and the results are promising.





1. TerraSAR-X image over Shanghai;

2. Top: Urban Land Cover Classification in Beijing using KTH-SEG;
lower: Urban Expansion Mapping in Beijing (left), Shanghai (center) and Pearl River Delta (right)

YOUNG SCIENTISTS

Four PhD students and five MSc students will be trained through this project.

FOREST CHANGE MONITORING

European PI(s)

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Chinese PI(s)

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Study Areas Test sites are located in Yunnan and Guangxi Provinces China, and in Thailand, Laos, Cambodia and Vietnam. Most of these sites measure 80 km x 80 km.

OBJECTIVES

The project will develop the use of Sentinel-1 SAR data for monitoring tropical and sub-tropical forests. The emphasis is on the early detection of logging activities to control resource use as part of sustainable development. Another aspect is the quantification of afforestation, an important process which is happening in China to counter the carbon emissions caused by deforestation and other human activities.

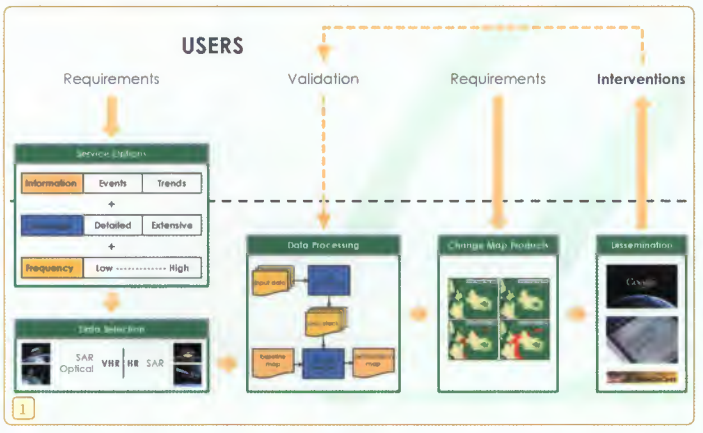
PRELIMINARY RESULTS

Initial work has concentrated on developing a processing chain using SAR data for detecting forest change. This includes data acquisition, pre-processing, change detection, post-processing and validation/ follow-up. Adaptive change detection algorithms have been developed and fine-tuned in work carried out within the framework of the EU FP7 REDD FLAME project.

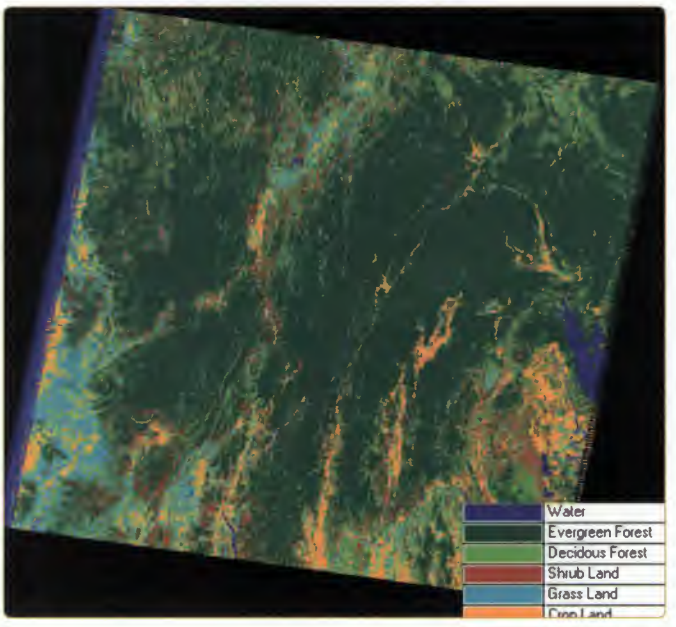
Baseline forest maps have been produced using optical satellite data for 5 test sites, including Sayabouiy Province, Laos. With the failure of Envisat it has not been possible yet to use newly acquired SAR images to start monitoring changes within the forested areas at the test sites. However, there is interest in using RadarSat, TerraSar-X or Cosmos Skymed data.

Once Sentinel-1 data are available the project will focus on the use of strip map dual polarisation 5m x 5m data. At least 1 image every 2 months per test site will be used to monitor forest change and provide this information to the relevant authorities.

The detected changes will be automatically post-processed in a GIS environment for reduction of false alarms, removal of noise and exclusion of non-forest land cover types. During the post-processing, additional information about the nature of the changes will be added, depending on the availability of auxiliary datasets and/or local expert knowledge. From the final change locations, an up- -to-date alarm map will be made.



1. Service concept and processing chain for early detection of deforestation (n.b. developed in the REDD FLAME EU FP7 project)



2. Baseline forest map for test site in Sayabouiy Province, Laos. (From Landsat TM)

YOUNG SCIENTISTS

Feng Qi, Ph.D. Student and Fan Yinglong, Masters Student, Institute of Forest Resources Information Technique, Chinese Academy of Forestry.

Xichao Dong of University of Sheffield/Beijing Institute of Technology will undertake a Ph.D. developing SAR change detection techniques.

CROPS' MONITORING

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Chinese PI(s)

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Study Areas In this project, two sites will be selected, one in North China plain and another in Europe covering the Northern France and Belgium. Each site is covering about 300 km by 300 km area. For the Chinese site, the centre Latitude

OBJECTIVES

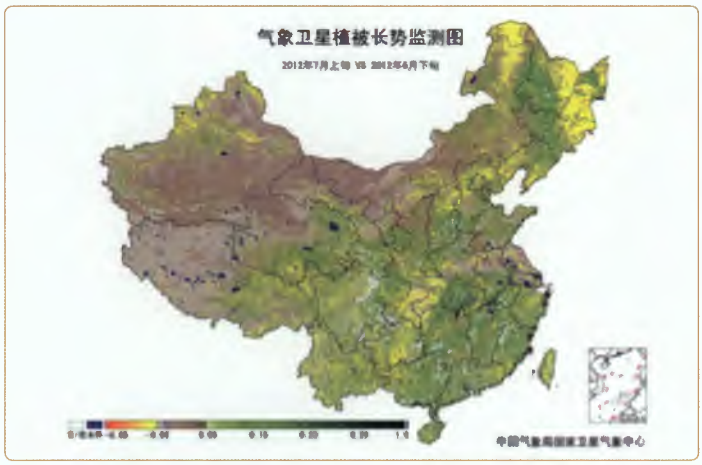
This proposal is to get better crop parameter retrieval by taking advantages of both ENVISAT-MERIS and FY-MERSI and then to enhance the application of satellite data in the crop assessment by the means of the assimilation of the crop parameters retrieved from satellite data into the crop model.

PRELIMINARY RESULTS

FY is the acronym of Fengyun satellite in Chinese or Wind and Cloud in English. FY-3 is the second generation of China's polar-orbiting meteorological satellite. Based on the experience and technology of previous FY-1 series satellite, it has made a great step forward. The FY-3 satellites can obtain global, all-weather, three-dimensional, quantitative and multi-spectral parameters of atmosphere, land surface and sea surface. The first experimental satellite (FY-3A) was launched on May 7, 2008 and the second experimental satellite (FY-3B) on November 5, 2010. The FY-3 series satellites will work for 15 years. Agricultural monitoring is one of key application areas. FY-3A and FY-3B both carry 11 payloads of which VIRR and MERSI are both key valuable sensors for the agriculture monitoring. They have the similar observing capabilities as the NOAA/AVHRR and EOS/MODIS or ENVISAT/MERIS.

With the support of Fengyun Satellite Program, the web based Fengyun Meteorological Satellite data services system was developed in the past years. Since 2005, the domestic and foreign users have been able to access to the Fengyun Satellite data at http://satellite.cma.gov.cn. The left figure above shows the web portal of the Fengyun satellite data services. The web portal provides the users with real-time and historical satellite data that were acquired and are acquiring from the FY-1D, FY-3A, FY-3B, FY-2D, FY-2E, NOAA-15, NOAA-16, NOAA-17, NOAA-18, EOS/TERRA, EOS/AQUA, MTSAT-2, MSG-1 and so on.

The operator of the FengYun Satellite, NSMC is operationally providing vegetation growth monitoring in China. The right figure above showcases vegetation growth condition monitoring with FY-3/ MERSI.



Web portal of the FY satellite data services (above) and the vegetation growth condition monitoring with FY-3/ MERSI (left)

YOUNG SCIENTISTS

In Chinese team, a master student is working on the FY-3 satellite data processing and assimilating satellite data into the crop model for the crop monitoring. In European team, a Ph.D student is working on the satellite data processing and information retrieving.

LU CHANGE & WATER QUALITY

European PI(s)

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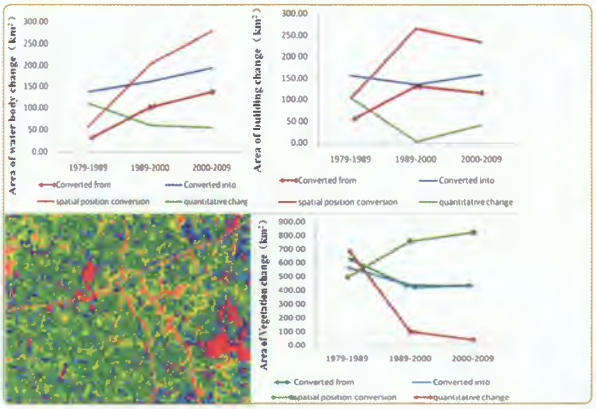
Study Areas Areas of Xin'an River watershed and Qiandao Lake (29º 32` 17.20``N. 118º 55` 39.47``E) as well as wetlands and aquatic ecosystems on Chongming Island (31º 39` 43``N. 129º 28` 41``E)

OBJECTIVES

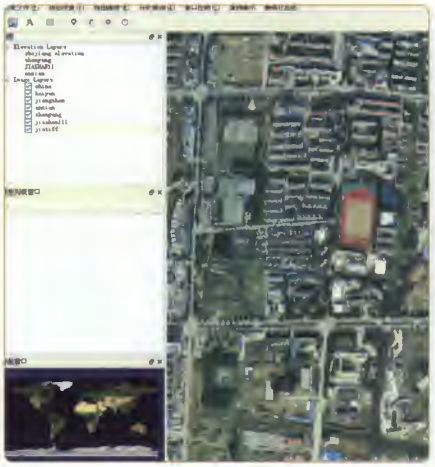
The 4 main objectives are: (i) understanding the impacts of watershed processes on fisheries and natural ecosystems through multidisciplinary study (ii) demonstrate the importance of remote sensing for accurate monitoring ecological processes and natural resources, (iii) Produce pollution risk maps for water and fishing resources, (iv) develop methods and algorithms for dynamic generation and update of various thematic maps to support for any development project in the area study areas.

PRELIMINARY RESULTS

Accurate land use/land cover information from 1979 to 2009 was extracted from Landsat MSS, TM, ETM and ALOS using object-oriented classification. Ground surface temperature (GST) maps were also generated from LANDSAT images. Vegetation, land use/land cover dynamics and the mutual conversions among different land use/ land cover classes were analyzed through the calculation of change matrix derived from classified images and application of land use/ land cover transfer model. There was great absolute changes in the vegetation cover and its associated dynamicity owing to the internal conversion to main land use classes at different time intervals. The decrease in vegetation cover was significant and the ratio of vegetation cover area to the total area of the island had decreased from 71% (1979) to 52% (2009) while Chongming Island expanded by 358km^2 from 1979 to 2009. The results indicate an increase in water area, build-up area and road during the same time period. The change trend of land use/land cover closely related to the requirement of social and economic development besides natural evolution factor. The results suggest that change trajectory of land use/land cover can provide a good quantitative measurement for a better understanding of the spatio-temporal pattern of land cover change and can provide much of the information needed for decision-making.



GST from LANDSAT (17/07/2009) (ground validated) & changes in land use over a 20 year period



Campaigns for GPS & UAV data acquisitions (photo) production of vector data in GIS system (below)

YOUNG SCIENTISTS

There are 5 young scientists in the team, who will be trained at Master and PhD levels in ecology, remote sensing, fisheries, and data mining/visualization.

WETLANDS MONITORING

European PI(s)

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Chinese PI(s)

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Study Areas Even Nen river wetlands (Heilongjiang Pr) are historical AOI, focus will be on the Yangtze reaches, from upstream, Napahai and Rouergai areas, to downstream, Poyang and Dongting lakes as well as Anhui lakes.

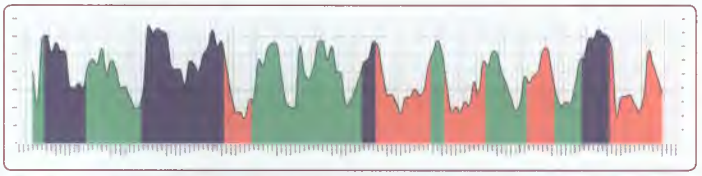
OBJECTIVES

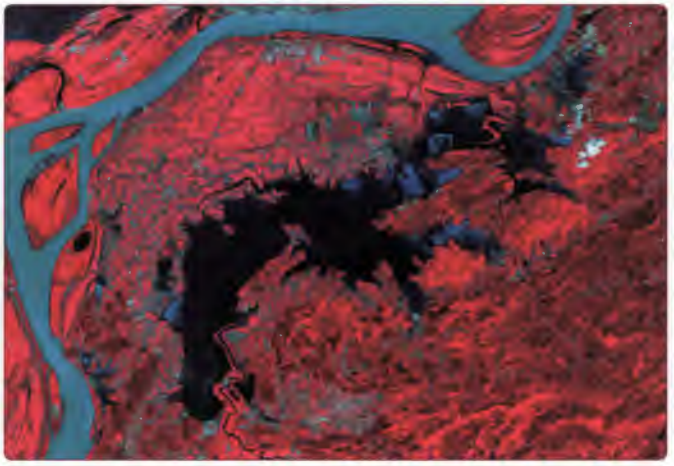
Facing challenges such as, water resources, environmental preservation, and public health, the project's goals, having water monitoring as the corner stone are: 1- large and small inland water bodies monitoring, in terms of extent, height and quality), associated with water resource or storage capacities analysis (from drought to flood); 3 NRT mapping action, 3- wetland ecosystem understanding, 4- epidemiology, as diseases are closely related with water resource dynamic 5- regional interaction and global context.

PRELIMINARY RESULTS

On the continuity of DRAGON 1 and 2, the monitoring of Poyang Lake was maintained on a relative high frequency thanks to the access of a large set of HJ1 completed by CSK and TerraSAR SAR images. An analysis of the water surface of Poyang Lake, 2000-2011 was done, highlighting the periods with excess or deficit of water. A major fact is the apparent increase of drought event, both in summer following the rain period, and during dry season.

Preliminary results obtained over Wuchang lake, Anhui Pr, based on a long term monitoring, 1973-2011 based on EO archived combining with water level and quality and aquaculture information indicate that since 1973, Zizania had been expanding rapidly in Lower Lake, Zizania expansion happened mostly between two flood events. Over the Napahai basin (Yunnan Pr), analysis of HR and imagery appear to show two important trends in wetland distribution since 1980. Until the mid-1990's there appears to be an increase in permanent water bodies and surrounding wetland areas due to the construction of water reservoirs. From the mid-1990's until 2010, wetland areas declined, correlating to an expansion of urban areas, agriculture and impervious surfaces (e.g. large roads, airport). These patterns mirror trends in Black-necked Crane counts in the basin showing increases from the 1980's through the late 1990's and declines since 2000.





Shengjin Lake (Anhui Pr) viewed by HJ-1 on the 3rd of May 2010 (42km) (left top) Poyang Lake water surface variations between 2000 and 2011, Blue water excess, red water deficit Black-necked Cranes feeding (photo)

YOUNG SCIENTISTS

Particular attention is paid on the integration of young scientist in this DRAGON project. Two PhD's students are directly involved on wetland habitat quality and quantity for migrating wildfowl, plus one on water quality. A few MSc are also involved.

CRUSTAL DEFORMATION & INFRASTRUCTURES

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Chinese PI(s)

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Study Areas Long-term and seasonal deformation of the Qinghai-Tibet Railway (QTR) in the Yangbajing Basin and its surrounding area, Tibet; The 24th March 2011 MW 6.8 earthquake occuring in Eastern Burma (Myanmar).

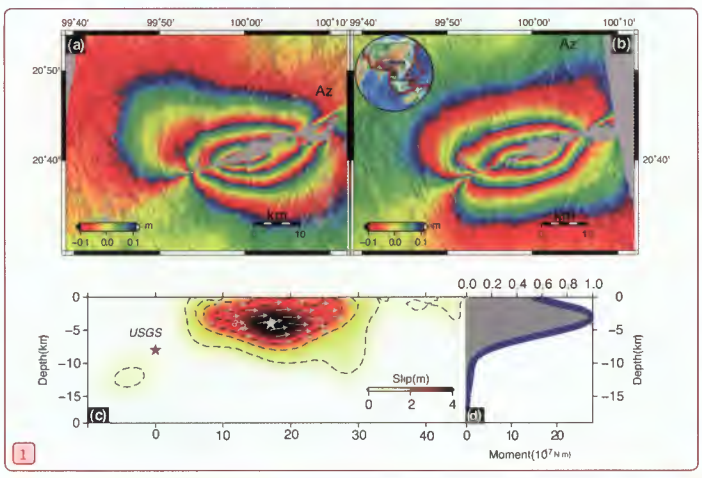
OBJECTIVES

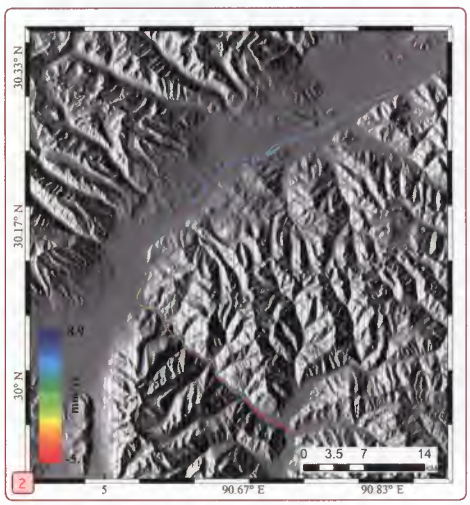
The Qinghai-Tibet Railway (QTR) crossing multiple active faults is prone to earthquakes and other natural hazards, and hence monitoring deformation is crucial to secure the QTR and its passengers lives. On 24th March 2011, a MW 6.8 earthquake struck Eastern Burma (Myanmar), which was the largest shallow event in this region in the past 50 years; determinaton of its source parameters will improve our understanding of future earthquake hazards in this region.

PRELIMINARY RESULTS

The QTR has been in service since 1 July 2006, and 26 scenes of Envisat images collected during the period between April 2006 and May 2010 were analysed to investigate the long-term and seasonal deformation of the QTR in the Yangbajing Basin and its surrounding area, Tibet. Fig. 2 shows the mean deformation velocity along the railway; it is clear in Fig. 1 that the QTR roadbed was relatively stable in the Yangbajing basin but it exhibited obvious subsidence in mountain areas most likely due to permafrost.

Two tracks of ALOS PALSAR images were used to investigate the focal mechanism and slip distribution of the 24th March 2011, MW 6.8 Burma earthquake (Feng et al., 2013). Three different SAR techniques, namely conventional interferometry, SAR pixel offsets and Multiple Aperture InSAR (MAI), were employed to obtain the coseismic surface deformation fields along the ~30 km length of the fault rupture. Our optimal model suggests that the rupture occurred on a near-vertical sinistral strike-slip fault with a strike of 70 degrees, and slip occurred mainly in the upper 10 km with a maximum slip of 4.2 m at a depth of 2.5 km (Figure 1).





1. The 2011 Burma earthquake: (a) coseismic interferogram from ALOS Track 126; (b) coseismic interferogram from ALOS Track 486; (c) slip distribution from InSAR; and (d) the grey area indicates the sum of scalar moment released along strike whilst the blue line shows the normalized slip as the function of the depth. Note: Inset in (b) shows the location of the earthquake.

2. Mean LOS deformation velocity of the QTR in the Yangbajing Basin and its surrounding area during the period from April 2006 to May 2010

YOUNG SCIENTISTS

European side: one 3rd-year PhD working on QTR in Delft and one 2nd-year PhD on earthquakes in Glasgow. Chinese side: one RA, two PhD and one MSc on InSAR algorithms in CEA; one lecturer and three PhD on earthquakes in Wuhan. Two PhD students, Yongsheng Li (CEA), Peng Li and Qiong Li (Wuhan) visited Glasgow in 2012.

SEISMIC ANOMALIES DETECTION

European PI(s)

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Study Areas On the basis of the coverage of the CSELF ground based network, and SWARM and CSES satellites, our research is focused on the areas of Beijing Capital lithosphere, Northeast China and Yunnan province.

OBJECTIVES

The overarching goal of the project is to develop viable methods and techniques for detecting anomalies from electromagnetic data observed by SWARM, CSES and the CSELF ground-based network in addition to characterizing anomalies. Our research is then focused on investigating correlation between characterized electromagnetic anomalies, and how these anomalies are related to seismic activities. The project also plans to employ precursors derived from thermal infrared data observed by CBERS-01&02 and Sentinel-3 satellites to complement electromagnetic anomalies.

PRELIMINARY RESULTS

Detecting electromagnetic anomalies from satellite and terrestrial sources is challenging. The effective methods and meaningful results could be regarded as a cornerstone for scientists to predict seismic events [1]. In the past months, the project partners has focused their research on development of intelligent data pre-processing methods and precursor extraction methods, and employed the methods to study two earthquakes occurred in Taoyuan, Yunan province and in Wenchan, Shichuan province. Fig.1 shows a preliminary analysis result on the Taoyuan earthquake, which were derived from the transformation of magnetic and electric field data from time domain to frequency domain, finally presented in time domain. Fig. 1 shows the corresponding wavelet coefficients, which reveal changes reflected in each of frequency bands. Fig. 2 shows one year maxima lines of NOAA outgoing longwave radiation (OLR) used for a cross validation to the analysis results of the Taoyuan earthquake as presented in Fig. 1. These results are not only compatible with the latest study on OLR observed in the upper ionosphere in [1], they also provide a very good basis for the improvement and continuous development of our methods and techniques [2] and application to SWARM and other satellite data in next phase of research work.