DRAGON PROGRAMME

BROCHURE 2007

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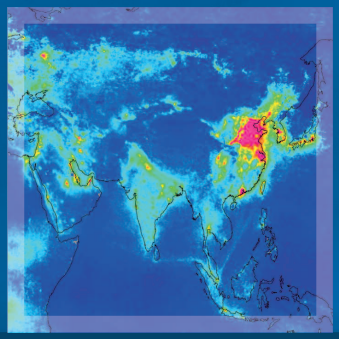
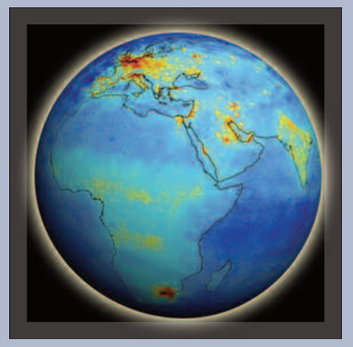
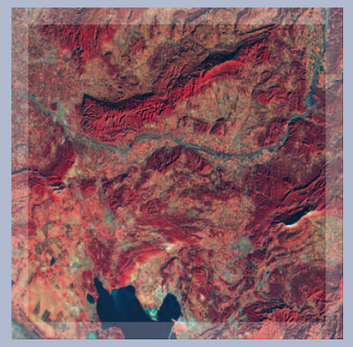
- PARTNERS







DRAGON 2007

THE 2007 DRAGON BROCHURE

This **2007 Dragon Programme brochure** presents the activities undertaken since the Lijiang Symposium that was held in July 2006 in P.R. China. At the Symposium, the joint Sino-European teams and young scientists reported on their latest results for the 16 projects investigating land, ocean and atmospheric applications of ESA EO data in P.R. China. Since then, ESA and NRSCC have organised two progress meetings in Beijing, one in October 2006 and the other in March 2007. At these meetings, Chinese scientists provided details about their project progress and further defined their EO data requirements. Since the formal start of the programme in April 2004, a large quantity of ESA EO data have been made available to all of the projects and detailed coordination of all requested acquisitions over China continues to be performed.

Post graduate training is a key component of the programme, and an advanced training course in atmospheric remote sensing was successfully held at Peking University in Beijing, during 6 days in October 2006. The training course was attended by 55 scientists from 30 institutions from all over China. Five European experts gave lectures and practical sessions on data processing, product development, validation and assimilation of EO and other data from atmospheric instruments on board ESA satellites.

Joint ESA / NRSCC publications such as the mid term publication (SP-611), the 2004, 2005 and 2006 brochures and articles are available via the Dragon web site at http://earth.esa.int/dragon/.

The fourth Dragon annual symposium is to be held in Aix-en-Provence in France from 18 to 22 June 2007 at which the latest project results will be presented for the 16 projects. In addition Dragon young scientists will report on their progress and joint field visits made during 2006 and early 2007.

The next step during 2007 is the preparation for the second advanced training course in ocean remote sensing that will be held at Satellite Ocean Environment Dynamics, Second Institute in Oceanography, Hangzhou P.R. China in October 2007.

We thank all Dragon investigators for their contribution to this 3 year programme. In 2008, the final Dragon Symposium will be held in Beijing. At the same time the proceedings of the final results of the programme will be published on CD-ROM and be made available on-line.

Best regards,

The Dragon programme co-ordinators
ESA - **Yves-Louis Desnos**, e-mail: yves-louis.desnos@esa.int
NRSCC - **Li Zengyuan**, e-mail: zengyuan.li@caf.ac.cn

Background

ESA, together with the National Remote Sensing Center of China (NRSCC), an entity under the Ministry of Science and Technology of the P.R. China, have cooperated in the field of Earth Observation application development for the last ten years. The cooperation has taken on a new momentum with the creation of a dedicated three-year Earth Observation exploitation programme called Dragon (2004 to 2007). The programme formally kicked-off in April 2004, with a Symposium that was held in Xiamen city in P.R. China. The Dragon programme focuses on science and applications development in P.R. China exploiting mainly data from ESA ERS and Envisat missions.

Objectives

The Dragon Programme is targeted to land, ocean and atmospheric investigations in the P.R. China that are outlined by NRSCC in the ESA-MOST Dragon proposal, available at http://earth.esa.int/dragon:

- To promote the use of ESA data from the ERS and Envisat satellites
- To stimulate scientific exchange in EO science and technology by the formation of joint Sino-European teams
- To publish co-authored results of the research and applications development
- To provide training in processing, algorithm and product development from ESA EO data in land, ocean and atmospheric applications

Project Themes

The thematic areas under investigation are as follows:

- EO and sport events
- Agricultural Monitoring
- Flood Monitoring
- Forest Mapping
- Rice Monitoring
- Forest Fire Monitoring
- Oceanography
- Terrain Measurement
- Seismic Activity
- Landslide Monitoring
- Air Quality Monitoring and Forecasting
- Chemistry/Climate Change in the Atmosphere
- Forest Information from POLInSAR
- Drought Monitoring
- Water Resources Assessment
- Climate and Ocean Systems

The Dragon Programme Web Site

http://earth.esa.int/dragon

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PROGRAMME

PROJECTS

PARTNERS

Symposium participants at the Marine Garden Hotel Conference Centre on Gu Lang Yu Island, Xiamen

2004 XIAMEN SYMPOSIUM
P.R. China

Date	April 27th - 30th 2004
Place	Gu Lang Yu Island - Xiamen, Fujian Province, P.R. of China
Hosts	ESA/NRSCC and local authorities
Participants	130 participants (from 60 institutes in Europe and China)
Web	50 presentations available on-line at: **http://earth.esa.int/dragon/Dragon_symposium.htm**

The 2004 Dragon Symposium was the formal kick off for all the 15 projects at which time the joint teams started their work, refined their Earth Observation and other data requests and produced their detailed work plans.
At the Xiamen Symposium, the joint Sino-European teams made presentations on their projects over 3 days. The programme included presentations on the monitoring of land natural resources, on supporting natural disasters management, on studying the atmosphere and oceanography in China.

Xiamen Symposium organising committee

Chinese and European participants to the Dragon Symposium Xiamen April 27-30 2004

2005 SANTORINI SYMPOSIUM
Greece

Date	27 June to 1 July 2005
Place	Santorini Island, Greece
Hosts	ESA, NRSCC and GSRT
Participants	120 from 50 institutes in Europe and China
Web	69 presentations available on line at: **http://earth.esa.int/dragon/programme.html**

DRAGON 2005 Symposium poster

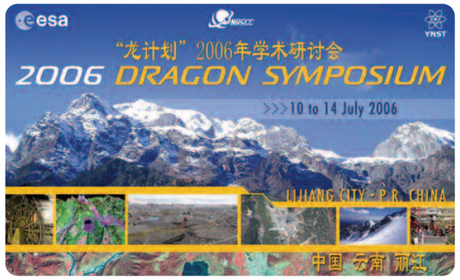
Chinese and European participants to the Santorini Symposium

Group meetings during the Santorini Symposium 2005

NRSC and ESA in cooperation with the Greek Ministry of Development, General Secretariat for Research and Technology (GSRT) organised the 2nd annual Dragon Symposium in Santorini, Greece, from 27th June to 1st July 2005.

The Symposium brought together the joint Sino-European teams after one year's activity. On a project-by-project basis, the teams provided the following:

- Reports on project progress including early results
- Up-dates on the project teaming particularly the inclusion of Greek scientists into the programme and their contribution
- Details on the EO data acquired and investigated after one year's activity
- Details on the in-situ data measurements and requirements
- Information on planning for the next 2 years
- Reports from the young scientists training programme
- Outlines on the progress and status of co-operation within the projects



DRAGON 2006 Symposium poster

2006 LIJIANG SYMPOSIUM
P.R. China

Date	10 to 14 July 2007
Place	Lijiang City, P.R. China
Hosts	Hosts: ESA, NRSCC and YNST
Participants	160 participants from Europe and China
Web	75 presentations on line at: **http://earth.esa.int/dragon/symp2006/programme.html**

NRSCC and ESA in association with Yunnan Science and Technology (YNST) organised the 3rd annual Dragon Symposium in Lijiang city, P.R. China, from 10 to 14 July 2006.

The 2006 Dragon Symposium brought together the joint Sino-European teams after more than two year's activity. On a project-by-project basis, the 16 project teams undertook the following:

- Reports on the progress of each project to date including the latest results
- Details on ESA EO and third party mission data acquired and investigated after two year's of activity
- Details on the in-situ data measurements and requirements particularly joint field visits made in China during 2005 and 2006
- Information on planning for the next year
- Reports from the young scientists training programme (N.B. there were a total of 22 presentations by young scientists)
- Outline the progress and status of cooperation within the projects

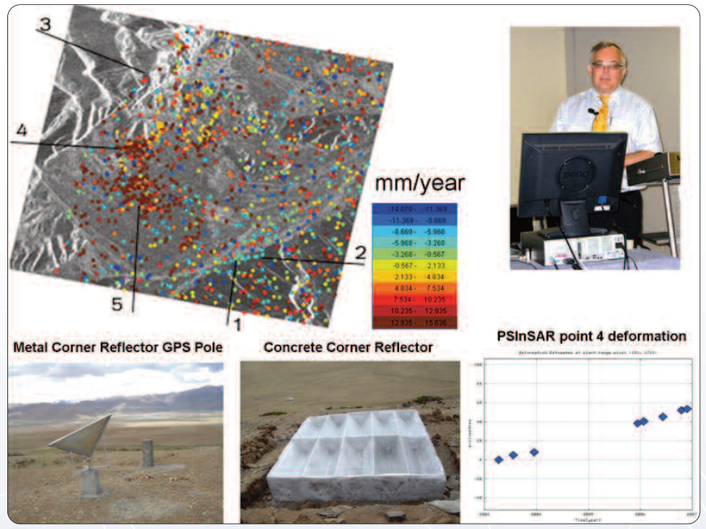
Chinese and European participants to the Lijiang Symposium

Participants during the opening session

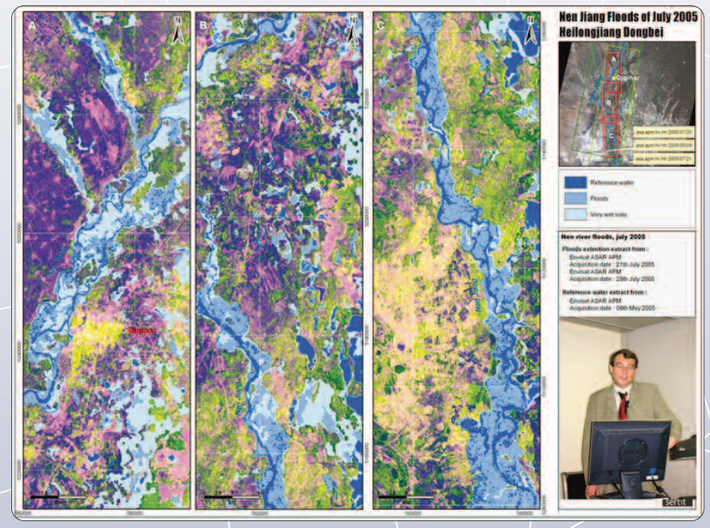
2007 MONTREUX ENVISAT SYMPOSIUM
Switzerland

Date	23 to 27 April 2007
Place	Montreux Conference and Exhibition Centre, Switzerland
Hosts	ESA
Participants	Dragon scientists and young scientists
Web	13 presentations in a dedicated session: **http://www.envisat07.org/overview.htm#D4E1**

The opening of the Montreux Symposium Dragon session by chairmen, Prof. Zhang Jingfa (left) and Yves-Louis Desnos (right)



Dragon lead investigator Prof. Jan-Peter Muller presenting results on monitoring the motion of the Dangxiong fault on the Tibetan plateau using PS InSAR



Dragon investigator Herve Yesou presenting maps and work on Envisat NRT actions in support of large area flood mapping in P. R. China

Session 4E1
An overview of the programme, its achievements, training and documentation and results was presented. There were 3 presentations on flood mapping using Envisat ASAR NRT data, terrain motion applications on the Tibetan plateau and rice modelling and monitoring. Methane is produced as a result of rice cultivation and models of methane production over China have been run for 45 years.

Session 4E2
There were 5 presentations by Dragon Young scientists. The first two were on forest applications in NE China and included the background and science to the generation of the forest biomass map as well as the use of ASAR AP data for forest mapping. The use of ASAR PSInSAR techniques and methods to increase temporal sampling were demonstrated for Shanghai. The fourth presentation was on the flood dynamics of Poyang Lake as derived from Envisat low and medium resolution products. The rice presentation provided an update on the use of ASAR medium and higher resolution AP data for mapping rice area, varieties, yield potential and management practices.

Session 4E3
The first presentation continued Dragon young scientists and covered land use / land cover mapping in the Zhanzhou region of Fujian province. There were two presentations on the exploitation of MERIS and ASAR data for ocean applications. The last presentation was on air quality monitoring in China. A consequence of rapid development and increased industrial output in China has been coupled with an increase in atmospheric pollutants with 4 major hotspots identified.

The papers will be available in the Symposium proceedings which will be released on CD-ROM SP-636).

Haiyuan fault near longitude 102.75º. Left-lateral accumulated displacements shown by arrows *Courtesy F. Métivier, IPGP*

Seismic and Inter-seismic Deformation Across Two Main Strike-slip Faults of Tibet (The Kunlun and the Haiyuan Faults) from conventional and Permanent Scatterers INSAR

Dr. Sun Jianbao, e-mail: suninsar@yahoo.com
Dr. Cécile Lasserre, e-mail: Lasserre@geologie.ens.fr

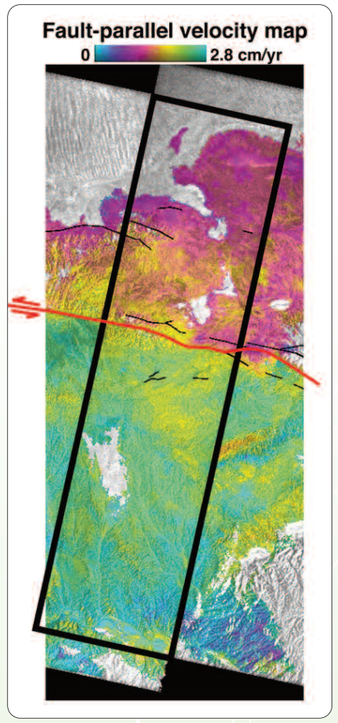
Prof. Xu Xiwei, Prof. Evangelos Lagios,Prof. Shen Zhengkang, Ms. Liang Fang

Seismic and Interseismic deformation along the Kunlun fault (PI: Sun Jianbao)
Long time series ERS and Envisat ASAR InSAR and PS InSAR will be used to investigate potential slip rate along the Dongdatan-Xidatan segment, the possible triggering effects of the Manyi earthquake on the Kokoxili earthquake, as well as the effects of the Kokoxili earthquake on the seismic hazard potential of other segments of the Kunlun fault.

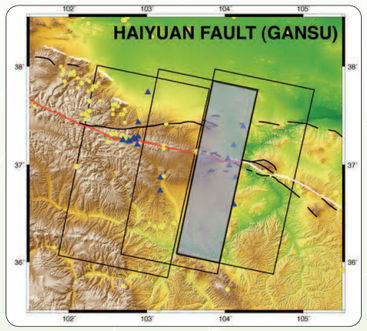
Interseismic deformation across the Haiyuan fault (PI: C. Lasserre)
The interseismic strain across the Haiyuan fault system using the Permanent Scatterers technique will be mapped. Standard DInSAR processing methods revealed poor phase coherence on test interferograms, due to the loess cover. GPS data across the fault will provide control points on the InSAR measurements.

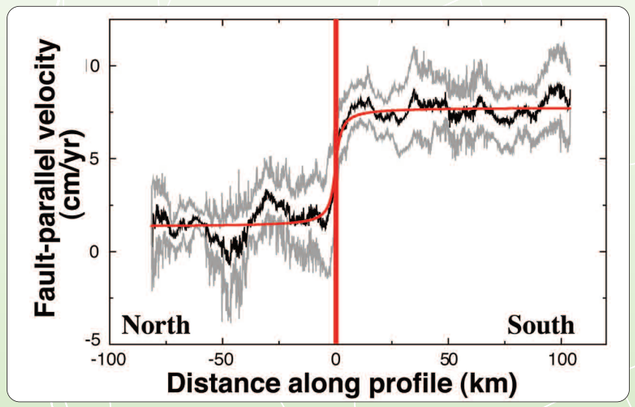
Northwest end of Xianshuihe Fault (PIs: E. Lagios and Shen Zhengkang)
The fault is seismically active at present with around 9-10 mm/yr left-slip across the Xianshuihe fault. A rate measurable by INSAR with a 4-5 year time scale if the coherence is high enough between SAR acquisitions. The InSAR results will be compared with GPS data collected from the Crustal Motion Observation Network of China between 1998 and 2001.

Yadong-Gulu Rift (PIs: E. Lagios and Shen Zhengkang)
This rift system is the most important in southern Tibet. It has a high West –East extention rate (about 5-7mm/yr) according to the recent GPS studies.



Fault-parallel velocity map and profile across the Haiyuan fault (Gansu, China), derived from ERS SAR data stacking. 7 mm/yr of interseismic strain accumulation is observed (Cavalié et al., in prep., 2007)





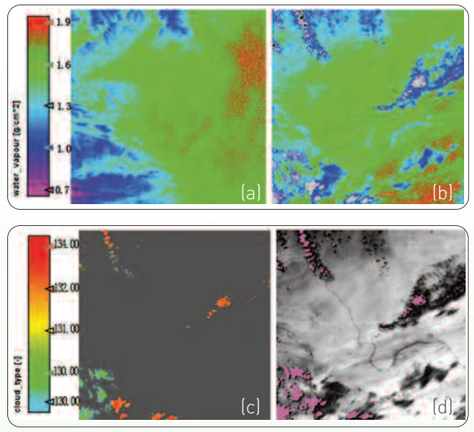
Monitoring the Landslides in Three Gorges Area by Using Corner Reflector Differential SAR Interferometry

Prof. Jan-Peter Muller, e-mail: jpmuller@ge.ucl.ac.uk
Prof. Zeng Qiming, e-mail: Qmzeng@pku.edu.cn

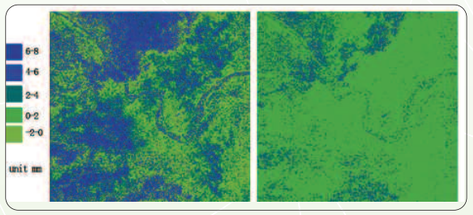
Dr. Hao Xiaoguang, Dr. Li Zhenhong, Dr. Liu Jianguo, Dr. Ye Xia,
Prof. Zhang Jingfa , Prof. Ouyang Zhuxi

Photo showing the new urban developments in Wushan located on steep reinforced slopes recorded on May 1st, 2007

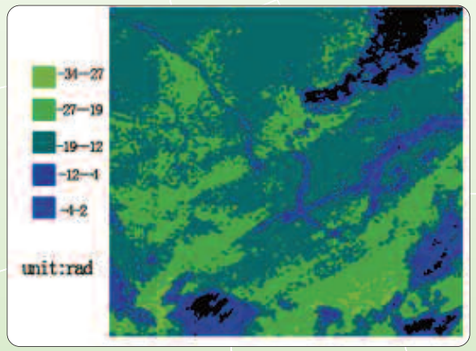
Atmosphere Correction Result refined in Yangtse River Region



(a) MERIS water vapour image of 15th Mar 2007; (b) MERIS water vapour image of 19th Apr, the gray areas are acquired under cloudy conditions; (c) MERIS cloud type image of 19th Apr 2007; (d) a cloud mask colored by maroon is applied to the water vapour image of 19th Apr



(left) the interferogram before tropospheric correction, STD is 1.36mm (right) the interferogram after tropospheric correction, 0.62mm



zenith path delay difference map

Over the last year, significant progress has been made on a number of different fronts including:

- atmospheric correction of the ENVISAT-ASAR interferograms using MERIS (residue correction reduced from 1.36mm down to 0.62mm)
- assessment of CR types and location characteristics (e.g. slope) to maximise their detection using SAR amplitude data
- measurement of CR position of 1-2mm per annum shown
- creation of 30m DEM of the entire Yangtze river form Yichang (dam location) to Wanzou by fusing ASTER and SRTM
- processing of tens of interferometric pairs although only 5 with Bp<100m
- studied the source regions for sediment (Jinsha river) and found that deforestation following forest fires most likely responsible
- mapped the development of new urban areas where relocation of over a million people had occurred

Since the beginning of the project, no significant landslides had occurred until 25 April 2007 where one CR is located. Results will be shown at the Symposium.

European and Chinese Agricultural project investigators discussing field data collection during a field visit to Zhangzhou on March 21, 2006

Agriculture and Land Use: ENVISAT Applications in Fujian Province

Prof. Shaun Quegan	email: S.Quegan@shef.ac.uk
Prof. Wang Qinmin	email: Qmwang@fzu.edu.cn

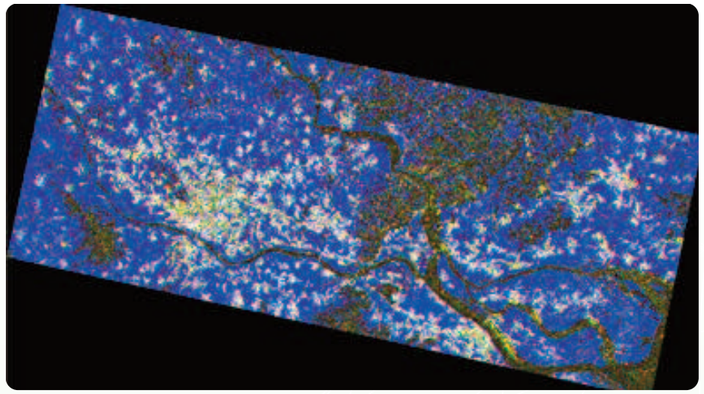
Dr. Wang Xiaoqin, Mr. Ling Feilong, Dr. Thuy Le Toan, Prof. Li Zengyuan, Dr. He Guojin, Prof. Lan Zhangren, Dr. Chen Henglin, Ms. Zhu Qingdong

The objectives of the project are to develop and validate methodology using Envisat data for three main issues:

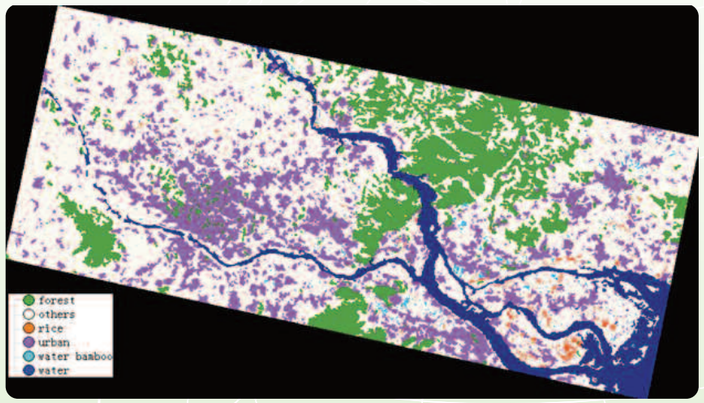
- Land use, land cover classification, with emphasis on agriculture and forestry, in interaction with the related Dragon application projects.
- Agricultural monitoring by retrieving crop and soil biophysical parameters.
- 10 year land use, land cover changes using archived ERS SAR data from the 1990s and up-to-date Envisat ASAR data.

Results and achievements

In the past 3 years of the Dragon programme, both Chinese side and European side have developed several different methods for crop mapping, particularly for rice, water-bamboo and banana mapping. Experiments on rice mapping were made by using ASAR AP data for different rice cycles in 2004, 2005 and 2006 at Zhangzhou and Fuzhou test sites. Agricultural crops were mapped by mainly using their temporal changes in backscatter in SAR images. The derived processing chains and classification results were reported in 2006. Since then, the project team has been investigating the use of ERS SAR and ASAR Interferometric Land Use (ILU) composites for land use classification and crop mapping as well as 10 year land use change detection. A parcel based classification methodology has been used in which parcel boundaries are extracted from high resolution optical imagery. The parcel boundaries are then used to extract mean parcel statistics in the SAR coherence and intensity images. Classification is based on mean parcel signatures. An example of an ASAR coherence composite is provided (Figure top). Land cover/land use change in the Zhangzhou area between 1995 and 2005 has been derived using ERS-1/2 SAR from 1996 and ENVISAT ASAR data acquired in 2005 (Figure bottom).



ASAR and ERS SAR coherence composite: Red: ASAR IMS coherence 17 Apr 2005 and 4 Sep 2005, Green: ASAR IMS coherence from 31 Jul 2004 and 4 Sep 2005, Blue : Coherence from ERS tandem pair 12 Mar 1996 and 13 Mar 1996



Zhangzhou-classification-map: Land cover, land use classification map of Zhangzhou in 2005 by using ERS and ASAR

Rice monitoring in China

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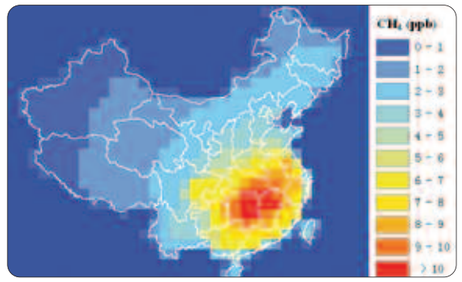
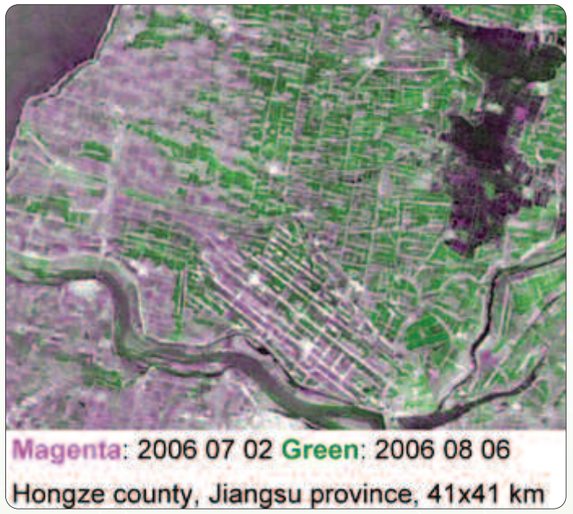
Dr. Tan Bingxiang	email: Tan@forestry.ac.cn

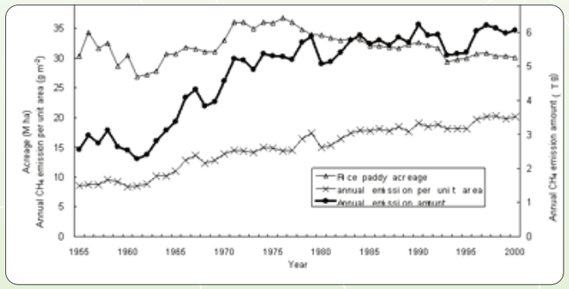
Dr. Alberte Bondeau, Mr. Alexandre Bouvet, Prof. Li BingBai, Prof. Li Zengyuan, Prof. Shaun Quegan, Prof. Huang Yao, Dr. Zhang Wen, Mr. Yang Shenbin, Dr. Sun Wenjuan, Mr. He Wei, Prof. Shao Yun



Model results show high seasonal tropospheric CH_4 enrichment due to rice cultivation (Courtesy of Institute of Atmospheric Physics, CAS, Beijing)



Monitoring of mid-season drainage using WSM data (VV). In this image, fields in magenta are flooded rice fields and fields in green are rice fields with low VV backscatter in July. This may correspond to temporary drainage that occurs approximately 3 weeks after transplantation



Modelling results from 1955 to 2000 – in the period 1955 to 1980 methane emissions were significantly increased due to implementation of the double cropping particularly in SE China. After 1980, methane emission from rice paddies remained stable

The overall objective is to refine remote sensing methods and rice production and biochemistry models to monitor changes in rice cultivation and to evaluate their impacts on rice production and Green House Gases (GHG) emissions in China.

For monitoring rice cultivation and production, remote sensing methods have been developed and assessed using data acquired at the main test site in Jiangsu province in 2004 and 2005, and tested at other sites in 2006. The following methods have been developed:

1. Mapping of rice areas using ASAR APP and WSM (reported '05 and '06)
2. Monitoring mid season drainage using high temporal WSM data (see Figure top)
3. Retrieving rice biomass using polarisation ratio from ENVISAT APP
4. Mapping of cropping system (single-double crop per year) using SPOT VGT.

For monitoring GHG emissions (CH4), a biochemistry model (CH4MOD) has been run for a 45 year period (see Figure at top of page and Figure bottom). Data of rice cultivation including plantation area, grain yields, rice straw and farm/green manure incorporation was collected on provincial scale year by year from 1955 to 2000. Daily air temperature of more than 750 meteorological stations all over China were obtained from http://cdc.cma.gov.cn. Soil sand percentage data, rice (single and double rice rotations) calendars were also acquired. Spatial pattern analysis has also been performed and shows that high methane emission were in Hunan, Hubei, Jiangxi, Jiangsu, Guangdong, Guangxi, Zhejiang and Anhui provinces. In the next phase of the work model results will be compared to methane concentrations observed from satellite observations particularly SCIAMACHY.

Mixed forest of the Liangshui Natural Reserve of Heilongjiang 2005), one of the test areas for the project in NE China

The Forest DRAGON - Forest Related Development of Radar Applications for Geomatic Operational Networks

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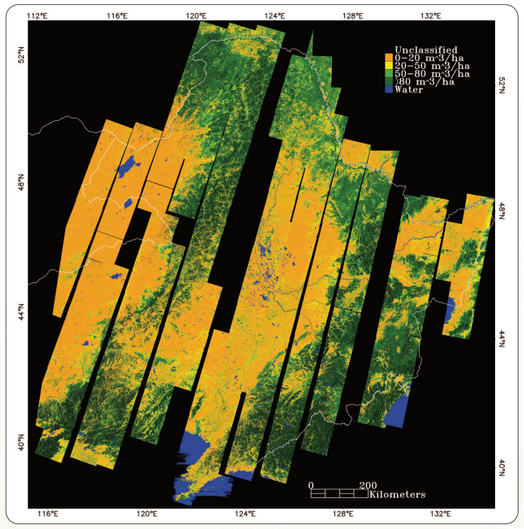
Prof. Li Zengyuan	email: zengyuan.li@caf.ac.cn

Dr. Chen Erxue, Dr. Stefan Erasmi, Dr. Thuy Le Toan, Dr. Jens Nieschulze, Dr. Pang Yong, Dr. Achim Roth, Dr. Maurizio Santoro, Dr. Urs Wegmüller, Dr. Andreas Wiesmann, Mr Oliver Cartus, Mr Tian Xin, Ms Zhu Haizhen, Dr Li Xiaosong, Mr Julien L'Hermitte

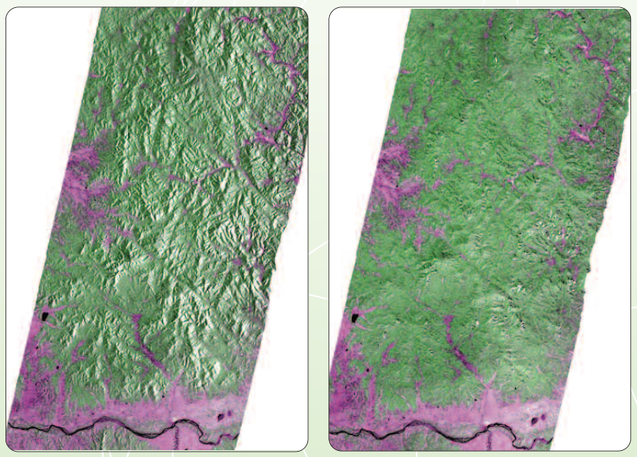
The objective of the Forest DRAGON Project is the development of algorithms for classification of Synthetic Aperture Radar (SAR) data and interferometric SAR (InSAR) data, aimed at the generation of forest and biomass maps at regional level for the main forested regions of China.

During the third project year the activities have focused on the consolidation of the data processing schemes and the retrieval algorithms for the generation of forest cover and biomass maps for Northeast China (top Figure). The generation of a wall-to-wall forest biomass map is based on a dataset of multi-temporal ERS-1/2 tandem coherence acquired between 1995 and 1998. 223 coherence images have been ingested in a fully automatic retrieval scheme based on a combination of the SIBERIA Project classification algorithm and the Interferometric Water Cloud Model, and aided by the MODIS Vegetation Continuous Fields (VCF) product.

Map update is pursued with multi-temporal ENVISAT ASAR AP images in HH/HV mode acquired between fall 2004 and spring 2005. Accurate geocoding, SRTM-based radiometric correction to avoid classification errors due to topographic features, and masking of layover areas has been performed for a dataset including more about 900 images covering the study region (bottom Figure shows examples). This enhanced dataset is used to produce a forest map for finally accurately identifying cover changes occurred after the ERS acquisitions.



Forest biomass map of Northeast China (preliminary version) based on ERS-1/2 tandem coherence data from 1995 to 1998 (Courtesy of Oliver Cartus, FSU Jena)



Terrain geocoded ENVISAT ASAR AP frames before (left) and after (right) consideration of the terrain topography in the normalization of the backscattering coefficient. Date: 20040929, Track number: 2418, Colour composite of HH(R)/HV(G)/HH(B). (Author: Tian Xin, CAF)

Forest Fire Monitoring Demonstration by Satellite Remote Sensing in China

Prof. José-Luis Casanova	e-mail: Jois@latuv.uva.es
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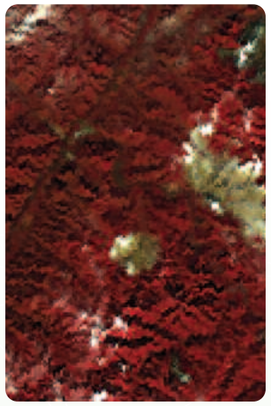
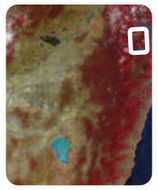
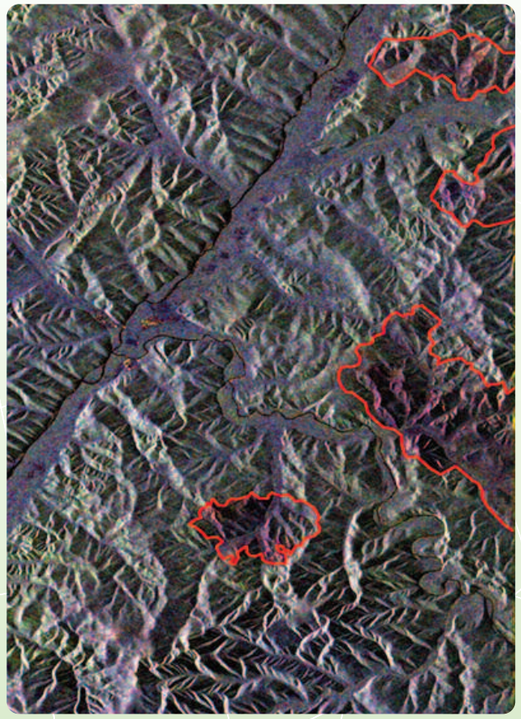
Dr. Johann G. Goldammer, Dr. Federico Gonzalez-Alonso, Dr. Charalabos Kontoes, Prof. Li Zengyuan, Ms. Cristina Moclán

In the P.R. China, the main fire regions are in Inner Mongolia, the montane-boreal forest in Northeast and tropical South of the country





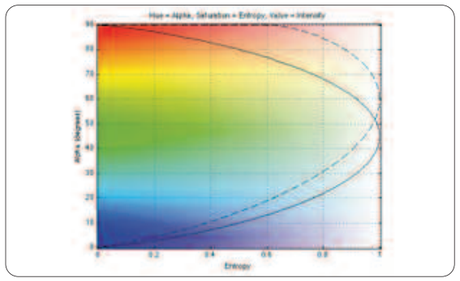
Capability to map forest burn areas using MERIS FR and ASAR AP imagery. Left MERIS FR composite acquired 26 Oct. 2006, 0.7534 μm (10), 0.6808 μm (8), 0.5597 μm (5), Right ASAR AP multi-temporal composite (I22 (20061027), I12 (20061027), I12 (20060714). ASAR AP imagery processed using POLSARPRO V 3.0 and MERIS imagery processed using BEAM 3.6



OBJECTIVES

1. To select a forested pilot area in China, which was historically affected by forest fires. This area will be selected by the Chinese partners.
2. To develop a suitable technique to obtain a risk forest fire index by means of AATSR and MERIS images. This risk index will merge several indicators: an indicator of vegetation evolution, an indicator of vegetation humidity, and indicator of meteorological conditions, mainly wind speed, and others. The parameters of this risk index will be adapted to the pilot area taking into account the historical fires and if necessary other factors such as fuel land cover, topographical conditions and so on.
3. To adapt a hot spot detection technique to the fires on the pilot area by means of AATSR images. This technique will include fire temperature detection, burning area, fire thermal power and reaction intensity. The Dozier method, including atmospheric effects will be applied to determine fire temperature and burning area. From these two values, the thermal power of the fire will be obtained. This thermal power is directly related to the destructive effects of fire and other characteristics such as high flame.
4. To set up a suitable methodology for burnt area cartography by means of MERIS and ASAR imagery

By means of MERIS and ASAR imagery, a new procedure has been developed in order to map burn scars following forest fires. In the MERIS FR composite (300m) shown left, the burnt areas in light colour compared to the surrounding forest shown in red. The ASAR APP multi-temporal composite shows the same burnt scar, but at higher resolution (30 m). The main advantage of the proposed procedure is that using both optical and SAR imagery, the burnt areas can be easily detected and the burn scars mapped.



Dual Polarisation Entropy/Alpha Diagram with HSV Colour Coding

Techniques for Deriving Forest Information From Polarimetric SAR Interferometry

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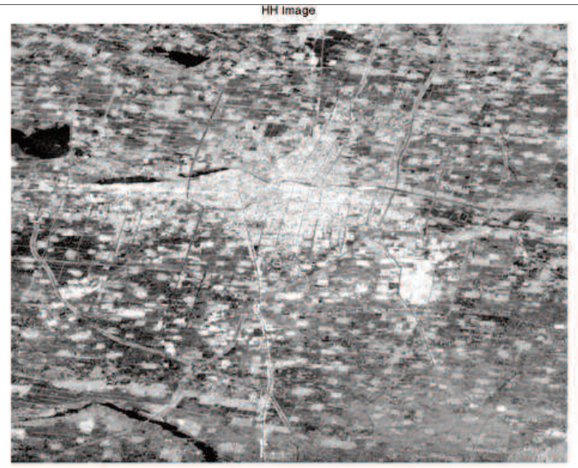
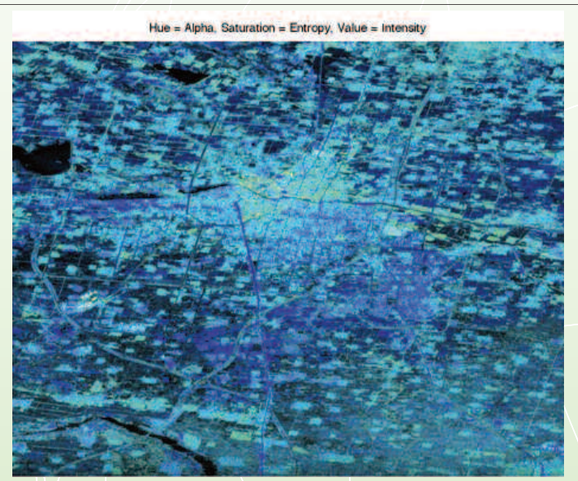
The project has received the first data from the ALOS PALSAR sensor for an area close to the Chinese forested test site. This L-band SAR data was provided in Fine Beam Dual (FBD) polarisation mode (HH and HV) at 34.1 degrees incidence. For such data, 2 important parameters can be plotted (see top left figure). The entropy represents the stability of the phase information of the scattered signal, being zero in stable parts and 1 in noisy regions, while alpha represents the change of polarisation of the reflected wave. This figure is colour coded according to a Hue-Saturation-Value or HSV technique. The dual polarisation entropy/alpha values for all scattering surfaces must lie within the solid line. Shown for reference is the boundary for fully Quadpol data (in dash).

The top image shows a conventional HH PALSAR image of Weifang city, Shandong province (home of the annual international kite festival). In the bottom image, the colour coded dual polarisation entropy/alpha/intensity image for the same scene is shown.

In contrast with the vegetated areas, the blue and red areas in the city are where the polarisation is maintained in amplitude and phase. This demonstrates the ability of the sensor to measure differences in the scattering properties of urban and vegetated areas. Future studies will look at the validation of the separation process using land cover maps for the area. It is planned to acquire multiple passes over our test area and investigate polarimetric interferometry for vegetation structure estimation.



HH L-band PALSAR Image of Weifang City, Shandong Province, China



L-band PALSAR Dual Polarisation Entropy/Alpha/Intensity Colour Composite Image of Weifang City, Shandong Province, China

Assessment of the Synergistic Exploitation of Envisat ASAR and MERIS Data for Plain Flood Rapid Mapping and for Flood Support Risk Management

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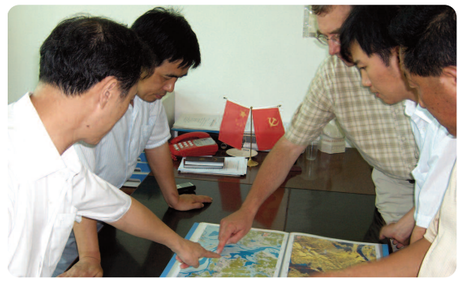
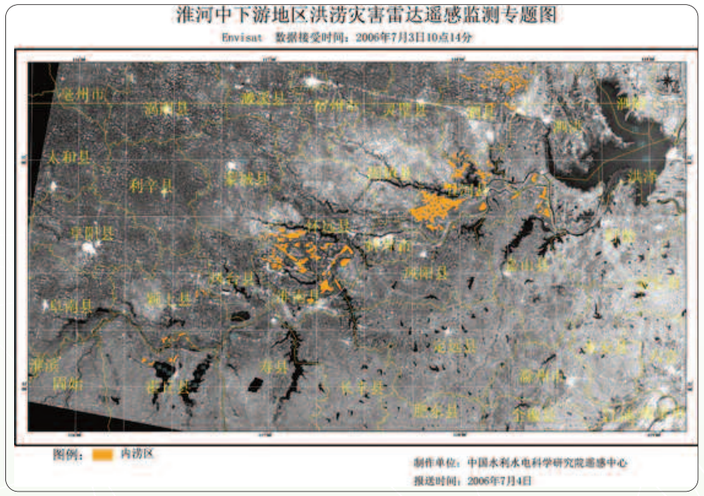
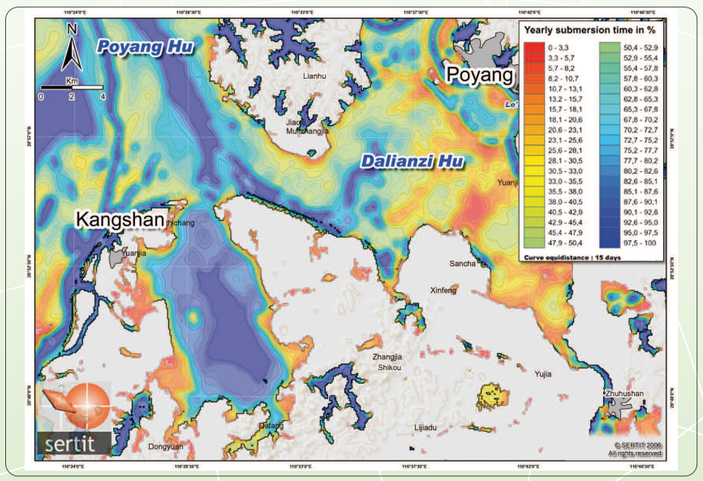


Project partners presenting Dragon flood products to the Water Resource Bureau of the Duchang County office (Jiangxi province) in July 2006



An example of NRT results : Exploitation of WSM ASAR data acquired the 4th of July 2006 over the flooding of the Huia river (Anhui and Jiangsu provinces, PR China) ; flooded areas are presented in orange (Courtesy of Pr LI Jiren and Dr Huang Shifeng, IWHR, Beijing).



Yearly submersion map, expressed in year percent, derived from a three years ENVISAT time series; South Eastern part of the Poyang lake (Jiangxi province) Darker blue indicates permanent water bodies, red area flooded only few days a year (Courtesy of R. ANDREOLI, SERTIT, Strasbourg)

Since 2004, an assessment of Envisat data potentialities for mapping and monitoring; insuring thematic accuracy and maximize coverage and revisit over the tests sites well representative of Asian major flood plains and Mediterranean fast flood, CEVENOL phenomenon, has been carried out.

The project has delivered major steps in term of ASAR and MERIS data processing and information merging. An ASAR assimilation procedure, plus a robust and semi automatic flood extraction procedure have been defined and validated. Exploiting 3 year of regular acquisition, a large panel of Envisat derived products have been generated consisting in monthly and yearly submersion maps, change and land cover maps etc.

Furthermore, 2005 and 2006 typhoons and monsoon floods affecting Chinese major flood prone and coasts have been monitored based on Envisat resources. These Near Real Time actions have exploited both emergency programming and rolling archive. In 2005 there were 11 successful NRT actions carried out over flooding events plus one during the 2005 benzene pollution over the Songhua River. In 2006, 8 successful NRT actions have been carried out, half for typhoons flood mapping in July and August 2006.

Studies will link meteorological and hydrological simulation models and damage assessment on off line mode (to generate RISK MAPS associated to impacts of flood corresponding to various return periods).

Satellite Tools for Water Resources Assessment and Management at River Basin Scales

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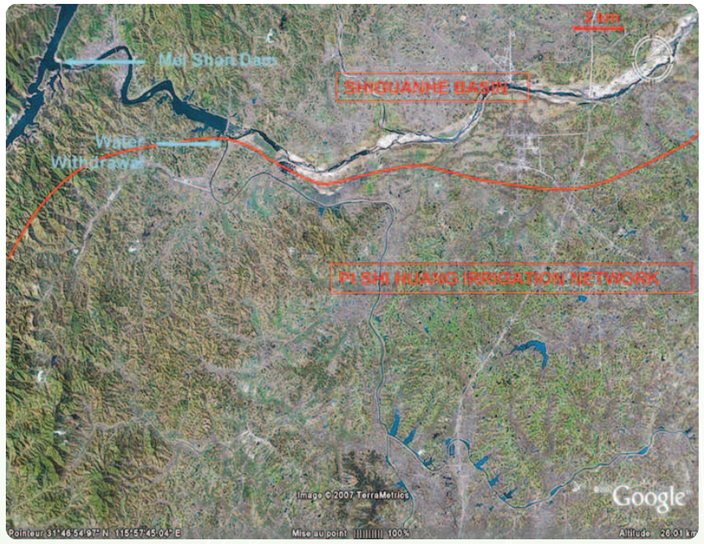
Dr. Huang Shifeng, Dr. Xin Jingfeng, Prof. Emmanuel Ledoux, Charles Baubion

Hydrological observation stations provide daily meteorological data used to calibrate surface run-off models, Courtesy of Xin Jingfeng

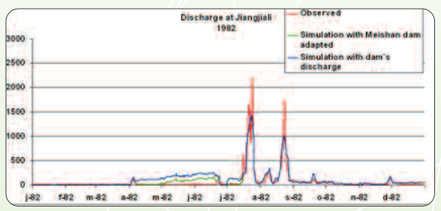
Objectives and background
For this project, the MODCOU model is being used to predict discharge for the Shiguanhe sub-catchment of the Huai River basin in China. The terrain database was populated using SRTM DEM and derived hydrological network, Landsat ETM land use map, and Google Earth maps to characterise the irrigation network (see top figure). Other geo-spatial data includes soil maps, meteorological and stream discharge data from 1982 to 1991. Since the first model runs reported last year, model performance has been refined and improved.

Analysis on model results
Analysis of the observed and modelled discharge shows two phenomena which are not explained by MODCOU model: 1. a significant amount of water that was released from the dams did not appear in the observed discharge during the irrigation season; 2. several peaks could be observed which are not modelled and several discharges are underestimated (see Figure centre). These differences are due to water being extracted from the river to supply an irrigation network outside of the basin. So an amount of 100 m3/s was retrieved from Mei Shan discharge during the irrigation period.

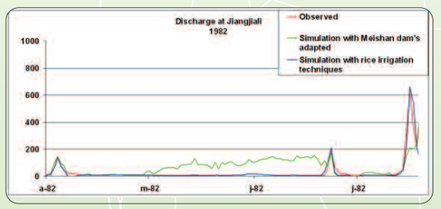
Up-date and improvements
A hypothesis was made that, during the irrigation season the amount of water which does not flow at the outlet is used for rice-irrigation within Shiguanhe basin, and this water was transferred to the rice-fields through a modification of the rainfall over those fields. Lastly the adaptation of the rice fields production function allows to represent the traditional methods Chinese farmers are using for rice cultivation, in particular the fill out of their fields when rainfall events are occurring (see Figure 3). As can be seen the correlation between observed and modelled discharge improves



Google earth map of the water extraction to the Pi Shi Hang irrigation network



External irrigation: a significant part (100 m3/s) of the water released by Mei Shan dam is used for irrigation in the Pi Shi Hang irrigation network outside of the basin. So this water has to be retrieved from the river (difference between green and blue curve)



Integration of rice farming techniques into the model: storage in the rice fields from may to mid July, and filling out of these fields on 15 July

Drought Monitoring and Prediction over China

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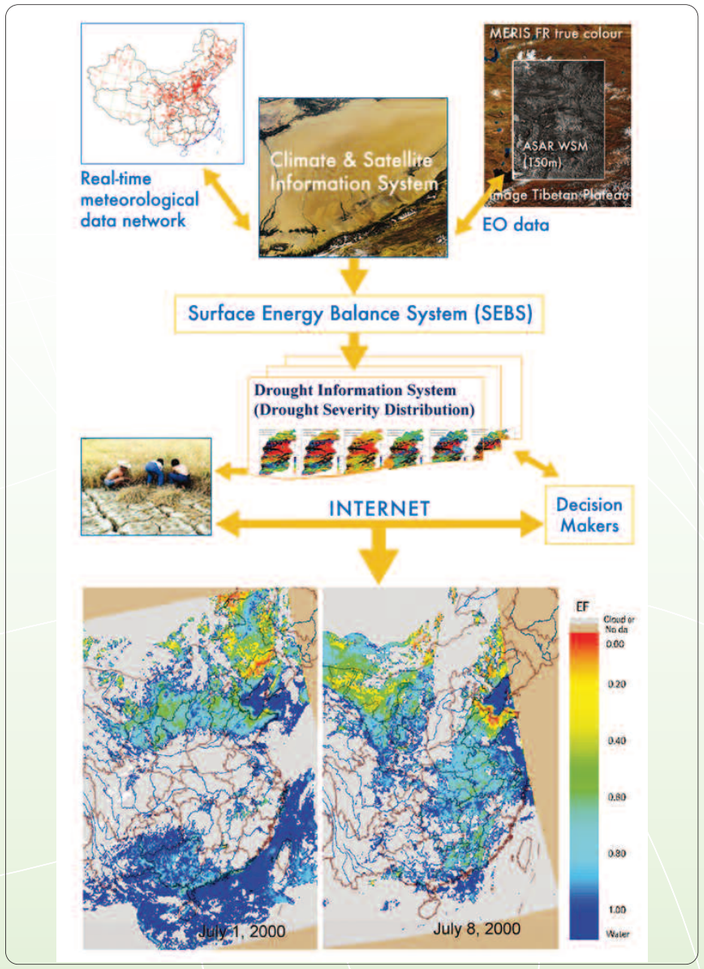
Zhao Yizhou and Rogier van der Velde installing soil moisture and temperature probes at 5 different levels up to a depth of 60 cm on the Tibetan Plateau



SEBS will combine meteorological, ground and satellite data to provide an on-line drought monitoring system. ASAR WSM imagery (top right) will help fill in the gaps in areas with persistent cloud cover (After B. Su et al. 2003)

The drought project combines satellite observations acquired by Envisat and "state of the art" land surface modeling to improve the monitoring and prediction of drought related land surface variables, such as root zone soil moisture and evapotranspiration. Within the project, Advanced Along Track Scanning Radiometer (AATSR) and Advanced Synthetic Aperture Radar (ASAR) wide swath mode (WSM) observations are utilized for the retrieval of evapotranspiration and soil moisture, respectively. Extensive ASAR WSM and AATSR data sets have been collected over the Tibetan Plateau and other study areas. Retrieval of the top 5-cm soil moisture has been performed over the Tibetan Plateau from the ASAR WSM observations. Based on these soil moisture products, data assimilation is being performed using different techniques (e.g. Direction Insertion and Ensemble Kalman filtering) and a suite of different land surface schemes.

Since the start of the dragon programme, two field campaigns have been conducted in China. In 2005, data on soil moisture and evapotranspiration has been collected over the heterogeneous Loess plateau in the Gansu province. In 2006, soil moisture and soil temperature profiles have been measured over the Tibetan Plateau. The data sets collected during these field campaigns have been analyzed and are currently exploited in modeling. At the current stage of research the data serves to improve the current soil moisture and evapotranspiration retrieval methodologies. In addition, the data assimilation framework is under further development to improve drought monitoring and prediction through soil moisture assimilation. Application is on the Tibetan Plateau only that serves as a pilot area.

Calibration and validation of -SCIAMACHY results using BRUKER IFS 120M. (Location: on the roof of the NSMC building in CMA, Beijing)

Air Quality Monitoring and Forecasting in China

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Prof. John Burrows, Prof. Gerrit de Leeuw, Dr. Zhao Fengsheng, Dr. Ma Jianzhong , Dr. Zhang Peng, Dr. Qiu Hong, Dr. Paul Simon, Dr. Ronald van der A, Dr. Roeland van Oss

Monitoring gas emissions using satellite observations

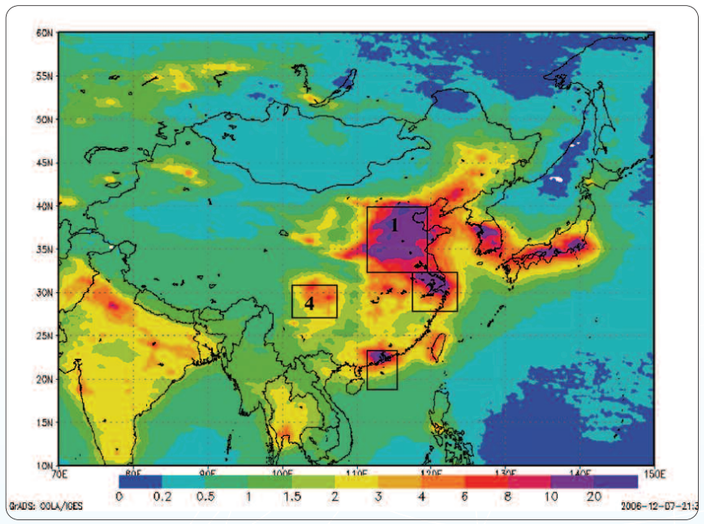
The figures show the results of NO_2 retrievals from ERS GOME in the 1990s and more recently from Envisat SCIAMACHY. As can be seen air pollution and emissions have become an increasingly important problem due to large-scale fossil fuel combustion related to an increasing energy demand and inherent fuel consumption. Particularly badly affected are the Beijing-Tianjin-Tangshan region (area 1) and the Yangtze delta region (area 2). Annual variations of tropospheric NO_2 over east and west of China have also been investigated and it is clear that there is an expected maximum of NO_2 in winter-time in the east of China. In the west of China there is a summer maximum in NO_2 concentration caused by natural emissions.

Modeling results on gas emissions

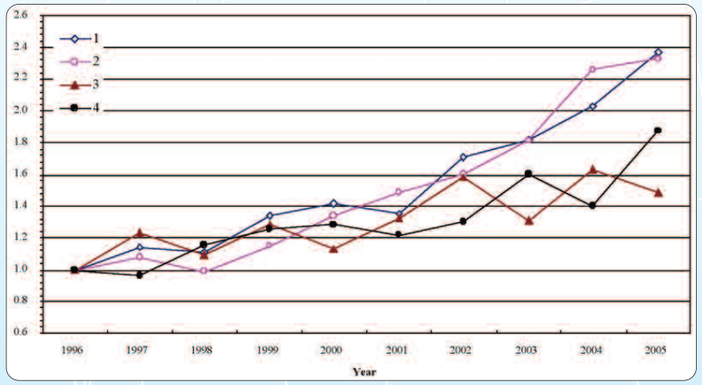
The spatial and temporal characteristics of CO and NO_2 simulations of China in 2003 have been modeled by the two-way nested global chemistry-transport zoom model. The modeling has shown that the seasonal variations of CO and NO_2 are obvious in China, and there are the high CO concentration in the eastern China (30-40 °N) and the high NO_2 concentration in the eastern and southwestern China. It is also found that the CO vertical variations are significantly changed with different seasons, while the NO_2 vertical profile variations of different seasons are very little. Further more, it could be seen clearly that the NO_2 model result fits the satellite measurements very well.

Retrieval of aerosol optical depth from MERIS data

Aerosol optical depth distribution of MERIS channel center at 565nm over seas has been studied for near shore waters in China. The research shows that the aerosol retrieval algorithm still needs improvement in turbid near-shore waters to correct for the influence of the significant signal coming from water.



Tropospheric NO_2 vertical columns averaged between April 1996 and October 2006 based on the results from GOME (1996-2003) and SCIAMACHY (2003-2006). Thanks for the data of tropospheric NO_2 provided by the TEMIS web site hosted by KNMI, Netherlands (http://www.temis.nl/)



The temporal evolution of tropospheric NO_2 columns for the four areas shown above

Dragon-Star - Exploitation of GOMOS and MIPAS Measurements for Studying the Change in the Middle Atmosphere

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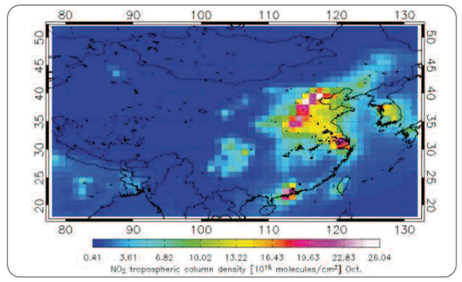
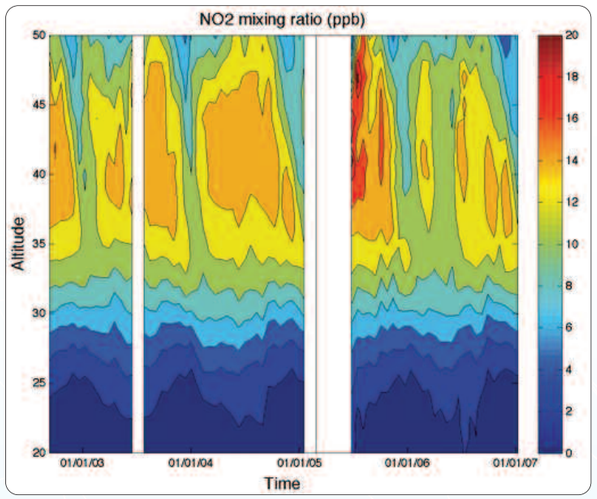
Dr. Dimitrios Balis, Prof. Bruno Carli, Dr. Seppo Hassinen, Dr. Kostas Kouttidis, Dr. Esko Kyro, Dr. Johanna Tamminen, Prof. Christos Zersfos, Dr. Zhang Peng, Dr. Liu Yi, Dr. Wang Pucai, Dr. Zheng Xiangdong, Ms. Li Xiaojing, Zhang Xingying, Dr. Zhang Yan



The spatial distribution of NO_2 with TM5 model results for Oct. 2003. The model output is in good agreement with satellite observations



Development of NO_2 vertical profiles as measured by GOMOS between 1.9. 2002 and 31.12 2006. The observations cover latitudes 20°N-53°N and longitudes 80°E-134°E. The NO_2 values are shown by number density and mixing ratio. Both show annual maxima during summer seasons. White areas indicate that no measurements were available. In January-August GOMOS measurements were disrupted by the malfunction of the steering point mechanism.

In this project opportunities are being investigated to enhance the exploitation of Envisat GOMOS, MIPAS and OMI data for atmospheric research. OMI is a joint effort between KNMI, NASA, and FMI, and is managed by NIVR/Netherlands.

A joint project between the GOMOS Expert Support Laboratory FMI and the MIPAS laboratory IFAC and the Chinese Team at National Satellite Meteorological Center (NSMC) provides experience on how expert instrument teams and a normal data user team can work together in using rather complicated data from GOMOS and MIPAS. The data access for GOMOS will first be provided by FMI but eventually it should be possible to access data by the public domain tools developed by ESA and FMI and by the cooperative tool development effort by the teams.

GOMOS and MIPAS data will be used for middle atmosphere studies at various spatial scales.

For examples the two figures on the left show the development of NO_2 vertical profiles as measured by GOMOS between 1.9. 2002 and 31.12 2006. The observations cover latitudes 20°N-53°N and longitudes 80°E-134°E. The NO2 values are shown by mixing ratio (top) and number density (bottom). Both show annual maxima during summer seasons. White areas indicate that no measurements were available. In January-August GOMOS measurements were disrupted by the malfunction of the steering point mechanism. An important part is validation comparisons between GOMOS, MIPAS and the Chinese ground stations. Over time, larger data sets and assimilation tools will be used to study the middle atmosphere processes and change.

Common research projects for Chinese and ESA earth observation satellites will be investigated.

Offshore winds and currents have large impact on shipping in the South and East China Seas

Coupling and Variability of the Southeast Asian Monsoon and Ocean Systems (SAMOS)

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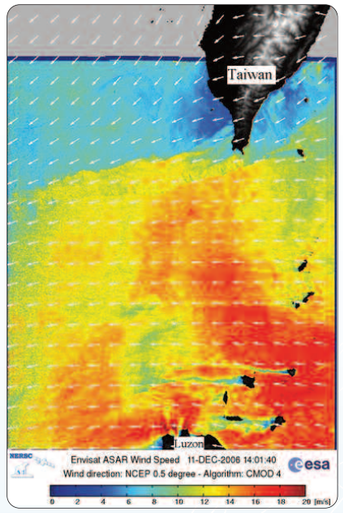
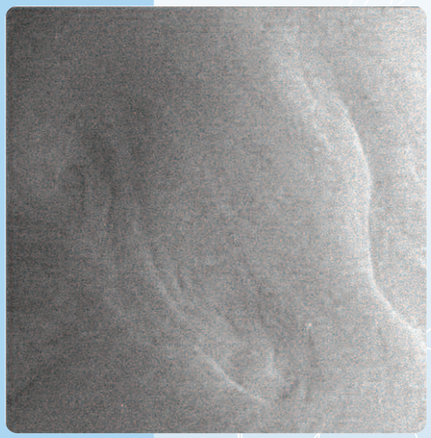
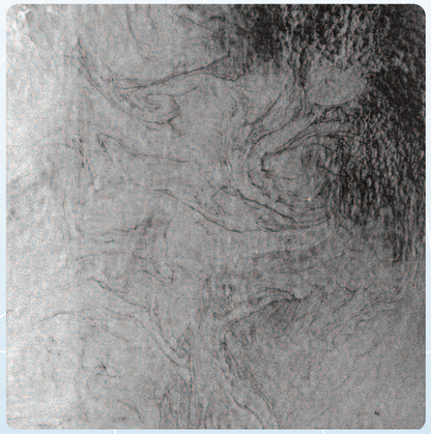
Prof. Helge Drange, Prof. He Mingxia, Dr. Bertrand Chapron, Prof. Wang Zifa, Dr. Laurent Bertino, Dr. Knut-Frode Dagestad, Lasse Pettersson

The coupled Southeast Asian Monsoon and ocean system is a regular seasonal climate feature that has profound and coupled connection with and impact on the atmospheric and ocean circulations in the region. This in turn leads to changes both in the near surface wind field, sea surface temperature, evaporation and precipitation signals. By the systematic use of coupled atmosphere-ocean models and inter-comparison and validation with satellite observations, the aim of the project is to advance the ability to understand and predict the dominant interactive coupling processes. The key study quantities are ocean current features including fronts, eddies and internal waves, near surface wind, SST, ocean colour and water quality. To this aim, primarily data from ASAR and MERIS onboard Envisat is used, in synergy with numerical models and remotely sensed data from other satellites. Within SAMOS a system has been set up to automatically download and process ASAR WSM scenes for the South and East China Seas. The scenes are automatically calibrated, and wind speed is derived with the CMOD-4 algorithm, taking wind directional input from the global forecast system of NCEP (see top Figure). The calibrated images and the wind maps are displayed on a web page in near real time, normally about 6 hours after acquisition. Thus it has been demonstrated that SAR imagery from Envisat ASAR can be used for coastal marine monitoring on a routine basis. ASAR imagery can also be used to monitor near surface currents and eddies, see bottom figure.



The figure shows one example of a variable wind field in the South China Sea calculated with the CMOD-4 algorithm based on an ASAR image and wind directional data taken from a global weather forecast model. North of Luzon (Phillipines) the wind is around 18 m/s, but drops to 5 m/s or even less in the wakes behind the smaller islands





This ASAR WSM-VV image acquired on 10 July 2006 reveals the presence of converging current fronts that are manifested through strong normalized radar cross-section associated with specular reflection from breaking wavesThis ASAR WSM-VV image acquired on 22 Sept. 2006 shows expressions of mesoscale and sub-mesoscale eddy features that are manifested through presence of surfactants that under moderate to light winds dampens the Bragg scattering waves and, in turn, low normalized radar cross-sections

Oceanography from Space - Internal Wave, Ocean Wave, Shallow Water Topography, Ocean Color, Kuroshio Current

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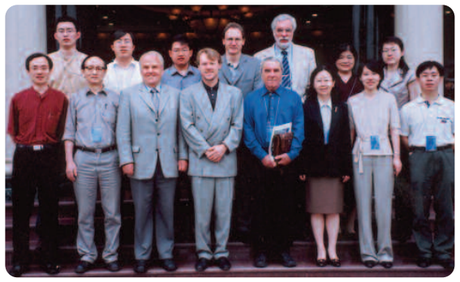
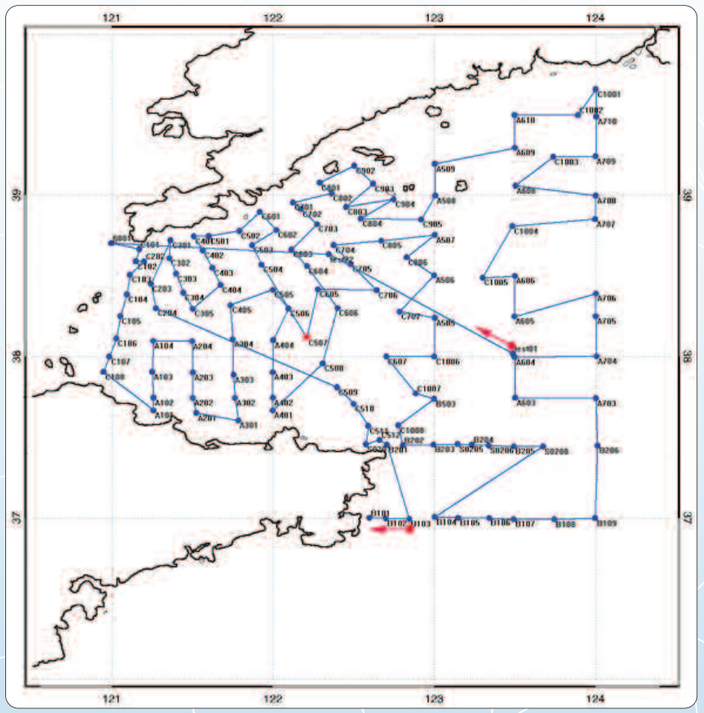


Dragon Oceanography from Space European and Chinese team members in Xiamen 2004

CHINESE PIs	EUROPEAN PIs
Prof. He Mingxia	Prof. Werner Alpers
Prof. Liu Zhishen	Dr. Roland Doerffer
Dr. Guan Lei	Prof. Andre Morel
Prof. Zeng Kan	Prof. Johnny Johannessen
Prof. Fang Mingqiang	Prof. Jürgen Fischer
Prof. Meng Junmin	Dr. Pierre-Yves Le Traon
Dr. Ma Yi	Prof. David Llewellyn-Jones
Prof. Zhao Chaofang	Dr. Bertrand Chapron
Prof. Li Hongping	Dr. Susanne Lehner
Prof. Du Tao	
Dr. Chen Xue-EN	
Dr. Du Keping	
Prof. Zhu Minhui	
Prof. Tang Junwu	



Distribution of in-situ measurements in the Yellow Sea made in the period Dec. 30, 2006 - Jan.17, 2007

The objectives of the projects are to investigate the following topics using ENVISAT multi-sensor data:

- Distribution and characteristics of internal waves in the China Seas;
- Characteristics of ocean wave directional spectrum in the China Seas;
- Detecting method for shallow underwater bottom topography;
- Retrieval methods for ocean color in the China Seas;
- Impact of the variation of the Kuroshio on oceanic processes in the China Seas and Global climate change.

The latest results on ocean colour and internal wave studies are reported.

OCEAN COLOUR IN-SITU DATA COLLECTION
In 2007, the oceanography team has undertaken two ocean optics in situ experiments. The first took place from Dec. 30, 2006 - Jan.17, 2007 in the Yellow Sea and the second from Jan.22- Feb.14 2007 in the East Sea. Data was acquired using equipment carried on-board the OUC research vessel "Dong Fang Hong 2" (in photo). The monitoring stations and sampling distribution for the 1st experiment are shown left.

OUC ocean research vessel "Dong Fang Hong 2"

Hyper-TSRB collecting Rrs(λ) data during sea truth campaign

Oceanography from Space - Internal Wave, Ocean Wave, Shallow Water Topography, Ocean Color, Kuroshio Current

Prof. Werner Alpers	e-mail: alpers@ifm.uni-hamburg.de
Prof. He Mingxia	e-mail: mxhe@orsi.ouc.edu.cn

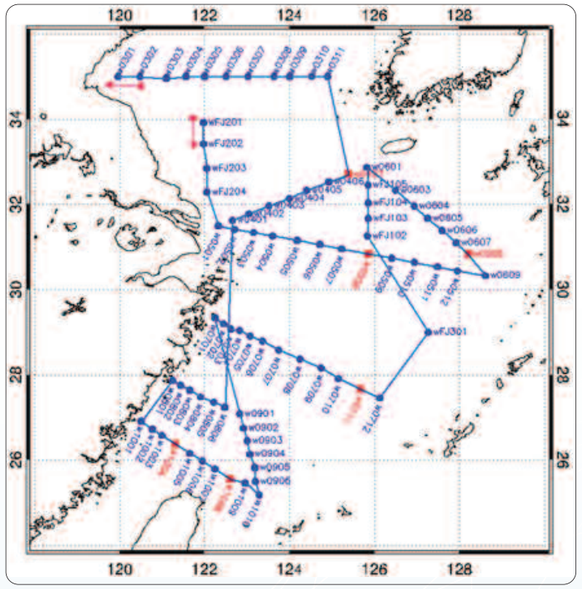
OCEAN COLOUR ANALYSIS

Remote sensing reflectance (Rrs) retrieved from ENVISAT MERIS Level-1 data using the FUB BEAM-plug-in, and MERIS Level-2 product from 26 measurement stations has been compared with in-situ measurements acquired using HyperTSRB (see top figures). In the comparison between in-situ and retrieved Rrs, the FUB retrieval performance is better than MERIS level-2 products. However they both overestimated the Rrs.

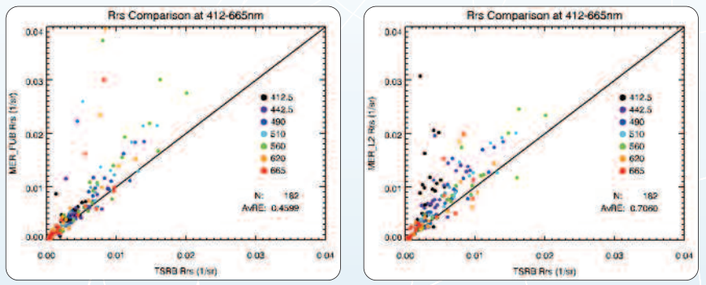
This overestimation has been further investigated by plotting spectral reflectance profiles for clear and turbid waters (see bottom figures). In the case clear water, in the wavelength region 400 to 550 nm, the FUB reflectance better approximates the in-situ reflectance, however for turbid water in the wavelength region 500 to 750 nm the MERIS L2 product is closer to the measured reflectance. More work is therefore required to better understand the differences and provide up-dated algorithms for product generation in such heavily sediment laden waters.

RED TIDES

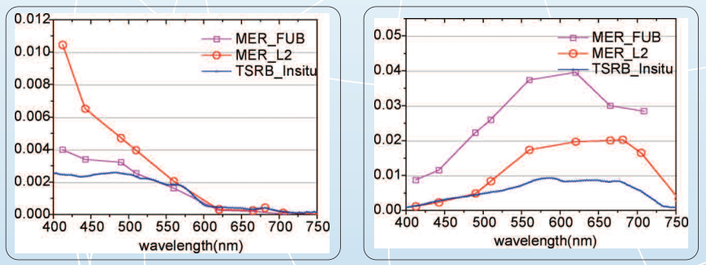
Red tides develop mainly in coastal areas and they affect directly fishing and shell fish industries. Red tides can even be toxic to humans and are caused by the dense growths of bacteria and algae. They are increasingly common due to heavy pollution from sewage and industries along the densely populated east coast of China and the Yangtze River. An objective is to develop techniques and data sets using optical satellite sensors to map the duration and extents of such tides. Results from spectrometer measurements show that Red tides have quite characteristic spectral response. The latest results will be reported at the Aix-en-Provence Symposium.



Distribution of in-situ measurements in the East Sea in the period Jan. 22 to Feb. 14 2007



Comparison between in-situ measured reflectance and MERIS reflectance, left MERIS FUB product from BEAM toolbox and right MERIS level 2 product

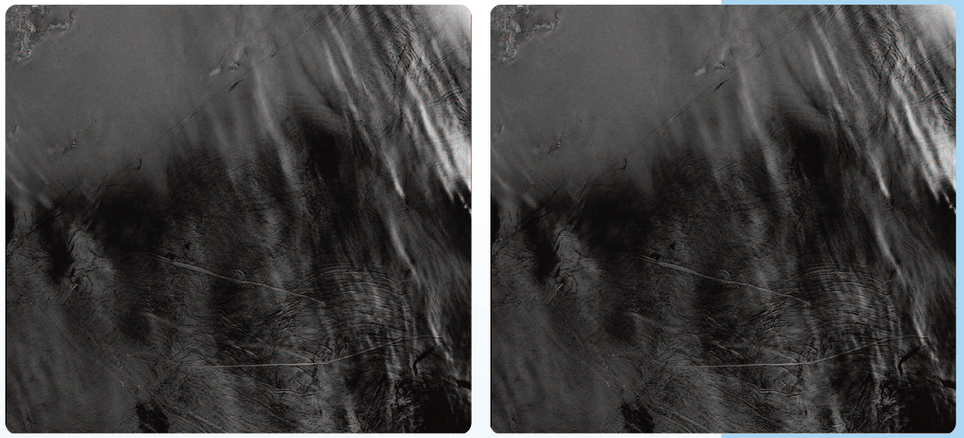


Comparison between in-situ reflectance and MERIS products for clear waters (left) and turbid waters (right)

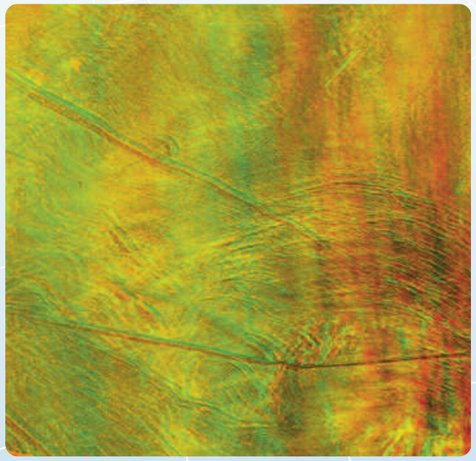
Oceanography from Space - Internal Wave, Ocean Wave, Shallow Water Topography, Ocean Color, Kuroshio Current

Prof. Werner Alpers	e-mail: alpers@ifm.uni-hamburg.de
Prof. He Mingxia	e-mail: mxhe@orsi.ouc.edu.cn

Ocean optics in-situ experiments group – sea data collection campaigns in Dec. 2006 and early 2007



Envisat ASAR image (left) and ERS SAR image (right) acquired on 21 April 2006 in the East Sea with 30 minutes time delay



Overlay of ASAR and ERS SAR images acquired on 21 April 2006, using such imagery the length and velocity of internal waves can be determined as well as ship velocity

INTERNAL WAVES

The results from the study of internal waves using 10 years of SAR and optical imagery were presented in the 2006 brochure and the study identified the distribution and temporal frequency of internal waves in the China seas. Here in reported are the results of using SAR imagery separated by short acquisitions to study the velocity of internal waves. On 21 Apr. 2006, heavy ship traffic and a great number of internal waves occurred in the Qingdao coastal area. These can be observed on the SAR images obtained on the same day. The images shown top left are the ENVISAT ASAR and ERS SAR images with 28 minutes' acquisition interval. The Figure bottom left, shows the Overlay of ENVISAT ASAR image with the ERS SAR image from which the ship speed and velocity of internal waves can be obtained.

SHALLOW WATER TOPOGRAPHY

The objectives are to develop shallow water topography detection technology using SAR data. Analytical and numerical models have been developed to extract information about underwater bottom topography from ASAR data based on SAR imaging mechanisms and a dynamical model (results were reported in 2006).

DRAGON PARTNERS

LIST OF INSTITUTIONS COOPERATING IN THE DRAGON PROGRAMME

■ Aristotle University of Thessaloniki,	*Greece*
Capital Normal University,	*China*
● Beijing Information Research Management Center,	*China*
BIRA, Belgisch Instituut voor Ruimte-Aëronomie,	*Belgium*
BRGM, Bureau de Recherches Géologiques et Minières,	*France*
● Bureau for International Cooperation,	*China*
Cemagref, Institut de Recherche pour l'Ingénierie de l'Agriculture et de l'Environnement,	*France*
● CERC, Cambridge Environmental Research Consultants,	*United Kingdom*
CESBIO, Centre d'Etudes Spatiales de la Biosphère,	*France*
China Seismological Bureau,	*China*
Chinese Academy of Forestry,	*China*
Chinese Academy of Meteorological Sciences,	*China*
Chinese Academy of Sciences,	*China*
Chinese Academy of Survey and Mapping,	*China*
Chinese National Center for Disaster Reduction,	*China*
■ CLS Space Oceanography Division,	*France*
CNES, Centre National d'Etudes Spatiales,	*France*
CNR, Consiglio Nazionale delle Ricerche,	*Italy*
■ Cold and Arid Regions Environmental and Engineering Research Institute, Chinese Academy of Sciences,	*China*
Demokritus University of Thrace,	*Greece*
DLR, Deutschen Zentrum für Luft- und Raumfahrt,	*Germany*
Earth Sciences and Engineering, Imperial College London,	*United Kingdom*
Ecole des Mines de Paris,	*France*
Ecole Pratique des Hautes Etudes,	*France*
ENS, Ecole Normale Supérieure,	*France*
First Institute of Oceanography,	*China*
FMI, Finnish Meteorological Institute,	*Finland*
Freie Universität Berlin,	*Germany*
Friedrich-Schiller-Universität Jena,	*Germany*
Fundación General Universidad de Valladolid,	*Spain*
Fuzhou University,	*China*
Gamma Remote Sensing Research and Consulting AG,	*Switzerland*
Geomatic Engineering, University College London,	*United Kingdom*
Georg-August-Universität Göttingen,	*Germany*
GFZ, GeoForschungsZentrum,	*Germany*
GKSS Forschungszentrum, Institute for Coastal Research,	*Germany*
■ ICL, Imperial College London,	*United Kingdom*
IFREMER, Institut français de recherche pour l'exploitation de la mer,	*France*
INIA, Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria,	*Spain*
INPT/ENSEEIHT, Institut National Polytechnique de Toulouse/Ecole Nationale Supérieure d'Electrotechnique, d'Electronique, d'Informatique, d'Hydraulique et des Télécommunications,	*France*
● Institute of Applied and Computational Mathematics, Regional Analysis Division, Vassilika Vouton, Crete,	*Greece*
■ Institute of Atmospheric Physics, Chinese Academy of Sciences,	*China*
Institute of Crustal Dynamics, China Seismological Bureau,	*Beijing*
■ Institute for Geology and Mineral Exploration,	*Greece*
● Institute of Geophysics and Geodesy, Academy Science of China, Wuhan,	*China*
Institute of Meteorological Sciences,	*China*
Institute of Natural Resources and Regional Planning, Chinese Academy of Agricultural Sciences,	*China*
● Institute of Remote Sensing Application, Chinese Academy of Sciences,	*China*
Institute of Remote Sensing and GIS, Peking University	*China*
■ ITC, International Institute for Geo-Information Science and Earth Observation,	*The Netherlands*
Jiangsu Academy of Agriculture Sciences,	*China*
● Kings College London,	*United Kingdom*
KNMI, Koninklijk Nederlands Meteorologisch Instituut,	*The Netherlands*
■ LIAMA, Sino-French Laboratory for Computer Sciences, Automation and Applied Mathematics,	*China*
METEO France,	*France*
Ministry of Water Resources,	*China*
■ NAGREF, National Agricultural Research Foundation,	*Greece*
■ National and Kapodistrian University of Athens,	*Greece*
■ National Observatory of Athens,	*Greece*
NERSC, Nansen Environmental and Remote Sensing Centre,	*Norway*
NRSCC, National Remote Sensing Center of China,	*China*
NSMC, National Satellite Meteorological Center,	*China*
Ocean University of China,	*China*
■ PIK, Potsdam Institute for Climate Research,	*Germany*
● Plymouth Marine Laboratory,	*United Kingdom*
POLIMI, Politecnico di Milano,	*Italy*
● Proudman Oceanographic Laboratory,	*United Kingdom*
Remote Sensing Technology Application Center, Ministry of Water Resources,	*China*
Research Institute of Forest Resources Information Techniques, Chinese Academy of Forestry,	*China*
SERTIT, Service Régional de Traitement d'Image et de Télédétection,	*France*
■ Shanghai Institute of Geological Survey,	*China*
SOGREAH, Société Grenobloise d'Etudes et d'Applications Hydrauliques,	*France*
State Key Lab. for Information Engineering in Surveying, Mapping and Remote Sensing,	*China*
State Oceanic Administration,	*China*
T.R.E. s.r.l., Tele Rilevamento Europa,	*Italy*
TNO/FEL, Toegepast Natuurwetenschappelijk Onderzoek/Fysisch en Electronisch Laboratorium,	*The Netherlands*
UN/ISDR, International Strategy for Disaster Reduction,	*Germany*
● United Kingdom Meteorological Office,	*United Kingdom*
Università degli Studi di Pavia,	*Italy*
Universität Bremen,	*Germany*
Universität Hamburg,	*Germany*
■ Université de Marne-la-Vallée,	*France*
Université de Rennes 1,	*France*
Université du Littoral Côte d'Opale,	*France*
Université Pierre et Marie Curie, Paris VI,	*France*
University College London,	*United Kingdom*
■ University of Adelaide,	*Australia*
University of Leicester,	*United Kingdom*
● University of Newcastle,	*United Kingdom*
■ University of Patras,	*Greece*
University of Sheffield,	*United Kingdom*
Wageningen Universiteit,	*The Netherlands*

■ Partner institution joining the Dragon Programme since April 2004
● New partner institution joining the Dragon Programme in October 2005

MERIS Reduced Resolution image (1.2 km) 15th February 2004 of China East coast

ADVANCED TRAINING COURSE IN OCEAN REMOTE SENSING

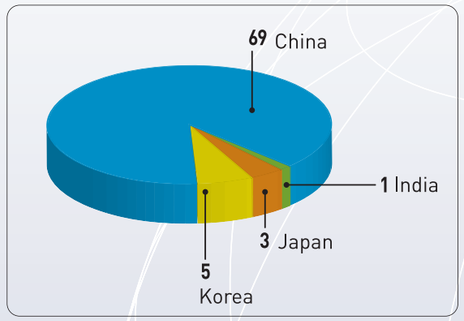
Date	October 25th - 30th 2004
Hosts	ESA, NRSCC and Ocean University of China
Lecturers	Dr. Roland Doerffer GKSS Research Centre, Germany Prof. David Llewellyn-Jones Univ. of Leicester, UK Dr. Pierre-Yves Le Traon CLS, France Prof. Johnny Johannessen NERSC, Norway Prof. Werner Alpers Univ. of Hamburg, Germany Prof. He Mingxia Ocean University of China, China

Ph.D. students, postdoctoral and research scientists interested in ocean remote sensing from China and other Asian countries were invited to a one-week training course organised jointly by ESA and MOST in the framework of the Dragon Programme. The advanced training course was hosted by the Ocean University of China (OUC) in Qingdao.

Lectures on:
- Current and future European and Chinese EO satellite missions
- Principles of SAR, MERIS, (A)ATSR, and RA measurements
- Products and applications in operational oceanography
- Practical exercises with BEAM and Bilko software tools

78 participants
(selected from 125 applications)
- Associate or Assistant Professors
- Senior scientists
- Engineers
- Ph.D. students

The lecturers



Participation to the training course by country

Participants and lecturers of the Ocean training course at OUC, Qingdao

ADVANCED TRAINING COURSE IN LAND REMOTE SENSING

Date	10-15 October 2005
Host	Capital Normal University (CNU), Beijing, P.R.China
Co-sponsors	ESA, NRSCC, CNU
Lecturers	Prof. José-Luis Casanova, University of Valladolid, Spain Dr. Thuy Le Toan, CESBIO, France - Prof. Eric Pottier, University of Rennes, France - Prof. Fabio Rocca, Politecnico di Milano, Italy Prof. Christiane Schmullius, Friedrich-Schiller-University of Jena, Germany - Prof. Bob Su, ITC, The Netherlands - Dr. Wout Verhoef, NLR, The Netherlands

Advanced training course in land remote sensing poster

European lecturers receiving guest professorships from Capital Normal University at the closing session

Prof. Eric Pottier explaining principles of polarimetric SAR theory during a land training course lecture at Capital Normal University, Beijing

PhD students, postdoctoral and research scientists interested in Land Remote Sensing were invited to a one-week advanced training course organized jointly by ESA and MOST as an initiative from the DRAGON programme. The training course was hosted by Capital Normal University (CNU) in Beijing.
A total of 103 participants (selected from 167 applications) attended the course, representing more than 50 different institutions from all over China.

Lectures on:

Land Applications Using SAR data
- Theory and principles of SAR and SAR interferometry over land
- SAR Polarimetry
- Applications for soil moisture, agriculture (including rice), forestry, floods, terrain motion

Land applications using optical and thermal data
- Theory of optical and thermal remote sensing over land
- MERIS, (A)ATSR instrument series
- Applications for forest monitoring, land use and land cover mapping, droughts, fire detection, agriculture

Participants and organisers of the land training course at CNU, Beijing

Poster of the advanced training course in atmosphere remote sensing

ADVANCED TRAINING IN ATMOSPHERE REMOTE SENSING

Date	16-21 October 2006
Host	Peking University (PKU), Beijing, P.R.China
Co-sponsors	ESA, NRSCC, PKU
Lecturers	**Prof. Bruno Carli,** Italian National Research Centre (CNR), Italy **Prof. Hendrik Elbern,** University of Cologne, Germany **Prof. Hennie Kelder,** Royal Netherlands Meteorogical Institute (KNMI), Netherlands **Prof. Erkki Kyrola,** Finnish Meteorological Institute (FMI), Finland **Prof. Paul Simon,** Belgian Institute for Space Aeronomy (IASB), Belgium

A total of 57 PhD students, postdoctoral and research scientists participated to a one-week advanced training course dedicated to atmospheric remote sensing applications. The training course was organized jointly by ESA and NRSCC and hosted by the prestigious Peking University. More than 30 different institutions were represented by the participants.

Lectures and Practicals

- EO Instruments (GOME/GOMOS/MIPAS/SCIAMACHY,TPM)
- Groundbased instruments (WMO, NDSC network)
- Retrieval techniques
- Validation, Models
- Data Assimilation and Applications

The European lecturers

Interactions between students and the support team for the practicals (ITC and PKU)

Participants, lecturers and organizers of the atmosphere training course

PROCESSING TOOLS BEST, BEAM, BEAT, BRAT, POLSARPRO

Software	ESA is providing, free of charge and on the Internet, a collection of user-friendly and open-source software tools for the visualization and exploitation of Earth Observation data, from Envisat, ERS and many other missions. Upgrades, documentation and support are available on the relevant website
Web	**http://earth.esa.int/resources/softwaretools/**

PolSARPro Training Course session during the PolInSAR 2007 workshop, ESRIN

BEAM is a collection of user-friendly tools for the exploitation of optical data. It is also an open-source Java platform for the development of remote sensing applications.
For software upgrades, documentation updates and more information about using BEAM, visit the website at http://earth.esa.int/beam

BEST is a collection of software tools, which has been developed to help the remote sensing community to exploit ESA SAR data.
For software upgrades, documentation updates and more information about using BEST, visit the website at http://earth.esa.int/best/

BEAT is a collection of software tools that provides access to and visualization of atmospheric remote-sensing data for the ENVISAT, ERS-2, Aura, and MetOp missions.
For software upgrades, documentation updates and more information about using BEAT, visit the website at http://earth.esa.int/beat

POLSARPRO is a toolbox for the scientific exploitation of polarimetric SAR data and a medium for high-level education in radar polarimetry and polarimetric interferometry.
For software upgrades, documentation updates and more information about using POLSARPRO, visit the website at http://earth.esa.int/polsarpro

BRAT is a collection of tool and tutorial documents designed to facilitate the use of radar altimetry data. The toolbox is able to read most distributed radar altimetry data, from ERS-1 & 2, Topex/Poseidon, Geosat Follow-on, Jason-1, Envisat and the future CryoSat missions, to perform some processing, data editing and statistics and to visualise the results. For software upgrades, documentation updates and more information about using BRAT, visit the website at http://earth.esa.int/brat/

Prof. Fabio Rocca from POLIMI Italy, with the members of Dragon Terrain team in Wuhan University, P.R. China, in October 2005

ACADEMIC EXCHANGES

Post graduate training	Working within the framework of the Dragon Programme, 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 the project teams have undertaken joint field campaigns in P.R. China
Academic exchange	European scientists have visited their partner institutions in P.R. China

In April 2007, Mr. Tian Xin joined the International Institute for Geo-Information Science and Earth Observation (ITC) as a sandwich Ph.D. student jointly supported by ITC and the Institute of Forest Resources Information Techniques Chinese Academy of Forestry.

The National Key Laboratory of Microwave Imaging Technology, from the Institute of Electronics, Chinese Academy of Science (MITL IECAS) is a new partner in the Dragon Project ID2556. In July 2006, Prof. Eric Pottier from IETR, University of Rennes, visited IECAS and attended Ms. Cao Fang's Ph.D. thesis defence on April 3rd, 2007. A convention between the two institutes (MITL IECAS – IETR) is in preparation.

There have been cultural exchanges between Politecnico di Milano and Wuhan University with a delegation of Chinese scientists visiting POLIMI in March 2007 to sign an academic exchange programme. A Chinese student will be hosted in Milan with a scholarship financed by POLIMI for a co-tutored Ph.D. programme.

In July 2006, a field survey was organized by Prof. Li Jiren team in order to validate the ENVISAT product as well as to present Dragon results to the institutes involved in flood monitoring in the Jiangxi province: Water resource and drought bureau, Flood control headquarter office, in Nanchang and flood retention basin agency such as the Flood and Dike management Agency of Kangshan.

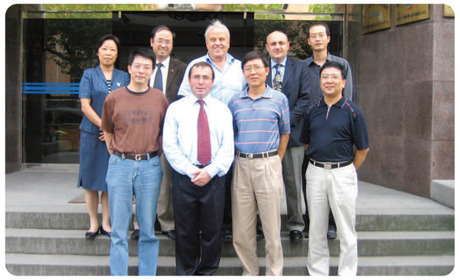
Sun Jianbao, Graduate University, Chinese Academy of Sciences, visited ENS Paris in December 2006. A GPS campaign across the Haiyuan fault has been organised. InSAR data analysis and installation of permanent GPS stations near the Kunlun fault have been funded by French Agencies.

(right) a GPS campaign across the Haiyuan fault (people from ENS, Paris and CEA, Beijing and Xian); (above) the Flood Dragon team during the field survey in the Jiangxi province

(left) Prof. Eric Pottier at Ms. Fang Cao's Ph.D. thesis defence; (below) 20m PBL tower (SMTMS) at the Linzhi Station, built in November 2006, as part of the ITP/CAS cooperation

DRAGON PROGRAMME MANAGEMENT

17 October 2006	Progress Meeting no.10 at Chinese Academy of Forestry, Beijing
19 and 20 October 2006	Meeting with Second Institute of Oceanography, Hangzhou P.R. China to discuss organisation of 2nd advanced training course in Ocean remote sensing in 2007
29 November 2006	Visit to 2007 Symposium venue, Aix-en-Provence, France
13 March 2007	Progress Meeting No.11 at Chinese Academy of Forestry, Beijing



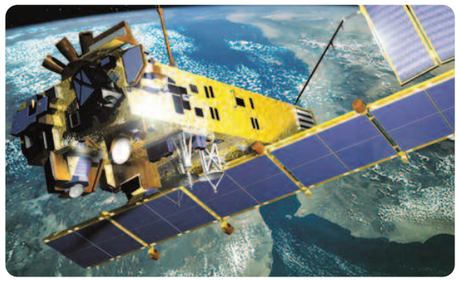
Meeting between ESA, NRSCC and staff of SOED, SIO, Hangzhou P.R. China on 19 October 2006

Progress meeting with ESA, NRSCC officials and Chinese investigators, 17 October 2006, Chinese Academy of Forestry, Beijing

NRSCC representatives with Chinese Dragon investigators, (at Dragon Progress meeting 11) 13 March 2007, Chinese Academy of Forestry, Beijing

On 17 October 2006, ESA and NRSCC had a joint progress meeting with Chinese Dragon investigators in Beijing. The progress and status of EO data delivery to the projects was reviewed. Further planning for EO data acquisitions was made. In the last 6 months overall 86% of requested ASAR and MERIS FR imagery were delivered to the projects. ASAR WSM and GMM, AATSR, MERIS RR and atmospheric chemistry instrument data are being accessed by ftp and the web file selector by several teams. On 19 October 2006, the organisation for the 2nd advanced training course in ocean remote sensing was initiated following a visit to the Second Institute of Oceanography, Hangzhou.

In November 2006, following a visit to Aix-en-Provence, ESA selected the venue for the fourth annual Symposium to be held in Aix-en-Provence. On 12 March 2007 ESA and NRSCC had a progress and planning meeting with the Chinese partners for the EO and sport project at which data delivery and early results were discussed. On 13 March 2007, ESA and NRSCC had a progress meeting (no. 11) with Chinese Dragon investigators. Further progress and results were presented by the project lead investigators and ESA informed about the organisation of the Aix-en-Provence Symposium. ESA and NRSCC had a second planning and organisation meeting with the Second Institute of Oceanography, Hangzhou (photo top of page).



ENVISAT is the largest Earth Observation spacecraft ever built. It was launched from French Guiana by Ariane 5 on the 1st March 2002

LATEST FIGURES

As of April 2007, a total of 13000 ASAR and SAR scenes delivered to PIs

As of April 2007, a total of 4000 MERIS FR and AATSR scenes delivered to PIs

Systematically available products accessed through the Internet (e.g. ASAR Medium Resolution, MERIS RR etc)

Several ESA Third Party Missions data available to PIs

ENVISAT ASAR and ERS SAR DATA

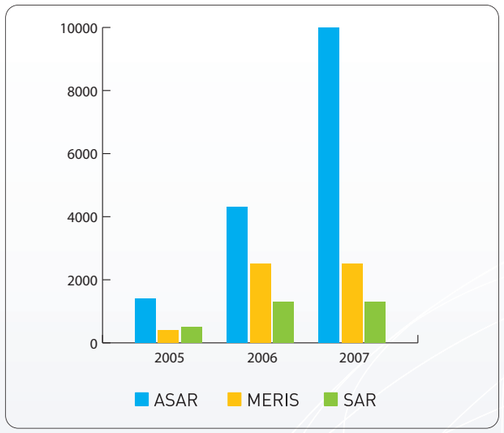
- ASAR and ERS SAR data newly planned and from the archive are available on CD/DVD
- ASAR planning requests are analyzed up-front in order to minimize the cancellations due to mode conflicts
- ASAR data in Near Real Time are available to the Flood Monitoring project in case of flooding, via Internet through the Rolling Archive

MERIS and AATSR DATA

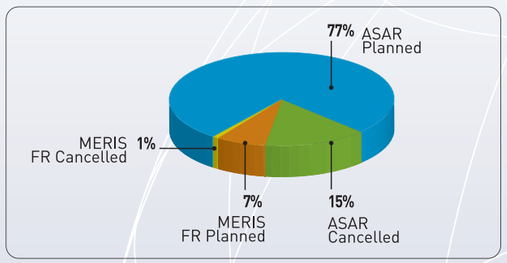
- MERIS FR data newly planned and from the archive are available on CD/DVD
- MERIS FR planning requests are analyzed up-front in order to minimize the cancellations due to on-board recorder conflicts
- MERIS RR and AATSR data are systematically available to all projects in Near Real Time, via Internet through the Rolling Archive and the Envisat Web File Server

ATMOSPHERIC DATA

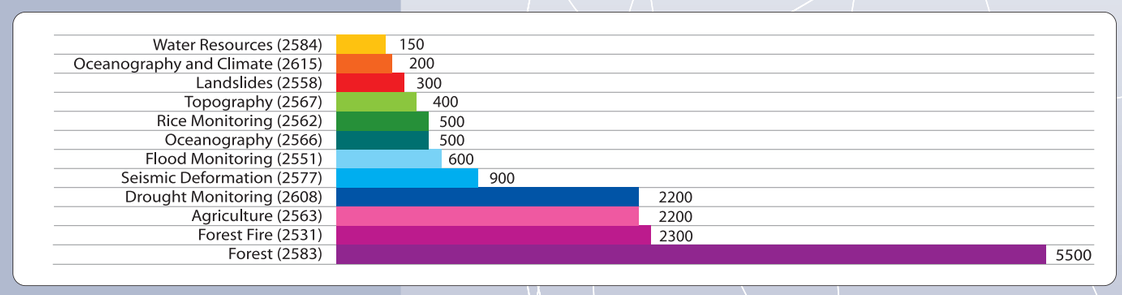
- GOMOS, MIPAS, SCIAMACHY and GOME data (already available to European Partners through FTP) were provided to Chinese Teams on DVD



ASAR, SAR and MERIS data delivery increase since April 2005



Percentage of planned data vs cancellations



Amount of ASAR and SAR data distributed so far

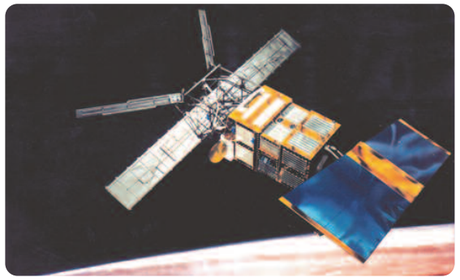
DRAGON STUDY AREAS

Instrument's planning conflicts are checked up-front following the "Dragon conflict free" scheme

Out of the 13000 ASAR or MERIS FR planning requests, 84% were successfully planned

The 16% unplanned were mainly due to conflicts with the increasing commercial requests over China

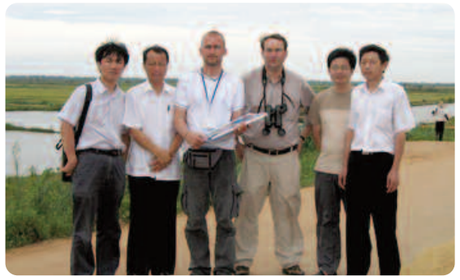
Few requests over the Eastern part of China were cancelled because not in ARTEMIS visibility (i.e. no simultaneous ASAR HR/MERIS FR acquisitions are available)



ERS-2: European Remote Sensing satellite was launched from French Guiana by Ariane 4 on the 21st April 1995

The Dragon study areas for land and ocean projects. N.B. the Atmospheric Chemistry instruments coverage is global; the PolInSAR project is currently not requesting ESA data

DRAGON YOUNG SCIENTISTS



Young scientist Remi Andreoli with Dragon Flood partners in P.R. China

ESA & NRSCC	Supported post graduate training for Chinese and European young scientists in land, ocean and atmospheric applications
Degrees	Master of Science, doctoral degrees and post doctoral research supervised by leading EO scientists in Europe and China
P.R. China	Study periods, field work, and data collection
Reporting	In dedicated sessions at Dragon Symposia
Latest results	Presentations at the 2007 Envisat Symposium, Montreux Switzerland

In both Europe and P.R. China young post graduate scientists are working on the Dragon projects. The type of studies supported include Master of Science, Ph.D. and post doctoral research. The first reporting by the young scientists was at the Santorini Symposium in June 2005 and the second was at the 2006 Lijiang Symposium where a total of 22 presentations were made in three sessions.

Research topics presented included land, ocean and atmospheric applications. In session 1, results were presented on interferometric processing and research for DEM construction and mapping in the particularly complex terrain of the three gorges area. There were also presentations on mapping deformation using coherent targets in Shanghai and on the measurement of strain across the Haiyuan fault. The second session covered the results on ocean research by Chinese scientists including studies on mapping internal waves and sea state categorisation and various land applications results in forest biomass and forest fire mapping as well as flood and drought mapping. In the third session there were presentations that covered rice mapping and methane modelling, NO_2 monitoring and forest/non forest classification using SAR and InSAR data.

During 2006 and 2007, several of the young European scientists have undertaken extended study periods and field data collection campaigns in P.R. China. They have been working with their Chinese counterparts. At the 2007 Envisat and Aix-en-Provence Symposia in April and June 2007 respectively, the young scientists will report on their further progress to date.

Lijun Lu (left) from Wuhan University P.R. China, Daniele Perissin (right) from Politecnico di Milano Italy, presenting results at the session dedicated to young scientists at the 2006 Lijiang Symposium

Alexandre Bouvet (CESBIO), France (left) and Remi Andreoli (SERTIT), France (right) presenting at the Montreux Symposium Dragon session on 26 April 2007

DRAGON UPCOMING EVENTS

2nd advanced training course in ocean remote sensing

Venue
The course will be hosted by Satellite Ocean Environment Dynamics, Second Institute of Oceanography, Hangzhou, P.R. China

Date
From 15 to 20 October 2007

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, Second Institute of Oceanography and ESA

Course Content
The lectures and practical sessions shall cover theory and processing of EO data from ESA's ERS and Envisat satellites for ocean monitoring and bio-geo-physical retrievals over the China seas

Web
The training course programme and registration forms are available from the Dragon website:

http://earth.esa.int/dragon/oceantraining2007.html
(English)

http://www.soed.org.cn/oceantraining2007
(Chinese)

Entrance to Second Institute of Oceanography, Hangzhou, P.R. China

Final results call for papers and publication

NRSCC and ESA propose that the final results are published as an ESA/NRSCC joint publication

Objectives
- To provide the final results of the project teams' work at the end of the three year Dragon Programme
- Co-authorship of papers by European and Chinese scientists
- Make available the Special Publication (SP) as a CD-ROM to all Dragon investigators

Schedule
- The call is open from the end of 2007
- Papers must be submitted at the 2008 Symposium
- The proceedings shall be available in the summer of 2008

Olympic Sailing Center at the Agios Kosmas area of Athens

Use of Earth Observation in Support of the Needs of Major Athletic Events: Case Study for the Olympic Games (Athens-Beijing-London)

Prof. Costas Cartalis,	e-mail: ckartali@phys.uoa.gr
Dr. Chen Guihong,	e-mail: chengh@beijingit.gov.cn
Dr. Li Jun,	e-mail: lij@beijingit.gov.cn

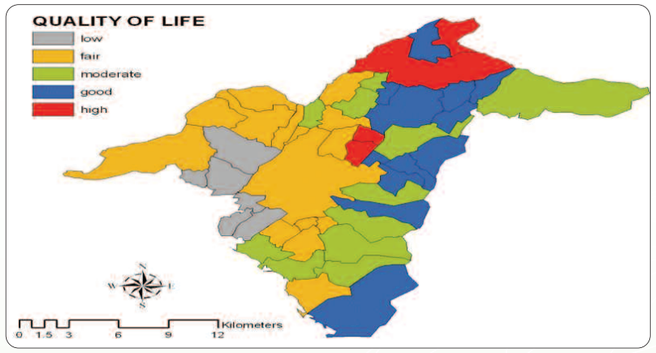
Dr. Michalis Petrakis, Dr. Iphigenia Keramitsoglou, Dr. Nektarios Chrysoulakis, Mrs. Marina Stahopoulou, Dr. Iarla Kilbane-Dawe, Dr. Roger Saunders, Dr. Roger Proctor, Dr. Jack Lee, Mr. Steve Groom, Dr. Yu Too, Dr. Zhang Yong, Dr. Li XiaoJuan, Dr. Wang Yanbing, Dr. Li Xiaojing, Dr. Zeng Kan, Dr. Zhuo Chen, Prof. Dr. Xue Yong, Prof. Guo Huadong, Prof. Wang Pucai, Dr. Liu Yi

Use of Earth Observation for the:
- Planning and organisation of major sport events,
- Planning and development of the host city,
- Monitoring of prevailing environmental and meteorological conditions (with emphasis during the Olympic period),
- Assessment of the impact of the sport event to the host city,
- Change detection due to the sport event with emphasis in environmental and quality of life changes.

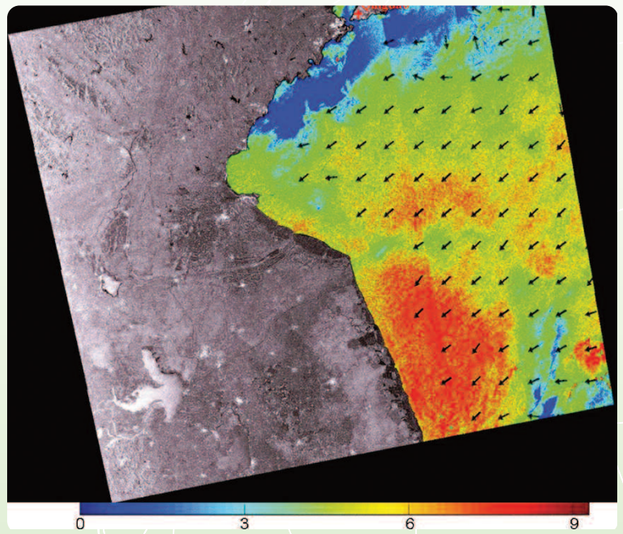
For the Athens Games of 2004, results so far include the assessment of the thermal environment, the spatial depiction of the Thom discomfort index, the spatial definition of the cooling degree days, the spatial depiction of aerosol thickness in the lower atmosphere and the definition of a special indicator which by comprising satellite and ground data provides a snapshot of the quality of life in Athens (see Figure top). The above are tested for the periods prior and following the Games by exploiting both archive (pre-Games) and up-to-date EO imagery to demonstrate the changes.

For the 2008 Beijing Games, results so far include the mapping of changes in the urban fabric around the Olympic park, the definition of aerosol optical thickness, the spatial and temporal analysis of urban green and the development of a GIS system which combines EO and other geo-spatial data. Results also include oceanographic information for the Qingdao area where the Olympic sailing event is to take place (see Figure bottom).

The consortium participated in the 2006 Lijiang Symposium PRC and has also demonstrated the project to the Beijing Organising Committee for the Olympic Games and to the International Olympic Committee.



Spatial depiction of a composite indicator on the quality of life in Athens (2005). Within the Dragon project, the quality of life indicator will be defined and inter-compared for the periods 1995-2000, 2000-2004 and the post games period



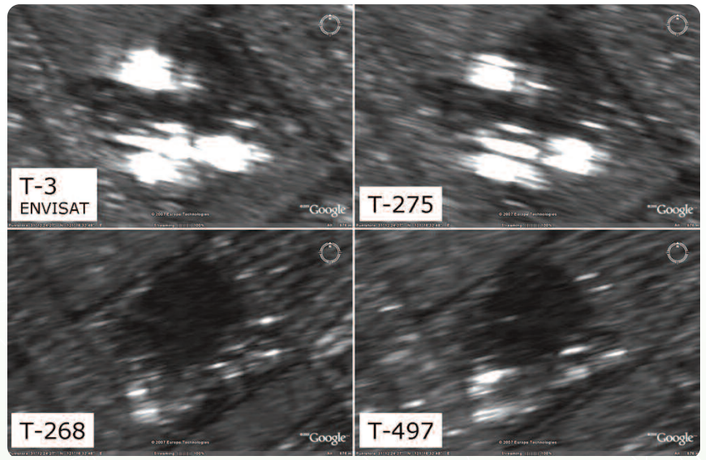
ESA EO data can be used to retrieve important information for the 2008 Olympic open water events such as wind field retrieval here shown derived from an ASAR image acquired on Aug-22 2006 (Courtesy of First Institute of Oceanography, Qingdao PRC). Within the framework of Dragon, using ASAR WSM imagery, such products can now be generated on a routine basis 6 hours after acquisition.

Topographic Measurement

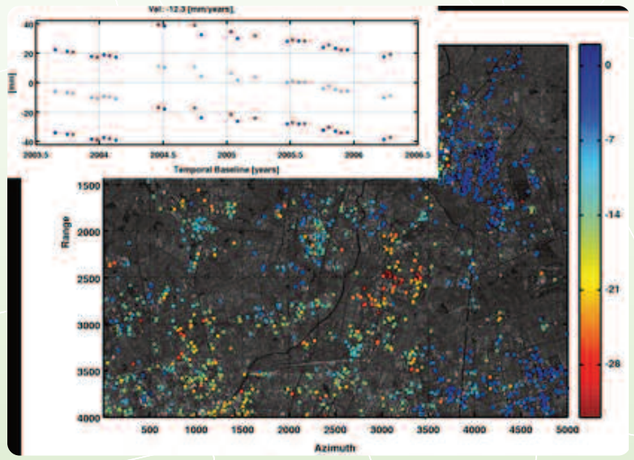
Prof. Li Deren,	e-mail drli@whu.edu.cn
Prof. Fabio Rocca,	e-mail rocca@elet.polimi.it

Dr. Alessandro Ferretti, Prof. Liao Mingsheng, Dr. Daniele Perissin, Prof. Yang Minghui, Prof. Wang Chao, Prof. Zhang A-Gen

Project partners searching for Permanent Scatterers in the Tiger Leaping Gorge, Yangtze River (China), July 2006.



Shanghai dihedrals seen by parallel tracks, shown are an optical image together with SAR georeferenced imagery. Credits: D. Perissin, POLIMI.



Deformation trend of dihedrals in Shanghai as estimated from the combination of ASAR data acquired by the ESA satellite ENVISAT from two different tracks (T268 and T497). The deformation history of a dihedral in Shanghai (Blue dots T268, red dots T497) By combining data acquired from parallel tracks, the revisiting time has been doubled. Credits: D. Perissin, POLIMI.

Objectives
- Urban subsidence
- Landslide analysis & monitoring
- Three Gorges Dam site stability
- Identification of flooded plain based on coherence

Background

Interferometric Synthetic Aperture Radar (InSAR) data gives researchers a new set of tools to measure topography, tiny shifts and deformations in the Earth's surface. This has application in the study of landslides urban subsidence, earthquakes, floods and other natural cataclysms in P.R. China where persistent cloud cover is limiting for optical sensors. The scientific investigations have focused on the application on topographic mapping and earth deformation monitoring using ERS-1/2 SAR and Envisat ASAR data.

Latest results

From the scientific point of view, for the very first time a multi-track Permanent Scatterers (PS) analysis has been carried out exploiting ASAR data acquired over Shanghai from two different parallel tracks. The developed technique is based on the use of dihedrals as a common network of PS's that can be observed by sensors flying along parallel tracks. For example in the top Figure, dihedral scatters are seen by the two parallel descending orbits (T3 and T275) and not by the two parallel ascending ones (T268 and T497). In such a way the ASAR data acquired by the ESA satellite ENVISAT can be fruitfully processed in a multi-temporal framework in order to retrieve deformation measurements, even when a low number of images per track is available (which happens due to unavoidable conflicts in the request of different acquisition modes of the ASAR sensor). The bottom figure shows the deformation field mapped using this method and the deformation history for a dihedral scatterer.