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The Dragon Programme

– A Collaboration between
ESA and the Ministry of Science and Technology (MOST) of China

Z. Bob Su

Z.Su@utwente.nl

<http://www.itc.nl/wrs>

Presented by Yijian Zeng



FACULTY OF GEO-INFORMATION SCIENCE AND EARTH OBSERVATION



Dragon Programme Background



Background

- China Remote Sensing Ground Station (Beijing)
 - ERS acquisition since 1994
- The agreement of the Co-operation between ESA and MOST, China for the operational use of ERS data in China was signed by Mrs. Zheng Lizhong, the former deputy director of NRSCC, MOST and Mr. Guy Duchossois from ESA in May, 1997. The following projects were created:
 - Rice Mapping in Southern China;
 - Land-use Mapping for Beijing Area;
 - Flooding Monitoring in China;
 - Oceanographic Study;
 - Mapping China Forest with ERS SAR Tandem Data.

Xiamen Dragon Symposium, 27-30 April 2004



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Background

- The former Secretary General of MOST, Prof. Lin Quan discussed the cooperation projects with the former Director General of ESA, Dr. Antonio Rodota in September, 1999.
 - Agriculture;
 - Land use;
 - Disaster;
 - To update forest map produced from ERS tandem data using Envisat ASAR data;
 - Oceanography;
 - Training.

Xiamen Dragon Symposium, 27-30 April 2004



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Dragon Programme Background



Background

- September 2003 meeting in Paris between Prof. Xu Guanhua, Minister of MOST and Mr Jean Jacques Dordain, Director General of ESA, it was agreed that a joint research programme in the field of remote sensing be initiated.
- As directors responsible for the programme, Prof. Shao Liquin, the former Director General of NRSCC, and Prof. Jose Achache, Director of ESA Earth Observation Programmes, have stressed the creation of joint Sino-European teams as a means to stimulate scientific exchange in Earth Observation science and technology. As a consequence, a formal programme of co-operation, "The Dragon Programme", has been initiated that brings together investigators from Europe and China.

Xiamen Dragon Symposium, 27-30 April 2004



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Dragon Programme Background



Objectives

- Exploitation of ESA data from ERS and ENVISAT satellites for Science and Applications development;
- Set-up joint scientific teams including lead scientists from China and Europe;
- Exchange of trainees working on the projects;
- Contribution to the following priority themes:

Agricultural Monitoring, Flood Monitoring, Forest Mapping, Rice Monitoring, Forest Fire Monitoring, Oceanography, Terrain Measurement, Air Quality Monitoring and Forecasting, Chemistry/Climate Change in the Atmosphere, Deriving Forest Information from POLInSAR Data, Drought Monitoring, Water Resources and Hydrology



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Xiamen Dragon Symposium, 27-30 April 2004



Dragon Programme overview

- **Dragon is a cooperation between ESA and the Ministry of Science and Technology (MOST) of the P.R. China.**
- Dragon I Programme 2004-2008, (15 projects)
- Dragon II Programme 2008-2012, (25 projects)
- Dragon III Programme 2012-2016, (50 projects)
- - Exploitation of ESA, TPM and Chinese EO data for geo-science and applications development in land, ocean and atmospheric applications
- - Joint Sino-European teams to investigate 50 thematic projects



Dragon Programme overview

- **ESA**

- ***Yves-Louis Desnos***

Head of R&D Section and Senior Advisor
Science and Applications and New
Technologies Department
Directorate of EO Programmes
ESA/ESRIN

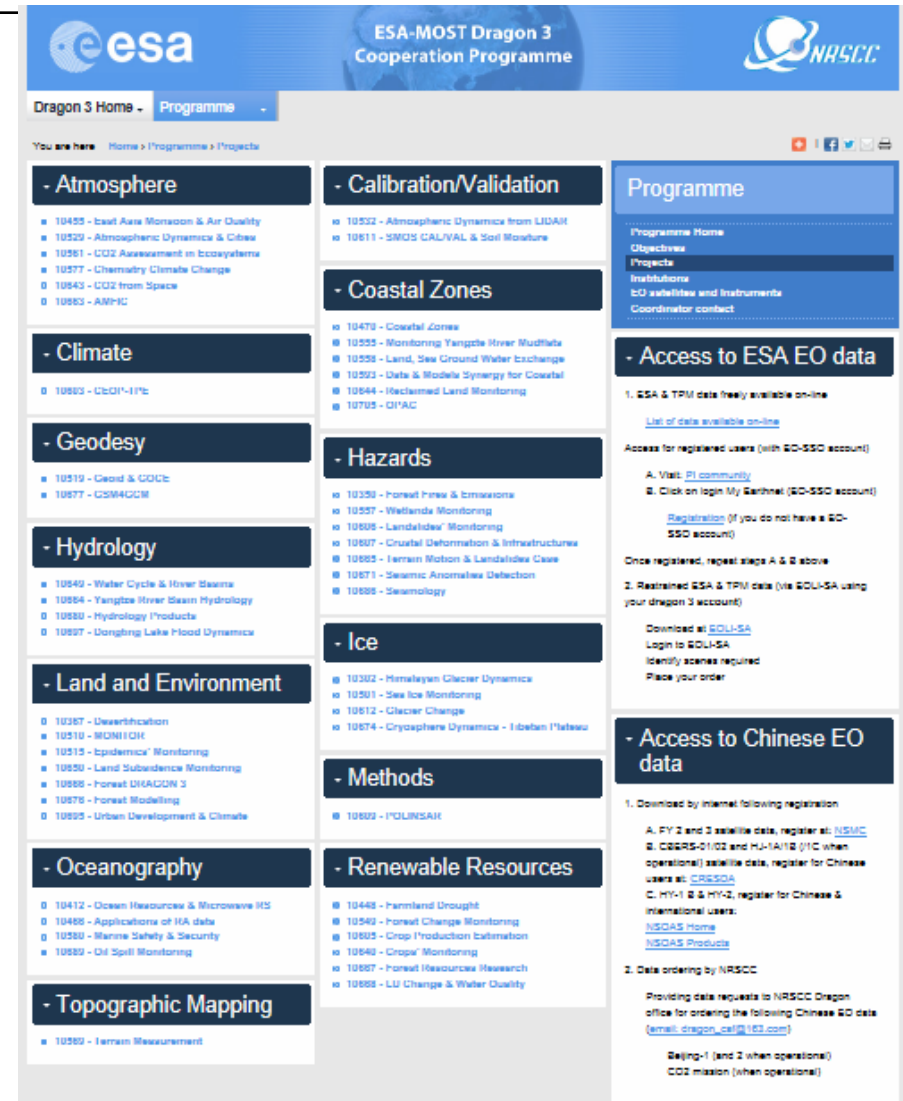
- **China**

- **Li Zengyuan**

Member of experts commission of National Remote
Sensing
Deputy Director of Institute of Forest Resources
Information Techniques
The Chinese Academy of Forestry



- Programme components
- 50 research projects
- 169 institutions from Europe and China
- Dragon advanced training courses
- Dragon young scientists (PhD/MSc/Posdotcs)
- Dragon visiting scientists

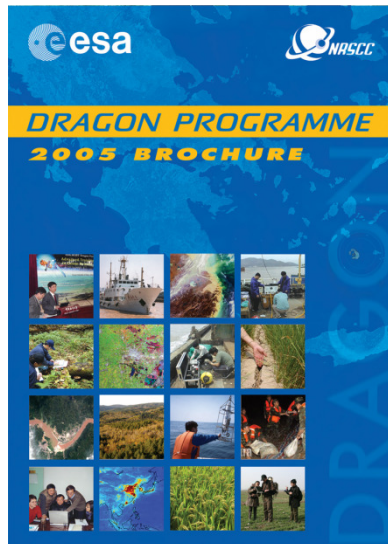


The screenshot shows the website interface for the ESA-MOST Dragon 3 Cooperation Programme. The header includes the ESA and NASCC logos and the programme name. The main content area is organized into several columns and sections:

- Dragon 3 Home - Programme**: Navigation menu.
- You are here**: Home > Programme > Projects.
- Atmosphere**:
 - 10455 - East Asia Monsoon & Air Quality
 - 10529 - Atmospheric Dynamics & Cities
 - 10561 - CO2 Assessment in Ecosystems
 - 10577 - Chemistry Climate Change
 - 10643 - CO2 from Space
 - 10663 - AMPC
- Climate**:
 - 10663 - CCI-M-IPF
- Geodesy**:
 - 10519 - Geod & COC
 - 10677 - GSMAGCM
- Hydrology**:
 - 10640 - Water Cycle & River Basins
 - 10664 - Yangtze River Basin Hydrology
 - 10660 - Hydrology Products
 - 10697 - Dongting Lake Flood Dynamics
- Land and Environment**:
 - 10267 - Desertification
 - 10510 - MONIICH
 - 10515 - Ecosystems Monitoring
 - 10650 - Land Subsidence Monitoring
 - 10666 - Forest DRAGON 3
 - 10676 - Forest Modelling
 - 10695 - Urban Development & Climate
- Oceanography**:
 - 10412 - Ocean Resources & Microwave ITS
 - 10466 - Applications of RA data
 - 10550 - Marine Safety & Security
 - 10660 - Oil Spill Monitoring
- Topographic Mapping**:
 - 10560 - Terrain Measurement
- Calibration/Validation**:
 - 10532 - Atmospheric Dynamics from LIDAR
 - 10611 - SMOS CAL/VAL & Soil Moisture
- Coastal Zones**:
 - 10470 - Coastal Zones
 - 10535 - Monitoring Yangtze River Mudflats
 - 10536 - Land, Sea Ground Water Exchange
 - 10593 - Data & Model Synergy for Coastal
 - 10644 - Reclaimed Land Monitoring
 - 10705 - DPAC
- Hazards**:
 - 10330 - Forest Fire & Emissions
 - 10557 - Wetlands Monitoring
 - 10606 - Landslides Monitoring
 - 10607 - Crustal Deformation & Infrastructures
 - 10665 - Terrain Motion & Landslides Case
 - 10671 - Seismic Anomalies Detection
 - 10666 - Seismology
- Ice**:
 - 10302 - Himalayan Glacier Dynamics
 - 10501 - Sea Ice Monitoring
 - 10612 - Glacier Change
 - 10674 - Cryosphere Dynamics - Tibetan Plateau
- Methods**:
 - 10602 - POLINSAR
- Renewable Resources**:
 - 10446 - Farmland Drought
 - 10540 - Forest Change Monitoring
 - 10605 - Crop Production Estimation
 - 10640 - Crops Monitoring
 - 10667 - Forest Resources Research
 - 10666 - LU Change & Water Quality
- Programme**:
 - Programme Home
 - Objectives
 - Projects
 - Institutions
 - EO satellites and Instruments
 - Coordinator contact
- Access to ESA EO data**:
 - 1. ESA & TPM data freely available on-line
 - List of data available on-line
 - Access for registered users (with EO-SSO account)
 - Visit: [PI community](#)
 - Click on login My Earthnet (EO-SSO account)
 - Registration (if you do not have a EO-SSO account)
 - Once registered, repeat steps A & B above
 - 2. Restricted ESA & TPM data (via EOUSA using your dragon 3 account)
 - Download at: [EOUSA](#)
 - Login to EOUSA
 - Identify scenes required
 - Place your order
- Access to Chinese EO data**:
 - 1. Download by internet following registration
 - FY 2 and 3 satellite data, register at: [NSMC](#)
 - CBERS-0102 and HJ-1A1B (11C when operational) satellite data, register for Chinese users at: [CRSSOA](#)
 - HY-1 & HY-2, register for Chinese & international users: [NSOAS Home](#) / [NSOAS Products](#)
 - 2. Data ordering by NASCC
 - Providing data requests to NASCC Dragon office for ordering the following Chinese EO data (email: dragon_csr@163.com)
 - Beijing-1 (and 2 when operational)
 - CO2 mission (when operational)

Dragon III Programme

- 50 projects
(circled ones most relevant to IGWCO)
- Dragon annual symposia
- Dragon proceedings



| | |
|--|---|
| <p>- Atmosphere</p> <ul style="list-style-type: none"> 10455 - East Asia Monsoon & Air Quality 10529 - Atmospheric Dynamics & Cities 10561 - CO2 Assessment in Ecosystems 10577 - Chemistry Climate Change 10643 - CO2 from Space 10663 - AMFIC | <p>- Calibration/Validation</p> <ul style="list-style-type: none"> 10532 - Atmospheric Dynamics from LIDAR 10611 - SMOS CAL/VAL & Soil Moisture |
| <p>- Climate</p> <ul style="list-style-type: none"> 10603 - CEOP-TPE | <p>- Coastal Zones</p> <ul style="list-style-type: none"> 10470 - Coastal Zones 10555 - Monitoring Yangtze River Mudflats 10558 - Land, Sea Ground Water Exchange 10593 - Data & Models Synergy for Coastal 10644 - Reclaimed Land Monitoring 10705 - OPAC |
| <p>- Geodesy</p> <ul style="list-style-type: none"> 10519 - Geoid & GOCE 10677 - GSM4GCM | <p>- Hazards</p> <ul style="list-style-type: none"> 10350 - Forest Fires & Emissions 10557 - Wetlands Monitoring 10606 - Landslides' Monitoring 10607 - Crustal Deformation & Infrastructures 10665 - Terrain Motion & Landslides Case 10671 - Seismic Anomalies Detection 10686 - Seismology |
| <p>- Hydrology</p> <ul style="list-style-type: none"> 10649 - Water Cycle & River Basins 10664 - Yangtze River Basin Hydrology 10680 - Hydrology Products 10697 - Dongting Lake Flood Dynamics | <p>- Ice</p> <ul style="list-style-type: none"> 10302 - Himalayan Glacier Dynamics 10501 - Sea Ice Monitoring 10612 - Glacier Change 10674 - Cryosphere Dynamics - Tibetan Plateau |
| <p>- Land and Environment</p> <ul style="list-style-type: none"> 10367 - Desertification 10510 - MONITOR 10515 - Epidemics' Monitoring 10650 - Land Subsidence Monitoring 10666 - Forest DRAGON 3 10676 - Forest Modelling 10695 - Urban Development & Climate | <p>- Methods</p> <ul style="list-style-type: none"> 10609 - POLINSAR |
| <p>- Oceanography</p> <ul style="list-style-type: none"> 10412 - Ocean Resources & Microwave RS 10466 - Applications of RA data 10580 - Marine Safety & Security 10689 - Oil Spill Monitoring | <p>- Renewable Resources</p> <ul style="list-style-type: none"> 10448 - Farmland Drought 10549 - Forest Change Monitoring 10605 - Crop Production Estimation 10640 - Crops' Monitoring 10667 - Forest Resources Research 10668 - LU Change & Water Quality |
| <p>- Topographic Mapping</p> | |





ESA-MOST Dragon 2
ADVANCED TRA

Dragon 2: 4 Advanced Training Courses 2 Land, 1 Atmosphere & 1 Ocean course



作“龙计划”二期



Topics


- Current and future Sino, ESA & TPM EO missions, instruments and data
- Access to ESA, TPM and Chinese EO data
- Principles and advanced theory of optical, thermal and microwave remote sensing
- ESA EO data pre-processing with BEAM, NEST, POLSARPRO
- Processing and products in land applications

Lecturers: 8 European and 2 Chinese EO scientists
Participants: 60 doctoral & post doc. students

ESA-MOST DRAGON 2 PROGRAMME
2nd Advanced Training Course in Land Remote Sensing




武汉大学, 中国, 2008年10月13日-18日
Wuhan University, P.R. China, 13-18 October 2008



Topics

- State of the art in space-based atmospheric science
- Key concepts of the ESA ERS and Envisat missions for atmospheric science
- Tools and methods for the exploitation of ERS and Envisat satellite data
- Theoretical and practical framework for further studies

Lecturers: 6 European and 3 Chinese EO scientists
Participants: 60 graduates, post grads. & doctorates



19 to 24 October 2009 | Nanjing University | Nanjing, P.R. China
南京大学, 中国, 2009年10月19日-24日



Topics

- Sino, ESA & TPM EO missions, instruments & data
- Access to EO data
- Principles and advanced theory of optical, thermal and microwave remote sensing
- ESA EO data pre-processing with BEAM, NEST, POLSARPRO
- Processing and products in land applications

Lecturers: 6 Chinese and 8 European EO scientists
Participants: 80 Masters, doctoral & post Doc. students

ESA - MOST DRAGON 2 PROGRAMME
Advanced training course in land remote sensing



中国科技部-欧洲空间局合作“龙计划”二期
Advanced training course in land remote sensing
6-11 September 2010 | CAREERI | Lanzhou P.R. China
中国科学院国家空间科学与应用研究中心 兰州, 中国 2010年9月6-11日

ESA - MOST DRAGON 2 PROGRAMME
Advanced training course in land remote sensing
中国科技部-欧洲空间局合作“龙计划”二期
陆地遥感高级培训班



2011 Advanced Training Course

ESA-MOST Dragon 2 Programme
→ ADVANCED TRAINING COURSE
IN OCEAN REMOTE SENSING



24-29 October 2011 | State Key Laboratory of Estuarine and Coastal Research
East China Normal University | Shanghai, P.R. China

- 60 Participants, M.Sc., Ph.D. & post doc. Level
- 13 lecturers (10 European & 3 Chinese leading scientists)

24-29 October 2011 | State Key Laboratory of Estuarine and Coastal Research
East China Normal University | Shanghai, P.R. China

2011年10月24-29日
华东师范大学河口海岸学国家重点实验室, 中国, 上海 10

Ex: Ocean training - Objectives of the Training Course

Current ESA missions



Future ESA missions (from 2014)



- Teach future PIs **basic and advanced principles** in optical, thermal, passive and active microwave for ocean surface measurements
- Demonstrate **processing algorithms & data products** for ocean applications
- Demonstrate the use of **toolboxes** for the scientific exploitation of ESA EO data
- Demonstrate **ocean applications**
 - SSH and Sea Level Anomalies
 - Wind and waves from RA & SAR
 - Chlorophyll & SPM from MERIS
 - Ocean salinity from SMOS
 - Ship detection and oil pollution from SAR
 - SST from AATSR

| | MONDAY <i>24 OCT. 2011</i> | TUESDAY <i>25 OCT. 2011</i> | WEDNESDAY <i>26 OCT. 2011</i> | THURSDAY <i>27 OCT. 2011</i> | FRIDAY <i>28 OCT. 2011</i> | SATURDAY <i>29 OCT. 2011</i> |
|--|--|---------------------------------------|---|--|--------------------------------------|--|
| | Opening & lectures | RA | MERIS | ASAR | (A)ATSR | Lectures AM & Closing |
| AM  | Registration | RA Lecture | MERIS Lectures | ASAR Lectures | (A)ATSR Lectures | Models, EO & other data assimilation |
| | Opening session | | | | | |
| | <i>Photo-call & coffee break</i> | <i>coffee break</i> | <i>coffee break</i> | <i>coffee break</i> | <i>coffee break</i> | <i>coffee break</i> |
| | ESA and Chinese EO missions for ocean RS | BRAT Prac. 1 RA data | BEAM Prac. 1 MERIS data | SARtool Prac. 1 ASAR data | Bilko Prac. 1 (A)ATSR data | EO data & climate change |
| | <i>lunch break</i> | <i>lunch break</i> | <i>lunch break</i> | <i>lunch break</i> | <i>lunch break</i> | <i>lunch break</i> |
| PM | Ocean research using ESA & Explorers data | RA Lecture | MERIS Lectures | ASAR Lectures | (A)ATSR Lectures | |
| | Dragon 2 projects in Ocean research | | | | | |
| | <i>coffee break</i> | <i>coffee break</i> | <i>coffee break</i> | <i>coffee break</i> | <i>coffee break</i> | |
| | Access to ESA & TPM EO data Access to Chinese EO data | BRAT Prac. 2 RA & Cryosat-2 data | BEAM Prac. 2 MERIS & SMOS data | SARtool Prac. 2 ASAR data | Bilko Prac. 2 (A)ATSR data | |
| | <i>Welcome Social Event</i> | <i>Poster Session</i> | | | <i>Social Event</i> | |

Software



→ **RA**



→ **MERIS & SMOS**



→ **SAR**



→ **AATSR**

2 Course DVDs



1. Contains

- Lectures presentations
- Practical sessions instructions
- Freeware
- Datasets
- Key ESA documents

2. Please take away and further study following the course

3. DVD distributed at the closing ceremony

Dragon Programme elements – web sites

- <http://earth.eo.esa.int/dragon/>
- <http://dragon2.esa.int/>
- <https://dragon3.esa.int/web/dragon-3/home>
- **ITC, University of Twente – Coordinator for Dragon Advanced Training Courses Since 2005.**



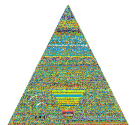


- 10th anniversary of the Dragon cooperation programme, 16 – 29 May 2014, Chengdu

- 2014 Dragon Advanced Training in Water Resources Programme, 13-18 Oct, 2014, Jiangxi Normal University, Nanchang



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2014 Dragon Water Resources Programme

n.b. all lecturers still to be invited



| DAYS 1 & 2: Water cycle | | |
|--|--|--|
| <i>Topic</i> | <i>Type</i> | <i>Lecturer(s) / Tutor(s)</i> |
| Components | Lecture (0.5 days) | TBD Chinese lecturer |
| Measurement | Practical (0.5 days) EO data: ASAR & Sentinel-1 SAR Toolbox: NEST | TBD European lecturer |
| Monitoring | Practical (0.5 days) EO data: SM SMOS & ASCAT Toolbox: BEAM with SMOS Box | European lecturer |
| Climate changes / modeling | Lecture (0.5 days) | TBD Chinese lecturer |
| DAY 3: East Asia Monsoon & Third Pole Environment | | |
| <i>Topic</i> | <i>Type</i> | <i>Lecturer(s) / Tutor(s)</i> |
| East Asia Monsoon | Lecture + Practical (0.5 days) | TBD Chinese lecturer |
| Third Pole Environment | Lecture + Practical: (0.5 days) EO data: SAR / SMOS / ASCAT Toolbox: TBD | Prof. Ma Yaoming (IPT, CAS) & Bob Su (Uni. of Twente) |



2014 Dragon Water Resources Programme

n.b. all lecturers still to be invited



DAY 4: Wetlands & Floods (Poyang Lake Case Example); Rivers & Lakes

| <i>Topic</i> | <i>Type</i> | <i>Lecturer(s) / Tutor(s)</i> |
|--|---|---|
| Wetlands & Floods (Poyang Lake Case Example) | Lecture & Practical (0.5 days) EO data: Optical & SAR Toolbox: ERDAS Imagine | Prof. Huang Shifeng (IWHR) & Dr. Herve Yesou (SERTIT) |
| Rivers and Lakes | Lecture & Practical (0.5 days) EO data: RA Toolbox: BRAT or TBD | Dr. Sylvianne Daillet-Rochette (LEGOS/CNES) |

DAY 5: Inland Water Quality & Hydrology; Drought Monitoring & Assessment

| <i>Topic</i> | <i>Type</i> | <i>Lecturer(s) / Tutor(s)</i> |
|----------------------------------|---|---|
| Inland Water Quality & Hydrology | Lecture & Practical (0.5 days) EO data: MERIS & OLCI Toolbox: BEAM & Plug-in TBD | Chinese lecturer NIGLAS (TBD) |
| Drought Monitoring & Assessment | Lecture & Practical (0.5 days) EO data: AATSR & SLSTR Toolboxes: BEAM & ILWIS | Prof. Bob Su & Lichun Wang & (Uni. of Twente) |



2014 Dragon Water Resources Programme

n.b. all lecturers still to be invited



DAY 6: Climate Change Initiative & Essential Climate Variables (0.5 days)

| <i>Topic</i> | <i>Type</i> | <i>Lecturer(s) / Tutor(s)</i> |
|-----------------------------|----------------------------|-------------------------------|
| Climate Change Initiative | Lecture (0.25 days) | TBD Chinese lecturer |
| Essential Climate Variables | Lecture (0.25 days) | Yves-Louis Desnos (ESA) |



Highlights of achievements:

- **1. PhD education related to Dragon**, 2. Scientific publications, 3. Field observations sites.
-

- 1. Promoted PhD (5)

Dr. Lei Zhong, 2006-2014; Dr. Xuelong Chen, 2010-2013; Dr. Yijian Zeng, 2007-2012; Dr. Changbo Qin, 2007-2011; Dr. Rogier van der Velde, 2005-2010.

(Theses available at: <http://www.itc.nl/Pub/WCC/WCC-output?l=5&d=WRS>)

- Ongoing PhD research (9)

Laura Dente, 2006-2014; Xin Tian, 2007-2014; Longhui Li, 2007-2014; Jahanzeb Malik, 2009-2014; Ying Huang, 2010-2014; Donghai Zheng, 2010-2014; Shaoning Lv, 2012-2016; Binbin Wang, 2012-2016; Qiang Wang, 2013-2017



cum laude graduation for Dr. Yijian Zeng

First ITC PhD degree with distinction as 200th ITC Doctorate!

Coupled Dynamics in Soil: understanding the transport mechanism of liquid water, water vapor, dry air and heat by field experiments and numerical simulation

WMO Young scientist award 2012



Highlights of achievements:

▪ 2. Scientific publications

<http://www.itc.nl/Pub/WCC/WCC-output?l=1&d=WRS>

Examples:

Chen, X, et al, 2014, Development of a 10-year (2001–2010) 0.1-degree dataset of land-surface energy balance for mainland China, ACP (in press)

Su, Z., et al., 2014, First results of the earth observation Water Cycle Multi - mission Observation Strategy (WACMOS) : open access. In: International Journal of Applied Earth Observation and Geoinformation : JAG, 26 (2014) pp. 270-285. (SH/RS)

Su, Z., et al., 2011, The Tibetan Plateau observatory of plateau scale soil moisture and soil temperature (Tibet-Obs) for quantifying uncertainties in coarse resolution satellite and model products, Hydrol. Earth Syst. Sci., 15, 2303–2316, 2011, www.hydrol-earth-syst-sci.net/15/2303/2011/, doi:10.5194/hess-15-2303-2011.

Su, Z., et al., 2013, Evaluation of ECMWF's soil moisture analyses using observations on the Tibetan Plateau : open access. In: Journal of geophysical research : D: Atmospheres, (2013), [118 \(11\)](#), pp 5304–5318.

van der Velde, R., Z. Su, 2009, Dynamics in land surface conditions on the Tibetan Plateau observed by ASAR, Hydrological sciences journal (in press).

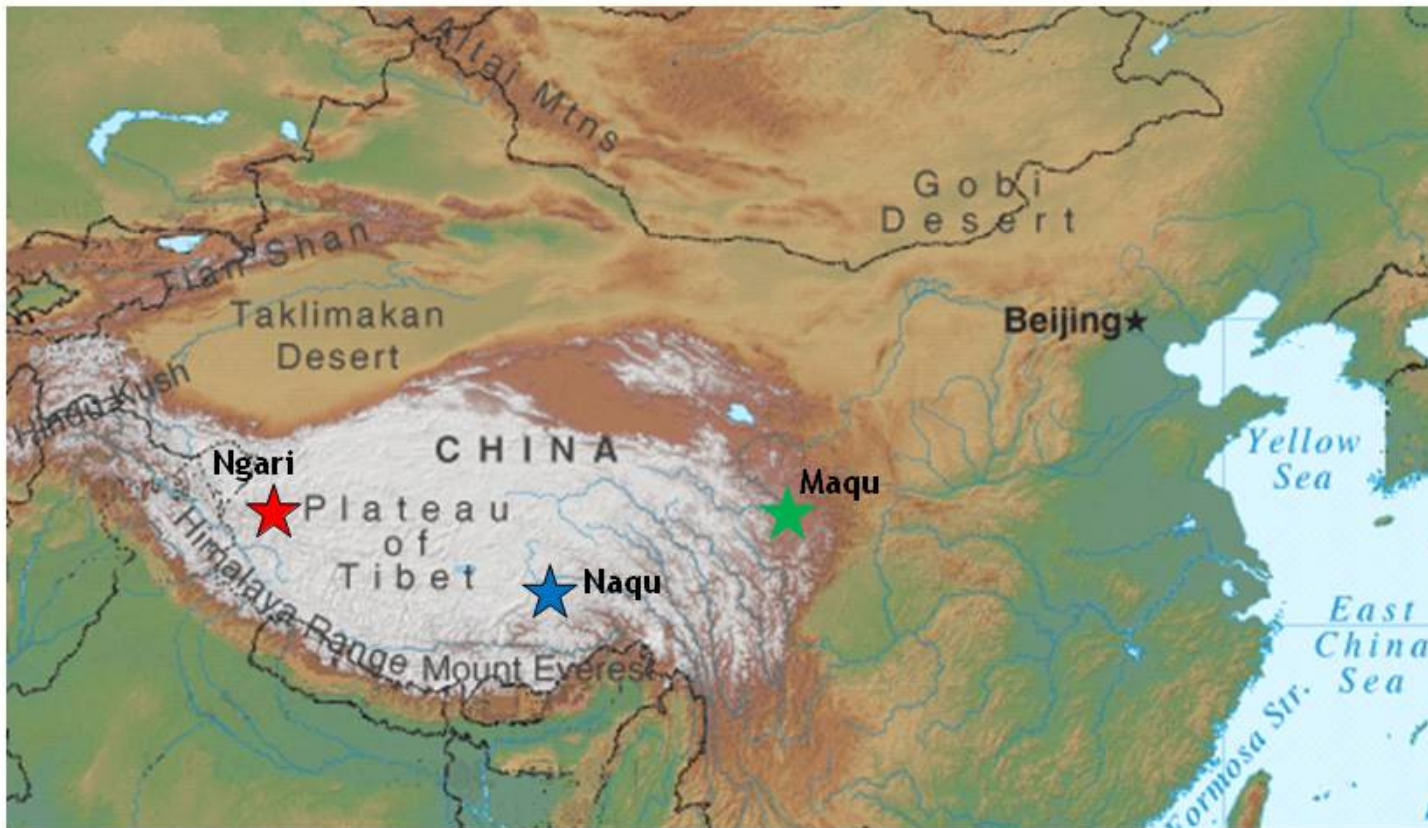
van der Velde, R., et al., 2009, Influence of thermodynamic soil and vegetation parameterizations on the simulation of soil temperature states and surface fluxes by the Noah LSM over a Tibetan plateau site, Hydrology and Earth System Sciences, 13, 759-777.

Zeng, Y., et al., 2011, Numerical Analysis of Air-Water-Heat Flow in the Unsaturated Soil: Is it Necessary to Consider Air Flow in Land Surface Models? JGR, 2011.



3. Field observations sites - ITC/CAS Soil Moisture Networks

Tibetan Plateau soil moisture and soil temperature Observatory (Tibet-Obs)



- ★ ~ Naqu Network (June 2006)
- ★ ~ Maqu Network (July 2008)
- ★ ~ Ngari Network (June 2010)

ESA Dragon programme
EU FP7 CEOP-AEGIS project

(Su, et al., 2014)

For more information

Z. Bob Su

Z.Su@utwnete.nl

<http://www.itc.nl/wrs>



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