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Front Cover–Pictures Prague and Czech University location of the 31th EARSeL Symposium.

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The Newsletter is a forum for an exchange of news and views among the members of the Association. The opinions expressed in the Newsletter do not necessarily reflect the views of the editor, the EARSeL Bureau or the other members of the Association.

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1. EDITORIAL

Dear members,

We welcome new and existing readers.

We are delighted to announce the expansion of the EARSeL family by the Department of Geoinformation in Environmental Planning of the Technische Universität Berlin.

The March issue of the newsletter brings you the reports of activities from Netherlands, Belgium and Croatia national representative of EARSeL.

We are certain the readers will find particularly interesting these national reports which contain an abundance of news and give evidence of the numerous activities in the field of remote sensing of our members.

We would like to highlight that the 31th EARSeL Symposium is coming and it will be full of very interesting presentations.

We are pleased to invite you to also attend the forthcoming Workshops linked to the EARSeL Symposium in Prague.

Please remind that you are cordially invited to send us your comments, suggestions and contributions to be considered for the next EARSeL NEWSLETTER.

We hope we will see you in Prague to enjoy and share this important event!

Sincerely,

Editorial Team

2.1 Report Remote Sensing Activities in the Netherlands in the Year 2010



Prof. Freek van der Meer

Netherlands delegate to EARSeL
ITC, Department of Earth Systems Analysis
PO Box 6, 7500 AA Enschede, The Netherlands.

Submitted to EARSeL Council meeting, ESA Headquarters, Paris,
France



**cloud free Landsat TM mosaic of the Netherlands courtesy Steven de Jong (UU).*

Introduction

This report is split into a general part I which contains information on activities in remote sensing at the National level in the Netherlands and a member specific part II that contains information from the individual members. The latter information was gathered by the Netherlands Delegate to EARSel (Freek van der Meer) who approached all of the members and asked them for a status report on activities in their organization on remote sensing relevant to the EARSel community. The replies received are listed in the Part II of this report. They have been inserted as provided by the contact person of the institute involved. No editing has been done on the various contributions. Content is at the discretion of the member organization.

Earth observation in NL; Part I “general”

report by Prof Freek van der Meer (ITC), Dr. Radboud Koop (NSO; NSO input modified after Dr Rolf de Groot)

The Netherlands' role in Earth Observation has been carved out by over the last 20 years of support and guidance by organisations such as the Netherlands Remote Sensing Board (BCRS), the Netherlands Agency for Aerospace Programmes (NIVR), the Netherlands Institute for Space Research SRON, the Netherlands Organisation for Scientific Research NWO and, since 2009, the Netherlands Space Office in which all these support activities have been merged.

For Earth Observation, NSO, in collaboration with the Earth- and Life Sciences Council of NWO, currently executes a funding programme for fundamental research (User Support Programme Space Research). Supported research themes include atmospheric research (chemistry, dynamics, radiation balance, climate, air quality), water (oceanography, processes in open oceans, coastal and inland waters, cryosphere) and solid Earth (gravitational field, geodynamics, magnetic field), see <http://www.spaceoffice.nl>.

In addition, NSO explores activities to promote and enhance economic and societal use of space in general and earth observation in particular, by means of communication and organisation in the space and user sectors and in society as a whole. For this purpose, in 2010, NSO conducted an extensive investigation into the opportunities and challenges in the space user arena. In 2011 the themes agriculture (precision farming) and water (regional water management) will be studied, whereas other topics will be preliminary investigated.

In the field of planetary geosciences a platform is active in the Netherlands (NPP Nationaal Platform voor Planeetonderzoek, see <http://www.planeetonderzoek.nl/> (only in Dutch)) that brings together scientists and industry in planetary research in the context of ESA's planetary exploration missions. Funding for planetary research is available through the NSO User Support Programme Space Research. Scientists often work in synergy in the fields of Earth sciences and planetary research to the benefit of both.

In 2010 several workshops were held with academia, government and private sector parties to discuss priority issues for earth observation in the Netherlands. Some of the conclusions of the meeting with the academic sector were that particularly “land remote sensing” lacks community based thinking and thus this sector is rather fragmented and this should be tackled. The academic sector, education and capacity building/development are strong points of the Netherlands in Earth Observation but it is still difficult to develop products for which there is a market. From a technological perspectives there are good chances for:

- Hyperspectrale sensors;
- LIDAR;
- GNSS

Netherlands is a player in these Technologies. In terms of application domains the following themes were noted:

- Atmosphere (air quality)
- water management
- soil moisture
- deformation monitoring
- (precision) agriculture

The themes that are considered by the academics as priority in terms of societal relevance are:

- Monitoring and understanding climate change as input to adaptation;
- Spread of diseases
- Natural disasters;
- EO as a governance instrument

Earth observation in NL; Part II “corporate”

The Netherlands has the following member laboratories (those in *italics* have filed a report that is included in this NL report):

1. Rijkswaterstaat Data en ICT Dienst (DiD) Department of Geo-information and ICT
2. Netherlands Institute for Sea Research
3. *Royal Netherlands Meteorological Institute (KNMI) Meteorology and Climatology*
4. National Aerospace Laboratory
5. *Centre for Geo-Information Wageningen UR*
6. *University of Twente, Faculty of Geo-Information Science and Earth Observation (ITC)*
7. *Department of Physical Geography Utrecht University, Faculty of Geosciences*
8. *TerraImaging B.V.*

For full contact details, please consult appendix 1 to this document. Below are contributions received from these members listing remote sensing activities in their organisations.

Royal Netherlands Meteorological Institute (KNMI)

Representative: Hans Roozkrans

In 2010 there have been no launches of European Earth Observation satellites that are of interest for KNMI. However, a major decision is made in 2010 by the EUMETSAT member states with the final approval of the Meteosat Third Generation (MTG) programme. The first (of 6) geostationary MTG satellite will be launched in 2017. Also further progress have been made with the preparation of the EPS Second Generation programme. The first next generation polar orbiting Metop satellite will be launched in 2019 with on board a number of new atmospheric instruments. KNMI has been an active player in the decision process for both EUMETSAT programme's.

The year 2010 was characterised by the focus on the continuation of operational EO tasks of KNMI: the production of EO products for the international user community, like Metop ASCAT wind products and OMI, Sciamachy and GOME-2 atmospheric chemistry products. These tasks are embedded in the so-called Satellite Application Facilities of EUMETSAT (KNMI is partner in 4 of 8 SAF's). In 2010 proposals are prepared to continue the SAF's for another 5 years (the CDOP-2 phase). KNMI also contributes to services that are under development in the framework of GMES (MyOcean, Geoland and MACC).

KNMI's contribution to the preparations for the development of two future ESA missions, TROPOMI/Sentinel-5 Precursor and Aeolus/ADM, have been continued in 2010. TROPOMI is a gap-filler between the OMI instrument on board of the EOS-AURA satellite and the Sentinel-5 mission. KNMI will deliver the PI for TROPOMI that will take care of the global and regional monitoring of atmospheric trace-gases. TROPOMI is planned to be launched in 2014. ADM is a Doppler Wind Lidar instrument that is meant to measure atmospheric wind profiles from space. KNMI is performing simulation studies on the impact of ADM data on weather model results. Many technical problems with the ADM laser technique have caused a major delay of the launch of ADM (originally planned for 2008). The current plan is to launch ADM in 2013.

The use of satellite data for the own operational tasks of KNMI has got a major boost in 2010. The eruption of the Eyjafjallajökull volcano on Iceland caused a major problem for the European aviation. KNMI used intensively Meteosat, GOME-2 and OMI data to monitor the ash plume and based on this information provided advices to the Dutch Aviation authorities. Another example is the use of Meteosat data to automatically detect convective clouds (Cb's and TCU's) in the vicinity of Dutch airports with the purpose to include this information in the AUTOMETAR product for pilots leaving and approaching these airports.

Centre for Geo-Information, Wageningen University & Alterra

Representative: Dr. Jan Clevers

Report written by Dr. Jan Clevers (WU) and Dr. Sander Mûcher (Alterra)

The Centre for Geo-Information (CGI) is a joint undertaking of the laboratory of Geo-Information Science and Remote Sensing (<http://www.geo-informatie.nl/>) of Wageningen University and the department of Geo-Information (<http://www.alterra.wur.nl/UK/research/Specialisation+Geo-information/>) of Alterra. The Centre for Geo-Information comprises two full chairs: Geo-Information Science with special emphasis on GIS, Prof. dr. ir. A.K. (Arnold) Bregt, and Geo-Information Science with special emphasis on Remote Sensing, Prof. dr. M. (Martin) Herold. In addition, two other chairs are affiliated with the Centre, namely an adjunct chair on theory of remote sensing and GIS (Prof. Dr. Martien Molenaar, former rector ITC) and an adjunct chair on radiative transfer (Prof. Dr. Wout Verhoef). The Centre focuses on education, fundamental research and applied research within the Geo-Information domain.

Concerning education the centre is in particular focused on the Master programme Geo-Information Science (<http://www.mgi.wur.nl/UK>). Besides the MSc Geo-Information Science, we also participate in the part-time MSc in Geographical Information Management and Applications (GIMA) (<http://www.msc-gima.nl>). PhD research is mainly affiliated with the C.T. de Wit Graduate School of Production Ecology & Resource Conservation (PE&RC) (<http://www.pe-rc.nl/>).

Research within the Laboratory of Geo-Information Science and Remote Sensing (GRS) has been fed from a steadily growth of the geo-information market. Although this market initially was driven by separately evolving strategies in separate segments, nowadays geo-information science has become a multidisciplinary and collaborative scientific environment. This trend is reflected in the activities of the GRS-group. Research always has a fundamental character, but with a clear link to the Wageningen application fields. Research activities include spatial data infrastructures, spatial data modelling, geo-visualization, quantitative remote sensing, and national, European and global scale land cover/use mapping and monitoring. Staff is working in collaboration with various national and international research institutions and organizations, including the government and private sectors to provide research in geo-information science in order to support policy development and the design and management of rural areas at various scale levels.

Main fields of research activities within GRS:

Remote Sensing Science

This field deals with quantitative, physical and statistical based retrieval of land surface parameters relevant for multiple monitoring applications and earth system modelling and with improved in-situ data analysis for the next generation remote sensing data and products.

Spatial Data Infrastructure & Sensors

This field of research focuses on two major connected themes: spatial data infrastructures and geosensor networks.

Integrated Land Monitoring

This field deals with the human impact on the Earth's surface in terms of biodiversity, climate and social-economic processes.

Society, Space and Decision

This field of research focuses on two major themes. The first theme is a physically and statistically oriented theme "spatial analysis". The other theme aims at society oriented research within the theme "Geo-Information (GI) and society".

Global context & societal benefits of Earth Observation

This field deals with solutions for policy needs and the increasing role of earth observation in monitoring, reporting and verification. Moreover, it deals with harmonization and validation for large-area land cover assessments. Within the Centre, Alterra has recently formed a new team Earth Observation (co-ordinated by C.A. Mûcher, <http://www.earthobservation.eu/>).

A number of remote sensing activities have been identified which can be regarded as the core expertise of Alterra-CGI:

1. Use of RS for regional crop modeling and crop yield forecasting. Core objectives here are: 1) the use of RS derived observations for improved crop modeling and crop yield forecasting through data assimilation and recalibration techniques; 2) the direct use of remote sensing derived indicators in crop yield forecasting systems through statistical approaches. Additionally, RS techniques are used for stratification of spatial domains and (qualitative) validation of crop model parameter settings (e.g. sowing dates). A characteristic of the research done in this domain is that there has been an emphasis on near-realtime application and that analysis techniques and the research approach has been designed with NRT in mind.
2. Habitat & Landscape characterization in relation to ecological modeling: The core objective is to obtain a better spatial identification and characterization of habitats and landscapes using RS derived indicators. Integration of RS derived information with other spatial data sources and in-situ data plays a crucial role. For example, the improved spatial identification of European habitats (inside and outside protected areas) by habitat modeling with RS indicators provides a better basis for habitat monitoring and design of Pan-European Ecological Network (PEEN). A better characterization of European landscapes in terms of landscape structural elements derived from RS, next to habitat identification, leads to improved ecological modelling. For example, used as important variables for ecological dispersal and population modelling (e.g. with LARCH model).
3. Time-series analyses. Expertise on analyses of RS time-series focuses on techniques for cleaning, filtering and information extraction from time-series of RS data mainly provided by sensors as like SPOT-VGT, MODIS and NOAA-AVHRR. The expertise is applied in several projects such as Ecochange (trends in phenology), China-drought (land surface temperature and vegetation anomaly detection for drought monitoring), Land degradation in the Sahel, Geoland-Carbon (validation of global carbon models) and eSOTER (PhD Rogier de Jong). The techniques that have been developed are currently applied to analyses of sowing windows for global

crop models, drought monitoring and prediction, and analysis of vegetation dynamic change in relation to climate change (e.g. EU-FP7 CEOP-AEGIS).

4. Land surface energy balance modeling: Deriving land surface energy balance components mainly using the optical spectral domain has been a long standing area of research. Surface energy balance models, e.g. SEBI, SEBAL, SEBS, S-SEBI and a dual-source model, have been developed by the researchers. Expertise has been developed on the application of the approaches for surface energy balance (as further step evapotranspiration) mapping at different temporal and spatial scales through various projects over the past and currently on-going (EU-FP7 CEOP-AEGIS, AQUASTRESS, etc).

5. Quantitative remote sensing research: Highly specialized radiative transfer models to retrieve both atmospheric variables (atmospheric volumetric water content, aerosol optical depth etc.) and land surface variables (directional fractional cover, land surface temperature, and soil and vegetation component temperatures etc.) using multi-angular and multi-spectral radiometric observations have been developed and evaluated. An image simulation system for the thermal infrared domain has been developed and applied to several ESA projects. The system can be used to simulate the processes of radiative transfer and heat and water exchanges within the canopy and between the land surface and the overlying atmosphere, in turn the bottom of atmosphere (BOA) TIR images. By combining with atmospheric profiles, Top-Of-Atmosphere (TOA) TIR images can be generated.

6. Land use mapping and monitoring: Considerable expertise has been obtained on land use/cover mapping and monitoring in projects such as LGN, CORINE Landcover, PELCOM and GLC2000. CGI creates and maintains the LGN national land use database (<http://www.lgn.nl/>, now version 6 is already available) and CORINE land cover database for the Netherlands (1990, 2000, 2006) which gives a strategic advantage for many projects. This knowledge is also used and combined in more advanced (and partially derived) products such as the European Landscape Classification (LANMAP, <http://www.alterra.wur.nl/UK/research/Specialisation+Geo-Information/Projects/lanmap2>).

During 2010 the following PhD graduation on a remote sensing topic within the Centre was finished:

- Dr. Jochem Verrelst: Space-born spectrodirectional estimation of forest properties.

There is a significant increase in attention paid to the derivation of combined structural and biochemical properties of vegetation from space-based spectrodirectional observations. The CHRIS sensor onboard the PROBA satellite offers a combination of hyperspectral and multi-angular data from space. In his PhD Verrelst estimated biochemical and structural properties of an Alpine forest using CHRIS data. The reflectance anisotropy of an Alpine forest was estimated by calculating a suite of broadband and narrowband vegetation indices from multi-angular data. The influence of both vegetation composition, as expressed by photosynthetic vegetation (PV) and non-photosynthetic vegetation (NPV), and structural variables on the anisotropic reflectance has been assessed. He studied how well chlorophyll content can be estimated from spectral data under varying forest conditions. Using the Rahman–Pinty–Verstraete model, the reflectance anisotropy has been quantified into a single parameter, the so-called Minnaert-k parameter. An analysis of the dynamics of the Minnaert-k parameter over the visible and NIR spectral region led to an improved understanding of the relationships between reflectance anisotropy and canopy structure. Finally, a mapping application was developed that quantifies forest cover heterogeneity at the subpixel scale by combining information from both the hyperspectral and angular domains.

Some specific on-going remote sensing activities concern:

- Hyperspectral Imaging Network (HYPER-I-NET), which is a four-year (2007-2011) FP6 Marie Curie Research Training Network designed to build an interdisciplinary European research community focusing on hyperspectral imaging activities (<http://hyperinet.multimediacampus.it/>).
- Mapping and monitoring land cover and land use in the Netherlands; recently the sixth version of the national land use of the Netherlands (LGN6, www.lgn.nl) has been produced.
- Assimilation of remote sensing data in regional crop growth models on crop yield forecasting has been applied to improve operational systems, such as the MARS-OP project coordinated by the European Joint Research Centre, Ispra, Italy.
- Assessment of the impact of global change on biodiversity of biomes and ecosystems by using advanced dynamic vegetation models parameterized with remote sensing data is performed within the FP6 ECO-CHANGE project (<http://www.ecochange-project.eu>).
- Energy balance modeling and irrigation performance monitoring was performed for pilot projects in Ukraine, Morocco and China to map drought based on satellite imagery to improve operational water management.
- HABISTAT - A classification framework for habitat status reporting with remote sensing methods. This project will use the latest state-of-the-art super resolution (SR) image reconstruction algorithms to narrow the gap of spatial resolutions between airborne and spaceborne hyperspectral data. To improve classification accuracies and to strengthen an operational-oriented classification chain, we will investigate the operational potential of ensemble classifiers in terms of stability, accuracy, ease of use, and computing costs (<http://habistat.vgt.vito.be/>).
- CEOP-AEGIS, Hydrology and Climatology of the Tibetan Plateau (<http://www.ceop-aegis.org/>). An international cooperation project between Europe and Asia to improve knowledge on hydrology and meteorol-

ogy of the Tibetan Plateau and its role in climate, monsoon and extreme meteorological events. CEOP-AEGIS is a Collaborative Project / Small or medium-scale focused research project – Specific International Co-operation Action financed by the European Commission under FP7 topic ENV.2007.4.1.4.2 "Improving observing systems for water resource management", and is coordinated by the LSIIT, University of Strasbourg, France.

- **BIO-SOS: BIOdiversity multi-SOurce monitoring System: from Space TO Species.** It is a new FP7-SPACE project (<http://www.biosos.wur.nl/UK/>), that started on the 1st of December, 2010, aiming to develop tools and models for consistent multi-annual monitoring of NATURA 2000 sites and their surroundings. The emphasis of the project is on NATURA 2000 sites in the Mediterranean part of Europe, but also sites in the Netherlands, Wales and even the tropical rainforest of Brazil are included.

- **MOCCASIN: MONitoring Crops in Continental Climates through Assimilation of Satellite Information.** It is a new FP7-SPACE project that started on the 1st of December, 2010, aiming at crop monitoring by integration of remote sensing in crop growth models. The project particularly focuses on estimating winter-wheat area (crop masks) and estimating the impact of winterkill in winter-wheat by updating the crop model status in spring based on leaf area index retrievals from medium resolution (200-300 m) sensors such as MERIS, MODIS and the Russian KMSS satellite. The project is targeting to develop and operationalize algorithms for modelling winterkill and data assimilation for implementation in the European MARS Crop Growth Monitoring System. More information on <http://www.mocccasin.eu>.

- More information, e.g. on ongoing PhD projects can be found at: <http://www.grs.wur.nl/UK/Research>.

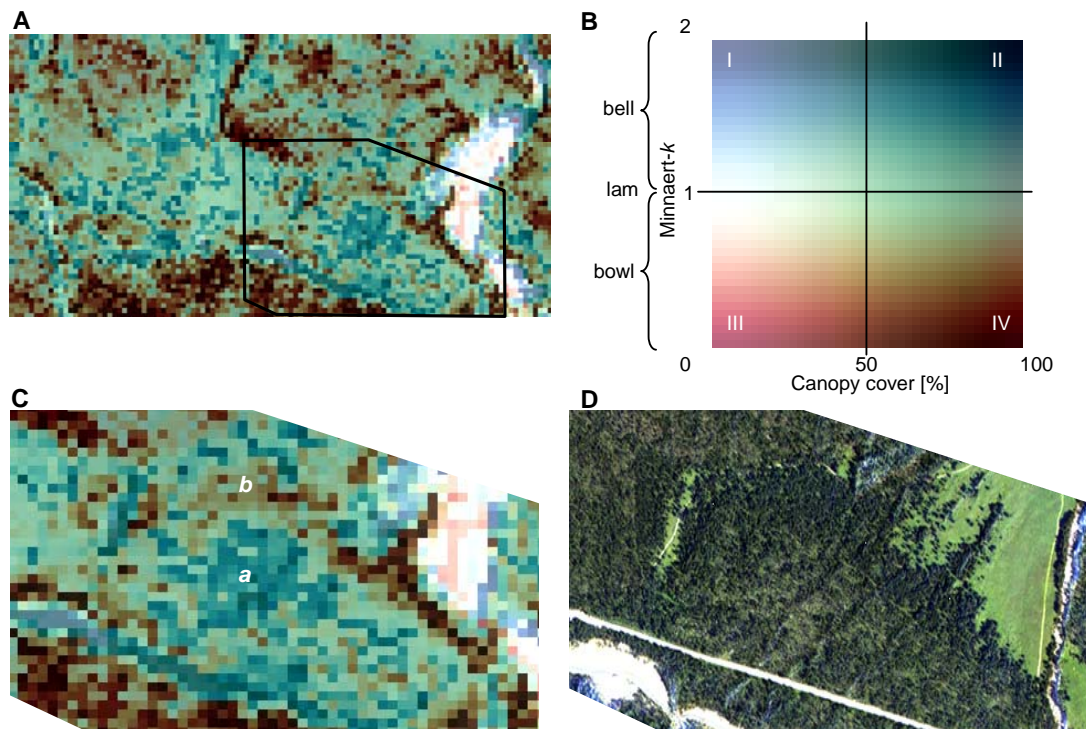


Figure 1: A) The RGB result of merging the Minnaert-k map with the canopy cover map. B) 2D color chart based on the color bar of the canopy cover map (x-axis) and the color bar of the Minnaert-k map (y-axis). C) Zoom-in of the merged map as presented in panel A. D) The reference image as derived from a high resolution stereo camera acquisition in summer 2003 (Source: PhD thesis Verrelst, 2010).

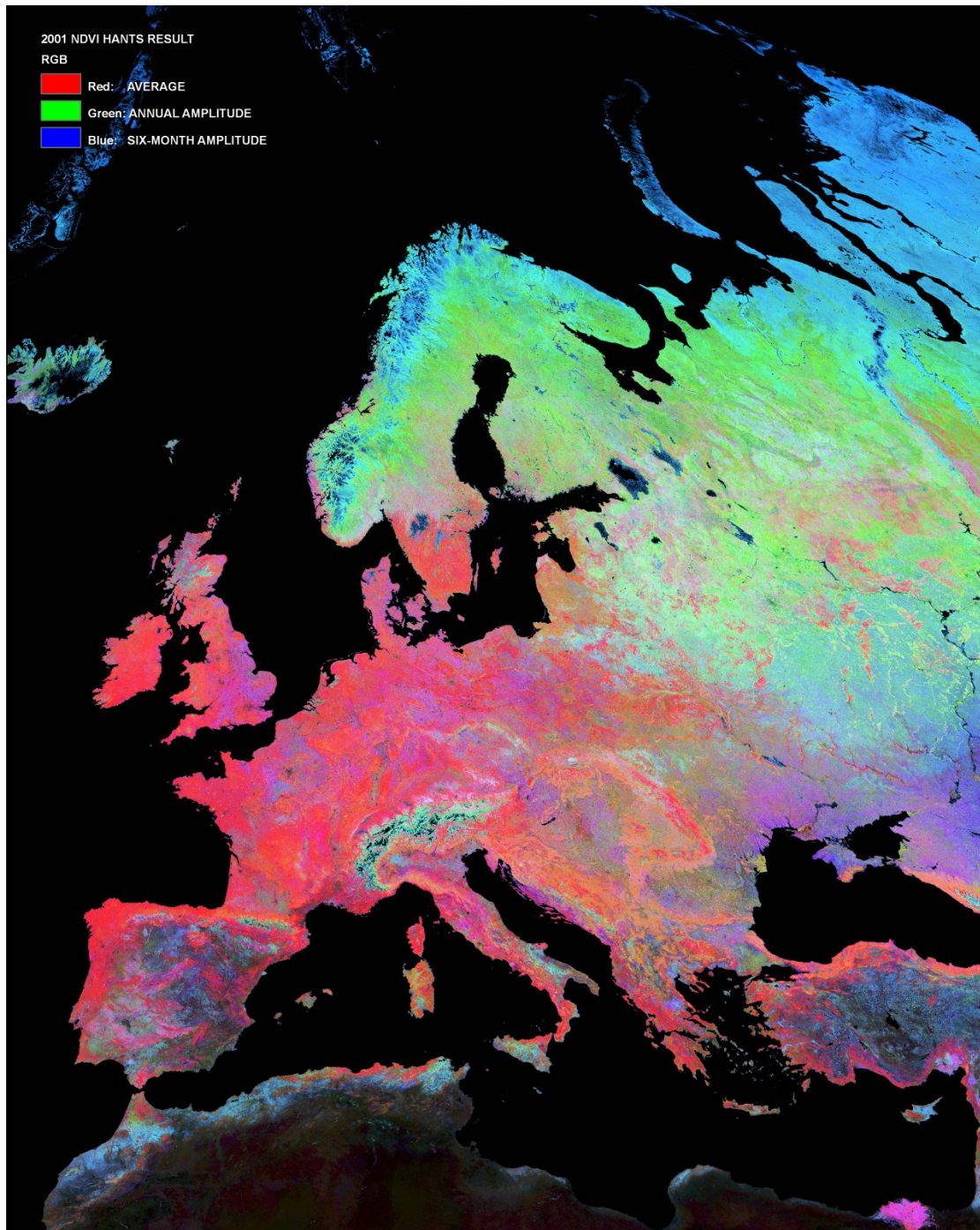


Figure 2: False colour European composite image of the HANTS results of the year 2001, where red colour indicates the NDVI average, green colour indicates the amplitude of annual frequency, and the blue colour indicates the amplitude of the six months frequency (contacts: matthijs.danes@wur.nl or gerbert.roerink@wur.nl).

University of Twente, Faculty of Geo-information Science and Earth Observation (ITC)

Representative: Prof. Freek van der Meer

The year 2010 has been a turbulent one in the positive sense of the word. As of this year ITC started to operate as the sixth faculty of the University of Twente and is now formally: the Faculty of Geo-Information Science and Earth Observation (ITC). The new dean/rector of the Faculty, Prof. Veldkamp, started his term succeeding Prof. Molenaar and the research programme of the ITC was visited and very positively evaluated by a external evaluation committee. The mission of ITC however did not change. At the heart lies education and research in geo-information sciences. But ITC is also committed to alleviating the shortage of skilled middle managers in developing countries with the ultimate aim of building sustainable capacity in the battle against poverty. The key

words characterising our activities are geoinformation management, worldwide and innovative. We concentrate on earth observation, the generation of spatial information, and the development of data integration methods. Furthermore, we provide tools that can support the processes of planning and decision making for sustainable development and the alleviation of poverty in developing countries and emerging economies.

Below a few examples of projects that ITC has carried out in 2010. A full list of projects is found at: <http://www.itc.nl/services>.

Coordinated Asia-European long-term observing system of Qinghai-Tibet Plateau (EU FP7)

Hydro-meteorological processes and the Asian-monsoon system are assessed with ground satellite image data and numerical simulations.

The goal of this project is to:

- Construct out of existing ground measurements and current / future satellites an observing system to determine and monitor the water yield of the Plateau, i.e. how much water is finally going into the seven major rivers of South East Asia; this requires estimating snowfall, rainfall, evapotranspiration and changes of soil moisture;
- Monitor the evaluation of snow, vegetation cover, surface wetness and surface fluxes and analyze the linkage with convective activity, (extreme) precipitation events and the Asian monsoon; this aims at using monitoring of snow, vegetation and surface fluxes as a precursor of intense precipitation towards improving forecast of (extreme) precipitations in South East Asia.

GEO Network for Capacity Building (GEO-Net-Cab; European Commission - DG Research Directorate Environment)

The purpose of this project is to create the conditions for the improvement and increase of the GEO capacity building activities and framework, with special emphasis on developing countries, new EU member states (and EU neighbouring states) and climate monitoring and will serve the bigger goal of improved effectiveness and efficiency of GEO capacity building for application in the GEO societal benefit areas. Coinciding with this purpose, successful brokerage with (potential) clients for earth observation products and services will be facilitated.

The project will deliver the following output:

- Capacity building needs in earth observation are identified (at a generic and global level, but with emphasis on the target regions).
- Specifications for earth observation capacity building are described.
- Resource providers are identified.
- Sustainable brokerage between stakeholders (including resource providers) is established.
- A mechanism to facilitate cooperation between stakeholders and providers is established.
- A global base of technical expertise for education and training in earth observation is established (with emphasis on developing countries, new EU member states and climate monitoring).
- Monitoring and evaluation mechanisms for determining the efficacy of GEO capacity building efforts are established.

Development of Geographic Information Sciences based Education and Research Programme at the National University of Rwanda (NUFFIC funded)

The main objective of the project was to develop capacity at the National University of Rwanda (NUR) to serve as a Training and Research Centre in the field of Geographic Information Science and Remote Sensing, with the aim to address issues that are important in Rwanda for Rural Sector Transformation and Poverty Reduction. This was done through support to the GIS Centre at NUR, staff training, development of curricula for short courses as well as development of curricula for BSc and MSc programmes.

Institutional Building for Natural Disaster Risk Reduction Georgia (Dutch Ministry of Foreign Affairs / Europe / MATRA)

ITC together with its project partner CENN (Caucasus Environmental NGO Network) implement this project to assist the Georgian Ministry of Environmental Protection and Natural Resources to enhance its capacity for effective DRR. Activities are focused at institutional capacity building in disaster risk reduction via introduction of modern spatial approaches and technologies and the development of risk communication strategy in spatial planning in Georgia. Project results will be capacitated local staff; developed and endorsed guidelines for risk assessment and incorporation of hazard and risk information into spatial planning and EIA/SEA; a new system is in place for DRR data management.

Sustainable Management of Mineral Resources (Worldbank)

ITC is partner in a consortium led by the Finish Geological Survey (GTK) to implement the World Bank funded project titled "Sustainable Management of Mineral Resources" in Uganda. The project takes place from November 2008 until May 2011 and supports the Government of Uganda, specifically the Department of Geological Surveys and Mines (DGSM), in producing geological maps, geochemical surveys and mineral resources assessments in selected areas of Uganda (the southern half of the country). ITC is responsible for part of the training activities in the project and organizes several short courses in Uganda and one longer tailor-made course for eight DGSM staff members in the Netherlands. ITC training topics include geological mapping, remote sensing, geology of mineral deposits, their appearance in remote sensing imagery, exploration methods, mineral potential mapping and modelling, digitalisation of geological data and airborne geophysics.

Phd graduations in 2010 include:

- Ambarwulan, W., Verhoef, W. (promotor) and Mannaerts, C.M. (promotor) (2010) Remote sensing of tropical coastal waters : study of the berau estuary, east Kalimantan, Indonesia. PhD thesis University of Twente; summaries in Dutch and English. 153 p. ITC Dissertation 173, ISBN: 978-90-6164-292-3.
- Du, N., Ottens, H.F.L. (promotor) and Sliuzas, R.V. (promotor) (2010) Integrating surface water management in urban and regional planning : case study of Wuhan in China. PhD thesis University of Utrecht; Summaries in English, Dutch and Chinese. 208 p. ITC Dissertation 164, ISBN: 978-90-6164-283-1.
- Foerster, T., Kraak, M.J. (promotor) , van Oosterom, P.J.M. (promotor) and Stoter, J.E. (promotor) (2010) Web - based architecture for on - demand maps : integrating meaningful generalization processing. PhD thesis University of Twente; summaries in Dutch and English. 173 p. ITC Dissertation 165, ISBN: 978-90-6164-285-5.
- Haile, A.T., Jetten, V.G. (promotor) and Rientjes, T.H.M. (promotor) (2010) Rainfall variability and estimation for hydrologic modeling : a remote sensing based study at the source basin of the Upper Blue Nile river. PhD thesis University of Twente; summary in English. 209 p. ITC Dissertation 166, ISBN: 978-90-6164-286-8.
- Knox, N.M., Skidmore, A.K. (promotor) and Prins, H.H.T. (promotor) (2010) Observing temporal and spatial variability of forage quality. PhD thesis University of Twente; summaries in Dutch and English. 165 p. ITC Dissertation 174, ISBN: 978-90-6164-294-7.
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- Ngene, S.M., Skidmore, A.K. (promotor) , Prins, H.H.T. (promotor) and van Gils, H.A.M.J. (promotor) (2010) Why elephant roam. PhD thesis University of Twente; summaries in Dutch and English. 195 p. ITC Dissertation 171, ISBN: 978-90-6164-290-9.
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- van Duong, H., Vosselman, G. (promotor) , Teunissen, P.J.G. (promotor) and Lindenbergh, R. (promotor) (2010) Processing and application of ICESat large footprint full waveform laser range data. PhD thesis TU Delft; summaries in Dutch and English. 211 p.
- Yang, Z., Ottens, H.F.L. (promotor) , Cai, J. (promotor) and Sliuzas, R.V. (promotor) (2010) The role of economic clusters in improving urban planning support. PhD thesis University of Twente; summaries in Chinese, Dutch and English.* Only extended abstract digitally available. 239 p. ITC Dissertation 170, ISBN: 978-90-6164-289-3.

More on research: <http://www.itc.nl/research>

ITC is co-hosting EARSel special interest group thermal remote sensing. SIG-TRS organized a thermal infrared workshop in Gent / Belgium on September 22 - 24 2010. This event was jointly organized with four other EARSel special interest groups: Urban remote sensing, 3D remote sensing, RADAR remote sensing and the SIG on Developing countries. Three sessions on TRS were held. The TRS presented at the ESA Oil and Gas Workshop in Frascati (Fabrizia Buongiorno gave a presentation). TRS also provided a support letter for the proposed TESSAP mission to the ESA EE8. This proposal did not make it.

Department of Physical Geography, Utrecht University

Representative: Prof. Steven de Jong

Report written by: Steven M. de Jong, Elisabeth Addink, Wiebe Nijland & Germari de Villiers

The Faculty of Geosciences of Utrecht University in The Netherlands is a successful research and educational organisation (www.geo.uu.nl). The Faculty has four departments: Physical Geography, Earth Sciences, Human Geography & Planning and Innovation & Environmental Sciences. The faculty has 5 bachelor programs, 16 master programs and a total of 2300 students. The remote sensing, GIS and geostatistical research and educational activities are mainly housed in the Department of Physical Geography. In the past year we continued our work on plague surveillance using earth observation and our hyperspectral activities for mapping vegetation and soil properties (see references under further reading). Below we present some examples of new projects and ongoing research projects.

GEOBIA2010 Conference

For Utrecht University, Ghent University and ITC the year 2010 was a busy year because the team organised the third GEOBIA conference 'Geographic Object-Based Image Analysis' from June 29th until July 2nd after the previous meetings in Calgary and Salzburg. The 2010 conference was an enormous success with over 195 participants (figure 1). The conference was chaired by Elisabeth Addink and Fieke Van Coillie. Topics covered on the conference were, among others, algorithms for segmentation of images and algorithms for object definition in images and a wide range of OBIA applications in forestry, ecology, geology, urban studies etc was presented and discussed. Based on the conference papers and presentation a special issue of the International Journal of Applied Earth Observation and Geoinformation (IJAE) is currently prepared. Further information is available on: <http://geobia.ugent.be>



Figure 1 The around 195 participants to the GEOBIA2010 conference in Ghent



Figure 2 The Ladies Frieke Van Coillie and Elisabeth Addink chairing the GEOBIA 2010 conference in Ghent.

Detection of vegetation water abstraction in a Mediterranean natural area using ERT

Water availability is an important constraint on tree and shrub development in Mediterranean ecosystems, but in practice it is difficult to quantitatively determine the dynamics and spatial (vertical and horizontal) distribution of soil moisture due to the rockiness of the soils. Gravimetric methods and TDR methods mostly fail under these difficult conditions. Precipitation during the growing season is usually low, causing primary production of biomass to be water limited and be dependent on soil water storage. UU and ITC evaluated the possibilities of using Electrical Resistivity Tomography (ERT). ERT measures the resistivity of the soil along transects of 30 m and variations of resistivity are mainly caused by differences of moisture content (figure 3). We applied ERT on several geological substrates (flysch, dolomite, limestone, basalt) and over the dry summer i.e. measurements in June and early September to have the maximum contrast in moisture content. Figure 4 shows the flysch substrate ERT profile for June, the profile for September, and the 'difference profile' between June and September. All the difference profiles show an increase of resistivity in the zone down to 4 m, but only the flysch is shown here as an example. This increase can most probably be contributed to water abstraction by vegetation. Field ERT measurements on different geological substrates and for different vegetation types may provide crucial information on where and how much water vegetation extracts from the soil. Further details of this study are available in Nijland et al. (2010).

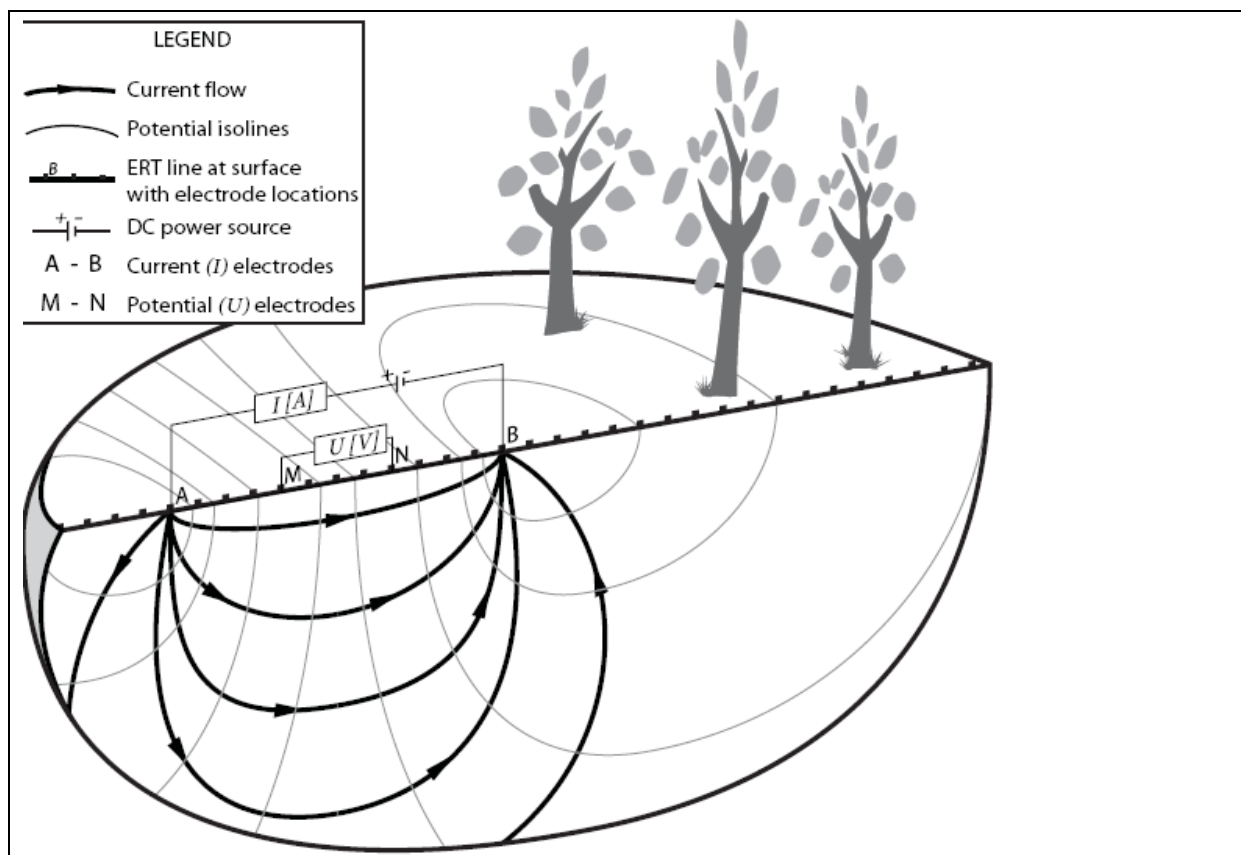


Figure 3 Concept of Electric Resistivity Tomography. The individual measurements are combined and provide an image of resistivity patterns. Measurements over time provide information on soil water content.

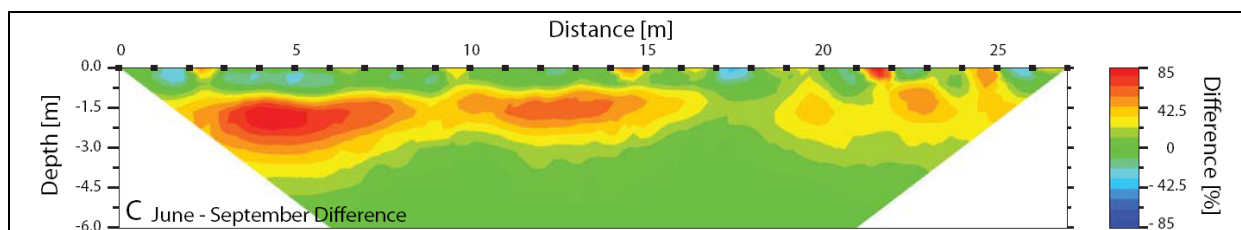


Figure 4 ERT profile on flysch showing resistivity difference between June and September 2007. High resistivity values (red) are an indication for strong water extraction by vegetation at depths between 1.2 to 3.0 m.

Lake delta and fluvial fan morphologies on Mars

Remote sensing is the only tool that we have available to study the morphology of the surface of planets. The department has currently two PhD candidates working on understanding and modelling the morphology of planet Mars and comparing the surface morphology of Mars with that of our Earth. Deltas, fans and channels on Mars clearly indicate the presence of surface water in the past. These features contain valuable information about the duration and magnitude of surface water. Martian deltas show architectural elements similar to terrestrial deltas. We study various types of remote sensing observations of the surface of Mars, we conduct laboratory experiments to construct fans and deltas under controlled laboratory conditions and we build computer simulation models to understand these flow and sedimentation processes. The experiments are carried out in the 'Eurotank', a large laboratory basin equipped with photogrammetry producing high-quality DEMs for quantitative comparison to Martian DEMs shown in figure 5. Results are compared and verified with terrestrial systems and the scaling between experiment and large-scale systems is addressed using verified models correcting for gravity. Figure 6a illustrates a stepped delta produced in the 'Eurotank'. Morphology and scaled size is very comparable with deltas found on planet Mars as the one shown in figure 6b in Coprates Catena. The most important but still preliminary conclusions are that 1) most deltas and fans present on Mars can be created ('mimicked') in the laboratory, 2) different types of deltas form as a function of water level, discharge volume and sediment load and 3) the deltas are formed, at least in the lab, in one single short-duration event. Our understanding of how deltas and fans form on Mars is increasing.



Figure 5 Experimental setup in the 'Eurotank' where we create fans and deltas within meteor craters to understand the water related processes on Mars. The centre of the photo shows a crater where a generated flow is building a delta.

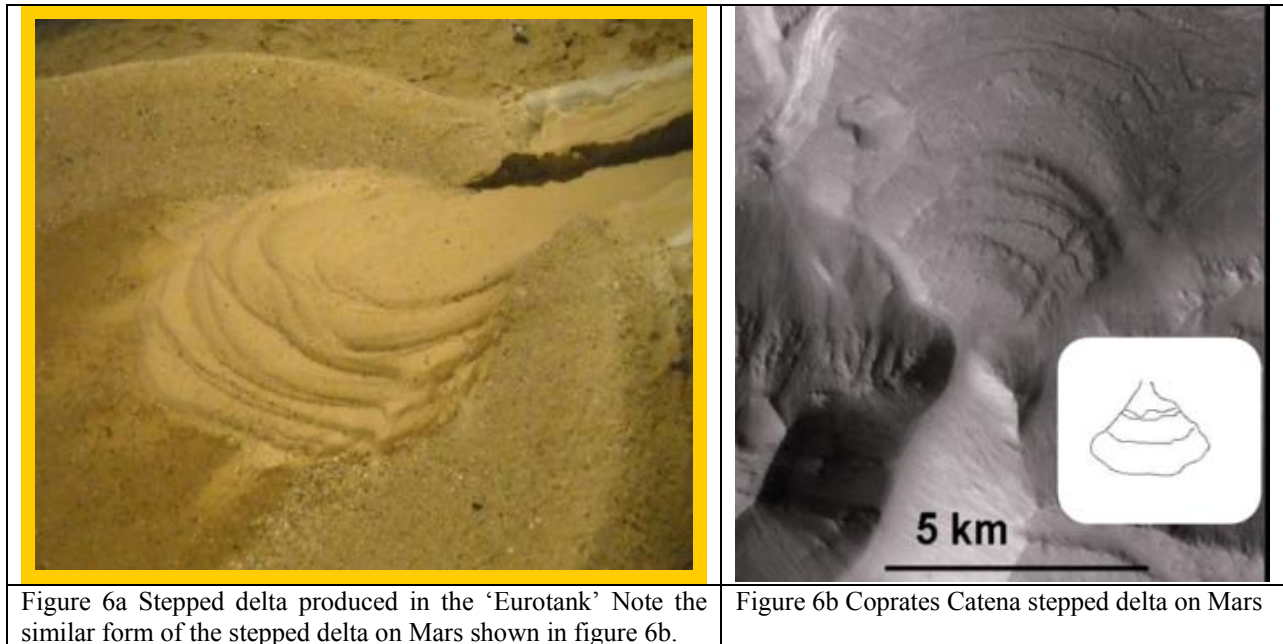


Figure 6a Stepped delta produced in the 'Eurotank' Note the similar form of the stepped delta on Mars shown in figure 6b.

Figure 6b Coprates Catena stepped delta on Mars

PhD project Improving near real-time flood forecasting using multi-sensor soil moisture assessment

This year we started a new PhD project funded by NWO/SRON-GO and the European Commission with the title above. We contracted Niko Wanders as the PhD candidate. Flooding is a major environmental problem in various parts of the world. The European Commission is developing an early warning system referred to as EFAS: European Flood Forecasting System. EFAS combines near real-time meteorological and river flow observations, ensemble weather forecasts, land cover maps, soil information and topographical information in the LISFLOOD model. The EFAS-LISFLOOD modelling system produces for any location along the main European rivers discharge forecasts and soil moisture for 10 days. One of the weaker points in the EFAS-EDO approach is the lack of reliable information on the surface soil moisture dynamics. Initial soil moisture is an important variable because it determines how much water can be stored in the soil before runoff starts. Currently, soil moisture status is computed using a water balance approach with data from meteorological stations as input. However, such soil moisture estimates suffer from model uncertainty transferred to errors in flood forecasts. Consequently, if additional remotely sensed soil moisture data were used to improve estimates of soil moisture status, flood forecasts are expected to improve. The objective of this study is to improve the LISFLOOD soil moisture module by using ERS/MetOp and SMOS derived daily soil moisture maps. Remote sensing is used here to improve model input, to improve model parameterisation through model calibration and to improve state estimation through data assimilation.

Further reading:

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- Kleinhans, M.G., H.E. van de Kastele and E. Hauber (2010), Palaeoflow reconstruction from fan delta morphology on Mars, *Earth and Planetary Science Letters* 294, 378-392, doi:10.1016/j.epsl.2009.11.025.
- Kleinhans, M.G. (2010), A tale of two planets: Geomorphology applied to Mars' surface, fluvio-deltaic processes and landforms, *Earth Surface Processes and Landforms* 35, 102-117, doi:10.1002/esp.1895.
- Nijland W., E.A. Addink, S.M. de Jong & F.D. van der Meer, 2009, Optimizing spatial image support for quantitative mapping of natural vegetation. *Remote Sensing of Environment* 113, pp.771-780.
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Terra Imaging B.V.

Representative: Ir. M.J.W. van der Vegt

Report written by: Ir. Sven Briels (Remote Sensing Specialist)

Since 1994 TerraImaging is modelling and visualising the earth's surface in three dimensions using remote sensing technologies. We supply quality data and products based on advanced technologies such as airborne Lidar and advanced digital cameras. Our customers require accurate, detailed geospatial information. TerraImaging provides services in the field of data acquisition, data processing and consultancy.

Trends and developments

The aerial photo market now seems to be stabilized into a mass production, low cost, high volume market. The LiDAR market is a more dynamic market with a strong technology push and stiff competition between data suppliers. The introduction of laserscanners with very high scanrates allow increasingly high point densities (now typical 5-15 pt/m²) which in turn unlock exciting new applications of the data. The increasing resolution even allows us to apply operations which were in the past limited to photo data. On the downside, due to the strong competition the market is faced with the effect of low-cost, low-quality data suppliers. We see large projects which are awarded to these companies due to tender rules which only slightly touch on quality but emphasize on price.

Experience in 2010

In the Netherlands we saw that the Dutch waterboards and Rijkswaterstaat are ahead of market developments with a high point density and very high quality nationwide height model: the AHN2 project. TerraImaging has been awarded to fly this project in the past two years and are confident that we will be involved in the coming years as well. The need to prove data quality to the customer with elaborate quality checks allowed TerraImaging to develop strong quality procedures, which are now applied for all our projects. We think of AHN2 as a very succesful project, the customer has obtained a high quality product and TerraImaging got the opportunity to prove and improve her quality procedures and technical expertise. We also saw a still fragile but slowly increasing interest in the application of LiDAR data. The municipality of Vlaardingen is one of the first municipalities to obtain AHN2 data. It awarded TerraImaging with the work of automatic extraction of ridge and gutter heights. The methods and software which was developed to perform this task now allows TerraImaging to create highly accurate geometric 3D models from LiDAR data.

Appendix 1: Full contact details of NL members in EARSel

Rijkswaterstaat Data en ICT Dienst (DiD), Department of Geo-information and ICT (AGI)
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Royal Netherlands Meteorological Institute (KNMI), J. N. Roozkrans, Wilhelminalaan, 10,
3730 AE De Bilt, Netherlands, hans.roozkrans@knmi.nl.

National Aerospace Laboratory NLR, Ir. M. van Persie, Voorsterweg, 31, P.O Box 153, 8300 AD Emmeloord,
Netherlands, persie@nlr.nl.

Centre for Geo-Information, Wageningen University & Alterra, Dr. J.G.P.W. Clevers, Droevendaalsesteeg 3,
P.O.Box 47, 6700AA Wageningen, Netherlands, jan.clevers@wur.nl.

University of Twente, Faculty of Geo -Information Science and Earth Observation (ITC), Prof. Freek van der Meer, Hengelostraat, 99, P. O.Box 6, 7500 AA Enschede, Netherlands, vdmeer@itc.nl.

Utrecht University, Department of Physical Geography, Prof. Dr. Steven M. de Jong, Heidelberglaan 2, 3584 CS Utrecht, Netherlands, s.dejong@geo.uu.nl.

TerraImaging B.V., Ir. M.J.W. van der Vegt, Groenewoudsedijk 40, 3528 BK Utrecht, Netherlands,
b.deboer@terraimaging.nl.

Total members on 15-01-11: 8

2.2 REPORT EARTH OBSERVATION ACTIVITIES IN BELGIUM IN 2010

Jean-Christophe Schyns
Belgian Science Policy Office

schy@belspo.be
<http://eo.belspo.be>

CURRENT BELGIAN EO RESEARCH PROGRAMMES

1. The STEREO II programme

Launched in 2006, the STEREO II research programme "Support to Exploitation and Research on Earth Observation" (25.85 M€, 2006-2013) is a national remote sensing programme funded by the Belgian federal government and managed by the Federal Science Policy Office.

The thematic research priorities are:

- › Global monitoring of vegetation and evolution of terrestrial ecosystems
- › Management of the local and regional environment (coastal zones, inland water, soil, forests and biodiversity, agricultural areas, urban and peri-urban areas)
- › Health and humanitarian aid
- › Security and risk management

The programme funds both basic scientific research (large thematic projects, small innovation and spin-off projects) and applied research (development of products and services) carried out by partnerships between research organisations and private companies and/or public administrations. International partners can participate in the programme on the basis of shared cost.

The calls for proposals

Following the fourth calls for proposals (and the selection for funding of 10 new projects) this is now a total of 25 projects which are on-going. Information on these projects and on projects in Earth observation previously funded by the Belgian science policy can be found on the following webpage: <http://eo.belspo.be/Directory/Projects.aspx>

A fifth and last call for proposals, worth 1 790 000 € and aimed at small innovation and spin-off projects and at the development of products and services was launched in January 2011. The selected projects are scheduled to start in January 2012.

For more information contact the programme administrators (vdab@belspo.be and schy@belspo.be).

Hyperspectral Campaign

In the frame of the BIOHYPE project (BIOmonitoring of urban habitat quality with airborne HYPerspectral observations) funded by the STEREO II programme, a hyperspectral campaign was organized in 2010. The data were collected with the sensors AHS (imaging 80-band line scanner radiometer) and CASI 1500 i (VIS/NIR pushbroom imaging spectrograph, EMU inside optics) on board of a Spanish airplane. During three days flightlines over the city of Ghent were performed despite some clouds. This campaign was supported by the European Facility for airborne Research (EUFAR).

2. Earth Observation HelpDesk

Continuous activities

The EODesk provides permanent support to Remote Sensing data users, first by ensuring the acquisition of satellite images needed for the research projects executed within the framework of Belgian science policy programmes and secondly by offering relevant and up-to-date information on remote sensing via the Belgian Earth Observation Platform <http://eo.belspo.be>. More than 370 people, mostly scientists, are registered to the mailing list which regularly informs them about the latest developments in the field of satellite Earth observation.

The EOedu website <http://eoedu.belspo.be> informs the public at large, teachers and students about the world of Remote Sensing. The 'Satellites' section provides access to an information sheet for a twenty of important satellites. This section has been completely updated and will be enriched in the near future. The satellite launch table has also been updated and provides an alphabetically or chronologically overview of the launch dates and activity periods for nearly 200 Earth observation satellites.

Teachers, students or other people interested in satellite imagery applications can subscribe to the EOedu Newsletter to follow some important events in the news as seen through the eyes of satellites (in French or Dutch only):

<http://eoedu.belspo.be/fr/mailling-index.htm>.

Specific activities

As the series of VEGETATION posters produced last year has been very successful, nearly 10,000 additional copies of posters were reprinted and distributed among Belgian teachers associations, universities or museums. The posters are also sent by post to foreign scientists or professionals working in the field of remote sensing, as well as to administrations and institutions. If you are interested, please send a request to eodesk@belspo.be.

The website linked to the posters series <http://eoedu.belspo.be/vgt10> is a useful tool to undertake further study of the 30 topics covered by the posters. The website '10 years of Imaging the Earth, Spot VEGETATION' has also been completed and each topic page is now available in printable pdf file for easier use in the classroom for example.

The images of the posters, as well as the texts of the website have been used by UNESCO to develop a beautiful exhibition entitled 'Satellites and World Heritage Sites, Partners to Understand Climate Change' that took place in the streets of Cancun, Mexico, during the UN Conference on Climate Change from 24 November to 10 December 2010.

<http://www.unesco.org/new/en/natural-sciences/science-technology/space-activities/space-for-heritage/mission/space-for-heritage-copy-1/space-for-heritage/>

BELGIAN PARTICIPATION IN EO RESEARCH PROGRAMMES**1. The Spot VEGETATION and PROBA-V programmes****Spot VEGETATION and the CTIV**

Since 1978, Belgium is a member of the Spot programme led by France. In 1998, the VEGETATION programme, fruit of a collaboration between various European partners: Belgium, France, Italy, Sweden and the European Commission was grafted onto the Spot programme. The VEGETATION programme consists of two observation instruments in orbit, as well as ground infrastructures. The two instruments are aboard the SPOT 4 and SPOT 5 satellites. With a swath of 2.200 km, the instruments observe each day almost the entire surface of the globe and its vegetation cover. After 10 years, the users of the data are very numerous and the applications of the products delivered are paramount in the fields of agriculture and of forest studies for example. One of the most important contributions of Belgium is the funding and the hosting of the image processing centre (CTIV) at VITO in Mol (Belgium) which processes, distributes and archives the data products since the beginning of the programme. Information on the VEGETATION programme can be found at <http://www.spot-vegetation.com/>.

PROBA-V

The VEGETATION 1 and VEGETATION 2 instruments will likely cease to be operational by the end of 2012, while the SENTINEL 3 satellites which are currently being built in view of the European GMES programme will not be operational in due time to contribute to the continuation of the availability of Vegetation type data.

Therefore, Belgium has decided to build a small satellite mission based on the successful PROBA expertise and using state of the art technology through ESA. This mission, called PROBA-V ("V" standing for Vegetation) will redress the data gap and will fulfil all of the specifications of the VEGETATION user community. In that way, it will be a complement to the Sentinel 3 satellites to be launched after PROBA-V.

Some characteristics of the PROBA-V mission:

- The spectral and radiometric remain the same as for the VEGETATION instruments: 4 spectral bands: blue (0.44-0.48 μ), red (0.62-0.698 μ), near infrared (0.79-0.90 μ), and SW infrared (1.56-1.65 μ);
- Spatial characteristics are improved compared to the VEGETATION instruments with data products available at a resolution of 1000 m (VNIR and SWIR), 600 m (SWIR) and 300m (VNIR);
- A nearly daily global cover, at least one acquisition per day beyond 35° latitude and 90% daily coverage of equatorial zones;
- Swath: 2250 km;
- Start of the operations: 2012 timeframe;
- Nominal operational mission life: 2.5 year with extension up to 5 years.

Some characteristics of the PROBA-V platform:

- PROBA V is a small satellite from the PROBA range (Project for on board autonomy) with a mass of 160 kg;
- The dimensions of the platform are the following: 765x730x840 mm³.

The International Users Committee (IUC)

The IUC is a group of scientists and users mostly interested in the interpretation of Earth observation data acquired regularly at medium resolution. They assist the project team in refining and adapting the characteristics of the system so that it can provide the best service to the users' community.

The PROBA-V Preparatory programme

Even though the PROBA-V mission has been designed as a continuity mission to the SPOT VEGETATION series, the sensors will have some different characteristics, either due to the technology used to collect data or to the enhancements in spatial resolution.

To take these differences into account a preparatory programme was initiated by the Belgian Science Policy Office. This programme is supervised by the IUC.

The main objectives of this Preparatory Programme are:

1. to get future users acquainted with these new data sets and their full characteristics and quality,
2. to prepare the full exploitation of Proba-V data sets with respect to the technical enhancements which are planned (spatial resolution in particular);

In the frame of this preparatory programme an international call for proposal was launched in July 2010. The total budget of the call: 1.000.000 € allows the funding of 12 projects with a duration of 1 year.

All these projects are focusing on one or more of the following topic:

1. Assessment of PROBA-V mission as a continuity mission to VEGETATION 1 & 2: applied comparison of characteristics as well as combined use of both data sources for time series studies.
2. Impact of enhancements of PROBA-V relatively to VEGETATION on the main uses of VEGETATION data sets. Application areas concentrate on vegetation and land cover studies, extraction of biophysical surface parameters...
3. Improvements due to enhancement of the spatial resolution to 1/3rd km is also discussed and evaluated.

Some projects are dealing with non-vegetation applications. In this case the objective is to put forward the interest of the new characteristics for applications which were not feasible with the VEGETATION series. The results of these projects are expected at the end of 2011.

For more information you can visit the following websites:

The PROBA V IUC website: <http://probav-iuc.org/>

The ESA website: http://www.esa.int/esaMI/Proba/SEM9FS4PVFG_0.html

2. Collaboration with UNESCO

In 2002 the Federal Science Policy Office - BELSPO (representative of the Belgian state) and the World Heritage Centre (representative of UNESCO) initiated a cooperation concerning the conservation of cultural and natural World Heritage. Between 2002 and 2006, BELSPO mobilized an important amount of money in the implementation of a pilot project focusing on the use of space technologies to develop an operational cartographic management and monitoring system for the 5 natural World Heritage sites of the Democratic Republic of the Congo.

After the success of the first phase, the agreement on the launch of a second phase was signed by the two parties' in November 2006. This second agreement which covers the period from 2007 to 2011 was planned to consolidate the achievements of the pilot project in the Democratic Republic of the Congo but also to launch new activities focusing on cultural heritage in Latin-America but also in Asia. These new activities consist of pilot projects specifically seeking to mobilize Belgian scientific know-how in using space technologies to assist local site managers.

The first project was focusing on the development and the implementation of an "Information Management System" to support the conservation authorities of the Calakmul site in the state of Campeche in Mexico. Following UNESCO requirements, the Belgian consortium proposed to develop and implement a four-dimensional Geographic Information System (4D GIS) for the conservation authorities of the Biosphere Reserve and Archaeo-

logical Urban Centre of Calakmul located in the Yucatan Peninsula (Mexico). Such a system will also help the Mexican Authorities to submit a comprehensive information dossier in order for the Calakmul site to be recognized as a 'World Heritage Convention mixed site'

More information on the website of the project: <http://calakmul.inah.gob.mx/conscientia>

The second project called: "*Silk Road Cultural Heritage Resource Information System*" started in April 2010. The main goal of this project is the development of a multi-scale Cultural heritage information system to support the nomination of the multi-national Central Asian' Silk Roads' cultural heritage sites.

The Belgian partners of the project come with their scientific know-how to implement a preventive conservation, monitoring and maintenance based management methodologies developing a 'Cultural Heritage Information System (CHRIS) that will be able to identify and monitor the heritage values of the proposed "Central Asian Silk Roads cultural heritage sites" and to contribute to its effective and sustainable management.

The website of the project: <http://www.silkroad-infosystem.org/specto/bin/view/home>

REPORT ON RESEARCH INSTITUTIONS AND VALUE ADDING COMPANIES

1. FLEMISH INSTITUTE FOR TECHNOLOGICAL RESEARCH (VITO)

APEX

During the year 2010 APEX was accepted by ESA and the sensor will be available for the scientific community from the spring 2011. APEX is operated by both VITO and the Remote Sensing Laboratories of the University of Zurich in Switzerland.

Website: <http://www.apex-esa.org>.

The ADASCIS project: Development of remote sensing and agrometeorological indices for crop damage and risk assessment in support of the Belgian Agricultural Calamity Fund and the insurance sector.

The ADASCIS project, funded by the STEREO-II programme of the Belgian Science Policy Office, aims to develop a pre-operational service for crop damage and risk assessment and control of farmers' claims for losses in support of the Belgian public authorities and the insurance sector. Earth Observation is used in combination with agrometeorological models to provide information at regional and local scale.

A number of "crop damage indices" have been developed to estimate crop growth, crop yield and/or more simply, meteorological conditions, in comparison with average or past historical data reflecting a "normal" situation. These indices have a sufficient spatial resolution to be used at municipality level, which is currently the decision level for requesting support from the Agricultural Calamity Fund. Remote sensing derived indices express the consequences of a harmful event (e.g. drought, excessive rainfall,...) on crops and provide accurate spatial information on the location and extent of damages. Meteorological data do not have such spatial accuracy but they explain the causes of yield losses. The combination of these indices strengthens the monitoring capacity by providing independent ways to confirm the impact of adverse climatic events.

Indices based on low and medium resolution satellite data (SPOT-VEGETATION, TERRA-MODIS) are used at municipality level for crop monitoring and identification of recurrent problem areas (delayed crop growth, low relative yields,...). To allow crop damage assessment at field level, these indices are complemented

with information obtained from high resolution optical (DMC, Landsat,...) and SAR imagery. In addition, agrometeorological indices are used such as the crop water stress index or the cereal yield loss index which estimates damage due to delayed harvest.

The indices are all validated with yield data from the Farm Accountancy Data Network (FADN).

Accurate assessment of the magnitude and frequency of remote sensing and meteorological parameters is of fundamental importance to determine the potential relationship with crop damage. Robust estimation of "return periods" has been investigated to properly interpret and map the relative importance of an adverse climatic event.

Mid-way the project the set of indices was presented to a Steering Committee consisting of representatives of the Agricultural Calamity Fund, the Flemish and Walloon agriculture administrations, farmers' organisations and the Belgian insurance sector. Drought stress indices coming from both agro-meteorology and remote sensing were retained by this group of potential users, as well as indices related to water excess preventing harvest at maturity which often leads to a qualitative and quantitative degradation of agricultural production. They also asked to develop an additional index for frost damage.

R. Oger and C. Marlier (CRA-W: Centre wallon de Recherches agronomique), I. Piccard (VITO: Vlaamse Instelling voor Technologisch Onderzoek), B. Tychon (ULg: Université de Liège) and M. Foguene (FPS: Federal Public Service for Economy, SMEs, Independent Professions and Energy).

The BelColour and MICAS projects: Monitoring Inland and Coastal water quality with Optical Remote Sensing

Els Knaeps, Dries Raymaekers, Sindy Sterckx (VITO)

Water quality monitoring of inland and coastal waters is growing in significance in the public and scientific domain because of the inherent delicate balance between human needs and environmental impacts. The MICAS and Belcolour projects performed under the authority of the Belgian Science Policy Office's STEREO II programme are dealing with the improvement of this water quality monitoring task through the extensive use of remote sensing techniques.

The MICAS project (Monitoring Inland and Coastal Waters with the APEX Sensor), developed a new curve fitting approach to derive Total Suspended Material (TSM), Phytoplankton and Colored Dissolved Organic Matter (CDOM) from hyperspectral water leaving-reflectance spectra. The approach is based on the wavelet transform of a semi-analytical model and is tested on water-leaving reflectance spectra simulated with the Hydrolight Radiative Transfer Code. For these simulations Specific Inherent Optical Properties (SIOPS) and water concentrations, representative for the Scheldt river (Belgium) and Lake Constance (Switzerland), were used as input. The results showed that the approach is less sensitive to errors in the atmospheric correction and specific sensor noise. In the Spring of 2011 a dedicated APEX airborne campaign will be organized over the Waddenzee to validate the model developed.

In the frame of the Belcolour project an adjacency correction algorithm, SIMEC, (SIMilarity Environment Correction) was developed. The algorithm was initially designed for airborne hyperspectral imagery (Sterckx *et al.*, accepted) but is now adapted for MERIS imagery. The adjacency correction algorithm estimates the contribution of the background radiance based on the correspondence with the NIR similarity spectrum, i.e. the NIR spectral shape as normalized at a single wavelength (780 nm). A key aspect of the method is that no assumptions have to be

made on the NIR albedo, such that the correction can be applied over more turbid waters, i.e up to the limit of validity of the similarity spectrum (at SPM loadings of 0.3 to 200 mg/l according to Ruddick *et al.*, 2006). The method was tested on a dataset of Lake Trasimeno. The results were compared with the ICOL (Improving Contrast between Ocean and Land) adjacency correction, which is implemented in the BEAM toolbox.

In a joint effort of the Belcolour and the MICAS projects, an in-situ measurement campaign was organized in July and October 2010 at pontoon Sint Anna at the Scheldt River to look at the water-leaving reflectance in the SWIR, in particular around the OLCI (Ocean Land Colour Instrument on Sentinel 3) 1020 nm band. Water-leaving reflectance measurements were made with ASD and TRIOS spectroradiometers, water was sampled for turbidity and TSM concentration and a BB-3 backscatter meter and CTD diver were attached to the pontoon to record backscattering, temperature and salinity. The results provide evidence of non-zero reflectance in the 950-1150 nm region in the Scheldt river and show a correlation of the OLCI 1020 nm water-leaving reflectance with TSM concentration in extremely turbid waters. The relationship between TSM and reflectance at 1050 nm and 1020 nm was positive with a determination coefficient of 0.92 and 0.68 respectively. These results suggest that spectral bands beyond 1000 nm contain information on the constituent concentrations.

Acknowledgement

This work has been performed in close collaboration with Kevin Ruddick from MUMM (RBINS) and Dani Odermatt from RSL (University of Zurich).

References

Ruddick, K., De Cauwer, V., Park, Y., 2006, Seaborne measurements of near infrared water-leaving reflectance: The similarity spectrum for turbid waters, *Limnol. Oceanogr.*, 51(2), 1167-1179.
Sterckx, S., Knaeps, E., Ruddick, K., Detection and Correction of Adjacency Effects in Hyperspectral Airborne Data of Coastal and Inland Waters: the Use of the Near Infrared Similarity Spectrum, *Int. J. Remote Sens.*, accepted

2. THE GEOHYDRODYNAMIC AND ENVIRONMENTAL RESEARCH GROUP (GHER), UNIVERSITY OF LIÈGE

Satellite data are very valuable for geophysical analyses, such as numerical weather prediction, ocean forecasting and climate research. Many of these applications require complete satellite data sets, although they often contain gaps (missing values) due to e.g. the presence of clouds or rain.

The GHER group at the University of Liège (Belgium) has developed DINEOF (Data Interpolating Empirical Orthogonal Functions), an open-source tool to reconstruct missing data in geophysical data sets. Based on Empirical Orthogonal Functions (EOFs), DINEOF uses an iterative procedure to calculate the values at the missing locations. DINEOF has been compared to Optimal Interpolation (OI), demonstrating that more accurate results are achieved, with up to 30 times less computational time. Another advantage of DINEOF is that there is no need for a priori knowledge of the statistics of the data set being reconstructed (such as covariance or correlation length).

DINEOF is able to reconstruct missing data in a large number of variables (e.g. sea surface temperature (SST), chlorophyll, winds...), either as monovariate or multivariate analyses. Spatial maps of the reconstruction error covariance estima-

tion, together with an estimation of outliers in the original data set, can be also calculated with DINEOF.

A near-real time application of DINEOF of the western Mediterranean Sea surface temperature is shown at <http://gher-diva.phys.ulg.ac.be/DINEOF/>, where more information about DINEOF can be found.

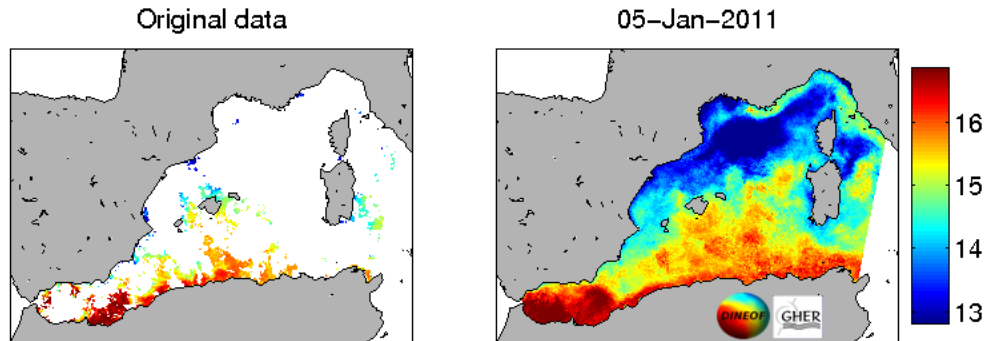


Figure caption: Left: cloudy AVHRR sea surface temperature on the western Mediterranean on the 5th January 2011 (snapshot from a 6-month data set). Right: Reconstruction obtained with DINEOF for the same date. Units are degrees C.

3. EARTH AND LIFE INSTITUTE (ELI) - GEOMATIC, CATHOLIC UNIVERSITY OF LOUVAIN

"In the framework of the World Wide Watch project supported by the STEREO II Program of the Belgian Science Policy Office, a new product derived from MODIS and VEGETATION instruments has been jointly developed and validated by UCL/ELI-Geomatics and FAO to detect the locust habitat greening. Since September 2010 this product is operationally distributed by VITO on a decade basis for the whole recession area ranging from Mauritania to Pakistan.

Following the first global 300-m GlobCover 2005 and the GlobCorine 2005 products, the global land cover map GlobCover 2009 derived from MERIS 300 m time series has been successfully delivered in 2010 thanks to a close collaboration between ESA and UCL/ELI-Geomatics. These products are available from the ESA portal.

Capitalizing on the Belgian expertise in agriculture monitoring, the AGRISAT conference gathered remote sensing and agriculture monitoring experts from all over the world in Brussels on the 13-15 October 2010 in order to review the state of the art in the field and to agree on the remote sensing satellite requirements to improve crop area mapping and vegetation growth monitoring. In the framework of the GEO Agriculture Working Group and following the JECAM meeting in Asia, the objectives of the Joint Experiments on Crop Assessment and Monitoring (JECAM) in Europe and Africa have been presented and the network of interested laboratories has been launched (more information about JECAM at <http://umanitoba.ca/outreach/aesb-jecam/>).

4. LABORATORY OF HYDROLOGY AND WATER MANAGEMENT, GHENT UNIVERSITY

Soil moisture is a key state variable in hydrology and climatology, it determines the proportion of precipitation that percolates, runs off or evaporates. Unfortunately, in situ soil moisture measurement is costly and time consuming, and only provides localized information. Tremendous research and development activities have been dedicated to the development of a large scale soil moisture observation system, and focused on remote sensing to achieve this ambition. Two ongoing research projects (HYDRASENS (SR/00/100) and EPIDEMOIST (SR/02/124)) at the Laboratory of Hydrology and Water Management (LHWM) and at the Department of Applied Mathematics, Biometrics and Process Control - Research Unit Knowledge-based Systems (KERMIT) of Ghent University (<http://lhwm.ugent.be>), assess the applicability of remote sensing for soil moisture estimation in two distinct research areas.

The first research project aims at integrating remote sensing, hydrologic and hydraulic modeling for the improvement of surface water management, in support of the European Water Framework Directive and the forthcoming Directive on Floods. In this research, Ghent University participates with the Université catholique de Louvain (UCL) and the Centre de Recherche Public – Gabriel Lippmann (CRP-GL). As soil moisture has a large impact on the occurrence of flood events, the retrieval of this variable from remote sensing receives major attention within this project. At the micro-catchment scale, this is achieved using a Ground Penetrating Radar (GPR) platform, operated by UCL. On the catchment scale, a methodology for retrieving soil moisture using a modeled effective roughness length was developed. LHWM in collaboration with KERMIT is developing an alternative approach, based on possibility theory, for the retrieval of soil moisture from Synthetic Aperture Radar (SAR) data. The advantage of this new method is that detailed knowledge of the soil roughness is no longer needed. A third methodology for retrieving soil moisture consists of using time series of radar imagery. In order to better understand the relationship between ground- and satellite-based radar data, the link between nearby (GPR) and satellite-derived soil moisture maps is being examined through scaling analysis. Besides soil moisture, another important variable for water management is the extent of floods. Within the project, CRP-GL investigates the remote sensing of flood extent through fusion of SAR data and high accuracy digital elevation models. Based on both types of remotely sensed deliverables, a data assimilation system is being designed for a coupled hydrologic/hydraulic model, with as objective the optimisation of discharge and flood forecasts.

The objective of the second research project is to improve spatial epidemiological models for *Culicoides* midges, which are the transmitting vectors of the Bluetongue virus, for veterinary applications. The occurrence of arthropod vectors of disease in general and biting midges in particular is determined by a large number of (a)biotic factors. Amongst others, soil moisture is one of the variables which is considered to be determinant for the presence or absence of the insect vector. However, until now, epidemiological research focusing on the prediction of the spread of *Culicoides*, only partially integrates knowledge on soil moisture within its spatial models. This project aims at deriving soil moisture estimates from optical remote sensing in the visible, near infrared and thermal infrared part of the spectrum, and the integration of these soil moisture proxies in spatial epidemiological models for the bluetongue vector.

EVENTS ORGANIZED IN BELGIUM IN 2010

- In March 2010 an ORFEO (Optical and Radar Federated Earth Observation) workshop was held in the Royal Military Academy (RMA) in Brussels. The main goal of the seminar was to present to the Belgian remote sensing community and to the members of CNES the results of the six projects realized in Belgium in the framework of the ORFEO support programme. More information in our website: <http://eo.belspo.be/Directory/Resources/Presentations.aspx>
- The annual Belgian Earth Observation day organised by the Belgian Science Policy Office took place in Chaudfontaine in May 2010. This meeting was the opportunity to make professionals and researchers concerned by remote sensing aware of the projects realized in Belgium in the framework of the STEREO II programme and to offer the possibility for networking. The day was opened by Frederic Achard (JRC) who has given a presentation on the TREES project as invited speaker. You can find all the presentations of this meeting on our website in the following page: <http://eo.belspo.be/Directory/Resources/Presentations.aspx>
- An important conference called GEOBIA - GEOgraphic Object-Based Image Analysis - was also organised in Belgium and more specifically in Ghent between the 29th of June and the 2nd of July. This workshop was a great success in terms of the quality of the speakers but also in term of number of participants. For more information, go visit the website: <http://geobia.ugent.be/>
- The second EARSel "Joint workshops" (Urban, 3D, Radar, Developing Countries and Thermal) was organized in Ghent, Belgium, from 22-24 September 2010. More information on the website: <http://www.geoweb.ugent.be/data-acquisition-3d/earsel-workshop>
- In the frame of the HABISTAT project (A CLASSIFICATION FRAMEWORK FOR HABITAT STATUS REPORTING WITH REMOTE SENSING METHODS) funded by the Belgian Science Policy through the STEREO II programme, a Habistat workshop was held in Brussels in October 2010. The goal of this meeting was to share the results of new initiatives for the reporting of Natura 2000 with the use of remote sensing in different European countries. With 105 participants coming from 13 European members' states, the workshop was a great success. The website of the workshop (and of the project): <http://habistat.vgt.vito.be/>
- In the frame of the Belgian presidency of the Council of the European union, two important events were organized by the Belgian High Representation for Space Policy:
 1. A high level conference called: "Space for the African citizen". The main goal of this conference was to focus on the contribution of space to Africa's global development. Website: http://www.belspo.be/eu2010/SpAfrCi_en.stm
 2. At a ministerial level "the Second International conference on Space exploration" was organized in Brussels in October 2010. Website: http://www.belspo.be/eu2010/ExplSpat_en.stm

EVENTS SCHEDULED IN BELGIUM IN 2011

- The annual Belgian Earth Observation day organised by the Belgian Science Policy Office will take place in spring 2010. Don't hesitate to consult the following website to be informed about the date and the place of this meeting: <http://eo.belspo.be/News/News.aspx>

2.3 REMOTE SENSING ACTIVITIES IN CROATIA IN 2010

The Sections, members of the Scientific Council for Remote Sensing of the Croatian Academy of Sciences and Arts, which involve experts from related institutions, carried out the majority of the activities in Croatia in 2010 in the field of remote sensing. In the following text, the activities of individual sections are reported on.

1 Photography, General Interpretation and GIS Section

In this Section, the dominant role is played by the GEOFOTO company, which mainly performs aerial photographing of the Earth by using various techniques. Apart from performing the usual aerial photogrammetric photographing, Geofoto acquired in 2010 the LIDAR (Light Detecting and Ranging) sensor, IGI LiteMapper 6800-400 system. This sensor collects – in the most up-to-date manner, by profile aerial scanning – positional and height-related data needed for defining the terrain surface and the natural and built facilities present on the terrain – the so-called digital surface model (DSM). Mounted onto either a helicopter or an airplane, LIDAR uses the near infrared part of the electromagnetic spectrum (1064 nm) for active data collecting by day or by night. The facilities may be registered even in the shade or in cloudiness. By using semiautomatic techniques for data filtering, it is possible to create several useful products from the original data (among others, the DTM, the vegetation model and the DSM, which includes the existing facilities). Geofoto uses the LIDAR system for aerial photographing of the Earth, both in Croatia and abroad.

In 2010, Geofoto performed the photographing of the island Fyn in the Kingdom of Denmark by the Vexcel UltraCam Xp (resolution 10 cm) digital aerial photogrammetric camera. The photographed surface covers approx. 3,500 km². Further, the project of aerial photogrammetric photographing and laser scanning of the entire territory of the Republic of Montenegro commenced last year.

Based on the Decision of the Government of the Republic of Croatia on introducing new geodetic dates and cartographic projections into the official use, the State Geodetic Administration drafted the following documents:

- frames for all TK25 sheets (new division; HTRS96/TM);
- 6,859 new DOF5 sheets in the new HTRS96/TM cartographic projection and the new division into sheets within the framework of the LPIS project.

The DOF5 sheets not older than 2006 were transformed to HTRS96/TM; thus, the State Geodetic Administration currently disposes of DOF5 in HTR96/TM and the new division into sheets for the whole territory of the Republic of Croatia (2006–2009 photographing). All HOK sheets were transformed to HTRS96/TM.

The draft Book of Rules on Cartographic Signs and the accompanying Collection of Cartographic Signs were composed. Apart from enhancing the design of cartographic signs, the Book of Rules also stipulates the content of databases, as well as data collecting for the basic geoinformational system (constant points, facilities, buildings and areas, power lines and accompanying facilities, traffic, vegetation and types of terrain, water, relief, borders and geographic names).

According to the NIPP plan, a web application for approaching the constant points database was designed, so that data are available to users on the Internet.

The Closing conference on Croatian-Norwegian technical co-operation in enhancing cadastre and cartographic capacities 2001–2010 was held (business information on www.dgu.hr). During a nine-year

period, five geoinformational projects (CRONO GIP) worth approximately Euro 6,965.580 (HRK 51,197.000), out of which amount the Kingdom of Norway had donated approx. Euro 4,493.605 (HRK 33,028.000), were realised.

Within this Section operates a working group that addresses and solves specific issues in the area of mineseeing and demining of mine suspected areas.

The Faculty of Geodesy of the University of Zagreb and the Croatian Mine Action Centre have deployed the *Advanced Intelligence Support System for Mine Suspected Area Assessment and Reduction*, used last year within two non-commercial projects:

- *Deployment of the Decision Support System for Mine Suspected Area Reduction*; and
- *Deployment of the Decision Support System for Mine Suspected Area Reduction in Bosnia and Herzegovina*.

The said projects were sponsored by the US State Department via the International Trust Fund for Demining and Mine Victims Assistance (ITF) with the seat in Ig (Slovenia), their aim being a better MSA assessment and reduction. The results of the work done within the said projects were presented in four papers at the annual symposium entitled *Humanitarian Demining 2010* (Šibenik, April 2010).

2 Geology and Geophysics Section

The activities related to the remote sensing methods application were performed according to the plan of works for 2010.

At the Croatian Geological Survey, remote sensing was applied within the research aimed at producing the geological maps of the Republic of Croatia, and the funds were provided by the Ministry of Science, Education and Sports. The following maps were produced: the basic geological map of the Republic of Croatia (scale 1:50,000); the basic geological map of the Republic of Croatia for engineers (scale 1:100,000); the structural and geo-morphological map of the Republic of Croatia (scale 1:100,000); and the tectonic map of the Republic of Croatia (scale 1:300,000).

At the INA-Naftaplin company, the remote sensing methods were primarily applied within the seismic terrain investigation.

3 Vegetation, Forestry and Agriculture Section

In accordance with the plan of works for 2010, the research addressing the increased forest damage was continued in order for the drying out prevention measures to be anticipated and implemented as efficiently as possible. This research was conducted by the means of infrared colour aerial photographs (CIR).

Since aerial photographing allowed an insight into the status of forest stands in the researched area, and the results of photointerpretation indicated to considerable fir-tree damage (average tree damage percentage being 61,79), the entering of snags into the inventory on infrared DOF was initiated. In the area under research, a total of 17,445 snags were mapped. Depending on location, the following data (gained from the digital relief model by raster GIS modelling) were added to each snag: terrain slope; height above the sea level; and exposure. The most important result of the implemented method are thematic maps showing the spatial distribution of snags in the area under research. Using GIS technology, the production of a map of the spatial distribution of snags takes 5-10 minutes per acre of the area entered into the inventory. The results of the analyses show that geomorphological features (terrain orientation; terrain slope; and height above the sea level) have also got an impact on the spatial distribution of snags.

Based on the research conducted, it may be concluded that the entering of snags into the inventory, done by the means of the interpretation of CIR aerial photographs and GIS, enables an efficient counting (detection) and spatial distribution (mapping) of snags. The interpretation of CIR aerial photographs enabled an insight into the current state, i.e. gaining an objective insight into the forest status (database) within a very short time period. By mapping on digital orthophoto (DOF), the spatial distribution of snags for the photographed area was developed.

The results of the performed analyses enable the studying of the individual characteristic features of the environment in relation to the forest drying out, and indicate the direction of future multidisciplinary research aimed at complex analyses of all the characteristic features of the environment. Further, research aimed at assessing the structural elements of forest stand based on the IKONOS image analysis was conducted. For each stand parameter, two regression models were assessed within the management class of the common oak (1101), for every age class individually. The regression models for the assessment of stand parameters were developed based on the values of spectral reflectance (reflection) registered on satellite images and the individual stand parameters. The results of the assessment of regression models show that all the observed parameters (number of trees, breast diameter, height, basal area and volume mass) may be very well assessed in models in all four spectral channels, with determination coefficients ranging between 60% and 80%.

The plan of works for the last year further included research related to examining the possibility of using geostatistic tools in remote sensing. In the forest area of *Lonjsko polje Nature Park*, by using infra-red colour (CIR) aerial photographing and geostatistic methods, the possibilities of detection, entering into the inventory and monitoring the health status of natural forest stands of the common oak and the ash were explored. For analysing the results of the forest damage interpretation, the following geostatistic tools were used: semi-variogram surface, experimental and theoretic variograms; whilst for producing continuous maps of the spatial distribution of damage indicators, the common kriging technique was used. The results have confirmed the validity of using the said methodology in assessing the descriptive statistic indicators of medium damage and the forest damage index, as they mostly coincide with the values of the visual assessment gained from CIR aerial photographing.

Last year, the EFI (European Forestry Institute) Regional Office for the South-East Europe (EFISEE) was opened in Varaždin. This is the fifth office (alongside Barcelona, Nancy, Bordeaux and Vienna), and, apart from Croatia, it will cover: Montenegro, Serbia, Macedonia, Albania, Bosnia and Herzegovina and Hungary. EFI is the leading organisation in the area of forestry, established by the Finnish Government in 1993, which includes 140 scientific institutions from all over the world. In 2008, the Institute of Forestry in Jastrebarsko became a member of this organisation.

4 Oceanography Section

During 2010, the work within several long-term monitoring projects was continued. As the research has recently been focused mostly to explaining the impact of climate on the sea ecosystem, these projects are necessary for collecting the basic oceanographic data (as the basis for the work). Metadata are available on the following website: <http://jadran.izor.hr/roscop/>.

In co-operation with the Croatian Meteorological and Hydrological Service, and with the aim of developing products useful for a wider circle of potential users, an inter-institutional virtual laboratory (ViLab), led by Dr. Branka Grbec (the Institute of Oceanography and Fisheries – IOR) and Dr. Branka Ivančan Picek (the Croatian Meteorological and Hydrological Service), as well as an ecosystem research

working group, were formed. The aim is monitoring the variability of physical parameters in the atmosphere, at the atmosphere-sea borderline, in the sea, and finally in the ecosystem. On the virtual laboratory website (<http://www.izor.hr/web/guest/virtual-laboratory>), the results of thermohaline survey done by the IOR and of the survey of the surface temperature and the atmospheric reanalyses above the sea during oceanographic survey done by the Croatian Meteorological and Hydrological Service are available. These results become available to users in almost real time, immediately following oceanographic cruising. By using up-to-date surveying, analysing and reanalysing, and applying modern information technology, information on atmosphere and sea parameters are submitted and become available not only to scientists active in other areas of science, but also to the general public.

The Institute of Oceanography and Fisheries, in its journal *Acta Adriatica*, brings a paper addressing the use of SAR satellite images (Mira Morović and Andrei Ivanov: *Oil Spill Monitoring in the Croatian Waters: Needs and Possibilities*). At the CIESM conference held in Venice in 2010, a number of experts participated with their papers, among which there were presented the results of optic in-situ and hyperspectral survey in the Kaštela Bay (M. Morović, M. Kišević, A. Smailbegović, V. Flander Putrle, R. Andričević and B. Grbec: *Spectral Signatures of Pigments in the Kaštela Bay*). Last year, experts from the Institute of Oceanography and Fisheries – together with experts from the Faculty of Civil Engineering in Split and the Faculty of Agronomy in Zagreb – carried out a survey with the optic profiler on the river Sava; simultaneously, the hyperspectral survey was carried out as well.

5 Spatial Planning and Environmental Protection Section

In 2010, the long-lasting work on producing the topographic map of the Republic of Croatia in the scale 1:25,000 (TK25) was concluded; thus, the State Geodetic Administration released all TK25 sheets into official use. Furthermore, 592 sheets of formatted maps were published in 64,576 copies. Aiming at the popularisation of planning and providing geoinformation, a *wall-map* was installed for the Split-Dalmatia County (for the Požega-Slavonia and the Vukovar-Srijem Counties, preparatory activities have been finished, but the *wall-maps* have not been installed yet). For the Government of the City of Zagreb, the Geofoto company produced a scale model of the City of Zagreb for the purposes of spatial planning. The scale model was made by 3D printing of the digital model of the city. The data used for the 3D model of the city are the following: aerial photogrammetric photographs; real ortophoto; digital relief model; and digital building model. The technological process of scale model making is entirely automated: using the Zcorp Spectrum Z5103D printer, models set in the form of virtual computer models are built by slowly applying layers of fine dust. The dimension of the scale model are 8 x 5 meters, the scale 1:1,000; and the city of Zagreb is shown from the tram depot in Črnomerec (west) to the tram depot in Dubrava (east), and from Medveščak (north) to the Budek lake (south).

The GEOSAT company was engaged for developing the international project entitled *OBSERVE-Strengthening and development of Earth Observation activities for the environment in the Balkan area* (FP7-ENV-2010), co-funded by the EC. The project was launched toward the end of 2010, and it will be active for two years. The aim of the OBSERVE project is to collect and compile all the necessary information for delivering an integrated analysis on the current status of EO activities and networks in the Balkans regarding environment monitoring, the potential benefit from the full exploration of an integrated capacity-building strategy and the prospect of creating a relevant permanent EO Community in the wider region. The OBSERVE project consortium consists of 15 institutions from 13 different countries, eight of which belong to the Balkan region. Ten partners are universities and research organisations, while the other five belong to the private sector.

6 Hydrometeorology Section

1.1.1

1.1.2 Satellite meteorology

In 2010, the second five-year phase of the international EUMeTrain project, in which Croatia has participated since 2004, commenced. The consortium members in this new project phase are the meteorological services of Austria, Germany, Finland, Croatia and Portugal. Within the project, same as in the previous years, computer-teaching material for interpreting satellite images and their linking to other meteorological data was prepared. During 2010, a working group within the Croatian Meteorological and Hydrological Service made a study on the cold front over Europe in December 2009. In 2010, special emphasis was put on Internet learning, so that two series of lectures were held: one addressing the topic of snow (in February 2010), and another addressing the topic of hazardous weather conditions (in October 2010). All the material composed within the project, including lecture clips, is available – in the form adjusted for interactive learning – on the website <http://eumetrain.org>.

Furthermore, the Croatian Meteorological and Hydrological Service continued its co-operation in the SATREP project, one of the programmes of the EUMETNET; the topic addressed by this project is composing a satellite report, or analysing the meteorological situation for the entire European territory, by using the conceptual models method. Within the framework of this project, the new Web Map Server was tested; this server allows the approach to satellite data and the data on models needed for composing a satellite report. Further, pilot Mosaic SatReps were composed, within which each service prepared its own analysis, after which all the analyses were compiled into a joint SatRep.

During 2010, representatives of the Croatian Meteorological and Hydrological Service participated as delegates of the Republic of Croatia in meetings of the EUMETSAT delegate bodies. Issues tackled at the meetings were the following: maintaining the geostationary and polar satellite in the orbit; plans for the following period; and plans regarding the launching of the third generation of satellites. In September, M.Sc. Nataša Strelec Mahović, representative of the Croatian Meteorological and Hydrological Service, participated in the EUMETSAT annual satellite conference held in Cordoba, Spain, with a poster to the topic *Using geostationary satellite data in detecting forest fires in Croatia*.

In 2010, the following scientific papers were published:

* Vilibić, I., Šepić, J., Rangelov, B., Strelec Mahović, N., Tinti, S. (2010): *Possible atmospheric origin of the 7 May 2007 western Black Sea shelf tsunami event*. J. Geoph. Res., 115, C07006, doi: 10.1029/2009JC005904.

* Strelec Mahović, N. (2010): *Detecting forest fires in Croatia – Testing the MPEF Active Fire Monitoring (FIR) product*. 2010 EUMETSAT Meteorological Satellite Conference, Cordoba, Spain, 20-25 Sept. 2010. Proceedings.

Radar meteorology

During 2010, the Croatian Meteorological and Hydrological Service participated – within the OPERA project – in the project entitled *Weather Radars in Europe* (WP1.1), headed by D.Sc. Bojan Lipovšćak as project leader. Within this project, a database on meteorological radars in Europe was designed. Within

the OPERA project entitled *Radar Data Hub*, the Bilogora and Osijek radar meteorological data were every 15 minutes operationally included into the European radar composite. Further, composite radar images of three radars (Bilogora, Osijek, and Lisca in Slovenia) were made and introduced into the operational use of composite radar and satellite data.

Lightning measurements

As of spring 2009, lightning data, collected by the German company Nowcast, have been available to the Croatian Meteorological and Hydrological Service. The data have been used since in everyday forecast-related work, as well as in scientific research on convective phenomena. Thus, the archival lightning data for the last five years were used in 2010 in order to single out the days of deep convection activity in particular parts of Croatia; these data were needed for the following graduation thesis: Mikuš, P. (2010): *Defining dominant weather types and the regime of currents during convective activity over Croatia*, mentored by D.Sc. Maja Telišman Prtenjak and M.Sc. Nataša Strelec Mahović. Within the framework of co-operation with the UK Met Office, the equipment for lightning data observation in the long-range spectral area (ATD project) was installed at the main meteorological station Varaždin. The data are continuously submitted within international exchange.

7 Archaeology and Historical Heritage Section

Remote sensing was used in terrain recognising performed for scientific projects conducted by the Institute of Archaeology and for major infrastructural works (roads, gas pipelines). A major number of major mediaeval fortifications in Slavonia and pre-historical ones in the coastal part of Croatia were discovered. Particular aerial photographs received from the State Geodetic Administration and satellite images revealed sites under the sea level (mansions that had once been on the Adriatic coast, salt pans or basins for keeping live fish), mostly dating from the antiquity. The research was conducted throughout the Republic of Croatia.

Report prepared within Sections by:

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3 EARSeL NEWS

3.1 New EARSeL member

Department of Geoinformation in Environmental Planning of the Technische Universität Berlin

The department of Geoinformation in Environmental Planning aims to provide innovative methods of geoinformatics for supporting and optimizing Environmental planning processes. Therefore, remote sensing is an important source of information. The continuing development of new sensors with increasing spatial, temporal, and spectral resolution offers the opportunity to derive more detailed information on environmental indicators, which is meeting the high requirements of the planning practice. The possibilities of multisource and multi-temporal data are evaluated in a variety of projects for subsequent use in planning processes.

A main focus of the department is the monitoring of biodiversity indicators of natural vegetation, especially within the Habitats Directive of the European Union. This so called NATURA 2000 sites cover approximately ten per cent of the territory of Europe and require a standardized monitoring every six years. In projects such as Habit-Change (www.habit-change.eu) or MS.Monina (www.ms-monina.eu) the focus is the development of an operational, objective, economically priced and as far as possible automated application for this monitoring. Especially information about the structure and composition of the existing vegetation within a growth period or phenological cycle is needed. Consequently, we contribute to an effective implementation of EO methods for operational use. For this purpose we utilize methods for large-area covering classification of high temporal resolution, with satellite systems such as RapidEye and TerraSAR-X, to estimate the quality of different vegetation types and habitats.



3.2 EARSeL-ESA Training Course on Earth Observation from Space in the Classroom at High Schools. 31 May 2011, Prague, Czech Republic.

Science teachers at high schools are invited to join the 3rd Workshop on Education and Training of the European Association of Remote Sensing Laboratories (EARSeL).

A main theme of the workshop will be a computer-based training course, organized by the European Space Agency (ESA) and EARSeL, on the following topics:

- Introduction to the principles of remote sensing using satellites
- [Eduspace](#), ESA's website for secondary school students, showing how to use earth observation in teaching and learning of many subjects and themes such as Earth from Space, Environmental Issues and Envisat for Schools
- Leoworks 4, ESA's educational image processing and GIS software for students and teachers.
- BLIF, a remote sensing web application for competence oriented school education, created at the University of Education in Heidelberg
- [SEOS](#), EARSeL's e-learning tutorials for use in geography, biology, physics and mathematics curricula at high schools

More detail in <http://www.earsel.org/SIG/ET/3rd-workshop/trainingcourse.php> Detail in the EARSeL Web

4 EARSeL Events

30 MAY - 3 JUNE 2011: 31ST EARSEL SYMPOSIUM AND 34TH GENERAL ASSEMBLY, PRAGUE TECHNICAL UNIVERSITY, CZECH REPUBLIC

MAY 31 - JUNE 1, 2011: 3RD WORKSHOP ON EDUCATION AND TRAINING. PRAGUE, CZECH REPUBLIC ORGANISED BY CZECH TECHNICAL UNIVERSITY, PRAGUE

JUNE 1-3, 2011: 4TH WORKSHOP ON LAND USE & LAND COVER. PRAGUE, CZECH REPUBLIC ORGANISED BY CZECH TECHNICAL UNIVERSITY, PRAGUE

JUNE 1 -3, 2011: 5TH WORKSHOP ON REMOTE SENSING OF THE COASTAL ZONE. PRAGUE, CZECH REPUBLIC. ORGANISED BY CZECH TECHNICAL UNIVERSITY, PRAGUE

JUNE 2-3, 2011: 1ST FORESTRY WORKSHOP: OPERATIONAL REMOTE SENSING IN FOREST MANAGEMENT:. PRAGUE, CZECH REPUBLIC. ORGANISED BY CZECH TECHNICAL UNIVERSITY, PRAGUE

SEPTEMBER 20-24, 2011: 2ND WORKSHOP ON REMOTE SENSING FOR ARCHAEOLOGY. POZNAN, POLAND JOINTLY ORGANISED BY EARSEL AND AARG.

OCTOBER 20-21, 2011: 8TH WORKSHOP ON REMOTE SENSING OF FOREST FIRES: FROM LOCAL TO GLOBAL ASSESSMENT. STRESA, ITALY. ORGANISED BY FACULTY OF FORESTRY AND NATURAL ENVIRONMENT, ARISTOTLE UNIVERSITY OF THESSALONIKI, AND JOINT RESEARCH CENTRE OF THE EUROPEAN COMMISSION.

Back Cover Pictures Czech University: location of the 31th EARSeL Symposium 2011 Prague



EARSeL Sponsoring Agencies:



Council of Europe



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