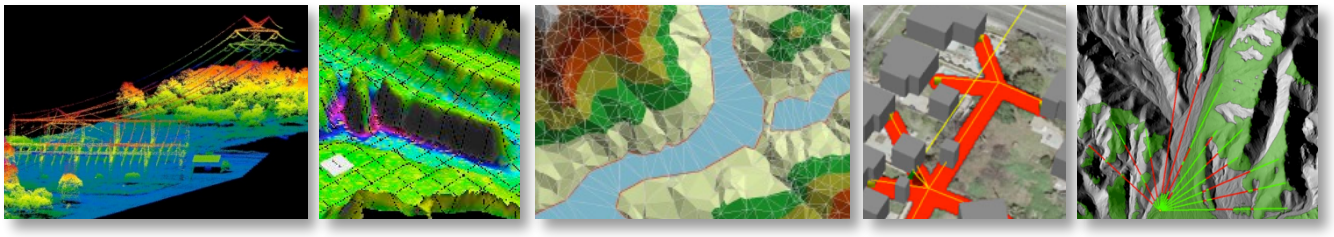
Dutch Network of PhD Students

3rd Remote Sensing Symposium

September 7 and 8, 2011 – Wageningen, The Netherlands

Programme and Abstracts



Netherlands Organisation for Scientific Research

WAGENINGEN UNIVERSITY
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PRODUCTION ECOLOGY & RESOURCE CONSERVATION

Programme

7 September

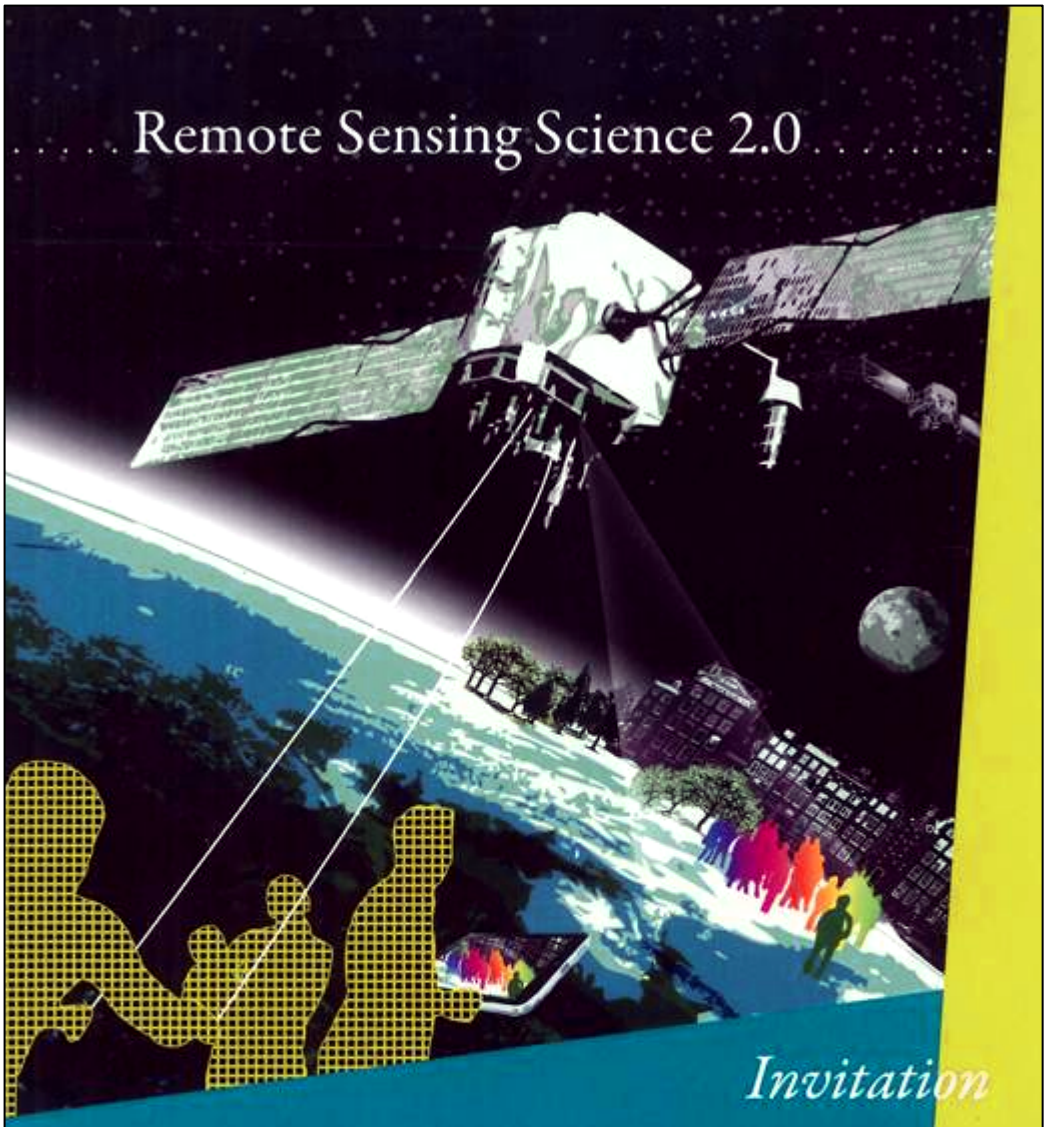
14:00 – 16:00 Plant Facility and Terrestrial LIDAR workshop
16:00 – 17:00 Demonstrations and drinks

8 September

Time	Programme	Venue
08:30-09:00	Registration	"Nieuwe Wereld"
09:00	Welcome and Introduction	Plenary room
09:10	Keynote: "Towards operational radar-based land monitoring" *Prof. dr Christiane Schmullius, University of Jena*	Plenary room
09:55	Coffee break + posters	
10:20	Oral presentations 1.1 Remote sensing of vegetation (dr Jan Clevers) 1.2 Urban and soil remote sensing (dr Harm Bartholomeus)	 Plenary room Parallel room
12:20	Lunch + posters	
13:30	Oral presentations 2.1 Aquatic remote sensing / hydrology (dr Harm Bartholomeus) 2.2 Atmospheric remote sensing / meteorology (dr Jan Clevers)	 Plenary room Parallel room
14:30	Keynote: "Monitoring and modelling human-induced changes in tropical forests worldwide" *Dr Guido van der Werf, VU University Amsterdam*	Plenary room
15:15	Wrap-up and walk to Aula (20 min.) *Prof. dr Andrew Skidmore, ITC University of Twente*	
16:00	Inaugural address *Prof. dr Martin Herold, Wageningen University*	Aula
17:00	Drinks	Aula

Afterwards: dinner party, drinks and live music at the International Club

Remote Sensing Science 2.0



Invitation

Prof. dr M. Herold

Inaugural lecture upon taking up the post of Professor of
Geo-information Science with emphasis on Remote Sensing
at Wageningen University on 8 September 2011

WAGENINGEN UNIVERSITY
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7 September: Plant Facility and Terrestrial LIDAR workshop

Registration and fee

The workshop is free of charge. Please register by email through Antoinette Stoffers: Antoinette.Stoffers@wur.nl

Venue

Wageningen University campus, building 101 (Gaia). Parking places are available for free. Public transport: take bus 88 from Wageningen centre or from railway station Ede-Wageningen (both less than 15 min). Bus stop: *Droevendaalsesteeg*.

Map of the campus: http://documents.plant.wur.nl/wur/plattegrond_campus.pdf

Description

Recently, Wageningen University realized a laboratory facility for assessing the anisotropic reflectance and emittance behaviour of soils, leaves and small canopies under controlled illumination conditions. In parallel, a full-waveform terrestrial LIDAR facility was realized for retrieval of vegetation structure. Both will be demonstrated in this workshop. Please find the full description on the website.

14:00– 14:05	Introduction to the workshop
14:05 – 14:40	Dr J. Clevers: "A remote sensing perspective on observing plant functional traits using reflectance anisotropy"
14:40 – 15:20	Prof. dr W. Verhoef: "Modelling spectral and directional observations of vegetation canopies: reflection, emission and fluorescence"
15:20 – 16:00	Dr J. Harbinson: "A biologist's perspective of leaf absorbance and fluorescence"
16:00	Demonstrations in small groups and drinks

8 September: 3rd Remote Sensing Symposium

Description

Following successful meetings in Amsterdam and Delft, the third Remote Sensing Symposium (RSS) will take place in Wageningen on 8 September 2011. The Symposium is organized by and focuses on PhD students primarily, but provides a forum for the research community and related industries as well. PhD students, post-doc researchers and other delegates from The Netherlands and surrounding countries (Belgium, Germany, Switzerland) are participating. Presentations focus on a wide range of topics, including atmospheric, aquatic and terrestrial remote sensing.

Venues

Hotel de Nieuwe Wereld (symposium)
Marijkeweg 5, Wageningen
- by car: http://www.denieuwewereld.nl/downloads/routebeschrijving.pdf (Dutch)
- by public transport: http://journeyplanner.9292.nl/ (use above address)

Aula Wageningen University (inaugural speech and drinks)
Generaal Foulkesweg 1, Wageningen
directions: http://documents.plant.wur.nl/wur/route_aula.pdf

International club (dinner party)
Marijkeweg 31, Wageningen
directions Aula to International club (we'll walk with you): http://tinyurl.com/RSSintclub

Registration and fee

Please come to the registration desk before 9AM to collect your name badge and the programme. The registration fee of €20 is to be paid in cash. Presenters (both oral and poster) are asked to bring their presentation on USB storage device to the registration desk.

Contact

You can contact Kim and Rogier before and during the symposium on:

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Oral presentations

Keynote presentations

09:10	Christiane Schmullius	Towards operational radar-based land monitoring
14:30	Guido van der Werf	Monitoring and modelling human-induced changes in tropical forests worldwide

Session 1.1: *Remote sensing of vegetation*

Convenor: dr Jan Clevers

10:20	Roberto Chávez	Spectral response of desert trees under water stress: a laboratory experiment using Prosopistamarugo plants from Atacama Desert, Chile
10:40	Martin van Leeuwen	Using terrestrial laser scanning and airborne LiDAR to retrieve tree-level attributes
11:00	Valerie Laurent	Estimating forest variables from top-of-atmosphere radiance using a coupled canopy-atmosphere model
11:20	Lucie Homolova	Estimation of plant functional traits of alpine grassland ecosystems from airborne imaging spectroscopy data
11:40	Hans Roelofsen	Remote sensing of plant traits and phytosociological vegetation types
12:00	Walter Debruyn	Working with 15 years of SPOTVEGETATION (Announcement of PhD opportunity)

Session 1.2: *Urban and soil remote sensing*

Convenor: dr Harm Bartholomeus

10:20	Christian Berger	AutoStructure – A proposal on (semi-) automatic mapping of urban structure types (USTs) using remote sensing data and methods
10:40	Robert Eckardt	Bridging gaps in multispectral satellite imagery – An innovative image fusion for the reconstruction of mission information
11:00	Sabrina Carvalho	Plant-soil feedback analyis through plant chemical portfolios and its high-resolution spectral signatures
11:20	Bram te Brake	Measuring soil water storage change in clay soils using radar interferometry
11:40	Nicole Richter	Surface Deformation of Kīlauea Volcano, Hawaii, from TerraSAR-X Interferometry
12:00	Laurens Ganzeveld	NitroSpace – Space based estimation of nitrogen deposition on ecosystems (Announcement of postdoc opportunity)

Session 2.1: *Aquatic remote sensing / hydrology*

Convenor: dr Harm Bartholomeus

13:30	Zheng Duan	Estimating water volume variations in lakes and reservoirs using satellite altimeter databases and satellite imagery data
13:50	Edwin Sutanudjaja	Calibrating a large-scale groundwater model using spaceborne remote sensing products: a test-case for the Rhine-Meuse basin
14:10	Daphne van der Wal	Remote sensing of intertidal areas

Session 2.2: *Atmospheric remote sensing / meteorology*

Convenor: dr Jan Clevers

13:30	Narangerel Davaasuren	The spatial extent of ship emissions in the Barents Sea by emissions inventory, EDGAR and WRF-chemistry global atmospheric models
13:50	Mehdi VosooghiDizaji	Backscattered mean power distribution in water clouds
14:10	Muhammad Cheema	Estimation of basin scale evapotranspiration and surface energy fluxes using microwave imagery driven ETLook algorithm

Poster presentations

Miguel Barrios	Remotely sensed vegetation moisture as explanatory variable of Lyme borreliosis incidence
Harm Bartholomeus	A new lab facility for measuring bidirectional reflectance/emittance distribution functions of soils and canopies
Matthijs Danes	Start of Growing Season 2010
Ben DeVries	Monitoring the impact of REDD+ implementation in the UNESCO Kafa Biosphere Reserve, Ethiopia
Parviz Fatehi	Ecosystem parameter mapping of Alpine regions using continuous fields derived from imaging spectrometer data
Sebastian Fritsch	Combining multi-temporal RapidEye data and light-use efficiency modelling to estimate regional cotton and rice yield at field and sub-field level for a Central Asian irrigation system
Yao Gao	Water Accounting of Yellow River Basin from Satellite Measurements
Hamid Reza Ghafarian Malamiri	Modelling of time series of satellite observations of land evaporation
Noriko Hosonuma	An assessment of deforestation and forest degradation drivers and activities in developing countries using the forest transition model
JuHyoung Lee	Enhancement of energy flux estimation with parameterization of remote sensed roughness
Martin van Leeuwen	3-D Modelling of Forest Structure for Parameterization of Radiative Transfer Models
Martin Lindner	An object-based multisensoral approach for the derivation of urban land use structures in the city of Rostock, Germany
Titia Mulder	Towards spectroscopic modelling of composite mineralogy
Claudia Pittiglio	A dominant scale emerges from diverse satellite platforms
Claudia Pittiglio	Elephant response to spatial heterogeneity in a savanna landscape
Arun Pratihast	Evolving technologies and community-based monitoring for effective REDD+ implementation
Johannes Reiche	Radar and optical remote sensing time series for monitoring changes in tropical forest in Fiji and Guyana: a PhD working concept.
Erika Romijn	Assessing national forest monitoring capabilities of tropical non-Annex I countries for participation in REDD+ monitoring
Michael Schultz	Challenges of spatial medium resolution RS time series analysis in the tropics
Ray Struthers	Hyperspectral measurements of Conference pear orchard
Hossein Torabzadeh	Review on of LiDAR and spectroscopy data fusion approaches for the derivation of forest biochemical and biophysical variables
Marcel Urban	Using coarse resolution land surface temperature time series data for vegetation analysis in the taiga tundra transition zone
Simone Vaccari	Terrestrial LiDAR as tool for forest structural assessment

Abstracts oral presentations

Session 1.1: *Remote sensing of vegetation*

10:20 Roberto Chávez — Spectral response of desert trees under water stress: a laboratory experiment using Prosopistamarugo plants from Atacama Desert, Chile

Assessing water stress of arid vegetation using remote sensing techniques can be very difficult since arid species are naturally adapted to survive water scarcity and these adaptations can dramatically influence their canopy reflectance/absorption properties. Therefore, a good understanding of the drying process is crucial for a proper assessment. In this paper, a laboratory experiment was carried out to study changes in canopy reflectance of Tamarugo plants under controlled water stress. Tamarugo (*Prosopistamarugo)*is an endemic and endangered tree species adapted to the hyper-arid conditions of Atacama Desert, Northern Chile.

In the absence of water stress, plants modified the sun/light incidence angle on the leaves by changing the folioles orientation. Folioles orientation changed from perpendicular to light rays in the morning (planophyle) to parallel after midday (erectophyle). Consequently, reflectance decreased from midday onwards. This occurred despite the angle of incoming radiation (ASD lamp) was fixed at 30º from nadir. This is the first time that this process has been described for Tamarugo and it probably constitutes an adaptation to avoid direct sun irradiation at the hottest time of the day. This movement is likely to be a process controlled by changes in cell turgor pressure and therefore can be affected by water stress. Under water stress, leaf cells ran out of water and consequently folioles were not able to change the light incidence angle anymore. Therefore, reflection during the day became more constant and the difference between morning and afternoon smaller. When leaf water decreased leaves became very dehiscent and fell down and consequently LAI as well as canopy reflection decreased.

Changes in reflectance during the day as well as changes along the experiment framework were successfully modelled by using the SLC model. Sensitivity analysis using SLC showed that changes in canopy reflectance due to water stress were mostly explained by Leaf Area Index (LAI), Leaf slope (LIDFa) and Leaf Water Content (Cw). The difference in reflectance between morning and afternoon can be used for early detection of water stress. Furthermore, NDVI and Derivative[1015-1050nm] can be used for detecting water stress in terms of LAI and Canopy Water Content (CWC), respectively.

10:40 Martin van Leeuwen — Using terrestrial laser scanning and airborne LiDAR to retrieve tree-level attributes

Forest structural attributes are important indicators for health, productivity, and biodiversity. Over recent years, LiDAR (Light Detection and Ranging) has been increasingly used to retrieve forest structural attributes at various scales ranging from the entire stands to attributes of individual trees. In this presentation an overview is provided of two methods developed for the retrieval of structural attributes of individual trees from ground-based and airborne LiDAR instruments, and on one method for the integration of these data. The methods aim towards modelling plant structure to support plant physiological studies and studies on the canopy radiation regime.

11:00 Valerie Laurent — Estimating forest variables from top-of-atmosphere radiance using a coupled canopy-atmosphere model

Physically-based approaches allow estimating vegetation parameters independently of space and time location by using radiative transfer (RT) models. Classically, the first step is to invert an atmospheric RT model to provide the top-of-canopy reflectance data, which is then used as a reference for inverting a canopy RT model, thus providing estimates of the vegetation parameters. Alternatively, it is possible to couple the canopy and atmosphere RT models and to simulate the top-of-atmosphere (TOA) radiance. The radiance measured by the satellite can then be directly used to invert the coupled model and estimate the variables. Numerous studies have demonstrated the higher information content of multiangular TOC reflectance data, which can be used to improve the estimates for surfaces with strong directional properties such as forests. I will present the results of a case study of three Norway spruce stands in the Czech Republic where biochemical and structural parameters were estimated from multiangular CHRIS TOA radiance data.

11:20 Lucie Homolova — Estimation of plant functional traits of alpine grassland ecosystems from airborne imaging spectroscopy data

Plant functional traits (such as leaf chlorophyll (Cab), water (Cw), and specific leaf area (SLA)) can help to understand functioning of terrestrial vegetation ecosystems. Even though field measurement of those traits is methodologically well established, it is limited to discrete sampling points at local scale. Because of that, spatially continuous and non-destructive mapping of plant functional traits at larger scales is of interests to the plant ecology community. Our research aims to retrieve Cab, Cw, and SLA from high spatial and spectral resolution airborne imaging spectroscopy data. The AISA images were collected during the vegetation season over subalpine and alpine grasslands in the French Alps. Traits retrievals were based on an already established methodology of leaf-canopy radiative transfer modelling (PROSPECT-SAIL coupled model) and look-up table inversion. The RT methodology was adjusted to the case of the alpine grasslands based on prior knowledge from field trait measurements, which accompanied image acquisition. The field observations allowed direct verification and accuracy assessment of the remote sensing based products. Preliminary statistical analysis of field trait data revealed that trait variability is strongly driven by species (40-75%) and less by environmental gradients such as altitude (less than 5% of the overall traits' variability was explained by the altitude). Principal component analysis identified a triplet of traits (Cab, Cw, SLA) having high potential to distinguish functionally different plant groups.

11:40 Hans Roelofsen — Remote sensing of plant traits and phytosociological vegetation types

Maps showing the spatial distribution of vegetation types provide information for nature management, but are expensive to produce and inaccurate. We present a remote sensing based approach to map the spatial extent of Dutch national vegetation types. These are defined on individual species abundance and co-occurrence, which is typically not discernable with remote sensing. We overcome this by not looking at vegetation types directly, but using functionality of the vegetation as intermediate between reflection and vegetation.

Firstly, indicator values were used as an ordinal measure of vegetation preference for soil moisture, nutrient availability and salinity. Partial least squares regression was used to link observed indicator values at a set of local vegetation plots to remotely sensed reflectance values, and to predict indicator values for the study area. Secondly, vegetation plots of a similar vegetation type appeared clustered in a three dimensional indicator value space. This space was distributed among vegetation types, yielding occurrence probability of a vegetation type as function of indicator values. Using the predicted indicator values, vegetation type occurrence probabilities were calculated, and each pixel assigned to the most likely occurring vegetation type. Additionally, the highest occurrence probability of each pixel was mapped to indicate spatial variation in model certainty. Indicator value were predicted reasonably well (R2 0.58-0.68). Vegetation type predictions were poor when 23 types were selected, but clustering these into 8 categories of functional similar types improved model efficiency to 0.61 and yielded a kappa coefficient 0.23.

12:00 Walter Debruyn — Working with 15 yearsof SPOTVEGETATION (Announcement of PhD opportunity)

The VEGETATION programme is the result of a space collaboration between various European partners: Belgium, France, Italy, Sweden and the European Commission. In 1998, it was grafted onto the SPOT programme, founded by Belgium, France and Sweden in 1978. The programme consists of two observation instruments in orbit, VEGETATION 1 and VEGETATION 2, as well as the necessary ground infrastructures. The first of the two VEGETATION instruments in orbit is aboard the SPOT 4 satellite, launched on 24 March 1998. The second is aboard SPOT 5, which was placed into orbit on 4 May 2002. In 2013 the Flemish Institute for Technological Research (VITO), will have been hosting the user segment of both SPOT-VEGETATION instruments uninterruptedly for 15 years. This activity includes the continuous processing, correction, archiving and distribution of the VEGETATION data and added-value products to scientific and commercial customers. See also: http://www.spot-vegetation.com/

Obviously we will not let the occasion of this 15th anniversary pass unnoticed. We will, amongst other activities, organize a contest to employ a PhD student at our Institute to work on the extensive VEGETATION (VGT)-archive for a 4-year period. The PhD candidate selected in this contest will be fully funded by VITO. The research will be conducted in close cooperation with a University, which will also act as promotor of the PhD thesis, whereas the Scientific Coordinator of the Remote Sensing Unit (TAP) at VITO will act as co-promotor. Please find hereunder a non-limitative list of subjects that can be proposed for the PhD study:

1/ sensor / platform properties, such as drift or viewing angle and their effects on the quality of derived products such as biophysical parameters,
2/ advanced ICT-techniques, such as cloud- and grid-computing to improve User-interaction with the user segment,
3/ improvement of data products, such as an albedo or phenology product based on VGT,
4/ accuracy of the data products in terms of metric measures by means of techniques such as error propagation,
5/ synergy of the VGT products with related products from disciplines such as hydrology to develop new methods or improved products.

General information & modalities of VITO PhD's can be found at:
http://www.vito.be/VITO/EN/HomepageAdmin/Home/Vacatures/doctoraten/doctoraatsmandaten

We are planning to start the PhD early 2012. This timing is driven by two facts: the VGT2 instrument will only be operational till the end of 2013 and its follow-on mission PROBA-VEGETATION (PROBA-V) is planned for launch in spring 2013. Presently, VITO, as part of an industrial consortium, is developing the user segment of the ESA PROBA-V mission. Therefore testing of the new methods or improved products based on Proba-V can be part of the PhD research. The latter is certainly encouraged, however, it is not a prerequisite.

A tentative timeline for the contest described is as follows:

- August 2011: Publication of the announcement of opportunity
- December 2011: Deadline for proposal submission
- March 2012: Contractual issues and start of the PhD activities at VITO.

Session 1.2: *Urban and soil remote sensing*

10:20 Christian Berger — AutoStructure – A proposal on (semi-) automatic mapping of urban structure types (USTs) using remote sensing data and methods

This study focuses on(semi-) automatic mapping of urban structure types (USTs). The UST approach is an ecological concept that enables planners to divide cities into areas with similar environmental conditions. Hence, USTs are of great value in the context ofstrategy formation for sustainable urban development. State-of-the-art remote sensingdata and methods hold the potential to automate the process of UST mapping. However, there is only limited knowledge about which features should be extracted from the available datato effectively describe USTs. As a consequence, the goal of producing area-wide, high-quality UST maps in a transferable wayremains a challenge in urban remote sensing. The present study addresses this challenge. A future work program is presented that schedules the systematic extraction, evaluation and selection of established, yet unconsidered and entirely new features to generically describe USTs. The targeted combination of suitable features leads tointegrative indicators that are then used within the framework of an object-based classification of USTs. The study concludes with a detailed, comparative validation of the UST mapscreatedand a comprehensive test of methodical transferability. Three German test sites are selected to carry out the analysis: The cities of Cologne (North Rhine-Westphalia), Rostock (Mecklenburg-Western Pomerania), and Erfurt (Thuringia). For the development and evaluation of the methodology, high-resolution multispectral satellite data from Quickbird and Ikonos, normalized digital surface models (nDSMs) from airborne laser scanning (ALS) as well as digital landscape models (DLMs) from the official topographic cartographic information system (ATKIS) are availablefor each test site.

10:40 Robert Eckardt — Bridging gaps in multispectral satellite imagery - An innovative image fusion for the reconstruction of mission information

A major prerequisite for a sufficient analysis in the field of Earth Observation is the provision of information free from external influences and disturbances. Cloud cover is recognized to be a source of significant loss of information and data quality by numerous scientific studies. The existence of cloud cover hinders the extraction of meaningful information since it is a source of uncertainty with regards to the application of any algorithm aiming at the retrieval of land surface parameters. In order to overcome the problem of cloud cover for Earth Observation applications, the reconstruction of areas beneath clouds can be regarded as a fundamental research topic, especially concerning the VIS/NIR regions of the electromagnetic spectrum. In the course of a growing variety of multispectral, hyperspectral and microwave satellite sensors opportunities for the provision of complementary data sources increase. Therefore the solution of problem may be regarded as a problem of synergy between these very data sources. The state of the art provides numerous technologies and cloud removal algorithms. Nevertheless, all of them suffer from certain major drawbacks. The proposed methodology presents an innovative, synergetic combination of two aspects. On the one hand a generic approach for the reconstruction of missing information by means of the information available in the very image. This technique facilitates a very elegant way to avoid radiometric distortions in the course of image reconstruction. On the other hand the estimation of the potential of Synthetic Aperture Radar (SAR) imagery to reconstruct missing information due to cloud cover.

11:00 Sabrina Carvalho — Plant-soil feedback analyis through plant chemical portfolios and its high-resolution spectral signatures

Reflectance spectroscopy has study the link between high resolution spectral signaturesand chemical portfolios of plants at several scales (Asner and Martin 2009, 2010).However thestudies considering plantintra-specific variation are still in their early stages and much knowledge is needed to understand the factors that affect chemical traits variation and its spectral signatures.

Much of the chemistry variation within plant species arises from interactions with the environment, natural enemies and symbionts (Hol et al 2004, Joosten et al 2010, Kirk et al 2010). The interactions between plant and aboveground herbivory or environmental factors is well acknowledged however soil organisms (e.g root herbivores) can induce plant responses aboveground as well (Bezemer et al 2003, Holet al 2004, Joosten et al 2010). Different levels of soil pathogen attacks or mutualistic symbionts may cause variation in the chemical constitution in plants within the same species that aboveground concepts cannot explain.These interactions between plant and soil may even have consequences for invasion success or biological control of plants (Joosten et al 2010).

We aimed to study which canopy chemical and spectral properties could be combined to distinguish the different stages of soil pathogenicity.Here we focused in canopy spectral measurement between 400 and 2500nm and plant chemical content that could be affected by soil biotic conditions. We hypothesize that soil pathogenic level will affect the concentration of fitness and defense components differently in natives and invasive species, and the spectral signatures will be able to discriminate between plants grown in soil with different pathogenic levels.

11:20 Bram te Brake — Measuring soil water storage change in clay soils using radar interferometry

Several radar interferometry (InSAR) studies have observed phase changes between agricultural fields. It has been hypothesized that these phase changes are related to soil moisture changes and elevation changes due to swell and shrinkage of clayey soils. There are however very limited InSAR studies in which SAR acquisitions and in-situ measurements on soil moisture and elevation changes were conducted simultaneously.

We hypothesize that phase changes over agricultural fields with clay soils are caused by swell and shrinkage. The swell and shrink behaviour of these soils is related to their moisture contents. Therefore surface elevation changes can be related to the amount of water stored in the unsaturated zone. The soil moisture status of the unsaturated zone determines the partition of precipitation into runoff, plant-available water, transpiration, evaporation and groundwater recharge.

In this study we are investigating whether InSAR could reveal the detailed data on surface level motion of clay soils needed for large-scale hydrological studies. Using TerraSAR-X data we investigate phase changes of agricultural fields in the Netherlands. Phase signals are linked to field observations of soil moisture and surface elevation changes. The suitability of InSAR to measure elevation changes due to swell and shrinkage is tested. The results suggest that swell and shrinkage of clays is observable by InSAR using short wavelengths. These observations could in the future be used to estimate soil water storage changes.

11:40 Nicole Richter — Surface Deformation of Kīlauea Volcano, Hawaii, from TerraSAR-X Interferometry

Nearly all volcanic eruptions are accompanied by measurable changes in the physical and chemical state of the volcanic system. Surface swelling, for example, is a characteristic expression of subsurface magma accumulation and is therefore an excellent indicator of potential future volcanic activity. Here, TerraSAR-X interferometry was applied to identify and analyze volcano-wide deformation of Kīlauea Volcano, Hawai'i, during June 2008 to early 2011. Pre- and co-eruptive TerraSAR-X interferograms of the Kamoamoa fissure eruption (March 5 - 9, 2011), have been produced. Results have been compared to ENVISAT interferograms (only available until October 2010, when a change in ENVISAT's orbit compromised the quality of derived InSAR data for Hawai`i) and GPS time series, both of which agree with the TerraSAR-X InSAR results. In comparison to ENVISAT, the TerraSAR-X data have the advantage of very high resolution (pixel size of about 3 m compared to 30 m for ENVISAT) and a repeat cycle of only 11 days (compared to 35 days for ENVISAT). With the availability of a very high-resolution LIDAR DEM of Kīlauea's summit to correct for topography, it is possible to make use of the satellite's high spatial resolution. Interferograms with 3 m pixel resolution provide information on instability of the summit eruptive vent, which has the potential to forecast collapses that lead to vent growth and occasional explosive events. These results could not be achieved with lower spatial resolutions, demonstrating the excellent prospects for continued use of TerraSAR-X as an operational volcano monitoring and research tool.

12:00 Laurens Ganzeveld — NitroSpace – Space based estimation of nitrogen deposition on ecosystems (Announcement of postdoc opportunity)

Nitrogen deposition plays a key role in biogeochemistry through its control of plant photosynthesis, nutrient availability, ecosystem acidification and biodiversity. Though global annual total emissions, also based on the application of atmospheric composition remote sensing productions, are relatively well known especially the removal of nitrogen by deposition remains largely uncertain at all scales. To overcome these uncertainties we have been recently granted funding to develop a prototype system which integrates a range of satellite products that will hopefully result in improved estimates of N deposition on ecosystems. The prototype system will combine SCIAMACHY/OMI for column NO2 measurements and METEOSAT-SG and TRMM for precipitation and cloud measurements, with an atmospheric chemistry model used in an assimilation mode to simulate oxidized nitrogen (NOy) deposition on ecosystems. The prototype system will also be applied to evaluate application of recently obtained column IASI/MetOp observations of the reduced nitrogen (NHx) component ammonia to include deposition of NHx. Focus of the work will be to assess how much improvement in NOy and NHx deposition estimates can be achieved through assimilation of these available remote sensing observations in atmospheric chemistry models. This will be evaluated through comparison of simulated N deposition with observed N-deposition for the polluted regimes of Europe and the USA and the contrasting rather pristine tropical forest regimes of Southern America and Africa.

I will present some of details on the rationale, the proposed approach, potential pitfalls and anticipated outcome of this rather novel approach of using remote sensing data to reduce uncertainties in the spatial and temporal distribution of N-deposition on ecosystems.

Session 2.1: *Aquatic remote sensing / hydrology*

13:30 Zheng Duan — Estimating water volume variations in lakes and reservoirs using satellite altimeter databases and satellite imagery data

An accurate monitoring of water volume variations in lakes and reservoirs is essential for better water resources management. Water volumes cannot be measured are a function of water level and surface area.The lack of measured water level and surface area is causing difficulties for monitoring water volume variations. In this study, four satellite altimeter databases for water level, i.e. (i) Global Reservoir and Lake Elevation Database (GRLED), (ii) River Lake Hydrology (RLH) product, (iii) Hydroweb and (iv) Global Land Surface Altimetry product of ICESat (ICESat-GLSA),were summarized and their performances were evaluated and compared using in-situ measurements from three lakes/reservoirs with different characteristics, i.e. Lake Tana(Ethiopia), Lake Mead (USA) and Lake IJssel (the Netherlands).Validated water levels from satellite altimeter databases were related to surface areas being estimated from Landsat TM/ETM+ data using MNDWI (Modified Normalized Difference Water Index). Water volumes were further estimated using the relationship of water level and surface area. The estimated water volume variations were finally evaluated using the measured data.We observe thatfour satellite altimeter databases differ significantly. The provided water level variations arein good agreement with in-situ measurements for Lake Tana and Lake Mead, but not good for Lake IJssel. Based on these water level variations in combination with surface areas extracted from Landsat TM/ETM+ data, the estimated water volume variationsare also similar to measured data with accepted accuracy for Lake Tana and Lake Mead.This study presents the feasibility of quick and accurate estimation for water volume variations in lakes and reservoirs using freely and easily available satellite data.

13:50 Edwin Sutanudjaja — Calibrating a large-scale groundwater model using spaceborne remote sensing products: a test-case for the Rhine-Meuse basin

Calibration of large-scale groundwater models is difficult due to lack of groundwater head measurement data. The calibration becomes even more complex if it must be done in developing countries with poor data availability. In this study, we discuss the possibility of calibrating such models using satellite remote sensing products. As the test bed, we use the combined Rhine-Meuse basin (200.000 km2). For this basin, an extensive groundwater head database is available. However, model calibration/evaluation is carried out using only spaceborne products while head data are solely used for model validation. The model itself uses as input only global datasets so that the modeling procedure is portable to other areas on the globe.

The model consists of the land surface model conceptualizing the unsaturated zone and the MODFLOW groundwater model simulating the saturated lateral flow in the deeper layer. Calibration is carried out by adjusting aquifer characteristics and unsaturated zone soil parameters. Two spaceborne products are considered:
(1) unsaturated zone/soil moisture storage: European Remote Sensing Soil Water Index (SWI) products (available in 1992-2006),
(2) total basin terrestrial water storage: GRACE gravity field solutions (2002-2008).

Results are promising and suggest that it is possible to calibrate such models using these

spaceborne products. Comparing uncalibrated and calibrated model simulations with observed groundwater head data, we conclude that model improvements can be made by integrating models with remote sensing products. We argue that, in the absence of groundwater head data, satellite remote sensing products are useful in calibrating groundwater models.

14:10 Daphne van der Wal Remote sensing of intertidal areas

Estuarine intertidal flats are among the most productive systems in the world, supporting large populations of shorebirds and fish that feed on benthic macrofauna and algae. These tidal flats are very dynamic environments and access can be difficult. Monitoring of such areas is therefore challenging. I will present three examples illustrating how remote sensing can be used to monitor the state of the intertidal area and to unravel mechanisms regulating intertidal ecology.

The first example demonstrates the fate of mud in intertidal areas. Mud content of bed sediments was retrieved from time-series of Landsat TM and ERS SAR satellite imagery. Results were related to information on suspended sediment in the water column from Envisat MERIS data and combined with a mud transport model to elucidate water-bed exchange processes.

In a second example, the distribution and dynamics of benthic algae were hindcasted from years of daily MODIS Aqua satellite data of temperate estuaries. The spatial distribution of benthic algae was closely related to emersion duration and mud content. Intercomparison between ecosystems revealed that the dynamics of benthic algae were largely driven by forces acting on a scale far beyond that of a single estuary, particularly by temperature and wind.

A third example shows how the dynamics of the macrofauna community can be predicted from environmental variables (e.g., mud) and food resources (e.g., microalgae) derived from sequential airborne hyperspectral remote sensing data, revealing a succession in the intertidal benthic community in response to environmental change.

Session 2.2: *Atmospheric remote sensing / meteorology*

13:30 Narangerel Davaasuren The spatial extent of ship emissions in the Barents Sea by emissions inventory, EDGAR and WRF-chemistry global atmospheric models

The future of the Barents Sea and extent of long-range and short transport of the air pollutants from the ship emissions within the region is unknown. The Artic governance needs formalization in terms of binding agreements between the Norway and Russia countries, including more active ratification of Annex VI of the MARPOL convention. The analysis of spatial extent of the ship emissions modeled by atmospheric models and estimated using the ships inventory data in the Barents Sea had shown the similar pattern. However, the issue of the low resolution of the global atmospheric modes and spatial extent of atmospheric process of air pollution and transport is not well known and therefore the in situ measurements and validation of the data and obtained results are needed.

13:50 Mehdi VosooghiDizaji Backscattered mean power distribution in water clouds

In current atmospheric radar approach, incoherent Rayleigh approximation is used as the standard scattering theory to retrieve cloud properties. In the present work scattering theory was investigated for water clouds cases. To validate this theory the correlation between particles has been studied. In order to examine the influence of inter-particle displacement on correlation between particles, a new idea was deployed to create turbulence among particles. For different turbulence settings the randomness of the medium was quantified by the real part of the correlation matrix. Alternative forms for Maxwell equations have been developed and discterized in order to calculate backscattered mean powers from cloud particles. With simplified discretized equations the backscattered electric field has been approximated for a single particle. This approximation of the electric field is the same as Rayleigh approximation used in meteorological literature. The discretized equations have been implemented in computer code to calculate backscattered power from particles inside a small box, located in the far field of radar. Both exact and incoherent Rayleigh backscattered mean powers from particles have been calculated. It has been shown that Rayleigh backscattered mean powers are good approximation for uncorrelated particles and both are distributed normally around the same mean value. In case of correlated particles the exact backscattered mean powers have shown to be distributed lognormally. Depending on the degree of correlation their distribution shifts from lognormal to normal, respectively for highly correlated and uncorrelated particles. With statistical results it has been concluded that for correlated water cloud particles, the exact backscattered mean powers will be smaller than incoherent approximation.

14:10 Muhammad Cheema **Estimation of basin scale evapotranspiration and surface energy fluxes using microwave imagery driven ETLook algorithm**

Availability of cloud free images to infer land surface temperature limits use of thermal infrared data to estimate actual evapotranspiration (ET) in large basins especially with monsoonal climate. To overcome this problem, a remote sensing model (ETLook) is introduced and tested in the Indus Basin. ETLook infers information on actual evaporation (E) and actual transpiration (T) from combined optical and passive microwave sensors, which can observe the land-surface even under cloudy conditions. A two-layer Penman – Monteith equation is applied separately for quantifying E and T. The average ET and evaporative fraction for the hydrological year 2007 is estimated as being 1.2 mm d-1and 0.26, respectively. The basin average sensible, latent and soil heat fluxes are estimated at 80, 32 and 0 Wm-2, respectively. The average net radiation for the basin is estimated as being 113 Wm-2. The ET at basin scale differs less than 1% from conventional data sources. ET results were also compared against previously conducted Bowen ratio and modeling studies. Results compared well with correlation coefficients of 0.70 and 0.75 at the annual time scale. The ETLook results – after combination with rainfall and outflow to the Indian Ocean – suggest a net change in storage of –73 billion cubic meters per year (BCM yr-1). Surface storage changes are estimated as 6 BCM yr-1, 67 BCM yr-1 can be ascribed to groundwater depletion (that results in 0.45 m decline of water table in 2007). This value is in the same ballpark than the over-exploitation assessment resulting from groundwater flow models (–69 BCM yr-1). Hence, the spatial information of ET, rainfall and storage change are congruent and provide key information on renewable water resources. Water management practices in the Indus Basin can become sustainable only if the ET is reduced by 73 BCM yr-1, being 15 % of the total basin evaporative loss.

Dinner party

All RSS participants are warmly invited by professor Martin Herold to attend a dinner party at the International Club, which is located close to Hotel de Nieuwe Wereld. Enjoy a meal and drinks with us, accompanied by live music. The remote sensing bands of Wageningen University (CGI band) and University of Jena (The True Colors) will be performing.

After the inaugural speech in the Aula we will walk to the International club (1.5km). The directions can be found here: http://tinyurl.com/RSSintclub

When leaving the party, you can walk back to Hotel de Nieuwe Wereld in 5 minutes. The closest bus stop (line 88 to Ede-Wageningen NS) is *Haagsteeg*, which is next to Hotel de Nieuwe Wereld. Please plan your trip by public transport from Marijkeweg 31 (International Club) or Marijkeweg 5 (Hotel de Nieuwe Wereld) on http://journeyplanner.9292.nl/.