

Second generation of chromo-stereoscopy for marine applications

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Abstract:

Three-dimensional (3D) visualisation is one of the requirements of cartographic visualisation for geospatial data with chromo-stereoscopy being one of several 3D systems available. The distinct advantages of chromo-stereoscopy over other techniques, such as Polarized lenses and anaglyph, have led to improvements in its usability through the design of a graphical user interface (GUI). The GUI allows the user to display their own data in both conventional and chromo-stereoscopic systems whilst taking into account cartographic considerations: familiarity, interaction and colour contrast.

This software integrates data stream for radar, GNSS, sonar systems and electronic charts and the CS impact. Hence, good understanding of these systems is essential.

The first GFG2 summer school provided a great opportunity to deepen my knowledge about GNSS principles and to meet some experts in that field. And I expect the second summer school will focus on the application side of GNSS. This technical knowledge will be ideal for enhancing my application.

Distant Monitoring of optical characteristics in Dvina estuary of the White sea with the use of airborne lidars

Alexandrova, Alina, Ministry of Environment and Nature Resources of the Republic of Chuvac

Abstract:

Airborne lidar survey of White Sea region was carried out from board of the aircraft laboratory AN-26 "Arktika". To conduct the survey the Polarization Airborne Lidar PAL-1M was used. PAL-1M has been designed specially for this aircraft laboratory. Spatial distributions of hydro-optical properties are drawn for the certain areas. The survey was carried out on July,20-21, 2008.

2D distribution of the effective scattering coefficient was retrieved and its quasi-periodic structure was obtained. Lidars allowed retrieving seawater optical characteristics vertical profiles, to locate and to identify various inhomogeneities in subsurface layer. Airborne lidar is a powerful instrument for investigations of seawater properties spatial variability. The instrument makes it possible the fast data acquisition over large areas of water and allows obtaining "instantaneous" spatial distributions of the World ocean parameters. The airborne lidar can operate in conditions where passive satellite remote sensing is impossible (in the dark time or in cloudy weather). The lidar important advantage as compared to other (acoustic, radar etc.) techniques is its unique capability of seawater characteristics measurements through the seawater surface.

Soil Moisture mapping using forward scattered GPS L1 signals

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Abstract :

The use of Global Navigation Satellite Signals Reflected (GNSS-R) is now widely accepted as a useful tool to retrieve geophysical parameters. The acquisition of high resolution global sea mesoscale altimetry using GNSS-Reflected Signals was proposed in 1993, and was named the PARIS concept. The feasibility of Soil Moisture (SM), mean vegetation height, topography, and Vegetation Water Content (VWC) retrievals using GNSS-R observables has been recently demonstrated in several scientific articles and PhD Theses.

In this work field, and considering the bistatic configuration of the GNSS systems (observation geometry), theoretical simulations of the GNSS reflection coefficient over bare soil scenario have been performed in order to analyze the feasibility of SM 2-D mapping. GNSS satellites transmit Right Hand Circular Polarization (RHCP) at L-Band (L1 C/A code at 1.575 GHz), but the scattered/reflected signals over the surface is mainly Left Hand Circular Polarization (LHCP). With two antennas polarized accordingly, direct and reflected signals can be sensed.

The algorithm proposed for the 2-D SM monitoring is based on sensing the peak of the so-called Delay-Doppler Maps (DDMs), which is the correlation of the received signal with a clean replica of the C/A code for different delays and Doppler bins, for the direct (up-looking antenna) and reflected (down-looking antenna) GNSS signals. By dividing both peak values, each one at each polarization, and considering the antenna pattern effect and the different noise temperatures for each receiving antenna and the noise figure of each receiving chain, a 2-D map of the soil reflection coefficient from each polarization can be obtained. Then, the SM 2-D maps can be directly obtained just by solving an inversion problem, from reflection coefficient to SM value obtained using some theoretical models, taking also into account speckle noise, multipath effects and surface roughness.

Field experiment results both 2-D SM maps will be shown at the poster.

Flooded area extraction & damage assessment from multispectral remote sensing imagery based on image classification

Alouene, Yosra, Mediterranean Agronomic Institute of Chania, Tunisia

Abstract:

I am a second year Master's student enrolled in the MSc programme of Geoinformation in Environmental Management of the Mediterranean Agronomic Institute of Chania in Greece. This is a 2-year programme focusing in creating highly specialized and effectively trained scientists able to tackle significant environmental issues in today's natural environment.

At present I work on my thesis which aims at exploring the combined use of optical remote sensing imagery with advanced image processing techniques in performing flooded area mapping and post-flooding damage assessment. The specific thesis objectives include: 1) to perform a comparative analysis of a range of advanced classification approaches when combined with medium spatial resolution multispectral imagery from Landsat TM imagery for mapping flooded area, 2) to evaluate the impact of extra spectral information (band ratios and/ or indices) in improving the flooded area cartography from TM imagery and 3) to perform an assessment of the flooding damage extent exploiting freely-distributed operational land use/land cover products.

I am very much interested in attending the summer school you organize focusing in providing key training and skills on the navigation and precise positioning and timing. This is focusing on a topic that is very interesting for me which is at the same time also very much linked to my work and professional interests. Accurate and timely positional information is of paramount need in remote sensing data analysis, especially in investigations related to different types of natural hazards such as floods, as I do at present. Accurate information on flooding extend is of key importance in flooded management and in mitigating its catastrophic effects. In addition, such information is needed in evaluating the accuracy of different image processing approaches employed in extracting flooded areas from remote sensing data. For example, accurate and timely positional accuracy is of practical value in my work to perform georeferencing, or to select precise training locations in implementing different flooded area techniques. Furthermore, having access to precise and timely positional information, the flooding area extend can be accurately evaluated (from field visits to affected sites), and this information is subsequently used for example in validating satellite-derived estimates of flooded area from image processing techniques. Precise positional accuracy is very important in my work also in deriving land use/cover maps and assessing the accuracy of such thematic maps derived from remote sensing imagery analysis.

Given the necessity for me to use precise and timely derived positional information in different aspects of my work, including those I briefly outlined above, I do strongly believe that participating to the summer school you organize would help me to extend my knowledge in this field, to learn more about the techniques employed and the uncertainties involved in precise positional accuracy estimation. Such knowledge I anticipate to be able to practically use and share with my colleagues in my future research and study at a PhD level .

Key Words: Flooded Area Mapping, Remote Sensing, Precise Positioning.

Healthcare interactions with Space Technologies: A study for the HealthTech and Medicines KTN.

Archibald, Alexandra, M4 Technologies Ltd, United Kingdom

Abstract:

In recent years there have been a number of studies performed to assess the viability of a more active role for Space Technologies in a variety of Healthcare sectors. This involvement ranges from the direct incorporation of sensor technology to the downstream use of remotely sensed Earth Observation imagery.

A key example of a nationwide technological healthcare initiative, and of particular note, is the Whole System Demonstrator Programme developed by the Department of Health (DoH) to show the potential for telehealth and telecare. Whilst a supplementary study (Henderson et al., 2013) has concluded that these technologies were not cost effective as a publically funded national service, findings central to the study show that telehealth can deliver a 15% reduction in A&E visits, a 20% reduction in emergency admissions, a 14% reduction in elective admissions, a 14% reduction in bed days and demonstrate an exceptional 45% reduction in mortality rates (DoH, 2011). The DoH concluded that telehealth and telecare could save the National Health Service (NHS) in the UK £1.2 billion (DoH, 2012).

As part of the research to be performed for the HealthTech and Medicines Knowledge Transfer Network (Health KTN) by M4 Technologies Ltd., all aspects of Space Technology will be investigated with a particular focus upon the use and implications of Global Navigation Satellite Systems (GNSS). Whilst the direct application of GNSS technologies is often understood (i.e. the emergency services and disaster response), the aim of this study is to recognise the less direct implications of GNSS in the health sector. To achieve this, it is important to not only interact with current and future players in this field, but also to fully understand the theoretical concepts and technological issues underpinning GNSS.

The final outputs of this research will be a report outlining current interactions between Space Technologies and Healthcare. Upon completion and assessment by the Health KTN, this research will act as a key guidance document for UK Government agencies and other stakeholders when allocating future research funding and resources, and undertaking pre-normative initiatives. In addition, this research will support related activities undertaken by the Health and other KTNs operating within the UK Space Innovation and Growth Strategy Restack programme.

Applications of Remote Sensing Precision Agriculture

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Abstract:

Precision agriculture (PA), a site specific timely intervention, has seen a growing importance over the past few years with widening practical application of remote sensing. This can mainly be attributed to advances in sensor technologies approaching the required temporal, spectral as well as spatial resolutions. PA could be implemented through the monitoring of crop biophysical and biochemical parameters. Leaf Area Index (LAI) is one of the key biophysical parameter for monitoring the crop condition. Although the use of spectral vegetation indices (SVIs) has been a common retrieval method for crucial information on crop condition from the huge stream of remote sensing data, the use of those indices has been constrained either by their lack of sensitivity to LAI or sensitivity to leaf, soil and canopy parameters. The objective of this research was therefore exploring the possibility to improve the sensitivity of SVIs using Radiative Transfer Modelling and assessing the performance of the existing SVIs across broad and narrow band sensors. It also aimed at evaluating the performance of European Space Agency (ESA's) upcoming multispectral space systems. Finally, validation is performed with different management practices and crop phenologies based on empirical data. To this end, PROSAIL model based simulated data as well as empirical field data measured for potato (*Solanum tuberosum* L.) crop using a crop scan MSR16R radiometer and LAI-2000 for the 2011 and 2012 growing seasons were used. In addition, a hyperspectral airborne prism experiment (APEX) image acquired on 27 June 2011 was used for evaluating the SVIs for image level application across multiple sensors. The role of GNSS is very crucial to locate the field measurements to be used as validation points for the image based estimation. The validation results partly depend on the accuracy of such GNSS applications to fix the locations of the ground truth data. Based on the result obtained, the short wave infrared (SWIR) bands followed by Red-edge showed better sensitivity to LAI for different soil moisture levels than the red bands. This implies that the former two spectral regions can provide complementary information for the improvement of NIR based SVI-LAI relationships. The evaluation of SVIs showed consistent performance across broad bands of TM and narrow bands of MSR16R, APEX, S-2 and VEN μ S. It was found that most of the SVIs considered showed high sensitivity to leaf Cab levels and leaf angle distributions (LADs). However, the SVIs showed less sensitivity to canopy background effects as simulated by the varying soil moisture levels. It was also found that the sensitivity function did not maintain consistent performance for all the SVIs as seen from their S record and the coefficient of determination and root mean square error (RMSE) values.

A high-resolution, time-variable afterslip model for the 2010 Maule Mw=8.8, Chile megathrust earthquake

Bedford, Jonathan, GFZ German Research Centre for Geosciences, Potsdam, Germany

Abstract:

The excellent spatial coverage of continuous GPS stations in the region affected by the Maule Mw=8.8 2010 earthquake, combined with the proximity of the coast to the seismogenic zone, allows us to model megathrust afterslip on the plate interface with unprecedented detail. We invert post-seismic observations from continuous GPS sites to derive a time-variable model of the first 420 days of afterslip. The afterslip pattern appears to be transient and non-stationary, with the cumulative afterslip pattern being formed from afterslip pulses. Frequency analysis of the slip rate for each patch of the interface model shows that the region of the interface with the highest aftershock density also has the most variable slip rate suggesting that afterslip pulses and aftershocks are closely related in time and space. Changes in static stress on the plate interface from the co- and postseismic slip cannot explain the aftershock patterns, suggesting that another process – perhaps fluid related - is controlling aftershocks. We use aftershock data to quantify the seismic coupling distribution during the postseismic phase. By combining the aftershocks and the afterslip model we can investigate to what extent the stress is being released seismically, hence making a map of seismic efficiency for the plate interface. We find that regions which sustain the very largest plate-interface aftershocks ($M_w > 6.8$) coincide with regions of anomalously large seismic efficiency, and these anomalies can indicate regions where we anticipate future large aftershocks.

Shrinking of the Aral Sea and its solutions

Begniyazova, Qumar, Uzbe State World Languages University, Uzbekistan

Abstract:

The Problems of the Aral sea, its influence on the ecology of the region and the health of the population. The offered solutions to the issue, the ongoing measures to prevent the Aral from drying. The joint activities to solve the problems with various countries, in particular with Germany. My own opinion on how to resolve the Aral sea problem.

Advanced Multi-GNSS Troposphere Modeling for improved Monitoring and Forecasting of severe Weather

Berckmans, Julie, Royal Observatory of Belgium, Belgium

Abstract:

The Royal Observatory of Belgium (ROB) uses GNSS satellite navigation signals to perform multi-disciplinary research and applications related to space geodesy (ground deformation, reference frame, time and frequency transfer...), including the modelling and monitoring of the Earth's atmosphere (both the ionosphere and the troposphere). In that context, our group uses GNSS signals for space weather research (including space weather climatology), for improving Numerical Weather Predictions (NWP), for monitoring severe weather (nowcasting) and for studying the climate change (trends and variability).

In this respect, the ROB contributes to several projects including the EUMETNET EIG GNSS Water Vapour Program (E-GVAP) aiming at the operational exploitation of GNSS signals for improving NWP. Within E-GVAP, ROB provides hourly-updated Zenith Tropospheric Delays (ZTDs) from a network of about 400 GPS stations covering Europe. Over the past years, many GNSS station operators have upgraded their equipment to observe simultaneously multiple GNSS (GPS, Glonass, Galileo). However, these additional observations are not presently exploited for operational meteorology, which still relies on the analysis of GPS-only observations to provide only ZTD (no or few information on spatial heterogeneities is provided).

Improving this situation is one of the goals of the new COST Action ES1206: Advanced GNSS Tropospheric Products for Monitoring Extreme Weather Events and Climate (GNSS4SWEC) to which the ROB participates. This Action targets the development of new/advanced tropospheric products (including gradients and slant delays) based on the use of the other GNSS systems such as GLONASS (Russian) and Galileo (EU&ESA). The performance of these new products will give more potential on the analysis of the atmospheric water vapor behavior (including its heterogeneities) and improve the use of GNSS in monitoring and forecasting of severe weather.

To improve its contribution to GNSS meteorology, the ROB is thus developing new tropospheric products with improved spatial and temporal resolutions, including the estimation of horizontal gradients and slant tropospheric delays, and based on the analysis of multi-GNSS observations. The ROB is also developing new tropospheric products based on real-time GNSS observations and sub-hourly analysis of GNSS observations (every 15 minutes) in order to improve its support to the monitoring and nowcasting of severe weather. +++ I will present my contribution to these new advanced research and developments in GNSS meteorology and climate.

Usage of ATOVS/NOAA data for the estimation of stability indices over Ukraine

Bobryshev, Oleksandr, Ukrainian Hydrometeorological Institute, Ukraine

Abstract:

I am project student at the Ukrainian Hydrometeorological Research Institute. I work in the research project "Estimation of Stability Indices from ATOVS/NOAA and ATOVS/METOP measurements over Ukraine". We have developed scheme of the estimation of stability indices over Ukraine using ATOVS/NOAA and ATOVS/METOP measurements. Stability Indices are defined as the stability of the atmosphere in hydrostatic equilibrium with respect to vertical displacements and is a critical factor in severe weather development. Atmosphere profiles, required for estimation of Stability Index are retrieved use the IAPP package which reads ATOVS level 1D data and produces temperature and water vapour profiles. K index, KO index, lifted index, and maximum buoyancy are obtained.

The retrieved temperature and water vapour profiles based on satellite data are in a good agreement with observed ground radio sounding data. In order to test the usefulness of this estimation of stability indices for short-term forecast several cases of rapidly developing convective storms observed over Ukraine were analyzed. The comparison between stability indices estimation from satellite derived atmospheric profiles and NWP forecast shows that the first one is able to predict instability better over pre-convective areas. Thus, it is expected that the nowcasting and short-range forecast can be improved by the operational Stability Index products derived from satellite measurements of atmospheric profiles.

GNSS provides possibility to retrieve some meteorological parameters. One of them is the amount of water vapour in a column of the atmosphere, which is one of main parameter which effect on atmosphere stability. By getting additional knowledge about this process I will get a possibility to use them in my work.

My research is based on the data from space-based instruments. Lectures about GNSS system will improve my understanding of technical details of measurement and reception of data.

As now I am just getting master degree I expect to continue my research in this field. The new knowledge will broaden my horizons and open new possibilities in my future work.

VADASE: Variometric Approach for Displacements Analysis Standalone Engine. The third way in GNSS Seismology.

Branzanti, Mara, University of Rome "Sapienza", Italy

Abstract:

The aim of my work is to show the fundamental role of GNSS in the seismology field (the so-called GNSS-seismology). In particular, I propose an innovative approach (VADASE) to estimate real-time coseismic displacements and waveforms when an earthquake occurs.

The interest toward accurate GNSS-derived coseismic displacements and waveforms is motivated due to the fact that they can support both the modelling of fault rupture and the seismic moment estimation without being affected by saturation, which commonly influence seismometers close to strong earthquake epicenters.

In this regard, during the Real-Time GPS Science Requirements Workshop held in September 2007 (Washington, USA), the goal of achieving 1-cm real-time GNSS coseismic displacement accuracies within the 3 min following an earthquake, was adopted.

Up to now, the established strategies in GNSS-seismology are the Differential Positioning (DP) and Precise Point Positioning (PPP).

The first approach guarantee high real-time accuracy, but strictly needs a GNSS network (at least a pair of permanent stations). Due to the adopted differential positioning, it only provides a relative coseismic displacement, which is the coseismic displacement with respect to (at least) one reference station. This feature represents a serious limitation for strong earthquakes, since even the reference station(s) could undergoes(undergo) a displacement.

Differently, the PPP requires observations collected by a unique receiver, but needs products (orbits, clocks) that at present are not routinely available in real time with the due accuracy.

To go beyond the limits of the classical approaches (DP, PPP) described above, a innovative variometric approach, implemented in the software VADASE (Variometric Approach for Displacements Analysis Stand-Alone Engine), developed at Geodesy and Geomatic Area, "Sapienza" University of Rome, can be considered.

It is able to estimate coseismic displacements and waveforms in real time, with an accuracy of few centimeters, considering observations [both at single (characteristic of low cost receivers) or double (feature of geodetic receivers) frequencies] and broadcast products collected at high rate (1 Hz or more) by a unique stand-alone GNSS receiver.

The effectiveness of the software VADASE was proven in near real time during the Japan Earthquake (M=9.1 - March 11, 2011)[1]. In this occasion VADASE provided the first displacements computation at IGS stations of MIZU (140 km from the epicenter) and USUD (430 km from the epicenter); only in a second time, the results have been compared (and confirmed) with the solutions produced by the most established strategies.

As regards its single frequencies applications, a study was carried out relatively the Emilia, Italy Earthquake (M=6.0 - May 20, 2012). In this case, the obtained results paved the way to the use of single-frequency receivers for GNSS seismology purposes.

In this respect it is evident that the use of low-cost receivers could allow a remarkable increase of the number of GNSS permanent stations, ensuring a much more detailed coverage of seismic hazard areas.

[1] Branzanti M, Colosimo G, Crespi M, Mazzoni A (2012) GPS near real-time coseismic displacements for the great Tohoku-Oki earthquake, doi:10.1109/LGRS.2012.2207704, IEEE Geoscience and Remote Sensing Letters

Hydrological services evaluation through satellite observations, SWAT hydrologic model and future applications of GNSS

Carvalho-Santos, Claudia, University of Porto & CIBIO, Portugal

Abstract:

My PhD research is focused on analyzing hydrological services provided by forests. I'm applying SWAT (Soil and Water Assessment Tool) hydrologic model in a small catchment in Northern Portugal. My aim is to evaluate the hydrological consequences of increasing forest area, comparing scenarios of different tree species (pine, oak and eucalypts). The task is not easy because the model is not so sensitive to vegetation parameters calibration. For this vegetation calibration I'm using literature records and NDVI series from MODIS to know the phenology of different land covers in the region. I'm not sure whether GNSS can give me a direct contribution on this, but I would like to hear from you. Streamflow is an important parameter to validate hydrologic models, but records sometimes do not exist. I would also like to hear about the use of GNSS to monitor streamflow. I believe GNSS can give a valuable contribution to maximize positioning and improve SAR records. Maybe GNSS with some technology exists to measure it directly?

Meanwhile, I was invited to write a state-of-the-art chapter for a book about remote sensing and hydrological services evaluation. It was a challenge for me, because the field of Earth observation, satellites and sensors was completely new. Nowadays I know a little bit more about satellites and products related to water, but I was not aware of the utilities of GNSS, other than conventional positioning. Therefore, the Gfg2 summer school will be important to increase my knowledge in the field of water.

Related to natural hazards, I would like to know more about the utility of GNSS for weather forecast, particularly precipitation. For example, how to feed hydrologic models, with near-real time data for floods and landslides alerts. GNSS itself can give us the terrain subsidence with high spatial accuracy. Also GNSS is supporting other satellites and sensors (working in other bands, e.g. SAR) to improve their positioning.

Finally, my group is devoted to biodiversity inventory and ecosystem monitoring. There are field campaigns where GPS is used. Recently, a drone UAV (unnamed aerial vehical) was acquired to monitor biodiversity, particularly habitats. Currently I'm not working directly with this, but in the future I would like to become more involved in this topic. Therefore, I would like to improve my knowledge about the importance of GNSS.

LTE, positioning and the Implications for GNSS over the Air Testing

Ciungu, Raluca Sofica, Barcelona City Council, Spain

Abstract:

Long Term Evolution (LTE) technology in mobile communications, often called 4G, is making its way into a host of consumer devices. It started with data-only modules for internet connectivity but quickly made its mark on smartphones, automotive communication, and embedded modules that provide fast and reliable wireless data connectivity to the machine to machine (M2M) market.

Nearly all consumer devices migrating to LTE also have a strong need to provide positioning capabilities with most consumer applications striving for 5-10 meter accuracy in all environments. GNSS systems remain the leading technology for positioning. When coupled to a cellular technology such as LTE, assisted GNSS (A-GNSS, where assistance is provided by the network) can provide improved location performance by making positions fixes faster and with improved yield when used at low GNSS signal strengths.

Considering all of the LTE frequency bands being deployed and all the possible interference scenarios, over the air testing is emerging as the best way to ensure that GNSS and LTE performance meets user expectations and industry requirements.

With LTE deployments under way in many markets around the world, and many more planned for the near future, it clearly will not be long before the majority of connected mobile devices and M2M modules rely on this technology. The fact that GNSS receivers will frequently be paired with LTE technology makes testing the two conjunctions with one another a necessity.

SPACE TECHNOLOGY AND PUBLIC HEALTH

Cusanelli, Nicola, Sinergie srl, Italy

Abstract:

Satellite technologies are a natural ally in public health emergencies for tracking the extent of disease outbreaks and natural disasters.

Great advances have been made in space technology in the past decade, and these advances have become useful for addressing humanitarian crises. The chief of these is using satellites to obtain images of a disaster zone quickly (earthquake or water-flood e.g.), so that rescue workers can focus their efforts where they are needed.

But there are other uses of satellites. Space technology applications to combat and even forecast the spread of disease are also fundamental instruments in ensuring the health of current and future generations.

Disease agents and their vectors each have particular environments that are optimal for growth, survival, transport, and dissemination. Factors such as precipitation, temperature, humidity, and ultraviolet radiation intensity are part of that environment. Each of these climatic factors can have markedly different impacts on the epidemiology of various infectious diseases.

Satellite remote sensing, global navigation satellite systems (GNSS), and geographic information systems (GIS) make it easier to integrate ecological, environmental and other data to predict the spread of diseases.

There were approximately 1,400 infectious diseases in the world, some of which were the main causes of mortality in developing countries, and that "a full half" of the world's population lived in infected areas.

Malaria alone infected 219 million people in 2010, triggering the death of 660 000 (<http://www.who.int/research/en/>). In this case, satellite data had also been used to measure temperature, humidity and vegetation, in order to estimate how many people were at risk. That data was then combined with terrestrial and in situ data on selected rural villages to estimate how many villagers were in danger of infection.

Other vector- and water-borne disease and epidemics, which are affected by climate and meteorological conditions, such as meningitis and cholera, cause serious disruptions to society and constitute a major burden on national health systems.

Earth-observing satellites provide a transnational picture of vector-borne diseases, irrespective of national frontiers. Space-based data also help scientists to predict high-risk areas before outbreaks occur, and new satellite platforms result in a better idea of risk factors and allow experts to make more informed decisions.

Single base RTK Technique in Urban Surveying

Fragkalas, Nikolaos, National Technical University of Athens, Greece

Abstract:

The continuous development of the Global Navigation Satellite Systems GNSS (GPS, GLONASS, GALILEO), has led to the creation of Networks of Permanent Reference Stations and to the use of network positioning techniques such as DGPS and RKT. Through the constant development of these techniques, a wide variety of their applications in urban surveying has been found in recent years.

Following these developments, Permanent GPS Stations and Networks were created in Greece.

In the present work, takes place the application of the classical method of urban surveying and the application of the RTK technique with adjustment recordings from a Permanent Reference Station (Single – Base RTK). This technique was implemented with the use of receivers from two different companies. The aim of this work is the application of the RTK technique and the evaluation of its precision in urban surveying.

In the area of Filothei, Attica, four building blocks was the chosen region of study, blocks that are 4100 and 4600 meters away from the Reference Stations of the two different companies, which are placed in region of Amarousio and Metamorphosis respectively.

Results collected from the application of the RTK technique, for each one of the receivers, were compared with results of the application of the classic tacheometry, and also compared with one another. The results of the comparisons show that the positioning accuracy ranks at only a few centimeters, something that supports the application of this technique as useful.

Three decades of Land Cover change in the Brazilian Amazon

Gabriel, Cristina, New University of Lisbon, Portugal

Abstract:

As well as being a student, I also work as a scientific researcher at the The Tropical Research Institute, in the area of Earth Observation. The project I am currently involved in is called "Remote Sensing of the regeneration of the tropical forests in Brazil: Mapping and Retrieving Biophysical Parameters". As part of this project, we aim to study the landscape evolution of Amazonia, using time-series analysis to map changes and collect biophysical parameters. This allows us to study several aspects about this landscape, such as the land fragmentation, the extent of forest regrowth and which can re-establish itself as a carbon sink, modeling and prediction of future landscapes, among other subjects.

I would appreciate the opportunity to participate in the summer school, to improve my knowledge in the area of Remote sensing, exploring the techniques of Earth observation and its environment, to be able to join a community of specialists in this scientific area. Also, it will allow me to learn with the experience of my colleagues about different methodologies and other applications of this subject. I think this course will improve my Curriculum vitae and help me to achieve a higher level of expertise, allowing me to develop my techniques and knowledge that will help me in my career and to continue my studies as PhD student, using the art of remote sensing applied to sustainable development.

Caspian Sea ice state monitoring

Klimchuk, Jane, State Research Center for Space Hydrometeorology “Planeta”, Russia

Abstract:

Powerful tool to detect changes in the sea ice cover in a near-real-time is a Sea Ice Chart based on remote sensing (RS) data. Important advantages of satellite imagery – spatial coverage, frequency and processing efficiency – provide the ability to capture rapidly changing state of marine environment at different time scales. Modern automated processing techniques allow to distinguish sea ice from clouds and identify sea ice components (age, morphology and types). Thus RS data are significant for dynamic Caspian Sea ice state detection. It works almost during the whole year for purposes of navigation and increased anthropogenic influence (e.g. offshore oil platforms). Under these conditions knowledge of hydrological regime of the Caspian Sea and its changes are of practical importance.

Considering the above Caspian Sea ice monitoring during winter season is an important research topic at State Research Center for Space Hydrometeorology “Planeta” (Russia). Nowadays for thematic products we use freely available optical RS data (e.g. MODIS Aqua/Terra, AVHRR/NOAA) and also Russian instrument KMSS/ “Meteor-M” (spatial resolution 50m.). Unfortunately at 2012 after ASAR/ENVISAT had gone we lost free access to any radar data. SRC “Planeta” provides Sea Ice Charts to regional meteorological services. This thematic product gives information on current Sea Ice state (density, age and origin), figures about ice hummocks (in forms and sizes), sea ice cover area with shore ice for navigation purposes. Here the comparison of several RS images free from clouds with different timing is used.

Thus for reason that GPS RS tool can measure Earth`s surface parameters (e.g. sea ice conditions) continuously, in all-weather and near-real-time we are interested to get an extensive knowledge about GNSS equipment, methods and data which we can apply to our on-going research projects. As Russia has its own navigation system GLONASS we are looking forward to learn new ways to use GPS reflected signals to monitor inaccessible sea ice cover etc.

Discovering of satellite data usability in diagnosis and forecasting weather hazards for aviation.

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Abstract:

Wind forecasting is very significant for aviation. Strong winds cause many troubles during takeoff and landing, become a reason of track change. Flank winds and wind shears are also very critical for any aircraft. Airport closing and flight delay are very wasteful for airline companies wind forecasting can help to avoid these events. That is why the topic was chosen, since its relevance is obvious.

Despite aviation the main branches which are also interested in wind forecasting:

- Agriculture.
- Power industry.
- Transportation.

Significance of accurate forecast is extremely important that is why a lot of wind forecasting methods have been developed. However my work is focused on modeling methods, especially non-hydrostatic meso-scale COSMO-model.

The COSMO model is a non-hydrostatic atmospheric prediction model. It is based on the primitive thermo-hydrodynamical equations describing compressible flow in a moist atmosphere (<http://www.cosmomodel.org/content/model/documentation/core>).

It uses several grids: 14, 7, 2.2 km and prognostic variables: horizontal and vertical Cartesian wind components, pressure perturbation, temperature, specific humidity, cloud water content. Optionally: cloud ice content, turbulent kinetic energy, specific water content of rain, snow and graupel. [1]

The model is used in Roshydromet, at web-site available (<http://www.meteoinfo.ru/cosmo-maps>): average wind at 10 meters height and wind blasts forecast; average wind at 500 hPa level and wind blasts at 10 meters height forecast. Both of them could be used in aviation. Of course the model can compute wind forecasts at other levels if it is necessary.

In my work I paid attention to input data which is needed to run the model, I mentioned them in my poster, data and its sources.

Since my work is about satellite data usability in wind forecasting the most important source of data from the list is satellite instrument ASCAT. ASCAT provides wind measurements over the water areas, which are also essential for aviation forecasting.

The Advanced SCATerometer (ASCAT) is a real aperture radar, operating at 5.255 GHz (C-band) and using vertically polarized antennas. Winds over the seas cause small scale disturbances of the sea surface which modify its radar backscattering characteristics and are dependent on both the wind speed over the sea and the direction of the wind. Obtained wind measurements can be assimilated in COSMO model and used for wind forecasting above the sea surface which is desirable for aviation purposes. ASCAT measures wind 10 meters above the sea surface. [2]

In my research I've discovered that it is possible to use satellite data in wind forecasting for aviation. COSMO-model which shortly viewed uses to forecast winds satellite data. One of the sources of data for COSMO model to forecast winds is data from advanced scatterometer ASCAT. Obtained wind measurements can be assimilated in COSMO model and used for wind forecasting above the sea surface which is desirable for aviation purposes. This is just a fact-finding work which will be involved in my bachelor's thesis about satellite data assimilation in hydrodynamic models.

References

1 - <http://www.cosmomodel.org/content/model/documentation/core/>

2 -

<http://www.eumetsat.int/website/home/Satellites/CurrentSatellites/Metop/MetopDesign/ASCAT/>

Forest change detection in time of war: Comparing a pre- and post- war time series dataset of change in forest cover & land use for Gola National Forest in Sierra Leone and household surveys

Markiet, Vincent, Wageningen University, Netherlands

Abstract:

My current MSC thesis focuses on the changes in forest cover between 1986 and 2012 for the Gola National forest on the border of Liberia and Sierra Leone. Focusing especially on the time when civil unrest (1991-2002) took place and how this affected the forest cover. The hypothesis states that forest cover remains constant or even regenerates in time of war. In combination with satellite imagery the research combines socio-economic data and on-the-ground data registered with Gps systems. The preliminary results show that forest cover slightly increased during the time of war.

This integration of socio-economic data, gps points and satellite imagery can result in information explaining the observed spatial patterns caused by human behavior. As human behavior is such a dynamic concept it is important for validation to include ground data, which is often lacking with solely remote sensing focused research.

GNSS can play a vital role in the validation of dynamic changes of spatial patterns such as forest cover. For my research Gps points were taken to validate the position of villages. These villages mainly rely on subsistence farming. The position of these villages is essential for the validation of changes in forest cover, as for such dense forested areas agriculture is one of the main drivers of deforestation.

When working with satellite imagery the atmosphere causes slight changes in the received signal by the sensor. As the atmosphere changes the signal received by the sensor this needs to be corrected for during the pre-processing phase. With new and improved technologies focusing especially on mitigating the influence of the atmosphere could enhance the signal received by the satellites. Eventually leading to a more reliable representation of the earth's surface.

In line with my (and possible future) research new and current improvements on GNSS systems could lead to improved representation of land cover. Currently a lack of satellite imagery, due to perpetual cloud cover, results in temporal gaps in the change detection making the results less accurate. With new GNSS systems data availability could be improved.

The use of GNSS products in calculation of evaporation in coastal regions

Milanova, Milena, Sofia University, Bulgaria

Abstract:

The determination of the evaporation in the fresh water balance has always been a problem, especially in the coastal regions where it is very important to estimate this component in order to investigate the dynamics of water level near the shore and in the semi-enclosed lagoons, estuaries and sea lakes. In this study an attempt is made to use the integrated water vapor obtained from GNSS products as an estimate of the evaporation in the Black sea coastal station Varna for the period 19-25 July 2007. The IWV is compared with the evaporation calculated using bulk parametrization. The data for wind speed, air temperature and precipitation used in the calculation are taken from NCEP meteorological reanalysis and the data for the Sea Surface Temperature (SST) are taken from AVHRR satellite observations. Conclusion about the applicability and limitations of this method is finally made.

Remote Sensing opportunities for biodiversity monitoring in REDD + MRV

Mulatu, Kalkidan, Wageningen University, Netherlands

Abstract:

My research topic focuses on identifying "remote sensing opportunities for biodiversity monitoring in Reduction of Emission from Deforestation and forest Degradation (REDD+) Monitoring Reporting and Verification". REDD+ projects are expected to present benefits to local communities and biodiversity beyond improving carbon stock and their impacts are expected to be monitored, reported and verified. Hence, there is a growing need to come up with a reliable MRV system to monitor impacts towards biodiversity due to the REDD+ projects. The aim of my research is therefore, to look in to remote sensing opportunities to monitor indicators of biodiversity change. One of these indicators are forest fragmentation and forest connectivity. In my research I proposed to monitor the indicators using Landsat Thematic Mapper (TM) and Enhanced Thematic Mapper (ETM+) satellite imagery of a certain time series, where supervised classification of forest and non-forest areas can be performed. These results can then be analysed using fragmentation analysis tools as Landscape Fragmentation Tool (LFT), Graphical User Interface for the Description of image Objects and their Shapes (GUIDOS), and FRAGSTATS. The results of the fragmentation analysis is then expected to be related to biodiversity trends in the study area, UNESCO Kafa Biosphere Reserve, a candidate REDD+ area in Ethiopia.

The emerging new technologies in remote sensing are expected to lead to a nearly accurate estimation of biodiversity changes occurring due to REDD+ activities. Therefore, GNSS-remote sensing is important for strengthening the biodiversity monitoring through animal satellite tracking, for identifying ecological networks (habitat patches, and ecological corridors). I therefore, want to investigate the possible opportunities, new technologies, and GNSS-remote sensing tools available to have an effective and efficient monitoring system in my research interest.

Mapping and classification benthic habitats of the BES islands using multispectral Imagery. Case Study of St. eustatius

Nieto, Paula, Wageningen University, Netherlands

Abstract:

I am now working on my MSc thesis for the Master of Geo-Information Science and Remote Sensing at Wageningen University (The Netherlands). The main objective of my research is to use multispectral data to map and classify benthic habitats at the island of St. Eustatius, as an accurate habitat map will be very useful for the management and protection of their marine biodiversity. The purpose is to help reveal the capabilities and limitations of the available data for coral reef mapping over the study area. This research will also evaluate the need of accurate bathymetric data for water column correction of the images.

I decided to choose this topic because I am passionate with marine environments, their biodiversity and their protection. GNSS is important for marine management in various ways. For my actual research, positioning is critical to data analysis regarding coral reefs, and GNSS provide accurate fieldwork positions for validation and sampling locations.

Also, GNSS have very important applications for marine habitats protection and monitoring, such as controlling and monitoring access to marine parks and marine reserve areas, coastal mapping, shoreline monitoring and sea level change. GNSS data can provide managers with valuable information about issues affecting the health and vitality of coastal ecosystems, such as marine accidents (oil spills) or algae booms.

GNSS signal analysis for weather monitoring

Nikolaidou, Thaleia, Aristotle University of Thessaloniki, Greece

Abstract:

A subject-phenomenon examined by two scientific groups aimed to different directions can sometimes be a win-win situation. Examining ionospheric and tropospheric delays in GNSS signals, geodesists, on the one hand strive to eliminate them, whilst meteorologists and environmentalists on the other, use them to derive weather forecasting models, study global climate change and estimate local weather parameters (temperature, pressure and water vapour). Or to put it another way, "one scientist's noise is another scientist's signal"*.

As a Rural and Surveying Engineer, I am working on a project on environmental monitoring using remote sensing data. Especially, I am researching on retrieving atmospheric parameters from GPS signals. The goal of the project is the creation, by using data from existing GPS networks, of a national weather monitoring GPS network which will be available through an on-line platform to serve multiple tasks: research as well professional. In particular my focus is its implementation in farming management along with Precise Agriculture (PA) techniques.

PA is defined as a farming management concept based on observing and responding to intra-field variations. Applying the technologies of Remote Sensing and GNSS aims to improve crop performance, profitability as well as environmental quality. The success of the concept relies on determining the accurate position where the cultivation practices should take place at a specific time. The core satellite system used so far for the RTK, DGPS and PPP applications, is GPS.

My research project proposes a system that would optimize returns on inputs for the farmers, while preserving resources for the environment. The building blocks of the system are satellite and airborne remote sensing images and GNSS signals for weather monitoring.

The last two decades the capabilities of GNSS remote sensing of the atmosphere have become obvious leading to what is known as GNSS-Meteorology. Due to the penetration GNSS signals have through clouds and dust, we are able to use them to derive atmospheric parameters like water vapor. Especially, retrieved Zenith Tropospheric Delay (ZTD) from GNSS signals is used for weather forecasting in numerical weather prediction models. Implementing this crucial knowledge on the PA techniques, a holistic approach is achieved. A simple case scenario would be to consult the farmer to avoid spraying pesticide if a rainfall is forecasted. Otherwise the loss would be double: economic for the farmer and environmental for the neighboring water resources by the pesticide washed out. Another example would be suggesting the farmer to irrigate in order to avoid water stress caused to the crop by a heat wave coming.

In other words, the system is able of providing field owners with farming guidelines and advices, based on the weather conditions principally forecasted using ZTD observations.

The future research is going to study how reflected GPS signal caused by multipath effect can be used for localized sensing of vegetation growth and soil moisture. The results will be used additionally to the remote sensing satellite images for the best outcome estimation. The

two data sources will also be compared and contrasted pointing out the strength points of each method.

MIR: the Microwave Interferometric Reflectometer, a new airborne GNSS-R instrument

Onrubia, Raul, Universitat Politècnica de Catalunya, Spain

Abstract:

Using GNSS signals as opportunity signals allows us to retrieve some environmental parameters, such as soil moisture, ice layer characterization or significant wave height. For this purpose, the reflected signal is correlated with a clean replica of the code (classical technique) or with the direct signal (interferometric technique). This last technique allows using wider bandwidths than in the conventional technique, achieving better resolutions. Despite this, the signal to noise ratio is lower than in the conventional case, and received signals from other satellites may contribute negatively.

A new airborne reflectometer is being developed at UPC: Microwave Interferometric Reflectometer (MIR). This instrument uses two dual-band arrays tuned to L1 and L5 bands of GPS (equivalent to E1 and E5 bands of Galileo). Each array has 19 antennas placed in a hexagonal shape. Once received, the signals are amplified, phase-shifted and combined properly to steer the beam. The up-looking array receives the direct signal and points a specific satellite to reduce the contribution from the other satellites. The down-looking array gets the reflected signal and points different ground areas. Two beams per band and antenna are formed. Additionally, a calibration signal allows measuring the phase and amplitude unbalances of the components.

The device is designed to be placed on a plane. An Inertial Measurement Unit (IMU) will be used to estimate not only the direction of the aircraft, but also the yaw, pitch and roll components of the displacement. With this information and the measurements resulting from the calibration process, a central unit will compute the required phase-shifting of each antenna to point properly the targets.

The resulting signals will be sampled using a software-defined radio and will be processed in FPGAs, where conventional (in open codes) and interferometric techniques will be applied to both bands. The use of multiple frequency bands can be used to perform ionospheric corrections on conventional reflectometry and can be understood as MIMO system on interferometric reflectometry, increasing thus the measurements precision in both cases.

A NEAR REAL-TIME MONITORING OF ATMOSPHERIC COLUMN DYNAMICS IN THE EQUATORIAL REGION USING GLOBAL NAVIGATIONAL SATELLITE SYSTEM.

Opaluwa, Yusuf Drisu, University technology Malaysia, Malaysia

Abstract:

Atmospheric water vapour as the most variable component of the atmosphere plays a crucial role in Earth's energy and water cycles. Information on atmospheric water vapour is essential in predicting global climate changes and rainfall phenomena on meso- to local-scales. Due to its large variability both temporally and spatially, accurate measurement of atmospheric water vapour has been very challenging in meteorology. The development of Global Positioning System (GPS) meteorology as a modern meteorological observing system out of geodetic expedition has been well detailed in literature since the last two decades. A number of studies have shown that "GPS meteorology" offers detailed coverage and continuous observations regardless of weather conditions. However, bulk of these researches have been concentrated around the mid-latitude to near tropical region due to near absence of GPS infrastructure in the tropical region (especially, sub-Saharan Africa and South-east Asia) for a long time. Unfortunately, the region is noted for its peculiar climatic dynamics and uncertainty that has hitherto remain unclear with global circulation models. This research therefore aims at investigating the characterisation of atmospheric column dynamics in the equatorial region. This is with a view to developing an atmospheric water vapour monitoring system for operational applications. To this end, integration of the ground-based GPS and space-based GPS radio occultation data is proposed.

TLS and GNSS combine usage in Forest Inventories

Papalampros, Lampros, Homeotech, Greece

Abstract:

Contemporary technological achievements lead to the development of automated methods of capturing detailed and highly accurate information, about objects' dimensions and geometry, without direct contact.

One of these achievements is Terrestrial Laser Scanner (TLS) which can capture not only three dimensional (3D) geometry, but texture and colour and furthermore with great speed. This new technology has been used, with significant success, in architectural, engineering and industrial measurement applications.

TLS, though it was announced as a revolutionary measurement technique, has some respectable drawbacks based on the insufficient knowledge about TLS particularities, which often makes projects unable to complete or unprofitable.

Nevertheless, taking into account the rapid rate of technological evolution, TLS is a very promising technique with great potentials in many fields of science.

Aims:

Last decade many researches have taken place in the field of forestry, evaluating the potential usage of TLS in extracting forest parameters such as diameter at breast height (DBH), stem height and stem volume, with promising results and great difficulties also.

Main aim of my thesis is the evaluation of TLS application in forestry, focused on the Greek forests and an attempt for a proposal of a new approach in forest inventory by exploiting the advantages of a TLS.

The difficulties in measuring the tree height from 3D point clouds, especially into dense stands, led to further investigation of a pattern than will make possible the estimation of tree height with a precise and respectable manner. Towards that perspective, the potential usage of taper equations is arisen.

TLS and GNSS technology in forest inventories

In order to manage to describe with great detail and accuracy the inventory parameters of a forest, a TLS is not enough but GNSS applications are also necessary. The need of precise positioning is crucial for an accurate inventory, taking into account that biometric information is captured in plot level.

Comparison of GPS L1 and Galileo E1 signals for GNSS-R ocean altimetry

Pascual, Daniel, Universitat Politecnica de Cataluna-Barcelona Tech (UPC), Spain

Abstract :

The GNSS signals reflected (GNSS-R) over land or ocean can be used in remote sensing to obtain geophysical parameters such as soil moisture, ice thickness or sea state. The theoretical model which describes the GNSS-R reflections is based on classical radar equations. The received signal is not a “single ray” but the addition of multiples echoes arriving at different times (delayed after the specular reflection) with different Doppler frequencies (because of the relative motion between the transmitter and receiver and also the surface’s roughness). The scattering of the reflected signal depends on the surface parameters, hence they can be obtained after proper signal processing.

In GNSS positioning the function that best describes the performance of a GNSS signal, is its autocorrelation (ACF). This ACF, is in fact the “autocorrelation in the time domain”, and depends on the modulation of the signal. However, in GNSS-R, is necessary to study the behavior of the signal not only in the time domain but also in the Doppler domain. This information is given by the auto-ambiguity function (often referred as Woodward Ambiguity Function or WAF).

The WAF is the two-dimensional autocorrelation of the signal in the delay-Doppler domain, and matches the ACF when Doppler is zero. The ACF characteristics of the GPS and Galileo signals are well-known in the literature. However the WAFs are not so well studied, since they are not so significant in positioning. In the GNSS-R field, some assumptions are made which may only be valid for the GPS L1CA signal but not for the new Galileo ones.

Modeling the WAF and its behavior as function of the receiver bandwidth is of crucial importance since its shape impacts on the overall received signal. Proper study of the WAF will help in the coming years to develop models to retrieve geophysical parameters using the GNSS-R signals. The poster presented at GFG2 will show the obtained WAFs of the new GNSS signals.

Rice Field's Soil Dielectric Constant Retrieval Utilizing GNSS-R Technique

Pei, Yuekun, Politecnico di Torino, Italy

Abstract:

The importance of soil moisture as a desired input for several applications such as hydrology, climatology and agriculture has been well recognized. Soil moisture is a key component of the water cycle. It directly influences the amount of evaporation, infiltration, runoff, and the amount of water uptake by plants. Soil moisture creates energy fluxes between the land and the atmosphere that induce weather systems that can affect large populated areas. Moreover, the accurate monitoring of soil moisture serves as a factor in hydrological and vegetation monitoring and for better seasonal forecasting. However, it is often a lack parameter for numerous whether prediction models since the monitoring of large area surface water resources is generally impractical via in situ observations because of the large number of sites required and the high cost of monitoring equipment. GNSS Reflectometry is an emerging technique which allows monitoring Earth's surface parameters such as soil moisture by applying an ad hoc processing to GNSS signal received after reflection.

In the framework of the regional Italian project SMAT-F1, an experimental campaign using small aircraft flying an area above Vercelli (Piedmont, North Italy) was performed to remotely sense rice fields' soil moisture by applying GNSS-R technique.

The Remote sensing group of Politecnico di Torino adapted a fully software receiver developed by the NAVSAS group for receiving direct GPS signal as positioning purposes. A Radio Frequency Front-End acquires signals by means of a commercial Left Hand Circularly Polarized antenna. Raw signals are sampled and converted into digital values, that are further processed applying a fully software open loop approach.

Both direct and reflected GNSS signals were collected by this receiver mounted on an aircraft and flying over rice fields in the Vercelli area. The raw-sampled reflected GNSS signal was processed into Delay Doppler Maps (DDMs) and Delay Waveforms exploiting a fully open loop scheme, in order to evaluate Signal to Noise Ratios (SNRs) time series, without the necessity to wait for standard GNSS close loop acquisition and tracking. Even if only the value of the correlation peak was used to estimate SNR and to derive dielectric permittivity information, this new open-loop approach allowed us to evaluate the entire autocorrelation function, whose knowledge could be used in future for other GNSS-R applications. A retrieval process able to estimate dielectric constant of soil surface from evaluated SNR was applied. The ground surface was considered rather smooth and the non coherent power contribution coming from glistening zone (through rough surface scattering mechanisms) was neglected. During the flight, the signal reflected by a lake surface was also acquired in order to calibrate the bistatic radar constant, after having fixed the dielectric constant characterizing the reflection area to a reasonable value. After the calibration, more reliable dielectric constant values were obtained of the rice field over flight. A good coherence between the fields' flooding state and the retrieved dielectric constant was observed.

Global Navigation System in earthquake studies

Petkova, Petya, Sofia University, Bulgaria

Abstract:

I am 3th year student of Physics Faculty of Sofia University "St. Kliment Ohridski" (Bulgaria). I am specializing in geophysics with focus on seismology. My interest in GNSS is in monitoring earthquakes and crustal deformation. I wrote an article for Bulgarian popular journal „Priroda“ and an educational brochure about studying the crustal deformations using GNSS technologies. I would like to broaden my knowledge in the field of GNSS.

Modeling land coverage in tropical rainforest

Rosa, Isabel, Imperial College London, United Kingdom

Abstract:

My main motivation for applying to the Gfg2 Summer School taking place in Potsdam (Germany) is the outcome of my interest on land use and land cover change research, which is one of the largest drivers of biodiversity loss and carbon emissions globally. In particular, I am extremely interested in the important role that Earth observation and remote sensing techniques play in acquiring data to model our constantly changing planet.

During my Master degree in Forestry and Natural Resources Management I focused my researched on the emissions from forest fires in Portugal. Currently, during my PhD at Imperial College London, I have been modelling land cover change in tropical rainforests. Both my Master and PhD research was based on large spatial datasets that were derived from satellite imagery. These data provided me the opportunity to improve my knowledge on how much of our planet's future will depend on the interaction between Humans and Land.

In particular, using annual deforestation maps of the Brazilian Amazon I was able to analyse the proportion of deforestation associated with different-sized clearings and to investigate how deforestation patch sizes varied in recent years. Then, using a set of land cover maps of the same region I developed a spatially-explicit probabilistic model of land cover change. Once the model was developed (and tested against observed data) I used it to test for the influence of choosing a particular calibration year in the performance of the model. Finally, to demonstrate the applicability of the model outputs, I determined the amount of carbon lost due to deforestation in the three main tropical regions (Central Africa, Amazon and Southeast Asia) from 1950 through 2010.

However, because the input data that I used as input in the model was collected by others I missed out the important step (and knowledge) on how to actually acquire these datasets and transform them into data that can be used for several applications (e.g. land cover change models). Earth observation systems and remote sensing techniques, and in particular Global Navigation Satellite Systems, will continue to provide the best tools to monitor and model environmental data, as well as to validate model outputs. As such, I feel that improving my knowledge on these techniques would be extremely important to continue developing my research, in particular the land cover change model calibration and validation, and a very important skill to fill what I believe to be a gap in my CV.

Furthermore, learning from internationally renowned experts working in remote sensing and Earth observation techniques as well as interacting with other young researchers and PhD students like myself would be extremely beneficial for my research. In addition, I would acquire a broad perspective on the current state of the art of remote sensing and Earth observation techniques.

Community platforms for crisis management: integrating dynamics to enhance evacuation systems in case of flood

Rosales Sanchez, Cristina, Wageningen University, Netherlands

Abstract:

My MSc thesis topic will be focus on how crowdsourcing can help to reduce the risk in case of disasters. The research will be based on how to improve evacuation models in case of floods occurrence through gathering the geolocation of citizens in potentially risk areas.

The results of the project would help to develop a mobile smartphone application that informs users of actual or potential flooding in an area of interest.

The tool would gather information on:

- user's location,
- weather conditions and predictions,
- dynamic traffic flows,
- road conditions,
- arised plans,
- others...

Many of that information could be determined by GNSS. The result of the data processing will allow the application to offer different alternative solutions to users in order to get a safer situation.

The tool would help to make clearer decisions about whether or not to evacuate a flood risk area. Alerts could reach those at risk via mobile technology.

In this way, GNSS based technology can serve the needs to effectively manage disasters and provide early warnings.

ANALYSIS OF THE SIMULATED OCEAN REFLECTED GPS SIGNAL FOR WIND SPEED ESTIMATION

Schiavulli, Domenico, Ferdinando Nunziata, Giovanni Pugliano, Maurizio Migliaccio

Università degli Studi di Napoli Parthenope

Abstract:

GNSS (Global Navigation Satellite Systems), i.e. GPS, GLONASS, Beidou and Galileo, are worldwide, all-weather, satellite constellations operating at L-band, dedicated to navigation purposes. Recently, several studies have been conducted to exploit GNSS signals for remote sensing applications. In fact, GNSS signals reflected off surfaces, i.e. multipath usually filtered out for navigation, carries on information about the reflecting scene. Therefore, this signal can be used to infer geophysical information about the scattering surface. This applications is known as GNSS-Reflectometry (GNSS-R). In particular, my work is focused on the opportunity to exploit GNSS-R for sea surface wind speed estimation. From an electromagnetic (EM) viewpoint, a model to analyze the GNSS signal reflected off sea surface is needed. The reference EM model is the so called Zavorotny-Voronovich (Z-V). The assumption at the basis of Z-V model is that the signal reflected off the observed scene comes from different points within a portion of the sea surface called Glistening Zone (GZ). The reflected power contribution from each point is characterized by its own shift in time, due to the scatterer position, and in frequency, due to relative motion of the transmitter, receiver and observed scene, respectively. Hence, the received power can be mapped in a Delay-Doppler Map (DDM). However, for receiver altitude and velocity lower than satellite configuration, the most obvious and direct way to measure the sea state, i.e. sea roughness, using GNSS-R is to produce a 1-D delay waveform, considering a fixed center Doppler frequency. In this work, the 1-D delay map is simulated using the Z-V EM model and tested for different system configuration and for varying wind speeds. The 1-D delay maps are generated mimicking different scenario: the first two are relative to airborne scenario, i.e. 10 km and 1 km receiver altitude, while the third one is used when dealing with platform configuration, i.e. 500 m receiver altitude. Different elevation angles are considered, i.e. 30°, 45° and 60° in different wind conditions, i.e. speed ranging from 4 m/s to 28 m/s.

GNSS-R performances are tested against two approaches based both on the analysis of two parameters, i.e. the Waveform Area and the Tail Decay, that allow extracting information about wind speed by analyzing the behavior of the obtained waveforms.

The first approach is implemented by varying the receiver accuracy. However, a finer receiver accuracy translates in higher computational time costs. The latter is based on varying the threshold used to compute the descriptors. In this case, a discussion about the presence of the noise is accomplished. The obtained results show that GNSS-R can be successfully exploited for sea surface wind speed retrieval purpose.

Characteristics of Sudden Stratospheric Warming Events in GPS Radio Occultations

Lena Schoon, Torsten Schmidt, Katja Matthes, Henryk Dobslaw

Abstract:

The Global Positioning System Radio Occultations (GPS-RO) as observed from low-Earth orbiting satellites provide high resolution refractivity profiles of the atmosphere since about 2001. The advantages of this technique are high accuracy, high vertical resolution within the upper troposphere and lower stratosphere (UTLS) region, long-term stability, global coverage, and all-weather capability. With more than one decade of data available, GPS-RO is now able to contribute to the characterization of atmospheric circulation phenomena that go beyond long-term trends and the seasonal cycle.

The polar stratosphere of the northern hemisphere exhibits occasionally a phenomenon known as „sudden stratospheric warming“ or „major mid-winter warming“ (MMW). MMWs are short-term disturbances of the northern polar vortex, usually appearing in January or February. The temperature suddenly rises up to 50K, westerly zonal winds turn into Easterlies and the polar vortex breaks down completely for several days. Zonally averaged monthly temperature climatologies from GPS-RO as processed at GFZ Potsdam are used in this contribution to characterize the MMW event in 2002/2003, while potential teleconnection effects of the Quasi-Biennial Oscillation on the temperature distribution at polar latitudes are explicitly taken into account.

The development of Antarctic Bottom Water since the Oligocene and its role in the thermohaline circulation

Seitz, Marion, The Open University, Milton Keynes, England

Background: Antarctic Bottom Water (AABW) has an indirect effect on global climate. It is one of two deep water masses that are part of the Thermohaline Circulation (THC). Since the THC is driven by density changes, any changes in the density of AABW are likely to change the flow of the THC – and subsequently global environmental conditions – in some way.

AABW formation and characteristics are linked to the presence and formation of sea-ice around Antarctica. Recent climatic warming trends and associated major calving events at Antarctic ice shelves might therefore cause a reduction in the volume of AABW or a change of its chemical and physical features.

This bachelor thesis aims to outline any past trends of interplay between changes in AABW and the THC by drawing together information from a wide range of scientific papers. Any possible impact on the flow of the THC and subsequently global climate, that stems from a decreased volume of AABW or its altered chemical and physical properties, can so be identified. This could ultimately enable policy makers to develop adaptations to changing environmental conditions in time.

Objectives: The main objectives of the thesis are (1) to demonstrate how the properties of AABW have changed since its inception in the Oligocene up to the present day, (2) to show how the addition of a new deep water mass (i. e. AABW) has impacted on the flow of the THC and (3) to demonstrate the interconnectedness of AABW and THC.

Methods: The research incorporates data from oxygen and carbon isotopes and foraminiferid assemblages within marine cores from the Southern Ocean and South Indian Ocean. Changes to the THC over the same timescale, based on computer models, are summarised and the likely interactions between AABW and THC described. The focus is on three distinct time intervals: late Oligocene/early Miocene, Last Glacial Maximum and the Holocene.

Results: The thesis shows how any long-term trends seen in the chemical and physical properties of AABW reflect global climatic patterns. It describes the correlation between changing mean annual surface temperature (as long-term indicator of climate change) and particular properties of AABW, and to what extent this correlation has influenced the THC.

Conclusion: The thesis evaluates whether evidence for recent climatic change can be correlated with any recent changes in AABW and discusses whether the THC could alter simply due to a change in properties of AABW and what the possible implications for global climate would be.

Postscript: This bachelor thesis is far from completion. In fact I have only started working on it a few weeks ago, so that I am still in the process of collating relevant papers and data. If interested, please feel free to let me know and I will send you a copy of the thesis after its completion.

Assessment of morphological changes in coastal features using DGPS data. The case study of Albufeira artificial dune (Portugal)

Silva, Tiago, Centro de Geologia da Faculdade de Ciencias de Lisboa, Portugal

Abstract:

Coastal geomorphology studies the shape of coastal landforms, features and the processes that contribute to the dynamic of coastal areas. The main theme for the presented work are changes in coastline and coastal landforms measured over specified periods. In the past, assessment of these changes was achieved by comparison of topographical maps. Once coastal landforms are subject to fast morphological changes, topographic maps often do not represent ephemeral features which are important in the dynamics of some coastal areas. With the introduction of the GNSS systems, the acquisition of accurate topographical data has become much easier; and consequently facilitated the obtainment of accurate topographic data of singular features, with a better resolution. This lead to an improvement in the surveys for the study of the evolution of coastal landforms.

This study focus on the evolution of an artificial dune constructed in 1996 at the Albufeira lagoon sand barrier. The Albufeira lagoon is located in the Trafaria-Sesimbra littoral arch, in the western Portuguese coast, 24km south of Lisbon (Portuguese capital). The sand barrier separates the lagoon from the Atlantic and is annually breached by machinery to ensure water renewability. The creation of an artificial dune in the northern area of the barrier, aimed its strengthening for prevention of overwash episodes that are able to input marine sediments into the lagoon and promote siltation. The evolution of the morphology of this dune was part of the surveys that were conducted during 2010/2011 and 2013 in the barrier and in the ephemeral inlet opened in 2010. The topographic surveys were executed using a Differential Global Positioning System (DGPS – models Leica GPS900 and Leica Viva Net rover GS08) in Real Time Kinematic (RTK). The obtained data were filtered and only data with an error of less than 10cm were considered for the construction of a Digital Terrain Models (DTM) in GIS environment. The various DTM were then compared in order to establish considerations about the evolution of the dune.

Preliminary data points to a decrease in length of the Albufeira lagoon artificial dune of about 280m (60%). The reduction in the dune length is due to the erosion of its S section, promoted by the migration to the N (induced by SW waves) of the tidal-inlet formed when the barrier is breached. The comparison of the performed topographical surveys allowed also the observation that the planimetric limits of the dune northern section are almost coincident, although in 2010 the top and base of dune were installed at a higher height comparatively to a topographic survey executed by the Portuguese Water Institute in 2002, resulting mainly from the accumulation of sand in its frontal and apical surface. From the DTM computed it was calculated that the dune suffered a loss of 37200m³ of sand between 2002 and 2013, this is mainly due to the erosion of the S sector of the dune, despite the sand deposited in the front and apical zones of the dune in other sectors.

Sofia university Atmosphere Data Archive

Simeonov, Cvetan, Sofia University, Bulgaria

Abstract:

The Sofia University Atmospheric Data Archive (SUADA) is developed to facilitate the use of vertically Integrated Water Vapour (IWV) data for meteorologic and climatic studies in Bulgaria/Southeast Europe.

The SUADA database includes:

- Ground-based Global Navigation Satellite Systems (GNSS) observations from:
 - EUREF post-processed IWV (total 7 796 observations) for station Sofia (SOFI 04.2001-11.2004)
 - IGS reprocessed IWV (total 16 293 observations) for station Sofia (SOFI 1997-2012)
 - Zenith Total Delay data (total 11 473 034 observations) from 29 stations from Zenith-geo company network in Bulgaria (since 11.2011)
 - IWV (total 15 297 observations) from 8 stations from IGS network on the Balkan Peninsula (for 19-25 July 2007 heatwave)
- Radiosonde IWV data (total 6 376 observations) for station Sofia (1997-2012).

The first application of the SUADA data is a study of water vapour dynamics during the 2007 heat wave in Bulgaria. IWV was derived from 8 GNSS stations in Southeast Europe for 19-25 July 2007 heat wave period. At the Black sea coastal stations Constanta and Varna, the peak of IWV is registered at 15 UTC, which is 3 hours after the temperature peak. Similarly, IWV peak at 15 UTC is characteristic for the Mediterranean sea station Athens and Adriatic sea station Dubrovnik. The IWV peak at 15 UTC can be explained with the peak of the sea breeze circulation that brings humid air from the sea inland. In contrast, at the inland stations Bucharest and Craiova the peak of IWV is between 6-9 UTC. The differences in diurnal cycle of inland and coastal stations show the high sensitivity of GNSS derived water vapour for capturing the small-scale local atmospheric circulation.

Heavy Goods Vehicle Routing in conjunction with Space Technologies: Investigating the improvements to air quality through innovation in the health and transport sectors.

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Abstract:

As new industrial districts, quarries, construction sites and distribution centres arise throughout Leicestershire, the number of Heavy Good Vehicles (HGV's) is ever increasing. . HGV movement does impose some negative attributes despite its necessity in providing goods and services and its role in the economy. The involvement of Space Technologies and sensory equipment could balance the interaction between freight transports through urban areas while reducing the negative impacts on air quality and health.

The incorporation of downstream Earth Observation technologies into HGV routing will result in increased efficiency, a generalised reduction in transport times and most importantly reduction in harmful emissions on public health. Despite the large use of GPS systems in HGV's, such as SatNavs, they do not necessarily provide the user with the most appropriate routing; taking into consideration air quality and emissions through sensitive areas. An example for the necessity of this research was shown, in 2011, when the Leicester Urban agglomeration zone was assigned (DEFRA 2011) so that Nitrogen Dioxide concentrations could be monitored effectively and consequently reduced by appropriate means. Nitrogen Dioxide is dangerous to public health and was found to be abnormally high in concentration in routes with large amounts and buses and freight, exceeding the annual limit of $40\mu\text{gm}^{-3}$ at value of $66.5\mu\text{gm}^{-3}$ (DEFRA 2011). The use of Earth Observation satellite systems in conjunction with the findings allows the careful monitoring and the implication of systems reduce to emissions harmful to public health.

Leicester City Council is dedicated to reducing the emissions and hazards associated with a high density on HGV movement through the city. Frequent Freight Quality Partnership meetings organise and discuss these issues and decide on how to tackle them. The demonstration of Global Navigation Satellite Systems (GNSS) in our modern world and how they can be successfully incorporated to improve many sectors has caught the attention of council members. The aim of the research is to fully explore the applications of GNSS technologies and how current uses can be built upon to improve routing and subsequent air quality.

The principal outcome of this research is long lasting and relevant reports providing essential guidance on the integration and further direction of Space Technologies on HGV routing and the various benefits it can bring. Leicester City Council is committed to sustaining good health of its inhabitants with a hope this research can benefit other local authorities and their cities UK wide.

References

DEFRA, Department for Environment, Food and Rural Affairs (September 2011) 'Air Quality Plan for the achievement of EU air quality limit values for nitrogen dioxide (NO₂) in Leicester Urban Area (UK0011)'

Burnt Severity Calibration for an Integrated Post-Fire Damage Assessment

Tiaga, Soares Lapa Remelgado Ruben, Universidade de Lisboa, Italy

Abstract:

Although a long range of research has been performed on the scope of forest fire early warning and prevention, this remains as one of the major hazards in southern Europe being responsible by significant direct and indirect impacts every year.

In 2003, while the intense and continuous negative precipitation anomalies combined with high positive temperature anomalies contributed for the development of the ideal physical conditions for the outbreak of large fires. However, despite the significance of the experience dry conditions, the high positive precipitation anomalies registered during Winter and Spring became a crucial factor. The registered dry conditions originated a large and accelerated vegetation growth contributing for the development and accumulation of fuel. Additionally, despite the observed consequences of this extreme fire season, the lack of response capacity in terms of methodological and technical means limited a clear assessment of post fire impacts conditioning the rationing of resources for the recovery of the affected areas.

In order to anticipate these extreme fire events and to contribute to a better understanding of post fire damages to both natural and human communities a continuous and integrated monitoring of both meteorological and vegetation conditions is needed. In scope of this issue GNSS applications provide important additional information allowing for the calibration and homogenization of remote sensing data as well as for a consequent improvement of a continuous monitoring of post fire vegetation conditions. The potential applications of GNSS-Radio Oscillations (RO) and GNSS-Reflectance (R) for the evaluation of atmospheric (e.g. temperature, humidity) and ground conditions (e.g. soil moisture, surface roughness) provide an important input for remote sensing data calibration allowing for a better integration of surface and atmosphere induced noise in a clear assessment of surface reflective properties. While the integration of GNSS for the mapping of burned areas is generally accepted as a basic routine of post fire season activates, its potential applications in the retrieval of the mentioned information as well as its importance for an accurate and efficient calibration of Earth Observation data is often neglected limiting the development of an efficient management of the affected areas.

In this presentation current activities regarding the short assessment of post fire conditions as well as a the concept for potential activities in the scope of future long-term assessment campaigns during the year of 2013 will be presented. Following a ground level post-fire burnt severity assessment using a composite Burn Index (CBI) as a basis for the calibration of remote sensing based fire severity trough a delta Normalized Burn Ratio (dNBR), the above mentioned applications of GNSS solutions will be considered as potential methodologies in the scope of upcoming field campaigns. These activities will serve as a support for an integrated damage assessment taking into consideration impacts to both human and vegetated communities which will be evaluated trough parallel research activities.

Reliably intermittent renewable energy sources

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Abstract:

The European energy and climate change policy was adopted by the Council and the Parliament in 2008, with ultimate goal of reducing global emissions by at least 50% below 1990 levels by 2050. To reach this goal we will substantially increase the amount of energy used from renewable sources, tripling renewable energy use to 20% by 2020. A large part will have to come from large scale intermittent renewable energy sources (IRES) such as wind and solar. However, large scale integration of IRES into the "EU electricity system" gives problems with the reliability. (e.g. to deliver power when the wind is not blowing and the sun is not shining)

To solve this problem the following two solutions might help, making this system more flexible and better predictions of available energy.

Pumped-storage hydroelectricity plants make it possible to store large amounts of energy, stored energy needed to manage the balancing act between production and consumption. In a pumped-storage plant, pump turbines transfer water to a high storage reservoirs during over production. The stored water can later be used to generate electricity to cover low production of IRES or temporary peaks in demand. The monitoring of water levels, regional weather forecasts and soil moisture levels make it possible to predict the availability of water in the reservoir, and thus the availability of energy. Precise regional weather forecasts makes is possible to predict the amount of energy produced by IRES, and thus giving the possibility to plan the demand accordingly.

Application of GNSS for severe Weather events in Bulgaria: case study 2012

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Abstract :

One of the applications of the GNSS Meteorology is to study severe weather events. Development of this applications is one of the tasks of working group two of the COST Action ES1206 "Advanced Global Navigation Satellite Systems tropospheric products for monitoring severe weather events and climate (GNSS4SWEC)". This work is a contribution to the COST Action and targets the use of Integrated Water Vapour (IWV), derived with the GNSS Meteorology method, during severe weather events provoked by a heavy rainfall in Bulgaria. Two case studies were made for 2012. The first is on the 25 May 2012. Using two-dimensional maps of the IWV distribution the passage of a cold front can be timed. The IWV peak is between 06:00 UTC and 12:00 UTC before the passage of the cold front at 18:00 UTC. In the second case study on the 27 June 2012 a strong south - north gradient of the water vapour is observed on the Balkan Peninsula before the intrusion of cold and dry air. This case study also demonstrates the synergy between GNSS meteorology and the use of Meteosat products.