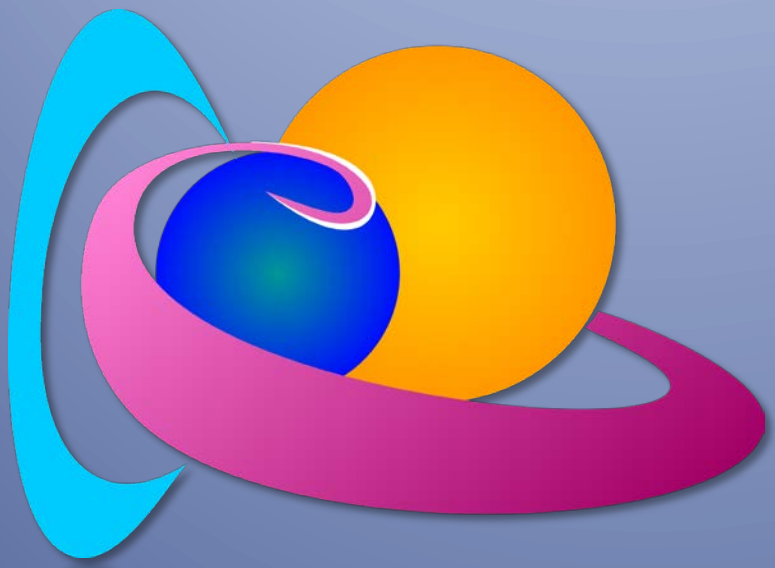

SOLAR-TERRESTRIAL CENTRE OF EXCELLENCE

STCE Workshop 2012 on "Water Vapour, Meteorology and Climate"

Scientific Program

Monday November 26, 2012 – Meridian Room at The Royal Observatory of Belgium

Presenters, Affiliations and E-mails

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Agenda

AGENDA OF THE WORKSHOP

Oral Presentations:

	09:15	*Icebreaker reception (Coffee/Tea)*	
	09:20	*Welcome*	*Eric Pottiaux*
T01	09:30	*Water Isotopologues Measurements From IASI/METOP to Investigate Humidity Processes*	Jean-Lionel Lacour
T02	09:50	*Stratospheric Analysis of Water Vapor Made at BIRA-IASB*	Quentin Errera
T03	10:10	*The Integrated Water Vapour project at Space Pole: inter-technique comparisons and time series analysis*	R. Van Malderen
T04	10:30	*Wrap-up of the new (proposed) COST Action "Advanced GNSS Tropospheric Products for the Monitoring of Severe Weather Events and Climate (GNSS4SWEC)"*	Eric Pottiaux
	10:50	*Pause (10 min)*	
T05	11:00	*The ROB contribution to GNSS data assimilation in Numerical Weather Prediction and Nowcasting*	Eric Pottiaux
T06	11:20	*News on the Belgian weather radar network*	Laurent Delobbe
T07	11:40	*The nowcasting system INCA-BE at the Royal Meteorological Institute: overview and current status*	Maarten Reyniers
	12:00	*Lunch time (40 min)*	
T08	12:40	*Evaluating the impact of more accurate water vapour measurements at high resolution on the meteorological analysis and forecasts in particular for (very) short ranges): discussion and perspectives at the RMIB*	Jean Nemeghaire
T09	13:00	*Regional Climate modelling at the RMI*	Rafiq Hamdi
T10	13:20	*Wrap-up of the BelAtmos project*	Alexander Mangold
T11	13:40	*Atmospheric water vapor and precipitation in Europe, Africa and Antarctica: Recent activities of the Regional Climate Modeling Research Group of K. U. Leuven*	Nicole Van Lipzig
T12	13:50	*The Role of Atmospheric Rivers in Accumulation in Dronning Maud Land, East Antarctica*	Irina Gorodetskaya
	14:00	*Open discussion panel*	

Poster Presentation:

Posters will be hang out for the whole workshop day

P01	*New Hourly-updated GNSS Tropospheric Products provided by ROB for Enhanced Support to GNSS-Meteorology and E-GVAP Members*	Eric Pottiaux
P02	*Towards Sub-Hourly GNSS Data Processing in Support of High-Resolution Rapid-Update NWP and Nowcasting Applications*	Eric Pottiaux
P03	*A Web Portal to GNSS-meteorology and Nowcasting Activities at ROB*	Eric Pottiaux
P04	*Advanced GNSS Tropospheric Products for the Monitoring of Severe Weather Events and Climate (GNSS4SWEC)*	J. Jones et al.
P05	*Evaluating the potential of ground-based instruments to validate the quality of integrated water vapour data measured by satellite-based observing techniques*	R. van Malderen et al.
P06	*3D field of water vapour density from GNSS tomography*	H. Brenot et al.
P07	*BelAtmos – Monitoring atmospheric composition*	Alexander Mangold

Abstract Book

Oral and Poster Presentations

ORAL PRESENTATIONS

T01 *Water Isotopologues Measurements From IASI/METOP to Investigate Humidity Processes*

09.30 Jean-Lionel Lacour *Université Libre de Bruxelles*

Measurements of the isotopologues ratios of water vapour (δD) in the atmosphere give information on exchange processes, which are helpful for constraining the atmospheric water budget and for identifying and quantifying the associated processes of the hydrological cycle. In this perspective the demonstrated capabilities of the Infrared Atmospheric Sounding Interferometer (IASI on METOP) instrument to measure water vapour isotopologues at any place twice a day, with relatively high spatial resolution and in a unique long term perspective (total period of 15 years) are of great interest for climate research.

Retrieving isotopologues ratios at the required accuracy is a challenging task. Using the optimal estimation method, a constraint is here applied using an a priori probability density function containing correlation information between HDO and H2O. We present retrievals of δD from IASI radiance measurements. We show that these are mainly sensitive to δD in the troposphere between 3 and 6 km. Spatial and temporal distributions of δD in selected regions are used to evaluate and to exploit our retrievals. In particular we present times series at both a subsidence site (Izana) and a convective site (Darwin). Monthly variations of δD latitudinal gradient will also be shown. Comparisons of our results with isotopologue-enabled Global Circulation Model (LMDz) will also be presented.

T02 *Stratospheric Analyses of Water Vapor Made at BIRA-IASB*

09:50 Quentin Errera and Simon Chabrillat *Belgium Institute for Space Aeronomy*

This presentation will summarize the modeling/assimilation activities related to the stratospheric water vapor achieved or planned at BIRA-IASB.

A first activity is based on the analyses calculated by the Belgian Assimilation System for Chemical Observations system (BASCOE) developed at BIRA-IASB. This is a 4D-Var system based on a 3 dimensional chemical transport model (3D-CTM) that considers 57 stratospheric species advected by the Flux-Form Semi-Lagrangian scheme (Lin and Rood, 1996, MWR), 200 chemical reactions and a parameterization of the physico-chemical processes due to the so-called Polar Stratospheric Clouds (PSCs). Wind and temperature fields are provided by ECMWF. The system has successfully assimilated stratospheric water vapor observations of UARS/MLS (1991-1993), MIPAS (2002-2004) and Aura/MLS (several periods between 2004 and 2010). A reanalyses of Aura/MLS (2004-20012) is planned for the 2013. Finally, the BASCOE system is producing near real time assimilation of MLS chemical observations (including the water vapor) in the context of GMES. In this presentation, this system and its analyses will be presented.

The second activity is based on the modeling of water vapor and ice PSC particles. The model consider the model as the one uses by BASCOE except that the PSC parameterization is replaced by a microphysical scheme that calculates the formation and evolution of the PSCs as well as the feedback of the PSC's microphysics on the gas phase species. This model will be presented as some results for the southern hemisphere winter 2007.

T03 *The Integrated Water Vapour project at Space Pole: inter-technique comparison and time series analysis*

10:10 R. Van Malderen (1,5), E. Pottiaux (2,5), H. Brenot (3), S. Beirle (4), C. Hermans (3) , M. De Mazière (3,5), T. Wagner (4), H. De Backer (1,5) and C. Bruyninx (2,5)

(1) Royal Meteorological Institute of Belgium, Brussels, Belgium
(2) Royal Observatory of Belgium, Brussels, Belgium
(3) Belgian Institute for Space Aeronomy, Brussels, Belgium
(4) Max Planck Institute for Chemistry (MPI-C), Mainz, Germany
(5) Solar-Terrestrial Centre of Excellence, Brussels, Belgium

Being the most abundant greenhouse gas in the Earth's atmosphere, water vapour plays a dominant role in the climate change debate. However, observing water vapour for climatological timescales in a consistent and homogeneous manner is challenging. To this end, water vapour estimations derived from reprocessing campaigns of continuously-operating ground-based Global Navigation Satellite Systems (GNSS) observations are very promising, providing climate researchers access to a world-wide dataset of continuous GPS-based Integrated Water Vapour (IWV) estimations spanning over the last 15+ years. In addition, the AErosol RObotic NETwork (AERONET) also produces such long-term and continuous ground-based observations of the IWV (i.e. the total water vapour content above the observation site) performed with standardized and well-calibrated

sun photometers. Besides those ground-based devices, also in-situ measurements (radiosondes) and satellite-based instruments (GOME/SCIAMACHY/GOME2 and AIRS) are able to capture the total column water vapour content at the balloon launch sites and globally, respectively.

The present study aims (1) to evaluate the quality and the consistency between the different techniques investigated and (2) to assess the applicability of the datasets for water vapour time series analysis and climate trend detection. Therefore, we compare the IWV measurements from these different techniques, focusing on a selection of almost 30 sites worldwide, and we investigate the geographical dependency of the properties of the resulting IWV scatter plots.

Finally, we show the first results of the analysis on the impact of the different data processing strategies (from raw data to IWV) for the GPS technique on the resulting water vapour trends.

T04 *Wrap-up of the new (proposed) COST Action "Advanced GNSS Tropospheric Products for the Monitoring of Severe Weather Events and Climate (GNSS4SWEC)"*

10:30 Jonathan Jones (1), Eric Pottiaux (2, 11), Guergana Guerova (3) Jan Dousa (4), Galina Dick (5), Olivier Bock (6), Rosa Pacione (7), Gunnar Elgered (8), Henrik Vedel (9) and Siebren de Haan (10)

(1) Met Office, (2) Royal Observatory of Belgium, (3) Sofia University, (4) Geodetic Observatory Pecny, (5) GFZ German Research Institute for Geosciences, (6) Institute Geographique National, (7) e-geos S.p.A. ASI/Centro di Geodesia Spaziale, (8) Chalmers Institute of Technology, (9) Danish Meteorological Institute, (10) Netherlands Meteorological Institute and (11) Solar-Terrestrial Centre of Excellence

Global Navigation Satellite Systems (GNSS) have revolutionised positioning, navigation and timing (PNT), becoming a common part of our everyday life. Aside from PNT applications, GNSS have proved to be an accurate sensor of atmospheric water vapour, the most abundant greenhouse gas, accounting for 60-70% of global warming, and of obvious importance in weather forecasting. Atmospheric humidity is one of the most variable and important parameters for forecasting extreme weather events and monitoring climate change, but is under sampled in current operational meteorological and climate observing systems.

The proposed EU COST Action (http://www.cost.eu) will address new and improved capabilities from concurrent developments in both GNSS and atmospheric communities to improve (short-range) weather forecasts and climate projections. For the first time, the synergy of the three GNSS systems, GPS, GLONASS and Galileo, will be used to develop new, advanced tropospheric products, stimulating the full potential exploitation of multi-GNSS water vapour estimates on a wide range of temporal and spatial scales, from real-time monitoring and forecasting of severe weather to climate research. The Action will also stimulate knowledge transfer and data sharing throughout Europe, particularly from West to East, and will promote the use of atmospheric data in satellite-based navigation services..

T05 *The ROB contribution to GNSS data assimilation in Numerical Weather Prediction and Nowcasting*

11:00 Eric Pottiaux (1,2) and Carine Bruyninx (1,2)

(1) Royal Observatory of Belgium
(2) Solar-Terrestrial Centre of Excellence

For more than a decade, the Royal Observatory of Belgium (ROB) has supported ground-based Global Navigation Satellite System (GNSS) meteorology, participating in European projects such as COST-716, TOUGH and the EUMETNET EIG GNSS Water Vapour Program (E-GVAP). To this aim, ROB contributes by developing and maintaining an operational Analysis Centre (AC) providing meteorologists with Zenith Tropospheric path Delays (ZTD) from a European network of GNSS stations using the Bernese GPS Software V5.0. In this presentation, we present the status of recent Research and Developments (R&D) and services at ROB to enhance its support to Numerical Weather Prediction (NWP) and to prepare support to the nowcasting and forecasting of severe weather activities that emerge within E-GVAP and a proposed EU COST Action "Advanced Global Navigation Satellite Systems tropospheric products for monitoring Severe Weather Events and Climate" (GNSS4SWEC, see related presentation T04).

T06 ***News on the Belgian weather radar network***

11:20 Laurent Delobbe *Royal Meteorological Institute of Belgium*

A new weather radar has been recently installed by RMI in Jabbeke. This radar will complement the observations provided by the Wideumont radar (RMI) and the Zaventem radar (Belgocontrol). The new radar is equipped with the dual-polarization capability which means that measurements are collected in both horizontal and vertical polarizations. In this presentation we will present the Belgian radar network and we will shortly describe the expected benefit of dual-pol measurements for hydrometeor classification and quantitative precipitation estimates. An overview of current weather radar applications will be given as well.

T07 ***The nowcasting system INCA-BE at the Royal Meteorological Institute: overview and current status***

11:40 Maarten Reyniers *Royal Meteorological Institute of Belgium*

In 2010, the radar group of the RMI started the implementation of a dedicated nowcasting system: INCA-BE (Integrated Nowcasting through Comprehensive Analysis). INCA-BE is a system for the analysis and nowcasts of not only precipitation, but also other meteorological fields, like temperature, humidity, wind, cloudiness, precipitation and precipitation type, and some derived fields. It operates at a horizontal resolution of 1km, and on an hourly basis (10 min for the precipitation and cloudiness fields). The precipitation module combines in real time radar observations with gauge measurements and NWP output, and produces a nowcast for the next four hours. A few case studies will be presented give a first impression of the performance of the system.

T08 ***Evaluating the impact of more accurate water vapour measurements at high resolution on the meteorological analysis and forecasts in particular for (very) short ranges: discussion and perspectives at the RMIB***

12:40 Jean Nemeghaire *Royal Meteorological Institute of Belgium*

In my presentation I will try to identify meteorological situations or systems where the implementation of more accurate water vapour measurements at high resolution is required.

Discussions and perspectives will be developed for different scales of meteorological analysis and forecasts ; in particular for the convective phenomena - the cyclogenesis and frontal waves - the low level humidity fields and their impact on the cloudiness (low level clouds and fog) and on the nocturnal cooling (amplitude of the diurnal variation of the surface temperature - risk of frost).

T09 ***Regional climate modeling at the RMI***

13:00 Rafiq Hamdi *Royal Meteorological Institute of Belgium*

This talk present an overview of the regional climate modelling (RCM) system used at the RMI. This new RCM is composed by a new version of the atmospheric model ALADIN, with the finest grid size of 4 km and sophisticated cloud and precipitation parameterisation, and a new land surface scheme SURFEX. This system will provide a downscaling of IPCC climate scenarios at 4km over Belgium to be used for climate change impact studies: urban climate, forest ecosystem, air quality, and evolution of the extremes. First, an evaluation of the system for present climate conditions is given and, as a first application, a study about the evolution of the Brussels's Urban Heat Island under an A1B emission scenario is presented.

T10 *Wrap-up of the BelAtmos project*

13:20 Alexander Mangold *(1) Royal Meteorological Institute of Belgium*

Placé sous l'égide de l'Institut Royal Météorologique de Belgique et bénéficiant de la collaboration de chercheurs de l'Institut d'Aéronomie Spatiale et de l'Université de Gand, le projet belge BELATMOS a pour but de contrôler les concentrations atmosphériques d'ozone et de gaz présents à l'état de trace, ainsi que les radiations UV et les particules d'aérosol en Antarctique dans le cadre de recherches climatiques.

Très peu de mesures de ce type ont été effectuées jusqu'à présent en Antarctique, en particulier à l'intérieur des terres où la composition peut différer des régions côtières. Il est capital d'évaluer les concentrations et de mesurer tout changement, afin de pouvoir mieux comprendre comment les aérosols atmosphériques et les gaz à effet de serre sont transportés sur de longues distances jusqu'en Antarctique.

Durant l'expédition BELARE 2008-2009, un chercheur de l'IRM a mis en place les deux premiers sur une total de dix autour de la Station Princesse Elisabeth. Ces instruments ont été conçus pour fonctionner, à terme, de manière autonome et pour relever des données en continu toute l'année.

BELATMOS is een Belgisch onderzoeksprogramma van het Koninklijk Meteorologisch Instituut van België, in samenvatting met de onderzoekers van het Belgisch Instituut voor Ruimteaëronomie en de Universiteit Gent, dat tot doel heeft waarnemingen te verrichten in verband met de ozonlaag en verwante sporenrengassen, UV-straling en aerosoldeeltjes in de atmosfeer van Antarctica, ter ondersteuning van het klimaatonderzoek.

Tot nu toe werden er erg weinig metingen van dit type verricht op Antarctica, vooral in het binnenland, waar de samentelling van de atmosfeer anders kan zijn dan aan de kust. De evaluatie van de concentraties en de wijzigingen is belangrijk om beter te begrijpen hoe aerosoldeeltjes en sporengassen zich over lange afstanden naar Antarctica verplaatsen.

Tijdens de BELARE 2008-2009-expeditie installeerde een onderzoeker van het KMI de twee eerste van tien instrumenten rond het Princess Elisabeth Station. Beide instrumenten werden ontworpen om autonoom te kunnen werken en het hele jaar onafgebroken gegevens te verzamelen.

T11 *Atmospheric water vapor and precipitation in Europe, Africa and Antarctica: Recent activities of the Regional Climate Modeling Research Group of K. U. Leuven*

13:30 N. Van Lipzig, E. Brisson, I. Gorodetskaya, K. Van Tricht, M. Demuzzere, W. Thiery, T. Akkermans, T. Böhme, S. Saeed, S. Van den Broucke, F. Chatterjee *Catholic University of Leuven*

(No abstract provided).

T12 *The Role of Atmospheric Rivers in Accumulation in Dronning Maud Land, East Antarctica*

13:30 I. V. Gorodetskaya (1), N. P. M. van Lipzig (1), F. M. Ralph (2), G. A. Wick (2), M. Tsukernik (3), A. W. Delcloo (4), A. Mangold (4) and W.D. Neff (2)

(1) Catholic University of Leuven
(2) National Oceanic and Atmospheric Administration
(3) Brown University
(4) Royal Meteorological Institute of Belgium

Presented by K. Van Tricht (1)

The poleward moisture transport in midlatitude regions is largely accomplished by the filamentary features of narrow enhanced water vapor bands, the so-called "atmospheric rivers" (Zhu and Newell 1998). The importance of atmospheric rivers for the coastal precipitation in middle latitudes is tremendous (e.g., California and South American Andes). This work investigates for the first time the role of atmospheric rivers in the Antarctic accumulation. The atmospheric rivers reaching the Antarctic ice sheet were detected using a modified method initially developed for midlatitudes. Integrated water vapor threshold established for middle latitudes was lowered from 2 cm to 0.5 cm at 70ºS following the decrease in the tropospheric moisture holding capacity due to the tropospheric air temperature drop in the polar latitudes. We identified 18 atmospheric river events during 2009 in the 0-80ºE sector of the East Antarctica including the region of our interest Dronning Maud Land. Using the accumulation data from the automatic weather station installed at Princess Elisabeth station located in Dronning Maud Land at the ascent to the East Antarctic plateau (72ºS, 23ºE, 1420 m asl), we found that these atmospheric river events were responsible for 40% (92 mm w.e.) of the annual total accumulation at PE during 2009. Year 2009 has been

characterized by unusually high accumulation at PE site (Gorodetskaya et al. 2012). The large contribution of atmospheric rivers to accumulation within this sector means that the difference in the total yearly accumulation can be caused by the fact that just a few large storms and associated with them atmospheric rivers arrive or fail to arrive in Antarctica. The five-day backward trajectory analysis demonstrated the tropical origins of one of the atmospheric river cases reaching the Antarctic coast. This links Antarctic accumulation to tropical latitude moisture availability and dynamics..

POSTER PRESENTATIONS

P01 *New Hourly-updated GNSS Tropospheric Products provided by ROB for Enhanced Support to GNSS-Meteorology and E-GVAP Members*

Eric Pottiaux (1,2) and Carine Bruyninx (1,2)

(1) Royal Observatory of Belgium
(2) Solar-Terrestrial Centre of Excellence

For more than a decade, the Royal Observatory of Belgium (ROB) has supported ground-based Global Navigation Satellite System (GNSS) meteorology, participating in European projects such as COST-716, TOUGH and the EUMETNET EIG GNSS Water Vapour Program (E-GVAP). To this aim, ROB contributes by developing and maintaining an operational Analysis Centre (AC) providing meteorologists with hourly-updated Zenith Tropospheric path Delays (ZTD) from a European network of GNSS stations using the Bernese GPS Software V5.0. This poster presents the status of the new hourly-updated GNSS tropospheric products provided by ROB for enhanced support to GNSS-Meteorology and E-GVAP members.

P02 *Towards Sub-Hourly GNSS Data Processing in Support of High-Resolution Rapid-Update NWP and Nowcasting Applications*

Eric Pottiaux (1,2) and Carine Bruyninx (1,2)

(1) Royal Observatory of Belgium
(2) Solar-Terrestrial Centre of Excellence

Atmospheric humidity is one of the most variable and important parameters for forecasting extreme weather events but is still under sampled in current operational meteorological systems. New and improved capabilities from recent developments in atmospheric communities to improve (short-range) weather forecasts imposes new requirements on tropospheric products delivered by the GNSS community. Therefore, ROB started to develop and maintain a new operational Analysis Centre (AC) to support high-resolution rapid-update Numerical Weather Prediction (NWP) and nowcasting applications in Europe (with a focus on the Benelux). This new AC aims to provide new, advanced sub-hourly-updated tropospheric products based on the processing of real-time GNSS observations from a European network of GNSS stations, with a densification in Belgium, the Netherlands and U.K. This poster presents the status of recent Research and Developments (R&D) and services at ROB aiming to support to the nowcasting and forecasting of severe weather activities that emerge within E-GVAP and a proposed EU COST Action “Advanced Global Navigation Satellite Systems tropospheric products for monitoring Severe Weather Events and Climate” (GNSS4SWEC, see related Poster).

P03 *A Web Portal to GNSS-meteorology and Nowcasting Activities and Services at ROB*

Eric Pottiaux (1,2) and Carine Bruyninx (1,2)

(1) Royal Observatory of Belgium
(2) Solar-Terrestrial Centre of Excellence

Along the past years, the number of GNSS stations included in the ROB operational analysis for GNSS-meteorology has more than doubled. Also, along with the evolution of the GNSS-meteorology requirements, the number of Analysis Centres (ACs) operated by ROB and the number of tropospheric products provided by ROB has also increased. These evolutions, as well as the expected new ones in the upcoming years, imposes to develop a complete set of tools (1) to provide clear information to the public and scientific communities on the tropospheric products provided by ROB, (2) to enable a continuous monitoring of such operational ACs, (3) to enable a continuous validation and (4) to provide access to specific tropospheric products provided by ROB. A few years ago, this evolution droved ROB to start developing a web portal dedicated to its activities in the framework of GNSS-meteorology and nowcasting and aiming those goals. This poster presents the current status of the web portal.

P04 *Advanced GNSS Tropospheric Products for the Monitoring of Severe Weather Events and Climate (GNSS4SWEC)*

Jonathan Jones (1), Eric Pottiaux (2,11), Guergana Guerova (3) Jan Dousa (4), Galina Dick (5), Olivier Bock (6), Rosa Pacione (7), Gunnar Elgered (8), Henrik Vedel (9) and Siebren de Haan (10)

(1) Met Office, (2) Royal Observatory of Belgium, (3) Sofia University, (4) Geodetic Observatory Pecny, (5) GFZ German Research Institute for Geosciences, (6) Institute Geographique National, (7) e-geos S.p.A. ASI/Centro di Geodesia Spaziale, (8) Chalmers Institute of Technology, (9) Danish Meteorological Institute, (10) Netherlands Meteorological Institute and (11) Solar-Terrestrial Centre of Excellence

Global Navigation Satellite Systems (GNSS) have revolutionised positioning, navigation and timing (PNT), becoming a common part of our everyday life. Aside from PNT applications, GNSS have proved to be an accurate sensor of atmospheric water vapour, the most abundant greenhouse gas, accounting for 60-70% of global warming, and of obvious importance in weather forecasting. Atmospheric humidity is one of the most variable and important parameters for forecasting extreme weather events and monitoring climate change, but is under sampled in current operational meteorological and climate observing systems.

The proposed EU COST Action (http://www.cost.eu) will address new and improved capabilities from concurrent developments in both GNSS and atmospheric communities to improve (short-range) weather forecasts and climate projections. For the first time, the synergy of the three GNSS systems, GPS, GLONASS and Galileo, will be used to develop new, advanced tropospheric products, stimulating the full potential exploitation of multi-GNSS water vapour estimates on a wide range of temporal and spatial scales, from real-time monitoring and forecasting of severe weather to climate research. The Action will also stimulate knowledge transfer and data sharing throughout Europe, particularly from West to East, and will promote the use of atmospheric data in satellite-based navigation services.

P05 *Wrap-up of our STCE presentation at GEWEX 2012: "Evaluating the potential of ground-based instruments to validate the quality of integrated water vapour data measured by satellite-based observing techniques".*

R. Van Malderen (1,5), E. Pottiaux (2,5), H. Brenot (3), S. Beirle (4), K. Mies (4), C. Hermans (3), M. De Mazière (3,5), T. Wagner (4), H. De Backer (1,5) and C. Bruyninx (2,5)

(1) Royal Meteorological Institute of Belgium, (2) Royal Observatory of Belgium, (3) Belgian Institute for Space Aeronomy, (4) Max Planck Institute for Chemistry (MPI-C), Mainz, Germany and (5) Solar-Terrestrial Centre of Excellence

The GlobVapour Project is developing multi-annual global water vapour data sets based on calibrated and inter-calibrated satellite radiances for long time series satellite observations. On the other hand, Integrated Water Vapour (IWV) estimations derived from ground-based Global Navigation Satellite System (GNSS) observation networks such as the International GNSS Service (IGS) network are also very promising, with continuous observations spanning over the last 15 years. Additionally, the AErosol RObotic NETwork (AERONET) also provides long-term and continuous ground-based observations of the IWV performed with standardized and well-calibrated sun photometers. Finally, radiosonde measurements offer long time series of IWV, but suffer from inhomogeneities due to changes in the used humidity sensors throughout time.

The aim of the present study is to set up an inter-technique comparison of IWV measurements from satellite devices (GOME/SCIAMACHY/GOME2) and the above mentioned ground-based and in-situ instruments. To this end, we selected 28 sites worldwide at which the GNSS observations were directly compared with simultaneous satellite IWV observations, together with sun photometer and/or radiosonde measurements, if available. In particular, we investigate the inter-technique biases, the influence of the presence of clouds on the IWV inter-technique comparison and the geographical dependency of the properties of the IWV scatter plots between all these different instruments.

P06 *3D field of water vapour density from GNSS tomography*

H. Brenot (1), C. Champollion (2), A. Deckmyn (3), R. van Malderen (3,5), N. Kumps (1), E. Goudenhoofdt(3), L. Delobbe(3), K. Stegen (4), and M. De Mazière (1,5)

(1) Belgian Institute for Space Aeronomy
(2) Geoscience Montpellier, France
(3) Royal Meteorological Institute of Belgium, Brussels, Belgium
(4) Royal Observatory of Belgium, Brussels, Belgium
(5) Solar-Terrestrial Centre of Excellence

The number of GNSS (GPS, GLONASS, Galileo) satellites and ground receivers will significantly increase in the next several years. From these observations a better monitoring of the troposphere is expected using tomographic imaging. For the moment the limitation of GNSS tomography is still due to a weak geometric representation. For this reason we present the importance exploiting horizontal gradients of delays to improve horizontal and vertical resolution of water vapour density retrieved by tomographic method. Our study will focus on GPS data from Belgian dense network (baselines from 5 to 30 km) and adjustments of tropospheric parameters (zenith delays, horizontal gradients, and slant integrated water vapour in direction of visible satellites) using GAMIT geodetic software. We have studied humidity 3D field comparisons between GNSS tomography, IASI satellite observations and ALARO model for different weather situations, and show the relevance of our tomographic retrievals for nowcasting.

P07 *BelAtmos – Monitoring atmospheric composition*

Alexander Mangold et al.

Royal Meteorological Institute of Belgium, Brussels, Belgium

Placé sous l'égide de l'Institut Royal Météorologique de Belgique et bénéficiant de la collaboration de chercheurs de l'Institut d'Aéronomie Spatiale et de l'Université de Gand, le projet belge BELATMOS a pour but de contrôler les concentrations atmosphériques d'ozone et de gaz présents à l'état de trace, ainsi que les radiations UV et les particules d'aérosol en Antarctique dans le cadre de recherches climatiques.

Très peu de mesures de ce type ont été effectuées jusqu'à présent en Antarctique, en particulier à l'intérieur des terres où la composition peut différer des régions côtières. Il est capital d'évaluer les concentrations et de mesurer tout changement, afin de pouvoir mieux comprendre comment les aérosols atmosphériques et les gaz à effet de serre sont transportés sur de longues distances jusqu'en Antarctique.

Durant l'expédition BELARE 2008-2009, un chercheur de l'IRM a mis en place les deux premiers sur une total de dix autour de la Station Princesse Elisabeth. Ces instruments ont été conçus pour fonctionner, à terme, de manière autonome et pour relever des données en continu toute l'année.

BELATMOS is een Belgisch onderzoeksprogramma van het Koninklijk Meteorologisch Instituut van België, in samenvatting met de onderzoekers van het Belgisch Instituut voor Ruimteaëronomie en de Universiteit Gent, dat tot doel heeft waarnemingen te verrichten in verband met de ozonlaag en verwante sporenrengassen, UV-straling en aerosoldeeltjes in de atmosfeer van Antarctica, ter ondersteuning van het klimaatonderzoek.

Tot nu toe werden er erg weinig metingen van dit type verricht op Antarctica, vooral in het binnenland, waar de samentelling van de atmosfeer anders kan zijn dan aan de kust. De evaluatie van de concentraties en de wijzigingen is belangrijk om beter te begrijpen hoe aerosoldeeltjes en sporengassen zich over lange afstanden naar Antarctica verplaatsen.

Tijdens de BELARE 2008-2009-expeditie installeerde een onderzoeker van het KMI de twee eerste van tien instrumenten rond het Princess Elisabeth Station. Beide instrumenten werden ontworpen om autonoom te kunnen werken en het hele jaar onafgebroken gegevens te verzamelen.

Practical Information

Practical Information/recommendations:

- The workshop will be held Monday 26th November 2012 in the Meridian room of the Royal Observatory of Belgium and will start at 09:30.
- The workshop is based on informal presentations focusing on present and future activities in the domain. Presenters are thus invited to present their work to provide the material needed for the open discussions and to stimulate collaborations.
- The expected time attributed to each talk is about 15 minutes, followed by 5 minutes of questions and discussions. More questions can be addressed during the open discussions.
- Time slots for presentations are indicative as they also depend on the questions and discussions after each talk.