# WG2 MEETING – POTSDAM – SEP 1, 2016, 9:00-11:30 AGENDA AND ABSTRACTS

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Sep 1, 2016

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# Tropical cyclone intensification, water vapor distribution and GNSS measurements

Rita Nogherotto, Jimmy Leclair de Bellevue, Riccardo Biondi, and Hugues Brenot

**Abstract**

Tropical cyclones represent the most important weather system involving La Reunion Island and an accurate prediction of their track and intensity is crucial to reduce the damages caused by their strong precipitation and winds. Cyclone Bejisa is a tropical cyclone that affected Reunion Island and Mauritius in the late December 2013 and early January 2014 with strong consequences both on the population and on energy supplies. Atmospheric water vapor is the main driver in the development of the cyclones and GNSS continuous observations of precipitable water (PW) constitute a relevant tools in studying its temporal and spatial distribution. Because of the high temporal resolution of their observations, they allow the resolution of high-frequency (e.g. diurnal) variations and they can be used to study, monitor and predict weather extreme events such as the tropical cyclones.

In this work we apply the GNSS technique to measure delays and variations of PW above stations due to the passage of the cyclone Bejisa. The local network is used to monitor the water vapor contents in direction of GNSS satellites (horizontal distribution) and its vertical distribution using tomography. In addition, the cloud top altitude can be retrieved using the Radio Occultation profile to find the relationship between cloud top altitude, storm intensity and IPWV variation.

# Investigating the effect of relative constraints on ZTD observation error correlation

Gemma Halloran and Eric Pottiaux

**Abstract**

The trend towards high resolution convective scale Numerical Weather Prediction (NWP) raises the question of the requirement for increasing density of observations, both in space and time. Zenith Total Delay (ZTD) observations derived from GNSS receivers have great potential to serve this requirement, with observation producers working towards real-time delivery of observations with good spatial and temporal coverage.

With the increasing NWP model resolution, we expect to resolve more of the detailed structure in the atmosphere, and therefore require observations which can give as much of this detail as possible. Due to the nature of ZTD processing, constraints are set on the estimated ZTDs, which result in temporal and spatial correlations within the ZTDs.

Using *a posteriori* diagnostics, the error correlations of ZTDs from three processing centres producing observations within the Met Office UK NWP model domain have been calculated. The effect of the relative constraints in the ZTD processing can be seen in both the temporal and spatial error correlation, and the diagnosed error covariance. This provides us with certain challenges for the use of ZTD observations in data assimilation, and we will discuss this here.

# Use of GNSS tropospheric products to study the foehn in Sofia for the 2004, 2008 and 2010

Krasimir Stoev [1,2], Martin Slavchev [1,2] and Guergana Guerova [1]

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(2) National Institute of Meteorology and Hydrology – BAS, Krasimir.Stoev@meteo.bg

**Abstract**

Foehn is a warm and dry wind that blows on the leeward side of the mountain. It is the well-known example of local atmospheric circulation, and also an extreme weather event. Forecasting extreme weather events is an important task for the short-term weather forecasts. The foehn in Bulgaria is observed on the northern slopes of the mountains, as a result of advection of warm air from the south and southwest. Its occurrence is highest in the north of Vitosha and north of the Balkan Mountains. The aim of the study is to use GNSS tropospheric products from the SOFI station to stady 21 days with foehn in 2004, 2008 and 2010. In our study the surface temperature changes are compared to the Integrated Water Vapour (IWV) variation before, during and after the foehn events.

# GNSS tomography and assimilation case studies using the COST benchmark dataset

Gregor Möller [1], Natalia Dymarska [2], Witold Rohm [2], Robert Weber [1]

1 Department of Geodesy and Geoinformation, TU Wien, Austria

2 Institute of Geodesy and Geoinformatics, Wroclaw University of Environmental and Life Sciences, Poland

**Abstract**

On finding an optimised tomography solution for nowcasting applications a subset of 72 GNSS stations in East Germany and parts of Czech Republic has been selected out of the COST benchmark dataset for the period June 2013.

The tropospheric parameters as provided by the Geodetic Observatory Pecný (GOP) were utilised together with the ALADIN-CZ data to compute slant wet delays and a priori wet refractivity fields for the tomography approach.

In a first step, the atmosphere above the test domain was divided into 0.5° x 0.5° x 1 km sized voxels up to 10 km altitude. The slant wet delays were processed to obtain improved wet refractivity fields with a temporal resolution of one hour. Further, the improved wet refractivity fields were assimilated like radio occultation data into the Weather Research and Forecasting model (WRF) to highlight its impact on the forecast field. In order to assess the quality of wet refractivity assimilation, the forecasted vertical profiles (wind speed, temperature and relative humidity) were compared to radiosonde observations.

Within this presentation, first the input dataset and the initial atmospheric conditions are introduced. Second, the tomography settings with respect to nowcasting and the improved wet refractivity fields are shown and compared to ALADIN-CZ data. Third, the settings of assimilation and preliminary results of the assimilation test cases are presented. Therewith we aim to set an initial point for further discussions and activities within the COST tomography benchmark activities.

# Understanding the role of the tropical moisture exports in extreme weather event of 7-8 January 2016 in Europe

Yuval Reuveni, Interdisciplinary Center, Herzliya , Israel

Simon O. Krichak, Tel Aviv University, Israel

Piia Post, University of Tartu, Institute of Physics, Estonia

Rigel Kivi, Finnish Meteorological Institute, Finland

Kalev Rannat, Hannes Keernik, Tallinn University of Technology, Estonia

**Abstract**

The year 2016 has begun on a stormy note across different parts of Europe. An extreme heavy snowfall event has taken place in the Baltic Sea area on January 8, 2016 with 73 cm of snow falling down in Merikarvia, Finland in 24 hrs. People living in northwestern parts of Spain have been put on flood alert during 07-08 January. Rainfall totals in in the area have been about 200 mm in a span of one week. Heavy rains have also affected eastern Scotland and north east England. A very heavy rainfall with 70-120 mm precipitation rate per 24 hrs has also characterized the eastern Mediterranean region during January 8. The series of extreme weather events in Europe may be linked to the formation of Hurricane Alex which was the first Atlantic hurricane in January since Alice in 1955 which originated as an extratropical cyclone near Cuba and Bahamas on January 6, 2016.

The hypothesis has been tested with the help of a series of simulations with the NCAR WRF atmospheric model using for verification detailed radar images and PW distribution data from GNSS data using over the Baltic Sea as well as eastern Mediterranean region. Results of the analysis demonstrate a notable contribution of the export of the tropical moist air masses in the formation of the extreme weather events in Europe.

# Assimilation of GNSS ZTD data from local dense GNSS networks in WRF model

Grzegorz Nykiel, Mariusz Figurski, Krzysztof Kroszczynski, Zofia Baldysz

**Abstract**

In Poland, currently exist four local GNSS reference networks - national ASG-EUPOS and three commercial: TPI NETpro, SmartNet and VRSNet.pl. In total, they consist more than 350 stations, which coordinates stability has been monitoring by Centre of Applied Geomatics at Military University of Technology (CAG MUT) since 2013. Stations coordinates and Zenith Tropospheric Delay (ZTD) are determined on the basis of daily solutions using Bernese 5.2 software. Since 2015, these data are being used in our studies related to the assimilation of GNSS ZTD in Weather Research Forecast (WFR) model. For selected period of time, which took place in the end of May 2014 and was characterized by heavy rain, assimilation of GNSS ZTD, was conducted. The aim of this study was to verify, how big influence on short weather forecast have GNSS ZTD data, which were assimilated next to the SYNOP and Upper Air data. The verification of conducted weather forecast was performed on the basis of meteorological measurements from the Polish meteo stations. Obtained results shows, that ZTD assimilation have positive impact on forecasted meteorological parameters, especially if assimilation is conducted in cycle mode.

# Combining multi-spectral satellite image data with GPS tropospheric path delays to produce regional Integrated Water Vapor (IWV) maps

Yuval Reuveni [1,2,3] and Anton Leontiev [4]

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2 Samaria and the Jordan Rift regional R&D Center, Ariel University, Ariel, Israel

3 Department of Mechanical Engineering & Mechatronics, Ariel University, Ariel, Israel

[4] *Department of Electrical Engineering, Ariel University, Ariel, Israel*

**Abstract**

Here, we present the use of Israel's geodetic GPS network for extracting tropospheric zenith path delays combined with near Real Time (RT) METEOSAT-10 Water Vapor (WV) and surface temperature pixel intensity values (7.3 and 12.1 µm channels, respectively) in order to obtain absolute IWV (kg/m2) or PWV (mm) distribution. The results show good agreement between the absolute values obtained from our triangulation strategy constructed from GPS Zenith Total Delays (ZTD) and METEOSAT-10 surface temperature data compared with available radiosonde Precipitable IWV/PWV absolute values. The presented strategy can provide unprecedented temporal and special IWV/PWV distribution, which is needed as part of the accurate and comprehensive initial conditions provided by upper-air observation systems at temporal and spatial resolutions consistent with the models assimilating them.