Onsala Space Observatory – IVS Analysis Center

Rüdiger Haas, Hans-Georg Scherneck, Tobias Nilsson

Abstract

We briefly summarize the activities of the IVS Analysis Center at the Onsala Space Observatory during 2008 and give examples of results of ongoing work.

1. Introduction

We concentrate on a number of research topics that are relevant for space geodesy and geosciences. These research topics are addressed in connection to data observed with geodetic VLBI and complementing techniques. Some topics are briefly presented in the following.

2. Analysis of the CONT08 Campaign

We started to analyze the VLBI databases of the CONT08 campaign. Unfortunately, only 5 of the 15 CONT08 experiments were correlated by the end of 2008. For one of these experiments the Onsala Mark 5 disk-module did not arrive at the Washington correlator in due time, so that the Onsala data have not been correlated yet and are not included in the corresponding VLBI database. Thus, only four CONT08 experiments with Onsala could be analyzed so far. In a first step we concentrated on the atmospheric path delays and compared the zenith wet delay (ZWD) results derived from the co-located techniques at Onsala, i.e. VLBI, GPS, and the microwave radiometers Astrid and Konrad, and radiosondes launched at the Landvetter airport, see Figure 1.

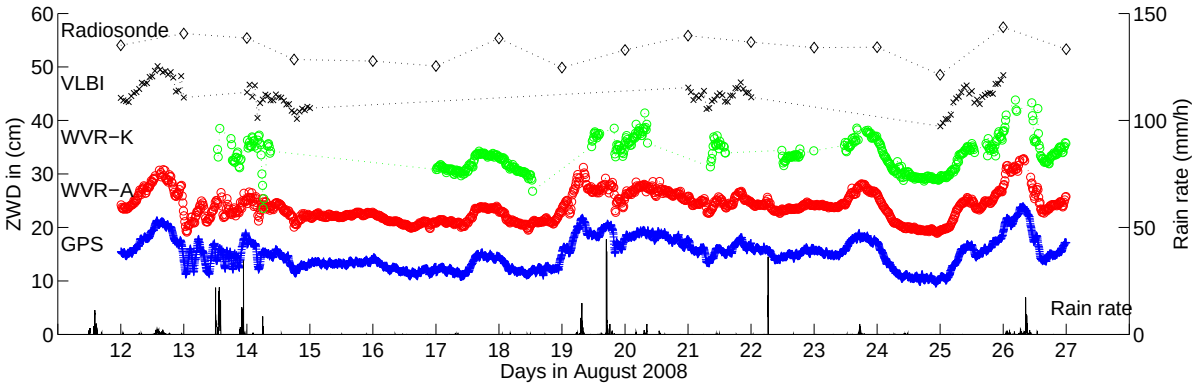

Figure 1. Time series of zenith wet delay (ZWD) and rain rate for Onsala during CONT08. Shown are ZWD results from GPS (blue plus signs), the microwave radiometers Astrid (WVR-A, red circles) and Konrad (WVR-K, green circles), VLBI (black crosses), and radiosonde observations at Landvetter airport (black diamonds). To improve readability, the results are shown with offsets of +10 to +40 cm with respect to the GPS results that are shown on the correct level. Rain rate observations are displayed in black at the bottom of the figure and refer to the right scale.

This preliminary analysis shows biases in the ZWD results of about −12 mm between the the microwave radiometer Astrid and GPS, −10 mm between VLBI and GPS, and +1 mm between VLBI and the microwave radiometer Astrid. The analysis will be continued and extended as soon as the still missing VLBI databases for CONT08 become available. Then we will also investigate high-frequency variations of the Earth rotation and orientation parameters.

3. Local Tie Measurements at Onsala

In September 2008 we performed measurements to determine the reference point of the 20 m radio telescope and the local tie between the reference points of the VLBI and GNSS monuments [1]. This project was performed in collaboration with the Institute for Geodesy and Geoinformation at the University of Karlsruhe, Germany. The measurements were done with a laser tracker and cat-eye reflectors that were mounted on the telescope cabin and reference markers in the local network. Figure 2 shows pictures taken during the measurement campaign. The data were analyzed with a new analysis approach [2], and the reference point of the telescope and the local tie were determined with complete covariance matrices. The results agree on the sub-millimeter level with the results of the previous local tie measurements performed in 2002 [3].

Figure 2. Left: the laser tracker mounted on a survey pillar inside the radome building of the 20 m telescope. Right: cat-eye reflectors mounted on the telescope cabin.

4. Local Tie Analysis for Yebes

In a collaboration with Susana Garcia Espada from the National Geographic Institute of Spain, we investigated the local tie between the VLBI and GNSS reference points at Yebes. For this purpose we reanalyzed the European VLBI databases and determined time series of the station position of the 14 m radio telescope at Yebes (Spain) with respect to ITRF2005. Additionally we analyzed for the same period of time the GPS data observed with the co-located IGS station at Yebes. For this analysis we used the Gipsy-Oasis-II software package and applied the precise point positioning strategy. After subtraction of a plate motion model we determined the baseline length between the IVS and IGS reference points at Yebes, see Fig. 3. The results appear to indicate a

local movement between these two reference points [4]. Further investigations are necessary.

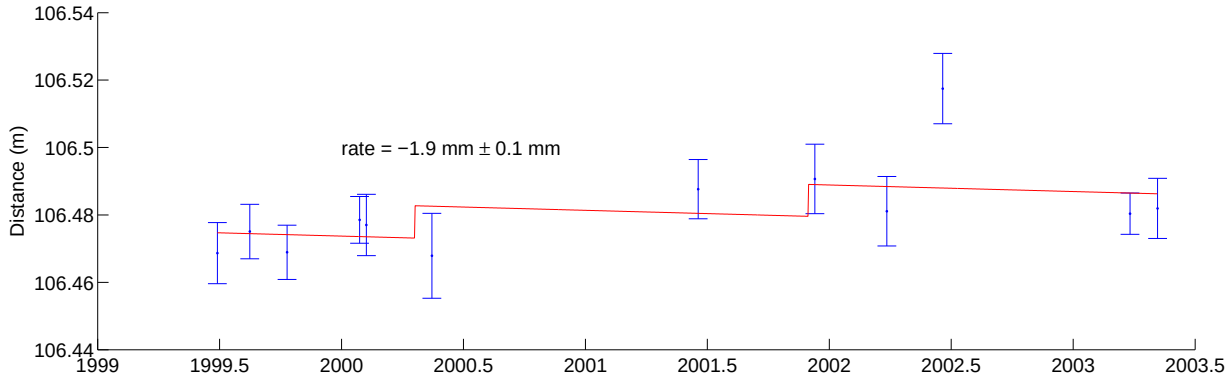

Figure 3. Time series of the relative distance between the VLBI and GPS reference points at Yebes.

5. Tropospheric Delays for VLBI2010 Simulations

During 2008 we continued to contribute with determination of equivalent zenith wet delays [5] to the simulations for the VLBI2010 project [6]. One of the most critical parameters for these simulations is the turbulence parameters C_n^2 and its temporal and spatial variation. The C_n^2 parameter can be derived, for example, from high-resolution radiosonde profiles. However, such data are only available for specific launch sites that in general do not coincide with existing or planned VLBI sites. Figure 4 shows mean and median profiles of the turbulence parameter C_n^2 for three sample radiosonde launch sites for the year 2005. In order to ensure realistic simulations of equivalent zenith wet delays, more work is needed to evaluate the reliability of these turbulence parameters and to develop models that allow them to be related to different epochs and locations.

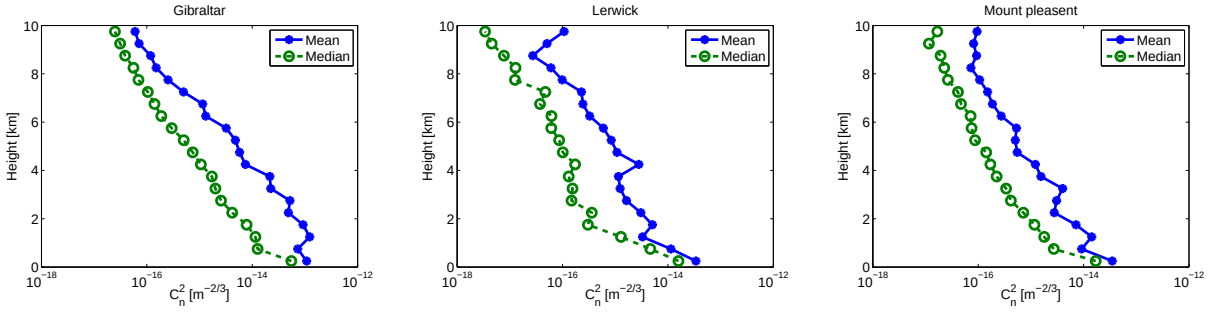

Figure 4. Mean and median profiles of the turbulence parameter C_n^2 for three sample radiosonde launch sites for the year 2005.

6. Ocean Tide Loading

The automatic ocean tide loading provider [7] was maintained during 2008 and extended by new ocean tide models. Now it is possible to use also the ocean models GOT4.7 [8], Andersen 2006 [9] and EOT08a [10].

7. Outlook

The IVS Analysis Center at the Onsala Space Observatory will continue its efforts to work on specific topics relevant to space geodesy and geosciences. For 2009 we plan to intensify the analysis of VLBI data and re-start our contribution to the IVS-TROP project.

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