The IVS Analysis Center at the Onsala Space Observatory

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Abstract

This report briefly summarizes the activities of the IVS Analysis Center at the Onsala Space Observatory during 2005. Some examples of achieved results and ongoing analyses are presented.

1. Introduction

The IVS Analysis Center at the Onsala Space Observatory focuses on a number of research topics that are relevant for space geodesy and geosciences. We address these research topics in connection to data observed with geodetic VLBI and complementing techniques. In the year 2005 the main focus was on thermal deformation of radio telescopes, loading phenomena, the European geodetic VLBI data, and sensing of atmospheric water vapor content with space geodetic and complementing techniques. Some results are briefly presented in the following.

2. Modeling of Thermal Deformation of Radio Telescopes

During 2005 we continued to model thermal deformations of radio telescopes. Our aim was to develop a model that allows to relate the air temperature measurements that are recorded in the VLBI log-files to vertical height changes of the radio telescopes. The model is based on previous work described in [1]. The work was done as part of a Sokrates-Erasmus student exchange project between Chalmers University of Technology and Vienna Technical University. Vertical height changes observed with the invar measurement systems at Onsala and Wettzell and the corresponding local temperature observations were used as input parameters for the model [2].

3. Ocean Tide and Atmospheric Loading

The service provided by the automatic ocean tide loading provider [3] has been maintained and extended during 2005 and the two new models TPXO.7.0 [4] and FES2004 [5] were added. The time series of atmospheric loading predictions [6] were updated to cover the year 2005.

4. Analysis of European Geodetic VLBI Data

We continued to analyze the data observed in the European geodetic VLBI network. Figure 1 shows the baseline length results through 2005 on all European baselines connecting to Onsala. For most of the baselines the weighted root-mean square (WRMS) scatter is on the order of 4–5 mm.

5. Contribution to the IVS TROP Project

Also during 2005 we continued to submit on a regular basis tropospheric parameters for all VLBI stations observing in the IVS R1 and R4 networks [7].

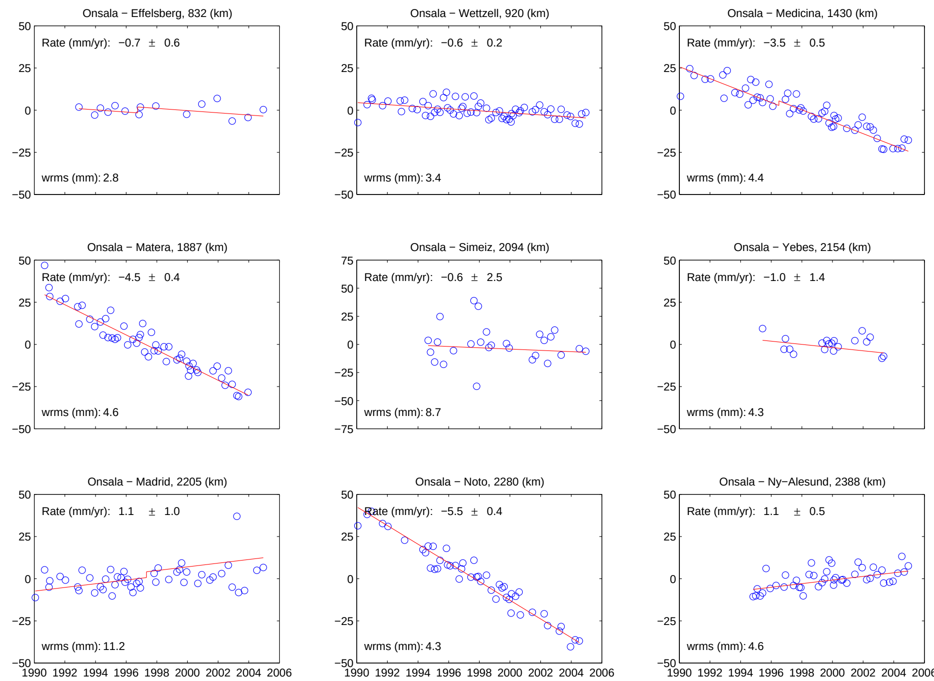

Figure 1. Baseline length observations in the European geodetic VLBI network. Shown are all European baselines connecting to Onsala.

6. IPWV Trends in Europe

We investigated trends in atmospheric water vapor for six European space geodetic stations that are equipped with both VLBI and GPS equipment and also have a radiosonde launch site relatively close by [8]. The zenith wet delay (ZWD) results obtained from VLBI and GPS were converted to Integrated Precipitable Water Vapor (IPWV) and combined with corresponding results from radio sondes (RS) by using a variance-covariance estimation strategy. Figure 2 shows the corresponding IPWV time series. The combined results were also compared to estimated IPWV trends from the ERA40 model [9]. Both groups of trends did only agree well for 2 out of the six sites. Furthermore, we detected a dependency of the GPS IPWV trends on the chosen elevation cutoff angle.

7. Atmospheric Gradients During CONT02

We continued to analyze the atmospheric parameters at Onsala during CONT02 [10], [11]. The radiometer data were reprocessed and the rain radar observations were used to identify and exclude radiometer measurements that were affected by rain. Results for zenith wet delays (ZWD) were presented in [12]. Scatter plots of gradient results from VLBI, GPS and the two microwave radiometers Astrid and Konrad that were operated at Onsala during CONT02 are shown in Figure 3 and reported in [13]. While the VLBI and GPS results agree reasonably well, there are small biases between the radiometer results and between radiometer and space geodesy results. The correlation coefficients are generally below 0.5 for all comparison pairs.

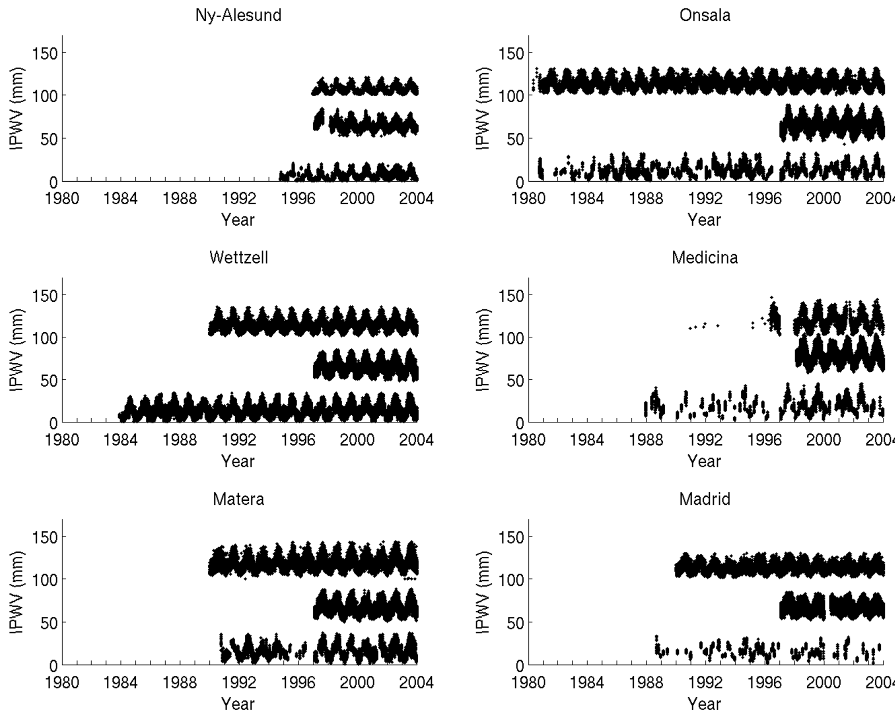

Figure 2. Time series of IPWV for six space geodetic stations in Europe. In each picture the displayed data show from the bottom to the top IPWV results for VLBI, GPS, and RS, respectively. Offsets of 50 mm and 100 mm are added for GPS and RS, respectively, in order to improve readability of the graphs.

8. Outlook

The IVS Analysis Center at the Onsala Space Observatory will continue its work on specific topics relevant for space geodesy and geosciences.

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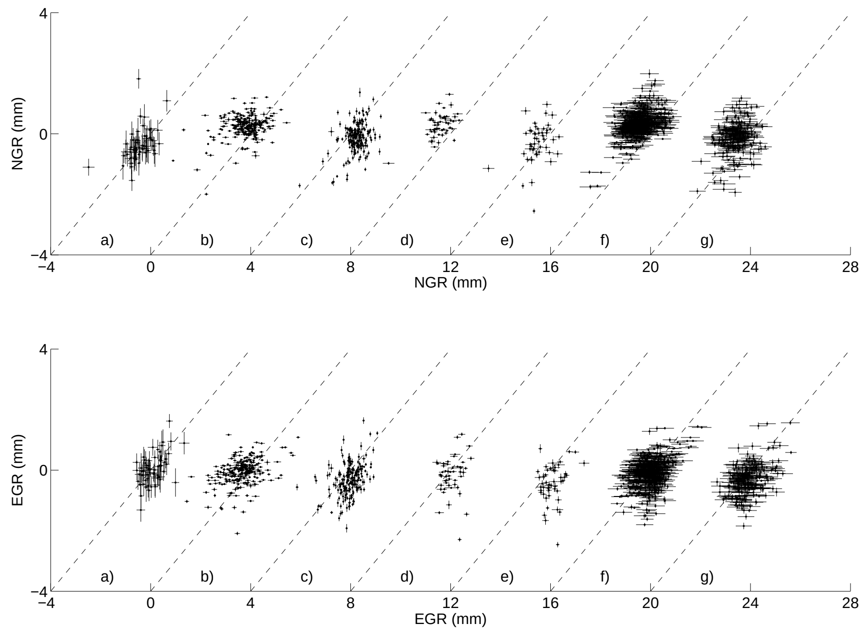

Figure 3. Scatter plots of north gradient (NGR, top) and east gradient (EGR, bottom) results: a) GPS vs. VLBI, b) Astrid vs. Konrad, c) Konrad vs. Astrid, d) Astrid vs. VLBI, e) Konrad vs. VLBI, f) Astrid vs. GPS, g) Konrad vs. GPS. From left to right the scatter plots are offset in steps of 4 mm along the x-axis. The dashed lines indicate lines of perfect agreement.

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