The IVS Special Analysis Center at the Onsala Space Observatory

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Abstract

We give a short overview on the activities of the IVS Special Analysis Center at the Onsala Space Observatory. Current topics of analysis and research are ocean tide and atmospheric loading, crustal deformation in Europe, atmospheric radio wave propagation, thermal deformation of VLBI radio telescopes, combining and integrating VLBI and GPS and earth rotation. Future plans are briefly described.

1. Introduction

The IVS Special Analysis Center at the Onsala Space Observatory (OSO) concentrates on a number of particular problems which can be investigated using and developing VLBI databases and analysis programs, and providing ancillary parameters. No routine analysis of global VLBI data in a service sense is performed or planned at OSO for the next few years.

2. Ocean Tide Loading

The studies performed at OSO cover theoretical modelling and empirical determination of ocean tide loading effects. New ocean tide loading coefficients based on recent ocean tide models have been calculated and made available for a global set of VLBI stations [1]. The ocean loading web site http://www.oso.chalmers.se/~hgs/README.html includes loading parameters computed on the basis of the recent GOT99.2 tide model [2].

A case study for the IVS station Westford showed that the refinement of the tidal modelling at the continental shelves leads to an improved agreement between modelled ocean tide loading and three-dimensional ocean tide loading effects derived from the analysis of VLBI data [1].

3. Atmospheric Loading

A data base with time series of atmospheric loading predictions based on global pressure fields has been generated for most of the VLBI databases since 1990 [1] and is available from our http server http://www.oso.chalmers.se/~hgs/apload/apload.html.

4. Crustal Deformation in Europe

The pure geodetic European VLBI experiments observed since 1990 have been analysed applying the two-step analysis strategy described in [3]. Crustal motion results and the corresponding large-scale strain-rate field in Europe have been determined [4].

5. Atmospheric Radio Wave Propagation

Atmospheric studies have been performed using the collocated techniques VLBI, GPS and microwave radiometry at Onsala [5]. Simultaneous observations with these three techniques during 1993 to 1998 showed correlation coefficients for the zenith wet delay between 0.74 and 0.87 and for the horizontal delay gradients between 0.27 and 0.51 [6]. Equivalent zenith wet delay values derived from VLBI and GPS have also been compared to values from Numerical Weather Prediction (NWP) models [7]. The agreement is promising with correlations at the level of 0.8.

6. Thermal Deformation of VLBI Radio Telescopes

The simple model describing the deformation of radio telescopes due to thermal influences [8] has been used to model the effects and to compare them to the vertical height changes measured at Onsala and Wettzell with the respective invar measurement devices (see Fig. 1).

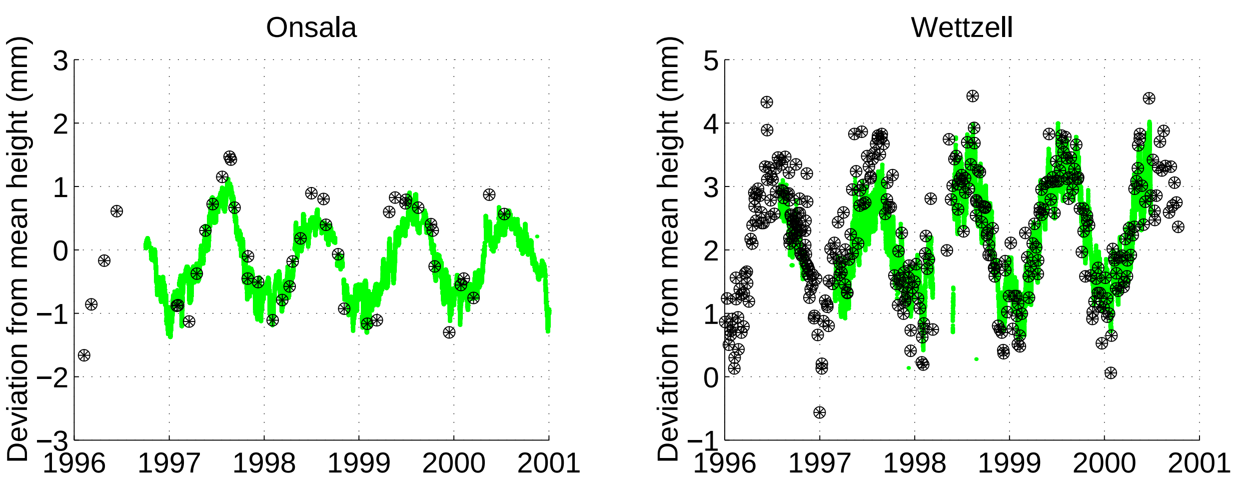

Figure 1. Vertical height changes of the VLBI radio telescopes at Onsala and Wettzell: solid lines - measured by the invar rod measuring systems; stars in circles - modelled with a simple model based on daily mean temperature from the VLBI data base, thermal expansion coefficient, and the telescope dimensions.

7. Combining and Integrating VLBI and GPS

Since each space geodetic technique has specific advantages and disadvantages, the combined and integrated use of several space geodetic techniques seems to be a useful approach. This is especially true for investigations concerning the crustal strain-rate fields and for the determination of absolute sea level changes. Therefore we started first investigations to combine and integrate VLBI and GPS in Europe [9]. The continuously growing data set of daily GPS solutions since 1993 available at OSO and in particular the GPS data from the BIFROST project [10] offer an excellent basis to continue these investigations.

8. Earth Rotation

The IVS Special Analysis Center at the Onsala Space Observatory participated in the First IVS Analysis Pilot Project and submitted an earth orientation parameter (EOP) solution obtained from the 52 NEOS-A sessions in 1999 (see Fig. 2).

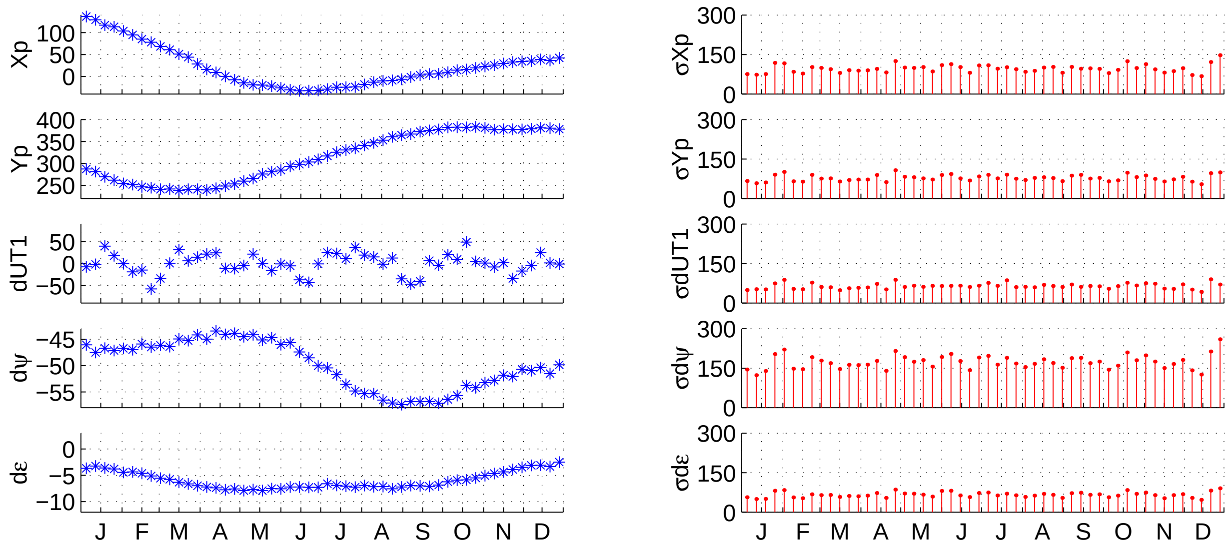

Figure 2. OSO's submission of earth orientation parameters derived from the 52 NEOS-A experiments in 1999 for the First IVS Analysis Pilot Project. The left column shows the earth orientation parameters in milliarcseconds, the right column shows the respective standard deviations in microarcseconds. For UT1-UTC (dUT1) an offset, a drift, an annual and a semi-annual term are subtracted.

9. Outlook

The IVS Special Analysis Center at the Onsala Space Observatory will continue to work on crustal loading and deformation effects. Special focus will be ocean tide loading and atmospheric loading but we will also work in the field of solid Earth tides. Parameter estimation and the covariances with EOP determinations will be of main interest. Eventually we will also contribute to IVS by submitting EOP solutions.

We will continue to analyze the European VLBI data with the aim to derive the most robust and reliable results for crustal motion and strain-rates. Our investigations will include also combination strategies with other space geodetic techniques like GPS, especially to achieve a more detailed view on the strain-rate field in Europe and to investigate changes in absolute sea level. We will also work on the geophysical interpretation of the results.

Our research concerning atmospheric properties will continue and we will use especially the collocated space geodetic and remote sensing techniques available at the Onsala Space Observatory. The investigations will reach from small scale structures in the atmosphere that can be detected with the new microwave radiometer [11] to climatological studies.

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