The IVS Analysis Center at the Onsala Space Observatory

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Abstract

The activities of the IVS Analysis Center at the Onsala Space Observatory during 2002 are summarised. Some activity concentrated on the CONT02 campaign. We describe briefly our future plans.

1. Introduction

During 2002 the activities of the IVS Analysis Center at the Onsala Space Observatory (OSO) continued to work on a couple of particular topics that are relevant to space geodesy and geosciences. Some activity focused on the CONT02 experiment. Routine analysis of global VLBI data in a service sense is currently not performed or planned at OSO.

2. Solid Earth Tides

The investiations concerning elastic properties of the Earth's body have been continued. The goal is to use global geodetic VLBI data together with gravity observations in order to study the tidal harmonic M_f (13.66 day period) at the high latitude station Ny-Ålesund. During 2002 we have been working on a direct estimation of the complex Love numbers for this tide from a large VLBI data set. Unfortunately, so far the investigations did not succeed in deriving reliable results. One concern is that the weak signal in harmonic station displacement still cannot be detected with our approach from the available VLBI data set and longer series of VLBI data are needed. However, we will concentrate on the development of different analysis strategies to continue the investigations.

3. Ocean Tide Loading

The automatic ocean tide loading provider [1] has been developed further. Now ocean tide loading parameters are provided in both formats, the old blokq-format and the new HARPOS-format. See http://www.oso.chalmers.se/~loading for further details.

4. Atmospheric Pressure Loading During CONT02

Time series of atmospheric loading effects on station position have been calculated based on global convolution of atmopheric pressure fields for the eight VLBI stations that participated in CONT02 in October 2002, see Fig. 1. Each diagram shows the air pressure loading effect, millimeters of displacements along the vertical, east and north (the latter with a plotting offset of 25 and 30 mm, respectively, for clarity) at each CONT02 station during the experiment (circular symbols) versus time in hours from October 16, 2002, shown on the lower abscissa. The curves without symbols show the loading effect throughout the year 2002. We conclude that air pressure loading variations during CONT02 were quite representative for the typical annual range.

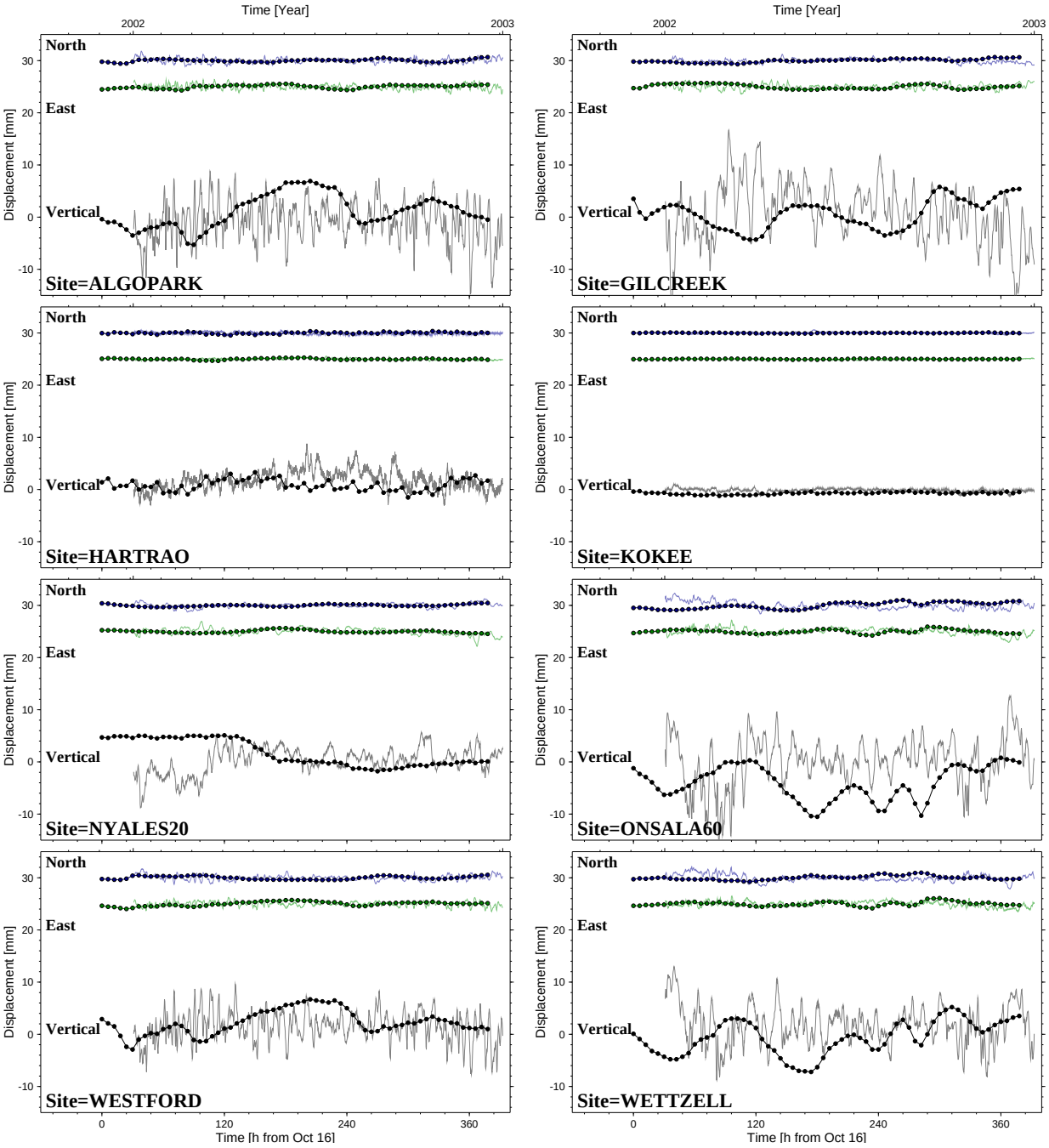

Figure 1. Time series of atmospheric loading during CONT02 (circular symbols, lower time axis) and during the whole year of 2002 (curves without symbols, upper time axis). Shown are vertical, east and north displacements (the latter plotted offset by 25 and 30 mm, respectively, for clarity).

The time series are available as usual in our own format under
ftp://anonymous@gere.oso.chalmers.se/pub/hgs/apload/core-vlbi-apl/*.tsf.Z
and in the new EPHEDISP format under
ftp://anonymous@gere.oso.chalmers.se/pub/hgs/apload/vlbi-E/*eph.gz
See also the home page at http://www.oso.chalmers.se/~hgs/apload.

5. Thermal Deformation of the Onsala Radio Telescope

Investigations have continued to model the thermal deformation of the Onsala radio telescope in the VLBI analysis. Figure 2 shows measured relative height of the telescope tower and several different temperatures measured at Onsala during CONT02. The relative vertical height is highly correlated with the mean temperature of the concrete telescope tower, see Fig. 1 c. The different temperatures (mean concrete, air inside radome, air outside) lag each other by several hours, see Fig. 1 e. A simple filter has been developed [2] to model the vertical height changes as observed by the invar rod measurement system at the telescope as a function of outside temperatures as logged in the VLBI log files. With this approach the relative vertical height of the telescope tower can be modelled with a maximum uncertainty of 0.15 mm, see Fig. 1 f.

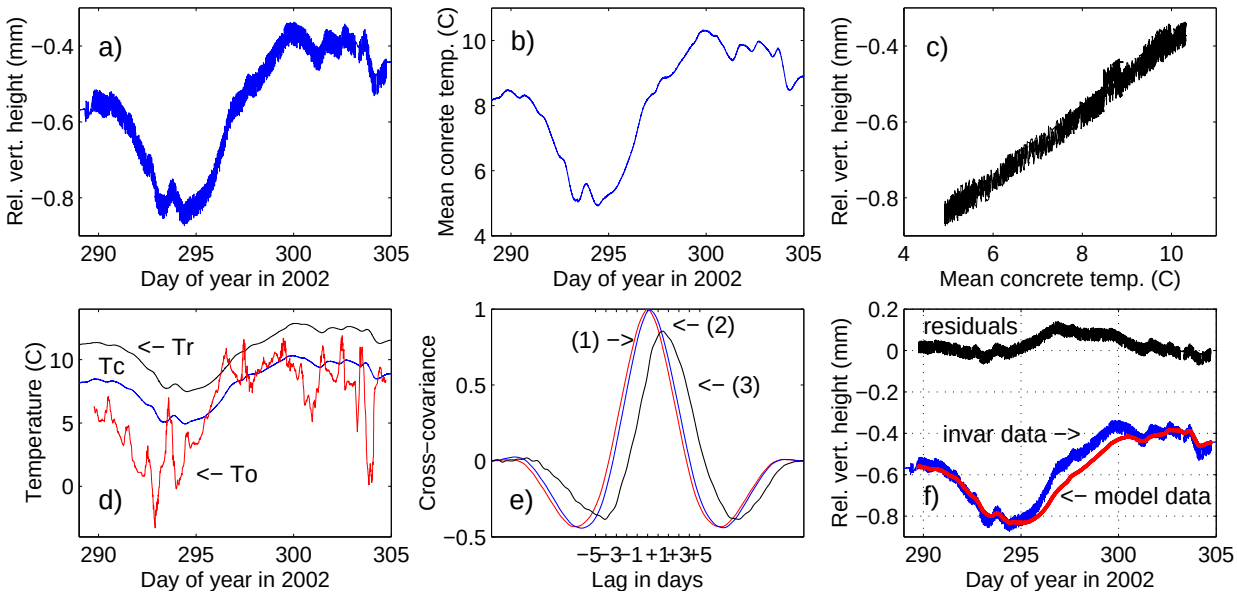

Figure 2. Relative vertical height and several temperatures at the Onsala 20 m telescope during CONT02: a) Relative vertical height as measured by the invar rod; b) Mean temperature of the concrete telescope tower; c) Scatter plot of relative vertical height versus mean concrete temperature. (The empirical expansion coefficient is $\gamma = 0.81 \cdot 10^{-5}$ (1/°C).); d) Several temperatures: To=outside temperature as logged in the VLBI log-file, Tc=mean temperature of the concrete telescope tower, Tr=air temperature inside the radome building; e) Cross-covariance functions: (1) autocovariance, (2) cross-covariance between mean concrete temperature Tc and radome air temperature Tr (lag 4:45 hours), (3) cross-covariance between outside air temperature To and radome air temperature Tr (lag 35:30 hours); f) Relative vertical height: original invar data (blue), model data based on outside air temperature logged in the VLBI log-files (red), and corresponding residuals (black).

6. Crustal Motion in Europe

The analysis of the purely European VLBI data has been continued [3]. A scientific report on the European geodetic VLBI network has been completed and published in early 2002 [4].

7. Atmospheric Radio Wave Propagation

The collocated space geodetic and remote sensing techniques at the Onsala Space Observatory have been used for atmospheric studies during 2002. Two water vapor radiometers have been operated during CONT02, one observing in a sky-mapping mode, and the other as a pointed radiometer following the VLBI observation schedule. Analysis of the data has started and will continue in particular in connection to the VLBI and GPS data observed during CONT02.

8. IVS Pilot Project - Tropospheric Parameters

The IVS Analysis Center at OSO participated in the IVS Pilot Project - Tropospheric Parameters in 2002. Tropospheric parameters for all VLBI stations participating in the IVS R1 and R4 networks have been derived and submitted to the IVS.

9. Outlook

The IVS Analysis Center at the Onsala Space Observatory will continue its work on specific topics in space geodesy and geosciences. These topics include tidal effects, loading phenomena, crustal motion, earth rotation, and atmospheric properties. Some part of the investigations will in particular concentrate on the CONT02 data. Work on combination of crustal motion observations from VLBI and other space geodetic techniques is planned.

References

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[4] Campbell, J., Haas, R., and Nothnagel, A. (eds.): Measurement of vertical crustal motion in Europe by VLBI. TMR Network FRMX–CT96–0071 Scientific Report 1996 - 2001, pp. 148, Published on behalf of the European Commission, ISBN 92–894–0763–8, European Communities, 2002.