Paris Observatory Analysis Center OPAR: Report on Activities, January - December 2011

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Abstract

We report on activities of the Paris Observatory VLBI Analysis Center (OPAR) for calendar year 2011 concerning the development of operational tasks and the Web site.

1. Operational Activities

1.1. 2011a Base Solution

A reanalysis of the complete 24-hour session database was done (2011a) and resulting EOP series and radio source catalogs were sent to the IVS. This solution estimated EOP and rates as session parameters, station coordinates and velocities as global parameters, and most of the sources' coordinates as global parameters. Troposphere and clock parameters were estimated every 20 min and 60 min, respectively, and gradients were estimated every six hours except for a list of 105 stations having a non-sufficient observational history. Axis offsets were estimated as global parameters for a list of 77 stations. We used up-to-date geophysical and astronomical modeling to compute the theoretical delay and partials, including the IAU 2006 nutation and precession, the Vienna mapping functions 1, the FES 2004 ocean loading model, and the antenna thermal deformations as provided by A. Nothnagel (2009, J. Geod., 83, 787). Since the solution was released after the 11 March 2011 earthquake in Japan, the displacement of the 32-m antenna at Tsukuba was modeled by splines, as done earlier for Fairbanks and the TIGO antenna at Concepción. We used the latest version of the Calc/Solve geodetic VLBI analysis software package. More details can be found at

`http://ivsopar.obspm.fr/earth/glo`

1.2. Station and Radio Souce Coordinate Time Series

Station and radio source coordinate time series were also produced. For each source, a page displays plots of original and smoothed time series and provides links to source information of various external databases (e.g., the French Virtual Observatory software package Aladin that permits someone to get the optical counterpart of the VLBI quasars, or the Bordeaux VLBI Image Database that gives the VLBI structure).

1.3. Operational Solutions

24-hour sessions were analyzed routinely within 24 hours after the version 4 database was submitted to the IVS. The operational solution was aligned to the 2011a global solution. Unconstrained normal equations relevant to EOP, rates, and station and source coordinates were sent to the IVS in SINEX format for combination in the framework of the IVS Analysis Coordinator's task.

Two operational solutions (2011i and 2011j) analyzing Intensive sessions after 2006 were also submitted to the IVS together with corresponding SINEX files. The solution 2011i processed

Intensive sessions in order to produce UT1 consistent with VTRF 2008a, ICRF2, and C04 Earth orientation data. The solution 2011j processed Intensive sessions in order to produce UT1 but is overparameterized (station coordinates and troposphere delays are also estimated together with UT1) and produces postfit rms delays as low as for the 24-hr sessions, i.e., lower than 2011i by a factor of two. In both solutions, due to the 11 March, 2011 earthquake in Japan, data points obtained from the analysis of the Tsukuba-Wettzell baseline should not be used.

All the above products, except SINEX files, were also published on the OPAR Web site. SINEX files were only sent to the data centers.

2. Follow-up of Various Phenomena

2.1. Free Core Nutation

The free core nutation (FCN) is a free oscillation of the Earth's figure axis in space due to the presence of a liquid core rotation inside the viscoelastic mantle. Its period is close to 430 days and is retrograde. Understanding the excitation of the FCN and its amplitude and phase variations is still an open question, although the community generally believes that the key resides in improved atmospheric and oceanic circulation modeling at diurnal and subdiurnal frequencies. At OPAR, we maintain an FCN model directly fitted to routinely estimated nutation offsets (Figure 1).

In addition to the FCN, amplitudes and phases of a set of 42 prograde and retrograde tidal waves are also fitted to the data. These tidal terms are interpreted as small deficiencies of the IAU 2000A nutation model. More explanations and material can be found at

`http://ivsopar.obspm.fr/earth/geo`

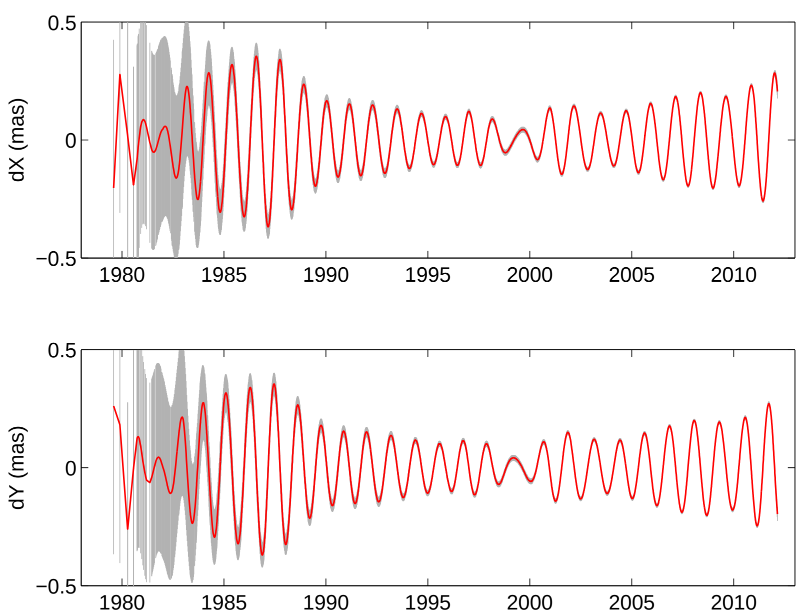

Figure 1. The free core nutation fitted to opa2010d nutation offsets with respect to the IAU 2006 nutation and precession models.

2.2. Displacement of TIGO at Concepción and of the Tsukuba Radio Telescope

Still using the routinely analyzed 24-hour sessions, we monitored the displacements of the station of TIGO at Concepción after the 27 February 2010 earthquake and of the radio telescope at Tsukuba after the 11 March 2011 earthquake. Figure 2 displays the UEN coordinates of the two sites with respect to the mean position as given in the VTRF 2008a. The monitoring is continued at

`http://ivsopar.obspm.fr/earth/tigo`
`http://ivsopar.obspm.fr/earth/tsukuba`

3. Staff Members

Staff members who contributed to the OPAR analysis and data centers in 2011 are listed below:

- Sébastien Lambert, Analysis Center manager, responsible for data analysis, development of GLORIA analysis software,
- Christophe Barache, Data Center manager, data analysis,
- Daniel Gambis, responsible for the IERS Earth Orientation Center, interface with IERS activities.

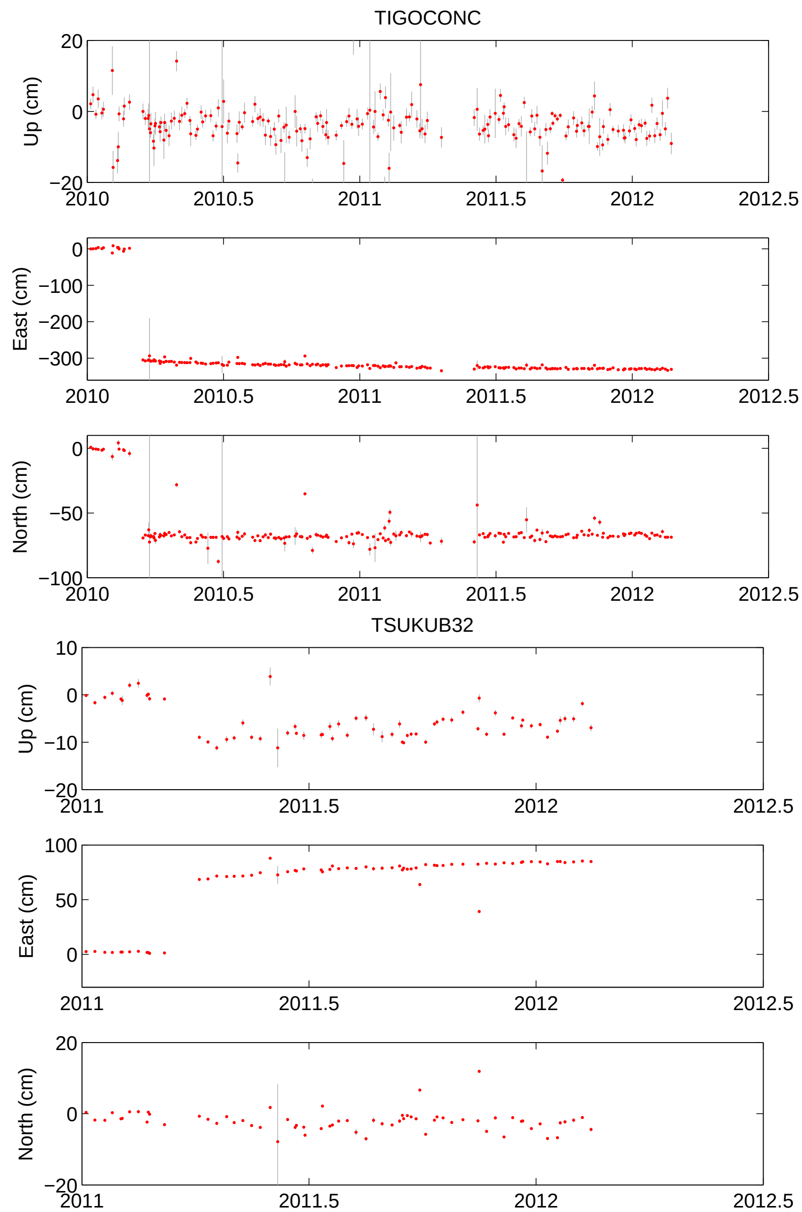

Figure 2. The UEN coordinates of TIGOCONC and TSUKUB32 antennas with respect to the VTRF 2008a solution.