3.3 Analysis Coordinator

Introduction

In this report, we outline the activities of the Analysis Coordinator during 2017. The main activities were contributions to the Unified Analysis Workshop (UAW) held Paris in 2017 and examining published paper that use IERS products and earth orientation parameters. The ACC is still examining the analyses of the VLBI and SLR contributions to ITRF2014 and the robustness of the estimate of the scale difference between VLBI and SLR.

2017 Unified Analysis Workshop: GNSS discussion

The 2017 Unified Analysis Workshop was held in Paris, France July 10–12, 2017 following the IGS Workshop and like the IGS Workshop. Both workshops were hosted by the Institut National de l'Information Géographique et Forestière (IGN). Both the IGS Workshop and UAW were held at the University of Paris-Diderot (15 rue Hélène Brion, 75013 Paris). The organization of 2017 UAW was led by GGOS through its science panel chair Richard Gross.

The ACC contribution to the 2017 UAW focused on systematics in GNSS which is the primary source for polar motion values in the IERS and for densifying the ITRF.

Four primary areas of sources of errors and biases were considered and the following recommendations reached.

1. The gravity fields used in the GNSS orbit integrations should be updated to match modern fields to make them consistent with the fields being used by the other IAG services. The update would include the static part of the field and a time variable component. For the GNSS satellite altitudes, temporal variations in only the lowest degree terms would be needed with just the 2nd degree terms possibly being the only ones needed. Projection of the temporal variations past the time when observed changes are available could use a simple annual sine and cosine fit. Planetary bodies in addition to the Sun and Moon should also be included in gravitational force modeling.

2. Other components of the force models for GNSS should also be updated and validated. The force models associated with radiation forces are the most uncertain and modeling of these forces can be made more consistent with the exchange of attitude information. The IGS plans to develop an attitude format and make attitude information available so that analysis centers can validate their models. The IGS has noted the appearance of the GPS draconitic period and harmonics of this period in time series of various geodetic products (e.g., positions and Earth orientation parameters). Long orbital arc analyses (longer than the 24-hrs

used by most IGS analysis centers) should be investigated to assess the levels of spurious signals in these analyses and to better understand the origin of the draconitic signals.

3. An updated short-period (diurnal and semidiurnal) model is needed and a method to determine whether this is an ocean-tide only with libration terms added or an empirical model based on VLBI data needs to be established. (GNSS estimates of short period EOP terms might by affected orbital modeling errors). The number of tidal waves to be included and the representation of the tidal signals needed also be decided.

4. Site dependent calibration of GNSS antennas are needed since these have a direct effect on the ITRF realization and position offsets when antennas are changed. Tests of the use of antenna specific phase center models are encouraged when these values are available without disturbing an existing antenna installation. Investigation and potential development of an in-situ antenna calibration system are strongly encouraged. In-situ calibration would be deployed at core sites where GNSS sites are tied to other geodetic systems

Literature search for publications using IERS products and EOPs

This year we looked at the types of publications that used IERS products. Over all there were 340 publications that appear in Google Scholar and have keywords IERS, Earth Orientation parameters. Of these publications, we list below those that have been published in journals and have been cited at least once. The list may not be complete but the 44 papers listed cover the range of topics addressed by the papers. The topics can be divided into four main areas (1) use of the IERS Conventions; (2) use of IERS Earth orientation parameters; (3) algorithms for improvements to IERS products and comparison between products; and (4) interpretation of variations in the EOP products i.e., excitation mechanisms of Earth rotation changes. Most of the papers use the IERS Conventions or IERS EOP series. Only four papers in 2017 discuss excitation mechanism (*Haddad and Bonaduce*, 2017; (*Naghibi et al.*, 2017; *Winska et al.*, 2017, *Youm et al.*, 2017). In 2017, most of the use of IERS products were for reference frame realization (using the ITRF and EOP estimates) and production (using IERS Conventions). There was little direct uses of the EOP estimates to directly study the rotation of the Earth. There is ongoing study into methods of improving EOP estimates (*Belda et al.*, 2017; *Haas et al.*, 2017; Karbon et al., 2017; *Lei et al.*, 2017; *Liu et al.*, 2017; *Nilsson et al.*, 2017). The most highly cited paper in 2017 (so far) is Nothnagel et al. (2017) which discussed the International VLBI Service.

IERS/EOP literature

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