International Earth Rotation and Reference Systems Service (IERS)

Report to IAG, 2003-2007

1 Publications and web sites

The following IERS Technical Notes were published between 2003 and 2007:
No. 30: B. Richter et al. (eds.): Proceedings of the IERS Workshop on Combination Research and Global Geophysical Fluids, 2003.
No. 31: C. Boucher, Z. Altamimi, P. Sillard, and M. Feissel-Vernier: The ITRF2000, 2004.
No. 32: D.D. McCarthy and G. Petit (eds.): IERS Conventions (2003), 2004.
No. 33: B. Richter et al. (eds.): Proceedings of the IERS Workshop on site co-location, 2005.
No. 34: Jean Souchay and Martine Feissel-Vernier (eds.): The International Celestial Reference System and Frame 2006.

The IERS Annual Reports give information about activities of all IERS components, as well as on IERS structure, Terms of Reference and contact addresses.

For rapid information, the Central Bureau issues IERS Messages which are being sent to about 2000 users.

Earth orientation data are distributed in IERS Bulletins A, B, C, and D.

The IERS components run about 20 web sites to present general information, data and publications. The central web site www.iers.org maintained by the Central Bureau provides information about IERS in general, its components and Earth rotation and reference systems as well as links to other servers. The web site contains also online versions of all publications since 2000.

2 Workshops

The IERS organized four Workshops:

- *IERS Workshop on site co-location* (Matera, Italy, October 23-24, 2003). More than 30 participants from Australia, South Africa, USA and Europe discussed various examples, analysis methods and survey strategies. Finally guidelines for co-location site surveys and report templates were proposed. The potential availability of survey teams as well as the planning for surveys were investigated and important recommendations were given. The Proceedings were printed as IERS Technical Note No. 33 and are available also online through IERS's website.

- *IERS Workshop on the Combination Pilot Project* (Napa, CA, USA, December 11, 2004). To discuss the future aspects and consequences of the IERS Combination Pilot Project experts of the IERS Working Group on Combination, the participants in the Combination Pilot Project together with representatives of the Technique Services - in total 23 persons - came together. The following topics were discussed:
  1) Combination Pilot Project and CONT'02 ("Weekly" SINEX);
  2) Long Time Series and their combination (ITRF, IERS200x, ...);
  3) Database and Information Systems.

- *IERS Workshop on Combination* (Potsdam, Germany, October 10-11, 2005). The workshop brought together nearly 60 experts from the fields of Terrestrial Reference Frame, Celestial Reference Frame and Earth Orientation Parameters to discuss the combination and validation strategies, the present status of combined intra- and inter-technique products, their development and adoption in the future. The Proceedings will be printed as IERS Technical Note No. 35.

- *IERS Workshop on Global Geophysical Fluids* (San Francisco, CA, USA, December 6-7, 2006). The goal of the workshop was to determine whether the GGFC was adequately addressing the needs of the community and what should be the priorities for changes. 25 specialists took place.

3 Activities of the IERS components

3.1 Central components

The *IERS Directing Board* (DB) met once or twice each year:
- Meeting No. 38 in San Francisco, December 8, 2003;
- No. 39 in Sèvres, September 23, 2004;
- No. 40 in Vienna, April 28, 2005;
- No. 41 in San Francisco, December 5, 2005;
- No. 42 in Vienna, April 8, 2006;
- No. 43 in San Francisco, December 11, 2006; and
- No. 44 in Vienna, April 15, 2007

to decide on important matters of the Service like minor structural changes, overall strategy, creating working groups, launching projects, changing Terms of Reference, etc.

Among the most important decisions made by the DB in 2003-2007 were the following:
- Creation of the IERS Working Group on Combination;
- Creation of the IERS Working Group on Site Survey and Co-location;
- Launching the EOP Prediction Comparison Campaign;
- Creation of the IERS Working Group on Prediction;
- Creation of the IERS/IVS Working Group on the Second Realization of the ICRF.

The *Central Bureau* coordinated the work of the Directing Board and the IERS in general, organized meetings and issued publications. It developed the IERS Data and Information System based on modern technologies for internet-based exchange of data and information. The system provides general information on the structure and the components of the IERS and gives access to all products.

The work of the *Analysis Coordinator* focused on initiating and coordinating the Analysis Campaign to align EOPs to ITRF2000 / ICRF, the SINEX Combination Campaign, and the Combination Pilot Project. He also issued new versions of the SINEX data format.

3.2 Technique Centres

The Technique Centres are autonomous independent services, which cooperate with the IERS.

The *International GNSS Service* (IGS), formerly the International GPS Service, is committed to provide the highest quality data and products as the standard for global navigation satellite systems (GNSS). Current GPS and GLONASS products support scientific objectives including

realization of the ITRF, monitoring Earth rotation, and many others. Pilot Projects have been launched to develop new products and services.

The *International Laser Ranging Service* (ILRS) is responsible for the coordination of SLR/LLR missions, technique development, operations, analysis and scientific interpretation. Since mid-2003, it has been producing weekly time-series of solutions for station coordinates and Earth orientation parameters.

The *International VLBI Service for Geodesy and Astrometry* (IVS) has continues to fulfil its role as a service by providing necessary products for the densification and maintenance of the Celestial Reference Frame as well as for the monitoring of Earth Orientation Parameters. On average, a total of more than 1000 station days per year were used in about 180 geodetic sessions during the year as the observational basis for the IVS products.

The *International DORIS Service* (IDS) was created by the International Association of Geodesy in July 2003 as the result of a successful DORIS Pilot experiment. The main contribution of IDS to Earth rotation studies is the production of series of daily pole coordinates and weekly Terrestrial Reference Frames. The quality of these results has improved with time.

See also the individual reports of these Services to IAG.

3.3 Product Centres

The *Earth Orientation Centre* is responsible for monitoring of long-term earth orientation parameters, publications for time dissemination and leap second announcements. It issues IERS Bulletins B, C, and D and corresponding data files. The Centre has set up interactive Web tools for selecting, plotting, analysing time series of the Earth orientation and its atmospheric excitation. Starting from June 2007, the consistency of the EOP series with the International Reference Frames is at a better level of accuracy.

The *Rapid Service/Prediction Centre* is responsible for providing Earth orientation parameters on a rapid turnaround basis, primarily for real-time-users and others needing the highest quality EOP information before the IERS final values are available. It issues IERS Bulletin A and corresponding data files. A lot of work has been dedicated to improvement of the centre's products, which includes the development of new strategies.

The *Convention Centre* released the electronic edition of the IERS Conventions (2003) in November 2003, and the corresponding paper edition was published in 2004. A new web site includes a discussion forum and pages for the Conventions updates. Several updates to the Conventions have been published since 2004.

The *ICRS Centre* has been working on validation of individual reference frames by comparison with ICRF-Ext.1, on monitoring source structure to assess astrometric quality, on the maintenance of the Hipparcos link, on linking the ICRF to frames at various wavelengths, and on other studies. The Centre published its Report for 2001-2004 as IERS Technical Note 34.

The *ITRS Centre* participated in complete surveys of some co-location sites, contributed to specifications for ITRF densification, developed the tools and methodology for generating the ITRF from SINEX inputs from the various space geodesy techniques, and maintained the IERS network. A new ITRS Web site was developed. In cooperation with the ITRF combination centres (DGFI and NRCan), the ITRS Centre finalized the ITRF2005 in October 2006.

The *Global Geophysical Fluids Centre* (GGFC) consists of eight Special Bureaus (SB) for Atmosphere, Core, Gravity/Geocentre, Hydrology, Loading, Mantle, Oceans, and Tides. These

provide data related to global geophysical fluids such as co-seismic excitation of Earth rotational and gravitational changes, glacial isostatic adjustment, core angular momentum changes, geocentre variations, oceanic tidal angular momentum, oceanic tidal variations in earth rotation, low-degree spherical harmonics of ocean and atmospheric tides, models for global oceanic angular momentum, models for oceanic centre-of-mass, a model for ocean bottom pressure, measurements of ocean bottom pressure, continental water storage and water flux, effective atmospheric angular momentum functions, spherical harmonic coefficients of surface pressure, global friction torque and global mountain torque, and Earth surface deformation due to surface mass loading. During the last three years, the amount of data and their quality have significantly improved in several cases.

3.4 Combination Centres and Working Groups

Eleven *Combination Research Centres* worked on the development of methods and software for the combination of data and products from different techniques. Three *ITRS Combination Centres* are responsible to provide ITRF products by combining ITRF inputs. Several of these Combination Centres took part in the Combination Pilot Project.

The *Working Group on Site Survey and Co-location* coordinates a Site Survey and Co-location Pilot Project with the intention of developing future recommended IERS standards for site survey and co-location. The major task of the *Working Group on Combination* is the coordination of the IERS Combination Pilot Project. The *Working Group on Prediction* is designed to build upon the foundation laid by the Prediction Comparison Campaign (PCC) and also investigate the new data sets from the Combination Pilot Project. The purpose of the *IERS/IVS Working Group on the Second Realization of the ICRF* is to generate the second realization of the ICRF from VLBI observations of extragalactic radio sources, consistent with the current realization of the ITRF and EOP data products.

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