

## 3 Reports of IERS components

### 3.1 Directing Board

The IERS Directing Board (DB) met twice in the course of the year 2006. Summaries of these meetings are given below.

**Meeting No. 42** April 8, 2006, Technical University of Vienna, Vienna, Austria

**Formalities** C. Ma reported about the activities as chair. In coordination with the DB he sent a letter of support for the Australian National Geospatial Reference System.

**Reports of the Unions (IAU, IAG/IUGG)** N. Capitaine presented a summary of the latest IAU and FAGS actions. This included the programme of the XXVIth IAU General Assembly in Prague from August 14 – 25, 2006 including details on Joint Discussion 16, sponsored by Division I Commission 19 together with Division X Commissions 4, 5, 7, 8, 31, 40 and titled “Nomenclature, Precession, and New models in Fundamental Astronomy”. In the list of invited papers members of the IERS DB are represented. As supplements to the IAU Resolutions of 2000 the WG on “Nomenclature for fundamental astronomy (NFA)” prepared several resolution proposals including a re-definition of TDB because there is no consensus on a description of TDB as it is currently understood. The second part of her presentation described the re-organisation of FAGS during the period 2006 – 2008. During the FAGS council meeting in Paris (March 29 / 30, 2006) the services presented their activity reports. The next step will be the preparation of a white paper by a subgroup of the FAGS Council (N. Capitaine, P. Wilkinson, R. Neilan) in close coordination with the Services Directors, the Unions and ICSU. A small allocation for the IERS is guaranteed till 2008. Due to the absence of C. Wilson his report about IAG activities was postponed.

**International Projects: GGOS and GEO** M. Rothacher reported on the activities and status of GGOS. During the GGOS retreat in February 2006 the GGOS structure for 2006 – 2007 was defined. User requirements, proposals for a GGOS portal, the preparation of the GGOS workshop in October 2006, as well as the preparation of the IUGG meeting in Perugia were discussed. M. Rothacher noted that GGOS will be based on the existing IAG Services and their products. GGOS is not taking over tasks of the existing, properly functioning IAG services. With respect to the IERS he sees two critical points. The IERS Conventions Centre should interact and work together with the GGOS WG on Conventions / Modelling / Analysis. The same holds for the IERS WG on Site Co-Location and the GGOS WG on Networks. The flow of information should be guaranteed by overlapping memberships.

In the 2006 work plan of the Group of Earth Observation (GEO) members and participating organizations are asked to reach agreements on GEOSS interoperability specifications, and an inventory should be produced of existing *in-situ* observation networks organized by societal benefit area. More specific tasks are to be developed for the years 2007 – 2009 and distributed for discussion.

**Report of Technique Services**

**IGS**

A. Moore reported that the IGS has prepared a new list of co-located sites which was submitted by R. Ferland to the ITRS Centre. In addition the status of the IGS solutions contributing to the ITRF was summarized by a note from R. Ferland to the CB:

Since the meeting last December the IGS activities related to the IERS touched on three components of the ITRF2005 combination:

1. The IGS weekly solutions had been provided last August up to GPS week 1333 (05/07/30). The IGS solutions for GPS weeks 1334 (05/07/31) to 1355 (05/12/31) were reviewed and provided to complete the series up the end of 2005. This was completed before the end of January.
2. The discontinuity table were also reviewed and updated using the usual data sources. A discontinuity list was provided by TUM, derived from their GPS reprocessing, from which several additions were made to the IGS list. The list currently includes close to 450 stations, with nearly 600 discontinuities. For various reasons not all stations in the list are part of the contributed stations to ITRF2005.
3. A subset of the preliminary GPS solution, recently provided by IGN, was tested. The stations corresponding to the IGS "IGb00" realization, were used to combine/align the IGS weekly combinations for GPS weeks 1360-1361-1362 (06/01/29 – 06/02/19). Note that those weeks are not part of the ITRF2005.

The table below shows the standard deviations between the weekly combination and the IGN solution. The statistics for the currently used IGb00 are also included for comparison:

week	#sta	weekly - IGN / IGb00		
		N(mm)	E(mm)	H(mm)
1360	80	2.0 / 3.6	1.8 / 3.4	6.4 / 12.9
1361	79	2.0 / 3.5	1.6 / 3.6	6.1 / 12.5
1362	80	2.0 / 3.5	1.8 / 3.8	5.8 / 12.4

Note that the most recent data in IGb00 is already almost 3 years old (Wk 1231 – 03/08/10). There is a factor of ~ 2 improvement with the IGN solution. The statistics obtained with the IGN solution are consistent with what has been experienced with previous IGS realizations.

**ILRS** R. Noomen gave an overview about the ILRS contributions to the ITRF2005. From 2003 onward the ILRS offered weekly solutions for station coordinates and EOPs as an operational product derived from observations to LAGEOS-1 & 2 and Etalon-1 & 2. In November 2005 the re-analysis of the SLR observations 1993 – 2003 was provided in the same weekly solution scheme. He concluded his presentation with the following recommendations:

1. The ILRS strongly recommends that the IERS use the current time-series of the ILRS and IVS “pos+eop” solutions for the definition of the scale of ITRF2005
2. The ILRS recommends that the IERS investigate the cause for the differences between the seasonal variations in global scale as observed by the ILRS and IVS.

**IVS** A. Nothnagel reported that the first results of the CONT05 series observed over 15 days in October 2005 look very good. Currently, the VLBI databases are being reprocessed with session limits reset from the original epochs to 0.00 to 24.00 UT in order to permit better combination with the satellite techniques and to investigate the reference epoch effect on the EOP results. The IVS plans to change to routine SINEX combination on the basis of datum-free normal equations with datum definition after combination by the end of 2006. So far it is unclear to what epoch the EOP should be referred to. Currently, the IERS CPP calls for the 12.00 UT (Noon) epoch while the C04 series is computed on the basis of the 0.00 UT (Midnight) epoch. In addition to this, the IERS Rapid Service/Prediction Centre asks to stay with the middle epoch of the VLBI observing sessions, which is generally around 06:00 UT. A short discussion evolved about this problem with statements about the fact that with the EOP rates and the respective variance-covariance information every user can re-compute the EOP at the epoch of choice. However, most users do not have this information readily available and error propagation will not be carried out correctly.

**IDS** F. Lemoine as the new analysis coordinator presented the two DORIS solutions contributing to the ITRF2005 prepared by IGN/JPL and LEGOS/CLS, which differ mainly in scale.

**Status of ITRF** The ITRS Combination Centres DGFI (D. Angermann) and IGN (Z. Altamimi) reported about their progress for the new ITRF. NRCan (R. Ferland) activities were described already under the reports of techniques centres/IGS.

Z. Altamimi estimated the comparisons between the ITRS CCs would be finalized at the end of April / beginning of May. The evaluation group should start with its work immediately and should be ready within 2 weeks.

The evaluation group would include:

- Analysis Coordinator: Markus Rothacher
- one representative of each Technique Centres
- EOP expert: Richard Gross
- Geophysics: Geoff Blewitt
- Advisory Board Conventions: Jim Ray

Each evaluation expert should describe his procedure and findings in a short report. The final ITRF will be published as an IERS Technical Note.

**Status of ICRF**

R. Gaume reviewed the history, current status and future of the ICRF. The IAU will be asked to support a new ICRF with the new observations and analysis.

**Convention Update Process**

G. Petit presented the new electronic access to the Conventions Updates which are highlighted and marked at the margin by a vertical bar. These updates have been carried out by a group of experts that the Conventions Centre convened with the support of the Advisory Board for IERS Conventions Updates. It was reported that the chapter 7, section 7.1.5 "Ocean Pole Tide Loading" now completes the introduction of the ocean pole tide model after the inclusion of the geopotential part in Chapter 6. The files needed to implement the new model "Ocean Pole Tide Loading" are available in <ftp://tai.bipm.org/iers/convupdt/chapter7/>. Similar work is under way for the atmospheric tidal loading. Models have been provided by Tonie van Dam and Richard Ray. In the discussion there was support for a free core nutation model in the Conventions. Before publication the changes will be presented the IERS Directing Board for endorsement.

**Working Group on Prediction**

W. Wooden summarized the meeting of the IERS Working Group on Prediction on Thursday April 6, 2006. He went through the charter, highlighting the goals and objectives and the proposed structure. He prepared a survey to focus the work better towards user needs.

H. Schuh presented selected results of the EOP Prediction Comparison Campaign. 8 teams with 12 different prediction methods participated in this activity. The information shown was compiled into a poster presented at the EGU General Assembly. After the first experiments the rules will be slightly changed to a regular submission every week (7 days) and 21 days for the midterm prediction.

**Working Group on Site Co-Location**

G. Johnston, chair of the working group, was not able to participate in the IERS DB meeting but organised a meeting of his working group on Friday April 7, 2006 where presentations about current

activities were given by Z. Altamimi “IGN Local Survey activities within the ITRF-PC”, J. Ray “Local Ties at the new BRFT Station” and J. Luck “Comparison of survey determined ties with SLR determined estimates”. All presentations and more information about the working group can be found under <<http://www.iers.org/MainDisp.csl?pid=68-40>>. In an open discussion the future status of this WG was discussed. Options include an IERS WG, IAG Service or sub-bureau of the ITRS Centre. G. Johnston will come back to this at the next IERS DB meeting.

#### **New polar motion/UT1/nutation series from Earth Orientation Centre**

D. Gambis demonstrated the new strategy for EOP determination. He explained that not only the software has been re-written but also the new nutation model IAU 2000 has been included. The daily solution is run automatically, the error estimates have been improved and the last 20 years can be analysed in one run. New approaches have been tried to combine LOD, ILRS and GPS solutions are used but there are still problems with the real-time UT1 determination using GPS LOD. D. Gambis explained the necessary steps to re-analyse the C04 series. For polar motion he proposed that the years 2000.0 to 2006.0 should be aligned to the ITRF 2005 to be consistent. The time span before 2000 might be extrapolated backwards with the linear drifts associated to EOP (ITRF2005). Further investigation is necessary here. UT1 and the nutation offsets will be treated as usual. For the ongoing analysis weekly global solutions based on CATREF (IGN software) can be produced with a delay of 4 weeks. The parameters can be station coordinates, polar motion, UT1 partially, and LOD using the space techniques SINEX solutions as input. Bulletin B would eventually be replaced by this global solution. To continue C04 for UT1 and nutation the VLBI intensive sessions and the nutation parameters are needed. An alternative method could be the use of DYNAMO (GRGS software), which would allow 6-hr EOP determination and a densified nutation solution using VLBI and GPS.

M. Rothacher offered the possibility to test most of the strategy within the IERS Combination Pilot Project (CPP).

C. Ma noted that when ITRF2005 is released the operational IERS EOP series have to be consistent with ITRF2005. However actual generation of EOP from SINEX combination needs to be handled differently and should be investigated within the CPP. Both the current method and the new combinations should run in parallel.

Z. Altamimi noted there is an urgent need for the “new” EOP series coming from the Earth Orientation Centre to ensure the consistency of EOPs after 2005. He didn’t support the idea to use DYNAMO because the programme system is not proven.

William Wooden expressed concern about the transition phase and the consequences for the Rapid Service/Prediction Centre.

Chopo Ma proposed that a change in offset and rate for the current operational series could be enough as a first step. The Earth Orientation Centre and the Rapid Service/Prediction Centre have to coordinate their actions and inform the users of the date of this realignment (action item). When available the new methods should be developed and tested within the CPP. The schedule for a transition to new EOP series has to be worked out between the two product centres taking into account the progress achieved within the CPP.

#### **Working Group on Combination**

Markus Rothacher gave a status report on what goals have been achieved to date, where are the deficits and what will be the next steps. Work related to combination has concentrated on the ITRF2005 and now should return to a focus on the pilot project. Who will participate in the CPP in the future must be confirmed. As a final vision for the CPP he developed the idea intra- / inter-technique combinations on a daily basis.

#### **Ad-hoc Committee for leap second**

Daniel Gambis gave a short overview about the ongoing discussion of the leap second. Last November at the ITU meeting the US representative of ITU brought in the proposal to freeze UT and suppress the leap second in the future. At the next ITU meeting in August this proposal will be evaluated. ITU sent a letter to various institutions including the IERS to ask their opinion. D. Gambis pointed out that the IAG in Cairns agreed to a resolution that there should be no change, i.e., UT would remain close to UT1. From the IAU perspective there is no problem to introduce the leap second as done in the past. The IERS Product Centres should respond to the ITU survey by themselves with a copy to the IERS Central Bureau.

#### **Central Bureau**

Bernd Richter gave a very short report about the activities. As stated in IERS Message 88 the ICRS Centre Report for 2001–2004 is available as Technical Note 34 in an electronic version. Printing will follow later this year. The IERS Annual Report 2004 was updated in some parts and will be printed also later this year. The IERS Data and Information System went public. The IERS has been represented several times, see items “Reports of the Unions, GGOS / GEO activities”. The preparation for the IERS workshop on geophysical fluids in Luxembourg Oct. 5–6, 2006 has been started.

#### **Miscellaneous**

Ron Noomen asked the IERS Directing Board for a letter to support laser reflectors on GNSS satellites.

**Meeting No. 43** December 11, 2006, San Francisco Marriott Hotel, San Francisco, CA, USA

**Introduction and approval of agenda** C. Boucher proposed to discuss the implications of the International Committee on Global Navigation Satellite Systems (ICG) but there was insufficient time. This item will be followed up by the Central Bureau and reported at the next IERS Directing Board meeting. The agenda was approved.

**Formalities** C. Ma welcomed the new members E. Pavlis and J. Müller, who were elected by the ILRS as the new representatives at the IERS Directing Board. Furthermore C. Ma as chair of the IERS sent a letter to the Canadian government to express the dismay and disappointment of the IERS over the cessation of the Canadian geodetic VLBI program. Unfortunately, no response has been received yet.

**ITRF 2005** The IERS Directing Board expressed its appreciation for the tremendous effort that went into the new realisation of the ITRF with its new input and combination strategies. This includes the ITRS Combination Centres as well as the Technique Services IDS, IGS, ILRS and IVS.

Z. Altamimi presented a description of the IGN process together with his understanding of the DGFI methods and gave some outline for the future process and realisation. He presented a critique of the DGFI concept for realising the ITRF.

In the following presentation H. Drewes described the DGFI strategy for the ITRF 2005 realisation. In a second talk H. Drewes tried to explain from his point of view the conceptual differences between the DGFI and IGN approaches. He emphasised that there is a significant difference in scale rate for SLR stations between the two solutions.

Z. Altamimi and H. Drewes discussed their differences in understanding about the use of Helmert transformation parameters in the combination process. M. Rothacher noted that at least for the intra-technique multi-year solutions both methods lead to almost identical results. M. Rothacher proposed that the local ties used, their weights, and the sites where velocities were set equal for different point realisations at the site should be summarized in a list. H. Drewes indicated that at some sites the vertical velocities were not equated in the DGFI combination, e.g., Wettzell. E. Pavlis demonstrated that the noise in the VLBI and SLR scale time series are at a similar level and that the variations of VLBI and SLR scale are similar in size. In various tests with SLR data the IGN and DGFI solutions performed equally except in scale. ILRS will add observations going back to 1976 to the weekly SINEX files. The ILRS re-

requested a specific tailored ITRF2005 for SLR purposes with the scale only (without rate) to be reset. Z. Altamimi stated that a specific ITRF2005-SLR solution is available where the scale and its rate were applied in order to be fully consistent with the currently available routine ILRS time series. E. Pavlis described the evaluation procedure for EGM96 as example of a well-defined validation process. F. Lemoine reported that the ITRF 2005 is a slight improvement for DORIS. R. Ferland described how IGS is using ITRF 2005. IGS increased the number of core stations significantly. A. Nothnagel was not able to participate in the meeting and sent his point of view concerning ITRF 2005, C04 and UT1–UTC in a short memo.

#### **New ITRF 200X**

M. Rothacher presented a draft version of the future ITRF process. Not all in the presentation was based on full consensus of the three authors. Z. Altamimi stated that only a single solution for the next ITRF should be presented for evaluation. A workshop before releasing the next ITRF was proposed. N. Capitaine pointed out that it is not clear how the evaluation panel will make a decision. There was general agreement by the IERS DB that a better defined evaluation process is mandatory. C. Ma noted that this discussion is the beginning of the process for a new ITRF 200x. Sites with GPS co-located with other space geodetic techniques need to be brought into the IGS reanalysis because GPS provides the ties between VLBI and SLR. E. Pavlis noted that at a particular co-location site a technique could be weak although the local ties measurement is strong. G. Gendt indicated that 1 – 2 years would be sufficient for the IGS reanalysis.

#### **New EOP series**

D. Gambis described the new C04 time series. Although there had been discussions in a validation group, questions were raised about how often the new series should be updated and how past values in the time series might be affected. W. Wooden indicated that the proposed procedure would be a major change in the concept of C04 as the “gold” or “true” standard. The Earth Orientation Centre and the Rapid Service/Prediction Centre should not overlap functions. New products can be developed but should not be given existing names. There was general agreement by the IERS DB that a detailed written document should be prepared before the new C04 is released for general use and that additional validation should be done to mitigate any concerns before the IERS “officially” adopts the new C04 system. Also, sufficient lead time should be given for testing before the transition occurs.

W. Wooden gave a review of the improvements by the Rapid Service/Prediction Centre. ILRS analysis results are incorporated on Thursday; combined ILRS results are regularly produced on Wednes-



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day. The Central Bureau should send out a message linked to the survey of prediction users planned by the Rapid Service/Prediction Centre in January 2007.

M. Rothacher proposed restarting the CPP (Combination Pilot Project) with the focus on producing rapid EOPs from technique service SINEX files. He proposed an informal meeting of the IERS Combination WG, IERS CPP and IERS CRCs on February 5, 2007 with the focus on combination of daily GPS rapid PM and VLBI intensive UT1.

#### **Report and discussion on the IERS Workshop on Global Geophysical Fluids**

T. van Dam reviewed the GGFC workshop held at the Grand Hyatt, San Francisco on December 5 and 6, 2006. Details (programme and presentations) are presented under <<http://www.iers.org/MainDisp.csl?pid=66-1100113>>. She noted various defects that have been found with GGFC data. ILRS offered to provide ongoing data for geo-centre variations and the University of Vienna is able to contribute its mapping function on a regular basis. The IERS Directing Board agreed that the GGFC chair will draft a plan for improving the GGFC data and in particular the SBL products to get more acceptance by the community.

#### **Proposal for an IERS Working Group on the Second ICRF**

R. Gaume presented the IERS / IVS Working Group on the Second Realisation of the ICRF and the corresponding IAU working group. The IERS Directing Board approved the IERS / IVS Working Group to be set up according the IERS rules. It was suggested that IAG should be involved in the approval of the next ICRF.

#### **Report of IERS Working Group on Site Co-location**

G. Johnston being excused, but he sent a report about the activity within the working group and the minutes of the latest working group meeting in Canberra on October 20, 2006.

#### **Report of the Conventions update process**

G. Petit presented the status of the ongoing update processes and stated that presently there is no agreement how to model core nutation. On September 20 and 21, 2007 the Conventions Centre will have a workshop at BIPM right after the Journées 2007 in Paris.

#### **Report on GGOS and GEO**

M. Rothacher gave a combined presentation about the activities in GGOS and GEO.

Important markers for GGOS are:

- Retreat in Oxnard, Ca., February 19 – 21, 2007,
- Session and meetings at the EGU in Vienna, Austria, April 15 – 20, 2007,
- Session and meetings at the IUGG in Perugia, Italy, July 2 – 11, 2007.

GEO activities are organised by the various committees, and the responsible IAG delegates will be invited. The 2007–2009 GEO work

plan includes task AR-07-03 "Global Geodetic Reference Frames". The next GEO summit will be held in Capetown, South Africa in November 2007.

In December 2007 a "Unified Analysis Workshop" is proposed to bring together the analysis groups of the various space geodesy techniques and the ITRS combination centres to discuss in detail the impact and problems of each technique focusing on the ITRF. The IERS is willing to be sponsor and organiser of this workshop.

**Reports of the Unions  
(IAU/FAGS, IAG/IUGG)**

N. Capitaine as IAU and FAGS representative summarised the main activities, resolutions and results of the 26th IAU General Assembly, Prague, Czech Republic, August 14 – 25, 2006 and the plans for reorganization of FAGS.

C. Wilson drew the attention to the forthcoming election of the IAG executive committee which includes the officers, heads of the commissions and important for the IERS the representatives of the IAG services. The nomination committee will contact the IERS Central Bureau.

**Next IERS DB meeting**

The next IERS Directing Board meeting will be held before the EGU in Vienna, Austria on Sunday, April 15, 2007.

*Bernd Richter, Wolfgang R. Dick*