REPORT ON IERS DIRECTING BOARD MEETING No 15

Wednesday 10 May 1995, 9:00 - 11:00 and Friday 12 May 1995, 18:30 - 21:30 at Paris Observatory

Attendance:

J. Ray (representing W.E. Carter), M. Feissel (Secretary), W.G. Melbourne, B.E. Schutz, C. Veillet, P. Willis, Y. Yatskiv (Chairman), K. Yokoyama, E.F. Arias, C. Boucher, D.D. McCarthy, D. Salstein,

12 May only: B. Kolaczek, L. Morrison, J. Vondrak.

1. REPORT OF ACTIVITIES IN 1994

GPS (W.G. Melbourne)

During the past year the GPS technique for monitoring EOP and maintaining the ITRF has continued to rapidly expand its scope and improve its accuracy.

The Global Network under IGS auspices has substantially improved the global distribution of GPS tracking stations, particularly in the southern hemisphere coverage.

The International GPS Service for Geodynamics (IGS) continues to have broad support from the scientific community; the expanded global coverage and ground communications has resulted in substantive improvements in accuracy. Also, the scope of IGS products is expanding rapidly, such as the provision of IGS clock solutions, and these products are becoming widely accessed by both scientific and commercial users.

The daily repeatabilities of the IGS GPS ephemerides are now approaching 10 cm 3dRMS, which translates into 0.2–0.5 mas for EOP determinations.

Plate motion velocities from GPS now agree with VLBI/SLR-derived velocities at the 2–3mm/yr level.

Geocentre determinations with GPS agree with SLR determinations in the x and y components at the few millimeters level and better than 2 cm in the z component.

Future trends in IGS scope and products include the provision of GPS clock solutions for rapid high accuracy surveying, the use of IGS networks to monitor and map water vapor and ionospheric electrondensity distributions.

LLR (C. Veillet)

Two stations have been operational for Lunar Laser Ranging for 1994: MLRS, Texas, USA, and OCA, Grasse, France. As for 1993, MLRS improved its observational capabilities to track the retroreflectors, resulting in an impressive increase in the data rate. At OCA, the four-year upgrade plan will finish at the end of 1995, leading to a 3-mm overall accuracy of the system. Unfortunately, MLRS and OCA have been, for one more year, alone in a very reduced network. In spite of efforts developed at Orroral (Australia), no lunar returns have been identified yet. In Wettzell (Germany), a few echoes have been received, but the station is not operational for LLR. MLRO (Matera Laser Ranging Observatory) is under construction, and should be a satellite and lunar facility in service in 1977.

University of Texas LLR group provided the IERS rapid service with a weekly solution based on the data from MLRS and OCA. Four analysis centres provided IERS with UT1-UTC series: JPL and U. Texas in USA, Munich Techn. Un. in Germany and the Chinese group in Shanghai. In addition to the annual submission to the IERS, a review paper (*Science*, **265**, 482-490) celebrating the first 25 years of LLR permitted a large advertisement for LLR and its use in many fields of science. LLR combined with VLBI allowed a new determination of the extragalactic-planetary frame tie.

If the interest of the continuation of LLR for IERS is clear for the years to come, its funding was still a question in many places in May 1995. That is the case for MLRS, mainly devoted to satellite laser ranging, where the funding for the analysis is in danger, as it is also at JPL. The Wettzell LLR and SLR station should spend more time observing the Moon, and the efforts focused to LLR at Orroral should be more conclusive.

VLBI (Jim Ray)

During the previous year, geodetic VLBI operations began at: 22-m antenna in Simeiz, Crimea; 25-m antenna at Urumqi, China; new 20-m dish at Green Bank, WV, USA; new 20-m dish at Ny Alesund, Spitzbergen. In addition, a new 20-m dish is soon to be operational at Richmond, FL, USA and the 10-station VLBA array, which is used primarily for astronomical projects, has been declared operational. The IfAG transportable TIGO system continues being under development. Meanwhile, the MV-2 mobile system and the old 9-m dish at Kokee Park, HI, USA have been decommissioned. Data quality has been consistently poor at both Kashima, Japan stations and at the Seshan 25-m antenna near Shanghai, China; so far, data have been essentially unusable from Urumqi.

Because of NASA funding cutbacks, routine VLBI data processing will soon end at the Haystack Correlator leaving only the Washington and Bonn Correlators to handle all Mark-3 data. Development of the Mark-4 data acquisition and correlators should continue unaffected.

Regular, weekly NEOS sessions continue with no problems although the Fairbanks station is now used only every other session rather than in all sessions. The daily Intensive UT1 sessions also continue with an improved data acquisition mode now being used to speed the processing.

Data analysis activities were ended at NOAA in early 1995 with the filing of a final annual report to the IERS. NEOS network operations were moved to USNO; no problems with EOP results have been noted due to these changes. NOAA continues to support NEOS data correlation and the operation of southern hemisphere stations, although the long term prospects for this funding are not good. As already mentioned, NASA funding for VLBI activities also continues to decline.

Extrapolating current trends, the viability of geodetic VLBI to support IERS functions may be threatened in the near future. Alternatives for continued access to UT1 measurements and the celestial reference system should be considered immediately, with particular emphasis on developing the potential of the VLBA.

DORIS (Pascal Willis)

Following the IERS call for participation, seven DORIS groups are now activitely participating in IERS. In 1994, the DORIS network has remained almost constant (49 well distributed permanent sites). The IERS/DORIS data issued from CNES/SOD (France) are now regularly distributed through two DORIS data centres : NASA/CDDIS (USA) and IGN (France). A survey has been performed to validate the operationality of the DORIS/IERS data dissemination to the IERS analysis centres. For the 1994 solutions, three DORIS solutions - (IGN (France), University Texas (USA) and GRGS/CNES (France) - have been submitted to the IERS Central Bureau for the Terrestrial Frame. Several major improvements are already foreseen for the future (multi-satellite approach, better tropospheric modelling, ...).

SLR (Bob Schutz)

Rapid service Earth rotation results for x, y, UT1 and LOD were computed weekly from Lageos by the Operational Centers: University of Texas Center for Space Research (USA) and Delft Technical University (The Netherlands). In both cases the Earth rotation parameters were computed using quick look data, which now consist of compressed data, or "normal points", computed at the station. Most sites transmit the quick look normal points routinely.

Current and past SLR data are archived at the NASA Crustal Dynamics Data Information System, NASA Goddard (contact Ms. Carey Noll) and at the EUROLAS Data Center, DGFI (contact Mr. Wolfgang Seemueller).

At the end of 1994, three sets of twin, spherical geodetic satellites were in orbit, all of which are covered with laser reflectors. The three twin sets are:

Starlette and Stella: approximate altitude is 700 to 1000 km,
Lageos-I and Lageos-II: altitude is approximately 5900 km,
Etalon-I and Etalon-II: altitude is approximately 19000 km.

The low altitude satellites (Starlette and Stella), as well as the Japanese satellite (Ajisai) have contributed to IERS, even though they are not currently used in regular Earth rotation studies. These satellites are used in the determination of the gravity field, which is an important component of SLR determination of Earth rotation parameters.

In addition to these geodetic satellites, SLR tracking is collected from two GPS satellites: GPS-35 (PRN-5) and GPS-36 (PRN-6). The SLR tracking provides an independent means of determining the accuracy of the GPS ephemerides, as well as enabling comparative studies of radiometric and SLR measurements.

In November 1994, the Tenth International Workshop on Laser Ranging Instrumentation was held in Canberra, Australia. Reports of new fixed stations under development were given, including designs of new portable systems. The Workshop reiterated the ongoing international collaboration and the continued network robustness. New developments in two color ranging were presented and Prof. Kurt Lambeck led a panel discussion on the future roles of laser ranging in support of Earth science. Proceedings on the meeting will be available in late 1995 and the next workshop will be held in October 1996 in Shanghai.

Central Bureau: ICRF (Felicitas Arias)

The 1994 realization of the IERS Celestial Reference System (ICRS) includes 531 radio sources (+5% relative to 1993), with 209 (+ 37%) considered as primary, i. e., with good observational history and precise position. The position uncertainties are derived from the agreement of coordinates in several individual Analysis Centres catalogues. In the 1994 realization, 239 sources had a position uncertainty smaller than 0.25 mas (+ 51%). The corresponding figures for the 1995 realization are respectively 608 sources, 236 primary, 244 sources with position uncertainty smaller than 0.25 mas. It should be noted that while the 1993 and the 1994 realizations included empirical corrections for regional deformations in declination, the 1995 one is based on rigid rotations only. The no-rotation condition from one realization to the next is now realized within ± 20μas.

The Hipparcos catalogue of star positions, proper motions and parallaxes will be published in the ICRS. The JPL ephemerides of the solar system bodies DE402 is also tied to the ICRS.

The Celestial Frame section of the Central Bureau participated activity in the IAU WG on Reference Frames (Chairman: L. Morrison). At its Grasse meeting in February 1995, the WG decided to recommend that IAU adopt the ICRS as the International Reference System, and to ask the IERS to take care of its future maintenance. We have started discussions with the other interested IERS centres about the future tasks and their distribution if the IERS responds positively to the IAU WG request. The Central Bureau is one of the four institutes represented in the sub-group that will derive the list of source coordinates for IAU and Hipparcos; the other institutes are JPL, GSFC, USNO.

Central Bureau: ITRF (Claude Boucher)

The Terrestrial Frame Section of the Central Bureau organized a two-day Workshop on ITRF immediately before the IERS Workshop. The ITRF Workshop was well attended by the Analysis Centres representatives and gave the opportunity of detailed discussion on several aspects of the implementation of the ITRF. Some improvements will be made for the 1995 computation, some others need further investigation. The discussions dealt with the following items.

- Improved method for combination: use of covariance matrix relative to the site positions and velocities - effective for ITRF94; minimum constrained vs. free solution; use of the SINEX-ISEF1 format.

- Definition of the ITRF datum: origin, scale, orientation and time evolution.

- Monitoring of the IERS Network: qualification of the stations and sites; design of the colocation sub-network; local surveys.

The Board agrees that these questions are important and should be studied further. The evolution of the combination method is a matter for the ongoing discussion between the Central Bureau, the Coordinators and the Analysis Centres. The Board recommends the setting up of a working group on the ITRF datum definition and of a Committee on IERS Network Design and Implementation (CINDI). Action: C. Boucher

The ITRF93 datum definition was such that the discrepancy with the IERS EOP was minimized. The Board recommends that the datum definition for ITRF94 go back to the earlier practice, with the origin to be defined by SLR, GPS and DORIS results, the scale by the same plus VLBI, the orientation by a no rotation condition at 1988.0, and the time evolution close to a No-Net-Rotation geophysical model.

The Board recommends that the ITRF be documented in more detail, keeping in mind that its increasing use entails less specialized users.

Central Bureau: Earth orientation (Martine Feissel)

The production and distribution of the four basic series of EOP was continued.

EOP(IERS) C 01 is in the form of normal values at 0.05 year intervals starting in 1846, with associated formal uncertainties. It is constructed in such a way that it is continuous at 1993.0 in level and first time derivative with the previously published IERS series of EOP (Annual Report, Bulletins A and B). It serves as a reference for the evaluation of systematic differences of the compared series. This solution is intended for long term studies. It provides the reference for the other EOP(IERS) series.

EOP(IERS) C 02 is in the form of normal values at 5-day intervals starting in 1962, with associated formal uncertainties. This solution is intended for geophysical investigations. EOP(IERS) C 03 is a series of one-day normal values of UT1-UTC and the duration of the day since 1984 and pole positions (terrestrial and celestial) since mid-1992, with some interruptions due to lack of data. This solution is intended for investigation of rapid variations. EOP(IERS) C 04 is a continuous series at daily intervals since 1962; the series is slightly low pass filtered, so that it can be linearly interpolated rightaway. This solution is permanently updated and can be obtained from the Central Bureau on request. It is fit to all applications where an accurate model of the Earth orientation irregularities is needed.

The series are mutually consistent within their stated uncertainties (better than 0.5 mas). The monthly Bulletin B is an operational version of EOP(IERS) C 04, based on the same data as Bulletin A. It is distributed by e-mail, ftp and airmail. The four basic series are available by ftp.

Sub-bureau for rapid service and predictions (Dennis D. McCarthy)

The data contributing to the compilation of Bulletin A are as follows. LAGEOS 3-day SLR, Delft 3-day SLR, NEOS daily VLBI, NEOS weekly VLBI, Texas LLR (CERGA), Texas LLR (MLRS2), JPL VLBI, GPS; the GPS data are a combination of polar motion data contributed to the IERS by organizations participating in the International GPS Service.

Table 1 shows a comparison between the IERS/CB Bulletin B values and the NEOS final values for 1994. It also shows the standard deviation of the differences between NEOS final values and the NEOS rapid service for 1994.

Table 1. MEAN AND STANDARD DEVIATION OF THE DIFFERENCE BETWEEN VARIOUS SOLUTIONS.

	NEOS final - Bulletin B		NEOS final - NEOS rapid	
	mean	std. deviation	mean	std. deviation
x	+0.00024"	0.00041"	+0.00000"	0.00081"
y	-0.00021"	0.00036"	-0.00031"	0.00074"
UT1-UTC	-0.000005s	0.000051s	-0.000003s	0.000145s

Table 2 shows the errors to be expected in the predictions based on data since 1990.

Table 2. ERRORS FOR DIFFERENT PREDICTION LENGTHS

Days in future	Terr. Pole 0.001"	UT1-UTC 0.001s	Celest. Pole 0.001"
10	3.8	1.5	0.3
40	10.9	6.6	0.3
90	18.2	11.4	0.3

Predictions of UT1-TAI up to 2002 January 1 can also be provided by the Sub-bureau.

The data described above are available from the Sub-bureau in a number of forms. You may request a weekly machine readable version of the IERS Bulletin A containing the current ninety days worth of predictions via electronic mail from ser7@maia.usno.navy.mil. Internet users can also direct an anonymous FTP to 192.5.41.22 or maia.usno.navy.mil, and access the ser7 directory where they can access the IERS Bulletin A or more complete databases. The NEOS Electronic Bulletin Board Service (NEOS BBS) offers 24-hour access via modem to current machine readable bulletins as well as copies of previous bulletins and databases. Also supported on this system is a mail feature to handle requests for specific data sets or additional information. The NEOS BBS accepts calls up to 9600 bps, 8 data bits, 1 stop bit, no parity at (202) 653-0597. World Wide Web access is now available at http://maia.usno.navy.mil/

AAM Sub-Bureau (David Salstein)

During 1994 the fifth full year of operation of the Sub-bureau for Atmospheric Angular Momentum, data sets were available from four meteorological centres. The atmospheric parameters, which are related to Earth rotation, were archived, distributed to scientists, and made available to the IERS. In addition, the Sub-bureau has been intercomparing the analysis data sets as well as assessing the skill of forecasts. A review of the operations and data sets is given by Salstein *et al.* (1993: *Bull. Amer. Meteorol. Soc.* **74**, 67-80). Also, during 1994, results from a special campaign, SEARCH'92, were described by Salstein and Kann (1994) and Salstein and Rosen (1994), during which atmospheric data sets had been collected on a higher frequency basis than heretofore, in conjunction with the geodetic sets of Earth rotation parameters that were being collected at the same time. A continuous measurements campaign (CONT'94) was held in January 1994. During 1994, some of the meteorological centres were preparing to reanalyze the state of the atmosphere over long periods up to several decades by making use of current assimilation systems. By the end of 1994, five years, 1985-1990, of the reanalyses have been performed (provisionally) for the United States National Meteorological Center, and five years (March 1985-February 1990) from the NASA Goddard Space Flight Center Laboratory for Atmospheres. Atmospheric Angular Momentum quantities from these centres have been computed by SBAAM personnel. More detail is available in the 1994 IERS Anual Report, Part III.

2. SUMMARY OF IERS WORKSHOP

The list of presentations is given in Annex. Some sessions are summarized hereafter.

Session on "future developments in atmospheric and oceanic data relevant to Earth rotation" (David Salstein)

This session had five presentations related to the current role that atmospheric angular momentum and ocean data play in research involving Earth rotation. Also featured was discussion of the ways in which future, improved, data could help in this pursuit. Among the topics discussed were the new analysis and modeling efforts to assess atmospheric and oceanic angular momentum. Also, elements of the regional distribution and of the specific time scales of the effective atmospheric functions and polar motion were included in the session. The oceanic excitation of annual and semi-annual polar motion, involving, in part, the use of Topex/Posiedon observations for sea level, was presented. Lastly, polar motion and the implications of related subseasonal instability of the atmosphere was discussed. Some of the related discussion involved the comparisons between different atmospheric sets, the level of agreement between atmosphere and Earth in the momentum buget and the probable role of the oceans in this regard.

Motions of the geocentre (Richard Eanes)

Accurate observations of targets whose motion is constrained by orbital dynamics provides a means of monitoring the motion of tracking stations with respect to the centre of mass of the entire Earth. Thus, such observations can be used to monitor the motion of the origin of the terrestrial reference frame with respect to the geocentre. There are secular, interannual, seasonal, intraseasonal, diurnal and semidiurnal components to the geocentre motion, and all of these can be studied using SLR, DORIS and GPS.

For the satellite techniques contributing to the IERS (SLR, GPS, DORIS) it is inconvenient to use an origin fixed by station positions attached to the solid Earth because this point moves with respect to the centre of mass of the solid earth+ocean+atmosphere and is therefore a poor choice of origin for dynamical equations. The motion of the TRF origin with respect to the entire Earth centre of mass is a consequence of mass transfer in the fluid components of the Earth and can be larger than 10 mm with the biggest contribution from ocean tides at diurnal and semidiurnal frequencies.

The degree 1 terms in the external potential of the entire Earth system are zero in a coordinate system whose origin coincides with the centre of mass of the planet. For any other origin, for example for the origin of the TRF, the degree 1 terms are not zero. As a consquence, there are two possible strategies that can be used for treatment of the geocentre motion. One can use the TRF origin for the integration of the dynamical equations of motion and account for the geocentre motion with temporal variations of the degree 1 Stokes coefficients and appropriate modification of the equations of motion to account for accelerations of this non-inertial point. Or one can use the centre of mass as the dynamical origin, use zero first degree Stokes coefficients and account for the geocentre motion as a kinematical translation of the origin of the TRF. The latter treatment is more convenient and is universally used.

Four papers were presented in the geocentre session and the topics included GPS results for long period geocentre motions, predictions of the size of geocentre motion expected from atmospheric pressure fields, long period motions derived from Lageos-1 and Lageos-2, diurnal and semidiurnal motions observed from Lageos-1 and comparisons of predictions to ocean tide models, and predictions of secular geocentre motions from several geophysical causes. The geocentre motions expected from atmospheric mass transfer were shown to be several mm in size and mostly seasonal and intraseasonal in character. Lageos results presented for 15-day geocentre position estimates had accuracies of 5, 5, 10 mm in x, y and z components. GPS results for a similar time interval have uncertainties of about twice these levels. Diurnal and semidiurnal geocentre motions deduced from Lageos tracking agree very well in z and show fair agreement in x and y. Difficulty separating the retrograde diurnal components of the equatorial geocentre motion was responsible for the degraded agreement in x and y.

IERS Standards (Dennis D. McCarthy)

Two sessions of the workshop were devoted to standards. After a brief overview of the plans for the 1995 revision of the standards by D. McCarthy to begin the first session, there were two presentations on geopotential models, one by E. Pavlis on the DMA/NASA/OSU model to degree and order 360, and the other by Richard Eanes on JGM3. Both promise similar results for IERS purposes but only the JGM3 will be available in time for the publication of the standards later this year. Both have ocean tide models included. These were followed by papers on tropospheric models, one by A. Niell and the other a review of a number of models by V. Mendes. Niell maintains that his model matches the radiosonde data better than the rest even though his model seems to lead to slightly worse VLBI results. Mendes showed that there was no clear choice of model for the standards. R. Peltier presented a paper on post-glacial rebound. He showed that the ICE-4G model is consistent with long-term polar motion as well as with estimates of the rate of change of J2. J. Ray presented T. vanDam's paper on atmospheric pressure loading. This causes vertical motions with a size of 25 mm peak-to-peak. Horizontal effects are also possible. Current models seem to improve results at inland mid-latitude sites, but for small networks this is not a problem. The problem in using these models is obtaining a reference "mean" pressure at each site. The paper proposed a pressure-loading service that would gather and maintain such data worldwide. H-G Scherneck reported on his latest ocean-loading efforts. Most new ocean tidal models are consistent with the Schwiderski models. He will make available his best estimates of site displacement due to ocean loading for the IERS Standards based on a combination of the Le Provost, Schwiderski, and his own Mediterranean Sea models for tides.

In the second standards session, D. McCarthy presented the proposed IERS precession/nutation model produced by T. Herring. V. Dehant followed with a report on recent work on a geophysical nutation model, cautioning users not to interpret the proposed IERS model as a geophysical model. C. Jacobs reported on M. Standish's work on DE 403 which will be tied to the IERS celestial reference system to better than two milliarcseconds. P. Wallace described the IAU working group on astronomical standards and M. Rothacher reported on standards needed for the International GPS Service. IERS Standards have been adequate

but new models may be needed for solar radiation pressure, antenna phase measures, and modeling of satellite attitude. C. Ma reported on the standards contained in the Calc 8 software. It contains the current IERS Standards models for relativity, solid Earth tides, tidal variations in the Earth's rotation, and "equation of equinoxes". He suggested further corrections to the Earth tides in the next version. V. Dehant described a new tide-generating potential containing 154 waves which will be available for the new standards. This model which is the expected product of an IAU/IUGG Working Group will include latitude and frequency dependent Love numbers.
J. Kovalevsky discussed the current IAU problem with the use of the Modified Julian Days (MJD). He suggested that the IAU Working Group on this subject consider asking the IUGG to request the IAU to rescind its latest recommendation on the subject in view of the usage of this term by the geodetic and geophysical communities. He also suggested that the IAU Working Group consider defining the MJD more specifically in terms of TT, TAI or UTC.

In the final discussion session led by J. Vondrak, participants managed to establish agreement on some of the new models for the IERS standards. The JGM3 geopotential will be adopted and the Lanyi atmosphere model will be continued. It was agreed that it was too early to adopt a standard model for the motion of the geocentre, and that we should consider adding a model for the thermal expansion of VLBI antennas and GPS stations. Discussion on the possibility of implementing a standard model for atmospheric pressure loading was indecisive. There was also considerable discussion without any resolution on the time evolution of the IERS terrestrial reference frame.

Review of the Workshop

The 1995 Workshop attracted about 100 participants (list given in annex), a large increase compared to the usual 60-70 of the previous years - except 1994, when it was joint with the IGS (150 participants). The general impression of the Board can be summarized as "lack of space, lack of time" to discuss, in appropriate depth, the many topics that are critical for the continued progress of the Service. The 1996 vintage should be improved in this respect.

3. DECISIONS AND RECOMMENDATIONS

VLBI contribution to IERS

The Directing Board decides to accept the request of the IAU Working Group on Reference Frames, that the IERS would maintain the realization of the International Celestial Reference System (ICRS) on the basis of VLBI observations of extragalactic objects beginning in 1997. This activity in an extension of the work on reference systems carried out by the IERS since 1988.

On the other hand, the Board is informed that NOAA, which is currently the VLBI Coordinating Centre, is willing to be relieved of this responsability as soon as another organization can be selected.

The Board will issue a Call for Proposals of VLBI participation in IERS for the maintenance of the celestial and terrestrial reference frames and the monitoring of Earth's rotation This Call for Proposals will redefine the VLBI contributions to IERS in this new context. It will ask for confirmation of present participations and applications for new activities. The deadline for responses will be 31 January 1996. The Board will review the proposals and make the selection at its 1996 spring meeting.

IERS Terrestrial Reference Frame

The Board decides to set up a working group on the ITRF datum and a committee for the monitoring of the IERS network. It makes recommendations for the ITRF94 datum and on the documentation of the ITRF (see p. 4).

4. ORGANISATION MATTERS

World data centre on Earth rotation

USNO, currently the WDC-A for Earth rotation, proposes that this function be transferred to the IERS Central Bureau. The latter accepts the transfer, with the agreement of the Board.

IERS Brochure, IERS Strategy

The IERS brochure, "Missions and goals for 2000" is available. It will be distributed widely by the Central Bureau.

The Board decides that an attempt will be made to prepare in addition a statement on the complementary use of techniques for the IERS missions, to be discussed at the next meeting (July 1995).

IERS publications

The IERS Conventions (1995) will be finalized after the IUGG XXI General Assembly. They will be published as IERS Technical Note No 21.

The 1994 IERS Annual Report will be distributed in July 1995. The two associated Technical Notes will be distributed in October 1995. For the 1995 isues, the technical description requested from the Analysis Centres submitting solutions will be extended to more detailed information. Action: the Central Bureau in cooperation with the Coordinating Centres.

Next meeting

July 1995 in Boulder Co (USA), during the XXI IUGG General Assembly.

Annex

1995 IERS WORKSHOP
Paris Observatory, 1995 May 10-12
Program

Wednesday 10 May

14:00 - 14:30 First discussion on the IERS Missions and Goals for 2000 Convener: Y. Yatskiv

Present status of IERS
Present status and plans of participating countries

14:30 - 15:30 Future developments in atmospheric, oceanic and other geophysical data of relevance to the Earth's rotation Convener: D. Salstein

Reanalysis and modeling efforts to assess atmospheric and oceanic angular momentum (Oral) *D. Salstein, R. Ponte, and R. Rosen*

Spectral analysis of short periodic variations of the regional EAAM function (Oral) *J. Nastula*

Oceanic excitation of annual and semi-annual polar motion (Oral) *R.Abarca and A.Cazenave*

Polar motion and atmospheric subseasonal instability (Poster) *D. Gambis and M. Feissel*

Comparison between the EOP and the results of atmospheric excitation in different frequency domains (Poster)*Jin Wenjing*

Technical announcement *M. Feissel*

16:00 - 17:25 IERS Standards Convener: D. McCarthy

1995 IERS Standards *D. McCarthy*

Geopotential *E. Pavlis*

Geopotential models and the IERS *B. Schutz*

Tropospheric model *A. Niell*

Tropospheric model *V. Mendes*

Post-glacial rebound *R. Peltier*

The status of determining atmospheric pressure loading effects on geodetic measurements (+ Poster) *T. vanDam/J. Ray*

Comparing loading effects due to recent ocean tide models *H.-G. Scherneck*

Thursday 11 May

9:00 - 10:30 Meeting by technique ***Conveners: The Technique Coordinators***

VLBI: J. Ray
Evaluating errors in VLBI data
C.S. Jacobs, O.J. Sovers, C.J. Naudet, and G.E. Lanyi

LLR: C. Veillet
Reports by analysis centres: CERGA, FSG, JPL, UTXMO

GPS: B. Melbourne

SLR: B. Schutz
The comparison between the EOP determination results on the basis of the combined Etalon and Lageos SLR data and Lageos data only
V. Glotov

DORIS: P. Willis
- Reports by groups:
  Data centre (CDDIS). Analysis centres (CSR, TUDelft, IGN)
- Answers to DORIS data questionnaire (CDDIS, CSR, TUDelft, IGN)
- General problems (standards, ...)

11:00 - 11:45 Motion of the geocentre ***Convener: R. Eanes***

Observing Geocentre Motions with SLR and GPS
M. Watkins, M. Heflin, R. Gross

Motions of the origin of the TRF *E. Pavlis*

Subdiurnal and Long Period Geocentre Motions from SLR
R. Eanes, S. Kar, S. Bettadpur

Some Theoretic Studies of the Possible Displacements of the Mass Centre of the Earth
Yu. Barkin (Poster)

11:45- 12:30 Poster presentation ***Convener: D. Gambis***

Global solution of the EOP from optical astrometry in 1900-1990. Analysis of residuals
C. Ron

Estimating, Combining, Filtering and Forecasting of EOP by Least-Squares Collocation Technique
Vadim S.Gubanov, Sergei D.Petrov, Yurij L.Rusinov and Oleg.A.Titov

MLRS LLR UT0 Results: Beginning the 2nd Quarter Century
Peter Shelus

Planning EOP determinations in Russian Deep Space Net
G.A. Krasinsky

Combination of polar motion series determined by individual IGS analysis centres using the variance component estimation *J. Hefty*

On disagreements between EOP high-frequency fluctuations in the various GPS series
E. Eisop and D. Gambis

Periodical seasonal crustal deformation as a possible line of research in the Earth rotation *L. Sinenko, L. Yunoshev, N. Kolosnitsyn*

Polar Motion derived from DORIS technique
P. Willis, E. Eisop and D. Gambis

Determination of short-term variations of the Earth's axis of rotation by VLBI data analysis
S. Bolotin, Ch. Bizouard, S. Loyer and N. Capitaine

Long period behaviour of polar motion deduced from the new homogeneous series
A. Brzezinski

Semiannual and subseasonal oscillations of Earth rotation parameters and atmospheric angular momentum with periods ranging from 20 to 150 days in 1978-1994 years
W.Kosek, B.Kolaczek

Interannual Length of day variations, and its geophysical excitations
R.Abarca, A.Cazenave, D.Gambis and D.Salstein

Structure and Astrophysics of Geodetic VLBI Sources
S. Britzen, A.-M. Gontier, A. Witzel, C. Schalinski, T. Krichbaum

The EOP (DUT) 95 L 01 Earth rotation solution
R. Noomen

14:00 - 15:00 Poster viewing ***Contact: N. Essaifi***

15:30 - 17:30 The IERS Terrestrial Reference System and Frame ***Convener: C. Boucher***

Summary of the ITRF Workshop *C. Boucher*

Status of the ITRF94 analysis *Z. Altamimi*

GPS velocities approach 1mm/yr *M. Heflin*

Rotation rates of terrestrial reference frames and rates in EOP series
M. Feissel

Friday 12 May

09:00 - 10:30 The IERS Celestial Reference System and Frame and the IAU
Convener: F. Arias

Status of the link of Hipparcos catalogue to the ICRS *J. Kovalevsky*

Hipparcos/VLBI link through VLBI observations of radio stars
J.-F. Lestrade

Hubble and tying the optical frame to the radio system: results for Hipparcos and future maintenance *P. Hemenway et al.*

Recent research on extra-galactic source apparent proper motions
T.M. Eubanks

A radio reference frame (Poster) *A. Fey*

Optical extragalactic link objects in IERS Celestial Reference Frame
A.-M. Gontier

A classification of extragalactic radio-sources based on their structures
P. Charlot

11:00 - 12:30	***IERS Standards***	***Convener: D. McCarthy***
	Nutation model	*T. Herring/ D. McCarthy*
	Geophysical nutation model	*V. Dehant*
	DE 402	*M. Standish/C. Jacobs*
	IAU Standards	*P. Wallace*
	IGS data processing and the IERS Standards	*M. Rothacher*
	IAG Standards	*D. McCarthy*
	Model predictions of short-period tidal variations in UT1 and polar motion	*R. Ray/C. Ma*
	Current calc/solves standards	*C. Ma*
	Tidal model	*V. Dehant*
	Use and precise definitions of JD and MJD	*J. Kovalevsky*
14:00 - 15:30	***IERS results: the coherent use of a mix of techniques***	***Convener: M. Feissel***
	Earth orientation in a preliminary Hipparcos reference frame	*J. Vondrak*
	The potential of a large laser gyroscope for earth-rotation monitoring	*U. Schreiber*
	Rapid variations of UT1-UTC determined by VLBI and GPS	*D. Gambis*
	The status of diurnal variations in the exchange of EOP	*J. Ray*
	A contribution of GPS to the determination of the celestial pole offsets	*R. Weber , G. Beutler, E. Brockman, M. Rothacher*
	Considerations in determining an optimal radio-source catalogue	*C. Ma*
	IERS plans for the maintenance of ICRS	*E.F. Arias*
16:00 - 17:30	***General discussion***	***Convener: J. Vondrak***

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