

IAU Division I Working Group
“Nomenclature for Fundamental Astronomy” (NFA)

Newsletter 2

Nicole Capitaine, 19 November 2003

1 Introduction

The present Newsletter of the Working Group “Nomenclature for Fundamental Astronomy” (NFA) provides the updated membership of the WG, information about terminology, educational and organizational issues and two draft questionnaires that are submitted to the WG for comments before being sent to the astronomical community and Almanac offices.

2 Updated Working Group membership

The membership of the WG NFA as provided in Newsletter 1 has been enlarged by including the two following additional members:

Veronique DEHANT (ROB, Belgique, Commission 19 President): *ex officio*
Chopo MA (GSFC, USA): *VLBI and IERS FAQs*

and the Commission 5 representative on the WG is in the process of being designated in place of Ray NORRIS.

This membership was approved by Division I Organizing Committee.

3 Information about terminology

A note by B. Guinot is provided at the end of this Newsletter (Annex 1) as a contribution to the discussion on the choice of “Celestial Intermediate Origin” instead of “Celestial Ephemeris Origin”. This Note reports on the past use of the “Conventional International Origin” for the terrestrial polar motion and makes suggestions for an adequate use of the acronym “CIO”.

Information on “Nomenclature Scheme for the telescope pointing chain of transformation” by P. Wallace about a nomenclature adopted for the purpose of program commenting and choosing variable names in software is provided in Annex 2. This can be helpful for terminology choices.

4 Educational effort

Two educational efforts to the scientific community regarding the resolutions deserve to be mentioned:

(i) The IERS now made available at: <http://www.iers.org/iers/earth/> a preliminary list of Frequently asked questions (FAQs) on the IAU 2000 resolutions that was prepared by Chopo Ma, with the help of members of this WG (B. Guinot, D.D. McCarthy, P. Wallace, N. Capitaine). There is also a glossary, references and a list of acronyms that is being enlarged and improved by W. Dick.

(ii) V. Dehant and O. de Viron are preparing at ROB a 3D representation to explain the new transformations involving the non-rotating origins, the CEO and TEO etc.. The provisional scheme of what they plan to show in the movie they are preparing is:

- the Earth rotation is not uniform,
- any point on Earth can be referred to two different reference systems, one tied to the Earth and one in space,
- we need a transformation to go from one reference system to the other. In this transformation, we want the diurnal rotation isolated,
 - how it was done previously,
 - why do we need a NRO and what is its motion,
 - how do we go from the TRF to CRF when using the NRO.

Any suggestions, or contributions regarding this project are welcome (contact: V. Dehant: v.dehant@oma.be and O. de Viron: o.devirion@oma.be).

5 NFA Questionnaires

Based on (i) the document “Draft of Nomenclature and Terminology for the IAU WG” by C. Hohenkerk (Annex 6 of Newsletter 1) and (ii) the preliminary list of questions about terminology provided in Newsletter 1, a questionnaire was prepared by C. Hohenkerk and discussed. It has eventually been split into two parts, Questionnaire NFA/A being intended to the astronomical community and Questionnaire NFA/B to Almanac Offices.

Draft of these questionnaires are submitted (attached to this Newsletter as PDF files) to the WG for comments and suggestions and answers from the WG are to be sent, with the deadline of 1 December 2003, to:

C. Hohenkerk: cyh@nao.rl.ac.uk and N. Capitaine: capitain@syrte@obspm.fr

The purpose of Questionnaire A is to provide information to the WG so that it can know the choice of the astronomical community among possible options regarding the terminology to implement and promulgate the IAU Resolutions, including those on nutation and the new origin.

The purpose of Questionnaire B is to provide information to the WG so that it can best help the Almanac Offices implement and promulgate the IAU Resolutions.

It is planned to send these WG questionnaires to the astronomical community (and post them on the WG webpage as well) for being filled with the deadline of 15 January. C. Hohenkerk agreed to be in charge of collecting the answers.

6 Proposal for Division Recommendations

D.D. McCarthy recently made a proposal for IAU Division I to suggest that the Division establish a procedure to adopt Division Recommendations at times other than at the General Assemblies. Such a procedure being of special interest for future acceptance of the results of the NFA Working Group, this proposal is appended to the present Newsletter (Annex 3).

2 November 2003

Bernard Guinot, Observatoire de Paris

Terrestrial Polar Origin

The potential ambiguity of the acronym CIO for both *Celestial Intermediate Origin* (on the equator of the CIP) and *Conventional International Origin* (for the terrestrial polar motion) invites to consider this latter, that I designate by CIO .

The concept of the CIO was introduced in 1967, following a suggestion of W. Markowitz, by IAU Symposium 32 (Markowitz and Guinot, 1968). The name and acronym were adopted by the IAU and the IUGG in 1967. The concept specifically applies to the International Latitude Service (ILS) established in 1900. A rigorous schedule of visual observations, by the elegant Horrebow-Talcott method, from a small number of stations on the same parallel, eliminated, in principle, the influence of errors in apparent star positions. Thus the results of the ILS were considered as an absolute reference for polar motion by some astronomers, in a system defined by constant values of the astronomical latitudes of observing stations. A specified set of values for 5 stations of the ILS defines the CIO. Let us reproduce the motivations as they appear in the Introduction of the Symposium 32 report.

The numerical values of the coordinates of the pole, x and y , which are obtained from a group of stations, depend upon the observed variations in latitude, which in turn depend upon the adopted initial latitudes of the stations. The successive Central Bureaus of the ILS have used different initial coordinates, in effect different origins - sometimes several, for different 6-year intervals. This introduced an element of confusion for geodesists, who wished to refer their observations to the same origin. At the Dublin meeting of the IAU, in 1955, it was recommended that observations for time be corrected for the motion of the pole, in a uniform manner. A Rapid Latitude Service to be conducted by the BIH was established. The polar motion deduced rapidly by the RLS was to be corrected systematically so as to agree with that obtained by the ILS, that is, the same origin would be used. This practice was not strictly followed; data were not obtained rapidly enough in the early stages. The origin used from 1949 to 1959 by G. Cecchini, the Director of the Central Bureau of the ILS, was called by him the "system of Wanach, 1900 - -05". In 1959 Cecchini adopted an origin called the "new system, 1900 - -05" and which is now designated the "mean pole of 1903.0". The fixed, initial latitudes which define this origin are given in Resolution No. 1 adopted at Stresa. This origin was retained when the Central Bureau of the ILS was moved to Mizusawa in January 1962 and the name was changed to Central Bureau of the IPMS.

Meanwhile, the origin used for the computation of $\Delta\lambda$ by the BIH was moved in the interval 1958.75 to 1958.95 to the so-called "mean pole of epoch", which approximates the moving center of the observed polar motion. Thus, different origins were used at different times, and not even the same one by the ILS/IPMS and the BIH. This situation caused difficulties in the reduction

of astronomical, geodetic, and satellite observations. Indeed, one could not be certain of the corrections to be used to refer observations to a single origin. Requests therefore arose for the adoption of a single, fixed origin to be used by both the BIH and IPMS.

The discussions at Stresa made clear the desire to adopt a fixed origin. One letter on this subject was received, from Mr. Bruce Lambert of the Division of National Mapping, Australia, who suggested adopting the pole of 1962.0. There were reasons, however, for adopting the pole of 1903.0. It is the one used by the IPMS; also, the Directing Board of the BIH, meeting in Paris on 18 March 1967, had adopted a recommendation that the BIH use the pole of 1903.0. The Stresa Symposium recommended adoption of this origin also.

Unfortunately, in the long history of the ILS (the ILS station were closed in 1984), changes in the number of the stations occurred, the establishment of observation schedules had lost its rigor. On the other hand, we may have doubts on the stability of the plumb lines to which observations were referred. For these reasons the accuracy of the coordinates of the pole was not as good as expected. Other drawbacks of the ILS pole coordinates were their low precision and the long delay of availability (exceeding one year, even for provisional results).

The delay was unacceptable by the Bureau International de l'Heure (BIH) for making UT1 available, so that the BIH began to compute its own set of pole coordinates in 1959. In 1967, the BIH adopted the CIO as pole reference, but this could be made only approximately, with uncertainties of several $0.01''$. At the same date, the BIH started to use an algorithm for simultaneous determination of polar motion and UT1, where terrestrial references were maintained statistically, assuming a global non-rotation of the verticals of numerous observation sites (about 80). Thus the BIH pole was not the CIO.

When the BIH began to use data of satellite techniques (1972), then of VLBI, these data were transformed into the BIH system in order to avoid discontinuities in polar motion and UT1. Later, the BIH system of terrestrial coordinates of sites was used by the IERS to orientate the International Terrestrial Reference Frame (ITRF).

Rigorously speaking, one cannot say that the polar origin of the ITRF is the CIO. The CIO is a concept attached to the former ILS. When the observations made in ILS stations are reprocessed in a uniform manner and a better rigour, in particular in order to study the drift of the pole, a new realisation of the CIO. is obtained; however, the current values of the coordinates of the pole are not shifted. The coordinates of the CIO, as defined by the astronomical latitudes of ILS, as well as the 1903.0 pole, are quantities to be experimentally determined and expressed in the ITRF. Let us remark, that, the estimated position of the CIO in 1967 approximately coincided with the mean pole of 1903.0. Recent evaluations of the position of the mean pole in 1903.0 show an offset with respect to the ITRF pole of more than $-0.1''$ in the X direction (IERS Annual Report 2002, p. 38 and EOPC01 series of the Earth Orientation Center of the IERS).

Suggestions

It would be a pity to lose the homogeneity of designations of various quantities in the Intermediate Terrestrial Frame. An ambiguity in the meaning of CIO can be easily avoided as follows:

1. The acronym CIO should not be used to designate the ITRF pole.
2. It does not seem to be necessary to have an acronym for “ITRF pole”.
3. When a short explanation on the choice of the IERS pole is needed; one can say that it coincides approximately ($+/- 0.1''$) with the mean position of the rotation pole at the beginning of the XXth century.
4. When needed in the specific context of the International Latitude Service, the Conventional International Origin could be designated by CIO in script.

Annex 3: Proposal for Division Recommendations

Dennis D. McCarthy, U. S. Naval Observatory

2 November 2003

I would like to suggest that Division 1 seek approval to establish a procedure to adopt Division Recommendations at times other than at the General Assemblies. Arguments in support of such a procedure follow.

1. The recommendations passed at the triennial General Assemblies are now being voted on by national representatives who are likely to have limited knowledge regarding the topics of concern to Division 1. As a result the recommendations will not have the same significance as past recommendations.
2. The recommendations concerning Division 1 are more likely to be accepted in actual practice if the membership of the Division is able to be involved in the voting.
3. Members can be informed and voting can be accomplished easily electronically.
4. Establishing such a process would eliminate the need to wait for up to three years to approve important recommendations. For example, we can expect that important recommendations regarding (a) the nomenclature for fundamental astronomy, (b) precession, and (c) the use of UT1 might need to be adopted sooner than 2006. The Division has established working groups for these topics. There is no need to wait for an extended period of time for Division approval if these groups have specific recommendations to make. It is clear from the discussion in Sydney that the nomenclature and precession recommendations could benefit the work of the almanacs as soon as they are prepared by the respective working groups
5. The proposed idea is consistent with recent attempts by the IAU Executive Committee to modernize the Union.

I recently discussed this idea with a few Division I members who expressed general support, and I believe that the work of Division 1 could benefit from the ability to adopt Division Recommendations at times other than at the General Assembly.