



Overview of the 100-year history of IAU Commission 19/A2

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Important dates

- **1919**, Brussels Conference
Standing Committee 19 on Latitude Variations
- **1922**, 1st IAU General Assembly, Rome
IAU Commission 19 "Variation of Latitude"
- **1964**, XIIth IAU General Assembly, Hamburg
IAU Commission 19 "Rotation of the Earth"
- **2015**, XXIXth IAU General Assembly, Honolulu
IAU Commission A2 "Rotation of the Earth"

Commission 19: To be renamed 'La Rotation de la Terre' (Rotation of the Earth) and to treat all matters concerning the astronomical determination of both universal time and latitude; Commission 31, which will retain its name of 'l'Heure' (Time), will treat the questions of the dissemination of time signals and the determination of Ephemeris time.

- International cooperation on the North parallel (39°08') (with the Geodetic Committee of the Geodetic and Geophysical Union).
- Support of the International Latitude Service operations (observing program; uniform algorithms and models for data reduction; funding).
- Establishing a central office for computation of the polar coordinates.

- Encourage and develop cooperation and collaboration in observation and theoretical studies of Earth orientation variations (the motions of the pole in the terrestrial and celestial reference systems and rotation about the pole).
- Serve the astronomical community by linking it to the official organizations that provide the International Reference Systems and Frames (ITRS/ITRF and ICRS/ICRF) and EOP: IAG, IERS, IVS, IGS, ILRS, IDS.
- Develop methods for improving the accuracy and understanding of Earth orientation variations and related reference systems/frames.
- Ensure agreement and continuity of the reference frames used for studying Earth orientation variations with other astronomical reference frames and their densification.
- Provide means of comparing observational and analysis methods and results to ensure accuracy of data and models and encourage the development of new observation techniques.

1922 - 1955

- Support of the ILS. Observations on the North parallel ($39^{\circ}08'$).
- Appointment of Joint IAU-IUGG Committee on latitude variations.
- Establishment of the Central Bureau on observation reduction and computation of the pole displacement (ILS CB).
- Computations of pole coordinates. Regular service. Operational service.
- Improvement of the positions and proper motions of the latitude stars (cooperation with fundamental astronomy).
- Improvement of the observing program and methods of data analysis, nutation model.
- Secular pole motion.

1961 - 1964

- Joint IUGG/IAU resolutions on reorganization of ILS into the International Polar Motion Service (IPMS), on detailed study of the local gravity field to investigate abnormal variations of the vertical, and other points related to latitude variations.

1967

- Recommend the Celestial International Origin (CIO) as the reference system for polar motion.

1973

- Organization of international networks of stations equipped with new observing techniques such as VLBI, LLR, and satellite navigation (Doppler) systems and evaluation of obtained results.

Models of precession-nutation

1963

- IAU established a WG to develop plans for a new system of astronomical constants.

1964

- IAU adopted a reference nutation model based on Woolard (1953).

1976

- IAU adopted a new system of astronomical constants associated with FK5, followed by precession model Lieske et al. (1977).

1979

- IAU 1979 Theory of Nutation; not adopted by IUGG.

1982

- IAU 1980 Theory of Nutation.

Models of precession-nutation

2000

- IAU 2000 precession-nutation model.

2006

- IAU adopted of the P03 precession theory and definition of the ecliptic.

Commission 19 was involved in development of the models of precession-nutation through its participation in the related IAU WGs and Symposia.

Time and time scales

1950s

- Several discussions and meetings (C19 and C31) devoted to input of the ILS to UT determination.

1955

- Introducing three UT time scales: UT0, UT1, UT2. C19 contributed to computation of UT1 through providing the pole coordinates (ILS).

1964

- C19 recommended "...that observatories participating in latitude observation shall publish as quickly as possible the detailed results of observations.
- C19 urges the BIH to complete a program of the homogeneous determination of the polar motion and UT from both time and latitude observations .

Time and time scales

1973

- IAU recommendation on the BIH functions (IAU C19, C31, 14th Conférence Générale des Poids et Mesures and in conjunction with the Bureau International des Poids et Mesures): establish TAI, implement UTC, ...

1979

- Dynamical times scales: Barycentric Dynamical Time (TDB), and Terrestrial Dynamical Time (TDT).
- New definition of UT1 through the relationship between GMST and UT1.

1985

- Responsibility of the IERS in respect to UT1 and leap seconds, and BIPM in respect to TAI.

1991

- Recommendations on the barycentric and geocentric space-time coordinates (metric, SI second, no rotation w.r.t. extragalactic sources, TCG, TCB, TT).

1994

- Definition of J2000.0 and Time Scales.

2000

- Re-definition of terrestrial time TT.
- Establishing WG to consider the redefinition of UTC.

2006

- Re-definition of Barycentric Dynamical Time (TDB).

From the beginning

- IUGG/IAG.

1964

- Homogeneous determination of the polar motion and UT from both UT and latitude observations in cooperation with BIH.

1970

- Project MERIT in cooperation with BIH.

1982

- MERIT main campaign (with BIH, in support of IAG resolutions).

1985

- Establishment in consultation with the IUGG a new International Earth Rotation Service within the Federation of Astronomical and Geophysical Services (FAGS) replacing both the IPMS and the BIH.

1988

- Intercommission resolution on Working Group on Reference Frames (WGRF) with continued cooperation with IAG, IUGG, and IERS.
- On IAU contribution to Federation of Astronomical and Geophysical Data Analysis Services (FAGS).

1991

- Creation of a permanent WG to develop, in cooperation with IAG and IERS, recommendations on best values of units and constants.

1994

- Joint WG of IAU and IUGG on the Non-Rigid Earth Nutation.

1997

- VLBI-based ICRS and ICRF as replacement of optical system FK5 (with IERS).

2000

- Recognizing IVS as a IAU service.

2003

- Cooperation of the IAU (Div 1 WGs, SOFA) with the IERS, and the almanac offices in various actions related to the IAU 2000 Resolutions on reference systems.

2009

- ICRF2 (with IERS, IVS)

2018

- ICRF3 (with IVS)

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- **CA2 OC includes representatives of IAG, IERS, and IVS.**
 - **IAU (through C19/A2) provides a representative to the IVS DB.**

Working Groups

IAU Commission 19/CA2 of (co-)organized or participated in many IAU and inter-union WGs:

- Joint IAU/IAG WG "Theory of Earth rotation and validation" (2015-2018)
- Joint IAU/IAG WG "Theory of Earth rotation" (2012-2015)
- IAU WG "Third Realization of ICRF" (2012-2018)
- IAU WG "Second realization of ICRF" (2003-2009)
- IAU WG "Numerical Standards of Fundamental Astronomy"
- IAU WG "Definition of Coordinated Universal Time" (2001-2006)
- IAU WG "Precession-nutation" (2000-2003)
- IAU WG "Reference Systems" (1997-2000)
- Joint IAU/IUGG WG "Nonrigid-Earth Nutation Theory" (1994-2000)
- ...

Most IAU resolutions mentioned above were based on the recommendations developed by these and other WGs

IAU Commission 19/CA2 (co-)organized many IAU (co-)sponsored scientific meetings:

- Journées "Systèmes de Référence et de la Rotation Terrestre" (2017).
- 23 Journées "Systèmes de référence spatio-temporels" (1988-2014).
- Joint Discussion 7 at the XXVIII IAU GA (2012).
- Joint Discussion 16 at the XXVI GA (2006).
- Joint Discussion 16 at the XXV IAU GA (2003).
- Joint Discussion 2 at the XXIV GA (2000).
- IAUC 180: Towards models and constants for sub-microarcsecond astrometry (2000).
- IAUC 178: Polar Motion: Historical and Scientific Problems (1999).
- IAUC 127: Reference Systems (1990).
- IAUS 141: Inertial Coordinate System on the Sky (1989).
- IAUC 56: Reference Coordinate Systems for Earth Dynamics (1980).
- IAUS 78: Nutation and the Earth's Rotation (1977).
- IAUC 26 On Reference Coordinate Systems for Earth Dynamics (1974).
- IAUS 48 Rotation of the Earth (1971).
- IAUS 13 The Future of the International Latitude Service (1960).
- IAUS 11 The Rotation of the Earth and Atomic Time Standards (1958).
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Conclusions

- IAU Commission 19/CA2 played and plays important role in IAU activity coordinating international cooperative efforts in improving our knowledge about the Earth's rotation, and establishing and maintaining the celestial and terrestrial reference frames.
- IAU Commission 19/CA2 initiated or supported many important resolutions related to the theory of precession-nutation, celestial and terrestrial reference system and frame, time scales and other topics of general scientific and practical interest.
- IAU Commission 19/CA2 works in close cooperation with other International organizations such as IUGG and IAG and thus provides link between these organizations and IAU.
- IAU Commission 19/CA2 was co-organizer and collaborator of several international services such as IERS, IDS, IGS, ILRS, IVS.
- IAU Commission 19/CA2 organized or co-organized many Working Groups including intercommission and interunion ones.

Telegram sent by IAU President Bertil Lindblad on January 30, 1951 to the Astronomical Council of the USSR

Particularly important for the further progress of astronomy are plans related to the variations of latitude, ...

Russian Astronomical J., Vol. 26, No. 3, p. 200 (1951)
(back translation from Russian)

Presentations at this meeting:

- Nicole CAPITAINE: the IAU Commission “Earth Rotation” and the IAU definition of the pole and UT1.
- Richard GROSS, A. BRZEZINSKI: The International Astronomical Union and Polar Motion.

A full paper devoted to the IAU C19/A2 history is under preparation; to be submitted later this year.

IAU Commission 19/A2 Presidents

1922 – 1935



H. Kimura

1936 – 1948



H. Spencer Jones

1948 – 1955



P. Sollenberger

1955 – 1961



E. Fedorov

1961 – 1967



B. Guinot

1967 – 1970



P. Melchior

1970 – 1973



H. Smith

1973 – 1976



C. Sugawa

1976 – 1979



R. Vicente

1979 – 1982



P. Pâquet

1982 – 1985



Y. Yatskiv

1985 – 1988



W. Klepczynski

1988 – 1991



M. Feissel

1991 – 1994



B. Kolaczek

1994 – 1997



J. Vondrák

1997 – 2000



D. McCarthy

2000 – 2003



N. Capitaine

2003 – 2006



V. Dehant

2006 – 2009



A. Brzeziński

2009 – 2012



H. Schuh

2012 – 2015



C. Huang

2015 – 2018



R. Gross

2018 – 2021



F. Seitz