

# The International Astronomical Union and Polar Motion (1919 – 1988)

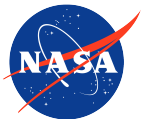
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Warsaw, Poland

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Astrometry, Earth Rotation and Reference Systems in the Gaia Era

October 7–9, 2019  
Paris, France



**Jet Propulsion Laboratory**  
California Institute of Technology

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# Leonhard Euler

(1707-1783)

Swiss mathematician

In 1765 published treatise  
*Theoria Motus Corporum  
Solidorum*

Predicted Earth  
should freely wobble  
as it rotates

Period of wobble:

$$\frac{A}{(C - A)} = 305 \text{ days}$$



# Seth Carlo Chandler, Jr.

(1846-1913)

American astronomer

In 1891 Chandler observed the free wobble of the Earth that was predicted in 1765 by Euler

Period of observed wobble:  
427 days

Later in 1891 Simon Newcomb explained difference between prediction and observation as due to “elasticity of the Earth” and “fluidity of the ocean”



*S. C. Chandler*

# International Latitude Service

Established in 1895

by the Internationale Erdmessung  
(International Geodetic Association)

Observations began in 1899

of common star pairs  
using visual zenith telescopes  
by stations located at  $39^{\circ} 8' \text{ N}$  latitude

Carloforte (Italy)

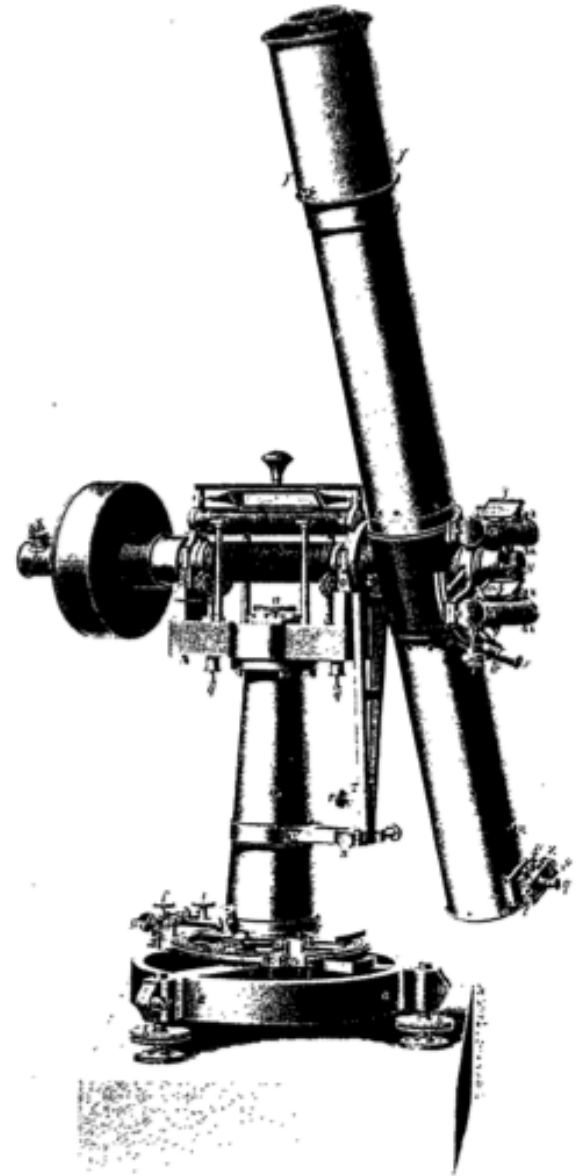
Gaithersburg (USA)

Mizusawa (Japan)

Ukiah (USA)

Cincinnati (USA)

Tschardjui (Russia)



Visual Zenith Telescope

# International Research Council

Established in July 1919

by representatives of National Academies

For the purpose

- to coordinate international efforts in the different branches of science and its applications
- to initiate the formation of international associations or unions deemed to be useful to progress of science
- to direct international scientific action in subjects which do not fall within the province of any existing association
- to enter into relations with the governments of the countries adhering to the Council to recommend the study of questions falling within the competence of the Council

Formed

International Union of Geodesy  
and Geophysics  
International Astronomical Union

. . .



Palais des Academies, Brussels

# IUGG and IAU

Both established in July 1919  
by the International Research Council

IAU established  
Standing Committee 19 on Latitude  
Variations

IGA had already established ILS  
Int'l Geodetic Assoc. (IGA) joined IUGG as  
Int'l Association of Geodesy (IAG)

Joint IUGG/IAU Commission on  
latitude variations established in  
1922

ILS became joint Service of IUGG & IAU  
ILS Central Bureau  
Int'l Latitude Observatory of Mizusawa  
H. Kimura, director



Hisashi Kimura

# Re-Reduction of ILS Observations

## WG on Pole Coordinates

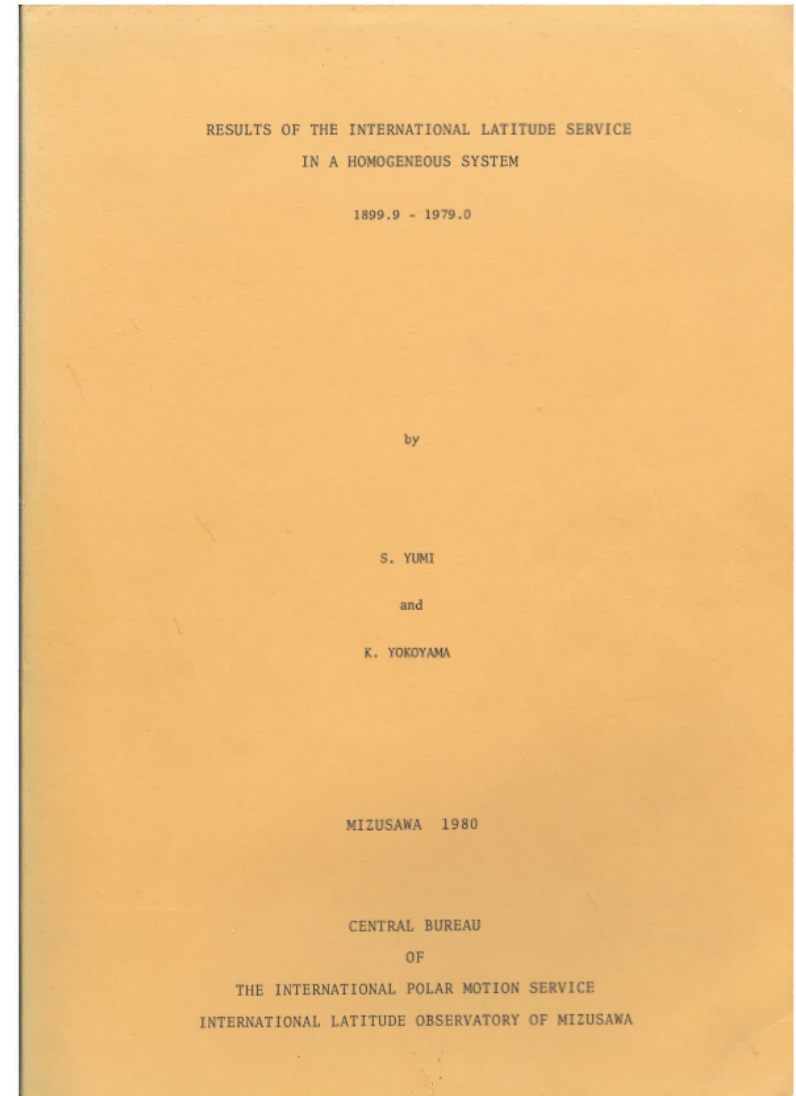
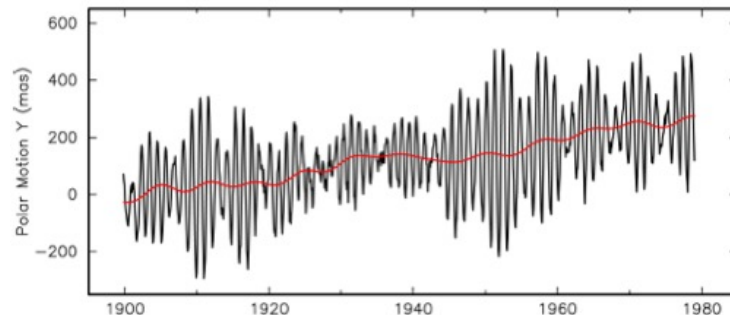
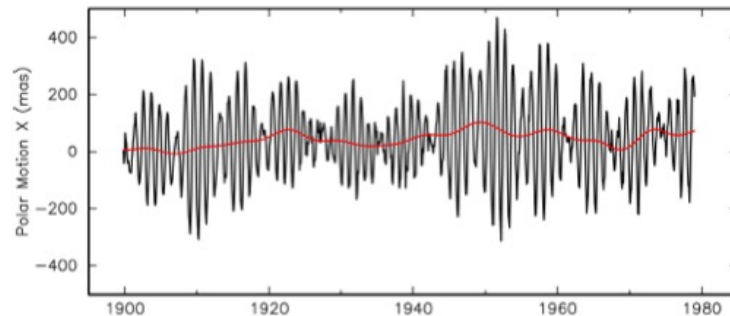
established in 1970 by IAU Commission 19

## For the purpose of

re-reducing ILS observations in a  
homogeneous system

## Resulting polar motion series

spans 1899.9–1979.0 at monthly intervals



# Re-Reduction in Hipparcos Frame

## WG on Earth Rotation in the Hipparcos Reference Frame

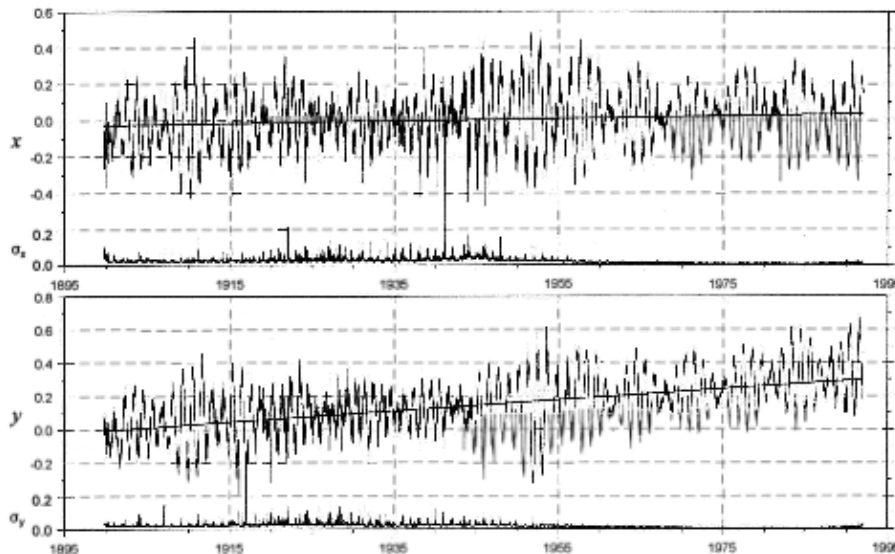
established in 1988 by IAU Commission 19

## For the purpose of

re-reducing optical astrometric  
observations in the Hipparcos reference  
frame

## Resulting polar motion series

spans 1899.7–1992.0 at 5-day intervals



Vondrák, et al. 1998



Jan Vondrák

# Service International Rapid

Established in 1955 upon recommendation of IAU

In order to reduce the delay in publishing UT1

Became an official part of BIH in 1962

# International Polar Motion Service

Established in 1962 by the IAU and IUGG to replace the ILS

In recognition

that many other stations located at many different latitudes are observing latitude variations using many different types of instruments

# Project MERIT

## Monitor Earth Rotation and Intercompare Techniques

### Established in 1978

upon recommendation by IAU Working Group "Determination of the Rotation of the Earth" chaired by George Wilkins

### For the purpose

of encouraging the development of new techniques, such as SLR and VLBI, for determining UT and polar motion

### Conducted "short campaign" in 1980

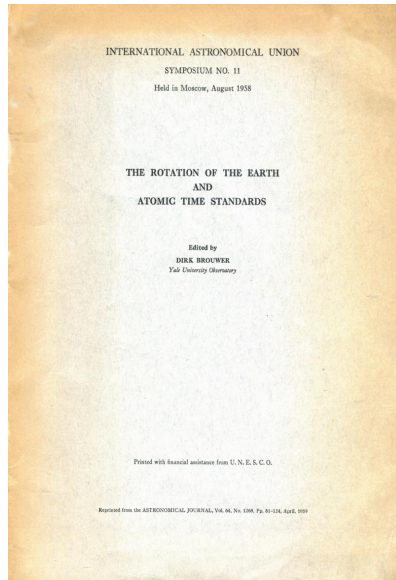
6 observing techniques participated (OA, DTS, SLR, LLR, CEI, VLBI)  
operational and analysis centers for each technique were established  
coordinating center at BIH established

### Conducted "main campaign" during 1983-84

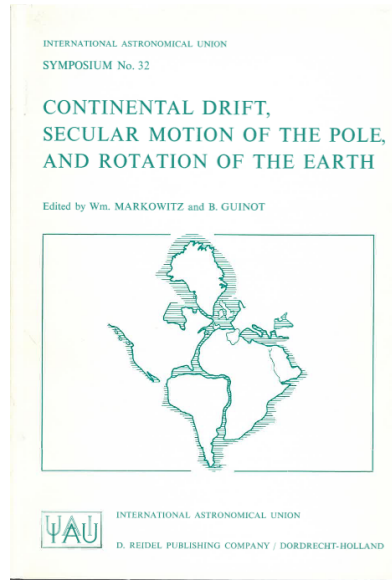
standards for reduction and analysis of data were adopted  
data distributed via electronic means  
results compared with atmospheric angular momentum  
special emphasis on improving terrestrial reference frame  
recognized importance of co-locating techniques, intensive observing campaigns

### Proposed establishing International Earth Rotation Service

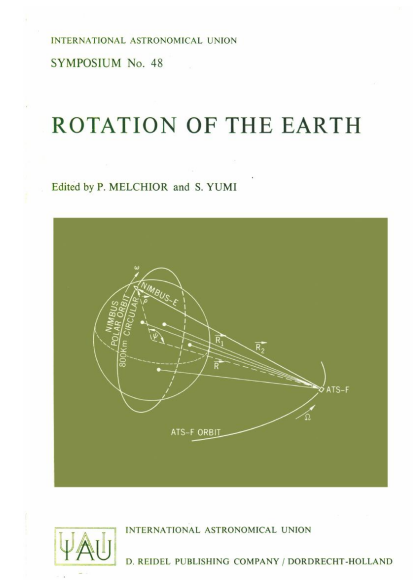
# IAU Symposia



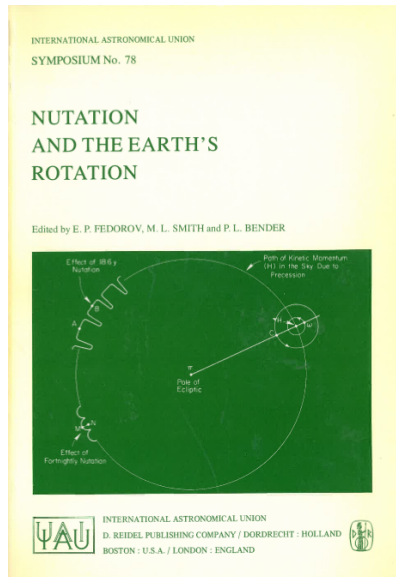
1958



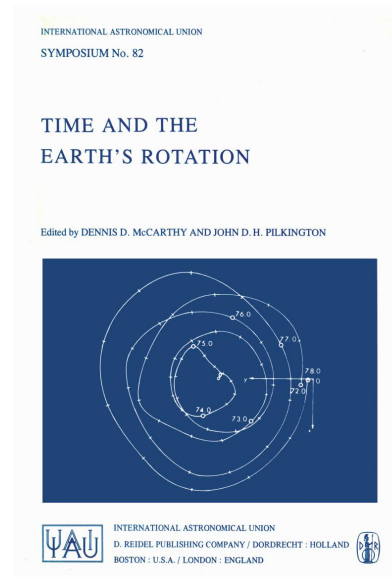
1967



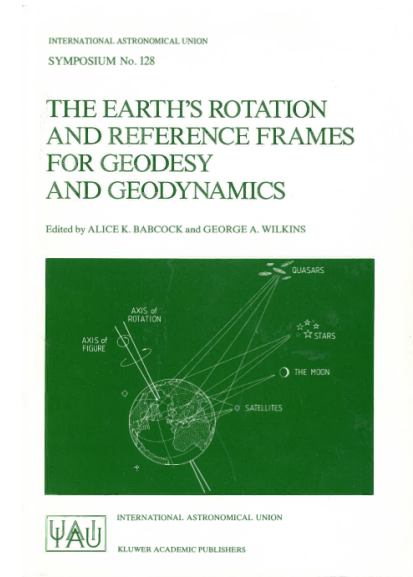
1971



1977

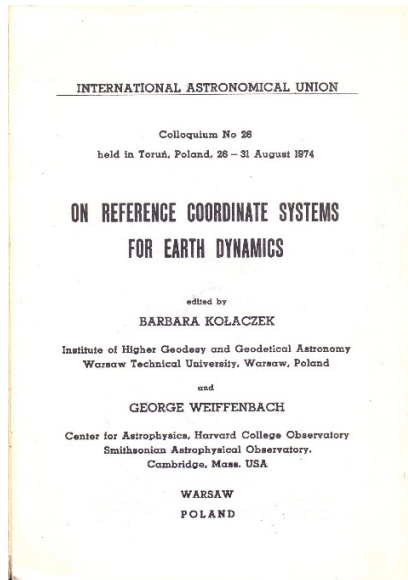


1978

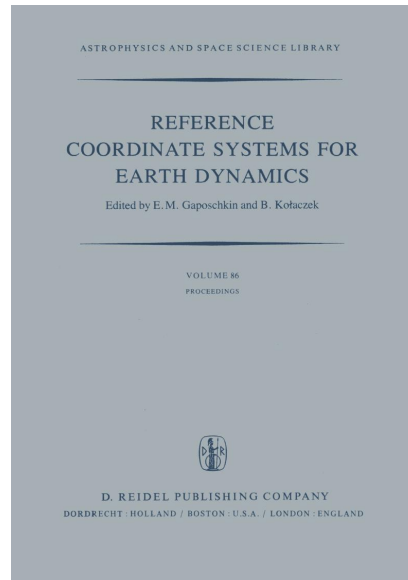


1986

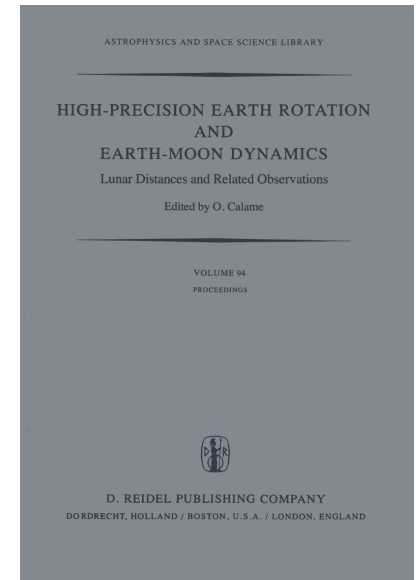
# IAU Colloquia



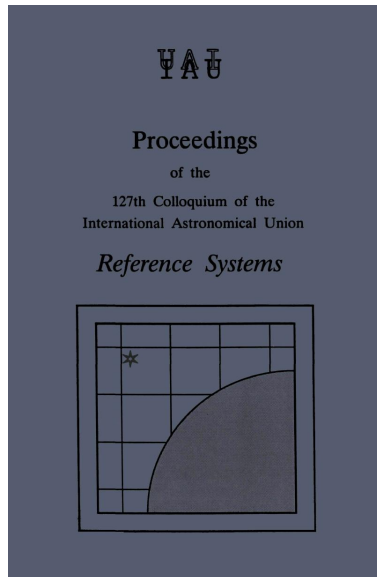
1974



1980

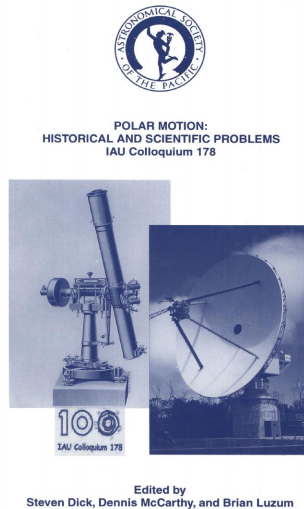


1981

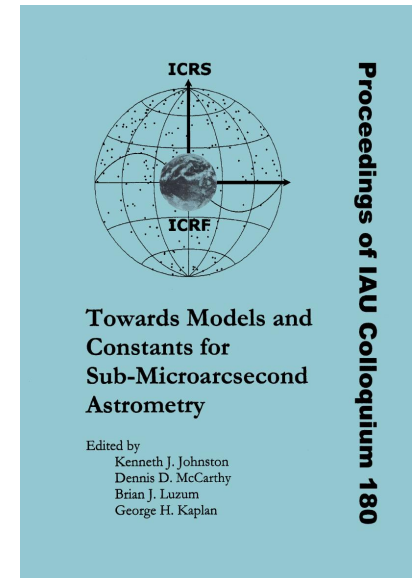


1990

Astronomical Society of the Pacific Conference Series Volume 208



1999



2000

# Summary

The IAU works with the IUGG & IAG to advance polar motion by

- establishing Services, Projects, and Working Groups
- organizing Symposia and Colloquia for scientific discourse
- adopting resolutions related to polar motion



If You Can't  
Measure It,  
You Can't  
Improve It

(William Thomson, Lord Kelvin)