

# **International Association of Geodesy** **(IAG)**

***2003-2007***

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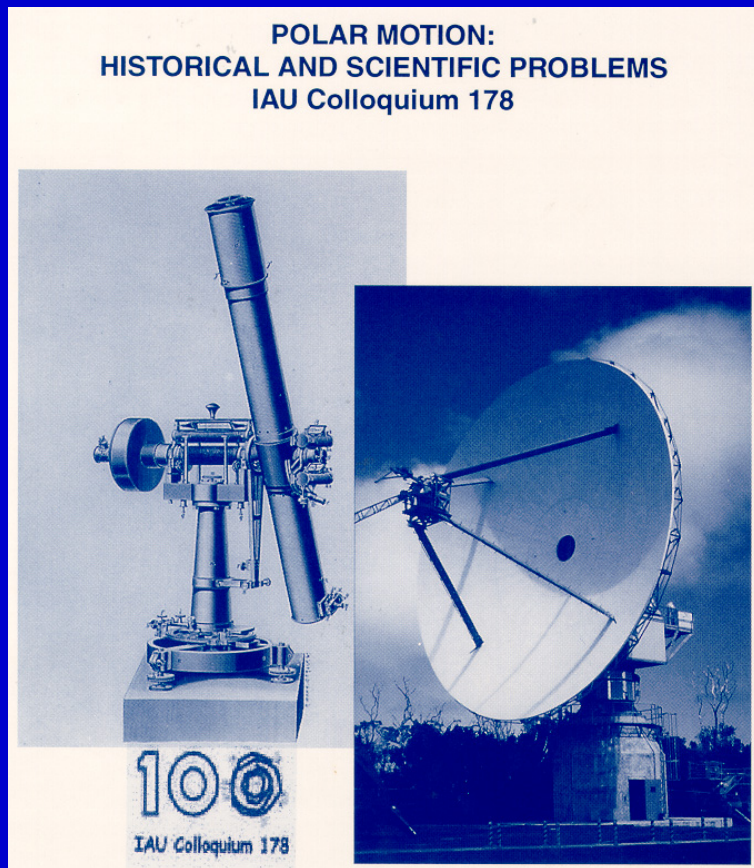
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# The Three Pillars of Geodesy

- Modern geodesy is based on
  - *geometry and kinematics,*
  - *Earth orientation and rotation,* and
  - *gravity field and its variability.*
- Polar motion, one aspect of Earth rotation, can-not be predicted accurately and therefore must be *continuously monitored.*
- The *gravity field* and the *terrestrial system* are not strictly stationary either. Therefore, *monitor-ing* is a central issue in geodesy.

# Motivation for a new IAG



- Geodesy went through a (r)evolution in the 2<sup>nd</sup> half of the 20<sup>th</sup> century:
  - space age & space geodesy
  - age of computers
  - new understanding of IAG services (IGS, IERS)
- IAG Structure in essence stable since 1951!

# Development of new IAG

- The new IAG Statutes and Bylaws were accepted at IAG Scientific Assembly in Budapest (September 2001).
- New elements:
  - four scientific Commissions
  - IAG Services on same level as Commissions
  - The IAG project IGGOS
  - IAG Outreach Branch
  - Inter-commission Committees, Individual membership

# The IAG Services

- Monitoring of global phenomena is a difficult task. In IAG such tasks are treated by *Services*.
- IAG is willing to establish a service, *provided*
  - there are clearly defined **products** and
  - an important **user community**.
- In IAG it makes sense to distinguish
  - geometry-related services
  - gravity-related services.

# The IAG Services in 2003

- *Geometry-related services*
  - PSMSL (1933), joint with IAPSO
  - Time section of BIPM (1988), Successor of BIH (1912),
  - IERS, Earth Rotation (1989), Successor of IPMS (1960), ILS (1899),
  - IGS, International GPS Service (1994),
  - ILRS, Intl. Laser Ranging Service (1998),
  - IVS, International VLBI Service (1999)
  - IDS, International DORIS Service (2003)

# The IAG Services in 2003

- *Gravity-related services*
  - ICET, Earth Tides (1956)
  - BGI, Bureau Gravimetrique (1951)
  - IGeS-1, Geoid Service (1991)
  - IGeS-2, Geoid Service (NIMA)
  - *not* the ILRS (!)
- Documentation is important, as well ...
  - IBS, Bibliographic Service (1889)
  - IIS, Information Service



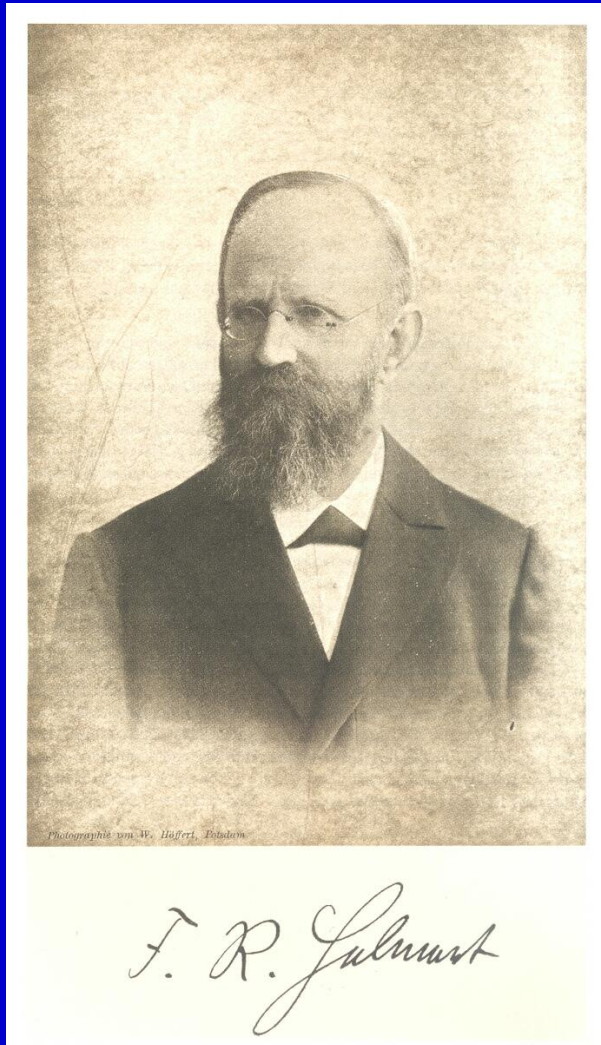
# Monitoring Earth Rotation

- Monitoring the Earth's rotation always was an *interdisciplinary* task, containing geodetic and astronomical aspects.
- It became more and more complex in the 20th century -- atmosphere sciences and oceanography had to be included, as well.
- The task was initially handled by the *ILS*, then by the *IPMS*, and eventually by the *IERS*.

# ILS, IPMS, IERS: A Case Study

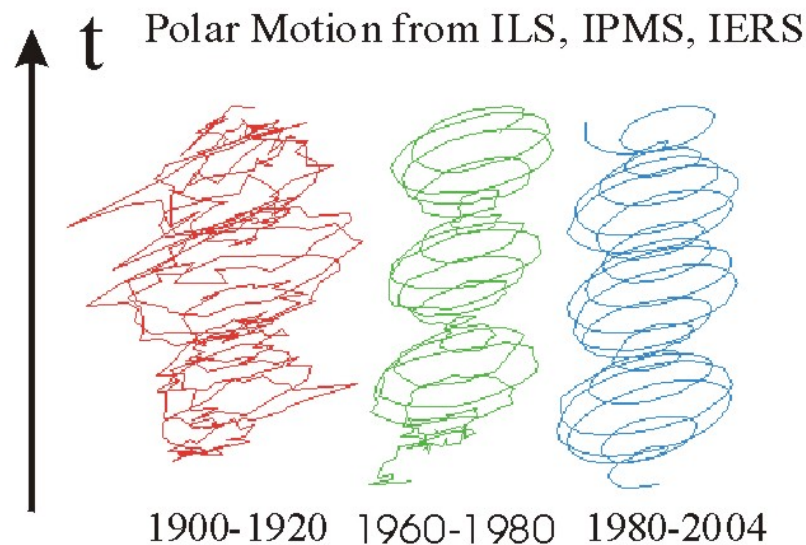
- The ILS was founded in 1899 as a service of IAG to monitor polar motion
  - using the astrometric observation technique
  - to determine latitude variations
  - of a network of six observatories at a Northern latitude of about  $39^\circ$ .
- The celestial system was given by the fundamental catalogs, the (mean) site coordinates by geodesy.

# ILS, IPMS, IERS: A Case Study



- The IAG Central Bureau was initially located at the Geodetic Institute of Potsdam.
- F.R. Helmert was the first Director of the IAG-CB.
- The Institute also acted as CB for the ILS with *C.T. Albrecht* as head.

# ILS, IPMS, IERS: A Case Study

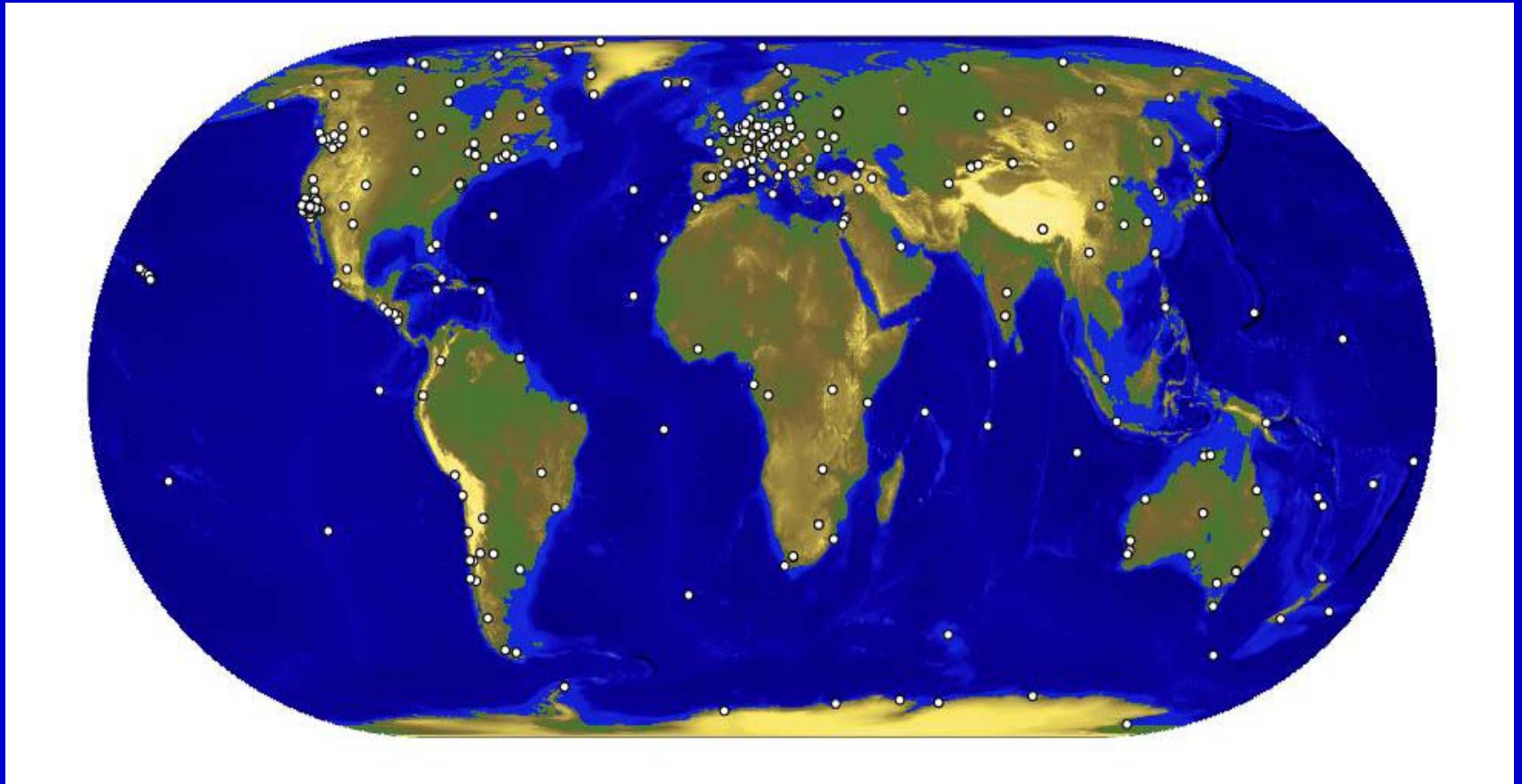


- The ILS (left) was capable of monitoring PM with about 100mas.
- The IPMS (center) did the same (with the same methods) with an accuracy of few 10mas.
- The IERS does the same with  $< 0.1$  mas accuracy.

# The IGS: A Case Study

- The *International GPS Service* IGS, developed 1989-1993, established in 1994, produces
  - GPS orbits of few cm-accuracy,
  - Clock corrections,
  - Dense global reference frame (sub-cm, -mm/y),
  - Earth Rotation Parameters (PM, lod),
  - Global ionosphere models,
  - Valuable tropospheric information,
  - ...
- and develops into a general *GNSS Service*.

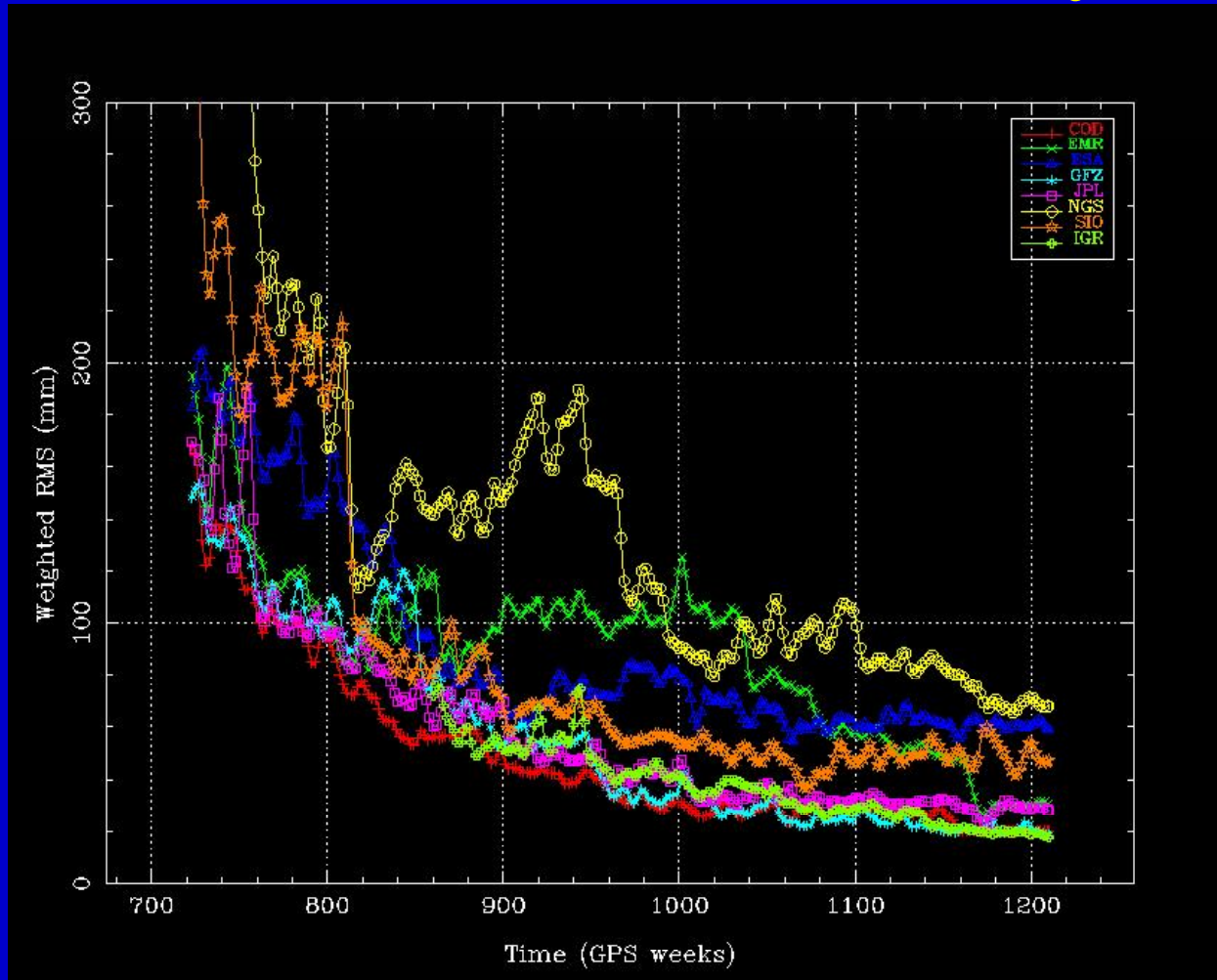
# The IGS: A Case Study



- The IGS Tracking Network in 2003

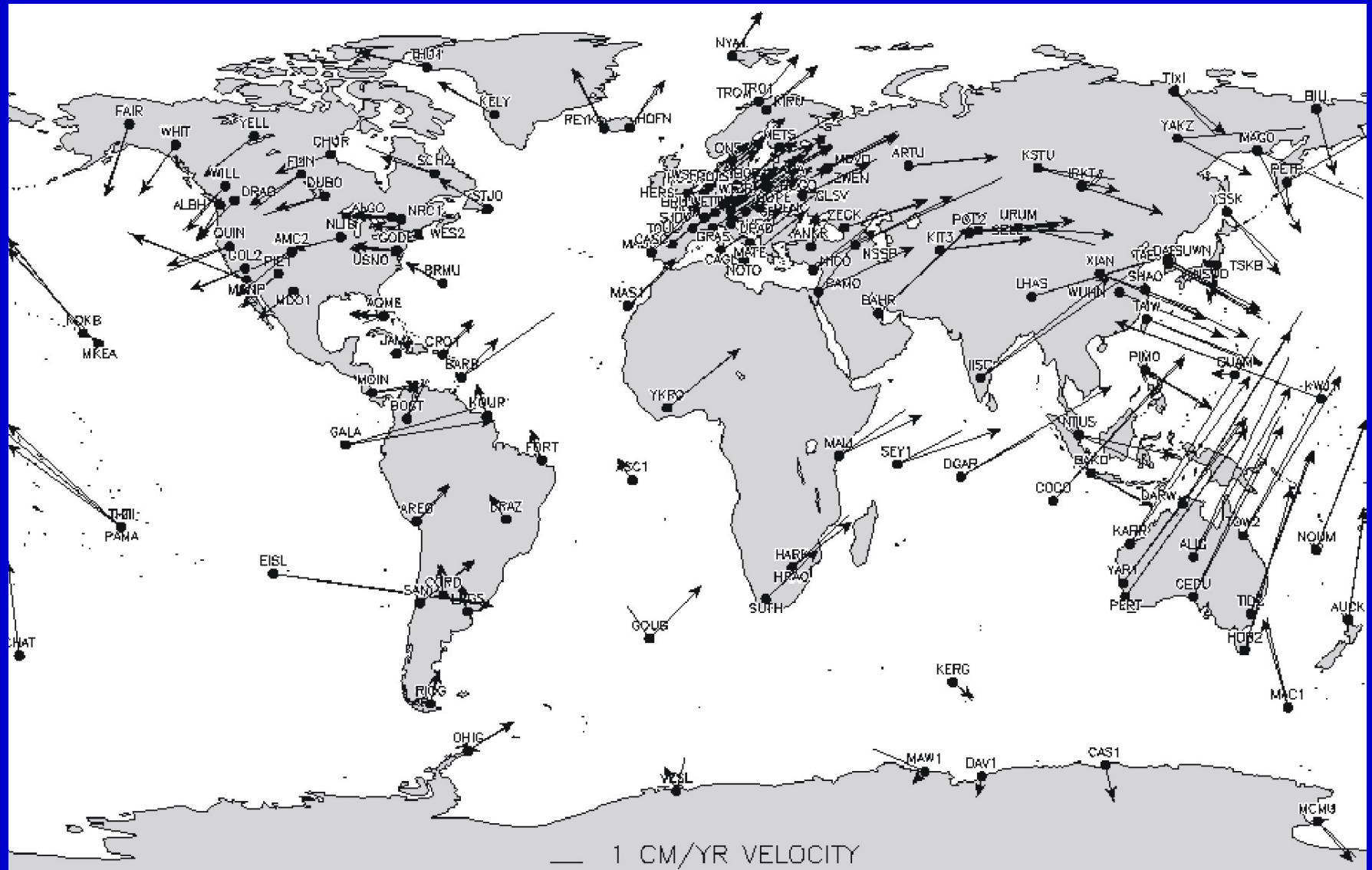


# IGS GPS Orbit Quality



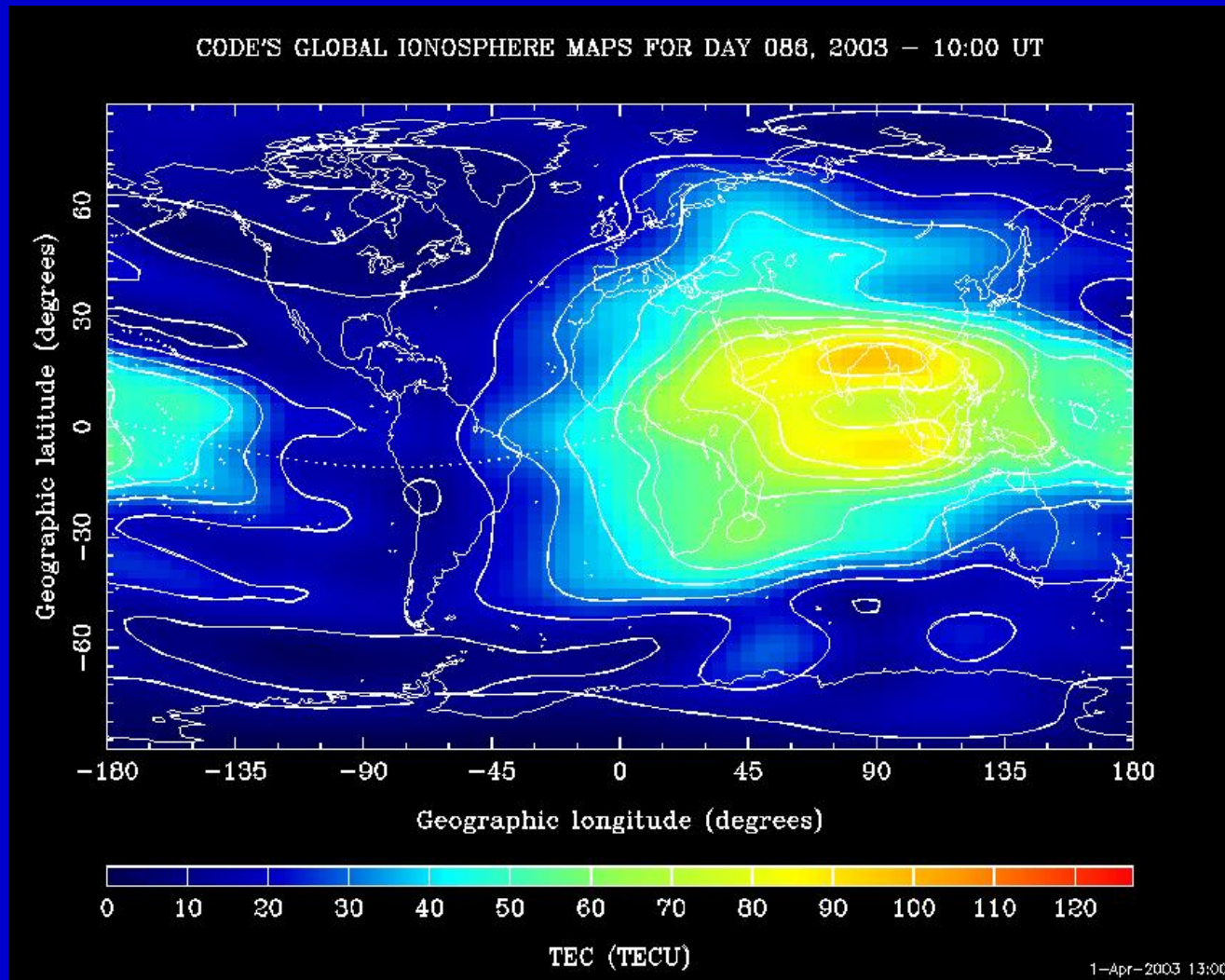
- GPS Orbit Quality w.r.t. official product

# IGS Coordinates & Velocities





# The IGS: A Case Study



- IGS Ionosphere Maps available since 1995

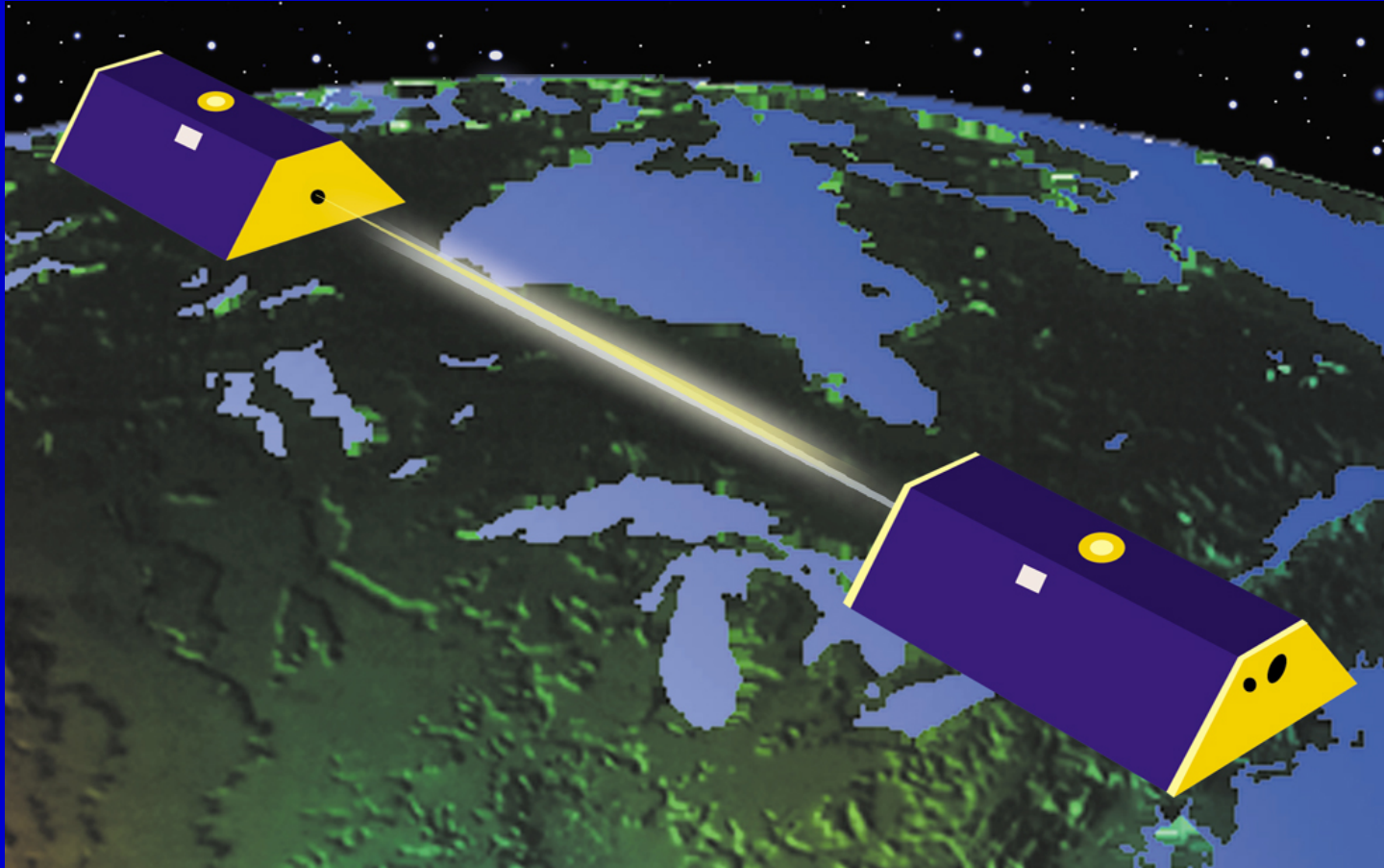
# Future of the Services

- The services will continue to play a decisive role within IAG.
- The challenge of the near future is the achievement of the  $10^{-9}$  consistency of geometry and gravity (including of course Earth rotation).
- The IGGOS, the new IAG's first Project, should *achieve this goal with the services!*

# IGGOS Definition

- *IGGOS* stands for *Integrated Global Geodetic Observing System*.
- *IGGOS* monitors the Earth system as a whole through the IAG Services.
- *IGGOS* is based on the 3 pillars of geodesy
  - *geometry and kinematics,*
  - *Earth orientation and rotation, and*
  - *gravity field and its variability*

# IGGOS: Motivation from Development of Space Technology



- Missions CHAMP, GRACE (above), GOCE mark beginning of a new era for gravity field determination

# IGGOS Vision

- IGGOS provides geodesy's contribution to Earth sciences.
- IGGOS integrates the work of IAG and is the bridge to the other geosciences.
- IGGOS is IAG's flagship.

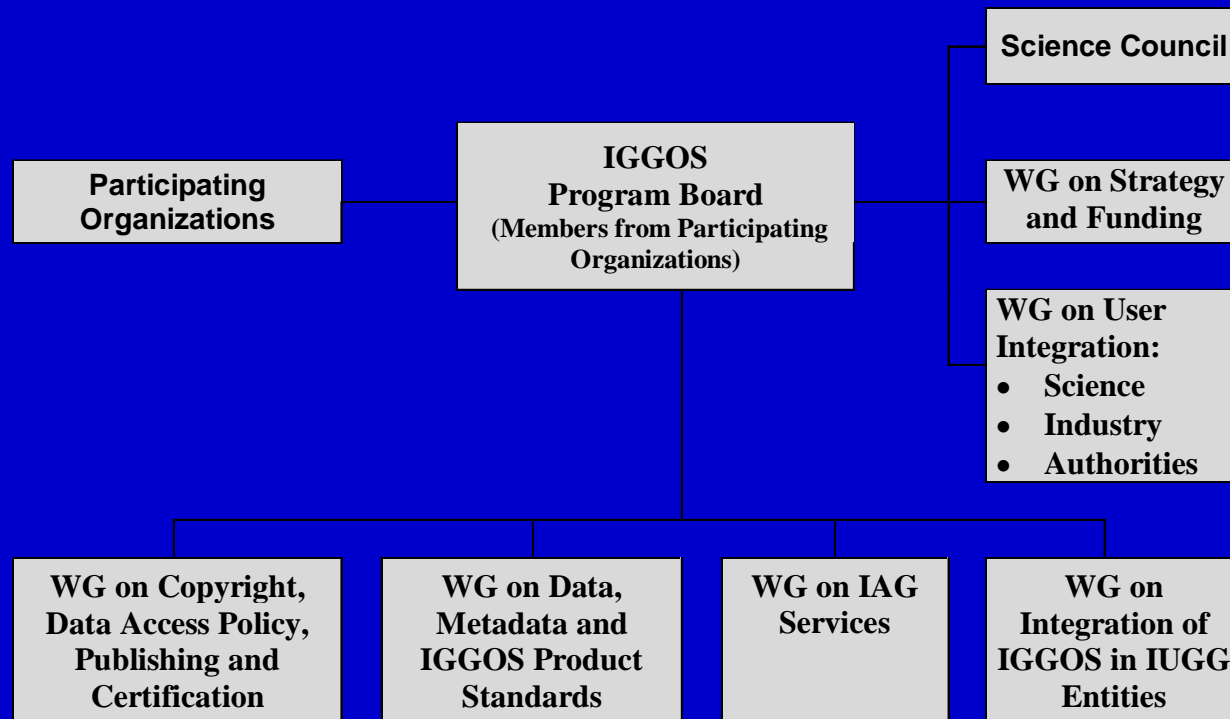
# Initial IGGOS Structure

- These *general principles* are observed:
  - IGGOS is based on the existing IAG Services.
  - IGGOS is *not* taking over tasks of the well working IAG services.
  - New IGGOS entities will be established only if there is a stringent requirement.

# Initial IGGOS Structure

- *Key elements* of the initial IGGOS structure:
  - *IGGOS Program Board* as the central oversight entity.
  - *Working Groups* with tasks independent of those of the IAG services.
  - *Science Council* representing the geodetic community.

# Initial IGGOS Structure





# IGGOS Schedule 2003-2005

- IGGOS Definition Phase 2003-2005
  - Define structure of the “final” IGGOS Project.
  - Develop IGGOS Science Plan.
- Prof. Chris Reigber is presiding the IGGOS Project for definition phase 2003-2005.
- Review of IGGOS Project by IAG EC at IAG Scientific Assembly 2005.
- Start of IGGOS Project on October 1, 2005.