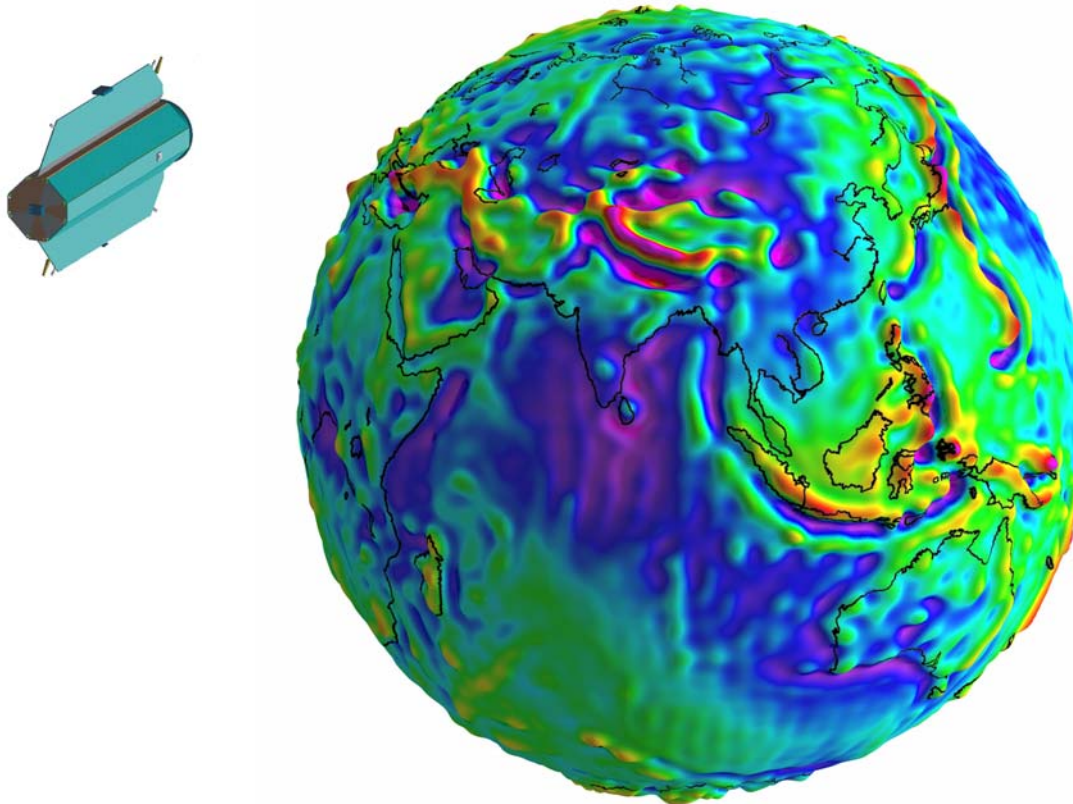


THE GOCE HIGH LEVEL PROCESSING FACILITY (HPF)

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² Space Research Organisation Netherlands (SRON)

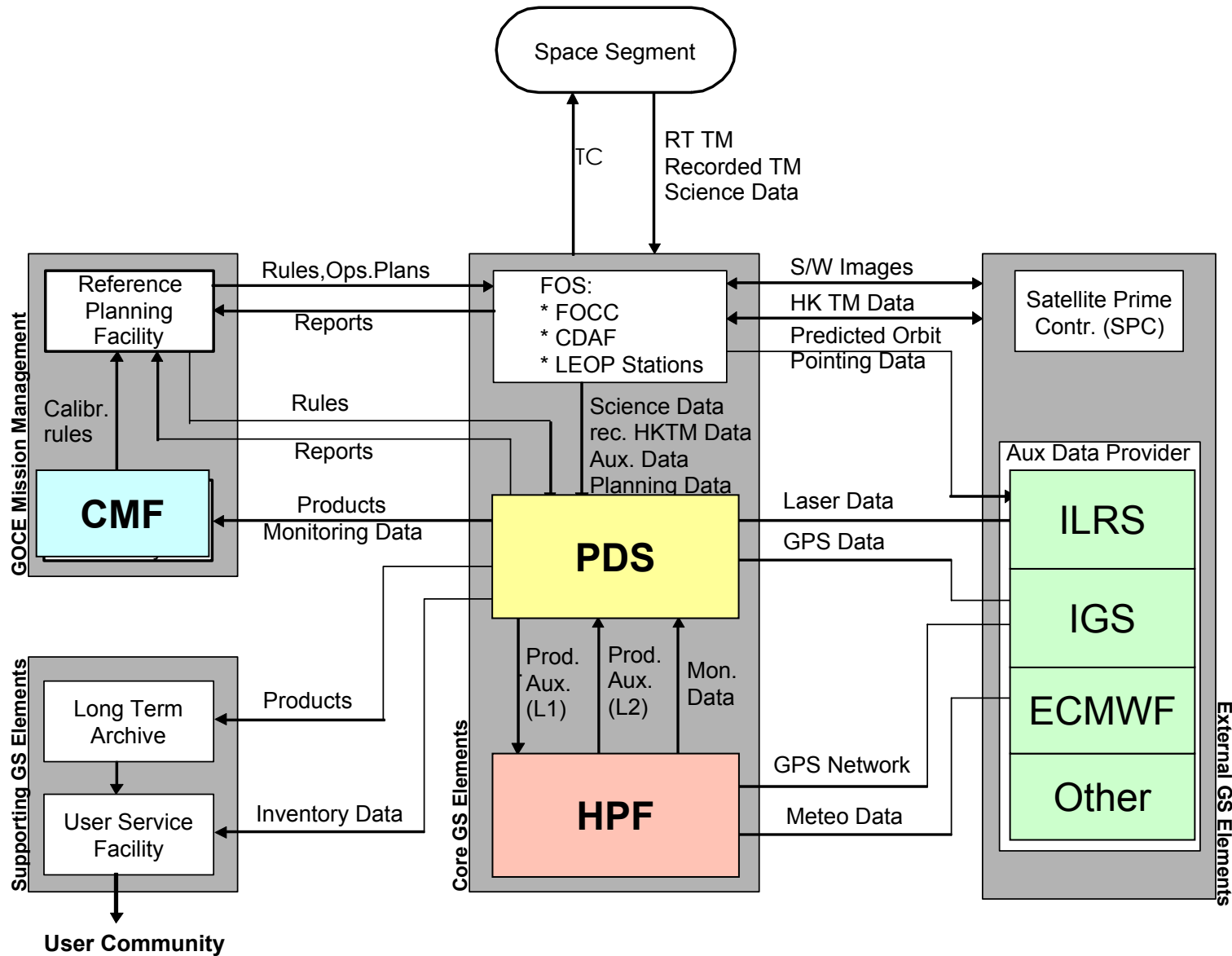


GOCINA Workshop, Luxembourg, 13.-15. April 2005

- 1. The High Level Processing Facility**
 - **Tasks & Organization**
 - **Processing Flow**

- 2. GOCE Level 2 Products**
 - **Products Specification**
 - **HPF Activities on Validation**

GOCE Ground System Elements



Tasks of High Level Processing Facility

- Generation of level 2 products from level 1b data from the Payload Data Segment (time series of internal calibrated gravity gradients and GPS data)
- Level 2 products are:
 - External corrected and calibrated instrumental data sets
 - Rapid science orbits and quick-look gravity field models
 - Precise science orbits and final GOCE gravity field models

Who is the HPF ?

1. The **European GOCE Gravity Consortium (EGG-C)** submitted a proposal to ESA covering the HPF development and operations. The project started in April 2004.
2. EGG-C is composed of 10 European institutes working in the field of gravity field research and orbit determination (see map).
3. The HPF is a **distributed system** composed of a central processing facility (located at SRON) and several sub-processing facilities (located at various institutes of EGG-C members).
4. The HPF is **led by a Principal Investigator** (Reiner Rummel) **and a management team** composed by IAPG (Th. Gruber) and SRON (R. Koop). The main contract for the HPF is signed between ESA and IAPG. High-level work packages are sub-contracted to EGG-C members.

Who is the HPF ?

**Institute of
Astrodynamics and
Satellite Systems, Techn.
University Delft, The
Netherlands (FAE/A&S)**

**Institute of Theoretical
Geodesy, University
Bonn, Germany (ITG)**

**Astronomical Institute,
University Berne,
Switzerland (AIUB)**

**Centre Nationale
d'Etudes Spatiales,
Toulouse, France
(CNES)**

**Politechnico di Milano,
Italy (POLIMI)**

**National Space Research
Center of the
Netherlands (SRON)**

**Institute of Geophysics,
University Copenhagen,
Denmark (UCPH)**

**GeoForschungsZentrum
Potsdam, Dept. 1 Geodesy
and Remote Sensing,
Germany (GFZ)**

**PI & Project Management:
Institute of Astronomical
and Physical Geodesy,
Techn. Univ. Munich,
Germany (IAPG)**

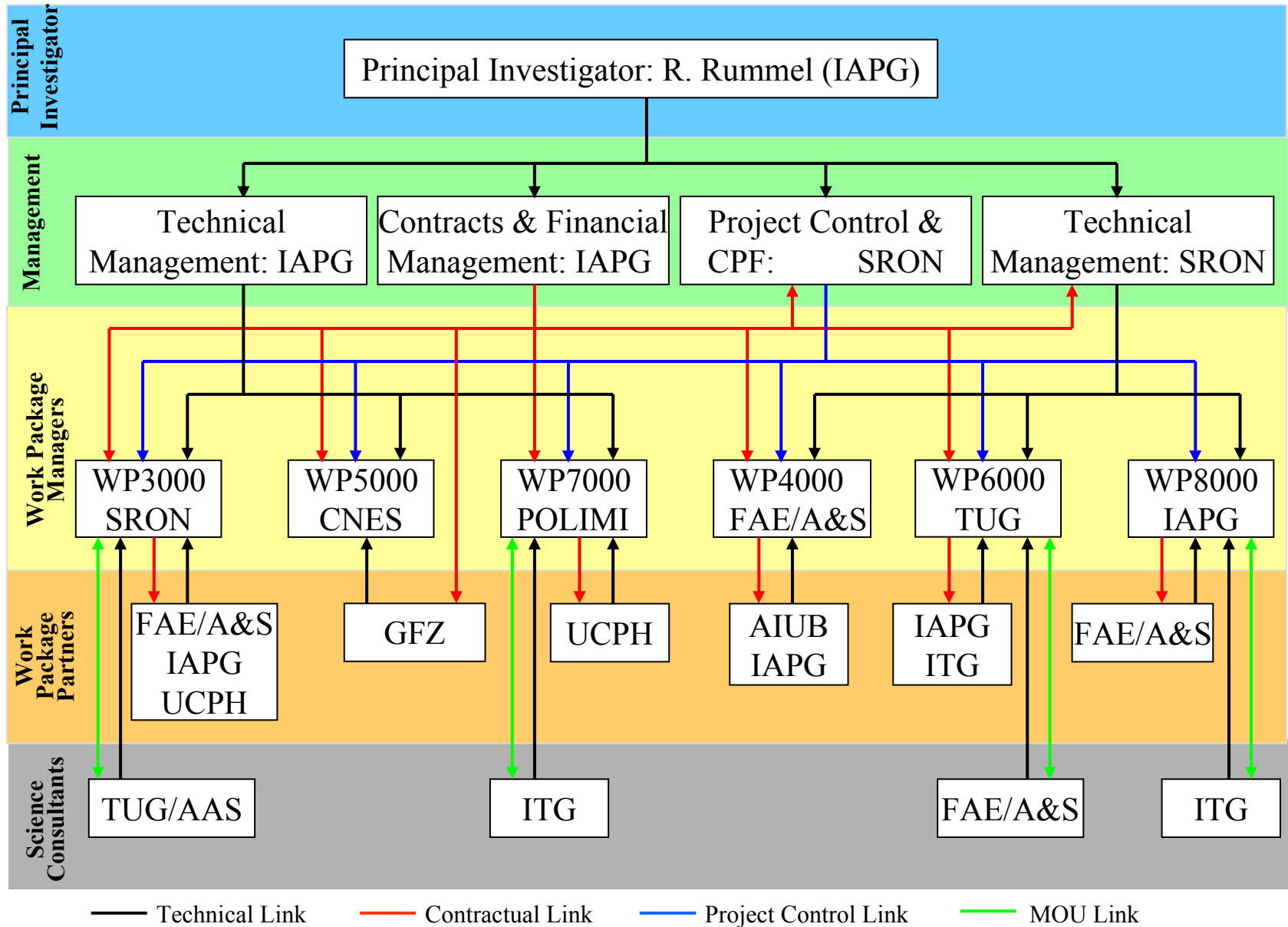
**Institute for Navigation and
Satellite Geodesy, Graz University
of Techn., Austria (TUG)**



Who is the HPF ?



How is the HPF organized



HPF Final Level-2 QL Products

Identifier	Description
Products of Orbit Determination (WP4000)	
SST_RSO_2	<ul style="list-style-type: none">• Rapid science orbit from reduced dynamic approach• Rapid science orbit from kinematic approach• Rapid science orbit quality assessment
Products of Gravity Field Determination – TUG (WP6000)	
EGM_QLK_2	<ul style="list-style-type: none">• Quick-look Earth gravity field model from SST only• Quick-look Earth gravity field model from SGG only• Quick-look Earth gravity field model from SST and SGG combination• Diagnosis report sheets for all models
Products of Product Validation (WP8000)	
EGM_QLK_2	<ul style="list-style-type: none">• Quick-look gravity field quality assessment report

All products are delivered in XML format !

HPF Level-2 Products

Identifier	Description
Products of Preprocessing (WP3000)	
EGG_NOM_2	<ul style="list-style-type: none">• Externally calibrated and corrected gravity gradients in GRF (2 weeks latency)• Corrections to gravity gradients due to temporal gravity variations• Flags for outliers, fill-in gravity gradients for data gaps with flags• Statistical information
EGG_TRF_2	<ul style="list-style-type: none">• Externally calibrated gravity gradients in Earth fixed reference frame including error estimates for transformed gradients• Transformation parameters to Earth fixed reference frame
Products of Product Validation (WP8000)	
SST_PSO_2	<ul style="list-style-type: none">• GOCE precise science orbits final product• Quality report for precise orbits
EGM_GOC_2	<ul style="list-style-type: none">• Final GOCE Earth gravity field model as spherical harmonic series including error estimates. Target: 1-2 cm / 1 mGal up to degree and order 200 corresponding to 100 km spatial resolution.• Variance-covariance matrix of final GOCE Earth gravity field model• Grids of geoid heights, gravity anomalies and geoid slopes computed from final GOCE Earth gravity field model including propagated error estimates• Quality report for final GOCE gravity field model

HPF Level-2 Gravity Field Product

In the HPF 3 Gravity Field Processors are developed. These are:

- **Direct Approach (CNES/GFZ):**
 - Filter design
 - SST: Orbit perturbation theory
 - SGG & SGG: Full normal equation systems
- **Time-Wise Approach (TUG, ITG, IAPG):**
 - Optimal regularisation and weighting parameters
 - Filter design
 - SST: Energy conservation
 - SST & SGG: Full normal equation systems
- **Space-Wise Approach (POLIMI, UCPH):**
 - SST: Energy conservation
 - Wiener filtering and gridding for spatialized observations
 - SST & SGG Block diagonal normal matrices with iteration

All models undergo a thorough validation. The final GOCE Gravity Field Model will selected according to the results of the validation.

Product Validation

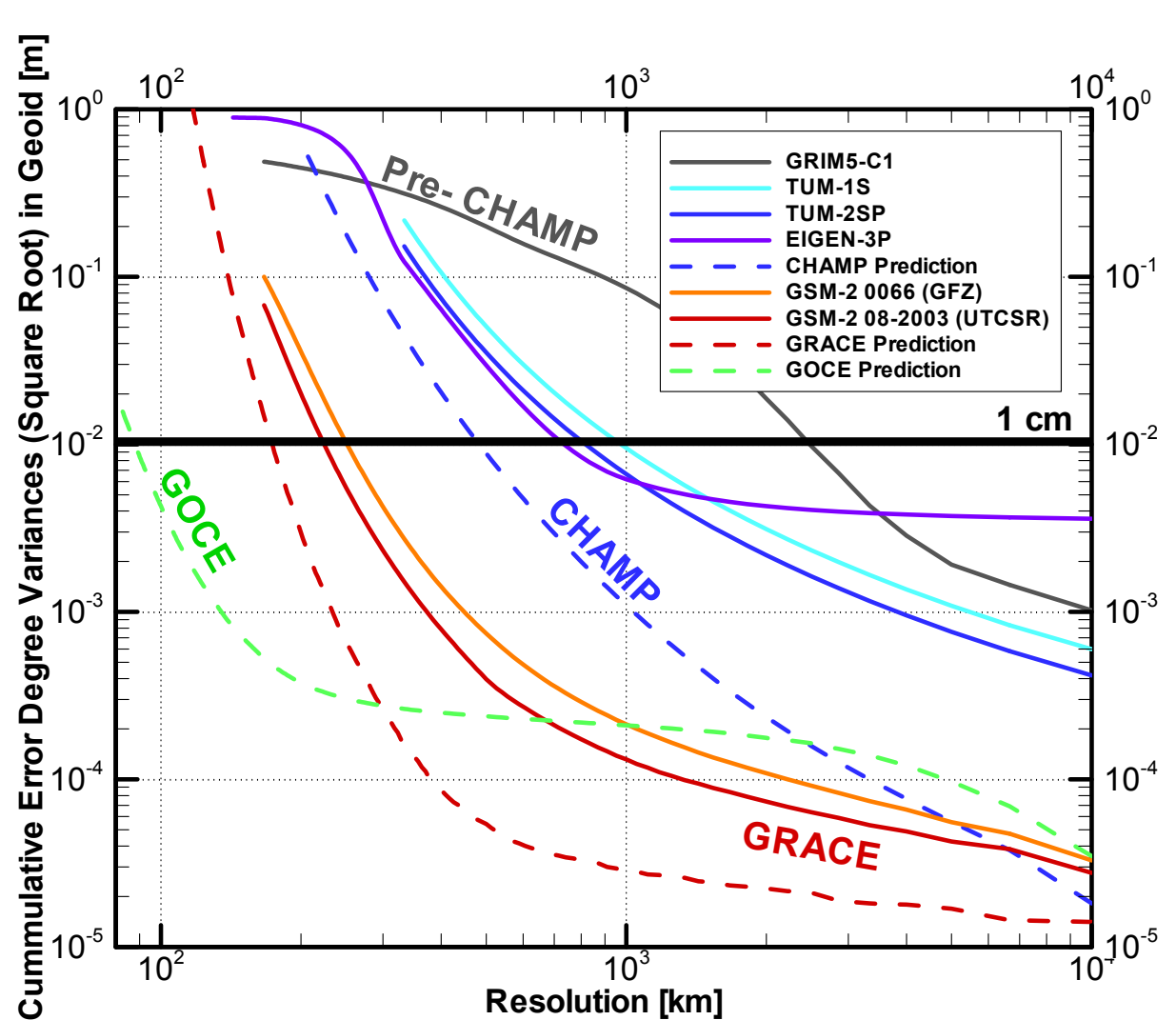
Orbit Validation

Tool	Test Data Sets	Quality Parameters	Problems
Orbit Overlaps	GOCE Orbits	Position and Velocity Differences at Overlaps.	Internal Consistency Check
SLR Residuals	GOCE SLR Tracking Data	RMS and Mean of Laser Ranging Residuals.	Few SLR Tracking Data for GOCE expected.
External Orbit Comparisons	External GOCE Orbits	Position and Velocity Differences.	Quality of External Orbits not known.

WP8000 Product Validation

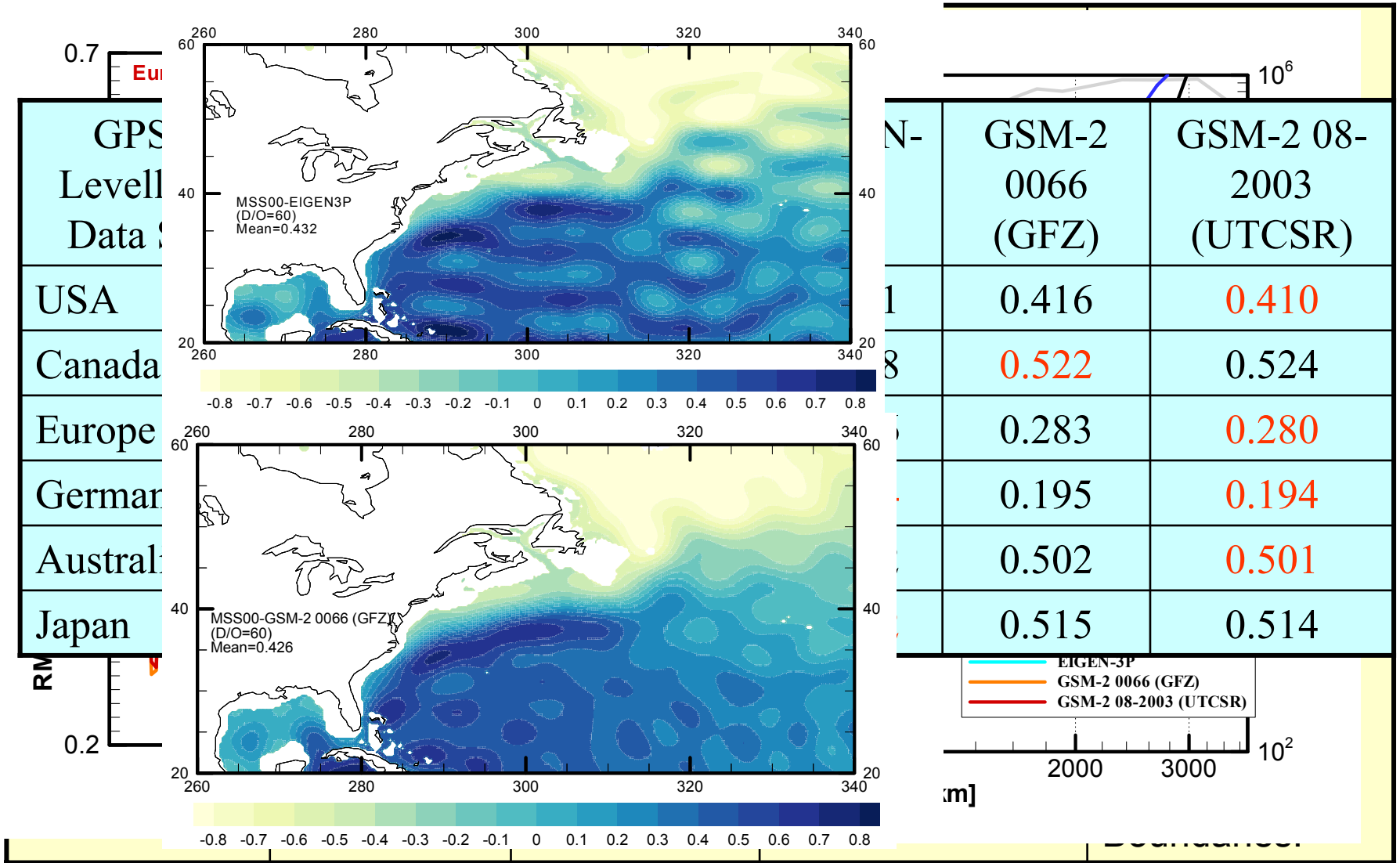
Gravity Field Validation

Tool	Test Data Sets
POD for other Geodetic and Altimeter Satellites	Tracking Data: S DORIS PRAR GPS, Altimet
Internal Error Assessment	Variance Covariance Matrix



WP8000 Product Validation

Gravity Field Validation



HPF Schedule - Development

