CHAMP Gravity Field Models using energy conservation and Fast Spherical Collocation.

by

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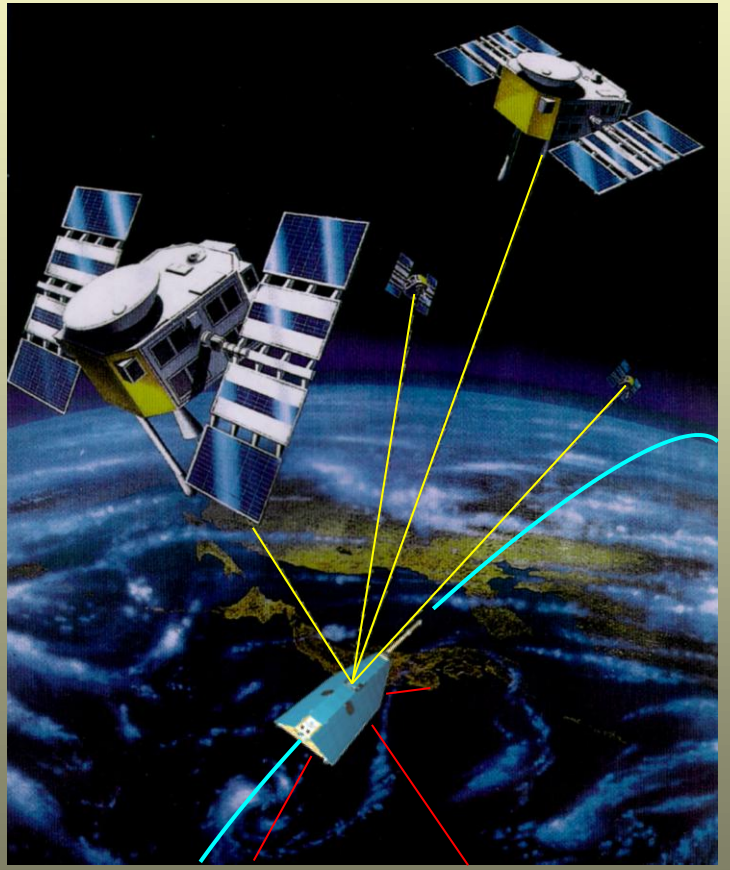
Introduction

http://op.gfz-potsdam.de/champ/

GPS Tracking of CHAMP



Introduction

- **10 s data from August 2001**
- **TUDelft precise orbits and revised attitudes**
- **Same method as in earlier studies**

Method (I)

Energy conservation

$$T_{sat} = \frac{1}{2} v^2 - V_s - V_m$$

$$- \omega (x v_y - y v_x) - F - U - E_0$$

Method (II)

- **(1) Kinetic Energy = Potential Energy**
- **(2) Time-varying potential in inertial space. Earth rotation accounted for.**
- **(3) Friction difficult to determine because accelerometers biased and have unknown, varying scale-factor**
- **(4) We use a-priori knowledge of gravity field**

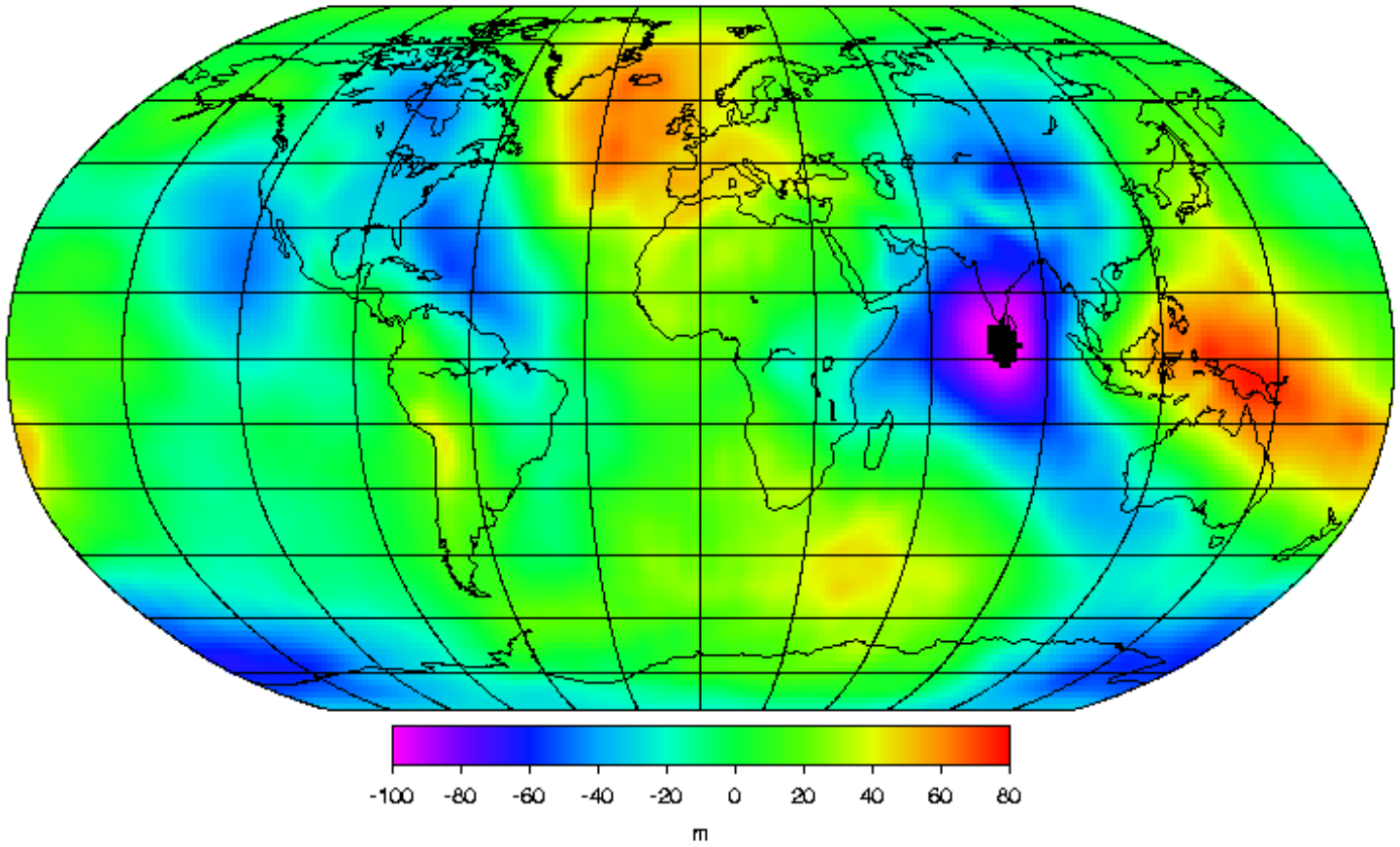
Friction Calculated

- (1) From velocity and y-accelerometer
- (2) Scalar product of velocity and acceleration vector
- (3) Bias parameter determined for each half day
- (1)+(3) Gives best results

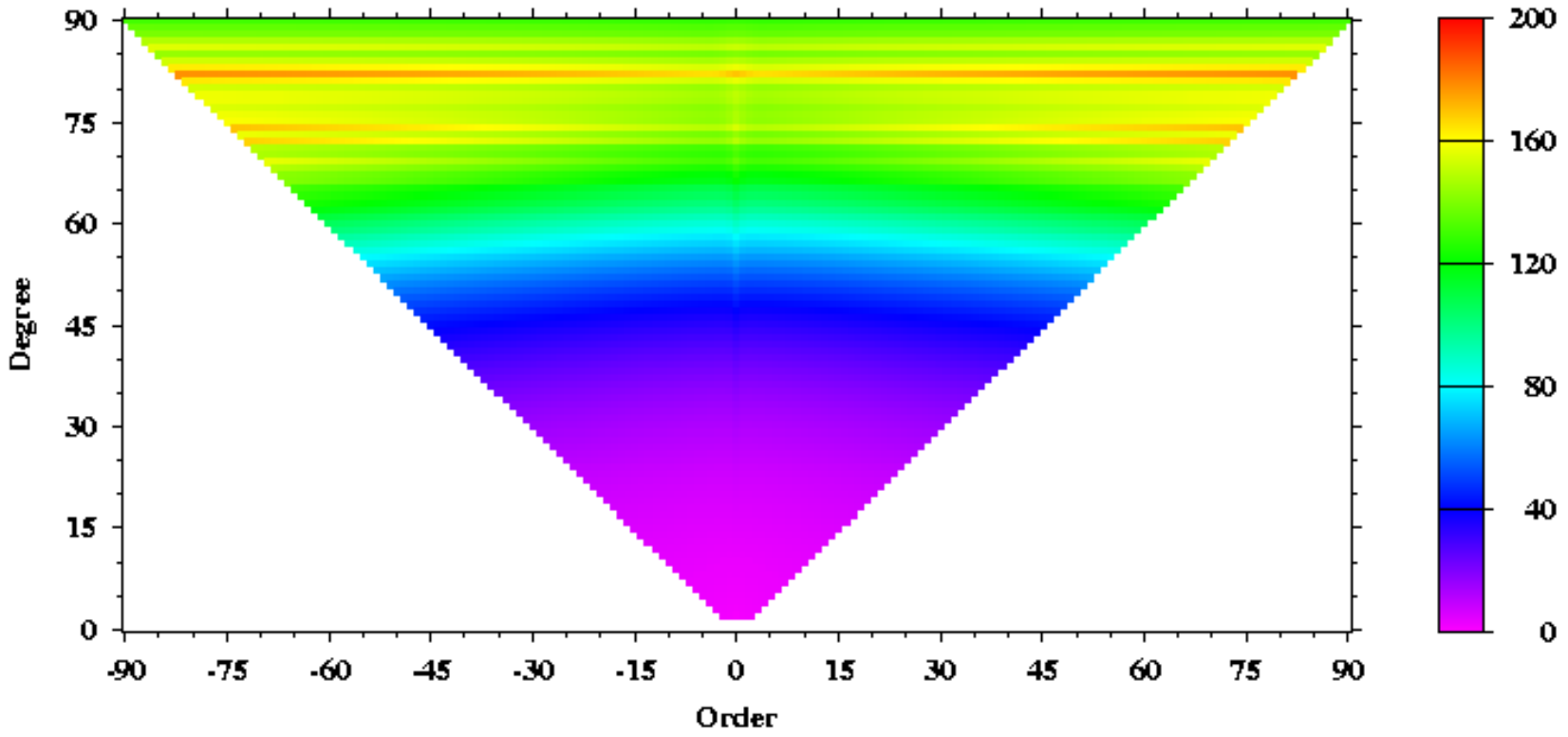
Estimation of coefficients

- **T up/downward continued to fixed altitude or radial distance using EGM96 gravity disturbances.**
- **Values gridded 0.5º using LSC (geogrid)**
- **Coefficients and errors from Fast Spherical Collocation**

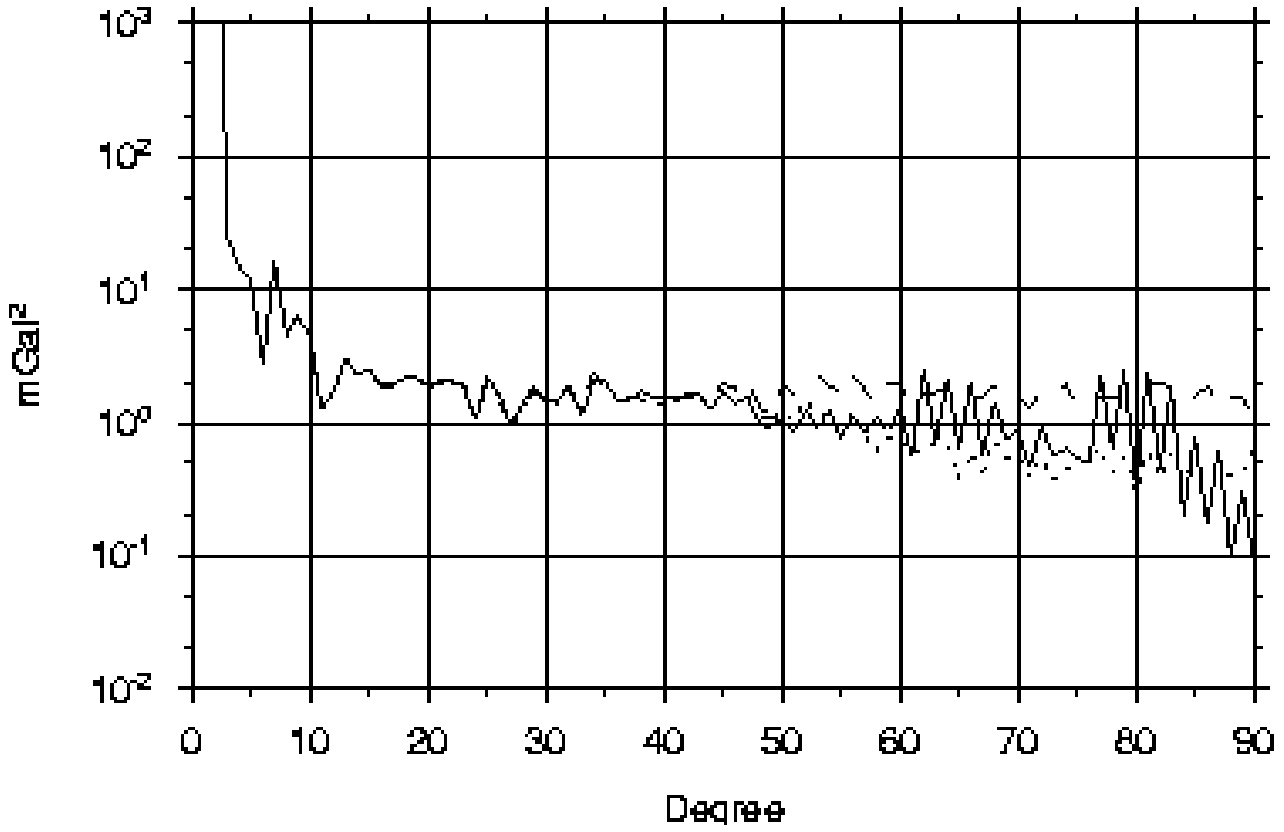
UCPH2003_03 Geoid



Error-estimates x 10^{-11}

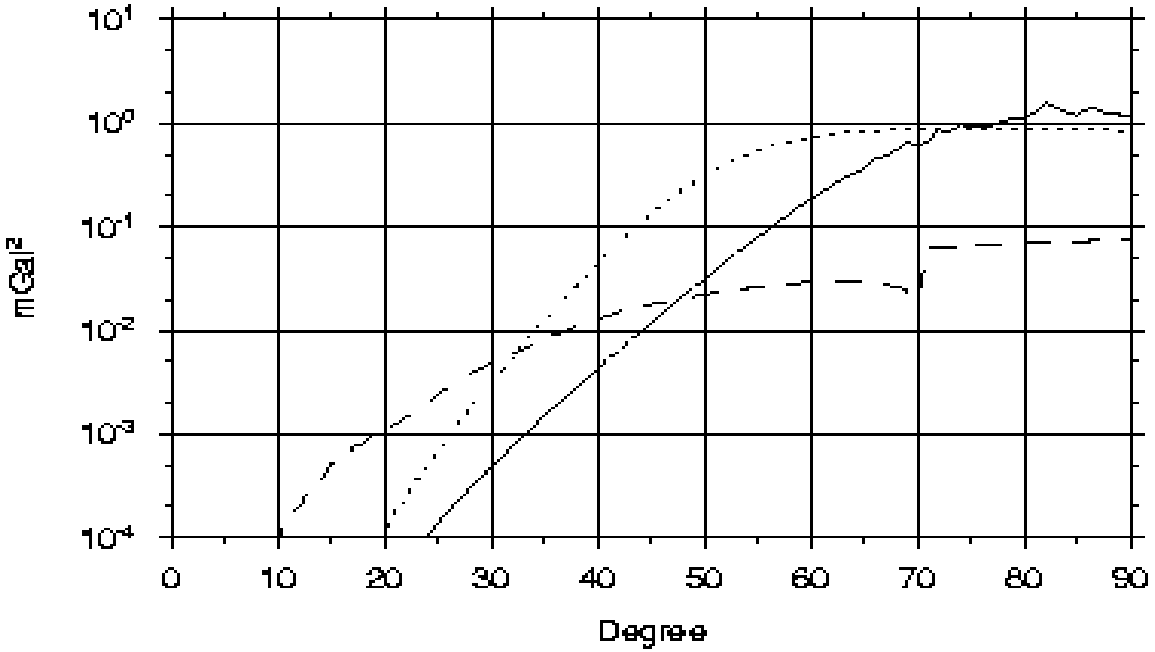


Degree-variances

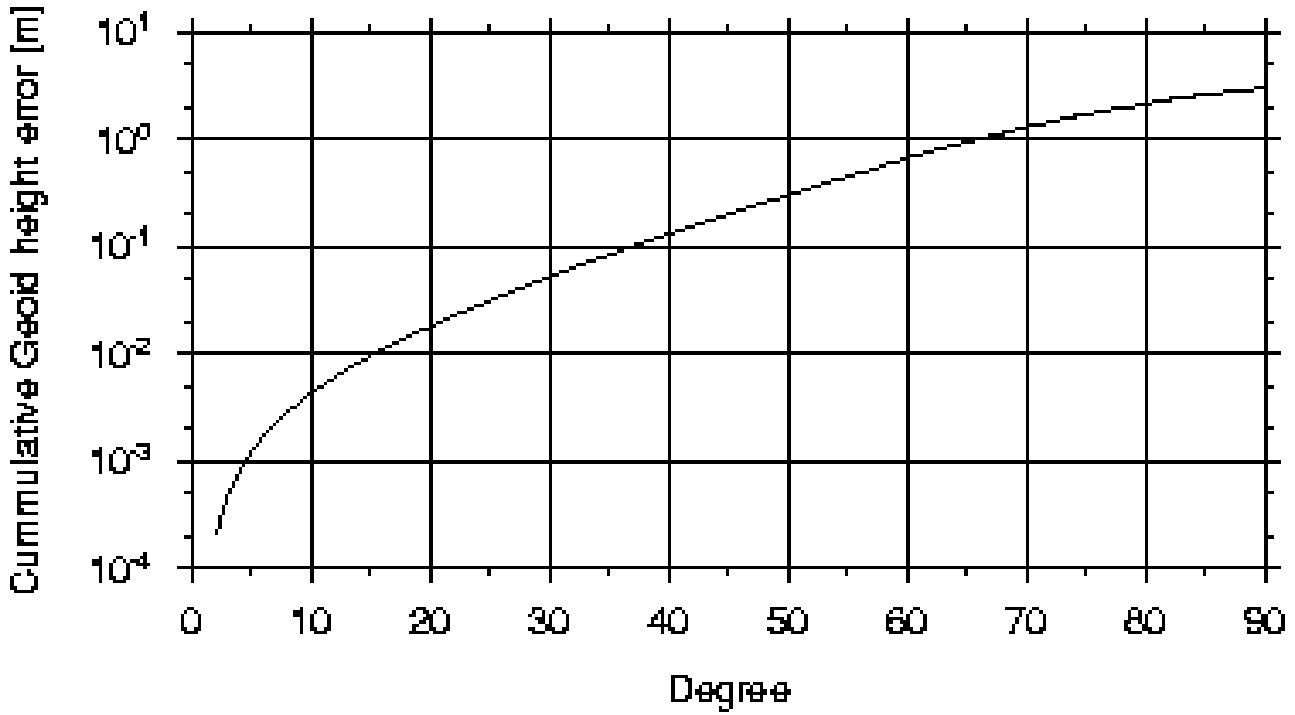


Error-degree variances

- **UCPH: solid, EGM96 ---, EIGEN-2 ….**



Cumulative geoid error



Comparison with EGM96 0.5º gravity

212675 mean gravity anomalies with error below 5 mgal

NMAX=60.

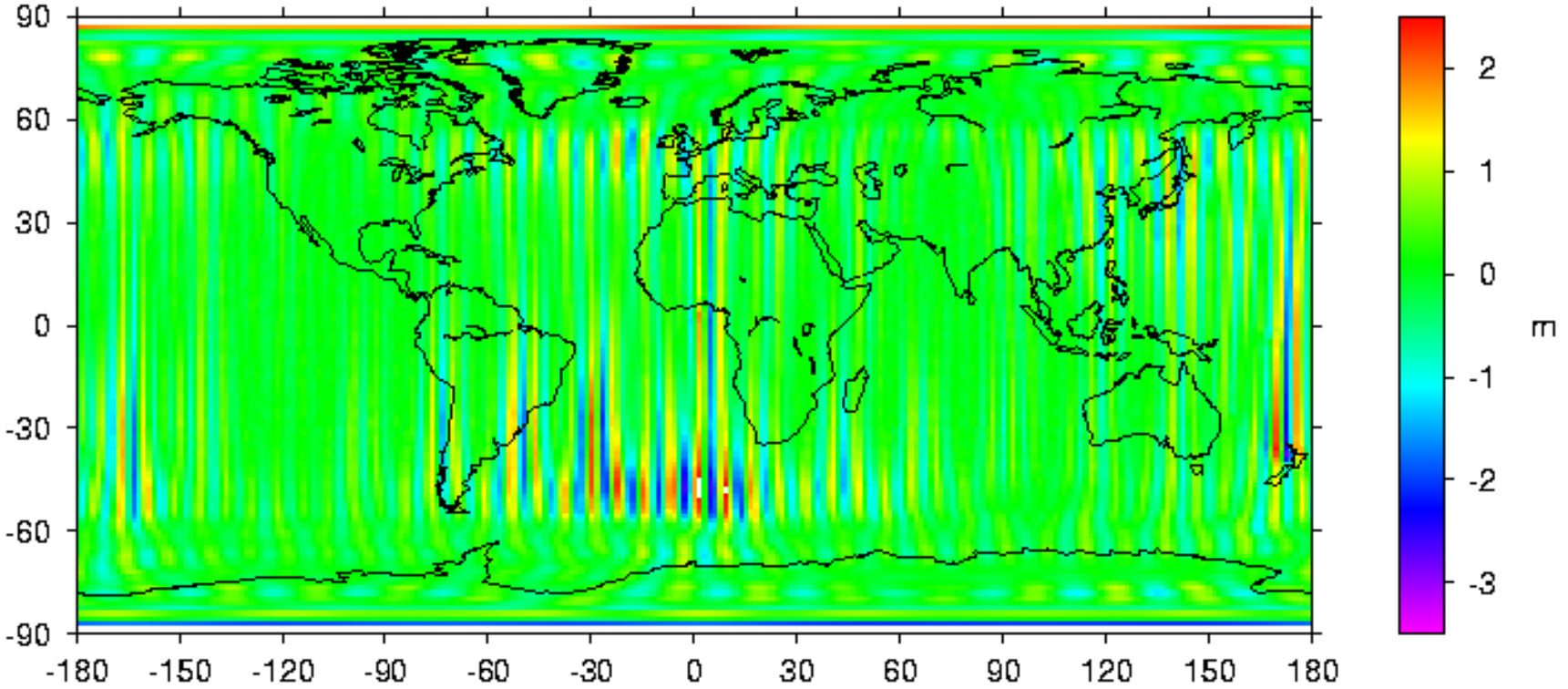
		UCPH 03_03bx	Eigen-2	EIGEN-GRACE	EGM96
Units: mgal	Obser-ved	Dif-ference	Dif-ference	Dif-ference	Dif-ference
Mean.	-1.1	-0.5	-0.5	-0.5	-0.5
St.dev.	27.0	19.9	21.4	21.2	21.1
Max.	450.7	399.2	403.6	401.7	401.3
Min.	-300.3	-286.4	-277.5	-266.7	-266.5

Comparison Greenland

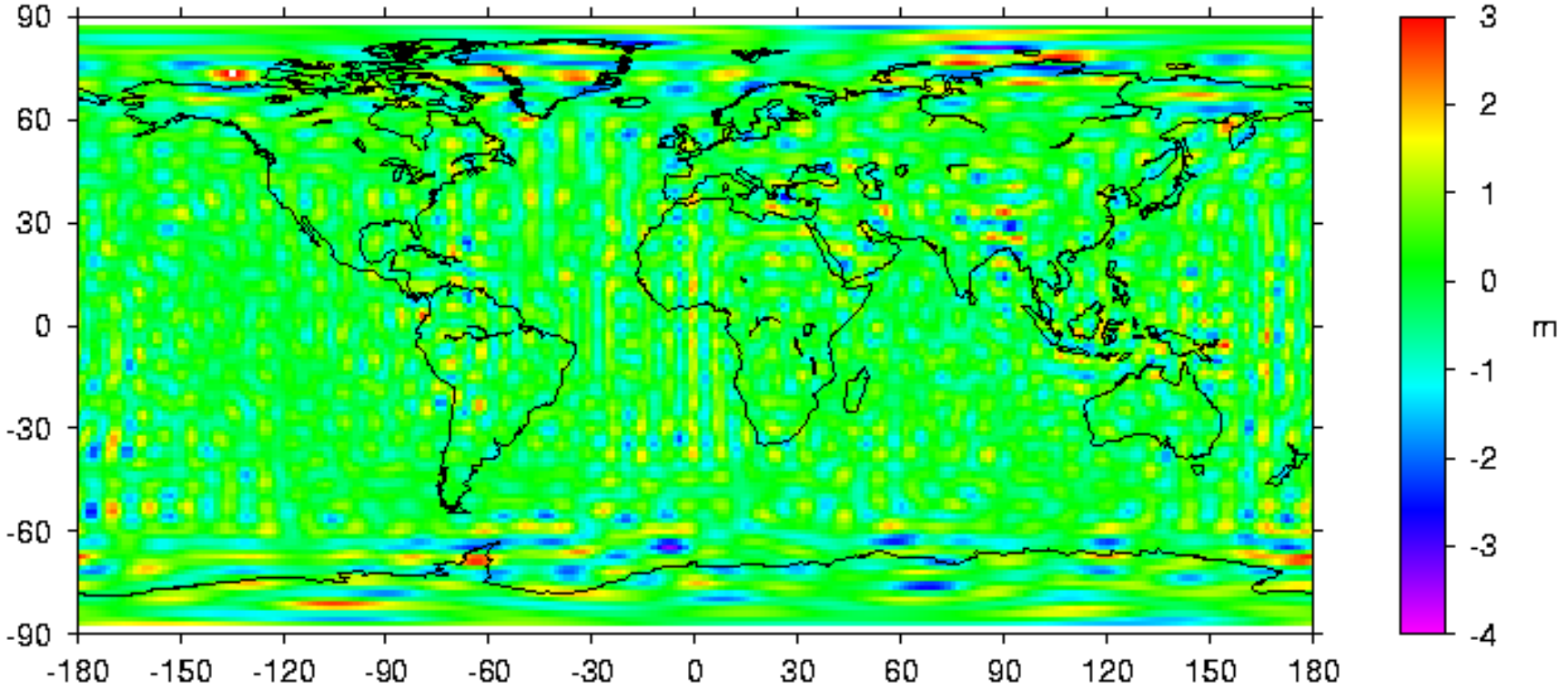
2150 5'x10' mean gravity anomalies in North-West Greenland.

Units: mgal	UCPH 2003_03	EIGEN-2	EIGEN-GRACE	EGM 96
Mean	-0.9	-6.6	-3.8	-4.6
St. Dev	13.8	15.8	17.1	17.8

Differences UCPH2003_2 - _3



EIGEN-2 - UCPH2003_03



CONCLUSION (I)

- Data are still contaminated with considerable noise due to the still large solar activity in the selected period.

- The uncertainty of scale-factors of the accelerometers and the noise in the attitude measurements reduced the precision of the calculation of the external forces.

CONCLUSION (II)

- Data from later periods with lower solar activity may give better results.
- Attitude processing must be repeated
- Gridding could be improved using general LSC and taking into account the along-track error-correlations.
- Kinematic orbits may give better results