TECHNISCHE UNIVERSITÄT DRESDEN

EGSIEM
European Gravity Service for Improved Emergency Management

Evaluation of recent GRACE monthly solution series with an ice sheet perspective

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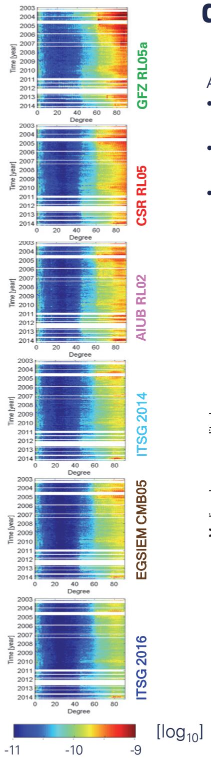
Introduction

- GRACE monthly gravity field solutions have undergone a remarkable evolution.
- Efforts are under way to derive combined solutions within the EGSIEM project (European Gravity Service for Improved Emergency Management).
- Which series should we use for applications such as ice sheet mass balance?
- We evaluate 6 series with $n_{max} \geq 90$ (most appropriate for polar applications).

- **GFZ RL05a**, $n_{max} = 90$
- **CSR RL05**, $n_{max} = 96$, truncated to $n_{max} = 90$
- **AIUB RL02** RL2 (by Uni Bern), $n_{max} = 90$
- **ITSG 2014** (by TU Graz), $n_{max} = 90$
- **EGSIEM CMB05** test combination, $n_{max} = 90$ (month-wise weighted mean of the above 4 solutions & JPL RL05; see EGU2016-7586 – this poster session)
- **ITSG 2016** (by TU Graz), $n_{max} = 90$ (see EGU2016-11547). This new solution is not included in the EGSIEM test combination.

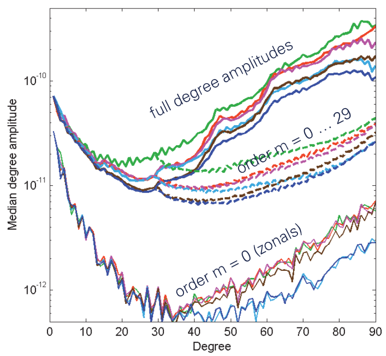
Monthly degree amplitudes



Spherical harmonic domain

Approach:
- Fit and remove constant + linear + annual + semiannual signal parts.
- Analyze the residuals as upper bounds of noise.
- Use only those months that are included in all series

Median degree amplitudes

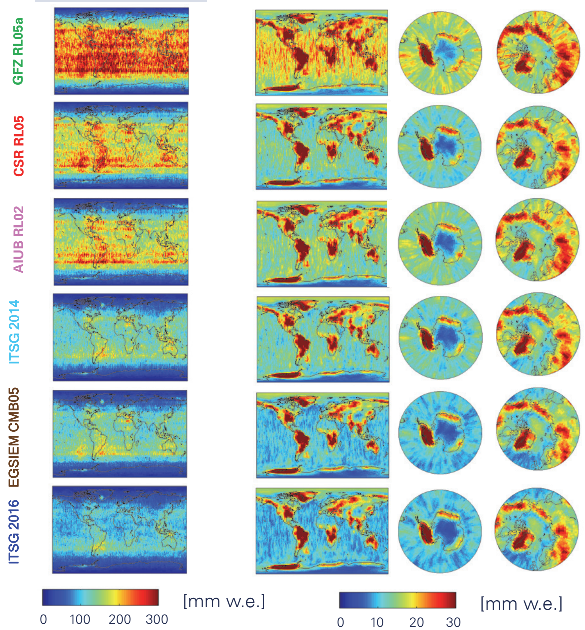


Spatial domain

Median absolute values of equivalent water height anomalies

200 km Gaussian

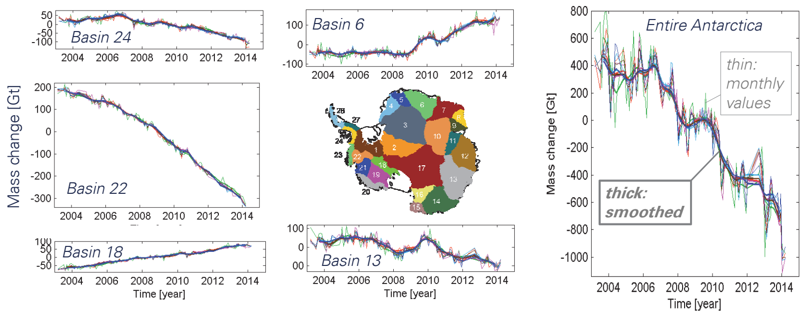
400 km Gaussian smoothing



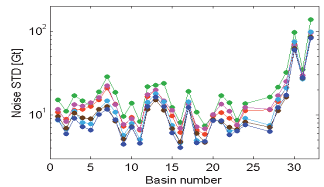
Integrated mass changes

Approach:
- Estimate ice mass changes by the regional integration method with tailored sensitivity kernels (EGU2016-12065 talk on Monday).
- GIA correction using IJ05_R2 model.
- Quantification of noise based on high-pass filtered month-to-month variability.

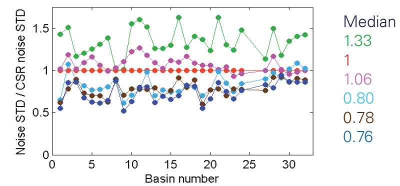
Mass change time series



Noise level for each basin



Noise level compared to CSR-RL05 results



Conclusions

- Noise levels of the different series differ by a factor of up to 2 in standard deviation.
- ITSG 2016 and EGSIEM CMB05 show lowest noise levels.
- EGSIEM CMB05 remarkably out-performs its individual input solutions (which do not include ITSG2016).
- Differences in noise levels become less pronounced when noise is reduced through filtering.
- We find no visible difference in the signal content of the different releases. → No indication that different noise levels are associated with signal dampening.
- Mass balance time series noise STD is about 24% lower when using ITSG 2016 instead of CSR-RL05. Therefore ITSG 2016 has been selected for ESA's Climate Change Initiative Gravimetric Mass Balance products.

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