Combination Service for Time-variable Gravity Field Models (COST-G) – current status

1. Introduction to COST-G

COST-G is the new Combination Service for Time-variable Gravity Field Models of the International Association of Geodesy (IAG). It will provide a combined time-series of gravity fields of the entire GRACE mission and operationally combined monthly solutions of GRACE-TF, once GRACE-FO L1B data will be released. Here we present the evaluation and combination of the most recent GRACE RL06 Level-2 products from CSR, JPL, GFZ and the alternative products ITSG-2018, GRGS-RL04 and AIUB-RL02. While COST-G will provide combinations on normal equation level, we here present a combination on solution level based on variance component estimation (VCE).

2. Quality control

Prior to combination all contributions undergo a quality control, taking into account:
- amplitude of mass variations in river basins (Figs. 1 and 2),
- mass trends in polar regions (Fig. 3), and
- noise content, evaluated by the RMS or STD of non-seasonal, non-secular variations either in the spectral domain (Fig. 4) or in the spatial domain over the oceans (Figs. 5 and 6-8).

Time-series revealing significant signal attenuation (most often related to regularization) are rejected not to bias the combination (here we keep all time-series for illustration). Individual monthly solutions exceeding a noise threshold may also be rejected, if their effect on the combination cannot be taken into account by relative weights.

3. VCE on solution level

With a 400km Gaussian filter. Stripes over the oceans indicate noise, bumpy features are mostly related to modeling issues. Note that AIUB-RL02 is the only of the time-series still with a problem.

4. Combination on solution level

To date, not all of the COST-G ACs provided NEQs of their monthly gravity fields. Therefore, the combination presented here is performed on solution level. In Figs. 4, 5 and 6 the noise assessment of the combined time-series is evaluated in the spectral and the spatial domain. With exception of the regularized GRGS-RL04 time-series the combined gravity fields are less noisy than all individual contributions.

5. Discussion

We could demonstrate a significant reduction of the noise level of the individual time-series by weighted combination on solution level. But our quality control also revealed problems in the individual time-series, like a regularization in GRGS-RL04 resulting in attenuated mass trend over greenland (Fig. 3). Note that the final COST-G combination will be based on normal equations and the regularization in GRGS-RL04 that only takes place in their solution step, will not pose a problem.

Studying the spatial RMS of differences to the mean (Fig. 7) reveals further peculiarities of the individual contributions. While among all time-series studied AIUB-RL02 is the only one still based on L1B-RL02 and old processing standards, differences in the ocean model applied for de-aliasing are also visible for GRGS-RL04. Artifacts in large river basins in the case of ITSG2018 are most probably related to their use of an a priori hydrological model for de-aliasing. Note the high consistency among the three RL06 time-series.

References


Contact address

Ulrich Meyer, Adrian Jäggi
Astronomical Institute, University of Bern
Sidlerstrasse 5
3012 Bern (Switzerland)
ulrich.meyer@aiub.unibe.ch
adrian.jaggi@aiub.unibe.ch

Poster compiled by B. Jenny