

Interactive comment on “Mitigation of ionospheric signatures in Swarm GPS gravity field estimation using weighting strategies” by Lucas Schreiter et al.

Anonymous Referee #1

Received and published: 3 September 2018

Dear editors and authors,

the manuscript “Mitigation of ionospheric signatures in Swarm GPS gravity field estimation using weighting strategies” shows how ionospheric disturbances do not only affect kinematic orbits from the Swarm satellite mission, but how they also propagate into time-variable gravity fields. Different weighting schemes are applied to the GPS observations and are then evaluated with respect to orbit and gravity field quality. Even though ionospheric disturbances were most prominent at the beginning of 2015, the paper comes at the right time to improve the recovery of time-variable gravity fields from the Swarm mission, regarding the gap between GRACE and GRACE-FO. The topic is

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of great importance and I suggest its publication after addressing my major comments below. I suggest to carefully revise the paper with respect to phrasing, spelling and figure quality.

MAJOR COMMENTS

My major concern is that you assess the quality of the monthly Swarm gravity fields with respect to the static AIUB-GRACE03S solution (e.g. Fig. 8, Fig. 9, Table 1, Table 2). Of course, ionospheric effects along the geomagnetic equator are well visible in this representation. But wouldn't it be better to assess the quality with respect to the monthly GRACE solution for the same month? The way you are building the differences, you automatically also look at the difference between a solution for a specific month and a static solution. The differences are then interpreted as error, for example when you compute the Geoid RMS. If you take the monthly GRACE solution as the “truth”, instead of the static solution, the difference should be zero in the ideal case (of course, this is not possible with Swarm). You would then only look at real errors. This is a serious issue and a comparison to monthly GRACE solutions needs to be included.

While the manuscript is highly technical and provides several processing details, and will undoubtedly be of great help for fellow Swarm analysts, it is difficult to grasp information from a quick glance. When looking at the abstract and conclusions sections ONLY, everything is described in terms of “large”, “very efficient”, “visible”, or “essential” but no numbers are given. I would strongly urge to include a few statements along “improvements are of the order of xx % in RMS when we ... while in case of ... this drops to ... %” or the like.

MINOR COMMENTS

- Fig. 7: Why don't you show the ROTI 2 weights? (It sounds like you were showing them on page 9, line 17)
- Fig. 8: Up to which degree are the gravity fields evaluated?

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- Please always indicate if you are looking at a gravity field from one satellite or at a combined (A/B/C) gravity field (e.g. Fig. 8).
- Please check the quality of your figures.
 - Often, the font size is very small
 - The two plots in Fig. 5 are not aligned
 - It would facilitate the reading of the axis/legends, if subscripts/exponents were used (e.g. $10^6 \text{ N}_e/\text{cm}^3$ in Fig. 1)
 - Sometimes, the space could be better filled, e.g. the plots in Fig.8 could be a lot bigger while still using the same space
 - Choice of colors in Fig. 16 for Swarm A/B/C
 - Please always specify the date, e.g. Fig. 1
- On page 9, line 16, you introduce ROTI 1 and ROTI 2. Afterwards, you sometimes use those terms, but sometimes you still use AIUB-ROTI and Graz-ROTI. Please pay attention to consistency.

TECHNICAL CORRECTIONS

Here, I will only present those technical corrections that apply to larger parts of the manuscript. Please see the attached version of the manuscript for more specific comments.

- Throughout the document, please check the correct syntax for referring to figures, sections, tables, etc. See https://www.annales-geophysicae.net/for_authors/manuscript_preparation.html
- Please check the captions of figures and tables. Sometimes there is a period at the end, sometimes not.

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- Please introduce abbreviations when a term is mentioned the first time, then use the abbreviation afterwards (e.g. LEO on page 1, line 2 and line 22. Also GPS, GRACE, GOCE, TEC, ...)
- Please check again all citations. There are several cases of wrong parentheses (e.g. page 16, line 20).
- Please check capitalization (GRACE, March, Gauss, ...).
- Please check the section names for consistent capitalization (e.g. 3.4 vs. 3.5), furthermore, 2 and 2.1 should not have the same title.
- I am not sure if it should be “reduced dynamic orbit” or “reduced-dynamic orbit”. I mostly found the second version in literature. You mostly use “reduced dynamic orbit” except for the caption of Fig.1.
- It should be “F10.7 index” and “Kp index”.
- I am not sure about the meaning/sense of “(eq.)”, e.g. in the caption of Fig.14.
- Please check the use of hyphens, e.g. epoch-wise, ROTI-based, derivative-based...

Kind regards, the reviewer

Please also note the supplement to this comment:

<https://www.ann-geophys-discuss.net/angeo-2018-91/angeo-2018-91-RC1-supplement.pdf>

Interactive comment on Ann. Geophys. Discuss., <https://doi.org/10.5194/angeo-2018-91>, 2018.

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