

Interactive comment on “A global empirical GIA model based on GRACE data” by Yu Sun and Riccardo E. M. Riva

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Received and published: 30 September 2019

This paper describes a dataset that includes GIA maps and water mass anomaly trends that are based on fitting pre-computed fingerprints to GRACE observations. This is a modification of work the authors and Reitbroek et al have previously done.

Overall, I think this is a well-written manuscript and the results look very exciting. I think the idea of fitting the fingerprints to just GRACE observations and not adding in complexity of non-homogeneous GPS and altimetry, steric, and climate models (as in reitbroek et al.) is superior as less prone to contamination from errors in the other datasets.

One issue, which the authors do acknowledge, is the assumption that their basis func-

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tions (the fingerprints) are orthogonal. If they aren't, then the estimated scaling parameters will be correlated and they can't really be treated as independent. This isn't really a problem if they cluster regionally and are independent of other regional clusters. The problem in this solution may be that the GIA over Antarctica may be correlated with the mass loss over Antarctica, so they can't really be treated independently.

The authors have all the information needed to test the level of correlation in their covariance matrix from the least squares estimation. I would like to see some analysis of the correlations between estimated parameters that can be computed from this matrix – in particular, the correlation between the GIA parameters and the Antarctica parameters. If these are NOT correlated significantly, then great – the authors have demonstrated that their GIA model can probably be treated independently from their mass loss over Antarctica. If they ARE correlated significantly, then they need to make some cautionary statements acknowledging this.

My only other comment would be a request for the authors to also include their GIA patterns and other patterns in terms of gravitational spherical harmonics (and not just geoid rates). This will allow easier combination for anyone using GRACE data to convert to water storage – this isn't the same as geoid height.

Other than these two minor issues, the paper is really nice and I encourage publication if the authors will comment on the correlation issue based on their covariance matrix.

Interactive comment on Earth Syst. Dynam. Discuss., <https://doi.org/10.5194/esd-2019-40>, 2019.

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