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Interactive comment on "The long-term GIA signal at present-day in Scandinavia, northern Europe and the British Isles estimated from GPS and GRACE data" *by* Karen M. Simon et al.

Anonymous Referee #2

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This study provides a semi-empirical estimate with uncertainties of the glacial isostatic adjustment (GIA) signal for the northern Europe. The authors use a published methodology to adjust ("invert") an a priori set of GIA models using observations, bedrock uplift rates (GPS) and time-variable gravity (GRACE). The area coherently covered by this study is much larger than previous studies. So this study aims at providing a reliable GIA signal with robust uncertainties that can be used as correction for other kind of data (e.g. tide-gauges) over a large area of northern Europe.

This study deserves publication but I have few major concerns. 1) The correction of the data for the recent signal is calculated without considering its large variability over

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Discussion paper

the last two decades. More specifically GPS time spans are not uniform and, as I understand, the elastic correction is not computed for each station coherently with its time span. The elastic correction is not constant in time. Greenland mass loss for example has accelerated in the last decades.

2) As for the GRCE correction of the mass loss in Svalbard and the Russian arctic, the "large" discrepancies in Table 1 are mostly due to the different time spans and to the fact that the mass loss there has not been constant at all. I understand that from Cryosat is still hard to derive mass changes, so I wouldn't include the range of possible estimate. The most reliable estimates for Svalbard and Russian arctic come from ICESat and GRACE and over the same period they agree well enough. Since you need to extract a long term signal I would simply use the GRACE data over the period for which you have the most reliable corrections.

3) The re-scaling procedure of the mass loss in Svalbard and Russian is questionable and shows that the filter applied to the GRACE data is way too heavy. In fact Root et al. 2015 (doi.org/10.1002/2015GL063769) perform the same kind of correction on the GRACE data in the Barents Sea without the need to rescale. The authors also recognize that they cannot properly invert for the gravity data and that the initial filtering could have been too strong. So what if more a suitable filter were used on the GRACE data instead? How and how much would the result change? Is the gravity signature of the a priori GIA filtered with the same filter?

Minor comments

It is not explicitly said that is a semi-empirical study. It is called explicitly "inversion" which is quite misleading at first glance.

The use of the word “posterior”: I suggest the use of "a posteriori" (if that is what the authors mean), but it is not necessary, it just sounds better to me.

L45-46. Forward models are supposed to have formal uncertainties only when the

models parameters are well (known and) constrained. The model parameters can have uncertainties depending on the error on the constraints (for the inversion). If a model parameter is unknown or have too large uncertainty then the error on the forward model is meaningless. The sentence is misleading (or incorrect), so I suggest rephrasing it.

L153-156. While this can be true, I think the GIA signal from LIA cannot explain large differences. The large differences come from computing the trend over different periods.

L241-244. The sentence is difficult to understand. Mostly because here the use of "... 'tuned' ice sheet history ..." is rather confusing. At first I believed it referred to the previous sentence so the following didn't make any sense. ICE5g and ANU for example are in fact 'tuned' ice histories. Anyway I believe the authors are referring to something else.

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