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Interactive comment on "Brief Communication: The global signature of post-1900 land ice wastage on vertical land motion" *by* Riccardo E. M. Riva et al.

Anonymous Referee #2

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General comment

This note concerns the effects of continental ice melting on vertical displacement in the time-window from 1900 to present. It is a timely study, which provides an important contribution to the understanding of long-term vertical movements of the Earth's crust, a topic of interest for the cryospheric and geodesy communities. I have a few comments, listed below.

Specific comments

Abstract. "Deformation" should be replaced by "vertical displacement" here and in the rest of the paper. They are used as synonyms but they are not, in my opinion.

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Discussion paper

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Line 23. Another less obvious effect that could be mentioned is the variation of gravitational potential \Phi that together with U give relative sea-level change according to the sea-level equation S=\Phi/\gamma + c -U where c is the notorious c-constant.

L26. I think this is realised, indeed, also in the cryospheric community.

L28. Actually the SLE is more general and can also deal with the viscoelastic Earth's response.

L30. In this brief communication... From what I have understood, the novelty here is the long time window considered (1900-now) for the computation of the elastic displacement, and the use of realistic ice sources.

L40. Quantification is not so problematic if the melting histories are well constrained.

L58. Adding the individual responses to obtain the total response is OK if you assume linearity. An indeed the SLE is linear as long as you do not allow for shoreline migration. But I guess that here the shorelines do not move.

L58. Compressible is OK. But I imagine also layered and consistent with the seismic travel times.

L59. 'period of interest' is vague. From the figures I see different rates at different times, that appears to contradict the use of a unique linear trend.

L65ff. It can be worth to recall that these fingerprints have a vanishing global average.

L68. I am not sure that 'pole tide' is appropriate. From e.g., http://www.navipedia.net/index.php/Pole_Tide I understand that the pole tide is related with the 14-months Chandler Wobble, which I am sure the authors have filtered out from their equations. What causes the lobes in the far field in the vertical displacements maps is the (non-oscillatory) secular component of polar motion.

L68ff. Where are these max values met?

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L76. . . Has been subsiding. . . well, the actual subsidence stems from this component plus GIA, etc. etc

L85. Ditto. See L76. These subsidences are virtual, they only represent one component of total subsidence, and probably not the largest one.

L84. Vertical displacement has certainly an effect on tide gauge. But also N = \Phi/\gamma + c has one. Is this negligible? Has this been computed? In a more in-depth study I recommend to show both S and N along with U, for the same sources considered in this study.

L111. The coseismic displacement can be also modelled globally (see http://onlinelibrary.wiley.com/doi/10.1029/2003GL019347/full).

L112. What is the signal identified therein? Unclear. Is the rate of solar motion driven by the ice sources considered? What is its amplitude and direction?

L130. I do not understand why the 'far field signature' is mentioned here. Viscosity also controls deformation in the near field.

See http://journals.fcla.edu/jcr/article/view/80095/77355 for advice on how hyphenate "sea level".

I remark the importance of providing gridded values of the fields computed here to the community.

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