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Discussions

[SED]

Interactive
comment

Interactive comment on "Sediment loading in Fennoscandia during the last glacial cycle" *by* Wouter van der Wal and Thijs IJpelaar

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The manuscript seeks to quantify the effect of post-LGM changes in sediment loading around Fennoscandia upon estimates of relative sea level, crustal motion and gravity changes. Sediment loading has only been addressed in a few papers, and this seems to be the first treatment for this region. The work is based on existing theory, although newly implemented within the authors' code. The conclusions are the effects of sediment loading are generally small, but may be important for present-day GPS and likely important for interpreting present-day gravity changes.

The paper was written in a way that suggested it was put together in a rush. The major changes I request below are largely related to figures and presentation. The English also needs some tightening up. I did not see any major flaws with the paper otherwise.

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[Discussion paper]

Major remarks: 1. Figure 3 is not a scientific figure. it is a perspective image, but cannot be interpreted. it needs colours scale, graticule, length-scale, axis labels etc.

2. Figure 4 is not appropriate. the authors have digitised this, so replace with the two variants of the reconstruction shown properly.

3. the authors use a sediment density of 2300 kg mˆ-3 but this choice is not defended or uncertainty tested. I presume sediment from different geological regions will have different densities.

4. I believe there is work on pro-glacial lake loading (Fleming et al?) that is possibly relevant to mention.

5. the authors present two models with sediment flux and other models that focus on offshore load changes, but do not present a sum of the two - it wasn't clear why

P1 L15 "smaller features" - smaller than what? (also later in the paper) L19: "older data" - older than what? vague. "the maximum effect..." needs some geographical context.

P2 L10: relative sea level does not go with "present-day" earlier in the sentence and so this needs a rewrite

P3 Eq 4 - lower case delta is used instead of upper I think. h and C are not defined. S should be SL

second last sentence : "parameters, the viscosity of the Earth, and the ice and ..." final sentence: how are marine grounded ice sheets handled - this is worth explicit mention given recent controversies (Purcell et al)

P4 L2: "is degree 256 and the ..." - not clear what the grid is L7/8: move "in Root ..." to "been shown by Root et al to. I note here these studies do not use sediment loading, so there's some issue here. L18: not clear if the timesteps refer to the input ice loading or something to do with the computation

P5: L3: "for the entirety of ..." L12: "Large scale ..." - sentence begins without context. This paragraph would benefit from the distance of the sediment transport being quantified. Figure 2 lacks any length-scale. it seems like a screenshot from Google Earth

P6L6: the sediment loading is taken to be up to present-day. Could the authors clarify how this change in rate corresponds with completion of deglaciation? surely the change in sediment loading scaled down as the ice sheet decayed? Or is some sediment transported by melt-water of subglacier outburst floods? L14: are -> were L16: add comma after "sediment"; remove next comma. There are no contours on Fig 3. L18: what is the resolution of the grid?

P7L7 find -> digitise. L8: reference FIg 5 here. L11: geoid shift - unclear what this means. over what period? L13: 'the fact' - really a fact? is it linearly proportional or non-linearly? how may that affect sediment transport rates?

Figure 5: suggest this can move to supplementary material. suggest you make a proper map in QGIS! it needs a colour scale

P9L2 results -> model input L5: M4-160-80 is not a sediment model. when is "displacement" relative to? Table 1: sed1, 2,3 are not referred to in the text and need descriptions. the box described in the caption could be shown on a figure

Figure 6 caption: clarify this is LGM to present loading changes Figure 7: suggest a second set of y-axis to show the difference between the two curves

P11L8: could the authors give an example of where people have used GPS to infer ice load? Figure 8: the locations of the Lidberg GPS shoudl be shown here or elsewhere

P12L2: residuals of what? L6: around the same magnitude? ;how much larger? L6-8: would be useful to understand typical % of signal L13: effect is small on what? L14: place over a large L15: higher signal than what? L16: affects->affected; delete location L18: suggest quantify the RSL effect here L22: not sure if these locations are all on

figures L26: in -> from L27: the *present-day* uplift

Matt King, March 29, 2017