

Interactive comment on “GPS based surface displacements – a proxy for discharge and sediment transport from the Greenland Ice Sheet” by B. Hasholt et al.

M. King (Referee)

matt.king@utas.edu.au

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The manuscript describes measurements of meltwater runoff and sediment transport at the outlet of the Watson River, Greenland, in an attempt to further understand changes going on within its catchment region. Comparison is also made with changes in GPS-derived coordinate time series and the major conclusion is that GPS adds some proxy data to discharge of this sort. The analysis mainly consists of correlation of the various measurements. I have concerns with the work as presented. While the data will have some value, and I don't disagree with the general thrust of the conclusions, modelling is required to establish what the authors currently conclude.

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1. The data and methods are very poorly described with a lot of important information missing. To me, it read a little more like a early draft than a final manuscript.
2. The analysis almost entirely consists of correlation of various measurement types, and no modelling, and it is not clear what the reader is meant to learn of the processes underway
3. The authors compare the measured discharges with 3d deformation from one GPS site. There is no elastic modelling, which requires the spatial pattern of change to be known, and hence there is an implicit assumption that the spatial pattern of mass change remains constant in time. No evidence is provided to this effect. While the discharge occurs at a single point this is not sufficient to say the sum of accumulation, surface melt, basal melt and sediment transport have a pattern that is constant across time and hence yielding a constant pattern of elastic response that would allow elastic modelling to be omitted. As such, I would say the work is currently flawed in this regard. This is important as the title and conclusions depend on this assumption.

Minor comments: Abstract: it is not clear if the first line is a general statement (and hence delete) or a statement related to this paper (in which case rewrite). respond->response L10: calculate *an* L15: not clear what the final clause refers to L20: "and has been used to detect..." L23: "recently (ref needed)"

P3831L1: can I assume the other 6% is just ice free? how much is upstream of the discharge measurement point? L17: "against" is not the right word. Of course surface topography is not the only control on basal hydrology Methods: the measurement of sediment transport is not described at all. not clear how the GPS seasonal mean is computed and its uncertainty. all data and methods should be described L23: not sure why King et al 2012 is cited here - maybe King et al Surv Geophys is meant?

P3832L2: Nielsen should be replaced by Farrell or something more fundamental L3: "the location of the former load" L7: are *a* few L8: what is the test period, precisely?. L8-10: needs more precise language L12: "upstream *of* the bridges" L13: discharge

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data not described at all L14: how is this accuracy quantified? And please confirm accuracy and not precision is meant (and if the latter, % is not a good unit for +/-) L19: gauge not gage. How well do these gauges sample snow? L21-23: describe why this assumption is made and why it is robust L27: accuracy here should be precision I believe L29: implicating->meaning

P3833L3-9: this is results, so move to results L4: is shown -> are shown L8: "confirms" suggests the authors are equating correlation and causation. This needs more work to be robust, ultimately modelling L23-25: this is methods, so move there

P3834L26: 2004 show surface L7: again correlation->causation L5: this is an erroneous assumption - elastic response is linear, but assumes source locations and relative magnitudes is constant in time. L13: this calculation is flawed because of the above L14: per mille -> better as per thousand? L15: origo? L18: "uncorrected" for what? L22: will add to; these few sentences are not clear

P3835L11-15: these conclusions are not supported by the data and are based on a series of false assumptions

Table 1: 6 or 6.0? Significance levels seem really very high.

Figure 1: add horizontal vector after subtracting the background rate Figure2: missing error bars (on both axes). label each year. Figure 3: "mio". add error bars and label years Figure 4: label year and add uncertainties Fig 7-11: uncertainties on y-axis Figure 11: "mio"

Matt King Aug 24, 2014

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