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The Cryosphere Discussions

Interactive comment on "Brief Communication "Importance of slope-induced error correction in elevation change estimates from radar altimetry"" *by* R. T. W. L. Hurkmans et al.

Anonymous Referee #5

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Importance of slope-induced error correction in elevation change estimates from radar altimetry, by R. T. W. L. Hurkmans, J. L. Bamber, and J. A. Griggs.

In this paper the authors report on the slope-induced error to the radar altimeter measurement. This correction is indeed very important in regions of fast flowing glaciers/ice streams and the ice sheet margins in general, where steep surfaces can lead to a misallocation of the actual altimeter measurement and, therefore, bias elevation/volume change estimates.

Overall evaluation

The paper is concise and presents a clear example of the potential effect of slope-

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induced error on altimeter data and derived estimates. However, all the analysis are restricted to one particular region, the Jakobshavn Isbrae Glacier, which makes it difficult to generalize the magnitude of this effect for any other region. The subject is a current issue in the field of radar satellite altimetry over ice surfaces, with important implications in glacier/ice sheet mass balance studies. Therefore, after minor revision (see details bellow) I would recommend the manuscript for publication in the TCD.

Specific comments

Page 160 line 18-20: Is this for a particular altimeter configuration? If so, which one (ERS-1, Envisat,...)? If not, it would be good to have a reference for this.

Page 163 line 3: The uncertainty in the slope angle is indeed crucial to the slope correction. How to have contemporaneous slope estimates (everywhere needed) independent of the altimeter measurements to be corrected? Need to expand a little bit the discussion about this.

Page 164 line 8-10: What about backscatter correction? This correction can effectively diminish the amplitude of the signal by a considerable amount (for example by 80%).

Page 164 line 10-12: How to determine in the "uncorrected" data set what data points are (or aren't) outliers? That is, if a robust fitting is used instead there are at least two points in Fig. 3a (far away from the fitted line) that would probably be treated as outliers, and the correlation would be much higher for the "uncorrected" data set.

Page 164 line 29: What dynamical changes are we talking about here? From a stationary velocity field only the steady state dynamics can be represented. To distinguish changes associated, for example, to glacier surges one would need a representation of the velocity field for different periods of time (a time series), something that in most cases is not available.

Page 165 line 3-4: By whom? I don't think this is the common practice. For example, some products such as the L2 IDRs from GSFC they come with a slope correction

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applied (see Brenner et al., 1983).

Page 165 line 10-12: Careful when generalizing this statement. The slope error is mostly problematic at the margins of the ice sheet (where the steep slopes are), ice shelves and the smooth topography of the ice sheet interior do not suffer much from this effect.

Page 168 Fig. 1: I would suggest drawing the velocity contours in white with the respective value on each contour. It would also be useful to have a circle representing the radar altimeter footprint (PLF) in real scale.

Page 170 Fig. 3: All the figures need a larger font; the text in the axis is difficult to read.

Interactive comment on The Cryosphere Discuss., 6, 159, 2012.