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Interactive comment on "ESA's Ice Sheets CCI: validation and inter-comparison of surface elevation changes derived from laser and radar altimetry over Jakobshavn Isbræ, Greenland – Round Robin results" *by* J. F. Levinsen et al.

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As satellite altimetry missions continue to monitor elevation changes of the cryosphere, the assessment of elevation change algorithms is timely and important. This study compares the performance of difference altimetry methods (lidar vs. radar) and processing algorithms (along-track vs. across-track) by comparing reconstructed elevation changes with ground-truth obtained by airborne laser altimetry within the rapidly changing drainage basin of the Jakobshavn Isbræ in West Greenland. The study uses a wide variety of algorithms and relies on a careful examination of the results. However, there appears to be several flaws in the analysis that should be addressed to produce a

robust comparison.

1. Selection of suitable cross-over methods for ICESat change detection. The appr. 70 m footprint of ICESat lidar measurements allows the reconstruction of elevation change time-series within small regions, measuring 1-2 km^2. Several participants of the study (SEC-6, SEC-7) applied crossover change detection methods adapted from radar altimetry measurements that use much larger grid cells. These solutions, especially SEC-7, dramatically reduce the resolution of the results, compared with methods developed for ICESat change detection (see for example SEC-8). Therefore, I recommend removing the SEC-7 result from the Round Robin experiment as it does not adequately represent the results obtained by ICESat specific cross-over change detection methods.

2. Present and examine the spatial distribution of airborne laser altimetry data used for validating the trends derived from satellite observations. While the mean differences between the satellite derived elevation changes and the validation data sets are small, they have large standard deviation. It is hard to interpret these results without examining the spatial distribution of the elevation change errors.

3. Derive separate statistics of elevation errors for fast flowing, crevassed and rugged glaciers and for smooth ice sheet surfaces. According to the manuscript, most elevation change errors are in the range of 0-1 m/yr over the smooth, higher elevation part of the ice sheet. Thus, the overall standard deviation of 1.3-5.5 m/yr of the elevation change errors implies very large errors within the steep, rugged coastal zone and over fast flowing outlet glaciers. A separate presentation of the errors for the smooth, higher elevation part and the rugged coastal region of the ice sheet would allow a better assessment of the different methods used for determining elevation change rates.

The very large differences between the crossover and along-track elevation change estimates derived from the same sensors and shown in Fig. 3 are especially disturbing. It is likely that the large differences between the laser altimetry derived XO and RT elevation change rates are caused by the extremely large cell size selected for deriving the XO solution (see 1). However, RT and XO solutions were derived using similar cell sizes for radar altimetry. The manuscript states “that is spite of a relatively high R^2 the different methods do not resolve the same signal”. This observation indicates a non-linear evolution of elevation change in time. Taken together with the rapid increase of elevation change rates toward the coastal regions and over the fast flowing Jakobshavn Isbræ, the altimetry record indicates a complex spatio-temporal evolution of elevation changes in the study region. Therefore, simple statistics, such as mean and standard deviation of the differences over the whole region might not be suitable for evaluating and comparing the performance of the different methods.

Finally, I recommend providing detailed information about the participants of the Round Robin experiments, including the name/affiliation of the research groups, participants and relevant publications, of course without establishing a connection between this information and the sensors and methods listed in Tables 1-4.

Interactive comment on The Cryosphere Discuss., 7, 5433, 2013.