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The Cryosphere Discussions

Interactive comment on "A new 1 km digital elevation model of the Antarctic derived from combined satellite radar and laser data – Part 1: Data and methods" *by* J. L. Bamber et al.

J. L. Bamber et al.

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This referee makes a number of specific comments that we address below.

1) Slope bias from 0.25-0.5 degs. This is a good point. In a previous paper (Bamber and Gomez Dans, 2005) we discuss what we believe is the physical explanation for the roughness-dependent bias. Up to a roughness of 0.25 degs the relationship between bias and roughness is physical. There is no physical explanation for why the bias should decrease from 0.25 degs upward. The number of data points and the standard deviation of the mean bias is, in general, larger than the correction. Areas where the roughness exceeds 0.25 degs are in high relief areas such as the Transantarctic mountains. As there is no clear relationship (either physical or empirical) between

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roughness and bias above 0.25 degs we have no choice but to apply no correction for the small area that this affects. The maximum correction is 15 m and this is applied to the data. Fig 3. is plotted up to 10 m to help show the pattern of smaller corrections that are most commonly applied. We have amended the figure caption to make this clear. The referee is, however, correct to point out that this is all unclear in the m/s and we have added a short section explaining these points.

2) Scatter plot for polynomial fit to standard deviations in section 2.2. This figure is, in effect, figure 1 from Bamber and Gomez Dans (2005) and so we didn't feel it necessary to reproduce this figure here. However, we have added a reference to this paper in the discussion and included the goodness of fit of the polynomial.

3) Semivariograms for sampling resolution. This is a good suggestion and an alternative approach to the one we adopted. The difficulty with this is that the ice sheet is a fractal surface and there is variability at all scales but with a non-uniform spatial distribution. The ice shelves, for example, have a relatively long-wavelength for the vertical variability while parts of fast flow features have high variability at short wavelength with measurement density dependent, primarily, on latitude. The tradeoff we discuss in the m/s is not so much to do with over-smoothing but with producing a DEM with postings that are not 'representative' or a 'fair' representation of the underlying spatial sampling of the raw data. Thus, we could have produced a DEM at higher resolution but felt that this would have been misleading or mis-representing the underlying sampling density.

4) We have added a discussion of fig 9. Well spotted!

Interactive comment on The Cryosphere Discuss., 2, 811, 2008.