General comments

I found this a generally well written and presented paper that was clear and well laid out. The figures are generally clear and appropriate and the paper was easy to follow.

The Antarctic Peninsula is an area that has experienced a large warming signal and is believed to be substantially out of balance. It is also an area that is likely to contribute significantly to mass imbalance in the future. The authors are correct in pointing out that accurate ice thickness is an important boundary condition for numerical modeling studies and that grounding line dynamics are sensitive to short wavelength bed geometry. The objective of deriving a high resolution and high accuracy bed topography for the Peninsula is therefore creditable and of value. To my knowledge, this is the first attempt to do this and Bedmap2 is certainly not optimal for use on individual glaciers and smaller catchments.

The difficulty with the paper, as it stands, is that the emphasis of the work is toward providing an improved data set for modeling: this is the argument used in the introduction. Nowhere, however, is it demonstrated, even qualitatively, that the data set they have produced will result in more robust model estimates of ice dynamics at a regional scale. There are two possible solutions to this. The first, which I do not recommend, is that they examine the impact of their new data set on higher-order model simulations of ice dynamics and, more importantly, predicted evolution compared with, say, Bedmap2. The second, and more practical, is to provide a more “balanced” introduction and not to over claim or over state the potential, but unproven, value of the new data set for modeling purposes.

Section 4 is welcome but I missed a figure showing the error map for the whole domain. Without robust and reliable error estimates for the derived ice thickness, they are virtually unusable and uninterpretable. This is fairly critical and I do not understand why it was not included. Fig 5 indicates that the errors are not spatially homogenous, which is no surprise. It would appear that the largest relative errors occur for the smallest thicknesses, which is presumably where the glaciers are most sensitive to external forcing and where the largest dynamic changes are likely to take place. This goes back to my first point about how much more useful the data set actually is for model prediction purposes? If relative uncertainties near the glacier terminus are, say, 100%, does this help model projections?

Specific comments

Why have the authors limited this analysis to north of 70 degs? The AP extends considerably further south to around 75 degs (see e.g. Cook and Vaughan, TC 2010). It would be interesting to see how Bedmap2 compared further south with this approach.

Related to the point above about errors is the comparison between measured and modeled velocities (Fig 4). As stated, Fig 4a cannot be used to determine the error directly because the data were used to tune the parameters. Fig 4b provides another measure of the error because to conserve mass the velocity (times thickness) must match the observed flux. It seems that the misfit in velocity also provides, indirectly, information about the error in thickness. Here the comparison is made just at OIB points but it could also be done continuously, and spatially, for the whole domain.

Fig 6a. Would be useful to add the difference in thickness in another colour.

Fig 7 shows absolute thickness errors. Not entirely clear where the grounding line/ice edge is here but assume its top right and that the relative errors for northern portion of Starbuck (~200 m) are large: 100% or more? Why not provide a relative error map for the whole domain? Referring to this might help to what extent this new data set can improve model prediction.