

### **General comments**

The authors have produced a synthetic bed topography for Antarctica aimed at assessing the “interaction between topography, ice-sheet dynamics and hydrology”. This is a worthy objective because, despite over half a century of airborne campaigns, there are still large swathes of Antarctica absent of any data on bed properties. The data set could be of value for testing the sensitivity of numerical models to bed topography but I have two general concerns about its use for this. First, it is evident that “topographic variance” is not a smoothly varying function spatially. This is problematic because the high-frequency component of the topography has only been sampled for a small fraction of the continent (Fig 1). The high frequency characteristics of almost all of West Antarctica and most of East, remain uncharted. In addition, the fraction sampled does not incorporate many of the marine sectors (particularly in West Antarctica) that are highlighted in the introduction as motivation for the work.

Second, the authors refer to “topographic roughness” without being clear about precisely what length scale this relates to. Inherently this length scale is determined by the along track sampling properties of the radar system rather than any underlying geophysical criteria. This is problematic because a key uncertainty in future projections is basal traction (Ritz et al, 2015), which is modulated by metre scale roughness. It would appear that HRES provides no information on roughness at this scale or at any scale below 200 m (given 100 m bin size). While this is shorter wavelength than BEDMAP2 it remains to be demonstrated that it is adequate to elucidate the role and/or importance of “bed roughness” on ice dynamics.

These issues are challenging to address, requiring greater data coverage, which does exist, and sensitivity studies with an ice sheet model to scales of basal topographic variability. It is beyond the scope of this study to do this but the authors, nonetheless, need to include consideration of these points in the paper.

### **Specific comments**

p2, 17 “heavy smoothing” is non scientific terminology. What is heavy? It doesn't have a mass.

p2, 18 poor phrasing.

p2 116-17 ditto

p4, 115 artefacting not a word

Fig 3. Figs a and b essentially identical (to the eye) and provide no real insight: they are identical to the BEDMAP2 topography at the scale plotted. Fig c appears to have had something horrible go wrong with the colour table/conversion. I have no idea what value the purple colours are. This figure needs redrafting to provide some useful info.

Fig 5. Even when zoomed to larger than the printed page I struggled to read the numbers and see the detail in the 18 graphs in this figure.

### **Reference**

Ritz, C., Edwards, T. L., Durand, G., Payne, A. J., Peyaud, V., and Hindmarsh, R. C. A.: Potential sea-level rise from Antarctic ice-sheet instability constrained by observations, *Nature*, 528, 115-118, 2015.