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Unveiling the Antarctic subglacial landscape.

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Better knowledge of the subglacial landscape of Antarctica is vital to reducing uncertainties regarding prediction of the evolution of the ice sheet. These uncertainties are associated with bedrock geometry for ice sheet dynamics, including possible marine ice sheet instabilities and subglacial hydrological pathways (e.g. Wright et al., 2008).
Major collaborative aerogeophysics surveys motivated by the International Polar Year (e.g. ICECAP and AGAP), and continuing large scale radar echo sounding campaigns (ICECAP and NASA Ice Bridge) are significantly improving the coverage. However, the vast size of Antarctica and logistic difficulties mean that data gaps persist, and ice thickness data remains spatially inhomogeneous.
The physics governing large scale ice sheet flow enables ice thickness, and hence bedrock topography, to be inferred from knowledge of ice sheet surface topography and considerations of ice sheet mass balance, even in areas with sparse ice thickness measurements (Warner and Budd, 2000). We have developed a robust physically motivated interpolation scheme, based on these methods, and used it to generate a comprehensive map of Antarctic bedrock topography, using along-track ice thickness data assembled for the BEDMAP project (Lythe et al., 2001). This approach reduces ice thickness biases, compared to traditional inverse distance interpolation schemes which ignore the information available from considerations of ice sheet flow. In addition, the use of improved balance fluxes, calculated using a Lagrangian scheme, eliminates the grid orientation biases in ice fluxes associated with finite difference methods (Budd and Warner, 1996, Le Brocq et al., 2006). The present map was generated using a recent surface DEM (Bamber et al., 2009, Griggs and Bamber, 2009) and accumulation distribution (van de Berg et al., 2006).
Comparing our results with recent high resolution regional surveys gives confidence that all major subglacial topographic features are revealed by this approach, and we advocate its consideration in future ice thickness data syntheses.

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