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Ice Shelf Tidal Motion in the Amundsen Sea – an Assessment of Tide Model Predictions using Radar Interferometry

Malcolm McMillan (1), Andrew Shepherd (2), and Peter Nienow (3)

(1) The Centre for Polar Observation & Modelling, The University of Edinburgh, UK (m.j.mcmillan@sms.ed.ac.uk), (2) School of Earth & Environment, The University of Leeds, Leeds, UK, (3) School of Geosciences, The University of Edinburgh, Edinburgh, UK

The tidal motion of an ice shelf can contaminate satellite-derived estimates of ice shelf thinning and flow speeds. Commonly, this signal is removed by simulating ice shelf tidal motion using a tide model. In this case, the quality of the tide model directly affects the accuracy of thinning and velocity estimates. Due to a lack of in situ records, tide model errors in the Amundsen Sea region of West Antarctica are poorly constrained. Satellite-based interferometric synthetic aperture radar can be used to measure surface displacement and so, over ice shelves, captures both ice flow and tidal displacement. Here we (1) describe two methods to isolate the tidal component of the interferometric signal, (2) use these methods to derive multiple observations of tidal displacement at the Dotson Ice Shelf, and (3) use these results to assess three tide models – TPXO7.1, CATS2008a_opt and FES2004. In both methods, we use model reanalysis pressure fields to correct for the inverse barometer effect, and find that on average this correction improves the agreement between tide model predictions and observations by 6 %. All three tide models considered here perform comparably well. Our first method directly measures the tidal displacement occurring during the acquisition of a single interferogram, and yields root mean square differences between model predictions and observations of 9 ± 7 cm. The second method, which isolates the difference in the tidal signals measured by two interferograms, yields root mean square differences of 11 ± 4 cm. Our assessment indicates that the accuracy of tide models in the Amundsen Sea is comparable to other regions around Antarctica, and suggests that tide model accuracy is not compromised by the lack of in situ measurements in this region.