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# Ocean tides under the Larsen C and Filchner-Ronne ice shelves: GPS comparison with models

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The ocean tides under the Larsen C and Filchner-Ronne Ice Shelves are some of the least well observed on Earth. Data to assimilate into ocean tide models is sparse and often of low quality, and the accuracies of the models are likewise difficult to assess. Tide model errors alias into measurements of ice shelf elevation from satellite altimetry and ice mass change estimates from the Gravity Recovery and Climate Experiment (GRACE). To address this shortcoming, three geodetic-quality GPS receivers were deployed on Larsen C Ice Shelf and ten on Filchner-Ronne Ice Shelf during Nov. 2007. About half of these were retrieved during Feb-Mar 2008, with the others left for the austral winter and retrieved during early 2009. Three-dimensional coordinate time series are determined using a kinematic precise point positioning approach. The resulting height time series are dominated by the ocean tides but also show a response to atmospheric pressure variations (the “inverse barometer effect”). After correcting for these using local pressure data, the individual tidal constituents at each site are obtained by standard tidal analyses. We compare the observed ocean tides with those from a range of global ocean tide models including TPXO6.2, TPXO7.1, FES2004, and GOT4.7, and various regional ocean tide models including the circum-Antarctic CATS2008a. Based on comparison to 24 largely independent records from around the Weddell Sea and Antarctic Peninsula, including the GPS records retrieved in early 2008, FES2004, used in current GRACE analyses, has an RMS error ˜7-8cm in each of the four major tidal constituents. GOT4.7 is the most accurate of the global models in this region with per-constituent RMS error ˜4-6cm, with better performance in the diurnal band (O1 and K1) than in the semi-diurnal band (M2 and S2). The RMS error of the best regional model (CATS2008a) is similar to GOT4.7 in the diurnal band (˜4-5cm) and lower (2–3cm) in the semi-diurnal band. While the models are improving over time, they still h