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The onset of Cenozoic Antarctic glaciation: understanding relative sea-level changes – model and field data comparison

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The onset of Antarctic glaciation across the Eocene/Oligocene transition (EOT; $\sim$34 Ma) is likely to have stored an amount of ice equivalent at least to $\sim$55 m of eustatic sea-level fall. Because of the solid Earth deformations caused by ice and ocean loads variations, and the gravitational attraction exerted by the ice masses on the oceans, the relative sea-level (RSL) change that accompanied and followed the Antarctic ice-sheet build-up was spatially heterogeneous. Recently, the Integrated Ocean Drilling Program (IODP) Expedition 318 has successfully drilled the Antarctic Wilkes Land margin. The RSL changes inferred from the new biostratigraphic and seismic data are revealing the near-field fingerprints of the ice-sheet expansion and may provide fundamental constraints on the volume, extent and chronology of initiation of Antarctic glaciation during the EOT. Here we couple a combined thermo-mechanical ice sheet-shelf model with a self-gravitating and radially stratified visco-elastic Earth model to simulate the ice-sheet evolution and the associated bathymetric changes from field observations. This approach allows us to compute at the same time (i) the bedrock deformation needed to realistically model the ice flow, (ii) the grounding line position along the marine margins, and (iii) the related gravitationally self-consistent RSL changes. The latter are compared with the geological evidences in order to (i) test the sensitivity of the data to the Earth rheological parameters and (ii) retrieve feedback for the ice sheet-shelf model.