AGU 100 FALL MEETING
Washington, D.C. | 10–14 Dec 2018

C51E-1115: Continuous Simulations over the Last 34 Million Years with a Coupled Antarctic Ice Sheet and Sediment Model

Friday, 14 December 2018
08:00 - 12:20
Walter E Washington Convention Center - Hall A-C (Poster Hall)

Much of the knowledge of Antarctic Ice Sheet variations since its inception ~34 Ma derives from marine sediments on the continental shelf, deposited in glacimarine or sub-ice environments by advancing and retreating grounded ice, and observed today by seismic profiling and coring. If coupled ice-sheet and sediment models can simulate these deposits explicitly, direct comparisons with the sediment record would be valuable in linking it to Cenozoic ice and climate history. Here we apply an existing 3-D ice sheet and sediment model to the whole period of late Cenozoic Antarctic evolution. The ice-sheet model uses local parameterizations of grounding-line flux, ice-shelf hydrofracture and ice cliff failure. The sediment model includes quarrying of bedrock, sub-ice transport, and marine deposition. Atmospheric and oceanic forcing is determined by uniform shifts to modern climatology in proportion to records of atmospheric CO2, deep-sea-core d18O, and orbital insolation variations. Initial ice-free and sediment-free bedrock topography is prescribed from the 34 Ma reconstruction of Wilson et al., Palaeo3, 2011, and their estimated rate of tectonic subsidence is applied in West Antarctica.

The model is run continuously from 34 Ma to the present, to capture the entire post-Eocene Antarctic landscape evolution and off-shore sediment packages in a single self-consistent simulation. In order to make these long simulations feasible, the model resolution is very coarse, 80 km. However the ice model's use of local parameterizations for fine-scale dynamical processes yields results that are not seriously degraded compared to finer resolutions in short tests. The primary goals are (1) to reproduce major recognized ice-sheet trends and fluctuations from the Eocene to today, and (2) to produce a 3-D model map of modern sediment deposits. "Strata" are tracked by recording times of deposition within the model sediment stacks. Unconformities in these strata occur in the model that can be compared with observed profiles. Initial results are presented, and preliminary overall comparisons are made with observed sediment packages, focusing on sensitivities to climate forcing, quarrying rates, and sediment parameters that stand in for alternate sediment rheologies.

Authors

David Pollard
Pennsylvania State University Main Campus

Robert M Deconto
Univ Massachusetts

Find Similar

View Related Events

Day: Friday, 14 December 2018