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Western ice sheet evolution studies in the Eastern Ross Sea (Antarctica): a 3D velocity model from seismic tomography.

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In this work, we present the main results obtained from the processing and the tomographic inversion of the multichannel seismic data collected by the OGS-Explora vessel during the 2006 Antarctic cruise. The aim of this work was to provide new insights about WAIS (Western Antarctic Ice Sheet) evolution in the Eastern Ross Sea (Antarctica) since the late Miocene times, and in particular new information about the erosion process that produced an important surface in the Lower Pliocene, called RSU2 (Ross Sea Unconformity 2), and about the nature of adjacent sediments.
The survey zone is a 90x60 km rectangular area in the Eastern Basin (Ross Sea) close to the continental margin and to the North of the DSDP 271 well. A total of 10 parallel lines in NE-SW direction and of 7 parallel lines in NW-SE direction were shot. The total length of the 17 lines is 1230 km, and the distance between two lines in both directions is 10 km.
The seismic data analysis and reflection tomography are the tools adopted to study the RSU2 morphology and the geometrical features of the overlying and underlying units in detail. Tomography is a very efficient tool to reconstruct the velocity macro model. We obtained the velocity model of the total investigated volume and the depth structure of five interpreted horizons by the travel-time inversion of the reflected arrivals picked in the pre-stack data.
The resulting model is used to reconstruct the geomorphological and depositional history of this sector of the outer continental shelf and to infer ice sheet dynamics during Miocene and Plio-Quaternary times. A seismic horizon, younger than unconformity RSU1, marks a significant regional change. High velocity anomaly observed in units below the RSU2 of Pliocene age (3-3.7 Ma) is interpreted as indicative of, glacial sediments over-compacted by overriding of thick and relatively stable ice sheet. The most prominent erosional surface marking the change from prograding to aggrading shelf margin lies below RSU3, interpreted to be of the late Miocene age.
A different dynamics of WAIS expansion over the continental shelf in Miocene-early Pliocene and in late Pliocene-Pleistocene times is suggested. The geometric change of the margin architecture, might indicate a regional, rather than local, change in the ice regime, possibly reflecting a significant step of WAIS evolution in the late Pliocene.