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The Moho depth and the inner crustal structure of the Antarctica region

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Different tectonic units cover the Antarctic territory: platform, orogens and depression structures. This structural variability is reflected both in thickness and physical properties of the crust. This continent has high interest for Earth sciences, because of its origin as the core of the Gondwana supercontinent, and because of a number of present-day peculiar features — such as its being stationary in the global plate tectonic frame, while it is bounded by extensional mid-oceanic ridges, and crossed by the largest known noncollisional mountain range. We present a new Moho map for the Antarctica, derived from geophysical data selected from the literature. The model covers the whole Antarctic region, from the South Pole out to the continental margin, including the Antarctic Peninsula. The Moho depth is represented with a resolution of $1^\circ \times 1^\circ$ on a Cartesian grid obtained by an equidistant azimuthal geographical projection. A large volume of new data has been analyzed: mostly seismic experiments, as well as receiver functions and geological studies. In general, we can identify three large domains within the Antarctic continental crust. The oldest Archean and Proterozoic crust of East Antarctica has a thickness of 36–56 km (with an average of about 41 km). The continental crust of the Transantarctic Mountains, the Antarctic Peninsula and Wilkes Basin has a thickness of 30–40 km (with an average Moho of about 30 km). The youngest rifted continental crust of the West Antarctic Rift System has a thickness of 16–28 km (with an average Moho of about 26 km). The mean Moho depth of the whole model is 33.8 km. The new Moho model exhibits some remarkable disagreements at places with respect to global model CRUST 2.0. Difference between these two models in the crustal thickness may amount up to 24 km (rms = 4.2 km) mainly due to improved resolution of our model's Moho boundary. There are significant changes in regions such as the Ross Sea (that may reach –6 / + 12 km), Dronning Maud Land (up to –2 / +16 km), Enderby Land (up to –2 / +10 km), Gamburtsev Mountains (+24 km), the Lambert Glacier region (–10 / +6 km), Wilkes Subglacial Basin (Wilkes Subglacial Basin, –6 km), Transantarctic Mountains (TAMS, –6 / +16 km), the Antarctic peninsula (+8 km), the Weddell Sea (–2 / +8 km). Thinned crust shows up throughout entire West Antarctica, except from the Antarctic Peninsula, partly in the TAMS, in the Wilkes Subglacial Basin and the Lambert rift in East Antarctica. The Gamburtsev Subglacial Mountains and the western portion of the Dronning Maud Land instead show a thickened crust. Note that the Antarctic Andes on the Antarctic Peninsula and the TAMS have a thinner crust than might have been expected according to their elevations. The origin of this feature is still unclear. Perhaps the crust of the Antarctic Peninsula experienced significant stretching in the past, while the TAMS are either isostatically uncompensated or supported by an anomalously light mantle beneath them. Additionally we received some new results about inner crustal structure of the Antarctica. Our model provides a starting point for numerical modeling of deep mantle structures via a thorough revision of the crustal effects in the observed fields. This model will be used as a starting point in the gravity modeling of the lithosphere and upper mantle structures. Also it may be used for wave propagation modelling at continental scale, crustal correction in tomography and other seismological applications. The new model is available for download in digital format. We plan to update the model in the near future by including new data, particularly in the most poorly covered regions.