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OESbathy version 1.0: a method for reconstructing ocean bathymetry with generalized continental shelf-slope-rise structures

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Abstract. We present a method for reconstructing global ocean bathymetry that combines a standard plate cooling model for the oceanic lithosphere based on the age of the oceanic crust, global oceanic sediment thicknesses, plus generalized shelf-slope-rise structures calibrated at modern active and passive continental margins. Our motivation is to develop a methodology for reconstructing ocean bathymetry in the geologic past that includes heterogeneous continental margins in addition to abyssal ocean floor. First, the plate cooling model is applied to maps of ocean crustal age to calculate depth to basement. To the depth to basement we add an isostatically adjusted, multicomponent sediment layer constrained by sediment thickness in the modern oceans and marginal seas. A three-parameter continental shelf-slope-rise structure completes the bathymetry reconstruction, extending from the ocean crust to the coastlines. Parameters of the shelf-slope-rise structures at active and passive margins are determined from modern ocean bathymetry at locations where a complete history of seafloor spreading is preserved. This includes the coastal regions of the North, South, and central Atlantic, the Southern Ocean between Australia and Antarctica, and the Pacific Ocean off the west coast of South America. The final products are global maps at 0.1° × 0.1° resolution of depth to basement, ocean bathymetry with an isostatically adjusted multicomponent sediment layer, and ocean bathymetry with reconstructed continental shelf-slope-rise structures. Our reconstructed bathymetry agrees with the measured ETOPO1 bathymetry at most passive margins, including the east coast of North America, north coast of the Arabian Sea, and northeast and southeast coasts of South America. There is disagreement at margins with anomalous continental shelf-slope-rise structures, such as around the Arctic Ocean, the Falkland Islands, and Indonesia.

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