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Improved global sedimentary and crustal thickness constraints: Implications for dynamic topography and geothermal resource assessment

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Sedimentary and crustal thickness constraints are crucial for refining dynamic topographic measurements and evaluating geothermal energy prospectivity. Continental sedimentary and crustal thickness measurements are constrained in this ongoing global study. Here, we present the updated methodology and results. Total sedimentary thickness is accurately constrained via a combination of well data and controlled-source seismic experiments. A minimum curvature gridding algorithm is used to interpolate between sedimentary thickness data points. Crustal thickness, defined as the vertical depth from the sediment-basement interface to the Moho, is derived from the updated sedimentary thickness grid and recently published studies which exploit controlled- and passive-source seismic data to constrain depth to Moho. A grid resolution of 0.03 degrees is found to be essential for capturing fine-scale lateral variations in sedimentary thickness. Resulting sedimentary and crustal thickness estimates are used to improve continental residual elevation constraints, a proxy for dynamic topography. Residual elevation is quantified by isolating and removing isostatic signals arising from sediment loading and crustal heterogeneity, revealing the magnitude of mantle-induced vertical motion at the surface. Our estimates additionally improve predictions of surface heat flow and geothermal gradients, directly informing geothermal energy assessments. Collectively, these datasets can be used to advance our understanding of mantle-lithosphere interactions and sustainable energy resources.