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Machine learning prediction of sediment thickness on the Northern Mid-Atlantic Ridge

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The boundary between relatively soft marine sediment and igneous ocean crust can be a more significant physical, hydrologic, chemical and biologic boundary than even the seawater-sediment interface. Existing global maps of sediment thickness (sediment isopach), although digital, were compiled from static data sources, and interpretively contoured. To update the map with new data it must be re-interpreted, a time-consuming process that is difficult to quantitatively repeat. We present here a geospatial machine learning (GML) prediction of sediment thickness where thicknesses have not been measured directly. The GML, developed at NRL, uses observed data (two-way travel times from seismic and/or acoustic profiles) as input. The output is a grid at a pitch of 30 arc seconds; essentially a digital thickness model (DTM), analogous to a digital elevation model. We use GML techniques developed and published at NRL as part of the Global Predictive Seabed Model (GPSM). To demonstrate the technique, we focus here on the Northern Mid-Atlantic Ridge, where ice-rafting contributes significantly to sediment thickness modulated by climatic influences, and where new seismic and bottom penetrating acoustic profiles are frequently acquired. Since the GML technique we use has been shown to be valid globally we expect to extend the DTM to global extent.