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Previously unknown topographic features beneath the Amery Ice Shelf, East Antarctica, revealed by airborne gravity

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The seafloor topography under the Amery Ice Shelf steers the flow of ocean currents transporting ocean heat, and thus is a prerequisite for precise modeling of ice-ocean interactions. However, hampered by thick ice, direct observations of sub-ice-shelf bathymetry are rare, limiting our ability to quantify the evolution of this sector and its future contribution to global mean sea level rise. We estimated the seafloor topography of this region from airborne gravity anomaly using simulated annealing. Unlike the current seafloor topography model which shows a comparatively flat seafloor beneath the calving front, our estimation results reveal a 255-m-deep shoal at the western side and a 1,050-m-deep trough at the eastern side, which are important topographic features controlling the ocean heat transport into the sub-ice cavity. The gravity-estimated seafloor topography model also reveals previously unknown depressions and sills in the middle of the Amery Ice Shelf, which are critical to an improved modeling of the sub-ice-shelf ocean circulation and induced basal melting. With the refined seafloor topography model, we anticipate an improved performance in modeling the response of the Amery Ice Shelf to ocean forcing.