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Tides stir up deep Arctic heat

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The Arctic is warming at twice the rate of the rest of the planet. One of the largest sources of heat to the Arctic Ocean is the warm salty Atlantic water (AW) which enters through the Fram Strait and circulates at intermediate depth round the Arctic basin. The heat contained in the AW is sufficient to entirely melt the Arctic sea ice but is insulated from the surface by a layer of colder fresher water. Across much of the Arctic Ocean there is insufficient turbulence to drive vertical mixing, and so heat fluxes are a result of double diffusion (DD) and are consequently weak (< 0.1 W m^{-2}). Here we present a new pan-Arctic series of direct measurements of TKE dissipation rate. The new measurements show enhanced turbulent mixing, and hence heat fluxes, over much of the continental slope around the Arctic boundary. The rate of TKE dissipation is found to increase with the bathymetric slope and vary longitudinally with the largest values to the north of Svalbard resulting in enhanced diapycnal heat fluxes over this region (20 W m^{-2}). The observed 2-order of magnitude longitudinal variation in TKE dissipation rate correlates with the rate of dissipation of tidal energy, estimated from the local difference between the work done by the tide generating force and the tidal energy flux divergence from the TPXO8 inverse tidal solution. This correlation leads to the conclusion that the enhanced mixing observed over the continental shelf break north of Svalbard is a result of tidal processes.