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Turbulence Observations beneath the Larsen C Ice Shelf, Antarctica

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Antarctic ice shelves restrain the flow of grounded ice into the ocean, and are thus an important control on Antarctica's contribution to global sea level rise. Ice shelves interact with the ocean beneath them, and the transfer of heat through the ice shelf-ocean boundary layer is critical in setting the basal melt rate and the sub-ice shelf circulation. The physics of this boundary layer is poorly understood, however, and its inadequate representation in numerical models is hampering our ability to predict the future evolution of Antarctic ice shelves and global sea-level rise. Using a hot-water drilled access hole, two turbulence instrument clusters were deployed beneath the southern Larsen C Ice Shelf in December 2011. Both instruments returned a year-long time series of turbulent velocity observations, providing a unique opportunity to explore the turbulent processes at two depths within the ice shelf-ocean boundary layer. Our results show that although the scaling between turbulent kinetic energy (TKE) dissipation and mean flow speed varies with distance from the ice shelf base, TKE dissipation is balanced by the shear production of TKE at both levels. Ultimately the aim of these observational efforts is to better constrain our parameterisations of the boundary layer in large-scale numerical models, allowing more accurate simulations of ice shelves to be made under the warming climate.