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Water Mass Characteristics and Distribution Adjacent to Larsen C Ice Shelf, Antarctica

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The physical oceanographic environment, water mass mixing and transformation in the area adjacent to Larsen C Ice Shelf (LCIS) are investigated using hydrographic data collected during the Weddell Sea Expedition 2019. The results shed light on the ocean conditions adjacent to a thinning LCIS, on a continental shelf that is a source region for the globally important water mass, Weddell Sea Deep Water (WSDW). Modified Weddell Deep Water (MWDW), a comparatively warmer water mass of circumpolar origin, is identified on the continental shelf and is observed to mix with local shelf waters, such as Ice Shelf Water (ISW), which is a precursor of WSDW. Oxygen measurements enable the use of a linear mixing model to quantify contributions from source waters revealing high levels of mixing in the area, with much spatial and temporal variability. Heat content anomalies indicate an introduction of heat, presumed to be associated with MWDW, into the area via Jason Trough. Furthermore, candidate parent sources for ISW are identified in the region, indicating the potential for the circulation of continental shelf waters into the ice shelf cavity. This highlights the possibility that offshore climate signals are conveyed under LCIS. ISW is observed within Jason Trough, likely exiting the sub-ice shelf cavity en route to the Slope Current. This onshore-offshore flux of water masses links the region of the Weddell Sea adjacent to northern LCIS to global ocean circulation and Bottom Water characteristics via its contribution to ISW and hence WSDW properties.

What remains to be clarified is whether MWDW found in Jason Trough has a direct impact on basal melting and thus thinning of LCIS. More observations are required to investigate this, in particular direct observations of ocean circulation in Jason Trough and underneath LCIS. Modelling experiments could also shed light on this, and so preliminary results based on NEMO global simulations explicitly representing the circulation in under-ice shelf seas, will be presented.