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

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Abstract:

The physical oceanographic environment, water mass characteristics and distribution in the area adjacent to Larsen C Ice Shelf (LCIS) are investigated using hydrographic data collected during the 2019 Weddell Sea Expedition. The results shed light on the ocean conditions adjacent to a thinning LCIS, on a continental shelf that is a source region for Weddell Sea Deep Water (WSDW), a precursor of the globally important Antarctic Bottom Water. Modified Warm Deep Water (MWDW), a water mass of circumpolar origin, is identified on the continental shelf and is observed to mix with Ice Shelf Water (ISW) and High Salinity Shelf Water (HSSW), both source waters of WSDW. A source water type decomposition analysis reveals high levels of mixing in the area, with much spatial 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 a flow of continental shelf waters into the ice shelf cavity; however, the impact on LCIS cannot be surmised from the available observations. ISW and HSSW are observed to make dominant contributions to the densest layers within Jason Trough, where waters are likely en route to feed the deep layers of the Antarctic Slope Current. This cross-shelf 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 HSSW, and hence WSDW properties.