



Seasonal changes in water masses and circulation on the Amundsen Sea continental shelf

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Warm Circumpolar Deep Water (CDW) circulation on the continental shelf of the Amundsen Sea has been implicated in accelerating the melting of the ice shelves, leading to increased ice mass loss. However, understanding of this process is limited by the difficulty of collecting data in this area, especially during the winter season when harsh conditions and sea ice cover limit traditional observation techniques. Here we present results of a seal tagging campaign on the Amundsen Sea continental shelf in 2014, producing the first near-year-round, full-depth sampling, and yielding an order of magnitude more profiles in one year than the entire historical multi-decadal CTD data set.

Analysis of > 11,000 new seal-borne hydrographic profiles from the summer, autumn and winter seasons of 2014 reveals that the warmest CDW reaches the continental shelf via the eastern trough. Profiles are divided into summer (February-May) and winter (June-October). Properties on the 27.77 isopycnal, representing CDW, throughout much of the eastern Amundsen Sea are up to 0.08 more saline and up to 0.5°C warmer in summer than in winter, suggesting greater quantities of CDW reaching the continental shelf in summer. Seasonal variations in CDW are particularly prominent around Burke Island and in the northwest of Pine Island Bay. Below the mixed layer in the region around Burke Island, isopycnals are ~100 m shallower in winter than summer.

In Pine Island Bay, a gyre circulation is revealed by doming isopycnals. In winter at the edge of the gyre, isopycnals are ~50 m shallower, but at the same time at the centre of the gyre, isopycnals are deeper. This suggests a slowing of the Pine Island Bay gyre in winter, with associated reduction in the doming of the isopycnals. Here we discuss the dynamical changes in circulation that are suggested by the seasonal changes in isopycnal slopes and water mass properties.