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Intrusion of Circumpolar Deep Water over the continental shelf in the central Amundsen Sea

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The Amundsen Sea sector is the most rapidly changing region of the Antarctic ice sheets. It has been claimed that the rapid retreat of the glaciers (or ice sheets) is primarily related to the intrusion of warm Circumpolar Deep Water (CDW) which acts as an oceanic heat source. The Amundsen shelf troughs were suspected to be main conduits supplying warm CDW onto the continental shelf, eroding the underside of the ice sheets and glaciers.

Despite the critical role of CDW in the continental shelf of the Amundsen Sea, vital information is still lacking concerning the spatial-temporal variability of CDW. This is mainly because the Amundsen Sea is remotely located and the harsh weather and sea conditions limit the access to its inner shelf. This pronounced lack of data hinders the evaluation and prediction of physical processes and associated biogeochemical processes in the Amundsen Sea. Using the icebreaker R/V Araon, a multi-disciplinary scientific cruise was conducted between December, 2010 and January, 2011 to reveal the spatial distribution of CDW on the Amundsen shelf.

During the expedition, total 30 CTD stations were visited. Warm CDW occupied a large volume seaward of the continental slope. During the transport onto the continental shelf it is modified by subsurface melting processes and interaction with Antarctic Surface Water into a fresher and colder water mass, Modified CDW (MCDW). Two cross-trough transects clearly show the intruding tongue of MCDW. The core of warm, denser water was mostly confined to the deeper part of shelf trough. The temperature of the surface water varied spatially. The warmest surface water, -0.8~-0.4°C, was found in the open polynya, and the coldest water was found below sea ice.

In order to understand the temporal variation of the flow of CDW, the shipborne measurements were combined with a mooring measuring temperature, salinity and velocity every hour during 2010. During the observation period, the average water and heat transport were 2.5 m^2/s and 26 MW/m along the western channel, respectively. The velocity of the CDW along the western channel showed a good correlation with the variation of eastward wind speed. Preliminary results collected during the upcoming Araon cruise during austral summer 2012 will be also presented in terms of CDW intrusion and its synoptic circulation on the Amundsen shelf.