



Landfast ice cover impacts shelf-ocean interaction over the southeastern Wandel Sea (Northeast Greenland)

Igor Dmitrenko (1), Sergei Kirillov (1), David Babb (1), Leif Toudal Pedersen (2), Søren Rysgaard (3), and David Barber (1)

(1) University of Manitoba, Centre for Earth Observation Science, Winnipeg, Canada (igor.dmitrenko@umanitoba.ca), (2) National Space Institute, Technical University of Denmark, Lyngby, Denmark, (3) Arctic Research Centre, Aarhus University, Aarhus, Denmark

The Wandel Sea is the only place in the high Arctic where the landfast ice can extend over the shelfbreak and upper continental slope. The Wandel Sea is covered by the multiyear landfast sea ice all year around, and only the interior of fjords becomes ice free during August-September. Since summer 2016 the multiyear landfast ice bridge over the Wandel Sea outer shelf became unstable, and a sizeable portion collapsed in August 2017. The landfast ice edge to the east roughly delineates the Wandel Sea continental shelf break, which is where a coastal polynya opens in response to southerly winds.

The landfast ice-tethered oceanographic mooring was deployed over the southeast Wandel Sea outer shelf from May 2015 to April 2016. The mooring located ~18-20 km from the landfast ice edge carried an Ice Tethered Profiler recording salinity-temperature-depth (CTD) and colored dissolved organic Matter (CDOM) fluorescence profiles every 3 hours for a year. This was accompanied by the ADCP velocity observations.

The satellite imagery shows that since mid-December 2015 the landfast ice edge, controlled by northerly winter winds through a surface Ekman onshore transport, was gradually extending eastward and in mid-March 2015 it was finally stabilized over the Wandel Sea upper continental slope. During this time, Ekman transport of the Pacific-derived Arctic water to the Wandel Sea shelf was observed. For the upwelling-favourable summer wind forcing, the Atlantic water on-shelf inflow is expected along with outflow of the Pacific-derived Arctic water through the overlaying water layer. In fact, however, the on-shelf Atlantic water flow was observed following the upwelling-favourable storms in June-July 2015 by about one month. We suggest that this delay is attributed to the landfast ice extending eastward beyond the shelfbreak. This implies that upwellings are sensitive to the sea-ice conditions over the continental slope. As soon as the outer part of the landfast ice area was collapsed, and the landfast ice edge was resided onshore by ~17 km beyond the shelf break, the Atlantic water on-shelf flow was established in response to the upwelling-favourable southerly wind forcing. Thus, the landfast ice extending during winter over the Wandel Sea shelfbreak and upper continental slope damps upwelling, which starts to develop in summer as soon as the outer portion of the landfast ice is collapsed.