Halocline water modification at the Laptev Sea continental margin

A general pattern in water mass distribution and potential shelf-basin exchange is revealed at the Laptev Sea continental slope based on hydrochemical and stable oxygen isotope data from summers 2005-2009 (Fig.1). Despite considerable interannual variations, a frontal system can be inferred between shelf, continental slope and central Eurasian Basin waters in the upper 100 m of the water column along the continental slope. Our analyses suggest that advective processes from upstream locations play a significant role in the halocline formation in the northern Laptev Sea.

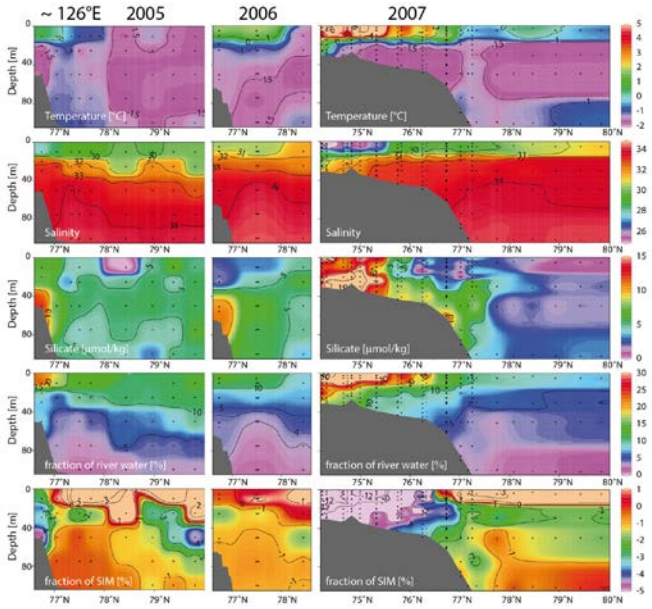

Fig.1: Sections across the shelf break along 126°E taken in summers 2005- 2007, Fractions of river water and sea-ice meltwatern are derived from $\delta^{18}O/S$ mass balances (Bauch et al. 20014). Note that negative fractions of sea-ice meltwater represent the amount of freshwater removed as sea-ice and are proportional to the amount of brine added to the water parcel.

In addition to the along-slope frontal system at the continental shelf break, a strong gradient is identified on the Laptev Sea shelf between 122°E and 126°E with an eastward increase of riverine and sea-ice related brine water contents. These waters cross the shelf break at ~140°E and feed the Low Salinity Halocline Water (LSHW, salinity S<33) in the upper 50 m of the water column.

High silicate concentrations in Laptev Sea bottom waters may lead to speculation about a link to the local silicate maximum found within the salinity range of ~33 to 34.5, typical for the Lower Halocline Water (LHW) at the continental slope. However brine signatures and nutrient ratios from the central Laptev Sea differ from those observed at the continental slope. Thus a significant contribution of Laptev Sea bottom waters to the LHW at the continental slope can be excluded. The silicate maximum within the LHW at the continental slope may be formed locally or at the outer Laptev Sea shelf. Similar to the advection of the sea-ice melt signal along the Laptev Sea continental slope the nutrient signal at 50-70 m water depth within the LHW might also be fed by advection parallel to the slope. Thus, our analyses suggest that advective processes from upstream locations play a significant role in the halocline formation in the northern Laptev Sea.

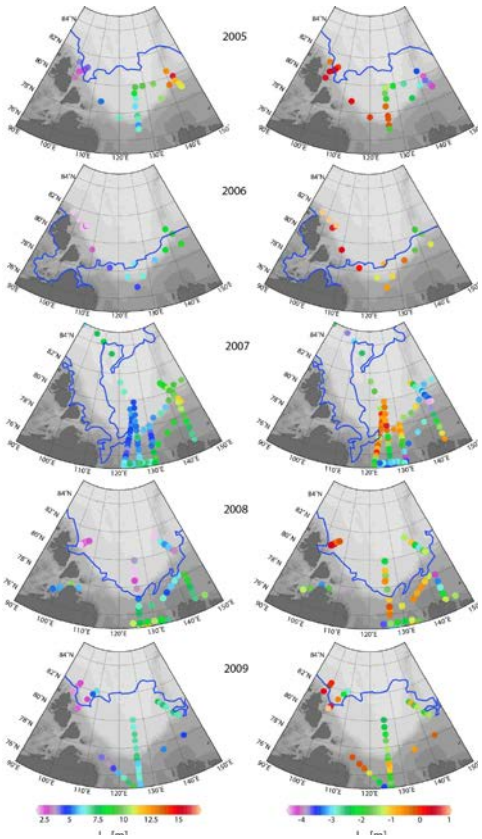

Fig.2: Integrals of river and sea-ice meltwater fractions over the upper 150 m of the water column. The sea-ice edge on Sep. 15th is shown in blue. The lack of correlation between the local retreat of the ice cover and the sea-ice melt signal consistently found at the continental slope supports the hypothesis of advection from upwind locations.

Reference: Bauch, D., Torres-Valdes, S., Polyakov, I., Novikhin, A., Dmitrenko, I., McKay, J. and Mix, A.: Halocline water modification and along-slope advection at the Laptev Sea continental margin, Ocean Sci., 10(1), 141–154, doi:10.5194/os-10-141-2014, 2014.

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