Geophysical Research Abstracts
Vol. 15, EGU2013-4759, 2013
EGU General Assembly 2013

Fronts and intrusions in the upper Deep Polar Water of the Eurasian and Makarov basins

Natalia Kuzmina (1), Bert Rudels (2,3), Natalia Zhurbas (1,4), Dmitry Lyzhkov (1,4)

(1) Shirshov Institute of Oceanology, Moscow, Russia, (2) Finnish Meteorological Institute, Helsinki, Finland, (3) Department of Physics, University of Helsinki, Finland, (4) Moscow Institute of Physics and Technology (State University), Dolgoprudny, Russia

CTD data obtained in the Arctic Basin are analyzed to describe structural features of intrusive layers and fronts encountered in the upper Deep Polar Water. This work is an extension of Arctic intrusions studies by Rudels et al. (1999) and Kuzmina et al. (2011).

Numerous examples of fronts and intrusions observed in a deep layer (depth range of 600–1300 m) in the Eurasian and Makarov basins where salinity is increasing, and temperature is decreasing with depth (stable-stable thermohaline stratification), are described. The data are used to estimate hydrological parameters capable of determining different types of fronts and characterizing intrusive layers depending on the front structure. Coherence of intrusive layers is shown to get broken with the change of front structure. An evidence is found that enhanced turbulent mixing above local bottom elevations can prevent from intrusive layering.

A linear stability model description of the observed intrusions is developed based on the Merryfield's (2000) assumption that interleaving is caused by differential mixing. Theoretical analysis is focused on prediction of the slopes of unstable modes at baroclinic and thermohaline fronts.

Apparent vertical diffusivity due to turbulent mixing at baroclinic and thermohaline fronts is estimated on the basis of comparison of observed intrusion slopes with modeled slopes of the most unstable modes. Apparent lateral diffusivity is estimated too, based on Joyce (1980) approach. These estimates show that intrusive instability of fronts caused by differential mixing can result in sizable values of apparent lateral heat diffusivity in the deep Arctic layer that are quite comparable with those of the upper and intermediate Arctic layers (Walsh, Carmack, 2003; Kuzmina et al., 2011).