INFLUENCE OF ATLANTIC INFLOW ON FRESHWATER CONTENT IN THE ARCTIC OCEAN

G.V. Alekseev[1], A.V. Pnyushkov[1,2], A.V. Smirnov[1], A.E. Vyazilova[1], N.I. Glok[1]

[1] — Arctic and Antarctic Research Institute, St. Petersburg, Russian Federation (alexgv@aari.ru)

[2] — International Arctic Research Center, University of Alaska, Fairbanks, USA

Inter-decadal changes in the water layer of Atlantic origin and freshwater content (FWC) in the upper 100 m layer were traced jointly to assess the influence of inflows from the Atlantic on FWC changes based on oceanographic observations in the Arctic basin for the 1960s – 2010s decades. For this assessment, we used oceanographic data collected at the Arctic and Antarctic Research Institute (AARI) and the International Arctic Research Center (IARC).

The results demonstrated that the upper boundary of the Atlantic water (AW) layer, identified with the depth of zero isotherm, raised everywhere by several tens of meters in 1990s – 2010s, when compared to its position before the start of warming in the 1970s (Fig. 1 a-d). The lower boundary of the AW layer, also determined by the depth of zero isotherm, became deeper. Such displacements of the layer boundaries indicate an increase in the volume of the Atlantic water in the Arctic basin coming through Fram Strait and the Barents Sea. As a result, the balance of water masses was disturbed and its restoration had to occur due to the reduction of the volume of the upper most dynamic freshened layer [1-3]. Accordingly, the content of fresh water in this layer should decrease, if it does not make up by the growth of fresh water from rivers and precipitation. Our results shown that FWC has decreased in the 50–100 m layer in the Eurasian part of the Arctic Basin to the west of 180°E in the 1990s (Fig. 1 e-h). In contrast, the FWC to the east of 180°E and closer to the shores of Alaska and the Canadian archipelago increased. These opposite tendencies have been intensified in the 2000s and the 2010s. The influence of fresh water influx manifested clear as an increase in water storage in the Canadian Basin and the Beaufort Gyre in the 2000s – 2010s (Fig.1 g, h).

Conclusions

The warming detected in the early 1990s in the layer of water of Atlantic origin north of the Kara Sea was traced throughout the Arctic basin in all subsequent decades including the 2010s. Large-scale changes in the AW layer affected the vertical structure of the entire water column in the Arctic Ocean. The upper boundary of the AW layer lifted up everywhere for several tens of meters compared to its position in the 1970s before the start of the AW warming. At the same time, the lower boundary of the AW layer became deeper as a result of the enhanced transport of the transformed AW through the Barents and Kara Seas. The FWC in the 50–100 m

layer decreased in the Eurasian part of the Arctic basin to the west of 180° E. Contrary, in the Canadian basin the FWC increased. The influence of freshwater influx on FWC changes was manifested as an increase in the water content in the Canadian Basin and the Beaufort Gyre in the 1990s - 2010s, which may be partly a consequence of the increase of the AW inflow into the North European basin, alongside an increase in cyclonicity over the Arctic basin and heat and moisture transports through the Atlantic sector of the Arctic Ocean.

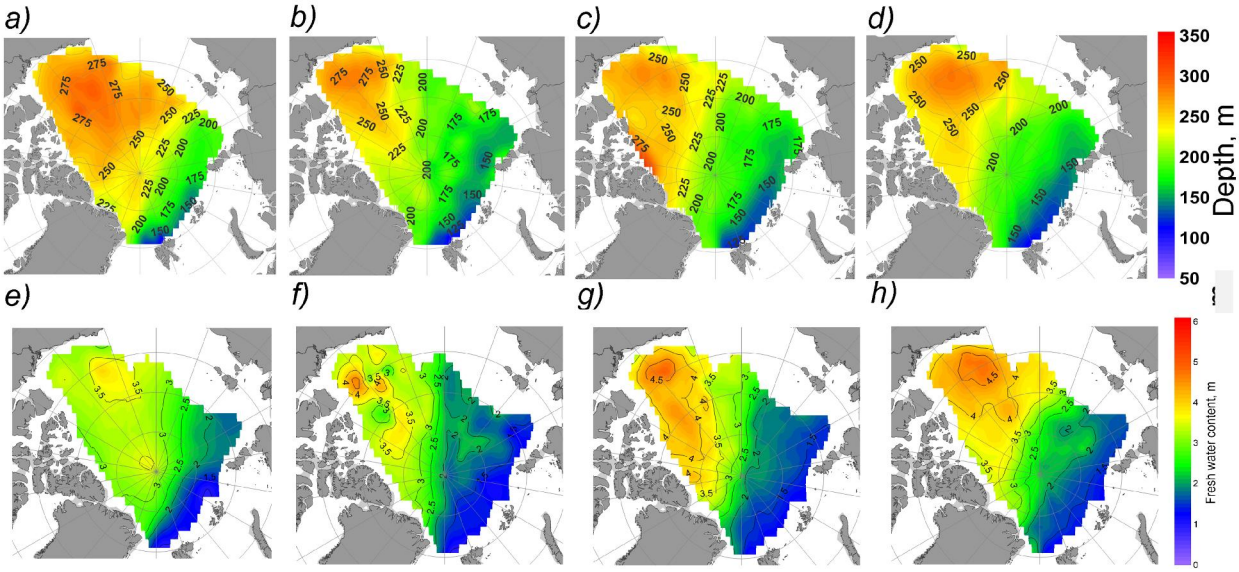

Fig. 1. The depth of the upper boundary of the AW layer in decades: a — in the 1970s, b — the 1990s, c — the 2000s, d — the 2010s. The fresh water content in the 50–100 m layer in decades: e — the 1970s, f — the 1990s, g — the 2000s, h — the 2010s

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