# INFLUENCE OF SST ANOMALIES IN LOW LATITUDES ON ATMOSPHERIC HEAT TRANSPORT TO THE ARCTIC

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The purpose of the study is to assess the influence of anomalies of the ocean surface temperature (SST) in the low latitudes of the Atlantic, Indian and Pacific oceans on the change in the winter meridional atmospheric heat transport to the Arctic and to propose the process-based explanation of this influence. Estimates of meridional atmospheric heat transport (MAHT) to the Arctic through the Atlantic “gate" (0 – 80° E at 70 ° N) in winter (December-February) 1980- 2015 fulfilled on the basis of ERA-Interim show [1] the main contribution of MAHT to the anomaly of winter surface air temperature (SAT) in the Arctic. Inter-annual variability of winter MAHT includes a trend and 5-7 years cyclicity, originated presumably from SST anomalies in the low latitudes of the Atlantic, Indian and Pacific oceans. To inspect this assumption, the area and month with maximal correlation between SST and winter MAHT, as well as the respective lag were found for each ocean [2]. Fig.1 shows the correlation between SST anomaly in October and winter MAHT with a 27-month lag. Fig.2 presents time series of SST for red areas in Fig.1 and winter MAHT to the Arctic for 1982-2014.

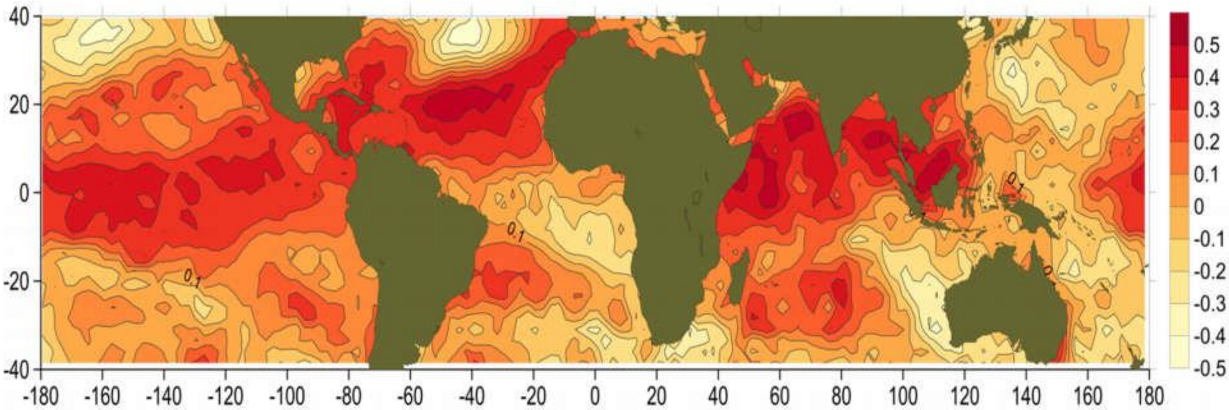


Figure 1. Correlation coefficients between SST anomalies in October in low latitude areas of the Pacific, Atlantic and Indian and anomalies of winter MAHT with a 27-month lag.

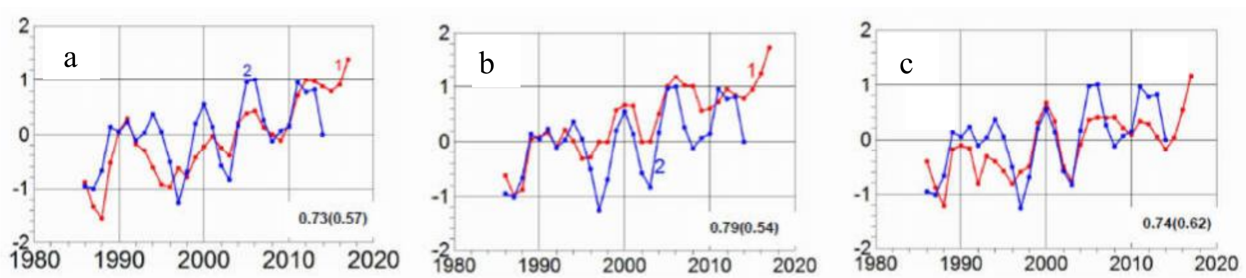


Figure 2. Time series of normalized SST (1) and MAHT (2) anomalies smoothed with a 3- year window. a – SST in the Indian Ocean in October and winter MAHT 27 months later; b – SST in the Atlantic, Indian, Pacific Oceans in October and winter MAHT after 27 months; c – SST in 10°N - 10°S area in August and winter MAHT after 30 months. Numbers in the bottom right corners are the correlation coefficients between (1) and (2). The values in the brackets are for the detrended time series.

The SST anomalies influence the atmospheric circulation through the NAO mode that is correlated significantly and negatively with SST (Fig. 3). The SST influence on the oceanic heat transport to the Arctic is confirmed by the correlation between SST anomalies in low latitudes and water temperature in 50-200m layer at section along the Kola meridian in the Barents Sea (table 1).

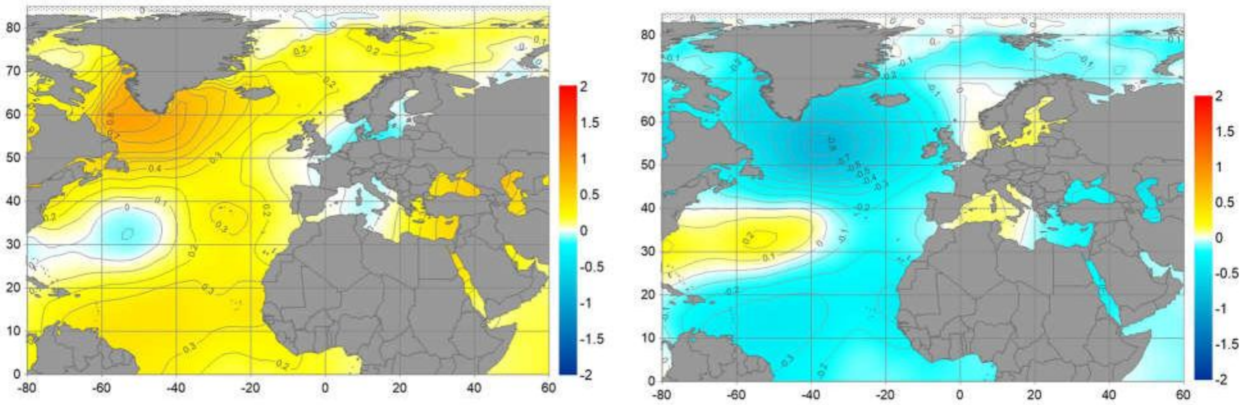


Figure 3. Composites of annual SST anomalies under strong negative (a) and positive (b) annual NAO.

Table 1. Correlation between SST anomalies in low latitudes and mean water temperature in 50- 200 m layer at section along the Kola meridian [http://www/pinro.ru/ /labs/labhidro/]. Slash divides coefficients for the raw and detrended series.

| SST anomalies | Corr. coefficients (lag, months) |
|---|---|
| In Atlantic Ocean , October | 0.76/0.46 (27) |
| In Indian Ocean, October | 0.74/0.49 (27) |
| In Pacific Ocean, July | 0.15/0.11 (30) |
| In area 10°N - 10°S, August | 0.55/0.34 (29) |

## Conclusions

The effect of SST anomalies in the low latitudes of the Atlantic, Indian and Pacific Oceans on the winter atmospheric heat transport to the Arctic through the "Atlantic gates" at 70$^{0}$N (0 to 80°E) and on the inflow of water from the North Atlantic into the Barents Sea has been established.

The delay (> 2 years) of the reaction of atmospheric and oceanic heat influxes to the Arctic on SST anomaly means that the influence is realized by the interaction of oceanic and atmospheric circulation modes.

It is the North Atlantic Oscillation (NAO) in the atmosphere, which is negatively correlated with the anomalies of low-latitude SSTs in all three oceans.

Negative NAO mode prevails with a positive SST anomaly at low latitudes and corresponds to positive SST anomaly in the high latitudes of the North Atlantic, which manifests themself three years later in the Norwegian and Barents Seas.

The oceanic circulation system, including the Gulf Stream, the North Atlantic Current and its continuation in the Nordic Seas spreads the influence of the SST anomaly to the Arctic. As a result, after 2.25 years the temperature of the water in the Barents Sea increases and the winter atmospheric heat transport to the Arctic intensifies.

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**References**

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