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Arctic atmospheric circulation patterns responsible for dry and cold air inflows to the Baltic Sea region

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Essential changes have taken place in atmospheric circulation over the Northern Atlantic in winter and spring during the second half of the 20th century. The winter temperature rise in Europe is frequently attributed to the intensification of zonal flow on the Northern Atlantic region and the same is valid for the Baltic Sea region. Intensification of zonal circulation and its expression through NAO and AO indices have been thoroughly studied, but less is known about mechanisms causing declination from the zonality of flow. Extremely cold weather in winter and spring in Baltic Sea region is related to the radiative cooling or advection of cold air masses. In both cases, the typical western flow is blocked and the region is directly influenced by atmospheric circulation conditions in the Arctic through the cold air advection events.

Our aim is to study which large scale atmospheric circulation patterns are responsible for this kind of cold air advection to the Baltic Sea region in winter and spring (from December to May). The second task is to identify if this kind of circulation has become less frequent in the region under research beginning from the last half of the 20th century till now.

Describing the atmospheric circulation patterns we use several classifications of atmospheric circulation on daily level. The domain of the classifications covers Atlantic-European sector of the Arctic, including area between Greenland and Novaya Zemlya archipelago. Manual classifications by Vangengeim-Girs and Dzerdzejevski are used, but also several newly calculated ones, that apply different classification methods from cost733class software. For the latter ones geopotential height fields at 500 hPa level from NCEP-NCAR reanalysis are classified for the period 1948-2013. The cold air advection events are determined by daily temperature drops by at least 3°C during 24 hours. The circulation types that bring advection of cold Arctic air to the Baltic Sea region are analysed in detail.