

Climate changes in the North Atlantic region

Alexander Polonsky[†];

[†] Marine Hydrophysical Institute, Ukraine

Leading author: apol@alpha.mhi.iuf.net

I'm going to present a brief review of the works devoted to the investigation of the regional manifestations of global warming, Atlantic Multidecadal Oscillation (i.e., of the quasiperiodic natural variations of the ocean-atmosphere system in the North Atlantic with typical time scales of 50-100 yrs.) and thermohaline catastrophe (i.e., shutting down of thermohaline circulation in the North Atlantic). The typical scale of the Atlantic Multidecadal Oscillation is determined by an adjustment of meridional oceanic circulation in the North Atlantic to the changes of the surface conditions there. The analyzed oscillation affects various climatic characteristics: air temperature, river discharge in the European and North-American regions, the number and intensity of tropical cyclones in the Atlantic Ocean, and the parameters of mid-latitude cyclones and anticyclones in the Atlantic-European region. The main mechanism by which the Atlantic Multidecadal Oscillation affects the climatic characteristics of the regions neighboring with the North Atlantic is the atmospheric response to the thermal anomalies in the ocean leading to a shift of the centers of atmospheric action and to the changes in the intensity and predominant directions of propagation of atmospheric cyclones and anticyclones. By using the results of long-term instrumental observations carried out in Eastern Europe and the data array of reconstructed temperature in the Alpine region, it is shown that the Atlantic Multidecadal Oscillation accounts for a significant proportion of low-frequency variations of temperature in Europe. This fact confirms the potential predictability of the regional atmospheric manifestations of the Atlantic Multidecadal Oscillation on the decadal-scale. The rate of quasiperiodical regional warming/cooling of surface air temperature due to Atlantic Multidecadal Oscillation can exceed the regional temperature rising due to global warming. In particular, the fast warming of the North Atlantic region during the last three to four decades of 21st century is due to coincidence of human-induced trend and transition from negative to positive phase of the Atlantic Multidecadal Oscillation. Realization of thermohaline catastrophe for the recent climatic epoch is unlikely because of circulation stability to imposed typical thermohaline fluctuations due to possible surface changes in the North Atlantic.