



Impact of the North Atlantic dipole on climate changes over Eurasia

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Hydrophysical and meteorological characteristics of negative (1948-1976, 1999-2015) and positive (1977-1998) phases of the Pacific Decadal Oscillation (PDO) / Interdecadal Pacific Oscillation (IPO) in the North Atlantic and Eurasia are constructed and investigated. Specifically, the near-surface temperature, sea-level atmospheric pressure, wind speed, heat content of the upper 700 m ocean layer, water temperature and salinity at various depths, the latent and sensible heat fluxes from the ocean to the atmosphere are analyzed. The fields obtained from different sources (20thC_ReanV2c, ERA-20C, JRA-55, NCEP/NCAR, HadCRUT4, HadSLP2, NODC, Ishii, SODA, OAFflux, HadSST3, COBE2, ERSSTv4) are in good agreement and complement each other. This gives important information about the hydrometeorological conditions in the region under study. Analysis of these data has shown that in the upper 1000 m North Atlantic layer there is a thermal dipole which can be interpreted as an oceanic analog of the atmospheric North Atlantic Oscillation (NAO). An index of the North Atlantic Dipole (NAD) as the difference between the mean heat contents in the upper 700 m oceanic layer between the regions (50°-70° N; 60°-10° W) and (20°-40° N; 80°-30° W) is proposed. A possible physical mechanism of the internal oscillations with a quasi-60-year period in the North Atlantic-Eurasia system of ocean-atmosphere interactions is discussed.

Dipole spatial structure from observations datasets and re-analyses were compared with the results of the Historical Experiment from the climate models of the CMIP5 project. It is found that several climate models reproduce dipole spatial structure of the near-surface temperature and sea level pressure anomalies similarly to these fields in the re-analyses considered. However, the phase diagrams of the gradient of near-surface temperature and sea level pressure between the Azores High and Island Low from climate models do not separate on subsets as the observation diagrams. Keeping in mind the prognostic goals we supposed that this result could be essential for revealing the relationships between the climatic parameters of the Eurasian continent and the thermodynamic processes in the specific areas of the North Atlantic Ocean.