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Association of the North Atlantic surface turbulent heat fluxes with cyclone dynamics

Sergey Gulev (1) and Natalia Tilinina (1,2)
(1) Shirshov Institute of Oceanology, RAS, (2) AWI, Brmerhaven, Germany

The atmospheric mechanisms forming extremely strong air-sea turbulent heat fluxes under the influence of extratropical cyclones in the North Atlantic are analysed using the NCEP-CFSR reanalysis for the winter periods from 1979 - 2010. Surface turbulent flux extremes were quantified by considering both absolute and relative extremeness of fluxes. For all moments of extremely high surface turbulent fluxes regional composites of the associated atmospheric conditions were built using reanalysis output. These composites clearly demonstrate a critical role of the cyclone-anticyclone interaction zone in forming surface flux extremes, thus, implying the importance of blocked cyclones for the strong air-sea flux situations that was also demonstrated by the analysis of case studies. Further we used the results of numerical cyclone tracking to identify extratropical cyclones associated with extreme air-sea flux events and to quantify the life cycle characteristics of these cyclones. Analysis performed for different percentiles of the frequency distribution of surface fluxes has shown that extreme surface turbulent heat fluxes over the North Atlantic are associated with less than 30% of winter cyclones mostly during the initial stage of their life cycle. Analysis of the lifecycle characteristics of these cyclones shows that they are considerably more intense than most North Atlantic cyclones, characterized by rapid deepening and slower propagation. The results are discussed in the view of the role of the North American High in forming atmospheric conditions favorable for the occurrence of extremely high air-sea turbulent heat fluxes in the North Atlantic mid and subpolar latitudes.