Geophysical Research Abstracts
Vol. 15, EGU2013-11913, 2013
EGU General Assembly 2013

Dominant modes of blocking variability in the North Atlantic region and their relationship with extreme temperature and precipitation events over Europe

Norel Rimbu (1,2), Gerrit Lohmann (1), and Monica Ionita (1)

(1) Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany (norel.rimbu@awi.de), (2) Bucharest University, Faculty of Physics, Bucharest, Romania

A two-dimensional blocking index for the winter atmospheric circulation in the Euro- Atlantic region for the last 140 years is calculated using the 500-hPa geopotential field extracted from the 20th Century Reanalysis Project database (http://www.esrl.noaa.gov/psd/data/gridded/data.20thC_ReanV2.html). Based on Empirical Orthogonal Functions (EOFs) analysis three patterns of interannual to multidecadal blocking variability in the Euro-Atlantic region have been identified. The first pattern captures an out-of-phase relationship between the anomaly of blocking frequency over the southern Greenland to northern Scandinavia region and the western part of Europe. The corresponding principal component time series (PC1) is significantly negatively correlated with the North Atlantic (NAO) index (r=-0.75) for the period 1899 to 2010. The second pattern of blocking variability captures an in-phase blocking variability which extends from the western part of Europe to the southeastern part of Greenland. The associated time coefficients (PC2) show strong multidecadal variations over the last 140 years. These multidecadal variations are related to the amplitude and phase of the Atlantic Multidecadal Oscillation (AMO). The third pattern of blocking variability captures an out-of-phase variation between the southern part of Greenland and Scandinavian blocking. The associated time coefficients (PC3) show pronounced interannual variations which are significantly correlated with the Scandinavian pattern index. Using the E-OBS gridded high resolution data set (http://eca.knmi.nl/download/ensembles/download.php), we calculate the fields of the frequency of the extreme high and extreme low temperature events as well as the field of the frequency of the extreme high precipitation events over Europe during the period 1951 to 2010. The frequency of the extreme high temperature and precipitation events is defined as the number of days in a winter when maximum daily temperature and daily precipitation are higher than the corresponding 90th percentile. The frequency of extreme low temperature events is defined as the number of days in a winter when minimum daily temperature is lower than the corresponding 10th percentile. A correlation analysis reveals that the dominant blocking variability patterns are related with large-scale anomalies in the frequency of temperature and precipitation extreme events. The first blocking pattern is associated with a north-south dipole in the frequency of temperature and precipitation extreme events. The second blocking pattern is responsible for interannual to decadal variations in extreme events mainly over western Europe while the third controls mainly the extreme temperature and precipitation variability over the southeastern Europe. We argue that a large part of the interannual to multidecadal variability of the extreme temperature and precipitation events over Europe are induced by the dominant climate modes, i.e. the NAO and AMO, through modulation of blocking activity in the Atlantic-European region.