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Baroclinic wave configurations evolution at European scale in the period 1948–2013

Daniel Carbunaru, Sorin Burcea, and Felicia Carbunaru
National Meteorological Administration, Romania, Bucharest

The main aim of the study was to investigate the dynamic characteristics of synoptic configurations at European scale and especially in south-eastern part of Europe for the period 1948–2013. Using the empirical orthogonal functions analysis, simultaneously applied to daily average geopotential field at different pressure levels (200 hPa, 300 hPa, 500 hPa and 850 hPa) during warm (April–September) and cold (October–March) seasons, on a synoptic spatial domain centered on Europe (-27.5o lon V to 45o lon E and 32.5o lat N to 72.5o lat N), the main mode of oscillation characteristic to vertical shift of mean baroclinic waves was obtained. The analysis independently applied on 66 years showed that the first eigenvectors in warms periods describe about 60% of the data and in cold season 40% of the data for each year. In comparison secondary eigenvectors describe up to 20% and 10% of the data. Thus, the analysis was focused on the complex evolution of the first eigenvector in 66 years, during the summer period. On average, this eigenvector describes a small vertical phase shift in the west part of the domain and a large one in the eastern part. Because the spatial extent of the considered synoptic domain incorporates in the west part AMO (Atlantic Multidecadal Oscillation) and NAO (North Atlantic Oscillation) oscillations, and in the north part being sensitive to AO (Arctic Oscillation) oscillation, these three oscillations were considered as modulating dynamic factors at hemispherical scale. The preliminary results show that in the summer seasons AMO and NAO oscillations modulated vertical phase shift of baroclinic wave in the west of the area (Northwestern Europe), and the relationship between AO and NAO oscillations modulated vertical phase shift in the southeast area (Southeast Europe). Second, it was shown the way in which this vertical phase shift modulates the overall behavior of cyclonic activity, particularly in Southeastern Europe.

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