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Seasonal variability of the drought phenomena in the Danube River catchment area and its relationship with large-scale anomaly patterns in spring

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Seasonal variability of the drought phenomena in the Danube River catchment area and its relationship with the large-scale climate anomaly patterns for the spring season (March-May) is investigated trough a statistical analysis of the self calibrated Palmer drought severity index (scPDSI) and the Standardized Precipitation Evapotranspiration Index (SPEI) and global climate anomaly fields.

Empirical orthogonal functions analysis (EOFs) was employed to study the spatio-temporal variability of the drought phenomena over the Danube River catchment area. The first EOF mode (EOF1) for both scPDSI and SPEI shows a monopolar structure with negative loadings all over the catchment area, while the second EOF (EOF2) shows a dipole structure between the western part and the eastern part of the catchment area. A composite analysis reveals that the drought conditions, in spring, over the whole catchment area (corresponding to EOF1) are related to a sea surface temperature pattern characterized by positive SST anomalies over the eastern part of the U.S. coast and the western part of the European coast and negative SST anomalies over the central and the northern part of the Atlantic Ocean. The corresponding atmospheric circulation pattern is characterized by negative Geopotential Height at 500 mb (Z500) over Greenland and positive Z500 anomalies over the central Atlantic Ocean extending up to the whole European continent. Dry (wet) conditions over the western (eastern) part of the Danube River catchment area, related to the second mode of variability (EOF2), are related with a more regional SST pattern characterized by negative SST anomalies over the eastern coast of U.S and the Mediterranean Sea and positive SST anomalies over the western coast of Europe. The corresponding Z500 pattern is characterized by a center of positive Z500 anomalies over the British Isles and the north-western part of Europe and negative Z500 anomalies over the southern part of Europe.

A wavelet analysis reveals that the time series associated with the dominant mode of variability is nonstationary with enhanced variability in the 2 – 6 yr band and in the 15 – 25 years band, respectively. The times series associated with the second mode of variability presents a strong and significant periodicity in the 10 – 14 yr band