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A drought severity climatology for the Carpathian Region using Sc-PDSI

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Monthly grids of the self-calibrating Palmer Drought Severity Index (Sc-PDSI) have been calculated for the period 1961-2010 for the Carpathian Region (17˚-27˚E, 44˚-50˚N) with a spatial resolution of 0.1˚x 0.1˚. Using the Sc-PDSI and the assumptions of the Palmer Drought Model (PDM), the approximated precipitation required for drought termination (achieved when the Sc-PDSI turns back above -0.5) and amelioration (achieved when the Sc-PDSI value turns back above -2.0) are computed for periods of 1, 3, 6, and 9 months. The Sc-PDSI is based on a modified version of the Palmer Drought Severity Index (PDSI), first introduced by Palmer (1965) with the intent to measure the cumulative departure (related to local normal conditions) of moisture supply and demand. Due to its empirically derived climatic characteristic (K) and duration factors - limited to U.S. climatic conditions - Wells et al. (2004) improved it and transformed the PDSI into the Sc-PDSI, which is more appropriate for spatial comparisons in different climatic regions. The Sc-PDSI is based on the supply-and-demand concept of a complex water budget system based on precipitation and temperature records and also on the soil characteristics at any location. The inputs used in this study are the Available Water Capacity of the soil (AWC) derived from the soil texture (European Soil Database of JRC) with a spatial resolution of 0.1˚x0.1˚, Potential Evapo-Transpiration (PET), and 6 hydrological parameters of the soil water balance: recharge, runoff, loss, and their potential values (used in the calculation of Palmer's constants to define the normal climate for the specific location, i.e. the so called CAFEC). PET has been computed using the 0.1˚x 0.1˚ gridded monthly precipitation and mean temperature for 1961-2010 provided by the CARPATCLIM project in the framework of the construction of a Climate Atlas for the Carpathian Region. The Sc-PDSI focuses on the monthly anomalies of the soil moisture, thus it was chosen to describe the spatio-temporal variability of the soil moisture availability across the Carpathian Region. This study provides an overview of drought events in the Carpathian Region over the last 50 years; moreover, a comparison amongst the results obtained on the same region and period of interest by means of the Sc-PDSI, SPI and SPEI is shown. Eventually, we discuss the possibility to reduce the uncertainty in the determination of the beginning and ending of drought conditions and we provide a quantitative measure of the probability that a drought event will be ameliorated or terminated in the next month.