INTERCOMPARISON OF METEOROLOGICAL DROUGHT INDICES FOR DROUGHT ASSESSMENT AND MONITORING IN GREECE

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EXTENDED ABSTRACT

Droughts are regional phenomena, which are considered as one of the major natural environmental hazards and severely affect the water resources and vegetation. Climate variability may result into harmful drought periods in semiarid regions. The research presented herein investigates the use of meteorological drought indices for drought assessment. Three drought indices based on rainfall were calculated and compared using precipitation data from 28 evenly spatially distributed meteorological stations over Greece for the period 1960-2000. These indices are the Standardized Precipitation Index (SPI, McKee et al., 1993), the Rainfall Anomaly Index (RAI, van Rooy, 1965) and the statistical rainfall Z-Score or standard score. The SPI calculation for any location is based on the long-term precipitation record for a desired period. This long-term record is fitted to a probability distribution, which is then transformed into a normal distribution so that the mean SPI for the location and desired period is zero. Positive SPI values indicate greater than median precipitation, while negative values indicate less than median precipitation. Because the SPI is normalized, wetter and drier climates can be represented in the same way, and wet periods can also be monitored using the SPI. RAI is a standardized index based on precipitation record and the ten extreme highest and lowest precipitation values. RAI is classified into nine abnormality classes, ranging from extremely wet to extremely dry conditions. The statistical rainfall Z-Score is the coefficient of variation of the rainfall anomaly and it does not require adjusting the data by fitting the data to any theoretical distribution. This paper evaluates the above meteorological drought indices for various time scales (1-, 3-, 6-, 9- and 12-month) in order to assess drought duration and intensity in Greece for various purposes. Shorter drought durations are important for agriculture while longer drought durations are significant for water resources management. The three drought indices are also validated for historical events of severe dry and wet periods. Advantages and disadvantages for the application of each index are compared and discussed. The results show that all the examined drought indices show similar patterns in detecting drought duration and intensity and are good tools to monitor moisture conditions. Also, comparison of the results with previous studies shows that, these indices are in good agreement with the Palmer Drought Severity Index (PDSI) and soil moisture anomaly Palmer Z-index for drought detection. Furthermore, application of these indices in specific cases of extreme wet and dry conditions show that these indices are able to simulate extreme drought and wet conditions and hence, they could be used for operational drought monitoring.

Key words: drought, drought indices, drought assessment, drought monitoring, precipitation, Greece