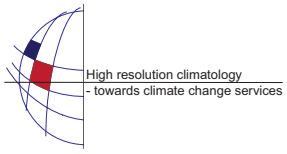
EMS Annual Meeting Abstracts
Vol. 7, EMS2010-392, 2010
10th EMS / 8th ECAC



Drought analysis in Serbia using the Standardized Precipitation Index

I. Tosic (1), A. Krzic (2), V. Djurdjevic (1), M. Unkasevic (1), and B. Rajkovic (1)

(1) University of Belgrade, Dept. of Meteorology, Belgrade, Serbia (itosic@ff.bg.ac.rs), (2) Republic Hydrometeorological Service of Serbia, SEEVCCC, Belgrade, Serbia

Many quantitative measures of drought have been developed. McKee et al. (1993) introduced the Standardized Precipitation Index (SPI) to quantify precipitation deficits on multiple time scales (1, 3, 6, 12, 24 and 48 months). The different time scales for which the index is computed address the various types of drought: the shorter seasons for agricultural and meteorological drought, the longer seasons for hydrological drought.
Computation of the SPI involves fitting a gamma probability density function to a given frequency distribution of precipitation totals. The parameters of the gamma distribution are used to find the cumulative probability of a precipitation event. An equiprobability transformation is then made from the cumulative distribution to the standard normal distribution with a mean of zero and variance of one. This transformed probability is the SPI value, which varies between +2.0 and -2.0. The SPI is a dimensionless index where negative values indicate drought while positive values, wet conditions.
The rainfall series for the present (1961-1990) and future (2071-2100) period were simulated using the Eta Belgrade University - Princeton Ocean Model (EBU-POM). The EBU-POM is a two-way coupled regional climate model, with the Eta/NCEP limited area model as its atmospheric part and POM as its ocean part (Djurdjevic and Rajkovic, 2008). Atmospheric model horizontal resolution was 0.25° and ocean model horizontal resolution was 0.2°. Concentrations of the greenhouse gasses were changed following the A2 scenario.
First, a gamma probability density function is fitted to the precipitation data during the period 1961-1990 (the calibration period). The SPI time series with the 12-month time scale (SPI12) for Belgrade and Niš were analyzed and compared with observations. August in 2000 was exceptionally dry in the greater Belgrade area and in northern and eastern Serbia (Unkasevic et al, 2004). The monthly totals were between 5 and 10 mm. Since, the maps of the SPI-12 for August during the period 2071-2100 were drawn to determine the spatial changes of droughts. According to the obtained results, moderately dry climate is expected over greater part of the southern Europe, while severely dry climate is expected in southern Greece.
From the analysis we can conclude that the EBU-POM model could capture the climatic data and also the drought indices well. Also, this analysis showed how SPI12 can be used to monitor drought conditions in Serbia.

Djurdjevic, V., B. Rajkovic (2008) Verification of a coupled atmosphere-ocean model using satellite observations over the Adriatic Sea. Annales Geophysicae, 26, 1935–1954
McKee, T. B., N. J. Doesken, J. Kleist (1993) The relationship of drought frequency and duration to time scales. Preprints, Eighth Conf. on Applied Climatology, Anaheim, CA, Amer. Meteor. Soc., 179–184
Unkasevic, M., I. Tosic, D. Vujovic, 2004: Variability and probability of annual and extreme precipitation over Serbia and Montenegro, Theor. Appl. Climatol., 79, 103-109