Exploiting teleconnection indices for probabilistic forecasting of drought class transitions in Sicily region (Italy)

Brunella Bonaccorso (1) and Antonino Cancelliere (2)

(1) Department of Civil, Computer, Construction and Environmental Engineering and Applied Mathematics, University of Messina, Italy, e-mail: bbonaccorso@unime.it, (2) Department of Civil Engineering and Architecture, University of Catania; Italy, e-mail: acance@dica.unict.it

In the present study two probabilistic models for short-medium term drought forecasting able to include information provided by teleconnection indices are proposed and applied to Sicily region (Italy). Drought conditions are expressed in terms of the Standardized Precipitation-Evapotranspiration Index (SPEI) at different aggregation time scales.

More specifically, a multivariate approach based on normal distribution is developed in order to estimate: 1) on the one hand transition probabilities to future SPEI drought classes and 2) on the other hand, SPEI forecasts at a generic time horizon M, as functions of past values of SPEI and the selected teleconnection index.

To this end, SPEI series at 3, 4 and 6 aggregation time scales for Sicily region are extracted from the Global SPEI database, SPEIbase , available at Web repository of the Spanish National Research Council (http://sac.csic.es/spei/database.html), and averaged over the study area. In particular, SPEIbase v2.3 with spatial resolution of 0.5° lat/lon and temporal coverage between January 1901 and December 2013 is used.

A preliminary correlation analysis is carried out to investigate the link between the drought index and different teleconnection patterns, namely: the North Atlantic Oscillation (NAO), the Scandinavian (SCA) and the East Atlantic-West Russia (EA-WR) patterns. Results of such analysis indicate a strongest influence of NAO on drought conditions in Sicily with respect to other teleconnection indices. Then, the proposed forecasting methodology is applied and the skill in forecasting of the proposed models is quantitatively assessed through the application of a simple score approach and of performance indices. Results indicate that inclusion of NAO index generally enhance model performance thus confirming the suitability of the models for short- medium term forecast of drought conditions.