

Investigating the potential of NAO index to forecast droughts in Sicily

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Abstract. Drought monitoring and forecasting is essential for an effective drought preparedness and management. The use of large-scale climatic patterns, such as El Nino Southern Oscillation (ENSO), North Atlantic Oscillation (NAO) or European Blocking (EB), can potentially improve the forecasting of drought evolution in time and space, provided the influence of such indices on the climatic variability in a region is verified.

In the present paper, first a preliminary correlation analysis between a drought index, namely the Standardized Precipitation Index (SPI) computed on areal average precipitation in Sicily, and NAO series, is presented. The analysis yields significant negative correlations between SPI and NAO, particularly with reference to the last decades, in agreement with previous studies related to other regions in Europe.

Then, stochastic models for the seasonal forecasting of the SPI, developed in a previous work (Cancelliere et. al., 2006), are extended in order to include information from NAO index as exogenous variable. In particular SPI forecasts at a generic time horizon M are analytically determined, in terms of conditional expectation, as a function of a finite number of past observations of SPI and NAO, assuming a multivariate normal as the underlying distribution. In addition, an expression of the Mean Square Error (MSE) of prediction is also derived, which allows confidence intervals of prediction to be estimated.

The forecasting performance of the model are verified by hindcasting observed SPI values computed on monthly areal average precipitation series observed in Sicily. In particular, validation is carried out by bootstrapping repeatedly the observations into two sets, one for parameter estimation and one for evaluating the forecasting accuracy of the model. Moreover, the mean MSE between the values derived by bootstrapping and the corresponding observed values is computed.

Preliminary results of the comparison between the model based only on the past observations of SPI values and the one that includes also the NAO index, seem to indicate a slight improvement of the latter model, although further analyses are needed in order to better assess the use of NAO as a predictor for droughts in Sicily.