STOCHASTIC FORECASTING OF STANDARDIZED PRECIPITATION INDEX

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The availability of drought forecasting for a given site or region, can help to improve the decision making process for drought mitigation, since appropriate measures can be selected based on the risk associated with the possible evolution of a current drought condition.

Among the several proposed indices for drought monitoring, the Standardized Precipitation Index (SPI) has found widespread application (McKee et al., 1993; Heim, 2000; Wilhite et al., 2000; Rossi and Cancelliere, 2002). The SPI is able to take into account the different time scales at which the drought phenomenon occurs, and because of its standardization, is particularly suited to compare drought conditions among different time periods and regions with different climatic conditions. Besides, due to its intrinsic probabilistic nature, the SPI is the ideal candidate for carrying out drought risk analysis (Guttmann, 1999).

In the paper, short-medium term forecast of the Standardized Precipitation Index is addressed by means of stochastic techniques. In particular, analytical expression of SPI forecasts are derived as the expectation of future SPI values conditioned on past monthly precipitation, under the hypothesis of uncorrelated and normally distributed precipitation aggregated at different time scales k. The forecast accuracy is evaluated in terms of the Mean Square Error of prediction (Brockwell and Davis, 1996), which allows confidence intervals for prediction to be computed.

Validation of the model is carried out with reference to precipitation series observed in 43 stations located in Sicily, Italy, making use of a moving window scheme for parameters estimation. As an example, Fig. 1 shows the comparison between observed and forecasted values SPI for one of the 43 stations, namely Caltagirone, for different combinations of the time scales k and M. On the same plots, 95% confidence intervals are also shown. From the figure it can be inferred a fairly good agreement between observed and forecasted SPI values as is also evident from the fact that almost all of the observed values lie within the confidence intervals.

The developed methodology can find useful application within a drought monitoring system, since it provides information that, properly integrated with other data (i.e., economical and environmental data), can effectively help decision makers to successfully

select appropriate mitigation measures.

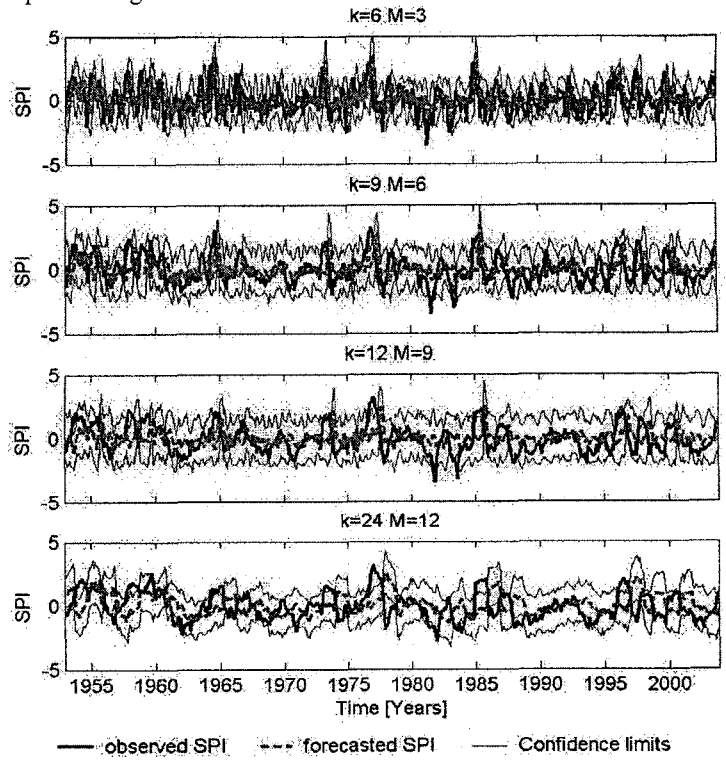

Fig. 1 Model validation: comparison between observed and forecasted SPI for Caltagirone station (moving window: 20 years)

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