Rainfall forecasting by coupling stochastic models and meteorological information

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The paper introduces a model for rainfall nowcasting, named PRAISE-ME (Prediction of Rainfall Amount Inside Storm Events-MEteo) . The model is based on a Bayesian approach that allows the integration between a stochastic model and meteorological information. Output is represented by a probability distribution of at site precipitation for a given temporal interval of nowcasting. This distribution results from a revision of a prior density, that is the output of the stochastic model, through the Bayesian integration with the prediction given by a meteorological model.

In this work the stochastic processor is represented by the PRAISE model (Prediction of Rainfall Amount Inside Storm Events); such model is characterised by a joint probability distribution between a random variable describing the rainfall depth cumulated over a temporal forecasting interval and a random variable named defined by a linear function of antecedent rainfall heights. As meteorological processor, the MM5 model was selected. The likelihood function derives from a trivariate probability density among the variables representing the meteorological information, the observed rainfall heights and the linear function values.

Parameter estimation and model applications are presented using hourly precipitation data of Cosenza raingauge for the temporal interval belonging on 1990-2004 and meteorological information for the period 2000-2004. The results clearly show a good revision if the meteo processor output and the observed rainfall heights are similar, but the coupled model previsions are better than meteo ones, even if the meteorological information are significantly different from real rainfalls.

In conclusion, the PRAISE-ME model is particularly suitable for at site rainfall nowcasting and it is characterised by a remarkable flexibility for a coupling with any meteorological model.