Geophysical Research Abstracts
Vol. 12, EGU2010-8895-2, 2010
EGU General Assembly 2010

Precipitation forecasting through an analog sorting technique: a comparative study

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This study deals with the comparison of three quantitative precipitation forecasting techniques based on the meteorological analogy concept. Given a target meteorological situation, the analog approach aims at searching in a meteorological archive a sample of past situations that are similar to the target one. From this sample, it is possible to derive the associated precipitation amounts, and then to give a probabilistic estimation of the expected daily rainfall.

The three methods differ by the variables involved in the selection procedure. All consider a selection of analogous situations in terms of synoptic circulation (step 1), and from this sample a subset of the most similar situations in terms of hygrometry is extracted (step 2).

Two methods consider in addition temperature instead of a preliminary sampling based on the occurence within the year. One method considers an intermediate step between steps 1 and 2, which takes into account the similarity of vertical velocity fields.

The study area covers the Saone river basin in France. Forecasts are evaluated in a perfect prognosis context (target situation comes from meteorological reanalysis) and in an operational forecasting context (target situation comes from weather forecasts). This analysis is based on verification measures: the Continuous Ranked Probability Skill Score, and scores from contingency tables (false alarm rate, probability of detection).

Results show that: (1) there is a significant increase in forecast skill when temperature and vertical velocity are introduced in the analog method (reduction of false alarm rate), (2) it is possible to anticipate rainfall events up to one week ahead and (3) the forecast skill of the analog methods depends on the ability of the weather forecast model to predict the variables of analogy.