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Forecasting the weather
- ensemble techniques
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Probabilistic Weather Predictions Based on Analog Forecasts

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Two new statistical correction techniques are introduced as a way of making probabilistic forecasts. The basic approach involves creating analog forecasts through the following two-step procedure. First, the current forecast is compared to all “past” forecasts of the same lead (from the same model). Next, the dates of the closest pattern matches are noted. The matching patterns, called analogs, are ranked in terms of their similarity to the current forecast, and an ensemble is formed from the observed or analyzed conditions on those ranked dates. The ensemble can take the form of a weighted mean, where the highest-ranking analogs are assigned the greatest weight, or by taking the median ranked member of the ensemble.

Two variants of this method will be described. The first variant, called AN, is a simple weighted average of the observations (or analyses) that verified when the 10 closest matching analogs were issued, and the second (ANKF) uses the Kalman filter to determine the weights of the analogs to form the ensemble.

This talk explores the deterministic aspects of the analog forecasts, while a companion talk at this conference will explore the quality of the probabilistic predictions formed from the analogs.

AN and ANKF are tested on 10-m-AGL wind speed forecasts from a Weather Research and Forecasting (WRF) model based prediction system. Hourly predictions from AN and ANKF at 800 surface and upper-air stations are evaluated for a yearlong period in 2010-2011 over the continental U.S. Their performance is compared to other commonly used statistical correction techniques: (a) the raw forecast (Raw), (b) a running 7-day mean bias correction (7-Day), and (c) a simple Kalman filter (KF) correction. Both AN and ANKF are able to predict drastic changes in forecast error, that are associated with rapid changes in the weather regime, whereas the 7-Day and KF algorithms are unable to predict such changes. Both AN and ANKF drastically reduce systematic error in the raw prediction, while simultaneously reducing random errors, and preserving very high correlation with the verifying observations, with AN exhibiting the best overall performance. Average improvements realized by AN are a 25%-35% reduction in the centered RMSE, and a 25%-40% increase in rank correlation, relative to Raw. Thus, AN yields highly accurate forecasts that are strongly correlated with the observations.