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Modes and Downscaling: the Two-Step Philosophy of Forecasting

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Abstract Text:

Renowned meteorologist Victor Starr stated in 1942 about the problem of forecasting: *„ The general problem of forecasting weather conditions may be subdivided conveniently into two parts. In the first place, it is necessary to predict the state of motion of the atmosphere; and, secondly, it is necessary to interpret this expected state of motion in terms of the actual weather which it will produce at various localities."* When considering the "Use of Large-Scale Climate Indices to Improve Forecasting for Water and Electricity Supply Management" we face the same problem, namely first to determine predictable (large scale) indicators of the atmospheric circulation, and second the estimation of small scale (local) weather, in particular rainfall, conditioned by the predicted indicators.

The conventional way of determining suitable large scale predictable indicators is to determine persistent patterns, such as the Southern Oscillation, North Atlantic Oscillation, Pacific North America Pattern but also European blocking. They are often determined as leading EOFs. Using these for outlooks of seasonal weather is common practice. Sometimes, their significance is oversold, such as the influence of ENSO for Europe. The second step represents a well-established practice, namely that of (empirical or dynamical) downscaling, which determines a distribution of weather states consistent with the predicted "motion of the atmosphere".

We discuss these concepts, in particular the predictable sub-spaces of atmospheric variability, a concept formalized as "Principal Interaction Patterns" by Klaus Hasselmann in the 1980s, and consistent (reduced) sub-spaces of regional and local weather variability determined by downscaling. An example is presented, forecasting rainfall in Southern China, based on the state (phase and intensity) of the MJO as predicted using "Principal Oscillation Patterns" of tropical 200 hPa velocity potential. Another example presents evidence of the utility for predicting severe persistent rainfall by postprocessing global weather forecasts with a regional climate model.

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