Adaptive supermodeling

Frank M. Selten (1) and Suzanne Bintanja (2)

(1) Royal Netherlands Meteorological Institute, Weather and Climate modelling, De Bilt, Netherlands (selten@knmi.nl), (2) University of Amsterdam, Amsterdam, Netherlands (suzanne.bintanja@uva.nl)

Weather and climate models contain numerous parameters that can be trained in order to improve forecasts. Synchronization based learning, - wherein parameters, as well as states, synchronize with their "true" values - is one approach to train parameters efficiently. It has recently been applied to train a so-called supermodel. A supermodel is a dynamical combination of an ensemble of different models. It differs from the standard multi-model ensemble forecasting technique in that forecast information is shared between the models during the simulation. Supermodeling does not help to improve the separate models, but is trained to combine forecast information such that model errors compensate each other optimally in the supermodel solution. Therefor supermodeling works best if the models are not on the same side of the observed reality (truth) in parameter space.

So far in training supermodels only the connections between the models have been trained, leading to better deterministic forecast skill and reduced climatological errors. In adaptive supermodeling, forecast skill is further enhanced by training connections and model parameters simultaneously. Adapting only a few parameters can allow the ensemble of models to "encompass" the truth more fully and allow a more effective compensation of model errors. The potential of adaptive supermodeling is demonstrated in numerical experiments with a global atmosphere model.