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# Supermodeling With A Global Atmospheric Model

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In weather and climate prediction studies it often turns out to be the case that the multi-model ensemble mean prediction has the best prediction skill scores. One possible explanation is that the major part of the model error is random and is averaged out in the ensemble mean. In the standard multi-model ensemble approach, the models are integrated in time independently and the predicted states are combined a posteriori.

Recently an alternative ensemble prediction approach has been proposed in which the models exchange information during the simulation and synchronize on a common solution that is closer to the truth than any of the individual model solutions in the standard multi-model ensemble approach or a weighted average of these. This approach is called the super modeling approach (SUMO). The potential of the SUMO approach has been demonstrated in the context of simple, low-order, chaotic dynamical systems. The information exchange takes the form of linear nudging terms in the dynamical equations that nudge the solution of each model to the solution of all other models in the ensemble. With a suitable choice of the connection strengths the models synchronize on a common solution that is indeed closer to the true system than any of the individual model solutions without nudging. This approach is called connected SUMO. An alternative approach is to integrate a weighted averaged model, weighted SUMO. At each time step all models in the ensemble calculate the tendency, these tendencies are weighted averaged and the state is integrated one time step into the future with this weighted averaged tendency. It was shown that in case the connected SUMO synchronizes perfectly, the connected SUMO follows the weighted averaged trajectory and both approaches yield the same solution.

In this study we pioneer both approaches in the context of a global, quasi-geostrophic, three-level atmosphere model that is capable of simulating quite realistically the extra-tropical circulation in the Northern Hemisphere winter.