

AIBased Ensemble Generation of Chemical Species for Use in Data Assimilation and Inversion

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Abstract

Ensemblebased data assimilation and inversion methods are widely used in atmospheric modeling and prediction systems. The computation cost of running an ensemble of models can often be very demanding, especially for air quality forecasting systems that can model tens to hundreds of chemical species. An artificial intelligence (AI) based model has been developed to emulate an ensemble of perturbations of chemical concentrations produced by the GEMMACH air quality forecasting system. The AIbased system was trained on an existing ensemble of surface level ammonia perturbation fields. Once trained, the AI model can produce an ensemble of perturbations in minutes when run on GPUs, in contrast to the ensemble produced by explicitly running the GEMMACH model (which was used for training) that took months to run on CPUs. This decrease in computational cost makes the prospect of using ensemblebased assimilation methods with chemical transport models for producing operational forecasts much more feasible. Using atmospheric ammonia as an example, it is shown that the AIbased model can produce ensembles with reasonable accuracy as well as produce similar analyses when used in an assimilation system when compared to the results when using the original ensemble generated by the physical model.