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Geoscientific
Model Development
Discussions

Interactive comment on "Automatic generation of large ensembles for air quality forecasting using the Polyphemus system" *by* D. Garaud and V. Mallet

Anonymous Referee #2

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General Comments:

The paper summarizes an innovative approach to running an air quality ensemble system using an automatic ensemble member generation. The system allows for uncertainties in emission data height, a large source for uncertainty, as well as chemistry and deposition and chemistry model physical parameterizations. The system appears to be designed carefully and using flexible modules that allow for easier system configuration

Meteorological uncertainties play a very large role as shown in previous studies. The authors chose to include this by randomly perturbing the input meteorology. I recommend describing why this approach is better than using inputs from members of

a met ensemble system. The latter approach would ensure mass continuity that is not guaranteed with the random perturbation approach. In addition, various vertical diffusion and cloud fraction schemes are allowed. These uncertainties could also be included from the input from a met. ensemble directly. Therefore, tests driven by a meteorological ensemble would provide a useful alternative to the approach shown that may produce inconsistencies. Emission magnitude certainties are not included directly, thereby ignoring a large source of uncertainty. Finally, the system should be evaluated with probabilistic matrices as uncertainty information is one of the most useful outputs from an ensemble system. It is recommended that reliability diagrams and ranked histograms be included to assess the system's reliability potential

Technical/Specific Comments:

Eqtn 2: define "n"

Eqtn 7: Von Karmen constant

Pg. 896, sect. 2.1.7: how are low and medium distribution for SNAP determined ?

Pg. 898, section 2.2.2: Why was 40 m chosen as the lowest model layer? Some chemical models have shown that lower layers improve performance.

Pg. 898, section 2.2.3: How is mass continuity assured here but winds are perturbed in section 3. How different are these options than ingesting vertical motions directly from the met model and then adjusting for mass-conservation ?

Pg. 899, Section 3.1: Aren't some fields being perturbed twice therefore possibly over-weighting their contribution. For example, winds are perturbed here but different mixing schemes are also used that are driven by winds? Can you provide statistics from unperturbed vs perturbed members to evaluate the benefit of these perturbations, if any?

Pg. 906: line 20: May be an unfair comparison as single realization will have higher resolution and more sophisticated physics than any ensemble member.

Pg. 908, Fig. 5: Any reason that reference model 5 has very low ozone in the north compared to the ensemble member ? Is the ensemble solution even a remote possibility ?

Pg. 908, Fig. 9: The night-time ozone range seems beyond the realm of possibility ?

System configuration evaluation using Talagrand and equally likely diagrams would help to identify members that are not realistic and should be removed.

Pg. 908, Fig. 10: A plot of probability of ozone exceedencing a certain value for the summer and reliability diagrams are crucial for understanding the utility of the system for probabilistic predictions.

Table 1: Describe how ranges of variables like time step were determined. Can some sensitivity results be performed to show the relative importance of these quantities (e.g.: Min Kz

Table 6: Can this table be plotted as a time-series instead to show little structure.

Interactive comment on Geosci. Model Dev. Discuss., 2, 889, 2009.