Atmos. Chem. Phys. Discuss., 13, C79–C82, 2013
www.atmos-chem-phys-discuss.net/13/C79/2013/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "E pluribus unum: ensemble air quality predictions" *by* S. Galmarini et al.

Anonymous Referee #1

Received and published: 6 February 2013

General Comments:

It is well known that air quality model outputs contain errors because of errors in the model input data, inadequate representation of the physical and chemical processes in the model, and numerical schemes chosen to solve the relevant equations. Also, if the initial state of the atmosphere is not known, its future state cannot be predicted. Therefore, it is necessary to develop and apply methods for correcting errors in model outputs. Several studies using methods such as data fusion, Kalman filtering, and ensemble modeling have been published in the literature for correcting the errors in the modeled concentrations. This paper presents the application of the KZ filter to examine the performance of individual models in an ensemble and develop bias-corrected pollutant concentrations. Also, a technique is presented for improving air quality fore-

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

cast with the KZ filter. The results of this study should be of interest to the research community.

Specific Comments:

- Note, the KZ filter has been applied before by Kang et al (2008) to produce bias-corrected air quality forecast. Previous studies have demonstrated that regional-scale meteorology and air quality models are not capable of simulating the intra-day variations seen in the observations. If the week-to-week variation of the ID component is negligible (i.e., if ID is nearly invariant in time), why not replace the modeled intra-day forcing with that seen in the observations in coming with the best model?
- The higher correlation seen for the diurnal forcing is attributable to day and night differences. How well do these models in the ensemble simulate the amplitude of the diurnal oscillation in the observations?
- Because of the leakage of energy across neighboring spectral bands (i.e., intra-day and diurnal), would it be better to employ the wavelet technique rather than the KZ filter to extract the diurnal forcing in time series data? Also, why not consider only two spectral components, namely, the short-term (ID+DU+SY) and long-term (seasonal and trend) components, for this analysis because the KZ filter can better separate these two forcings in time series data?
- What's the explanation for the large differences seen between the modeled and observed long-term (i.e., baseline) components? If a regional model doesn't properly simulate the longer-term forcing seen in the observations, should it even be treated as a member of the ensemble because it could yield an inappropriate ensemble product (e.g., median model *mm*)?
- There are edge effects associated with the moving average filter, making the information at the tails of the time series unreliable. Hence, how does this affect

ACPD

13, C79–C82, 2013

the results if the KZ filter is used for the forecast period? From the operational perspective, how could this scheme be implemented since it relies on calculating all components right through the present (actually, right through the end of the forecast period in the forecast "F-Step") while we know that the SY and BL components estimated with the KZ filter are heavily influenced by edge effects for the last half length of the KZ?

- The proposed method and analysis is framed in a forecasting context, but its usefulness was demonstrated with hindcast model runs that utilized data assimilation. This distinction matters because the method seems to rely heavily on the idea of "error persistence", e.g. the model with the lowest SY/BL RMSE during the last seven days is assumed to predict a good SY/BL component during the next seven days. I would think that meteorological data assimilation tends to make a given model's ozone error more persistent in time as that error is now more influenced by how well (or poorly) that model represents chemistry rather than how well the met model can "forecast" transport. In other words, I would expect a meteorology model's skill to vary more with changing conditions so that one week's skill is quite different from next week's skill when that meteorological model is run in the forecast mode. Therefore, the finding that the method works well when applied to these hindcast model runs does not necessarily imply that it will work well with forecast simulations.

- The paper contains sentences throughout that are either too wordy or vague. For example, I don't understand the sentence "...This new approach to ensemble analysis is motivated by the illusory conception that the statistical treatment would account for the process variability and by the fatal assumption that model results are independent" in the introduction.

Cited Reference:

ACPD
13, C79–C82, 2013

D. Kang et al. Bias Adjustment Techniques for Improving Ozone Air Quality Forecasts, J. Geophy. Res., Vol 113, D23308, doi:10.1029/2008JD10151, 2008.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 581, 2013.