**Atmospheric
Chemistry
and Physics
Discussions**

Interactive
Comment

Interactive comment on "Application of WRF/Chem-MADRID and WRF/Polyphemus in Europe – Part 1: Model description and evaluation of meteorological predictions" *by* Y. Zhang et al.

Anonymous Referee #1

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In the two manuscripts, Zhang et al. compare two air quality models, an offline-coupled model and an online-coupled model to assess their capabilities and differences in simulating air pollutants and aerosol-meteorology interactions over Europe. In the first part, the model settings are introduced and the meteorological performance against various observations is presented.

Generally, the purposes of the study are interesting, the methods are valid, and the results are reasonable. However, I have several concerns to the manuscript. I do not recommend the publication of this manuscript in its current version. Major revisions are needed to improve the manuscript.

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Interactive Discussion

Discussion Paper

Major comments: 1) In this study, the authors try to compare an offline-couple model and an online-coupled model. However, the meteorological evaluation only focuses on WRF results which are only used for the offline model. Due to the feedbacks of air pollutants and complex interactions between meteorological variables with pollutants, the online-coupled model should have different meteorological predictions. The differences between meteorology predicted by offline and online models are what I expected to see in the manuscript. In fact, the authors only briefly discuss the difference in T2 and Precipitation between offline and online models in Page 17 Lines 10-20. If the meteorological differences due to aerosol feedbacks are only "decrease near surface temperature and precipitation", I highly doubt about the merits of this study. It is only an evaluation of WRF outputs, and does not worth it to be published separately on ACP. Furthermore, without assessing the differences between the online and offline meteorology carefully, the comparison of offline model and online model in Part 2 tends to be less interesting: the differences in air pollutant concentrations are due to the air quality models unnecessarily they are offline or online. 2) Why mean bias (MB), the root mean squared error (RMSE), the normalized mean bias (NMB), the normalized mean error (NME), and correlation coefficients are used in this study? Emery et al. (2001) have proposed different statistics merits for different meteorological variables together with benchmarks. Using different statistics merits avoid a possible comparison with the suggested benchmarks and cannot give readers how good the performance is. 3) In addition to the variables evaluated in this study, there are other important meteorological variables having substantial effects to air quality simulations such as solar radiation, PBL height, or the vertical distributions of temperature, humidity, and wind fields. How about the model performance on these meteorological variables? 4) For the time series at specific sites, different selections of sites will lead to different conclusions. Also, from the time series, it is difficult to tell how close the predictions to the observation or which domain has better results. A statistics merit for each variable at each site will help the readers.

Specific comments: 1) Table 3 and Table 5 can go to appendix. 2) Based on Table 4,

not all meteorological are improved using finer grid resolutions. Is there an explanation to this? 3) Why wind direction is not shown in Figure 3 and Figure 4? Why no time series of wind direction shown at selected specific sites? 4) The value range of 0 to 360 for wind direction is not real direction. Difference between 0 and 360 is 0 instead of 360. Is this feature considered in the calculation of wind speed statistics? If it is used, it should be pointed out in Table 4. Otherwise, the values will be misleading. In Figure 5 and Figure 6, this situation should be considered as well. For example, July 28, 2001, the difference between prediction and observation at D02 and D03 is not as large as what we see. 5) Add statistics to time series figures from 7 to 14?

Reference:

Emery, C., Tai, E., Yarwood, G., 2001. Enhanced meteorological modeling and performance evaluation for two texas episodes, in: Report to the Texas Natural Resources Conservation Commission, p.b.E., Internatioanl Corp (Ed.), Novato, CA.

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