

## ***Interactive comment on “Online coupled meteorology and chemistry models: history, current status, and outlook” by Y. Zhang***

**Y. Zhang**

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Reply to Comments by Christian Seigneur

Interactive comment on “Online coupled meteorology and chemistry models: history, current status, and outlook”; by Y. Zhang c. Seigneur seigneur@aer.com Received and published: 31 March 2008

The review paper by Yang is timely as the interactions between meteorology and air quality are becoming very important, particularly in the context of the effect of climate on air quality and vice versa. It is, therefore, a very useful contribution to the scientific literature, which provides a clear description of the state-of-the-science, identifies some current deficiencies and outlines several future directions. The comprehensive technical review of the selected models is particularly useful to understand the various

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levels of coupling that exist in different models. This paper focuses on U.S. online coupled models and the author should state this point explicitly in the abstract (e.g., add "in the United States" at the end of the third sentence).

Reply:

The third sentence in the abstract has been changed to:

This paper reviews the history and current status of development and application of online coupled meteorology and chemistry models, with a focus on the online models developed in the U.S.

There are a few cases where some additional technical information could be provided for completeness. The application of WRF-Chem (Tie et al., *Atmos. Environ.*, 41, 1989-2008, 2007) to Mexico could be mentioned (MCCM is also being applied to Mexico; however, results may not have been published yet). The incorporation of MADRID into Meso-NH could be mentioned (Tulet et al., *J. Geophys. Res.*, 111, D23208, doi:10.1029/2006JD007152, 2006). It may also be useful to note on p.1859, lines 1-5, that MADRID 1 has been upgraded to Sesqui-MADRID (MADRID 1.5) and now treats phase separation (which is not treated in any of the models reviewed here) (Pun, Development and initial application of the sesqui-version of MADRID, *J. Geophys. Res.*, in press) and that MADRID 2 has been modified to be compatible with any gas-phase mechanism (Pun et al., *Environ. Sci. Technol.*, 40, 4722-4731, 2006). It would also be worthwhile to point out that some of the original smog chamber studies for secondary organic aerosol formation used high NO<sub>x</sub> concentrations and that the yields for aromatics and monoterpene oxidation may be underestimated in the models that use those yields (e.g., Ng et al., *Atmos. Chem. Phys.*, 7, 3909-3922, 2007; 7, 7159-5174, 2007).

Reply:

The above models and updates will be incorporated in the revised version of the paper. In the final section, I suggest discussing the extension of online coupled models to in-

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clude emissions. Some emissions are a strong function of temperature (e.g., biogenic VOC emissions from vegetation, evaporative emissions for anthropogenic VOC), solar radiation (e.g., isoprene emissions), precipitation (e.g., mercury emissions from soils), and wind speed (e.g., dust emissions from soil erosion, sea salt emissions). Currently, emissions are treated off-line but will need to be treated on-line if one wants to correctly treat the effect of climate and meteorological changes on air quality in a truly integrated manner. Some of those feedbacks are mentioned in the final section (e.g., dust erosion) but the need to have a meteorology/emission/chemistry online integrated modeling system could be stated explicitly as an important next step in this research area.

Reply:

This is a very good point, which will be addressed in the revised version of the paper.

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Interactive comment on Atmos. Chem. Phys. Discuss., 8, 1833, 2008.

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