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Atmospheric Chemistry and Physics Discussions



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

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General Comments:

I appreciate the author?s effort in assembling a review paper that broadly describes the capabilities of several coupled meteorology and chemical models. A review paper is a useful tool for comparing and contrasting current modeling capabilities and identifying knowledge gaps in our understanding of aerosol-cloud-radiation-chemistry feedback processes. But a review paper also needs to be accurate. Since our group is one of the primary contributors to the WRF-chem model, I would like to point out many of the factual errors in the manuscript that misrepresents the capabilities of WRF-chem (listed under the specific comments).

1) Part of the problem is that the author does not indicate which version of the WRF-chem model is being referred to. WRF-chem, as with other models mentioned in the paper, undergo periodic revisions. Some of the errors may be associated with describing capabilities in an old version of the code. Version 3 will be released to the public in early April, and it would be most useful for readers to report on capabilities associated with that version.

2) Another aspect that will confuse readers of this paper is differences between the official ?released? version of the code and versions developed by individual scientists. The author reports on implementation of the CB05 and MADRID modules in the code, that is not yet available in the public community version of WRF-chem (including version 3). These capabilities are only available from the author. This needs to be pointed out in the paper. If the author wishes to describe these modules in WRF-chem, then why not describe modules other scientists have implemented in WRF-chem? To be a balanced review article, requires the author to either 1) include all other model developments that have been developed and have yet to be included in the release version (and there are many) or 2) report only on the official release of the code.

Specific Comments:

Page 1845, line 18: The statement implies that photoloysis rates produced by the Fast-J algorithm are not affected by on-line trace gases and aerosols. This is incorrect.

Page 1846, line 23: Fast (2005) is an inappropriate reference here. It is a conference proceeding that describe and evaluation of the boundary layer characteristics produced by two PBL schemes in WRF, and does not document chemistry modules.

Page 1846, line 26: CB05 is not yet part of the publicly available version of the WRF-chem code, and this needs to be stated here. Version 3 also includes a version of the Kinetic PreProcessor (KPP) that builds code compatible with WRF-chem so that users can build any chemical mechanism they want.



ACPD

8, S994–S997, 2008

Page 1847, line 2: MADRID is not yet part of the publicly available version of the WRF-chem code, and this needs to be stated here. The aerosol model from the GOCART global climate model is now part of the version 3 release of WRF-chem.

Page 1847, line 17: Fast (2005) is an inappropriate reference here.

Page 1850, line 17: As stated previously, CB05 is not part of WRF-chem version 3.

Page 1850, line 23: MOSAIC does not employ bulk Carnegie Mellon aqueous chemistry.

Page 1852, line 1: Fast (2005) is an inappropriate reference here.

Page 1852, line 4: Gustafson et al. (GRL, 2007) describes cloud-aerosol interaction processes and aerosol indirect effects we coupled with MOSAIC in WRF-chem.

Page 1852, line 21: Table 3 implies that MADE/SORGAM and MOSAIC aerosol treatments are identical except that one is modal and one is sectional. For MOSAIC, sea-salt is treated as separate species: Na and Cl. MOSAIC also includes aerosol water, calcium, calcium carbonate, and menthansulfonate. The number of sections for MOSAIC in version 3 of WRF-chem is either 4 or 8 (not 8 reported in the table); however, the code can be easily modified for any number of sections. Aerosol properties are similar to, but not the same as in MIRAGE.

Page 1853, line 28: For MOSAIC, aerosol number is always treated prognostically. The text somehow implies that the user can choose either diagnostic or prognostic.

Page 1854: line 19: For WRF-chem version 3, the user can choose either volume averaging, Maxwell-Garnett, or shell-core mixing rules when using either MADE/SORGAM or MOSAIC. This is description is out-of-date.

Page 1857, line 5: MARS is no longer used for MADE/SORGAM in WRF-chem version 3. It now uses ISORROPIA.

Page 1858, line 23: MOSAIC does not treat SOA in the WRF-chem version 3 release



ACPD

8, S994–S997, 2008





as implied in the text. We are currently developing several approaches for treating SOA in MOSAIC, but they will not be included in the released version of the code until they are thoroughly tested and reported in a peer-reviewed publication. It should be noted that the understanding of SOA is far from complete and SOA predicted by most models is much lower than observed (e.g. Volkhammer, GRL 2006).

Line 1863, line 15: Cloud-aerosol interactions affect precipitation rates when using MOSAIC.

It would also be useful to comment on the treatments employed in the meteorological parts of the code (i.e. nonhydrostatic, data assimilation, etc) in addition to chemistry, since the paper is on ?coupled meteorology and chemistry models? as stated in the title.

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