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Geoscientific Model Development Discussions

Interactive comment on "WRF-CMAQ two-way coupled system with aerosol feedback: software development and preliminary results" *by* D. C. Wong et al.

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1 general comments

This paper presents an important development of the CMAQ modelling system, allowing it to be coupled to the WRF model in a two way manner. Coupled models are an important development from the traditional CTM approach to modelling air quality as discussed by Grell and Baklanov (2011). The long history and strong user base of CMAQ mean that it is a useful advance to develop a coupled version of CMAQ and this work clearly lies within the scope of GMD.

The paper is well written and there are no problems with the structure or the references.

However, there are some areas in which the presentation of the methods and the analysis of the results need to be strengthened.

2 Specific comments

In the introduction, while mention is made of the direct radiative effects of aerosols, no mention is made of the indirect effects. While it is reasonable to begin the coupling with only the direct radiative effect, the indirect effects should not be ignored in the introduction and this should be noted as a limitation of the inital current coupled set up. (I note that a plan to add indirect effects is mentioned in the Summary and Further Work section).

The description of the coupler is very limited. In particular there is insufficient detail on how the aerosol optical properties are calculated and this section needs to be expanded with details of the methods used. It would be particularly helpful to compare and contrast these with the methods used to calculate these properties in WRF-Chem.

The results are in two sections on the performance of the coupler and the scientific performance. I feel that the section on the scientific performance is not as well developed as it needs to be. The comparison with the observations of radiation should be made more quantitative by adding some calculations of root mean square errors and average biases. These should also be calculated for the comparison with the AOD. It would also be useful to include some comparisons with other meteorological variables such as relative humidity and wind speed/direction. Finally, the only run carried out was in conditions where the aerosol loading was relatively high. It would strengthen the case for the importance of coupling if the benefits (or detriment?) outside of a strong fire episode were to be included. It would also be helpful to examine the impact of the calling frequency on the model skill as well as the computational performance.

If any user guide for this coupled configuration has been produced it would be useful to include it in the supplementary material for the paper. Also is it planned to add this code to the main CMAQ and WRF code bases or maintain them as separate modifications indefinitely?

3 Technical corrections

There are a few minor corrections to the text:

1 Introduction

This whole coupling approach has been widely used in the research community as well as in the real-time National Air Quality Forecasting system (Otte et al., 2005), it has several potential shortcomings

This would read better as:

This whole coupling approach has been widely used in the research community as well as in the real-time National Air Quality Forecasting system (Otte et al., 2005), but it has several potential shortcomings

2.3 Coupler

In addition to the data coupling described in the next section, implementation of direct feedback requires new subroutine for the calculation of the aerosol optical properties

should be

In addition to the data coupling described in the next section, implementation of direct

feedback requires a new subroutine for the calculation of the aerosol optical properties

4.2 Scientific performance

The coupled model using the options discussed in Sect. 4.1, was applied to a domain covers California and portion of the surroundings states

should be

The coupled model using the options discussed in Sect. 4.1, was applied to a domain which covers California and portions of the surrounding states

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Interactive comment on Geosci. Model Dev. Discuss., 4, 2417, 2011.