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**Geoscientific
Model Development
Discussions**

Interactive comment on "Implementation of a new aerosol HAM model within the Weather Research and Forecasting (WRF) modeling system" *by* R. Mashayekhi et al.

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Reply to referee 2
We thank the reviewer for his/her constructive comments on the manuscript. The following is a list of our answers to the reviewer's concerns:

Specific comments:

1. *Title: the current title is misleading and does not reflect the content of the paper.*
In response to the similar comment raised by the first reviewer, we have mentioned the

main scientific subject of the manuscript that is based on testing the implementation of the aerosol HAM model within the regional WRF framework. From this point of view, the current title is well reflecting the main scientific goal of the study. On the other hand, the great part of the results presented in the manuscript has been focused on the aerosol-radiation interactions especially over a geographical region, Middle East, which is generally poorly monitored. Thus, according to this point the title should include the geographical region and the main scientific contribution of the study. In agreement with both reviewers, we have finally decided to change the title of the manuscript to **The aerosol-weather prediction modeling system WRF-HAM: radiative effects of primary aerosol impacts over Middle East** in the revised paper. This title not only shows the main scientific goal of the coupled system, it also covers the geographical region for which the results and discussions are presented in the manuscript.

2. *Abstract: it should describe the geographical area considered in this study and include the overall description of the observations.*
We have changed the abstract of the revised paper to include the description of the geographical area and observations used in this study.

3. *Introduction: extend the introduction including: a clear justification of the coupling, the research questions the authors would like to answer, the main objective of the development.*
It has been also raised by the first reviewer. The introduction section in the revised manuscript now includes more descriptions of our main scientific goal of the coupling.

4. Methodology:

- *The emission rate section should be extended.*
  We have extended the emission rates section in the revised paper to describe the emission of different aerosol species considered in this study in more details by adding the following text:

> The sulfur emissions are considered from fossil-fuel and bio-fuel emissions (Cofala et al., 2005) and from vegetation fires (van der Werf et al., 2003). The emission of sulfur is divided into two different group of high and low emission fluxes. Emissions from industry, power-plants and shipping are assumed as high sulfur emissions and distributed between 100 and 300 meter above the surface, while the sulfur emission from road, off-road and domestic activities are grouped into the low emissions and considered as surface fluxes. 97.5% of all sulfuric emission is assumed in the form of SO2 and 2.5% in the form of primary sulfate. We attribute 50% of ship-, industrial-, and power-plant emissions to the accumulation mode with a number median radius $\overline{r}$ =0.075 and σ=1.59 and 50% to the coarse mode with $\overline{r}$ =0.75 and σ=2.00. Other primary sulfate emissions are assumed to be equally divided to the accumulation mode and the Aitken mode with $\overline{r}$=0.03 and σ=1.59. The black and organic carbon are considered to be emitted from fossil-fuel and bio-fuel emissions (Bond et al., 2004) assuming an emission size distribution with a number median radius of $\overline{r}$=0.015 and σ=1.59 and from vegetation fires (van der Werf et al., 2003) with $\overline{r}$=0.04 and σ=1.59. The biogenic monoterpene emissions of Guenther et al. (1995) are scaled by the factor of 0.15 to estimate the production of Secondary Organic Aerosol (SOA) from biogenic sources. Black carbon emissions are assumed insoluble. 65% of all POM emissions are assumed soluble. The insoluble fraction of

> SOA is assumed to condense on the insoluble Aitken mode and the soluble fraction on the soluble Aitken and accumulation modes. For the conversion of the carbon mass of POM into the total mass of POM, a factor of 1.4 is applied. The monthly average dust flux is distributed over two size-bins (accumulation and coarse modes) and is prescribed to take place in the lowest model layer. The freshly emitted dust is assumed insoluble. 96.8% of the dust flux mass is assigned to the coarse mode with mass median radius of 1.75 and σ=2.00 and 1.4% to accumulation mode with mass median radius of 0.37 and σ=1.59. The emission of sea salt is distributed over soluble accumulation and coarse modes.

  We have also inserted a table in the revised paper summarizing the emission information.

- *What kind of temporal profiles the authors use for their emissions?*
  We used the constant emission rate for each aerosol species.

- *Include examples of map of mineral dust emission distributions for both time periods.*
  Because of the great importance of mineral dust in our simulation domain, we have added two maps demonstrating the spatial distribution of the monthly mean mineral dust emission for May and February periods.

- *Include a section dedicated to the observations including the measurements and their site locations.*
  The revised paper is now included the more details about the measurement site

locations used in this study for evaluating the simulations.

5. Results:

- *Check the results/configuration for the Figures 1 and 2.*
  There was a bug in the model. We checked the model and fixed the problem.

- *Compare the results with the scientific literature and report the finding on the manuscript.*
  A similar point was raised by the first referee. We have added paragraphs in the revised paper containing the comparisons of our model results with the scientific literature.

- *Provide more quantitative analyses.*
  We added the quantitative analysis for the simulated PM10 mass concentrations in the revised paper. A table containing the EMEP network monitoring site locations and their corresponding statistics is also added to the revised paper.

- Figure 4c) and d):
  These two figures show the contribution of simulated aerosol compositions averaged over two selected high and low episodes. Not only the averaged fraction of each aerosol species shows the dominant contribution of mineral dust in Tehran (figures 4c) and 4d)), but also the time variation of different aerosol species proves this result. We have added here a figure which shows the time variation of each five aerosol components. This figure shows the main contribution of mineral dust in PM10 mass concentration along the whole times

of simulation at Tehran. The result of this figure is also mentioned in the revised paper. It will help to better understand the main contribution of mineral dust over Tehran.

Technical issues:

- Page 692, line 4: the point is taken.

- Page 694, line 19-22: according to what mentioned in the specific issues above, this result is kept.

Interactive comment on Geosci. Model Dev. Discuss., 2, 681, 2009.

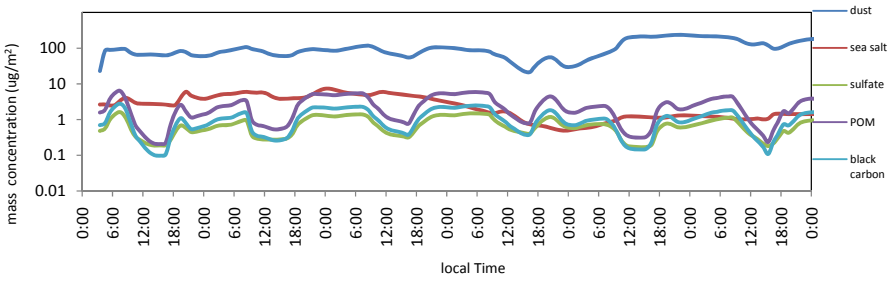

Fig. 1. Time series of simulated aerosol componenets in Tehran during the simulation period from 22 to 28 February 2006