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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Simulation of dust aerosol and its regional feedbacks over East Asia using a regional climate model" *by* D. F. Zhang et al.

Anonymous Referee #3

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General comments

This manuscript presents a simulated result of dust aerosol over East Asia and its radiative feedback with a regional climate model RegCM3. The authors first compare their results with some indices of ground based and satellite retrievals, and then describe the effect of radiative feedback of dust. The subject of this manuscript is appropriate for ACP. However, the results in this manuscript seem incomplete, and I feel the authors are rushing to publish their research in a premature stage. My main concerns are the following points. 1) The evaluations of the model remain qualitative, 2) the effect of longwave radiation is not included, and 3) the conclusion does not contain much new

findings.

The simulated dust concentration is compared with the air quality index (AQI), which is a function of PM10 and other pollutants. The authors could try to convert the AQI to equivalent PM10 concentration, as Gong et al. (2003). In the calculation of the empirical aerosol index (Dust Index), the authors use 550nm wavelength, although eq. (3) is fitted to 380nm. For judging the model performance, the authors should care more about the quantitative evaluation.

Second, as the authors stated, the radiative effect of dust in longwave spectrum is not included, and the reason seems that it is not just implemented yet. Since the longwave radiative effect of dust aerosol can be large and affect the atmospheric stability, which can affect the conclusion of this study, I suggest resubmitting the manuscript after the longwave radiative effect is included.

Third, the conclusions do not seem new findings to me. The decrease of dust emission due to increase of atmospheric stability by radiative effect of dust is reported by some previous studies (e.g., Perlwitz et al., 2001, JGR; Miller et al., 2004, JGR). On the other hand, the characteristics of the East Asia compared to other dust source regions, such as frequent cloud cover, snow cover, and complex geography are not discussed, although the authors stated a purpose of this study is to present the dust radiative effects and regional climatic response.

In all, this manuscript seems a quick report of a model development, but does not contain a significant scientific progress. Therefore, I don't think this manuscript is suitable for publication in ACP at this stage.

Specific comments

Page 4626, line 6: It is convenient for readers to state in the abstract that only the shortwave radiative effect is included. So this line may be better "... one with (Exp. 2) the shortwave radiative effects of ...";

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Page 4632, line 27-: The authors state that the refractive indices are taken from Balkanski et al. (2007) and OPAC databases. However, it is unclear that how they actually determine the refractive indices in their model, because the values of Balkanski et al. (2007) and OPAC databases are quite different, and Balkanski et al. (2007) tested several sets of refractive indices from the hematite content. It is desirable to show the actual values of refractive indices in the model.

Page 4632-: What the authors call “dust index” is the “empirical aerosol index” in Ginoux et al. (2003). The readers may be confused if the different terms are used for a same expression.

Page 4632: In section 2 (or 3), proper references and credits to the observational data (AQI, MISR data, AERONET data, and Aerosol Index) should be given.

Page 4634, line 6-: Please describe the definition and data source of the air quality index.

Page 4638, line 21-: The number of the occurrence of dust events and threshold of simulated dust emission (Table 4 and Fig. 11) are not related to the optical properties of dust, so the following three paragraphs should be divided into a different section. I suggest comparing the results in Table 4 and Fig. 11 to the observed synoptic records.

Page 4640, line 4-5: If the range of radiative forcing is -2.5 to -10 Wm^{-2}, isn’t it negative everywhere (not “mostly”)?

Page 4640, line 29-: “Changes in large scale circulations do not appear to be a factor as indicated by the fact that Fig. 13E does not show significant changes in wind speed.” This may be partly because that the RegCM3 is a regional model and uses NCEP/NCAR reanalysis lateral boundary conditions, so the large scale circulation does not affected much by the dust radiative forcing.

Technical corrections

Page 4640, line 20: “(Perlwitz et al. 2001)” should be “Perlwitz et al. (2001)”

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Fig. 7: The labels of the figures are too small to read.

Fig. 7: At the end of the caption, “*e5 for divergence” should be “(e) for divergence”

Figs 8 and 11: These graphs are difficult to read because the colours of the bars are very similar. Also, the bar graphs are very difficult to read the temporal variations.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 4625, 2008.

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Interactive Comment