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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Exploring the relationship between surface $PM_{2.5}$ and meteorology in Northern India" *by* Jordan L. Schnell et al.

Anonymous Referee #2

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The authors investigated the ability of an advanced new version of the NOAA GFDL-AM4 model to reproduce observed PM2.5 and its relationship to meteorology over Northern India. Considerable improvements in the meteorological part (modified topographic gravity wave drag parameterization, new double plume moist convection scheme, updated GFDL radiative transfer code) as well as in the chemistry and aerosol physics modules (updates in gas phase and heterogeneous chemistry, improved treatment of sulfate and nitrate chemistry, revised wet deposition scheme) were implemented in GFDL-AM4 and applied for the model simulations. Furthermore, increased horizontal and vertical resolutions compared to AM3 runs were used. A detailed analysis of the model results and comparison with measurements were performed to evalu-

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Discussion paper

ate the model performance and find out correlations of daily-averaged PM2.5 concentrations with meteorological variables. As a result, the spatial distribution of aerosol climatology and seasonal cycle simulated by the advanced AM4 has been significantly improved relative to AM3. The improved model reproduces most of the observed PM2.5–meteorology correlation patterns well, especially in the eastern IGP.

The authors provide a comprehensive and thorough study of the PM2.5 burden in Northern India due to the specific emissions as well as the extreme physical, chemical, and meteorological conditions in this area. The applied model NOAA GFDL-AM4 is state-of-the-art for the description of atmospheric chemistry-transport processes and regional climate modelling. The model results were analyzed and discussed extensively. However, due to the complexity of the modelling system and the relatively coarse grid resolution, such a discussion is difficult and sometimes speculative. It would therefore be desirable to verify several interesting findings by more detailed model runs with finer scale resolution for shorter selected periods. Altogether, the paper is sound, informative and well written. It can be published in the current form.

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