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Interactive comment on “Radiative and thermodynamic responses to aerosol extinction profiles during the pre-monsoon month over South Asia” by Y. Feng et al.

Anonymous Referee #2

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General comments: Feng et al., 2015 made an attempt to understand the radiative and thermodynamic responses to uncertainty associated with aerosol extinction vertical profiles over South Asia during March 2012. They tried to address the model uncertainties in simulating the extinction profiles using available in-situ and satellite measurements. This topic is of significant relevance and the study is carried out in an interesting way. The paper is generally well written and the findings are interesting. The following comments should be addressed before the manuscript would be satisfactory for publication in ACP.

Specific comments:

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1) In section 3.1, authors evaluated model simulated AOD using MODIS derived AOD and found that model underestimate the AOD by a factor of 2. Model is not able to capture the high AOD belt over Indo-Gangetic Plain (IGP) and most of northern parts of India (Figure 1). Dust transport from West Asia (MODIS AOD) is also not captured in the modelled AOD (Figure 1). Authors need to check dust emission flux to figure out how well model able to simulate dust source regions. A brief discussion about species-wise AOD information could be useful for explaining the underestimation of model simulated AOD.

2) Authors discussed the evaluation of modelled AOD for March 2012, even though the simulations are available for eight months (From August 2011 to March 2012). It would be useful if authors use the entire simulation period for the model evaluation.

3) Authors found that “ 83% of the model low-bias is due to aerosol extinctions below 2 km”. A brief discussion about the vertical distribution of anthropogenic and wildfire emissions treatment in the model would be useful to the reader here. How this treatment could influence the uncertainty in the vertical distribution of extinction?.

4) Authors separated the effect of absorption and scattering properties using two simulations (Case 1 and Case 2). But between Case 1 and Case 2, there can be considerable changes to the aerosol distributions. How does this contribute to the uncertainty in simulated aerosol extinction profiles?

Technical comments:

Page 16903, Line 26: Wrong citation year (Pan et al., 2015).

Page 16905, Lines 10-14: Recent multi-model evaluation paper (Quennehen et al., 2015) is missing from the manuscript.

Page 16907, Lines 15: Compiled SO₂ emissions is confusing. Rewrite the sentence.

Page 16910, Lines 17: The geographic pattern of AOD distributions is not reasonably well captured. Rewrite the sentence.

Figure 2: Why MPL data extinction profiles peak is different than other data sets?

The following reference is not cited in the manuscript.

Quennehen, B., et al., (2015), Multi-model evaluation of short-lived pollutant distributions over East Asia during summer 2008, *Atmos. Chem. Phys. Discuss.*, 15, 11049-11109, doi:10.5194/acpd-15-11049-2015.

References:

Pan, X. et al., (2015), A multi-model evaluation of aerosols over South Asia: common problems and possible causes, *Atmos. Chem. Phys.*, 15, 5903-5928, doi:10.5194/acp-15-5903-2015.

[Interactive comment on Atmos. Chem. Phys. Discuss.](#), 15, 16901, 2015.

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