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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The effect of ENSO-induced rainfall and circulation changes on the direct and indirect radiative forcing from Indonesian biomass-burning aerosols" *by* A. Chrastansky and L. D. Rotstayn

Anonymous Referee #1

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General remarks:

The manuscript presents a global climate model study with the main purpose to compare model simulations results of Indonesian biomass-burning aerosols and their direct and indirect radiative forcing for two model set-ups: one driven with sea surface temperature (SST) for the specific years to be investigated (1997 and 2000) and one with climatological SST. The motivation seems rather artificial, as it is school-book knowledge that during El Nino or La Nina years, rainfall patterns and amount are considerably dependent on SST, in particular in Indonesia. In other words, without realistic SST,

one should not expect to simulate realistic rain fall amounts and patterns and associated aerosol burden and aerosol forcing. Therefore the last sentence of the abstract presents a well known conclusion. In the abstract it is stated that the effects on rainfall anomalies on the regional aerosol burdens and radiative forcing have not been investigated, but searching the literature, e.g. Heil et al. (2006) and Aldrian and Susanto (2003) already studied such issues, except the radiative forcing, which however is to a major extent dependent on the aerosol load. Therefore, it remains open which new knowledge is added by the model exercise presented in this manuscript. As Indonesian vegetation fire aerosols and their radiative effects have been studied extensively, in particular during the El Nino event 1997/1998 a lot more of the available and cited references should be considered in the manuscript for comparisons with model results. In addition, evaluations of model results are rather sparse, e.g. one-by-one comparison of rain-fall rates as modelled and observed by GPCP – a difference plot is missing or AOD's from different years than 1997 and 2000. As Indonesia represents the most convective region of the Earth, where several models fail to reproduce realistic rainfall patterns, not only because of coarse grid resolution - this should be addressed in the manuscript as well. In total, due to the weak motivation, the lacking consideration of already published material and the overall model related discussion with too few observation studies considered, I cannot recommend the manuscript for final publication in Atmospheric Chemistry and Physics.

Specific remarks:

- page 5250 line 25 – page 5251 line 5: here only the first indirect effect is discussed. I suggest discussing the other indirect radiative forcing effects as well, to include references to studies of the indirect aerosol effects in Indonesia into the manuscript und to give estimates of the importance of the first, second and third indirect aerosol effect over Indonesia, which represents the most convective region of the Earth.

- page 5252 line 2: the model resolution is relatively coarse in the horizontal and vertical direction. How reliable can it be expected that convection is modelled satisfactory? See

(Neale and Slingo, J. Clim. 16, 834-848, 2003)

- page 5252 line 7-12, page 5253 line 19-28: except for mineral dust, which is out of the focus of this study, a bulk mass approach is used for the aerosols. More information about the assumed aerosol size distribution needs to be added to the manuscript in order to give the reader the possibility to understand how the direct and indirect radiative aerosol effects are determined.

- page 5252 line 13: please distinguish more carefully between gases and aerosols, e.g. SO2

- page 5252 line 17: which temporal resolution is used? If monthly emissions are used, how do you take into account the variability in between and how important is this for the overall results?

- page 5252 line 24/25: please include explicitly that prescribed oxidants are used, which ones (OH, O3, H2O2 or more?) and mention their temporal resolution as well as from which source these are taken from. Do you take the diurnal cycle of OH into account? Do you use 1997 oxidants concentration for the 1997 simulation? If not, you may be missing the changing oxidation capacity during this event (see Duncan et al., 2003). Please provide more information and discussion.

- page 5253 line 4, line 16: Does the dry deposition scheme include gravitational settling throughout the whole atmosphere for carbonaceous aerosols and sulphate or is this ignored?

- page 5255: Rather technical information how the code is used. Please try to explain less code orientated.

- page 5257/5258, section 3.2.1.: Model results should be better evaluated, at least a difference plot between GPCP and model results should be included and discussed. I do not agree with the sentence on page 5258 line 20, that the model captures the rainfall patters in the Indonesian region very well. Here again, it will be necessary to

evaluate convective rainfall patterns separately. Please do not write SO4

- page 5259, section 3.2.2.: please compare with Heil et al. (2006)

- page 5262, line 5: Here only September and October averages are shown, before it was July to November. I suggest to use the same averaging period for the results presented in the manuscript.

- page 5262: the interpretation is very model biased. There are numerous references to observations available which should be considered for comparison.

- page 5267 section 3.7: I suggest to delete this section. I cannot recognise the importance of this section.

- page 5268 section 3.8: The authors should mention in much more detail the uncertainties in their model approach.

- page 5269 section 4: This section needs considerable improvements as the conclusions presented here do not go beyond the state of the art of knowledge.

- Figure 8 seems to be unnecessary as more ore less the same pattern is shown in Figure 9.

Aldrian E., Susanto R.D., Identification of three dominant rainfall regions within Indonesia and their relationship to sea surface temperature, International Journal of Climatology, 23, 1435–1452, 2003.

Heil, A., Langmann B., Aldrian E., Indonesian peat and vegetation fire emissions: Study on factors influencing large-scale smoke-haze pollution using a regional atmospheric model, Mitig. Adapt. Strat. Glob. Change, 12, 113–133, doi:10.1007/s11027-006-9045-6, 2007.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 5247, 2012.