This paper presents estimates of monthly 3D aerosol solar heating rates and anthropogenic radiative forcing at surface, TOA and within the atmosphere. A regional climate model nudged by meteorological re-analysis data is used as a tool in combination with a regional aerosol/chemistry model and a regional radiation model. MODIS and AERONET aerosol data is used for data assimilation.

The results are of interest and merit publication in ACP. However, there are quite a few things that are not clearly presented and I recommend a significant revision. In addition, I think the language could be improved substantially and the manuscript would benefit from somebody reading it through carefully, correcting language mistakes and technical jargon.

Overall comments:
1. It is unclear how the MODIS AOD product is used in the model. How is the vertical resolution obtained? It's only stated on page 835 that "we… provide vertical structures while Chung et al. (2005) assumed uniform vertical aerosol profiles". In addition, it is stated on page 828 that "MODIS onboard the Terra satellite gives near-global coverage". Looking at a typical daily MODIS coverage, I wouldn't exactly call that "near-global" coverage.
2. In general, the authors use the term "aerosol" in a very casual manner and it is not always clear what they refer to. Is it aerosol mass? Number? Chemical composition? Spatial distribution? Horizontal distribution? E.g page 824, line 8-9 ("…observationally constrained aerosols…", "The simulated aerosols…"), page 826, lines 19-21 ("…aerosol concentration…", "…average annual aerosol distribution…"), page 830, lines 19-20 ("…assimilated aerosol distributions…", …"three-dimensional aerosol concentrations…")
3. The description of chemistry/aerosol model is very brief and there is no discussion on how the assumptions made in the model may influence on the results. What aerosol parameters are actually simulated by the model? Only aerosol mass or aerosol mass in different size categories? Is it a model aerosol model or a bin model? Are the aerosols internally or externally mixed? Is there any aerosol chemistry in the model? How are the aerosols treated in terms of wet deposition? And what about other OC emissions than biomass burning? It is also of interest to know which aerosol parameters (e.g. size, mixture) that are used by the radiation model.
4. Discussion on vertical BC mass concentration profiles. The authors state that "it is encouraging that the observed BC [mass] concentration magnitude is approximately in the simulation range". This may be true, but the model is generally substantially higher than the observations. What could be the reason for this discrepancy? And what could be the reason for the discrepancy in BL concentrations?

Specific comments:
1. Page 822, line 26: The statement about the aerosol forcing derived using NCAR/CCM3 is unclear and not really relevant to the abstract.
2. Page 823, line 7: Sea salt does not absorb long wave radiation. Do the authors mean black carbon?

3. Page 824, line 2: Giorgi et al. (2002) are not the only ones to adopt a regional model to simulate aerosols.
4. Page 825, line 13: The authors say that the interannual variability of the simulated East Asian summer monsoon rainfall was improved when using nudged global reanalysis data. How much did the simulation improve? Are there still weaknesses?
5. Page 826, line 3: The authors state that three-hourly meteorological data from the PNNL regional model are used as input to the chemistry model. Does this include cloud and precipitation data? Why is this data then not used for the radiation model?
6. Page 828, line 24: How often is the assimilation procedure performed?
7. Page 829, line 4: What is the size range for MODIS fine and coarse mode AOD?
8. Page 831, lines 6-9: Sea salt is only adjusted towards the coarse mode AOD. How does this work over the ocean where sea salt could contribute substantially to the fine mode AOD?
9. Page 831, line 13: How are the modeled SSAs calculated? And what about the other optical parameters?
10. Page 832, line 13: What is the resolution of GOCART?
11. Page 833, lines 16-17: What is meant by "updated and expanded values"?
12. Page 835, lines 14-15: Why is the negative forcing particularly pronounced over the Northern Indian Ocean?
13. Page 836, lines 12-14 (and line 21-22): It is not clear to me what exactly are the differences between the present study and the study by Chung et al. (2005) and why "aerosol observation is the primary importance in calculating direct aerosol forcing". I would say that the crucial point is that the model simulates absorbing aerosols in a satisfactory way and that this in the present study is achieved through SSA assimilation. But it could also in principle be achieved with a better aerosol model.
14. Page 838, lines 27-29: Could the authors specify what they mean with "… useful as input to regional climate modeling"?

Language comments:
1. Page 823, lines 10-11: The authors use the term "aerosol distributions" in a very casual manner. Is it mass or size? Or is it spatial and temporal distributions? And I assume both the size and the mass are used for the radiation calculations?
2. Page 824, line 2: I suggest changing "satellite aerosol observations" to "satellite retrieved aerosol observations".
3. Page 824, line 3: A space is missing between "simulate" and aerosols".
4. Page 824, line 16-17: I suggest changing "…better resolve atmospheric and aerosol processes" to "…better resolve atmospheric processes and the interaction between aerosols and meteorological parameters" or something similar. The aerosol dynamics/physics/chemistry is not really better resolved with a high-resolution model.
5. Page 825, line 5: I suggest moving the line "The model domain was expanded for this study" to line 14 where the reference to the actual model domain applied is found.
6. Page 825, line 24: I suggest inserting an "a" before "larger constrain".
7. Page 825, line 28: I suggest removing changing "oceans" to "ocean".
8. Page 828, lines 1-2: I suggest substituting the word "upgraded" with "improved" and clarify briefly how the model was improved by Chung et al. (2005).
9. Page 830, line 23: "…chemical specie" should be "aerosol chemical compound" or something similar.

10. Page 830, lines 12-13: It would be nice (for clarity) to specify which are the absorbing aerosols.
11. Page 831, line 2: I suggest changing "…high dust month…" to "…a month with high dust emissions…"
12. Page 832, line 16: I suggest changing "… not stretched as far to…" to "…not dispersed as far towards…"
13. Page 832, lines 16-21: These sentences do not read very well.
14. Page 833, line 10: I suggest referring to the section where the "minor modifications" are described.
15. Page 834, lines 27-29: What is meant by "…blending boundary layer aerosol structure data and lifted aerosol structure data"?
16. Page 835, line 15: F(S) and F(A) are not defined.
17. Page 835, line 19: I suggest changing "…noticeably big" to "… noticeably large".
18. Page 835: The sentence starting on line 27 and continuing on page 836 does not read very well.
19. Page 837, lines 1-3: This sentence does not read very well.
20. Page 837, line 7: "maxima" should be "maximum".
21. Page 837, line 22-23. I suggest changing "sizable" to "large".
22. Page 837, line 26: I suggest changing "greater" to "larger".
23. Page 837, line 28: "Cina" should be "China".
24. Page 837, line 6: I suggest changing "..from the surface" to "…altitude".
25. Page 838, line 17: Change "computation" to "computational".
26. Page 838, line 26: Change "greater" to "larger".
27. Page 840, line 6: Change "maxima" to "maximum".
28. Page 840, line 22: "foraerosol" should be "for aerosol".

Figures:
1. Figure 5: Why Is assimilated values full line in left panel and circle in right panel? This is somewhat confusing.
2. Figure 6: It would be nice to have (at least approx.) levels of model layers indicated in the figure.