Atmos. Chem. Phys. Discuss., 13, C9754–C9757, 2013
www.atmos-chem-phys-discuss.net/13/C9754/2013/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Evaluation of aerosol number concentrations in NorESM with improved nucleation parameterisation" *by* R. Makkonen et al.

Anonymous Referee #1

Received and published: 6 December 2013

General Comments:

This manuscript describes additions to the Norwegian Earth System Model (NorESM), namely the extension of CAM4-Oslo to include an explicit representation of new particle formation and a modified representation of secondary organic aerosol. The authors then examined the sensitivity of simulated total particle concentration to these additions, and compared the model output to an extensive set of observational data.

The paper is certainly within the scope of ACP and is interesting; I would recommend publication following clarification on the minor issues listed below.

As a general comment, I wonder if trying to compare multiple simulations to such a wide range of observation "types", in sufficient detail, may be too much for one manuscript.

Minor / Specific Comments:

Section 2.4.2, p26397, line 12: just from ozonolysis? Or all oxidation products?

Section 2.4.2, p26397, line 13: can the oxidation products condense onto other particles? (i.e. larger than the nucleation mode?)

Section 5.1, p26403, lines 20-21: is this sentence referring specifically to the ActNuc_BC12 simulation? That seems to be more like five-fold, i.e., 2205 / 409 ?

Section 5.1, p26403, lines 24 onwards: It's a bit confusing to have the figures like they are in Figure 2, i.e., no nucleation – nucleation in Figure 2a, which gives a general reduction in particle concentration, but then in the text discuss the sensitivity to nucleation as an increase. Would it make more sense to plot this the other way around? Or at least discuss the percentage decrease in terms of a lack of nucleation?

Section 5.2.1, p26406, lines 10-12: April-May peak not in observations

Section 5.2.1, p26406, line 15: I'd rephrase "seems to work best" to something more scientific.

Section 5.2.2, p26406, line 25: It may aid the reader to clarify that these two locations are in different hemispheres and therefore have opposing seasonality. There also seems to be a large difference between the median and mean values on the plots at these two locations

Section 5.2.2, p26407, lines 5-7: It is touched on briefly here but it would be useful to have some discussion of how representative the mean vs. median is at these locations and a sense of the interannual variability in the observations (e.g., standard deviation?).

Section 5.2.3, p26407, line 26: from the plot several of the simulations look pretty similar, why is ActNuc_BC24 chosen as reproducing the concentrations "very well" ?

Section 5.2.5, p26409, line 1: I'm not sure you can call this a summer "minimum", the concentrations are still higher than in the winter.

Section 5.2.5, p26409, lines 4-5: Is this surprising? What year are the wildfire emissions from?

Section 5.2.6, p26409, lines 23-25: could this also be affected by the lack of seasonal cycle in primary anthropogenic emissions?

Section 5.2.7, p26411, lines 1-3: as a more general comment, doesn't the way this model treats SOA (even with the improved representation) preclude any detailed analysis of its impact on total particle number concentration, since (beyond the nucleation mode) you are adding new particles at 40 nm rather than allowing the SOA to partition to existing particles (which would increase their size but not number).

Section 5.4, p26412, lines 14-16: that is true for the mean, but the simulations appear able to capture the median value?

Section 5.4, p26412, lines 18-19: what is the "uncertainty range of observations" that you refer to here?

Section 5.4, p26414, line 20: "100%" of what?

Section 5.5: I am not sure that this section adds much to the previous analyses?

Technical Suggestions:

As far as I can tell, the Supplement just contains the same figures as the paper?

p26400, line 2: Should the Metzger reference be in brackets?

p26402, line 8: insert "one" before "location"

p26413, line 21: change "campaing" to "campaign"

Figure 3: there is no scale for the background contours?

Figure 4: where was IMPEX? MIRAGE is on here twice

Figure 5: it would be useful to define the components (in the pie chart) in the figure caption.

Figures 6 – 12: Depending on the layout of the final manuscript it might be worth reproducing the legend from Figure 5 on a couple of these to save the reader from referring back each time. Also, it might be better if they are shown in the same order that they are discussed: e.g., 5, 8, 7, 6, 9, 10, 11, 12.

Figure 10: these plots are far too small

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 26389, 2013.