Atmos. Chem. Phys. Discuss., 14, C95–C97, 2014
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Atmospheric Chemistry and Physics Discussions

Interactive comment on "An evaluation of O_3 dry deposition simulations in East Asia" *by* R. J. Park et al.

Anonymous Referee #1

Received and published: 10 February 2014

The paper by Park et al. presents a modeling study evaluating the roles of dry deposition in controlling surface ozone distributions by comparing two schemes (Wesely and M3DRY) widely used in current chemistry transport models, WRF-Chem and CMAQ. The authors found that using different schemes resulted in fairly large difference (up to 10 ppbv) in surface ozone mixing ratios on the monthly basis. Overall, the paper contains several new findings, providing substantial impacts to the modeling community looking at air quality in East Asia. I actually found the paper very interesting. The manuscript is generally well organized and written. I believe the paper should be published after revisions, which are relatively minor as listed below.

Major comments:

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Interactive Discussion
Discussion Paper

(1) In-situ ozone dry deposition velocity measurements in Asia: The authors state that their evaluation is limited due to the lack of observations of ozone deposition velocity in East Asia. I would generally agree with this statement. However, Matsuda et al (2005) (as referenced by the authors) presented measurement of ozone dry deposition in deciduous (teak) forest in northern Thailand. The observed diurnal cycle of dry deposition velocity is shown in Figure 3. I wonder why this data are not included in Figure 2. I would suggest the authors to consider this observation in comparison with their model, and modify the sentences accordingly.

(2) Seasonal variations of ozone dry deposition: The authors mainly discuss deposition in spring with an example in May 2004. Why is it? Do the authors have any specific reasons? As t noted in the manuscript, it seems that stomata plays a dominant role in determining the total deposition velocity, particularly during photosynthetically active period. I presume that the dry deposition would have seasonal variations. Is the impact by dry deposition greater in warm seasons than in cold ones? Is the impact greater in summer than in spring? Well, greater but not much, maybe? I am interested in how dry deposition perturbs the balance of photochemical production and long-range transport from spring to summer seasons, since these two are competing factors in controlling distributions of surface ozone in East Asia. For example, photochemical production is stronger in summer than in spring, while transport from Asian continent to downwind happens more efficiently in spring than in summer. I would like to see some analysis for the seasonal variations of ozone dry deposition and its roles in seasonal cycles of ozone in East Asia.

Minor comments:

Page 920, L3: “determine”. . . better to rephrase “control”?

L17: observations of “flux” or “dry deposition”?

Page 921, L12: “gradually” would be unnecessary

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14, C95–C97, 2014

Figures 3 and 4: NIER and EANET sites. Are these plots averages at several sites or at specific single sites? Many of the EANET sites are located at island but the characteristics are greatly different between north and south (Tanimoto et al., GRL, 2005). Diurnal cycles are observed in summer at some sites, for example, at Rishiri. Please be more specific to the locations and seasons of the observations. Also, any references or websites for the NIER sites?

Page 929, L9-12: How large is the difference between the two schemes?

Figure 4: The authors compare diurnal cycles by observations and models in the mixing ratios. I think relative changes are good enough to look at the contributions from dry deposition.

Figures 7 and 8: I assume this plot is for May 2004, but there is no indication when.

Figure 8: Why is the difference larger in marginal sea off the coast of Asian continent, compared to open oceans? Any comments?

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 919, 2014.