Atmospheric
Chemistry
and Physics
Discussions

Interactive comment on "Insights into seasonal variation of wet deposition over Southeast Asia via precipitation adjustment from the findings of MICS-Asia III" *by* Syuichi Itahashi et al.

Anonymous Referee #2

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Overall comments This manuscript is dealing with the wet depositions of S, N, and A in Southeast Asia. In order to estimate their monthly wet deposition amounts, authors analyzed nine air quality modeling outputs with different CTM models, versions, and the configurations, and used the ensemble mean of them to compare the results to the observations. For the better match with the EANET observations, authors introduced the precipitation-weighted wet deposition adjustments based on the observed precipitations at the weather stations and from the satellite measurements. This manuscript is well written, but a few issues should be addressed clearly before the consideration of publication in the journal. Please see the major and specific questions and comments below.

Major comments: 1. The main purpose of the manuscript is not clear. Authors might have focused on the measurements of wet depositions of S, N, and A, and their spatial distributions. On the other hand, it is not certain what the insight of the precipitation weighted adjustments authors want to tell. 2. Authors also need to explain the advantage of the so-called precipitation weighted adjustments of the monthly wet depositions. In my opinion, the wet deposition map in Southeast Asia can be directly developed with the observation data over the region by applying a spatial interpolation. Considering the uncertainties laid on the estimation, it is not sure how the new estimation is reliable or can be applied for the future research. 3. It is presumed that the precipitation amount is the dominant factor to determine the total wet deposition amounts. But the modeled amounts of the wet depositions can vary depending on the airborne concentrations. However, no model validation for the concentrations of air pollutants is available in the manuscript. 4. Still the proposed adjustment method for the wet deposition would be useful. However, the limitation and cautions in the use should be discussed in detail.

Minor comments: Line 114-115: In Eq (1), how is the ensemble mean different from the mean of individual models? Authors mentioned here the ensemble mean better matched to the observations, but it seems the mean of individual models is used in Eq. (1).

Line 143: Can authors explain what 'percentages' is meant here more clearly?

Line 151: Are there any approaches to evaluate the airborne concentrations first? Over- or under-predictions of the airborne concentrations may lead to the discrepancy between the observations and simulations.

Line 158: Light precipitation explained in Lines 54-55 might have caused the overestimation of modeled wet deposition. Have authors evaluated or analyzed the role of rain intensity and the rainfall hours to control the amounts of the modeled wet depositions? In Fig 2, compared to the modeled precipitation amounts, the models overpredicted the wet-deposited amounts more excessively.

Line 164-165: More specifically, is this due to the meteorology model issue or the algorithm in the CTMs?

Line 174: In Fig 3, compared to the monthly variations of precipitations, those of the wet depositions are relatively small. The absolute amount of precipitation plays a role of determining the wet depositions, but it would not be critical.

Line 185: Is the ENS calculated for the one EANET site?

Line 248: That could be one of reasons, but still not sure how the precipitation significantly affects the magnitude of wet depositions. Authors may define 'precipitation' in the manuscript. As I understand, precipitation that affects the wet depositions of air pollutants include the rainfall amount, intensity, frequency, and the duration.

Line 258: There clearly exist under-predictions of precipitations during dry season while over-prediction during wet season. Therefore, authors may apply the adjustment for dry and wet season separately instead of the annual total. For example, precipitations in Thailand during dry season was under-predicted, but those for wet season was over-predicted in the model.

Line 376: Site-specific adjustment factors utilizing the observation data can be applied to revise the wet deposition amounts in the spatial plots. If the main purpose of the precipitation-weighted adjustment of the wet depositions is to derive the realistic data close to the observations, why is a simple method like a spatial interpolation of the observed data not applied in this study? What advantage can we expect from the modeled wet deposition adjustments introduced in this study instead of a simple method?