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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Diurnal variation and size-dependence of the hygroscopicity of organic aerosol at a forest site in Wakayama, Japan: their relationship to CCN concentrations" *by* Yange Deng et al.

Anonymous Referee #1

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Overview: Deng et al. present a detailed characterization and analysis of organic aerosol contribution to aerosol particle hygroscopicity through measurements with a Humidity Tandem differential mobility analyzer (HTDMA), Aerosol Mass Spectrometer (AMS) and complementary measurements of black carbon and trace gas species in Wakayama, Japan. The site is one that is very well characterized by previous field campaigns and well described in the literature. This study combines positive matrix factorization (PMF) analysis with aerosol hygroscopicity measurements to understand the time and size – dependent variation of organic hygroscopicity on overall aerosol

hygroscopicity. I recommend publication of the study after addressing a few minor issues.

General Comments: In general, the discussion of biogenic secondary organic aerosol (aged and fresh BSOA) and the AMS volatility factors (LOOA and MOOA) seem disconnected from each other. As the paper transitions from the PMF analysis to a hygroscopicity based derivation of BSOA (section 4.3 to section 4.4) there doesn't not appear to be a clear transition of tying together of the two concepts or how/why they should or should not be connected. A clearer distinction and transition would be helpful. Specific Comments: Page 11 line 4: "observation" conveys a short time period or single time, where the measurements happened over the course of 20 days. A different description (measurement period, campaign, etc.) might be more appropriate. Page 13 line 8: prior or previous rather than former. Page 13 Figure 2: The O:C ratio seems to vary quite a lot for a value that is an average. What do the percentiles look like (similar to a box and whiskers plot)? This would probably help since the range of change in O:C really isn't that large (0.58 – 0.64). Page 14 Figure 3: Similar to the issue with figure 2, some of the data is very noisy at the 30 min bins. Specifically, the 30 nm has as much variability point to point as the range of other lines on the graph. Looking at the times series in the Supplementary information (Figure S12), this is because 30 nm also has the lowest data coverage and the 30 min bins do not afford high enough points per average. Either consider longer time bins or remove the 30 nm line from the panel. Page 22 Figure 6: It was not initially clear looking at this figure that the aged and fresh lines were different based on different analyses of the data. It wasn't clear why the shouldn't have added up to the OA line. Consider adding to the caption to allow the figure to stand alone better. Supplement Figure S14: If only the data in the 360 nm panel <0.4 is being used to fit the line, then the other point at 0.9 zooms the graph out and makes the fit look better than it really is (a line fit through a cloud of data points similar to the 300 nm panel). Also, with this graph, the negative korg values are non-real and must be the result of issues with the combination of the AMS data and the kappa values. Consider filters for removing these in quality control, or changing the

limits on the range of volume fractions of organics required to calculate korg (as you mentioned on page 9 line 10).

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