

Interactive comment on “Observational evidence for aerosols increasing upper tropospheric humidity” by Laura Riuttanen et al.

Anonymous Referee #2

Received and published: 1 September 2016

This is an interesting paper that studied the relationships between aerosol loading and upper tropospheric humidity using satellite remote sensing data. The paper is very well written and easy to follow. The authors have comprehensively explored many elements of uncertainty, however I still have some questions on the analysis. I suggest the publication of the manuscript after addressing some comments as follows.

Specific comments:

1. During the summer season, there might be diurnal variation of precipitations. Since the UHR change could result from the convective transport of marine boundary layer air to the upper troposphere and AODs are measured 11 hours ahead of URH, differences in diurnal variability between precipitation (UHR) and AODs are likely to contribute to the seen relationships. Suggest test it.

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2. The binning approach is not totally convincing for excluding the meteorological/synoptic effects on AOD. In addition, the value ranges of those bins are not clear. I would think more logically one should compare the 10-m wind speed and surface humidity between high AOD and low AOD scenarios and test the statistical significance of 10-m wind speed differences and surface humidity differences between the high and low AOD scenarios. Not only that AODs are influenced by humidity but also it has significant contributions from large size natural sea salt aerosols (their emission rates are wind speed dependent).

3. Is it possible to only use clear sky AOD (with cirrus fraction = 0 or < 0.1), given that cirrus clouds lead to biases in AOD values? Does the results change when using only clear sky AODs?

Minor comments:

Page 7, Lines 10 and 15: I disagree that bulk microphysics cannot capture important aerosol effects, and only spectral bin microphysics can capture the effect. Through improved coupling between aerosols and microphysics in conjunction with maybe some improvement in the bulk microphysics (including ice nucleation scheme), there is no reason that more detailed bulk microphysics cannot simulate those effects.

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-561, 2016.

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