

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

Anonymous Referee #1

Received and published: 19 August 2016

General Comments:

This is a very interesting study to investigate the impacts of aerosol on the increase in upper tropospheric humidity by using remote sensing datasets over the ocean east of China. The study shows that increased aerosol loads are associated with higher upper tropospheric humidity via changes in the microphysics of deep convection. Based on long-wave radiation transfer calculation, the authors concluded that an increase in upper tropospheric humidity leads to a positive regional radiative effect. The results are well presented and structured, and the topic is suitable for publication in Atmos. Chem. Phys. after addressing some specific comments listed below.

Specific Comments:

An increase in the number of atmospheric aerosols acting as cloud condensation nu-

C1

clei (CCN) would slow down the diffusion growth of droplets, and thus smaller cloud droplets. To better support this mechanism using observational evidences, cloud particle effective radii (or cloud albedo) and cloud fraction, which can be retrieved by remote sensing observations, are suggested to be included in the analysis.

Identification of deep convective clouds might further improve the results. MODIS-detected cloud top pressure and CloudSat data would be helpful to select the cases with deep convective clouds.

It should be noted and be mentioned in the article that using AOD as a measure of CCN concentration may introduce substantial uncertainties which is dependent on the aerosol type, vertical profile and hygroscopic growth.

The discussion on long-wave radiative effect is somewhat incomplete and unclear. For instance, the time period of the calculated the top-of-the-atmosphere radiative effect should be clarified, monthly mean or instantons values, in Section 2.5. Moreover, discussions on radiative effect are too short in Section 3.3. It would be better to discuss the radiative effect in detail, such as the difference between tropical moist (TM) and mid-latitude dry (MLD) conditions.

Technical Corrections:

Caption of Figure 11: please check the labels of panels in the caption. Page 6, Line 8: MSL should be defined here. Figure 10: the abbreviations like omega and dir in this figure need to be specified in the caption.

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

C2