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# Humidified aerosol properties in cloudy environment

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The remotely sensed aerosol retrievals in the transition zone between clouds and clear sky ("the twilight zone") are affected by aerosol humidification, undetectable clouds, and complex cloud radiative 3D effects. Recent work that has estimated this total effect found a strong exponential dependence of the aerosol retrievals on the distance from the nearest cloud, up to 30 km from the detected cloud edge. In this work, an extensive statistical analysis, based on 32 year record of upper atmosphere observations (radiosonde data) in several locations around the globe, enables the evaluation of the mean RH values in various cloudy environments (not inside clouds). In all cases, the observed mean RH values in cloudy environments are higher than the mean RH values for cloud free conditions, but still, in most cases, not sufficiently high to significantly contribute to the aerosol radiative forcing through hygroscopic growth.

Furthermore, the profiles of warm cumulus cloud-field conditions were analyzed. Assuming, based on a recent study, that the RH increases exponentially when getting close to cloud edges, the radiosonde data provide the needed information for calculating the coefficients of the analytical decay functions. The extracted exponential e-folding scales and background RH values (far from clouds) agree with past observations and large eddy simulation results, showing that the aerosol radiative effect by hygroscopic growth is significant only in regions located $\sim$0.5 km around clouds. This suggests that the total effect of the twilight zone on aerosol retrievals might not be dominated by aerosol humidification at distances of 0.5$\sim$30 km from clouds.