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The aerosol impact on cirrus clouds and precipitation

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Aerosol, clouds and precipitation interaction is one the most challenging problems in climate research and climate predictions. The magnitude and mechanisms of aerosol impacts on cloud properties (e.g. particle sizes), and the resulting influence on precipitation are poorly known, primarily due to lack of accurate global scale observations. The aerosol impact on ice clouds is especially lacking. New data from NASA's satellites, particularly from the "A-train constellation", create a new opportunity to advance understanding of the aerosol-cloud-precipitation interactions. In this study we analyze the nearly-simultaneous measurements of clouds and pollutants along A-train tracks. In particular, Aura MLS measured CO is used together with ice water content (IWC) observed by MLS to classify cirrus clouds as "clean" or "polluted". We then analyze the Aqua MODIS cloud particle size and TRMM precipitation to investigate how pollution may change precipitation, cloud ice and their correlations. Aerosol optical depth data from MODIS and CALIPSO are also used. The analysis results for the South America region will be presented. We find evidence of suppressed precipitation and reduced ice particle size associated with the polluted clouds during dry bio-mass burning season, in which there is a strong correlation between the observed CO and aerosol, indicating microphysical influence of aerosols on ice clouds. In contrast, there is neither significant changes in precipitation nor in ice particle size associated with the CO-polluted clouds during the wet rainy season, in which the observed CO is not well-correlated with aerosol.