An A-train Perspective on Cloud-Aerosol-Precipitation-Interaction over Eastern China

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The quantification of Cloud-Aerosol-Precipitation Interaction (CAPI) remains arguably elusive due to the difficulties in simultaneously obtaining collocated aerosol, cloud and precipitation observations, in addition to the pervasive involvement of meteorology. In this seminar, the changes in warm clouds and the vertical structure of precipitation are investigated over Eastern China, mostly based on near-simultaneous retrievals from MODIS/AQUA, CALIOP/CALIPSO, and CPR/CLOUDSAT, flying as part of A-train. The combination of CALIOP and CPR was applied to determine the exact position of warm clouds relative to aerosols. Under mixed conditions, the cloud droplet effective radius (CDR) decreased with increasing AOD at moderate aerosol loading (AOD<0.4), and then became saturated at an AOD of around 0.5, followed by an increase in CDR with increasing AOD, known as boomerang shape. Using ground-based measurements of daily mean PM10 and TRMM precipitation data over the Pearl River Delta (PRD) of China, rain rate (R) tended to be lower under polluted conditions than under clean conditions. A rise in the highest mean 5‰ of Z (radar reflectivity) was seen as the atmosphere changed from pristine to lightly polluted in the presence of stratiform and convective rain, but not when it was shallow-cloud rain. The normalized contoured frequency of the altitude difference in Z (ΔZ) suggests the aerosol suppression (invigoration) effect on shallow and stratiform (convective) rain below (above) 5 km level. Below the freezing level, the occurence of >45 dBZ reflectivities was enhanced at the expense of that of lower reflectivities.

Key words: CALIOP, MODIS, TRMM, Cloud, Aerosol