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Observations of the Interaction and/or Transport of Aerosols with Cloud or Fog during DRAGON Campaigns from AERONET Ground-Based Remote Sensing

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Ground-based remote sensing observations from Aerosol Robotic Network (AERONET) sun-sky radiometers have recently shown several instances where cloud-aerosol interaction had resulted in modification of aerosol properties and/or in difficulty identifying some major pollution transport events due to aerosols being imbedded in cloud systems. AERONET has established Distributed Regional Aerosol Gridded Observation Networks (DRAGON) during field campaigns that are short-term ($\sim$2-3 months) relatively dense spatial networks of $\sim$15 to 45 sun and sky scanning photometers. Recent major DRAGON field campaigns in Japan and South Korea (Spring 2012) and California (Winter 2013) have yielded observations of aerosol transport associated with clouds and/or aerosol properties modification as a result of fog interaction. Analysis of data from the Korean and Japan DRAGON campaigns shows that major fine-mode aerosol transport events are sometimes associated with extensive cloud cover and that cloud-screening of observations often filter out significant pollution aerosol transport events. The Spectral De-convolution Algorithm (SDA) algorithm was utilized to isolate and analyze the fine-mode aerosol optical depth signal for these cases of persistent and extensive cloud cover. Additionally, extensive fog that was coincident with aerosol layer height on some days in both Korea and California resulted in large increases in fine mode aerosol radius, with a mode of cloud-processed or residual aerosol of radius $\sim$0.4-0.5 micron sometimes observed. Cloud processed aerosol may occur much more frequently than AERONET data suggest due to inherent difficulty in observing aerosol properties near clouds from remote sensing observations. These biases of aerosols associated with clouds would likely be even greater for satellite remote sensing retrievals of aerosol properties near clouds due to 3-D effects and sub-pixel cloud contamination issues.