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Investigation of Aerosol-Cloud Interactions based on Satellite Based Remote Sensing in Northeast Asia

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The subject of aerosol-cloud interactions has received prominent attention because of still higher uncertainty in estimating its climatic forcings and its possible climatic implications. Although the various studies on the aerosol indirect effect have been carried out all over the world, relatively few focuses have been put on the Northeast Asian region, which has suffered from a lot of anthropogenic air pollution and various kinds of aerosol compositions. Detailed and integrated careful observations are needed to understand the complex coupled mechanisms of aerosol-cloud interaction and its radiative forcing, but these strategies have not been applied to the region yet. The first step to aerosol indirect study in Northeast Asia is to have an overall understanding of the current state of aerosol and cloud optical properties derived from ground and satellite-based remote sensings available since 2001. First of all, there seem to be no annual increasing/decreasing trends of monthly-average aerosol optical depth (AOD) from MODIS in the downstream region of China, which is also confirmed by the aerosol robotic network (AERONET). In general, AOD showed the strong horizontal gradient from China to Korea, with no relevant systematic association with the effective radius and optical depth of the liquid-phase cloud, which might be attributable to the masking synoptic meteorological variations and the coarse horizontal grid (1 deg by 1 deg). Specific comparisons of AOD and the effective radius demonstrated the significant negative correlation only in summer and over the Yellow Sea, where the relative variability of cloud (e.g. cloud optical depth) appears to be suppressed and aerosol loadings tend to be significantly variable relative to other regions and other seasons, which could indicate the seasonal and spatial sensitivity of aerosol-cloud interactions. With regard to the cloud scale in addition to the above climatic perspective, an association of the cloud with aerosols has been eventually examined using Atmospheric Brown Cloud data in March 2005.