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Use of spectral irradiances measured at surface of SKYNET sites to study aerosol optical properties and aerosol direct radiative effects

Pradeep Khatri[†]; Tamio Takamura; Akihiro Yamazaki; Yutaka Kondo
[†] CEReS Chiba University, Japan
Leading author: pradeep.nep@gmail.com

Due to the importance of aerosols on climate change study, they have received considerable interests in the recent years. As a result, aerosols are being monitored by several space- and ground- based remote sensing approaches. Aerosol optical parameters obtained from ground-based remote sensing methods are widely used to validate results from several satellites as well as numerical model simulations. Among several ground-based remote sensing networks in the world, SKYNET network has monitoring sites in different parts of the Asia. This network is equipped with several instruments for the study of aerosol, cloud, and radiation interaction. Sky radiometer (Manufacture: PREDE Co., Ltd., Japan) of SKYNET network is the key instrument to study aerosol characteristics. Sky radiometers have been continuously collecting data at different parts of the Asia for several years. We analyzed sky radiometer observation data of different observation sites, including desert and semi-arid regions, biomass burning region, urban area, and marine area to understand characteristics of aerosols of different atmospheric scenarios of Asia. We also calculated direct radiative effects of aerosols of different atmospheric scenarios. We further extended the study to understand dominant light absorbing aerosols using sky radiometer observation data. We observed strong spatial and temporal variations of aerosol optical properties and aerosol radiative effect depending on the observation site and study period. As the first part of the presentation, we will summarize the important results of our study covering the characteristics of aerosol and aerosol radiative effect, and types of dominant light absorbing aerosols over some SKYNET sites located within East Asia. In addition to sky radiometer, MS-700 spectroradiometer (Manufacturer: EKO Co., Ltd., Japan) is another instrument for aerosol measurement at some key SKYNET sites. In contrast to sky radiometer that collects data by tracking the sensor towards the sun using solar tracker, this instrument measures spectral global and diffuse irradiances using horizontal receiver surface. As a result, correction of cosine error is the primary problem for such radiometer. More specifically, correction of cosine error for measured diffuse irradiance is challenging. We developed a new method to correct diffuse irradiance and also developed an algorithm to retrieve key aerosol optical parameters, such as aerosol optical thickness and single scattering albedo, using spectral irradiances measured by MS-700. We found very good agreement for aerosol optical thickness and reasonable agreement for single scattering albedo with results from sky radiometer. As the second part of the presentation, we describe the data analysis algorithm for MS-700 radiometer and comparison of results between sky radiometer and MS-700.