Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

AAS005-06 Room: 201B Time: May 27 10:15-10:30

Comparison of chemical/optical properties of atmospheric aerosol at Phimai between a field study and the SPRINTARS model

Haruo Tsuruta[1*], Toshihiko Takemura[2], Jinchula Chotpitayasunon[3], Boossarasiri Thana[3], Pradeep Khatri[4], Tamio Takamura[4], Nobuo Sugimoto[5], Eiji Oikawa[1], Toshiro Inoue[1], Tadahiro Hayasaka[6], Teruyuki Nakajima[1]

[1]CCSR, The University of Tokyo, [2]RIAM, Kyushu University, [3]Chulalongkorn University, Thailand, [4]CEReS, Chiba University, [5]Atmospheric Environment Division, NIES, [6]CAOS, Tohoku University

Atmospheric aerosols were measured at the Observatory of Atmospheric Research, in Phimai, Thailand, a station of SKYNET, during 2007-2008. The mass concentration and major chemical components of fine aerosols were much higher in the dry season when northeasterly or easterly winds were predominant, than in the wet seasons when southwesterly winds were predominant. According to the backward trajectory analysis of NOAA ARL HYSPLIT MODEL, air masses arrived at Phimai were transported from Indian Ocean in the wet seasons, while in the dry season, they were transported from South China, East China Sea or South China Sea through Indochina. In fine particles, ammonium sulfate, and elementary carbons (EC) and organic carbons (OC) were major components. The concentration ratios of EC to non sea-salt sulfate in the early dry season were almost equal to those at Amami-Oshima in southwest Japan, where the anthropogenic aerosols were transported from the urban-industrial area of the east coast of China. The ratios in the latter dry season when air masses were transported from South China Sea, however, were much higher than those in the early dry season. It is caused by aerosols emitted from biomass burning of agricultural residues in/around Thailand, which was detected by MODIS fire maps especially in the latter dry season. Single scattering albedo (SSA) measured by sky radiometer at the Observatory was >0.95 in the wet seasons, and much higher than in the latter dry season (0.80 -0.90). Aerosol optical thickness (AOT) was <0.20 in the wet seasons, much lower than in the dry season (0.20-0.70). These optical properties are consistent with the time series of aerosol chemical composition. In coarse particles, nitrate and sea-salt particles were dominant in the wet and dry seasons. The ratio of nitrate to OC was higher in the air masses transported through Bangkok in the wet seasons.
These results from the field data were compared with SPRINTARS (Spectral Radiation-Transport Model for Aerosol Species), a numerical model which has been developed for simulating effects of atmospheric aerosols by natural or anthropogenic sources on the climate system through radiation budget on the global scale. Time series of aerosol mass concentration, aerosol optical thickness (AOT), and single scattering albedo (SSA) in the wet and dry seasons, is qualitatively in good correlation between the field data and the model. The field data frequently showed high sulfate aerosols transported from east China by northeasterly/easterly winds in the dry season, and which is well simulated by the model. According to SPRINTARS, a large-scale dust storm generated in desert areas of northwest China on 26-27 Feb. 2008, and soil dust is transported over Japan during 2-4 March, and part of which is transported to Phimai during 4-6 March. The field data showed one of the highest concentrations of sulfate and mineral dusts on 5 March, and which is consistent with the model. However, the model simulates lower concentration of soil dust in the dry season than in the wet season except for the dust storm period, although the field data showed higher concentration of soil dust in the dry season, which may be derived from soil dusts in local scale. Effects of biomass burning on atmospheric aerosols may not be large in the SPRINTARS model, compared to those in the field data, which showed that atmospheric aerosols derived from

biomass burning were dominant especially in the latter dry season. The field data would be easily affected by localized biomass burning.

Keywords: fossil fuel combustion, biomass burning, skyradiometer, AOT, SSA