Optical and chemical properties of atmospheric aerosols at Phimai in Thailand by surface measurements, CALIOP data, and the SPRINTARS model

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Abstract

Atmospheric aerosols were measured at the Observatory of Atmospheric Research, in Phimai, Thailand, a station of SKYNET, during 2006-2008. The mass concentrations and major chemical components in fine and coarse aerosols were analyzed, and the optical properties

such as AOT and SSA were calculated from the data measured by skyradiometer. Surface wind data typically showed a wet season (from May to September), and a dry season (from October to April) which is divided into early (October-November), middle (December-early March), and latter (middle March-April) periods. In this paper, the following topics are summarized;

1. Chemical characterization: For $PM_{2.5}$ aerosols in the dry season, the air pollutants emitted by fossil fuel combustion was dominant in the early season, which was transported from east Asia. In contrast, in the latter period, the aerosols emitted by biomass burning in Indochina Peninsular were predominant. The middle period showed a mixture state between the early and latter periods. The concentration ratio of EC/nss-SO_4 showed a large difference between the early and latter periods, and which was consistent with the result simulated by the SPRINTARS model.

2. Optical properties: AOT in the field study showed a clear seasonal variation, and was much higher in the dry season than in the wet season. The AOT in the dry season could be positively correlated with the mass concentration of $PM_{2.5}$ near the surface. And SSA was compared with that independently calculated with a shell-core model using the measured chemical composition.

3. Comparison between the SPRINTARS model and the field measurements: The seasonal variation in the concentration of elemental and organic carbons, ammonium sulfate, sea-salt particles and dust particles, calculated by the SPRINTARS model generally showed a good agreement with the field measurements. The dust concentration in the dry season, however, was much lower in the model than in the measurements, and which may be attributed to the local dust particles which lifted up by thermal plumes generated from biomass burning.

4. Long range transport of dust aerosols in the wet season: Trace elements such as Si and Ti which are good indicators of dust aerosols showed high concentrations during 17-20 June 2008 even in the wet season, comparable with those in the dry season. CALIOP data and the result of the SPRINTARS model showed a large amount of dust aerosols over Indian Ocean up to the height of 5km, and backward trajectory analysis by using the NOAA HYSPLIT model showed a long range transport of polluted air massess rich in dust aerosols from the desert areas in west Asia/east coast of North Africa.