5-1502

Development of an Advisory and Assessment System for the Environmental Impacts of Aeolian Dust

Atsushi SHIMIZU
National Institute for Environmental Studies (NIES)
16-2 Onogawa, Tsukuba-City, Ibaraki 305-8506, JAPAN
Tel: +81-29-850-2489 / Fax: +81-29-850-2579
E-mail: shimizua@nies.go.jp

In cooperation with: Meteorological Research Institute, Kyoto University, Yamanashi University

Key words: Aerosol Transport Model, Asian Dust, Lidar, Data Assimilation, Epidemiology

We conducted continuous observations of the vertical distribution of Asian dust by the AD-Net lidar network in East Asia. The data confirmed a negative trend of Asian dust density over Japan over last 10 years and that the intensity was dependent on altitude (Shimizu et al., 2017). We improved measurement of near-surface aerosols by introducing a small telescope with a wide field-of-view into the lidar system. Internal mixing of Asian dust and anthropogenic pollutants was suggested through an analysis of the color ratio (the ratio between extinction coefficients at two wavelengths). Asian dust density values obtained by a polarization optical particle counter (POPC) corresponded well with the dust extinction coefficients obtained by lidar near the surface. We supplied AD-Net data to the Ministry of the Environment (MOE) for their Dust and Sand-Storm information webpage, and the data were also utilized in activities related to several MOE working groups.

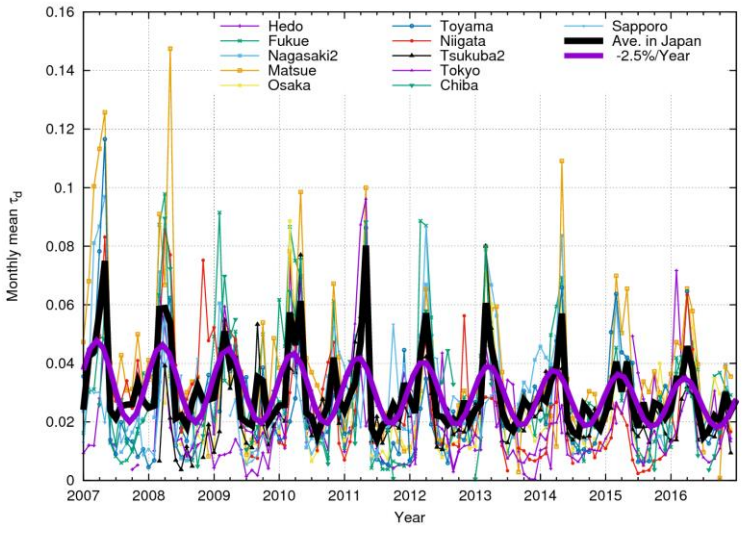

Fig. 1 Time series of monthly mean averaged dust optical depth detected by the AD-Net lidar network during 2007 to 2017. The thick black and thick purple lines correspond to the observed and fitted curves. The thin lines indicate results by independent lidars.

We improved one global aerosol transport model (MASINGAR mk-2) and provided calculation results to researchers working on other sub-themes. We developed an analytical

method (LETKF) to assimilate satellite observation data (Himawari-8) in this model and confirmed improvement in analytical accuracy. In addition, we developed a data assimilation method (2D-Var) capable of high-speed computation and started a daily data assimilation and prediction experiment using satellite observation data. We conducted an aerosol re-analysis (JRAero) using the 2D-Var system and prepared a high-quality four-dimensional global aerosol dataset for 2011–2015 (Yumimoto et al., 2017). The dataset was provided to those working on other sub-themes and was also released for use by external researchers.

In addition, we clarified points requiring elucidation when using lidar in epidemiologic studies, and we shared those and resolved some related issues. As a result, it has become possible to conduct health risk assessments in areas where lidar observations have not been available and epidemiologic studies have not been performed due to a lack of current information on Asian dust concentrations. We further proposed a provision method and actually provided information to vulnerable people and demonstrated that by providing information we could reduce the risk of unscheduled clinic visits by vulnerable people on days with high Asian dust concentrations.

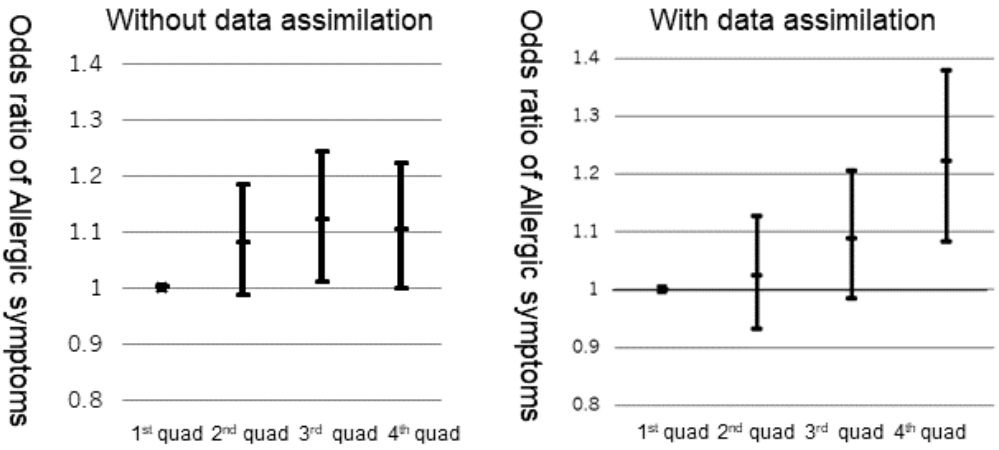

Fig. 2 (Left) Odds ratios of allergic symptoms on Asian dust days, determined by chemical transport model without data assimilation, (right) similar, but Asian dust days determined by model with data assimilation.

References:

Shimizu, A., N. Sugimoto, T. Nishizawa, Y. Jin and D. Batdorj (2017)
Variations of Dust Extinction Coefficient Estimated by Lidar Observations over Japan, 2007-2016. Scientific Online Letters on the Atmosphere, 13: 205-208

Yumimoto, K., T.Y. Tanaka, N. Oshima and T. Maki (2017)
JRAero: the Japanese Reanalysis for Aerosol v1.0. Geosci. Model Dev., 10: 3225-3253