An investigation of transboudary particulate matter over northeast Asia

M. E. PARK[1], C. H. SONG[1]*, R. S. PARK[1], J. LEE[2], S. J. LEE[1] AND J. KIM[3]

[1]School of Environmental Science and Engineering, Gwangju Institute of Science and Technology, Gwangju, Korea (*correspondence: chsong@gist.ac.kr)
[2]Goddard Space Flight Centre, NASA, Greenbelt, MD, USA
[3]Department of Atmospheric Science, Yonsei University, Seoul, Korea

CMAQ modeling was conducted for a period of 1 April to 31 May, 2011, in order to assess the impacts of Long-Range Transport (LRT) events on the particulate matter (PM) concentrations over northeast Asia. Meanwhile, a Korean geostationary satellite, Communication, Ocean, and Meteorological Satellite/Geostationary Ocean Color Imager (COMS/GOCI)-retrieved data were also used in this study to overcome the temporal limitation of the Low Earth Orbit (LEO) satellites. The LEO pass over the region of interest once a day (or several days), although these has been mainly applied to investigate the characteristics of AOD over northeast Asia. The GOCI-retrieved AOD products were obtained through Yonsei aerosol retrieval algorithm and CMAQ model simulations considered dust and biomass burning emissions and their transports. The CMAQ-calculated AOD was then improved by integrating hourly GOCI-retrieved AOD via a data assimilation technique for the purpose of producing more accurate AOD products over northeast Asia. It clearly showed the several long-range transport events of the small- and large-scale AOD plumes from Central East China (CEC) to the Korean peninsula. In addition, according to statistical analysis of the assimilated AOD for the LRT and non-LRT events at five AERONET sites, the average AOD increased by LRT events was found to be 0.40 above the background AOD value of 0.24.

Contribution of ammonium nitrate to aerosol optical depth and direct radiative forcing by aerosols over East Asia

RAE S. PARK, SO J. LEE, SUNG-K. SHIN AND CHUL H. SONG*

School of Environmental Science and Engineering, Gwangju Institute of Science and Technology (GIST), Gwangju, 500-712, Korea (rspark28@gmail.com, *correspodence to chsong@gist.ac.kr)

This study focused on the contribution of ammonium nitrate (NH_4NO_3) to aerosol optical depth (AOD) and direct radiative forcing (DRF) by aerosols over an East Asian domain. In order to evaluate the contribution, CTM-estimated AOD was combined with satellite-retrieved AOD, utilizing a data assimilation technique, over East Asia for the entire year of 2006. Using the assimilated AOD and CTM-estimated aerosol optical properties, the DRF by aerosols was estimated over East Asia via a radiative transfer model (RTM). Both assimilated AOD and estimated DRF values showed relatively good agreements with AOD and DRF by aerosols from AERONET. Based on these results, the contributions of NH_4NO_3 to AOD and DRF by aerosols (Φ_{AOD} and Φ_{DRF}) were estimated for four seasons of 2006 over East Asia. Both Φ_{AOD} and Φ_{DRF} showed seasonal variations over East Asia within the ranges between 4.7% (summer) and 31.3% (winter) and between 4.7% (summer) and 30.7% (winter), respectively, showing annual average contributions of 15.6% and 15.3%. However, these contributions can be even larger in the locations where NH_3 and NO_x emission rates are strong like the Central East China (CEC) region and Sichuan basin. For example, both Φ_{AOD} and Φ_{DRF} over the CEC region range between 6.9% (summer) and 47.9% (winter) and between 6.7% (summer) and 47.5% (winter), respectively. Based on this analysis, it was concluded that both Φ_{AOD} and Φ_{DRF} cannot be ignored in East Asian air quality and radiative forcing studies, particularly during winter.

Keywords: Ammonium nitrate (NH_4NO_3); Aerosol optical depth (AOD); Direct radiative forcing (DRF) by aerosols; Assimilation; AERONET; EANET

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