Geophysical Research Abstracts
Vol. 12, EGU2010-7763, 2010
EGU General Assembly 2010

Seasonal and regional aerosol characteristics in East Asia investigated with model-predicted and remotely-sensed aerosol properties

C. H. Song (1), M. E. Park (1), K. H. Lee (3), H. J. Ahn (1), Y. Lee (1), J. Y. Kim (2), K. M. Han (1), J. Kim (4), Y. S. Ghim (5), and Y. J. Kim (1)

(1) Department of Environmental Science and Engineering, Gwangju Institute of Science and Technology (GIST), Gwangju, Republic of Korea (chsong@gist.ac.kr/+82-62-970-3404), (2) Hazardous Substance Research Center, Korea Institute of Science and Technology (KIST), Seoul, Republic of Korea, (3) Earth System Science Interdisciplinary Center (ESSIC), University of Maryland, MD 20742, USA, (4) Department. of Atmospheric Science, Yonsei University, Seoul, Republic of Korea, (5) Department of Environmental Science, Hankuk University of Foreign Studies, Yongin-si, Gyeonggi-do, Republic of Korea

In this study, the spatio-temporal and seasonal distributions of EOS/Terra Moderate Resolution Imaging Spectroradiometer (MODIS)-derived aerosol optical depth (AOD) over East Asia were analyzed in conjunction with US EPA Models-3 Community Multiscale Air Quality (CMAQ) v4.3 modeling system. In this study, two MODIS AOD products (τ_{MODIS}: τ_{M-BAER} and τ_{NASA}) retrieved through a modified Bremen Aerosol Retrieval (M-BAER) algorithm and NASA collection 5 (C005) algorithm were compared with the AOD (τ_{CMAQ}) that was calculated from the US EPA Models-3/CMAQ model simulations. In general, the CMAQ-predicted AOD values captured the spatial and temporal variations of the two MODIS AOD products over East Asia reasonably well. Since τ_{MODIS} cannot provide information on the aerosol chemical composition in the atmosphere, different aerosol formation characteristics in different regions and different seasons in East Asia cannot be described or identified by τ_{MODIS} itself. Therefore, the seasonally and regionally varying aerosol formation and distribution characteristics were investigated by the US EPA Models-3/CMAQ v4.3 model simulations. The contribution of each particulate chemical species to τ_{MODIS} and τ_{CMAQ} showed strong spatial, temporal and seasonal variations. For example, during the summer episode, τ_{MODIS} and τ_{CMAQ} were mainly raised due to high concentrations of $(NH_4)_2SO_4$ over Chinese urban and industrial centers and secondary organic aerosols (SOAs) over the southern parts of China, whereas during the late fall and winter episodes, τ_{MODIS} and τ_{CMAQ} were higher due largely to high levels of NH_4NO_3 formed over the urban and industrial centers, as well as over Chinese agricultural and livestock farming areas with high NH_3 emissions. τ_{CMAQ} was in general larger than τ_{MODIS} during the year, except for spring. The high biases ($\tau_{CMAQ} > \tau_{MODIS}$) may be due to the excessive formation of both $(NH_4)_2SO_4$ (summer episode) and NH_4NO_3 (fall and winter episodes) over China, possibly from the use of overestimated values for NH_3 emissions in the CMAQ modeling. According to CMAQ modeling, particulate NH_4NO_3 made a 14% (summer) to 54% (winter) contribution to σ_{ext} and τ_{CMAQ}. Therefore, the importance of NH_4NO_3 in estimating τshould not be ignored, particularly in studies of the East Asian air quality. In addition, the accuracy of τ_{M-BAER} and τ_{NASA} was evaluated by a comparison with the AOD ($\tau_{AERONET}$) from the AERONET sites in East Asia. Both τ_{M-BAER} and τ_{NASA} showed a strong correlation with $\tau_{AERONET}$ around the 1:1 line (R=0.79), indicating promising potential for the application of both the M-BAER and NASA aerosol retrieval algorithms to satellite-based air quality monitoring studies in East Asia.