Geophysical Research Abstracts
Vol. 21, EGU2019-12659-1, 2019
EGU General Assembly 2019

Variability of the direct radiative forcing of aerosols due to surface albedo variations

Dong Yeong Chang (1,3), Jongmin Yoon (2), Jos Lelieveld (3,4), Andrea Pozzer (3), Jhoon Kim (1), and Seong Soo Yum (1)

(1) Yonsei University, Atmospheric science, Seoul, Republic of Korea (dongyeong.chang@mpic.de), (3) Max Planck Institute for Chemistry, Atmospheric Chemistry, Mainz, Germany, (2) Climate and Air Quality Research Department, National Institute of Environmental Research, 22689 Incheon, Republic of Korea, (4) The Cyprus Institute, P.O. Box 27456, 1645 Nicosia, Cyprus

We use Aerosol Robotic Network (AERONET) observations to categorize aerosol data into three different types, i.e. mineral dust, biomass burning, and urban-industrial aerosols, and calculate their radiative forcing at varying surface albedo. In general, the radiative forcing positively correlates with the aerosol loading, but the efficiency relies on the aerosol type and aerosol-radiation-surface interactions. Based on the linear relationship between the radiative forcing efficiency and surface albedo, all three aerosol types show dramatic changes in radiative forcing at the top of the atmosphere, from cooling to warming. The forcing sign depends on the critical surface albedo, which can range between about 0.5 to more than 0.75. Using MODIS aerosol optical thickness and surface albedo data, we apply the critical surface albedo to calculate radiative forcing for selected events (i.e. a large Asian dust event, extensive Russian wildfires, and a thick urban-industrial aerosol haze event). We demonstrate the spatially varying radiative forcing for each case (ranging from about -85 to +70 W/m2, -79.4 to +0.2 W/m2, and -82.8 to +0.3 W/m2, respectively). This study shows the importance of aerosol–radiation–surface interactions for the aerosol radiative forcing and predictions of climate change.