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Direct radiative forcing due to anthropogenic aerosols and Asian dust in March 2002 in East Asia

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The Asian Dust Aerosol Model (ADAM) and the aerosol dynamic model with the output of MM5 in a grid of 30X30 km^2 have been used to simulate the temporal and spatial distribution of the Asian dust aerosol and the anthropogenic aerosol concentrations in East Asia for the period of 19-23 March 2002 when a severe Asian dust (Hwangsa) event was observed in Korea. The simulated aerosols are implemented to estimate radiative forcing at the surface and the top of atmosphere with the use of the National Center for Atmospheric Research (NCAR) column radiation model (CRM) of community climate model 3 (CCM3). The estimated mean total aerosol mass in the analysis domain (90-145˚E and 20-55˚N) for the period of 19-20 March 2002 is found to be about 880 mg m^{-2}, of which 98% and 2% are, respectively contributed by the Asian dust aerosol and the anthropogenic aerosol. However, the direct radiative forcing contributed by the anthropogenic aerosol is about 40% of the mean radiative forcing at the surface (-11Wm^{-2}) and 45% of the mean radiative forcing at the top of atmosphere (-6Wm^{-2}), implying the importance of the anthropogenic aerosol on the direct radiative forcing at both the surface and TOA. On the other hand the atmospheric absorption is found to be 5W m^{-2}, of which 3Wm^{-2} and 2Wm^{-2} are, respectively contributed by the Asian dust aerosol and the anthropogenic aerosol, suggesting the importance of the Asian dust aerosol on the regional radiative energy balance especially in the high occurrence frequency season of spring.