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Aerosol radiative effects on the meteorology and distribution of pollutants in the Mexico City Metropolitan Area during MCMA-2006/MILAGRO Campaign

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Aerosols scatter or absorb incoming solar radiation, perturb the temperature structure of the atmosphere, and impact meteorological fields and further the distribution of gas phase species and aerosols. In the present study, the aerosol radiative effects on the meteorology and photochemistry in the Mexico City Metropolitan Area (MCMA) are investigated using the WRF-CHEM model during the period from March 24th to 29th associated with the MILAGRO-2006 campaign. Aerosols decrease incoming solar radiation by up to 20% and reduce the surface temperature by up to 0.5 [U+F0B0]C due to scattering and absorbing the incoming solar radiation in Mexico City. The absorption of black carbon aerosols can also enhance slightly the temperature in the planetary boundary layer (PBL). Generally, the change of the PBL height in the city is less than 200 m during daytime due to the aerosol-induced perturbation of temperature profile. Wind fields are also adjusted with the variation of temperatures, but all the aerosol-induced meteorological changes cannot significantly influence the distribution of pollutants in the city. In addition, when convective events occur in the city, the aerosol radiative effects reduce the convective available potential energy (CAPE) and the convective precipitation is generally decreased. Further studies still need to be performed to evaluate the aerosol indirect effect on precipitation in Mexico City.