2012 AeroCom (Aerosol Comparisons between Observations and Models)
10-13 September 2012, University of Washington, Seattle, USA

Modeling Black Carbon over different regions Asia and Europe: influence of the emission inventory, of the model horizontal and vertical resolution

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(Oral Prsentation)

Abstract

An atmospheric general circulation model BCC_AGCM2.0.1 coupled with a size-segregated aerosol module CUACE /Aero was used to investigate the influences of different emission data, of the model horizontal and vertical resolution on Black Carbon distributions over different regions Asia and Europe. The global aerosol model system was driven by climatological SST, and by two kinds of emission data, namely, Cook et al. and IPCC-AR5 emission data respectively for 31 model years. The last thirty-year monthly mean model results compared with AeroCom data and multi-year average surface measurements have been analyzed focusing on the two main anthropogenic regions: Asia and Europe. The model results show that the aerosol model system can reasonably reproduce horizontal, vertical and seasonal distributions of Black Carbon (BC) except that the simulated BC surface concentrations are a little underestimated in some emission regions than AeroCom simulations driven by two emission data. The results also show that the BC concentrations tend to be a bit lower while the simulated annual average precipitation fluxes are more reasonable by IPCC-AR5 emissions than by cook et al. ones. It is also pointed out that the variations of emissions cannot remarkably affect the total amount of the precipitation and cloud, especially those of their seasonal variations, one of the reasons might be attributed to the system model's failure to describe the microphysical processes reflecting the interactions between cloud and aerosol. Further experiments also show that because the BC aerosols mainly stayed in emission regions and have a short lifetime, so they are seldom transported to the upper troposphere and then the influence of the vertical resolution is weak, however, the horizontal resolution has some great influence on the surface concentrations especially in emissions regions, for example, because of coarse resolution, the model cannot correctly describe the characteristic of BC variations in some sites especially in some surface observation sites.

Further research should be performed to investigate the connections among the various interactive processes and to explore the potential influences in detail involving the aerosol model.

[1] Supported by the National "863" program of China (2010AA012304), the Special Grant in Atmospheric Sciences of the China Meteorological Administration (GYHY200906020) and the National "973" Program of China (2011CB403405)