Simulation of global distribution of temporal and spatial variation of $PM_{2.5}$ concentration in the future

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According to the emission scenarios of aerosols and their precursors, RCP2.6(low emission), RCP4.5(medium emission) and RCP8.5(high emission) scenarios given by the Fifth Assessment Report of Intergovernmental Panel on Climate Change (IPCC AR5), the temporal and spatial variations of the concentrations of total $PM_{2.5}$(the sum of anthropogenic and natural aerosols),anthropogenic and natural aerosols in $PM_{2.5}$ over the globe from 2010 to 2030 and 2030 to 2050, as well as the contributions of anthropogenic and natural aerosols to these variations under the green emission scenario (RCP4.5) over China are simulated in this work, using an aerosol-climate online coupled model from National Climate Center. Results show that from 2010 to 2030, the spatial variations of the column concentrations of $PM_{2.5}$ under the three emission scenarios are basically similar to each other. The column concentrations of $PM_{2.5}$ increase over Europe, North Africa, and the ocean to the west of North Africa, but the increase over North Africa and the ocean to the west of it is more significant than that over Europe. However, the column concentrations of $PM_{2.5}$ decrease over the Arabian peninsula. The annual mean surface concentrations of $PM_{2.5}$ over China decrease approximately by 2.55 $\mu g/m^3$, with the anthropogenic aerosols accounting for about 28% and the natural aerosols accounting for about 72% under RCP4.5 scenario. From 2030 to 2050, the spatial variations of the column concentrations of $PM_{2.5}$ differ greatly under the three different emission scenarios. The column concentrations of $PM_{2.5}$ increase apparently over North Africa and ocean to the west of it, while decrease over East Asia under both RCP4.5 and RCP8.5 scenarios. Whereas, the results under RCP2.6 scenario are quite different from RCP4.5 and RCP8.5 scenarios. In China, the column concentrations of $PM_{2.5}$, as well as the anthropogenic and natural aerosols in $PM_{2.5}$, are reduced further than the previous period under RCP4.5 scenario, with the contributions(about 34%) of anthropogenic aerosols increasing.

Keywords: PM2.5, anthropogenic aerosol, natural aerosol, BCC_AGCM2.0_CUACE/Aero

