The Simulation Study of Global Distribution of Temporal and Spatial Variation of PM2.5 Concentration

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The global distribution of temporal and spatial variation of column concentration of PM2.5 as well as anthropogenic and natural aerosols contributed to the PM2.5 from the year of 1850 to 1980 and the year of 1980 to 2010 was simulated in this work by using an aerosol-climate online coupled model of BCC_AGCM2.0.1_CUACE/Aero. Then, we analyzed the different contributions of anthropogenic and natural aerosols in five species of aerosols (sulfate, black carbon, organic carbon, sea salt and dust) to the PM2.5. The results show that in period of 1850 to1980, the column concentration of PM2.5 increases significantly over the globe, especially in the Arabian Peninsula, the north of China and the Sahara Desert in the Northern Hemisphere. The increasing of the column concentration of anthropogenic aerosols in the PM2.5 is mainly due to sulfate aerosols, especially in North American, Europe and the eastern of China, and the change in summer is the most significant. Besides, the change of natural aerosols in the PM2.5 depends mostly on dust aerosol, mainly locating in several large desert regions in the world, and the change in spring is the most significant. As to the seasonal changes of PM2.5 concentration, the variation of anthropogenic aerosols contributes the largest of 87% in autumn, the minimum of 31% in spring and almost equal percentage to natural aerosols both in winter and summer. In the period of 1980 to 2010, the global change of column concentration of PM2.5 differs greatly, it increases respectively in the south and east of Asia, the west and south of the Sahara Desert while decreases sharply in the Europe, central Asia and the northern center of Africa. Column concentration of anthropogenic aerosols in the PM2.5 is decreased in North American and Europe while increased in East and Southeast Asia and changes largely in summer too. Whereas, the corresponding natural aerosols is reduced sharply in desert regions, and these changes in winter and spring are both significant. As to the seasonal changes of PM2.5, the contribution percentage of change of anthropogenic aerosols to the total change of PM2.5 is reducing, all less than 50%.

Key words: PM2.5, BCC_AGCM2.0.1_CUACE/Aero, anthropogenic aerosol, natural aerosol