Sulfur dioxide emissions in China and sulfur trends in East Asia since 2000

http://www.firstlight.cn 2010-07-13

With the rapid development of the economy, the sulfur dioxide (SO2) emission from China since 2000 is of increasing concern. In this study, we estimate the annual SO2 emission in China after 2000 using a technology-based methodology specifically for China. From 2000 to 2006, total SO2 emission in China increased by 53%, from 21.7 Tg to 33.2 Tg, at an annual growth rate of 7.3%. Emissions from power plants are the main sources of SO2 in China and they increased from 10.6 Tg to 18.6 Tg in the same period. Geographically, emission from north China increased by 85%, whereas that from the south increased by only 28%. The emission growth rate slowed around 2005, and emissions began to decrease after 2006 mainly due to the wide application of flue-gas desulfurization (FGD) devices in power plants in response to a new policy of China's government. This paper shows that the trend of estimated SO2 emission in China is consistent with the trends of SO2 concentration and acid rain pH and frequency in China, as well as with the increasing trends of background SO2 and sulfate concentration in East Asia. A longitudinal gradient in the percentage change of urban SO2 concentration in Japan is found during 2000–2007, indicating that the decrease of urban SO2 is lower in areas close to the Asian continent. This implies that the transport of increasing SO2 from the Asian continent partially counteracts the local reduction of SO2 emission downwind. The aerosol optical depth (AOD) products of Moderate Resolution Imaging Spectroradiometer (MODIS) are found to be highly correlated with the surface solar radiation (SSR) measurements in East Asia. Using MODIS AOD data as a surrogate of SSR, we found that China and East Asia excluding Japan underwent a continuous dimming after 2000, which is in line with the dramatic increase in SO2 emission in East Asia. The trends of AOD from both satellite retrievals and model over East Asia are also consistent with the trend of SO2 emission in China, especially during the second half of the year, when sulfur contributes the largest fraction of AOD. The arrested growth in SO2 emissions since 2006 is also reflected in the decreasing trends of SO2 and SO_4^{2-} concentrations, acid rain pH values and frequencies, and AOD over East Asia.

存档文本