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Past, Present, and Future Anthropogenic Emissions over Asia: a Regional Air Quality Modeling Perspective

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Climate change will also affect future regional air quality which has potential human health, ecosystem, and economic implications. To analyze the impacts of climate change on Asian air quality, the NIER (National Institute of Environmental Research, Korea) integrated modeling framework was developed based on global-to-regional climate and atmospheric chemistry models. In this study, we developed emission inventories for the modeling framework for 1980∼2100 with an emphasis on Asia emissions. Two emission processing systems which have functions of emission projection, spatial/temporal allocation, and chemical speciation have been also developed in support of atmospheric chemistry models including GEOS-Chem and Models-3/CMAQ. Asia-based emission estimates, projection factors, temporal allocation parameters were combined to improve regional modeling capability of past, present and future air quality over Asia. The global CO emissions show a 23% decrease from the years 1980 to 2000. For the future CO (from year 2000 to 2100), the A2 scenario shows a 95% increase due to the B40 (Residential-Biofuel) sector of Western Africa, Eastern Africa and East Asia and the F51 (Transport Road-Fossil fuel) sector of Middle East, USA and South Asia. The B1 scenario, however, shows a 79% decrease of emissions due to B40 and F51 sectors of East Asia, South Asia and USA for the same period. In many cases, Asian emissions play important roles for global emission increase or decrease depending on the IPCC scenarios considered. The regional ozone forming potential will be changed due to different VOC/NOx emission ratio changes in the future. More similarities and differences of Asian emission characteristics, in comparison with its global counterpart, are investigated.