

## Large-scale air pollutions and their relationship in inflow, outflow and source regions of East Asia

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East Asia is one of the regions where the rapid increases of large-scale air pollutions emerge as a serious concern. In addition to the problems of air quality degradation, emission control, environmental risk, and health effect in a domestic level, long-range transport of the East Asian air pollution bring the issue to regional and global problems. In this work, we use the air pollutants data, mainly ozone, from observation in the three different regions of East Asia, namely 1) background region of Siberia and central Asia, 2) highly anthropogenic region in eastern China, and 3) the rim region of the Asia-Pacific, and investigate the air pollutant characteristics and their relationship. From the intra-continental transport point of view, these regions are regarded as the inflow region, source region, and outflow region of East Asia, respectively. The results show that large-scale emission in East Asia influence the air pollution levels heavily in the source region, and to the significant extent in the outflow region. The data from inflow region observed at Mondy, Siberia and Vostosnaya East, Kyrgyzstan indicate that air pollutions characteristics in this region remain much of the global background atmospheric pollutions as they are mostly intact from large-scale anthropogenic emissions. When the air masses are transported to source region, the air pollutants levels increase significantly. Air mass sector analysis indicates that annually ozone increases 17 ppb in average upon transport from the inflow to source regions using our observation data with a maximum of 40 ppb in June. In the source region, episodes of extremely high pollutions have been regularly observed. In this region, strong enhancements by anthropogenic emissions from industrialization and urbanization have been verified. The residence time analysis of air masses confirms the increases in ozone with longer air masses transport time over source region in East China during the first 36-70 hours, with the estimated ozone build up of 40-50 ppb/day at one of the observation site, Mt. Tai. In the outflow region, increases of air pollutants level are observed with the transport events directly from the source region. The observation data at Okinawa show the averaged increase of 25 ppb of ozone during May-June 2004 when the air masses are transported from East China as compared with the non-pollution events.