Estimation of sulfate aerosol sources during an intensive field campaign in October–November, 2015 at Cape Hedo, Okinawa

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Air quality in Asia is a major regional-to-global environmental problem, and under such circumstances, several collaborative international experiments have been conducted over the western Pacific region. To investigate the transformation of aerosols during long-range transport (LRT) is necessary for promoting our understanding of regional air pollution and climate change. An intensive observation campaign at Cape Hedo, Okinawa, Japan (CHAAMS) was conducted from late October to early November 2015. The location of CHAAMS is suitable for capturing the atmospheric pollutants via LRT. During this period, sulfate (SO_4^{2-}) was the dominant aerosol component, and the air quality model can capture the observed meteorological conditions and SO_4^{2-} variation. By using the air quality model with the tagged tracer method, the sources of high SO_4^{2-} concentration were estimated. On October 27, when the westerly wind was dominant, the main source was anthropogenic SO_2 emissions in China. On November 1, when the northerly wind prevailed, the impact of volcanoes in western Japan was significant and the conversion ratio from SO_2 to SO_4^{2-} was lowest, at less than 70%, due to the faster transport. During the latter part of the campaign, the northerly to easterly winds were prominent, and the impacts of Korea, Japan, and ship to SO_4^{2-} observed at CHAAMS were also obvious. On November 4, when the contributions from Korea, Japan, and ship were the highest, the conversion ratio was also the highest, at greater than 95% due to long-range transport. The modeled sources of volcanoes and ship emissions corresponded well with the observed coarse-mode SO_4^{2-} and V/Mn ratio, respectively. It was demonstrated that the mutual evaluation of sources from model and observations enable to estimate SO_4^{2-} sources with higher confidence.

Keywords: Sulfate Aerosol, Source contribution, Air quality model, Long range transport

