4.016 Abundance and emission flux of the anthropogenic iron oxide aerosols from the East Asian continental outflow.

Early Career Scientist

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Abstract:

Anthropogenic iron oxide (FeO_x) aerosols can affect atmospheric radiation, marine biogeochemistry, and human health. However, due to a lack of observational data, their atmospheric abundance and emission flux are not well understood. In this study, we observed size-resolved concentrations of FeO_x (170–2100 nm) and black carbon (BC, 70–850 nm) aerosols at a remote site in the East China Sea in March 2016 using a modified single-particle soot photometer (SP2). Light signals from individual particles obtained by the SP2 and morphology and compositions analyzed by transmission electron microscope revealed that most of observed FeO_x aerosols are anthropogenic magnetite-like particles. Clear correlations between mass concentrations of FeO_x and BC (R^2 = 0.717) and between FeO_x and carbon monoxide (CO) (R^2 = 0.718) in air masses from China were obtained, which indicates that their emission sources are spatially similar. Their correlation slopes of mass concentration (ng/m^3) are ~0.3 and 0.0015, respectively. Based on the correlation slopes and reported emission inventories of BC and CO in China, we estimate emission flux of anthropogenic FeO_x aerosols from China to be 0.183–0.372 FeTg/yr. Assuming that FeO_x/BC and FeO_x/CO emission ratios remain constant for anthropogenic sources, we also estimate global emission flux of anthropogenic FeO_x aerosols to be 0.669–0.935 FeTg/yr. This value is comparable to that of the current emission inventories of total Fe (FeO_x + non-FeO_x) in PM_{10} from fossil fuel combustion (0.51–0.87 FeTg/yr), although our estimate limits only FeO_x particles with 170–2100 nm in mass equivalent diameter. Our results indicate that the current emission inventories of Fe aerosols from fossil fuel combustion are likely to be underestimated.