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Sources and processes of iron aerosols in a upwind megacity of Northern Pacific Ocean

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Iron (Fe) in aerosol particles is a major external source of micronutrients for marine ecosystems, and poses a potential threat to human health. To understand these impacts of aerosol Fe, it is essential to quantify the sources of dissolved and total Fe. In this study, we applied a receptor modelling for the first time to apportion the sources of dissolved and total Fe in fine particles collected under five different weather conditions in Hangzhou megacity of Eastern China, which is upwind of East Asian outflow. Results showed that Fe solubility (dissolved to total Fe) was the largest in fog days (6.7 ± 3.0%), followed by haze (4.8 ± 1.9%), dust (2.1 ± 0.7%), clear (1.9 ± 1.0%), and rain (0.9 ± 0.5%) days. Positive Matrix Factorisation (PMF) analysis suggested that industrial and traffic emissions were the two dominant sources contributing to the dissolved and total Fe during haze and fog days through the primary emission and atmospheric processing, but natural dust minerals were the dominant source for Fe in dust days. Here the PMF identified additional 15% of dissolved Fe associated with secondary sources during haze and fog days, although it was less than 5% during dust and clear days. Transmission electron microscopy analysis of individual particles showed that approximately 76% and 87% of Fe-containing particles were internally mixed with acidic secondary aerosols in haze and fog days, respectively. Our results indicated that wet surface of aerosol particles promotes heterogeneous reactions between acidic species and anthropogenic Fe aerosol, contributing to higher Fe solubility during fog and haze days.