Aerosol radiative forcing of pyrogenetic iron oxides

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Combustion aerosols affect the climate by absorbing and scattering radiation. Iron (Fe) oxides emitted from pyrogenetic sources largely reside in supermicron aerosols. Fe oxides on aerosols are known to absorb sun light and heat the atmosphere. However, supermicron aerosols from pyrogenetic sources are ignored for radiative forcing in climate models. Here, we use a global chemical transport model and a radiative transfer model to estimate the radiative forcing of Fe oxides from pyrogenetic sources. The model results suggest that Fe oxides from pyrogenetic sources significantly contribute to a warming effect at the top of the atmosphere over the air polluted regions in East Asia as well as biomass burning source regions. However, the estimates strongly depend on chemical speciation of Fe oxides. These nanoparticles are also important as bioavailable Fe for human health and external nutrient input to marine ecosystems. Our results highlight the need for improving the process-based understanding of the effects of emission sources and chemical transformation on both the optical properties and bioavailability. Since a rapid growth in energy consumption of iron and steel industry in upcoming developing countries is projected in the next decades, this is especially crucial for assessing the future impact of air quality changes on climate and ecosystems.