**Atmospheric radiative and oceanic biological productivity responses to anthropogenic combustion-iron emission in the 1850-2000 period.**

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**Abstract**

Aerosol-iron absorbs shortwave solar radiation and warms the atmosphere. After deposition, it enhances biological productivity in iron-limited water and cools the atmosphere by a carbon drawdown pathway. We estimate the present-day global atmospheric heating, as direct radiative forcing, by transporting mineralogy-based anthropogenic emissions in an atmospheric transport model and coupling with a radiative transfer scheme. Oceanic response, as net primary productivity, is estimated by linearly multiplying anthropogenic soluble iron deposition in the iron-limited regions by various carbon-to-iron ratios of phytoplankton. Global mean direct radiative forcing by this emission source is +0.04 to +0.1 W/m2, mainly over industrialized regions of Asia and East Europe. Present-day global NPP by soluble anthropogenic iron deposition in iron-limited oceans is 0.15-0.80 Pg C/yr, mainly in the North Pacific waters. While the radiative interactions by particles are short-lived due to aerosol lifetimes, the carbon dioxide impacts are cumulative. Using scaled soluble iron deposition, we estimate the cumulative 1850-2000 net primary productivity by anthropogenic sources to be 7-35 Pg C and the present-day atmospheric CO2 concentrations could have been 0.3-1.7 ppm higher without this source. This results in a CO2-equivalent cooling of 0.004-0.023 W/m2. We show that both, the atmospheric and oceanic responses to anthropogenic iron have been much smaller compared to other sources of iron such as desert dust and are likely to remain smaller in future as combustion methods switch to cleaner technologies.