Atmospheric global dust cycle and iron inputs to the ocean

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[1] Since iron is an important micronutrient, deposition of iron in mineral aerosols can impact the carbon cycle and atmospheric CO2. This paper reviews our current understanding of the global dust cycle and identifies future research needs. The global distribution of desert dust is estimated from a combination of observations of dust from in situ concentration, optical depth, and deposition data; observations from satellite; and global atmospheric models. The anthropogenically influenced portion of atmospheric desert dust flux is thought to be smaller than the natural portion, but is difficult to quantify due to the poorly understood response of desert dust to changes in climate, land use, and water use. The iron content of aerosols is thought to vary by a factor of 2, while the uncertainty in dust deposition is at least a factor of 10 in some regions due to the high spatial and temporal variability and limited observations. Importantly, we have a limited understanding of the processes by which relatively insoluble soil iron (typically _0.5% is soluble) becomes more soluble (1–80%) during atmospheric transport, but these processes could be impacted by anthropogenic emissions of sulfur or organic acids. In order to understand how humans will impact future iron deposition to the oceans, we need to improve our understanding of: iron deposition to remote oceans, iron chemistry in aerosols, how desert dust sources will respond to climate change, and how humans will impact the transport of bioavailable fraction of iron to the oceans.