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Popular Summary

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Tiny suspensions of solid particles or liquid droplets, called aerosols, hover in earth's atmosphere and can be found over just about anywhere including oceans, deserts, vegetated areas, and other global regions. Aerosols come in a variety of sizes, shapes, and compositions which depend on such factors as their origin and how long they have been in the atmosphere (i.e., their residence time). Some of the more common types of aerosols include mineral dust and sea salt which get lifted from the desert and ocean surfaces, respectively by mechanical forces such as strong winds. Depending on their size, aerosols will either fall out gravitationally, as in the case of larger particles, or will remain resident in the atmosphere where they can undergo further change through interactions with other aerosols and cloud particles. Not only do aerosols affect air quality where they pose a health risk, they can also perturb the distribution of radiation in the earth-atmosphere system which can inevitably lead to changes in our climate.

One aerosol that has been in the forefront of many recent studies, particularly those examining its radiative effects, is mineral dust. The large spatial coverage of desert source regions and the fact that dust can radiatively interact with such a large part of the electromagnetic spectrum due to its range in particle size, makes it an important aerosol to study. Dust can directly scatter and absorb solar and infrared radiation which can subsequently alter the amount of radiation that would otherwise be present in the absence of dust at any level of the atmosphere like the surface. This is known as radiative forcing. At the surface dust can block incoming solar energy, however at infrared wavelengths, dust acts to partially compensate the solar losses. Evaluating the solar radiative effect of dust aerosols is relatively straightforward due in part to the relatively large signal-to-noise ratio in the measurements. At infrared wavelengths, on the other hand, the effect is rather difficult to ascertain since the measured dust signal level is on the same order as the instrumental uncertainties. Although the radiative impact of dust is much smaller in the infrared, it can still have a noticeable influence on the distribution of energy in the Earth-atmosphere system. This is mainly attributed to the strong light-absorptive properties commonly found in many earth minerals.