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Potential for changes in mineral dust concentration to impact global clouds and climate

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Airborne mineral dust scatters and absorbs radiation and has diverse impacts on cloud physical and radiative properties. Records show that dust concentrations have varied widely in the past and expectations are that they will change in future climate, with uncertain implications for Earth's global radiative budget. In this study we use a modified version of the Community Earth System Model (CESM) to quantify the global radiative effects of potential increases and decreases in large-scale dustiness from present-day conditions. We isolate and quantify the contribution of each mechanism wherein dust perturbations impact climate - including direct scattering and absorption, impacts of dust heating on low cloud formation ('semi-direct effects'), and indirect effects through both cirrus and mixed-phase stratiform clouds - in order to evaluate how these counterbalance one another and control the total impacts on global radiation.