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Dust shatters like glass: Implications for the climate forcing of mineral dust aerosols JASPER KOK, Cornell University — Soil-derived mineral dust aerosols impact climate through interactions with clouds, ecosystems, and radiation, which contributes substantially to uncertainties in understanding past and future climate changes. One of the causes of this large uncertainty is that the size distribution of emitted dust aerosols is poorly understood. In fact, a compilation of measurements indicates that regional and global circulation models overestimate the emitted fraction of clay dust aerosols (< 2 μm diameter) by a factor of ~ 2 – 8. I resolve this discrepancy by deriving a simple theoretical expression for the emitted dust size distribution that is in excellent agreement with measurements. This expression is based on the analogy of dust emission with the scale-invariant fragmentation of brittle materials such as glass. Since regional and global circulation models are usually tuned to the shortwave radiative effect of dust, which is dominated by clay aerosols, these findings suggest that models have substantially underestimated the emission of larger silt (> 2 μm diameter) aerosols, which tend to produce a net warming effect. I show that this underestimation of silt aerosol emission has implications for the effect of dust on regional and global climate.

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