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Keywords

- aerosols
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Index Terms

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- Atmospheric Composition and Structure: Radiation: transmission and scattering

- Abstract
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Abstract

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Geoengineering: Whiter skies?

Key Points

- Stratospheric sulfate geoengineering will whiten skies
- Stratospheric sulfate geoengineering will brighten skies
- The effects are strongly dependent on aerosol size distribution

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One proposed side effect of geoengineering with stratospheric sulfate aerosols is sky whitening during the day and afterglows near sunset, as is seen after large volcanic eruptions. Sulfate aerosols in the stratosphere would increase diffuse light received at the surface, but with a non-uniform spectral distribution. We use a radiative transfer model to calculate spectral irradiance for idealized size distributions of sulfate aerosols. A 2% reduction in total irradiance, approximately enough to offset anthropogenic warming for a doubling of CO_2 concentrations, brightens the sky (increase in diffuse light) by 3 to 5 times, depending on the aerosol size distribution. The relative increase is less when optically thin cirrus clouds are included in our simulations. Particles with small radii have little influence on the shape of the spectra. Particles of radius $\sim 0.5\ \mu$m preferentially increase diffuse irradiance in red wavelengths, whereas large particles ($\sim 0.9\ \mu$m) preferentially increase diffuse irradiance in blue wavelengths. Spectra show little change in dominant wavelength, indicating little change in sky hue, but all particle size distributions produce an increase in white light relative to clear sky conditions. Diffuse sky spectra in our simulations of geoengineering with stratospheric aerosols are similar to those of average conditions in urban areas today.

Figure **1** of **4**
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