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Composition Dependence of Stratospheric Aerosol Radiative Forcing

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Model results suggest organic aerosol represents a significant fraction of total stratospheric aerosol radiative forcing, which in itself could represent as much as a quarter of global radiative forcing. Other model investigations suggest that the radiative influence of organic aerosols and dust must be included to obtain consistency with satellite measurements of stratospheric aerosols. *In situ* observations suggest that stratospheric aerosol composition is strongly vertically dependent and contains a significant organic component in the lower stratosphere. Laboratory studies suggest a range of possible values for the complex refractive index of organic aerosols in the stratosphere. The real part of the refractive index could vary over a range that brackets the value of the real refractive index for pure sulfuric acid/water aerosols. The imaginary part of the refractive index of the organic component is highly uncertain, suggesting aerosols that range from being purely refractive to significantly absorbing (eg, brown carbon). The mixing state of these mixed composition aerosols is also uncertain; depending on the complex refractive index of the organic component, morphological variation could have a significant influence on aerosol radiative properties. In this work we perform a sensitivity study of shortwave radiative forcing of stratospheric aerosols, examining the influence of different plausible values of complex refractive index and particle morphologies. *In situ* measurements of aerosol size and composition are used to represent the size distribution, vertical profile, and organic mass fraction for the computation of aerosol optical properties. These profiles of aerosol optical properties are used as inputs to a radiative transfer model to calculate profiles of shortwave fluxes and radiative heating rates for standard model atmospheres. The implications of the variations in aerosol optical depth and resulting radiative forcing are interpreted in terms of implications for satellite measurements of stratospheric radiative forcing. The various radiative forcing results and remote sensing implications for different scenarios of organic complex refractive index and morphology call for better understandings of the effects of chemical evolution and transport dynamics on the aerosol optical properties in the stratosphere.