Distinct particle modes in the lower stratosphere constrain secondary aerosol chemistry and gas-phase concentrations

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There are distinct types of aerosol particles in the lower stratosphere. Stratospheric sulfuric acid particles with and without meteoric metals coexist with mixed organic-sulfate particles that originated in the troposphere. That these particles remain distinct has important implications for aerosol chemistry and the concentrations of several gas-phase species. Neither semi-volatile organics nor ammonia can be in equilibrium with the gas phase. The gas-phase concentrations of semi-volatile organics and ammonia must be very low, or else the sulfuric acid particles would not stay so pure. The upper concentration limits are around a pptv. Yet the sulfuric acid particles in the Northern Hemisphere show a very small but measurable uptake of organics and ammonia, indicating non-zero gas-phase concentrations of those species. Finally, the organic-sulfate particles must be resistant to photochemical loss, or else they would no longer retain their organic content.