

Photolysis of H₂SO₄ as a Source of SO₂ and SO in the Mesosphere of Venus

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Recent observations from Venus Express suggest that the mixing ratio of SO₂ in the mesosphere (85-110 km) is in the range 0.1-5 ppm (Belyaev et al. 2009). As these values are larger than the abundance of SO₂ in the atmosphere of Venus above the cloud tops, the results are puzzling. Independent ground-based measurements reported large spatial and temporal variability of SO and SO₂ as well as their enhanced concentrations in the mesosphere region (Sandor et al. 2007). We propose that these puzzling observations could be explained if there is a new source of SO₂ and SO in the mesosphere of Venus derived from the photolysis of H₂SO₄. The proposed mechanism has four components: (1) SO₂ from the deep atmosphere is oxidized just above the cloud tops, resulting in the formation of H₂SO₄ aerosols (Yung and DeMore 1982), (2) transport of H₂SO₄ aerosols from the cloud tops to the mesosphere, (3) evaporation of H₂SO₄ aerosols in the region of elevated temperature, and (4) photolysis of H₂SO₄, SO₃ and SO. We note that elevated values of SO₂ were observed in the terrestrial upper stratosphere by the Atlas shuttle mission (Rinsland et al. 1995). The authors attributed the source of SO₂ to photolysis of H₂SO₄, via a similar mechanism as proposed here.