Analytic modeling of SO_x in Venus' mesosphere

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Observations of SO and SO_2 in Venus' mesosphere have found substantial abundances of SO and SO_2 above 85 km altitude (Bertaux et al, 2008; Sandor et al, 2010). Submillimeter observations have also identified substantial temporal variations in mesospheric SO and SO_2, significant differences for SO and SO_2 in the day- and night-side mesospheres, and larger SO and SO_2 mixing ratios at 85–100 km than at 70–85 km (Sandor et al, 2010). An initial attempt to model the submillimeter observations has been made by extracting approximate analytic expressions for the day- and night-side equilibrium SO_x (= SO + SO_2) chemistry from a global-average photochemical model (Mills and Allen, 2007). Given the substantial abundances of sulfuric acid aerosol detected in Venus' mesosphere (Wilquet et al, 2009) and the substantial variability observed for mesospheric temperatures (Bertaux et al, 2007) and water vapor abundances (Gurwell et al, 2008), initial modeling has focused on the [SO_2]/[SO] ratio. Good agreement is found between the calculated and observed day-side [SO_2]/[SO] ratios using the concentrations of O, ClO, and OH from global-average calculations (Mills and Allen, 2007). The calculated night-side ratio, however, is two orders of magnitude larger than is observed, making the same assumptions for the concentrations of O, ClO, and OH. This suggests either the night-side chemistry is not a equilibrium or the assumed concentrations of O, ClO, and/or OH in the night-side model are not correct. The approximate analytic day- and night-side SO_x models and comparisons with observations will be presented.

References

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