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Author: Mr. Prasad Rathod
India

Ms. Prachi Gangurde
India
Mr. Utkarsh Talele
India

ADVANCING VENUS MISSION CAPABILITIES: DEVELOPMENT OF A SPECTROSCOPIC ALGORITHM FOR RETRIEVAL OF CLOUDS & AEROSOLS FROM NADIR AND OCCULTATION MEASUREMENTS IN THE VENUSIAN ATMOSPHERE

Abstract

The formation of aerosols and clouds in the Venusian atmosphere is characterized by unpredictability and randomness. Sulphur dioxide (SO2) present in sulphuric acid droplets exhibits a high affinity for atmospheric gases such as HCl(Hydrogen Chloride), HF(Hydrogen Chloride), and HBr(Hydrogen Bromide). These reactions result in a reduction in the freezing point of suspended aerosol compounds, creating a viscosity gradient. This poses potential risks for vehicle corrosion when rovers land on Venus. The boundaries of lower clouds (LCB) are significantly influenced by eddy diffusion, which alters the mixing ratio of sulphur contents in the atmosphere. These phenomena pose challenges for spectroscopy in modeling the Venusian surface. This study developed a spectroscopic algorithm to model the Venusian surface vertically and spatially (with temporal distributions) to aid missions aiming to land on Venus. The aerosols formed by the interaction of SO2 with atmospheric constituents are initially modeled using equations for Henry's constant. Subsequently, a modified version of the Kransnopolsky and Pollack model is implemented, incorporating improved Henry constants and eddy dynamics to vertically model the atmosphere. This model will be used to develop spectroscopic algorithms based on solar and radio occultation (using SOIR data derived from Venus missions). Spatial distribution for spectral developments will be achieved using Nadir observations aided by SPICA/UV. This research aims to address the unresolved aspects of the upper atmospheric layer of the Venusian surface, which has received limited attention in short-term and short-scale studies. It is observed that SO2 concentrations increase in the top layers compared to the bottom ones. This study will stochastically model (using Monte-Carlo Simulations) the convective mixing and volcanism of the Venusian surface and will conduct short-term and short-scale spectroscopic research on the top layers. The developed spectroscopic algorithm can be utilized in multiple future Venus missions.