

A study of the habitability of Venus clouds, implications on planetary protection

The atmosphere of Venus consists mostly of carbon dioxide (CO₂) with opaque clouds of sulfuric acid aerosols. The atmosphere is hottest at the surface, with an averaged surface temperature of 450 °C, above which temperature decreases with altitude at nearly the dry adiabatic lapse rate of ~10 °C /km. In the region of roughly 48 to 70 km there are three cloud layers formed by aerosols of sulfuric acid. While the present-day surface of Venus is too hot to be habitable, it has been postulated that the cloud layer with lower temperatures may be favorable to life.

The COSPAR Panel on Planetary Protection (PPP) evaluated the current knowledge about the environment of the clouds of Venus, to inform the planetary protection requirements for space exploration missions that are targeting Venus. The panel studied in detail three environmental parameters: water activity, temperature and acidity.

This work reports the conclusions of the COSPAR PPP: the environmental conditions within the Venusian clouds are orders of magnitude drier and more acidic than the tolerated survival limits of any known terrestrial extremophile organism. Therefore, the Panel recommended that all exploration missions to Venus remain as Category II, this includes NASA's VERITAS and DAVINCI missions, and ESA's EnVision mission.

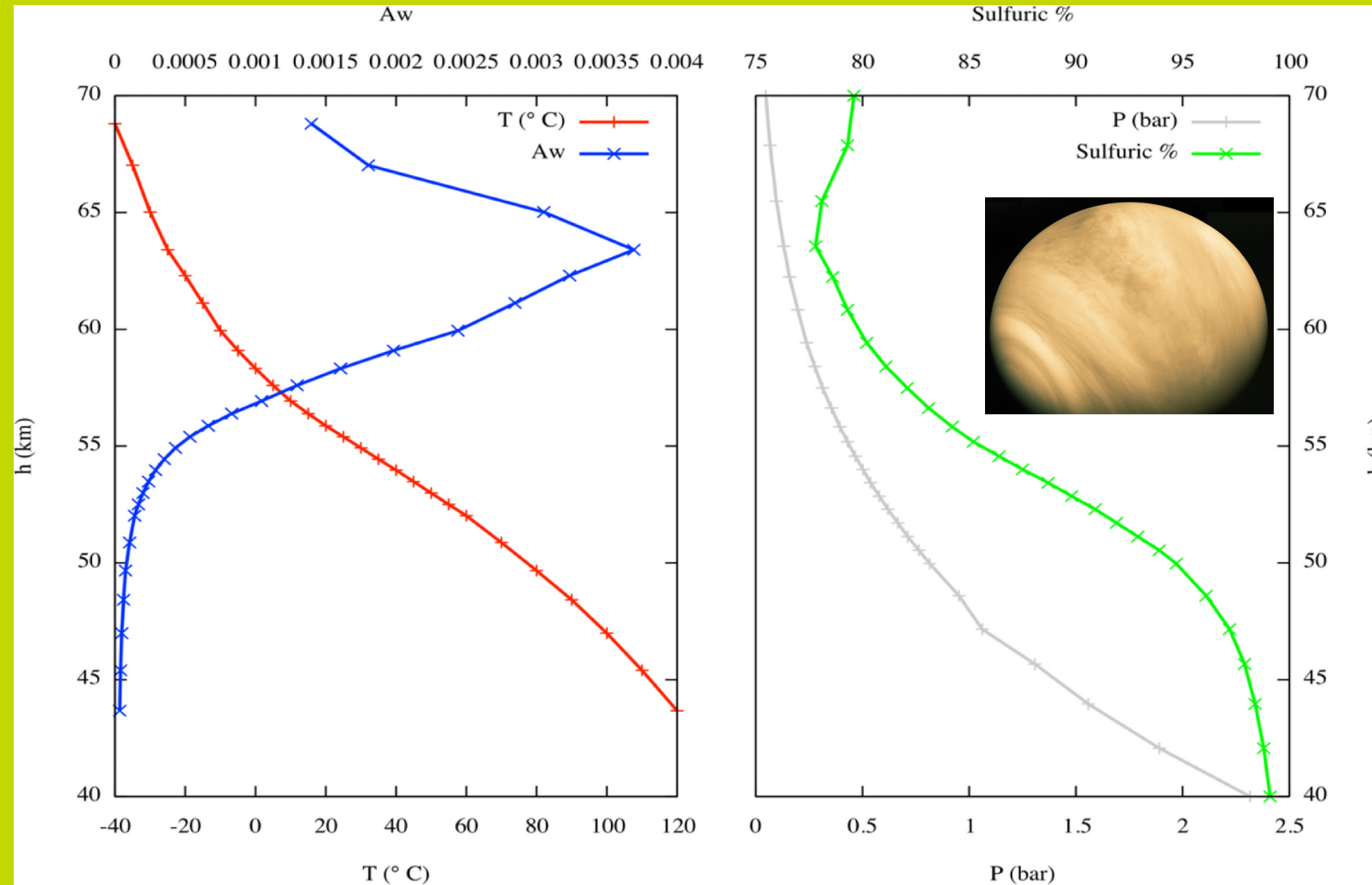


Image: Vertical profile of the Venus cloud layer: (left) temperature and water activity, (right) pressure and sulfuric acid concentration (credit Zorzano et al). Inset: false-color mosaic view of Venus's upper clouds, NASA's Mariner 10 mission in 1974. Credit: NASA.

The COSPAR planetary protection requirements for space missions to Venus.

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