

Modelling cloud microphysics on Uranus

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Abstract

As on Earth, Uranus has a dynamic atmosphere and undergoes a cycle of seasons. Different images of Uranus have revealed the presence of discrete clouds at different locations and time periods [1,2]. Based on the altitude of these clouds and the saturation vapour pressure curves of several possible condensates in Uranus's atmosphere, it has been possible to infer that these clouds were made of methane (CH_4) ice particles. However, more information about the cloud density and size of droplets is required to better understand the different dynamic processes involved in the atmosphere. In addition to methane clouds, previous work based on radiative transfer simulations have suggested the presence of different cloud layers at several levels below the tropopause [3]. However, as a result of the limitation of ground-based telescopes (or observations from telescopes in orbit around the earth) the detection and analysis of the composition and properties of those clouds is a big challenge. According to the gas abundances in Uranus's atmosphere and the T-P profile, a variety of cloud compositions can be found: clouds made of methane (CH_4), hydrogen sulphide (H_2S), ammonia (NH_3), ammonium hydrosulphide (NH_4SH) or water (H_2O) (see **Figure 1**). In this work, we will make use of cloud microphysics to provide key constraints on the density, vertical distribution, size of droplets and time scale of the different clouds that may be present in Uranus's atmosphere.

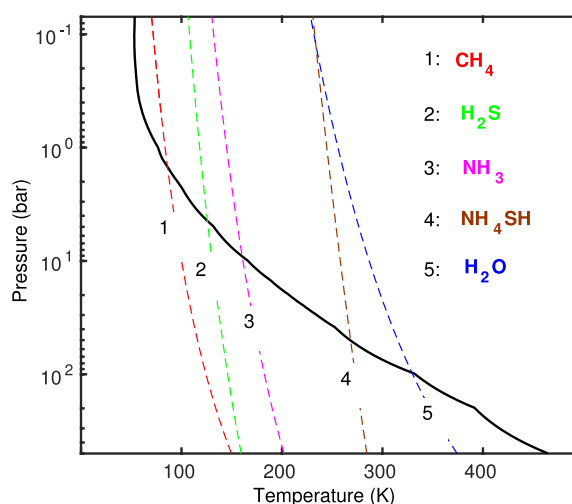


Figure 1: Vertical temperature profile in the atmosphere of Uranus (continuous black line) and the saturation vapor pressure curves for several possible condensates (dashed lines). The cloud base of each specific condensate is given by the point where the two curves cross.

References

- [1] Karkoschka, E.: Uranus' Apparent Seasonal Variability in 25 HST Filters. *Icarus* 151, 84-92 (2001).
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- [3] Sromovsky, L., et al.: Methane on Uranus: The case for a compact CH_4 cloud layer at low latitudes and a severe CH_4 depletion at high-latitudes based on re-analysis of Voyager occultation measurements and STIS spectroscopy. *Icarus* 215, 292-312 (2011).