Investigation into the Jovian cloud structure by means of visual methane band imaging and near-infrared spectroscopy

Takafumi Temma [1], Satoru Takeuchi [2], Hitoshi Hasegawa [3]

[1] Kwasan Obs. Kyoto Univ., [2] Earth System, Fukuoka Univ, [3] ASTEC

Observations at methane absorption bands are effective measures to investigate into the Jovian cloud structure. The scattered sunlight observed at strong absorption bands contains information about the aerosol particles in the uppermost atmosphere, and observations at weaker bands help to determine the aerosol distribution in the lower atmosphere. We analyse both the near-infrared spectroscopic data taken at the National Observatory Okayama and the visual imaging data acquired at the Hida Observatory. We discuss the latitudinal difference in the Jovian cloud structure and the existence of a thick cloud layer in the deep Jovian atmosphere.

Since the existence of three cloud layers of ammonia, ammonium-hydrosulfide, and water was predicted on the basis of thermochemical theory (Ref.1), various Jovian cloud models have been proposed from ground-based observations and space-probe missions, such as Pioneer and Voyager. Then, in 1995, the Galileo space probe entered the Jovian atmosphere and could not find a thick cloud layer around 5 bar level, whose existence had been taken for granted by the previous models (Ref.2,3). Although it has been said that the entry site might have been an unusually cloud-free region, it seems necessary to reflect on the Jovian cloud structure again.

Observations at methane absorption bands are effective measures to investigate into the Jovian cloud structure. The scattered sunlight observed at strong absorption bands contains information only about the aerosol particles in the uppermost atmosphere, and observations at weaker bands help to determine the aerosol distribution in the lower atmosphere. In fact, the fundamental atmospheric parameters (e.g. cloud scattering function) of Jovian clouds are not well-determined, and this causes degeneracy in cloud model solutions for the observed data. Consequently, meaningful discussions are hampered especially when the number of observational bands are small.

Therfore, we analyse both the near-infrared (K-band) spectroscopic data taken at the National Observatory Okayama last August and the visual mathane band imaging data (619, 726, 750 and 890 nm) acquired at the Hida Observatory last September. We discuss the latitudinal difference in the Jovian upper cloud structure and the existence of a thick cloud layer in the deep atmosphere.

References

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