EPSC Abstracts,
Vol. 4, EPSC2009-750, 2009
European Planetary Science Congress,
© Author(s) 2009

Development of a Radiative Transfer Model for the Venus Atmosphere

M. Takagi (1), K. Suzuki (2), H. Sagawa (3), P. Baron (4), J. Mendrok (4), Y. Matsuda (2) and Y. Kasai (4)

(1) University of Tokyo, Japan (takagi@eps.s.u-tokyo.ac.jp / Fax: +81-3-5841-8791), (2) Tokyo Gakugei University, Japan, (3) Max Planck Institute, Germany, (4) The National Institute of Information and Communications Technology, Japan

Introduction

It has been undestood that the vertical temperature distribution in the lower Venus atmosphere is determined mainly by a radiative-convective process. This temperature distribution is modified by upward heat transport of the atmospheric general circulation (which remains little known) to be slightly stable. We would like to construct a new radiative transfer model (RTM) based on the latest spectroscopic data in order to investigate the general circulation of the lower Venus atmosphere. It has been pointed out by Hollingsworth et al. (2007) that the radiative process is of importance for the generation of the atmospheric superrotation. The present study is essential for further investigations on the Venus atmospheric dynamics.

Model

The RTM constructed in the present study is based on the correlated k-distribution method. The absorption of CO_2 and H_2O are evaluated from the HITEMP and HITRAN spectroscopic database, respectively. In the following calculations, the Lorentzian line profile and those introduced by Pollack et al. (1993), Tonkov et al. (1996), Fukabori et al. (1986), and Meadows and Crisp (1996) are taken into account. The collision induced CO_2 continuum is based on the work of Moskalenko et al. (1979). Diurnal variation of the solar flux is not taken into account.

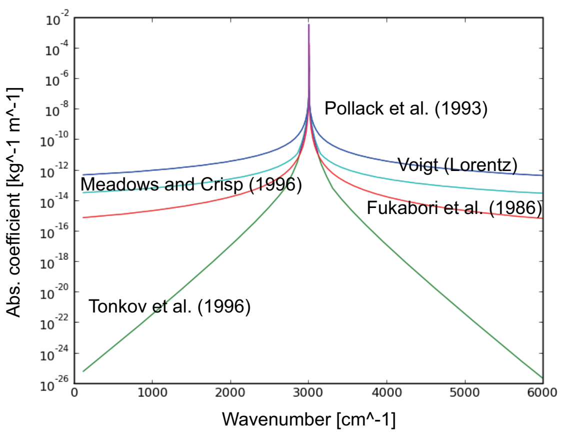

Figure 1: Line-profiles

Results

In the cases of the line profile given by Pollack et al. (1993), it is shown that the bottom temperature is less than 550 K, which is considerably less than the observed one (730 K). Effects of the CO_2 continuum and the H_2O vapor absorption on the bottom temperature are about 130 K and 100 K, respectively. The temperature profiles are not so affected by the H_2SO_4 cloud (40-70 km) except in the cloud layer. On the other hand, the bottom temperature exceeds 2000 K in the Lorentzian line profile cases. This preliminary result agrees with the fact that the CO_2 line profile is sub-Lorentzian. The CO_2 line profile should be carefully examined in order to improve the RTM for the Venus atmosphere.

References

[1] Hollingthworth, J. L. et al. (2007) *GRL*, 34, L05202.

[2] Pollack, J. B. et al. (1993) *Icarus*, 103, 1–42.

[3] Tonkov, M. V. et al. (1996) *Appl. Optics*, 35, 4863–4870.

[4] Fukabori, M. et al. (1986) *JQSRT*, 36, 265–270.

[5] Meadows, V. S. and Crisp, D. (1996) *JGR*, 101, 4595–4622.

[6] Moskalenko, N. I. et al. (1979) *Izv. Atmospheric and Oceanic Phys.*, 15, 632–637.