金星大気における放射対流平衡温度の数値実験
A sensitivity study of the radiative-convective equilibrium temperature profile in Venus atmosphere

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Venus has a dense atmosphere entirely covered by a thick cloud layer (ranging over 50 –70 km altitude). Due to the high opacity of the atmosphere, there is almost no remote-observational access to the lower atmosphere below the cloud. Past (only a few, though) in-situ measurements suggest that the atmosphere is stable below the cloud down to 32 km, and then a convective layer appears down to 18 km. The lower atmosphere below 18 km seems to be stable again. The nature of such a thermal structure is still not understood clearly.

To better knowledge on the thermal structure (radiative transfer of the thermal flux), we calculated the radiative-convective equilibrium temperature profile of Venus atmosphere using a newly developed 1-D radiative transfer model "MSTRN-Venus". The absorption coefficients of the molecular gases in the Venus atmosphere (CO_2, H_2O, CO, SO_2, HF, HCl, and OCS) are calculated in each 0.025cm^{-1} wavenumber and correlated k-distribution are calculated and applied. The spectroscopic parameters such as the transition position and line strength are taken from the recent compilations of HITRAN, HITEMP, and UCL08 catalogs. In addition, the collision-induced absorption of CO_2 is also included. We prepared the absorption coefficients under several pressure and temperature conditions within the ranges of 0.01 - 100 bar and 100 - 800 K, respectively. The results are kept in a look-up table of (p, T) domain so that we can interpolate the absorption coefficient for any pressure and temperature condition without repeating a burden computation. The upward and downward flux density is calculated for a given atmospheric profile using the MSTRN code. This code has been successfully applied in several studies of our terrestrial atmosphere, and also adopted as the radiation calculation module of several general atmospheric circulation models.

The presentation will discuss the sensitivity of the radiative-convective temperature profile concerning the abundance of minor species, incoming solar heating, and cloud opacities.

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