Takahashi, Y. O., Y.-Y. Hayashi, G. L. Hashimoto, K. Kuramoto, M. Ishiwatari, and H. Kashimura, 2024: Radiative effects on the formation of the stably stratified layer in the lower atmosphere of Venus, J. Meteor. Soc. Japan, 102, https://doi.org/10.2151/jmsj.2024-025.

- **Plain Language Summary:** The static stability is one of the concerns in considering the structures of the lower atmosphere of Venus. The present study shows that the stably stratified layer forms in the lower atmosphere of Venus as a one-dimensional radiative-convective equilibrium state by the use of a specific combination of volume mixing ratio profiles of radiatively active species within the observed ranges, but the stability of the layer is lower than observed one. It is shown that radiative effects of continuum absorption can contribute to the formation of the stable layer whose stability is comparable to the observed one, if its absorption coefficient is increased.

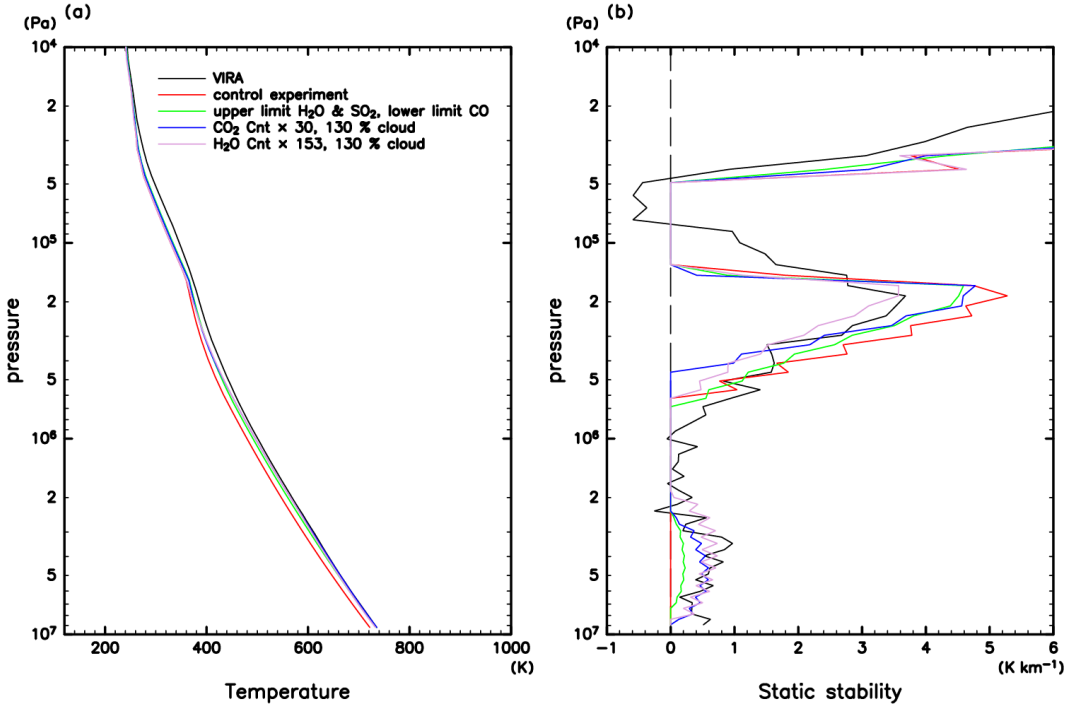

Figure 1. Radiative-convective equilibrium profiles of (a) temperature, and (b) static stability. The red and green lines are those calculated in the control experiment, and in the case with observed upper limit profiles of H_2O and SO_2, and an observed lower limit profile of CO, respectively. The blue and magenta lines are those calculated in the case with increased continuum absorption coefficients for CO_2 and H_2O, respectively, along with increased mixing ratio of clouds. The black lines are those for the VIRA model.

Highlights:

- The radiative-convective equilibrium calculated with the upper limit profiles of H_2O and SO_2, and the lower limit profile of CO within the observed ranges for the Venus lower atmosphere represents a stably stratified layer, but its stability is lower than observed one.
- Increasing the continuum absorption coefficients of CO_2 and H_2O, which are not well constrained observationally and experimentally, results in the formation of the stably stratified layer whose stability is comparable to the observed one.
- The important targets of future observations and laboratory measurements are to obtain more precise profiles of the mixing ratios of H_2O, CO, and SO_2 in the Venus atmosphere, and to determine the continuum absorption coefficients of those.