Venusian Upper Mesosphere and Lower Thermosphere GCMs Intercomparison Project. A. Martinez.[1], A. S. Brecht[2], H. Karyu[3], S. Lebonnois[1], S. W. Bougher[4], T. Kuroda[5], Y. Kasaba[3], G. Gilli[6], T. Navarro[7], H. Sagawa[8]. [1]Laboratoire de Météorologie Dynamique, LMD/IPSL, Paris, France. (antoine.martinez@lmd.ipsl.fr; sebastien.lebonnois@lmd.ipsl.fr), [2]NASA Ames Research Center, MS 245-3, Moffett Field, CA, 94035, USA (amanda.s.brecht@nasa.gov), [3]Department of Geophysics, Tohoku University, Sendai, Japan. (karyu@pat.gp.tohoku.ac.jp; kasaba@pparc.gp.tohoku.ac.jp), [4]CLaSP, University of Michigan, 2418C Space Research Building, Ann Arbor, MI, 48109, USA (bougher@umich.edu), [5] Department of Geophysics, Tohoku University (tkuroda@tohoku.ac.jp), [6]Instituto de Astrofisica e Ciências do Espaço (IA), OAL, Tapada da Ajuda, PT1349-018 Lisboa, Portugal (ggilli@oal.ul.pt), [7]University of California, Los Angeles CA, USA. (tnavarro@epss.ucla.edu), [8]Department of Astrophysics and Atmospheric Sciences, Kyoto Sangyo University (sagawa@cc.kyoto-su.ac.jp).

Introduction: Several Venusian Global Climate Models (GCMs) are currently developed around the world. To explore the robustness of these Venus GCM results in the thermosphere, an inter-comparison project has been set up, to explore the similarities and main differences between the USA VTGCM developed by S. Bougher and A. Brecht (VTGCM; **[1]**), the Japanese VTGCM developed at Tohoku University (TUGCM; **[2]**), and the IPSL Venus GCM (LMDZ; **[3]**). Although the GCMs describe the same environment, they are different in many ways, especially because of the characteristics of the model or the parameterization of the physical processes. This study should lead to a better understanding of the importance of parameterization in physical processes as well as a better understanding of the controls of these processes. A detailed analysis will be carried out on the comparison of the data and their consequences.

Inter-comparison Project: This study will focus on the upper mesosphere and the lower thermosphere, which corresponds to a pressure between 100 Pa and 10^{-6} Pa, and the simulations will all have the same solar conditions (Extreme UltraViolet) of 70 solar flux unit (s.f.u) and 200 s.f.u.

Data. In order to validate the robustness of the predicted atmospheric features, we also have observations from several Venusian missions such as Pioneer Venus, Magellan or Venus Express giving us information on the atmospheric composition, temperature and density for different solar and geographical conditions.

Comparison example. In Fig 1, we display the vertical profile of the temperature for low latitudes (<30°) for noon at ~70 s.f.u. TUGCM shows a similar evolution to LMDZ and VTGCM, but with a shift in pressure (the temperature peak is at a lower pressure). The dayside difference, between LMDZ-VTGCM and TUGCM, can be partly explained by the parameterization of the Near InfraRed (NIR) heating rate. Indeed, the peak heating pressure (and amplitude rate) is lower in TUGCM than in VTGCM or LMDZ, which shifts the temperature profile higher. It is also explained, for lower pressures, by a lower EUV heating efficiency in TUGCM (10%) than in LMDZ (17%) or VTGCM (20%).

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References: **[1]** Brecht, A. S., Bougher, S. W., Shields, D., & Liu, H.-L. (2021). *Journal of Geophysical Research: Planets*, 126, doi: 10.1029/2020JE006587. **[2]** Hoshino, N., Fujiwara, H., Takagi, M., Takahashi, Y., and Kasaba, Y. (2012), *Icarus*, *217*, 818–830, doi: 10.1016/j.icarus.2011.06.039. **[3]** Gilli, G., Lebonnois, S., González-Galindo, F., López-Valverde, M.A., Stolzenbach, A., Lefèvre, F., Chaufray, J.-Y., Lott, F., Icarus, Vol 281, 2017, 55-72, 0019-1035, https://doi.org/10.1016/j.icarus.2016.09.016. **[4]** Limaye, S., et al., Icarus 294, 124-155 (2017). Doi:10.1016/j.icarus.2017.04.020

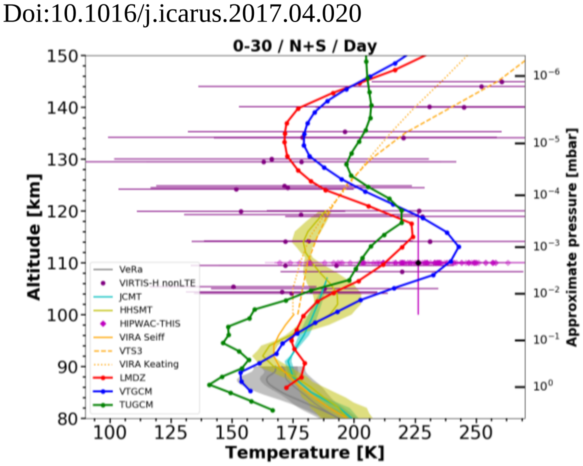

Figure 1: LMDZ (IPSL Venus GCM; red), VTGCM (USA VTGCM; blue) and TUGCM (Japanese VTGCM; green) temperature profiles compared to averaged temperature profiles observed by Venus Express and ground-based instruments for different local times (after **[4]**).