

## Exploring the Atmosphere of MArS and VEnus with Remote Observations and Simulations: A Belgium-Japan partnership (AMAVERO) 2017-2018

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Recent explorations of Mars and Venus atmospheres by numerous spacecraft and ground-based telescopes have suggested their active photochemistry and dynamics on these planets. Characteristics of spatial and temporal variations of temperature, wind, and atmospheric constituents are essential to understand them. However, (1) 3D distributions (i.e., spatial variation + vertical profiles) of temperature, wind, and trace gases on Mars, and (2) those at the middle atmosphere (from the cloud top to the upper atmosphere, 60-140 km) of Venus, are still poorly understood.

In 2017-2018 FY, Japan-Belgium collaboration program AMAVERO (Exploring the Atmosphere of MArS and VEnus with Remote Observations: A Belgium-Japan partnership) is running. This project studies those aspects by collecting observational datasets from Belgium and Japan. Belgian side provides the data taken by European Mars Express (MEx), ExoMars Trace Gas Orbiter (TGO), and Venus Orbiter Venus Express (VEx). From Japan, the data taken by ground-based and space-borne telescopes with Japanese Venus Orbiter Akatsuki are provided. Moreover, we share the numerical tools to analyze the observational datasets, and develop the numerical models of the atmospheres to interpret the observational results. In 2017, we sent several scientists from Japan to Belgium and initiated the following researches based on the exchange of young research staffs, postdocs, and graduate school students: (1) Collaboration of ground-based observation data taken by ALMA sub-mm array, SOFIA IR airborne telescope, and MIRAHI IR heterodyne spectrometer attached to Tohoku Univ. Haleakala 60cm telescope. (2) Development of Limb retrieval code JACOSPAR for the utilization toward future ExoMars Trace Gas Orbiter and its test application for H<sub>2</sub>O vertical profile derived from Mars Express and other orbiter data. (3) Distribution and dynamics of Venusian atmosphere observed by Akatsuki IR imagers. (4) The intercomparison of MGCMs with water cycle in different approaches. In this presentation, those summary and the next plan in 2018 will be presented.

This project was generated from the long-term collaborations between Japan and European groups for Mars and Venus sciences associated with Mars Express (2003-), Venus Express (2005-2015), CrossDrive project (Collaborative Virtual Environments for Mars Science Analysis and Rover Target Planning, 2014-2016), ExoMars Trace Gas Orbiter (2016-), with groundbased and numerical simulation works. Any proposals and contributions which enhance the activities are welcomed.

Keywords: Mars, Venus, atmosphere, groundbased observations, orbiter observations, numerical simulations