

Exploring the Atmosphere of Mars with Remote Observations and Numerical Studies: Belgium-Japan partnership 2017-2019

Yasumasa Kasaba[1]; Hiromu Nakagawa[2]; Hideo Sagawa[3]; Takeshi Kuroda[4]; Takeshi Imamura[5]; Ann Carine VANDAELE[6]; Shohei Aoki[7]; Isao Murata[8]; Naoki Terada[9]; Takeshi Sakanoi[10]; Yasuko Kasai[4]; Atsushi Yamazaki[11]; Takao M. Sato[12]; Hiroyuki Maezawa[13]; Hiroki Kashimura[14]; Makoto Taguchi[15]; Severine ROBERT[6]; Valerie WILQUET[6]; Arnaud MAHIEUX[6]; Kosuke Takami[2]; Sae Aizawa[16]; Masashi Toyooka[2]; Takehiko Akiba[17]; Nao Yoshida[18]

[1] Tohoku Univ.; [2] Geophysics, Tohoku Univ.; [3] Kyoto Sangyo University; [4] NICT; [5] The University of Tokyo; [6] BISA; [7] BIRA-IASB; [8] Environmental Studies, Tohoku Univ.; [9] Dept. Geophys., Grad. Sch. Sci., Tohoku Univ.; [10] Grad. School of Science, Tohoku Univ.; [11] ISAS/JAXA; [12] ISAS/JAXA; [13] none; [14] Planetology/CPS, Kobe Univ.; [15] Rikkyo Univ.; [16] Geophysics, Tohoku Univ; [17] Geophysics, Tohoku Univ.; [18] Geophysics, Tohoku Univ.

Recent successful explorations of Mars and Venus atmospheres by numerous spacecraft and ground-based telescopes have suggested their active photochemistry and dynamics. Characteristics of spatial and temporal variations of temperature, wind, and atmospheric constituents are essential to understand the photochemistry and dynamics. From April 2017 to March 2019, Japan-Belgium collaboration program, AMAVERO (Exploring the Atmosphere of MARS and VENUS with Remote Observations: A Belgium-Japan partnership) is running. In this project, we study the following aspects. (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.

These objectives are achieved by collecting observational datasets from Belgium and Japan. Belgian side provides the data taken by European Mars orbiter Mars Express (MEx) and Trace Gas Orbiter (TGO), and Venus Orbiter Venus Express (VEx). From Japan, we provide the data taken by ground-based and spaceborne telescopes with Japanese Venus Orbiter Akatsuki. Moreover, we share tools to analyze the observational datasets, and develop the numerical models of the atmospheres to interpret the observational results. We are executing the following researches based on the exchange of young research staffs, postdocs, and graduate school students: (1) Collaboration of ground-based observations by ALMA sub-mm array, SOFIA IR airborne telescope, and MIRAHI IR heterodyne spectrometer. (for Mars + Venus). (2) Development of Limb retrieval code JACOSPAR for the utilization to ExoMars Trace Gas Orbiter and its test application for H₂O vertical profile derived from Mars Express data. (for Mars: to be appeared in this meeting as Toyooka et al.). (3) Distribution and dynamics of Venusian atmosphere observed by Akatsuki IR imagers. (Venus). (4) The inter-comparison of Venusian and Martian GCMs with cloud and water cycles in different approaches. (for Mars + Venus) (5) Variation of the homopause and atmospheric composition in the upper atmosphere with the comparison between VEX/SOIR + MAVEN + TGO with numerical simulations.

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 TGO (2016-), with groundbased and numerical simulation works. In this meeting, we show the progress and the activities on-going in this project related to Mars Express and ExoMars with the link to MAVEN. In 2018, hot studies are now executed for the Martian global dust storm occurred in summer. Now, we try to extend this project with additional two years in order to cover the full TGO observational activities linked to (1)-(5). Those activities will be extracted to the collaboration of future missions in Japan (e.g. MMX) and Europe (e.g. M4 Venus mission study). Any proposals and collaborations are welcomed