

From Venus to Mars: viewpoint of comparative meteorology

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The next Japanese planetary mission focusing on atmospheric science will be the Mars observation in the MMX (Martian Moons eXploration) mission. The spacecraft will enter a near-equatorial, high-altitude, circular orbit around Mars in 2025 and stay in orbit for 3 years. During this Mars-orbiting phase, the spacecraft will collect samples from Phobos and remotely observe Phobos, Deimos and Mars. Continuous, high-resolution, multi-wavelength, global observations of the Mars atmosphere enable monitoring of meteorological processes driving dust/water cycle in the atmosphere-surface system. The instruments used will be a near-infrared imaging spectrometer and multi-band cameras.

The Mars observation in MMX is considered a natural extension of the Venus orbiter Akatsuki. The observation sequence of MMX is similar to that of Akatsuki in that global images are acquired at short time intervals from an equatorial orbit similarly to Earth's meteorological satellites. From the viewpoint of comparative meteorology, Martian meteorology is contrasted with Venusian meteorology in many aspects. Examples include: superrotation on Venus vs. strong high-latitude jets on Mars; weak thermal forcing on Venus vs. strong thermal forcing on Mars; internal oscillation on Venus vs. seasonal cycle on Mars; wave-driven circulation on Venus vs. heat-driven circulation on Mars; slow convection on Venus vs. fast convection on Mars; uniform aerosols on Venus vs. variable aerosols on Mars; weak vertical coupling on Venus vs. strong vertical coupling on Mars. In order to maximize scientific achievements, feedbacks from Akatsuki to MMX are required.

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