火星のO2分布と化学：テラヘルツセンサによる観測を見据えて

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O2 distributions and related chemistry on Mars: Towards the investigations with the future Mars terahertz sensor missions

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The importance of O_2 (molecular oxygen) for the atmospheric chemistry on Mars had been overlooked historically, because it has been thought to exist horizontally and vertically constant (~1400 ppmv) and impossible to observe from ground-based telescopes due to the deep absorption of the terrestrial O_2. However, the recent sub-millimeter spectroscopic observation using the Herschel Space Observatory suggested the possibility of higher concentration of O_2 near the Martian surface based on which detected the non-uniform vertical distribution of O_2 in global-mean abundance [Hartogh et al., 2010], and, since then, we have started to investigate the importance of O_2 for the atmospheric environment of Mars.

The abundance of O_2 is chemically related to the existences of O_3, H_2O, HO_2, H_2O_2, CO and methane. Simulated results by a Mars global climate model (MGCM) including a chemical suite (Mars Climate Database v5.3) did not show the specific vertical variances of O_2 abundance except the winter polar regions where the composition changes due to the condensation of CO_2. It means that current MGCMs may lack the processes which cause the vertical gradient in the O_2 abundance that suggested by the Herschel observation: e.g., unusual chemical reactions inside local dust storms and/or other surface activities including biological and geological ones.

Terahertz sensors which are planned to be onboard future satellite missions may observe the abundances of O_2 and chemically-related molecules (O_3, H_2O, H_2O_2), and would be suitable for the first specific observational investigations of O_2 distributions and its formation/loss processes on Mars. In this presentation we show test experiments of O_2 distributions using our MGCM (DRAMATIC) with water cycle and a preliminary chemical module, and discuss the potential scientific interests for future terahertz observations from Mars landers/orbiters.