Simulation of Possible Water Emission from RSL on Mars using a High Resolution GCM

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We are investigating the possibility of the detection of water vapor emission from the Recurring Slope Lineae (RSL) [McEwen et al., 2014; Stillman et al., 2016] by the Mars orbiters, and the feasibility study of required observational horizontal/vertical resolutions and accuracy is ongoing. To provide the theoretical estimations of those values required for the detection of RSL, we simulated the possible water vapor emission from RSL using a Mars Global Climate Model (MGCM) with a horizontal high resolution, ~1.1 degrees (~67 km) of grid interval coordinate. The MGCM (DRAMATIC) well simulates the annual changes of water column densities, within the discrepancy of ~6 pr.um (~40%) in overall. In addition, the MGCM is capable of the calculation of the distribution of HDO/H_2O isotopic ratio [Kuroda, 2017].

We have performed the simulation of water vapor emission from RSL in the Chryse and Acidalia Planitiae (CAP) region, assuming that the emission occurs when the surface temperature is above 238 K with the emission rate of 0.1 mm h^{-1} [Altheide et al., 2009]. The preliminary results showed that the emitted water vapor would reach to the altitude of up to ~6 km (~4 hPa) in a short time, due to the convection in the daytime boundary layer, and be spread in the area of 3×5 degrees in ~10 hours. However, the amount of emitted water vapor is very small in comparison with the background amount, and the instrumental sensitivity of at least ~0.1 ppm / ~0.01 pr. um would be needed to detect the emission by the observation. But the values can vary depending on the possible temporal and spatial resolutions of the observation, which would be investigated in the future.

(References)

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