R009-25
Zoom meeting D ：11/2 AM1 (9:00-10:30)
09:45-10:00

Day-night variation of O2/CO2 in Mars lower thermosphere

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The location of a compositional boundary, the homopause, influences theremospheric composition and thereby the escape of the species to space. We report detection of the homopause, for O_2/CO_2 profiles on Mars made by the Mars Atmosphere and Volalite EvolutioN/Imaging Ultraviolet Spectrograph, which allows us to study the vertical structure of the atmospheric compositions of O_2 and CO_2 in the 20 to 150 km altitude region (Groller et al., 2015, 2018). Our inferred O_2 and CO_2 density profiles have a typical vertical resolution of 2 to 10 km, which is smaller than or equal to the averaged atmospheric scale height (6 to 12 km, depending on altitude). The O_2/CO_2 ratio below the homopause is equal to the values of well-mixed homosphere; while, the O_2/CO_2 ratio above the homopause is enhanced by diffusive separation. The altitudes of the homopause substantially varies with latitude, season, and local-time in the range between 100 and 150 km. The predictions of the Mars Climate Database (Millour et al., 2012), however, systematically underestimate the altitudes of homopause by ~20 km. At a certain pressure level, we find that the variation of homopause is not obvious between day and night in the first half of the Martian Year. This suggests that inflation and contraction of the lower atmosphere can explain the variation of homopause. Meanwhile, the variation of homopause in the latter half of the Martian Year is noticeably difference between day and night. The inferred eddy diffusion coefficients at homopause are in the range between 10^7 and 10^8 cm^2s^{-1}. This reasonably agrees with the extrapolated results by previous studies (Izakov, 1978; Slipski et al., 2018). Time constant of diffusion must be order of 10^4 to 10^5 s (hours to days). The day-night variation can be explained as a signature of the global circulation in the upper atmosphere, in addition to the difference of eddy diffusion coefficient. Our result may imply a strong upwelling on the dayside and subsidence on the nightside. This enhances more fractions of lighter species on the nightside. This process is well known on the Earth, and especially Venus, where the nightside bulges in H and He are factors of hundreds and thousands in the thermosphere. Similar physics can work on Mars, as reported by Elrod et al (2016) which represented the He bulge in Mars thermosphere. The classical diffusion calculations are made to demonstrate the considerations discussed above.