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Seasonal variations of N_2/CO_2 at 140 km altitude derived from MAVEN/IUVS

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We have investigated the seasonal variation of the N_2/CO_2 ratio at 140 km altitude derived from ultraviolet spectroscopy remote-sensing measurements by Imaging Ultraviolet Spectrograph (IUVS) aboard MAVEN. We used the dataset of level 2 version 13 revision 1 data provided by the Planetary Data System, which includes retrieved CO_2 and N_2 number density profiles derived from dayglow emissions. We analyzed N_2 and CO_2 number densities observed from October 2014 to May 2018. The observations covered almost all solar longitudes within the two Martian Years. The retrieved CO_2 density has small uncertainty but the retrieved N_2 density has relatively larger uncertainty in particular above ∼170 km due to the dimmer emission intensity. For precise analysis of the N_2/CO_2 ratio, we confine our analysis to the data at 140 km altitude where N_2/CO_2 has uncertainty less than 50%. We found that the N_2/CO_2 ratio at 140 km altitude significantly varies in the range of 0.02 to 0.20, which shows an annual sinusoidal trend. The higher ratio appears during aphelion and the lower ratio appears during perihelion. CO_2 and N_2 number densities also have similar annual variations. It is noted that the CO_2 density varies by a factor of 100, while N_2 density by a factor of 10. This large CO_2 variation affects the N_2/CO_2 ratio at 140 km. The potential sources of the seasonal variation we found are variations (1) of the surface mixing ratio, (2) of the homopause altitude, and (3) of the thermospheric temperature. In this paper, the effect of surface mixing ratio is discussed using Mars Climate Database version 5.3 [Forget et al., 1999; Lewis et al., 1999]. We also address the effects of other sources by considering the seasonal variation of homopause altitude [Slipski et al., 2018] and background temperature [Bougher et al., 2017; Stone et al., 2018].