[JJ] Evening Poster | P (Space and Planetary Sciences) | P-CG Complex & General

[P-CG23]Planetary Magnetosphere, Ionosphere, and Atmosphere

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Exploration of Moon, Venus, Mars, Mercury, Jupiter, Saturn, and beyond together with rapid developments of numerical simulations provides us new view of planetary environment. This session collects general contributions of new findings about planetary magnetosphere, ionosphere, and atmosphere. New methodology and technology development studies for future explorations are also welcome. In order to put the common knowledge at different planets into perspective, this session aims to facilitate discussions on comparative planetary environments.

[PCG23-P01]The homopause altitude of Martian atmosphere derived by the vertical N_2/CO_2 ratio profiles observed by MAVEN/IUVS.

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The altitude of Martian homopause can be changed due to the solar flux, the global circulation, and the gravity wave breaking. The atmosphere below the homopause is well mixed by eddy diffusion. Above the homopause, the mixing ratios of lighter species increase with height due to the diffusion separation. Therefore, the homopause altitude is a key to understanding the atmospheric constituents at the exobase that has lost to space. In addition, the turbopause, which is located at almost the same altitude of the homopause, is defined as the altitude where the molecular diffusion coefficient is equal to the eddy diffusion coefficient. The former coefficient can be derived from a number density. Although, the eddy diffusion coefficient is hard to be constrained by observations and have had large uncertainties, it can be constrained by the homopause altitude.

On Mars, there are a few limited previous observations of homopause so far. The Viking probe was the first to argue that it was located at ~120-130km altitude [Nier and McEloy. 1977]. Recently, Jakosky et al. [2017] showed substantial variation of the homopause altitude from February 2015 to June 2016 by NGIMS onboard MAVEN. Due to the limitation of orbital motion, their results derived were not able to separate the local time, solar zenith angle, geographical location and season. NGIMS measurements are usually made above ~150km altitude along a long orbital-path in horizontal distance, generally 1500km although the homopause would be located at ~120km. This means that they have to assume isothermal temperature atmosphere to infer the homopause.

Imaging UltraViolet Spectrometer (IUVS) onboard MAVEN can cover the region between homopause and exobase in the range from 120 to 200km altitude. In addition, IUVS limb-observation is generally performed along the vertical track. IUVS measurements provide opportunities for investigating the homopause altitude directly and solving the source of the variations as seen in Jakosky et al.,[2017]. In this paper, we have investigated the seasonal variations and latitudinal variations of the homopause altitude of the Martian atmosphere by MAVEN/IUVS.

We used N_2/CO_2 profiles to infer the homopause altitudes in the period from October 2014 to May 2017. We applied a fit to the N_2/CO_2 profile in the range between 130 and 200km to extrapolate the profile to the homopause altitude, which represents the intersection with N_2/CO_2 value measured on the surface by Mars Science Laboratory (MSL) (cf. Mahaffy et al. [2013]). In order to investigate the seasonal and latitudinal variations, we divided IUVS dataset into 4-seasons in solar longitude (Ls=30-60, Ls=120-160, Ls=200-300 and Ls=300-10 due to the difference of the homopause altitude trend). Only the dataset obtained in 10-14hr local time was analyzed in this study. The highest location of the homopause was seen at Ls=300-10 in the northern winter to spring. This indicates that the effect other than solar flux may play an important role on the homopause altitude. We also found that the slope of N_2/CO_2 profiles decreased in the period from Ls=200-300 to Ls=120-160. At Ls=300-10, it is noteworthy that the N_2/CO_2 values indicate relatively constant along the altitude below ~150km. This result may suggest the direct detection of the homopause in this altitude range. However, the constant value of N_2/CO_2 derived from our result below ~150km sometimes shows larger value than that obtained from MSL. The variability of N_2/CO_2 in season may need to be considered. As the surface N_2/CO_2 value larger, the homopause altitude becomes larger.

In this paper, we will also show the initial result of the eddy diffusion coefficient and its comparison with previous modeling predictions (e.g. Imamura et al. [2016] and Leovy [1982]).