火星探査機MAVENの観測データを使用したmagnetic pileup boundaryとion composition boundaryの比較

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Comparison of Martian magnetic pileup boundary with ion composition boundary observed by MAVEN

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Martian upper atmosphere directly interacts with the solar wind, since Mars does not possess the intrinsic global magnetic field. This interaction forms a transition region between the shocked solar wind (magnetosheath) and the ionosphere, in which characteristic boundary structures are embedded. Previous studies have shown existence of the induced magnetosphere or magnetic pileup region in the transition region. Mars Global Surveyor (MGS) observed the magnetic pileup boundary (MPB), a boundary between the magnetosheath and the magnetic pileup region by its magnetometer and electron reflectometer [e.g., Vignes et al., 2000, Trotignon et al., 2006]. On one hand, Phobos 2 and Mars Express (MEX) observed the ion composition boundary (ICB) by their ion mass analyzer [e.g., Breus et al., 1991, Dubinin et al., 2006], where the ion composition changes from the solar wind origin to planetary origin dominant. Due to the lack of continuous simultaneous observations of the magnetic field and ion composition, however, relations between MPB and ICB are far from understood. In this study, we investigate relative locations and characteristics of MPB and ICB and their dependence on solar wind parameters, utilizing a full package of plasma instruments onboard Mars Atmosphere and Volatile EvolutioN (MAVEN).

We conducted a statistical analysis of the ion, electron, and magnetic field data obtained by MAVEN from November 2014 to March 2015 in order to investigate relations between MPB and ICB. We identified MPB from the electron and magnetic field data by inspection based on Trotignon et al. [2006]. We calculated the density ratio between the planetary heavy ions and the solar wind protons to investigate the ion composition around MPB. Results show that there is a north-south asymmetry in locations of MPB and ICB. Observations also indicate that the relative location of MPB and ICB has deference between dayside and nightside. The MPB locations also depend on the solar wind parameters. We will also report on the dependence of MPB and ICB on the solar wind velocity, density, and dynamic pressure.

Reference:
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