

電離圏へのエネルギー流入と酸素及び水素イオン流出との関係の太陽天頂角依存性 Solar zenith angle dependence of relationships between energy inputs to the ionosphere and O⁺ and H⁺ ion outflows

北村 成寿^{1*}; 関 華奈子¹; 桂華 邦裕¹; 西村 幸敏²; 堀 智昭¹; Strangeway Robert J.³; McFadden James P.⁴; Lund Eric J.⁵
KITAMURA, Naritoshi^{1*}; SEKI, Kanako¹; KEIKA, Kunihiro¹; NISHIMURA, Yukitoshi²; HORI, Tomoaki¹; STRANGE-
WAY, Robert J.³; MCFADDEN, James P.⁴; LUND, Eric J.⁵

¹名古屋大学 太陽地球環境研究所, ²カリフォルニア大学ロサンゼルス校, ³カリフォルニア大学ロサンゼルス校, ⁴カリ
フォルニア大学バークレー校, ⁵ニューハンプシャー大学

¹STEL, Nagoya University, ²Dept. of Atmos. and Oceanic Science, UCLA, ³Inst. of Geophys. and Planetary Phys., UCLA,
⁴Space Science Laboratory, UC Berkeley, ⁵SSC, Univ. of New Hampshire

Recent satellite observations and simulations have clarified that plasma outflows play an important role in abrupt changes in the ion composition in the plasmashet and ring current during geomagnetic storms. Statistical studies by Strangeway et al. [2005] and Brambles et al. [2011] indicated that the flux of ion outflows is correlated well with soft electron precipitation (precipitating electron density and electron density in the loss cone), and DC and Alfvénic Poynting fluxes using the data obtained by the FAST satellite near the cusp region in the dayside during the 24-25 September 1998 geomagnetic storm. To distinguish between O⁺ and H⁺ ion outflows, we performed statistical studies using the ion composition data in addition to the ion and electron data obtained by the FAST satellite at 3000-4150 km altitude during January 1998 and January 1999. The long-term dataset enables us to identify empirical formulas between the outflowing O⁺ and H⁺ ion fluxes and the precipitating electron density, the electron density in the loss cone, the net electron number flux, and the DC and Alfvénic Poynting fluxes in a wide solar zenith angle (SZA) range (for dayside, 50-110 degree; and for nightside, 90-150 degree). In the SZA range of 90-110 degrees, the above formulas in the dayside are almost similar to those in the nightside. While SZA dependence of the relationships between the outflowing O⁺ and H⁺ ion fluxes and the DC and Alfvénic Poynting fluxes are weak, the empirical formulas between the outflowing O⁺ and H⁺ ion fluxes and soft electron precipitation, especially the precipitating electron density and the electron density in the loss cone, depend on SZA. Although the precipitating electron density and the electron density in the loss cone that correspond to the outflowing O⁺ ion flux of about 10⁷ /cm²/s increase with decreasing SZA, the outflowing O⁺ and H⁺ ion fluxes become more sensitive to an increase in soft electron precipitation with decreasing SZA.

キーワード: イオン流出, 極域電離圏

Keywords: ion outflow, polar ionosphere