

Temperature trend of electron and ion with plasma density in middle and low latitude in the topside ionosphere

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It is important to understand energy flow from electron to ion and neutral species because main heat source of ionospheric plasma is photoelectron created by solar EUV. First, electrons are heated by photoelectrons, then heated electrons reduce their energy through the Column collision with ions. Finally, ions are cooled by inelastic collision with neutral species. Temperatures of electron (T_e), ion (T_i) and neutral species (T_n) get close to each other during night time due to lack of significant heat source. Heating rate of electron by photoelectron is proportion to ambient plasma density while cooling rate of electron is proportion to square of the plasma density. Therefore, T_e decreases with increase of electron density (N_e) in general. However, some satellite results show T_e increases with increase of N_e when N_e is high enough (more than about 10^6 cm^{-3}). To understand the unexpected T_e , it is also important to know T_i variation because ion plays as a heat sink of electron. In this paper, we summarized correlation of N_e with T_e and T_i observed by HINOTORI, CHAMP and ROCSAT-1 in the topside ionosphere. Since these satellites did not observe T_e and T_i simultaneously, T_e , T_i and N_e measured with the incoherent scatter radars at Jicamarca and Millstone Hill are also shown. Using these data, we discuss possible cause of unexpected high T_e in high N_e region.

Keywords: topside ionosphere, electron temperature, electron density, ion temperature, photoelectron, middle and low latitude