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#ラダクリシュナ ポルナカツ シュリデヴィ [1)], Yoshizumi Miyoshi[1)], Yu Yiqun[2)], Jordanova Vania[3)]
([1] 名古屋大学, [2] 北京航空航天大学, [3] ロスアラモス国立研究所

Understanding the role of EMIC wave-particle interactions in driving westward ion drifts in the dusk-side sub auroral ionosphere

#Shreedevi Radhakrishna Porunakatu[1)], Miyoshi Yoshizumi[1)], Yiqun Yu[2)], Vania Jordanova[3)]
([1]ISEE Nagoya University, [2]Beihang University, [3]Los Alamos National Laboratory

The dusk-side mid-latitude ionosphere is characterized by fast, sunward flow channels of a few degrees in width, known as Subauroral Polarization Streams (SAPS). Occasionally, these regions exhibit distinct, latitudinally narrow enhancements in velocity, referred to as double-peak Sub-auroral Ion Drifts (DSAIDs). SAPS are associated with Region 2 Field-Aligned Currents (R2 FACs) that flow into the low-conductance sub-auroral ionosphere, while DSAIDs have been linked to the presence of a double-conductance trough in this region. Nishimura et al. (2022) demonstrated that sub-auroral ion drifts intensify in the presence of electromagnetic waves, with local plasma structures exerting greater control over the velocity characteristics of these westward flows than solar wind or global magnetospheric conditions. This study investigates the occurrence of westward ion flows in the dusk-side sector during a geomagnetic storm event, utilizing simulations from the RAM-SCB model. To explore the relationships between R2 FACs, electric fields, EMIC wave-particle interactions, proton precipitation, ionospheric conductance, and westward flows in the dusk-side sub-auroral ionosphere, we conducted two simulation studies, one with and one without EMIC waves. The simulations confirmed that EMIC wave-induced proton precipitation leads to localized enhancements in conductivity, which, in turn, generates high-speed westward flows in the dusk-side sub-auroral ionosphere. Our findings reveal the significant role of wave-particle interactions in shaping ionospheric behavior during disturbed conditions.