(Form11-1)

Interrelation between electron temperature and O(^{1}D) emission intensity

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I, Kshitiz Upadhyay, a PhD student at Physical Research Laboratory, Ahmedabad, India visited the ISEE, Nagoya, Japan from Oct 01st to Dec 29th, 2023 under the SCOSTEP Visiting Scholar (SVS)-2023 program. The purpose of the visit was to perform the research work based on the investigations of night time atomic oxygen OI 630.0 nm emission intensity and the corresponding electron temperature variation for a mid-latitude phenomenon, known as Stable Auroral Red (SAR) arcs. In this work, the measurements of SAR arc emission intensities over Athabasca (Canada) and conjugate electron temperature (Te) from DMSP for the events of year 2015 and 2018 observed by Gololobov et al., 2023 were utilized. As Gololobov et al., 2023 found a positive correlation between electron temperature and 630.0 nm emission intensities, we used these measured electron temperature and emissions to obtain the required plasmaspheric heat flux for the production of night time SAR arc emissions using a physics-based model, GLOW (Solomon, 2017). We further used these GLOW model obtained energy fluxes to estimate the electron densities using the Maxwell-Boltzmann's energy distribution function (MBF) and a comparison was made with DMSP measured electron densities. The results on estimated heat flux using measured emission and temperatures were found to match well as reported earlier by Kozyra et al., 1997, which were based on theoretical studies.

Apart from SAR arc studies, a partial work based on OI 630.0 nm nightglow emission intensities was also carried out during the stay at ISEE. These nightglow emissions were obtained using OMTI all-sky imager at Tromsø (Norway) for geomagnetically quiet days. In addition to observed nightglow emissions, GLOW model was also used to estimate the intensities of these emissions by providing measured electron density profiles from collocated EISCAT radar. The results obtained by the comparison of observed and estimated nightglow intensities over zenith suggested the occurrence of low-energy particle precipitation from plasma sheet region to the equatorward boundary of nightside auroral oval during geomagnetically quiet times. These results on low-energy transfer evident by OI 630.0 nm nightglow emissions also indicate towards the importance of magnetosphere-ionosphere coupling phenomena at high-latitudes during quiet periods of geomagnetic activity.

References

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