Characteristic behaviour of Stable Auroral Red (SAR), Strong Thermal Emission Velocity Enhancement (STEVE) and Red-Green arc during High Intensity Long Duration Continuous Auroral electrojet Activities (HILDCAA) events

Ayushi Nema
Sardar Vallabhbhai National Institute of Technology
Surat, India
Ph. D. Research Scholar

Being selected as SCOSTEP Visiting Scholar (SVS) Fellow 2024 was one of the great opportunities I had. I visited the Institute for Space Earth Environmental Research (ISEE), Nagoya University, Japan for the duration of 90 days from 28 September to 27 December 2024 to work under the supervision of **Dr. Kazuo Shiokawa, Director ISEE, Nagoya University**. My stay in Nagoya Japan was provided by the International Residence Higashiyama under the support of ISEE. All expenses were covered by the host organization.

During my stay, I worked on understanding behaviour of SAR arcs, STEVE and Red-Green arcs during HILDCAA events. This is one of the first studies ever conducted during HILDCAA events. SAR arcs are optical phenomena caused by interaction of the inner edge of ring current with contracted plasmasphere. These are the red lines with 630.0 nm emission and weak green lines of 557.7 nm. Coulomb collision is considered as the main cause for the transfer of energy from ring current ions to plasmaspheric electrons. Similar to the SAR arc, STEVE was also reported to occur during HILDCAA events. STEVE, purple color arc accompanied by green line, on the other hand are characterised by picket fencing structure. In previous studies, both SAR arc and STEVE have been reported to occur during the recovery phase of geomagnetic storms. Along with SAR arc and STEVE, we also reported the occurrence of Red-Green arcs. These arcs display emission in both red and green lines.

During the stay, I analysed the occurrence rate of SAR arc, STEVE and Red-Green arc. The data used in this study was taken from All-Sky Imagers under the PWING project. I utilised Athabasca, Canada; Nyrola, Finland and Kapuskasing, Canada all-sky images for detection. The detection of arcs were done for HILDCAA events occurring from 2006 to 2019, which is approximately one solar cycle. It was found that these optical phenomena tend to occur mostly at midnight hours with no visibility during day time.

In my leisure time, I explored Nagoya city. The transport services were very good for communicating from one place to another. There are shrines near the university, where you can go and find solace. Prof. Shiokawa took us to Shigaraki for a visit to the MU Radar Observatory. It was a very beautiful town full of ceramic arts. Those 3 months were very fruitful to me. I would like to thank Yoko and Karina for their help during my stay at residence. I am thankful to Prof Shiokawa for providing me this research opportunity and not the least the office staff, Mai and Sayaka for making the joining process easier.