

Name: Dessalegn Ayehu

Affiliation: Bahir Dar University, Ethiopia

## **Mechanisms for generating the post-midnight irregularities of equatorial ionosphere**

I have conducted research on the generation mechanisms for the post-midnight irregularities of equatorial ionosphere at Institute for Space-Earth Environmental Research (ISEE), Nagoya University Japan during my research visit, from April 30 to July 29, 2024. This research project was supported by ISEE using the funding of the PBASE program. The research work took place at the Division for Ionospheric and Magnetospheric Research group, ISEE, under Dr. Yuichi Otsuka (Associate Professor) supervision.

The research aimed to understand the mechanisms for generation of the post-midnight equatorial ionospheric irregularities. The in-situ and remote measurement data from ICON satellite during Dec, 2019 to Nov, 2022 are examined. The ion density and vertical ( $\mathbf{E} \times \mathbf{B}$ ) drift velocity from IVM, height of the peak density (hmF2) from FUV, and thermospheric neutral winds from MIGHTI on board ICON were analyzed during my stay at ISEE.

The preliminary result showed that the occurrence probability of the post-midnight equatorial ionospheric irregularities is more intense during May, August, and September in 2020 and during June solstice in 2021. Moreover, it is also found that the strong post-midnight irregularities are predominantly occurred in the African sector. Monthly variations of the post-midnight irregularities, vertical drift velocity ( $\mathbf{E} \times \mathbf{B}$ ), and hmF2 show similar patterns. This indicates that the upward vertical drifts, which uplift the ionospheric  $F$  layer to higher altitudes, play a dominant role in the generation of the plasma irregularities by initiating the growth of the Rayleigh-Taylor instability in the post-midnight period.

During my stay, I have participated in various seminars, group discussions, and Q & A sessions, which has given me the opportunity to exchange about current space weather research interests, to deepen my understanding in the realm of Space Physics and to improve my research experiences. The discussions I made with Dr Yuichi Otsuka have significantly enhanced my work as his proficiency in irregularities was invaluable assets to my research endeavors. The suggestions and comments I got, on my presentation, from Dr. Otsuka, Prof. Shiwokawa, and other senior researchers were highly valuable. I am working on the remaining part of the research work and will publish a paper in a prestigious academic journal.

Moreover, I also had the privilege to visit the Middle and Upper atmosphere (MU) radar observatory in Shigaraki where I got opportunity to see ground based instruments (phase array antennas radar, All-Sky Imagers, and FPI) along with scientific briefing by Dr. Otsuka.

In addition to the scientific experience I have acquired, I had also memorable impressions, like travelling in Shinkansen train and subway train, visiting beaches with friends, and sharing social and cultural values.

Finally, I would like to thank to PBASE program for their funding support. I am very grateful to Prof. Shiwokawa Kazuo, Director of ISEE, for offering this research visit opportunity and Dr. Yuichi Otsuka for his tremendous support throughout the course of my visit. Last, but not least, I like to express my appreciation to staff members of Higashiyama International Residence, Yoko and Karina for their generous hospitality during my stay at the residence.



Photo with Dr. Otsuka