3rd URSI AT-AP-RASC, Gran Canaria, 29 May – 3 June 2022

Sporadic E Detection from an Ultraviolet Remote-sensing Experiment

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Sporadic E (E_s) is a phenomenon where thin layers of charged particles coalesce to create a highly localized, anomalous layer of ionization in Earth's E-region ionosphere, typically at an altitude somewhere between 90 km and 160 km. HF signal propagation is significantly impacted by E_s, which creates an unexpected source of refraction for radio frequencies up to the VHF region of the spectrum. Regions of E_s are characterized by a high concentration of metal ions, primarily Mg^+ and Fe^+, that are deposited by meteor ablation in the atmosphere. The metal ions converge in thin layers as the result of wind shears at low and mid-latitudes. The U.S. Naval Research Laboratory (NRL) has developed a new experiment for E_s detection through remote sensing of ionospheric Mg^+ from a space-based, CubeSat-compatible sensor.

The Triple Magnesium Ionospheric Photometer (Tri-MIP) was developed as a 1U CubeSat compatible sensor to detect a mid-ultraviolet (MUV), Mg^+ doublet emission near 280 nm. [1] The initial flight of Tri-MIP will be on the Slingshot-1 spacecraft that is anticipated to launch into a circular orbit at an altitude of 500 km and an inclination of 45º. Paired with a 1U scanning ultraviolet mirror (SUVM) on the Slingshot-1 spacecraft, Tri-MIP will provide altitude profiles of Mg^+ airglow emissions through limb scans of Earth's ionosphere along the wake direction of the orbit. Tri-MIP is a highly sensitive, miniaturized alternative to larger spectrometers that have observed the same emission, for example the Ionospheric Spectroscopy And Atmospheric Chemistry (ISAAC) instrument on the DoD Space Test Program's Advanced Research and Global Observing Satellite (ARGOS) or the SCanning Imaging Absorption SpectroMeter for Atmospheric CHartographY (SCIAMACHY) on the ESA ENVIronmental SATellite (ENVISAT). Furthermore, Tri-MIP is especially well-suited for E_s detection and may allow for the observation of faint signatures E_s that are otherwise not visible with other commonly used, remote plasma detection methods, such as ground-based ionosondes or GPS radio occultation experiments. This presentation will show background for the Tri-MIP measurement approach and the data reduction approach that will be applied to the observations.

1. A. C. Nicholas, K. F. Dymond, S. A. Budzien, A. W. Stephan, B. A. Fritz, C. M. Brown, and T. T. Finne, "Triple Magnesium Ionospheric Photometer (Tri-MIP) Instrument Overview" *Proc. SPIE 11832, CubeSats and SmallSats for Remote Sensing V*, **118320A**, 2 August 2021, doi: 10.1117/12.2594905.

Acknowledgement: Authors are funded by the Chief of Naval Research.