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Poster
The Earth’s outer belt is populated by energetic electrons (tens of keV to multi-MeV), which can be trapped by the magnetic field or precipitate into the atmosphere (energetic electron precipitation, EEP), depositing energy at altitudes of a few tens to a few hundred km. These electrons shape the near-Earth radiation environment and influence atmospheric energy input. However, global electron flux maps are limited by sparse continuous observations at LEO and MEO.
We leverage observations by the long-term NOAA POES and EUMETSAT MetOp LEO constellation to develop a machine learning model that nowcasts (and potentially forecasts) energetic electron conditions in LEO, including trapped and precipitating populations. The model is driven by geomagnetic indices such as AL and Sym-H, applied regionally to capture the local-time-dependent characteristics of electron dynamics. We demonstrate preliminary results that our model reproduces expected precipitation and trapped flux patterns under both quiet and active geomagnetic conditions.
These electron maps enhance space weather monitoring, aiding in the assessment of energy input into the atmosphere. Radiation belt electrons can induce adverse effects on satellites, including charging, electronic degradation, and increased instrument noise. Monitoring trapped electrons helps identify high-flux regions that may impact satellite performance. Additionally, precipitating electrons influence atmospheric chemistry (e.g., ozone depletion) and ionospheric conductance, which affects communication systems. Our model serves as a pilot study for electron dynamics in LEO, paving the way for applications in proton modeling and coupling electron/proton precipitation with atmospheric and ionospheric effects.

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Geospace/Magnetosphere Research and Applications
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Space Weather Workshop 2025
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