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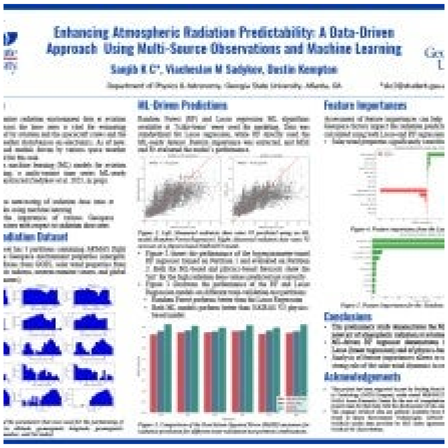
Poster
Radiation from solar and galactic sources impacts Earth’s atmosphere and space environment, posing challenges for aviation safety, satellite operations, communication systems, and power grids. Accurate radiation prediction remains a challenge due to the complex dynamics of radiation variability. Physics-based models do not precisely match experimental observations, suggesting the potential physics effects not yet included in the models.

To address these challenges, this study employs machine learning (ML) techniques to improve nowcasting of radiation dose rates at aviation altitudes and to explore the importance of various Geospace environment factors such as global solar activity, solar wind properties, and geomagnetic indices. Data used in this research are ML ready datasets prepared by the Radiation Data Portal team which include ARMAS in-flight radiation measurements, NAIRAS V3 model predictions, GOES proton and electron flux, OMNIWeb solar wind and geomagnetic indices, neutron monitor counts, and global solar activity parameters.

Preliminary analysis using linear model with regularization (Lasso regression) and Random Forest regression, demonstrate statistically significant improvement in predictive accuracy, with lower Mean Squared Error (MSE) compared to physics-based model. The average mean squared error (MSE) value for Random Forest regression is 13.09 (μSv/s)^2 trained over six train-validation-test combinations and Physics-based model is 16.37 (μSv/s)^2. Both the Lasso regression-based and Random Forest-based feature importance estimations indicate the significant role of the solar wind parameters in radiation environment forecasting. These findings highlight the potential of ML-driven approaches to refine existing models and support development of operational, data-driven frameworks for space weather forecasting.

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