Research & Reviews: Journal of Pure and Applied Physics ISSN: 2320-2459

# Commentary on Short-Term Forecast of High Energy Electron Flux Based on GPR

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Commentary

**Received**: 09-Oct-2023, Manuscript No. JPAP-23-116106; **Editor assigned**: 11-Oct-2023, Pre QC No. JPAP-23-116106 (PQ); **Reviewed**: 25-Oct-2023, QC No. JPAP-23-116106; **Revised**: 01-Nov-2023, Manuscript No. JPAP-23-116106 (R) **Published**: 08-Nov-2023, DOI:10.4172/2320-2459.11.4.005.

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**Citation:** Lu J, Commentary on Short-Term Forecast of High-Energy Electron Flux Based on GPR. Res Rev J Pure Appl Phys. 2023;11:005.



## ABOUT THE STUDY

The author introduces a new forecasting technique and a delayed analysis method for parameter selection in space weather within the issue, "Short-term forecasting of high-energy electron flux at geosynchronous earth orbit," by Jianyong Lu and team [1]. They first conduct a delayed analysis of input parameters for parameter selection, including solar wind parameters, geomagnetic parameters, and historical high-energy electron flux. Subsequently, they employ Gaussian Process Regression (GPR) method based on prior information to predict high-energy electron flux. Comparative evaluations are then carried out against well-established models that are typically employed in this domain. The results unequivocally favor the GPR as the superior model for high-energy electron flux prediction. Notably, the GPR surpasses other intelligent models, including Backpropagation Neural Network (BPNN), Support Vector Machine Regression (SVR), Decision Tree Regression (DT), and Long Short-Term Memory Network (LSTM). These findings underscore the efficacy of the GPR in forecasting high-energy electron flux. Additionally, their prediction model effectively forecasts extreme disturbance events, such as sudden increases or decreases in electron flux by several orders of magnitude. It is essential to emphasize that the primary focus of their study lies in the realm of short-term forecasting, specifically targeting predictions 1 day ahead. While the GPR demonstrates its competence in this context, its performance for medium-term forecasts, particularly 2 and 3 days ahead, needs additional validation. Consider that the dynamic nature of high-energy electron flux, some signal processing techniques conducive to decomposition and reconstruction can be further explored in future. One such avenue is the application of Empirical Mode Decomposition, which holds promise as a complementary approach to enhance predictive capabilities of the GPR. Moreover, introducing a rolling forecasting mechanism for real-time parameter updates during the prediction process could significantly bolster the efficacy of the model in mid-long term forecasting.

In summation, this article on high-energy electron flux prediction offers a valuable reference point for researchers and practitioners across diverse domains. Its contributions extend beyond the field of space weather forecasting. The article employs novel approach such as delayed analysis method of parameter selection and the GPR model based on prior information. By outperforming established models and intelligent algorithms, the GPR shows its potential for widespread adoption. Additionally, the model's proficiency in predicting abrupt disturbances of high-energy electron flux holds paramount importance for ensuring the safe operation of geosynchronous orbit satellites. In essence, the parameter selection methodology and prior information modeling framework outlined in this article offer a transferable blueprint for addressing forecasting conundrums in various disciplines.

## REFERENCES

1. Peng G, et al. Short-term forecast of high-energy electron flux based on GPR, Astrophys Space Sci 2022;367:89.