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Improvement of real-time probabilistic forecast of >2 MeV electron fluence levels on geostationary orbit

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Relativistic electrons that constitute Earth's radiation belts are considered as a cause of anomalies on artificial satellite. As space weather monitoring and forecast in NICT, we have monitored the variation of the radiation belt electron flux on geostationary orbit observed by GOES-16 and 18 satellites.

We developed the probabilistic forecast model of radiation belt electrons by using a deep learning (DL) method, RadeAI. The method implements multi-layer perceptron which has the input layer, three hidden layers, and the output layer. The softmax function is applied on the output layer which generates probabilities of four fluence levels of radiation belt electrons with 24 hours lead time. The input layer receives the solar wind and electron fluence data past 72 hours with time resolution of 1 hour. We evaluated the accuracy of the forecast by taking ROC curves and reliability diagram with consistency bars. The results show that there was room for improvement in accuracy.

In order to improve the accuracy of RadeAI, we consider input data set to be more appropriate for the forecast of fluence level of >2 MeV electrons than the current model. The input data set for the current model was 1-hour averaged data, so the information of temporal variation within 1 hour was completely eliminated. We will evaluate the influence of solar wind temporal variation within 1 hour on the >2 MeV electron fluence. By choosing the input data set that has higher correlation with the variation of the fluence, RadeAI would become possible to forecast more accurately. In this presentation, we will show the performance of the improved RadeAI by comparing with the current one.