R010-07
B 会場 ：11/27　AM2 （10:30-12:00）
11:00〜11:15

#西宮 祐太 [1)], 三好 由純 [2)], 田 采祐 [3)], 堀 智昭 [4)], 三谷 烈史 [5)], 篠原 育 [6)], 高島 健 [6)], 東尾 奈々 [6)], 浅村 和史 [7)], 齊藤 慎司 [8)], 塩田 大幸 [9)]
([1]ISEE, ([2] 名大 ISEE, ([3] 名大 ISEE 研, ([4] 名大 ISEE, ([5] 宇宙研, ([6] 宇宙機構／宇宙研, ([7] 宇宙研, ([8] 情報通信研究機構, ([9] 情報通信研究機構

Solar Wind Parameter Dependence of the Radiation Belt Electron Flux Variations using the XAI technique

#Yuta Nishimiya[1)], Yoshizumi Miyoshi[2)], ChaeWoo Jun[3)], Tomoaki Hori[4)], Takefumi Mitani[5)], Iku Shinohara[6)], Takeshi Takashima[6)], Nana Higashio[6)], Kazushi Asamura[7)], Shinji Saito[8)], Daikou Shiota[9)]
([1]Institute for Space-Earth Environmental Research, Nagoya University, ([2]Institute for Space-Earth Environemental Research, Nagoya University, ([3]Institute for Space-Earth Environmental Research, ([4]Institute for Space-Earth Environmental Research, Nagoya University, ([5]Japan Aerospace Exploration Agency, Institute of Space and Astronautical Science, ([6]Japan Aerospace Exploration Agency/Institute of Space and Astronautical Science, ([7]Japan Aerospace Exploration Agency, ([8]National Institute of Information and Communications Technology, ([9]National Institute of Information and Communications Technology (NICT)

The radiation belt is a region in the inner magnetosphere where the most energetic electrons in geospace are trapped by the Earth's magnetic field. Significant variations in energetic electron flux occur during magnetic storms, and a continuous increase in the outer belt electron flux often leads to satellite anomalies. Thus, forecasting flux variations of energetic electrons is crucial for mitigating these risks and is a key aspect of space weather research. We have developed a forecast model for outer belt electron flux variations using a recurrent neural network (RNN) with a long short-term memory (LSTM) architecture. This model utilizes electron flux data obtained by the Arase/HEP and XEP instruments, which observe electrons in the energy range of ~100 keV to ~3 MeV, along with solar wind parameters. Furthermore, we have incorporated Shapley Additive exPlanation (SHAP) from eXplainable Artificial Intelligence (XAI) into our model to analyze the relative contribution of the input parameters affecting electron flux variations. The SHAP values indicate that both the solar wind speed and the time-integrated southward IMF significantly contribute to the flux enhancement. Solar wind speed is the primary factor, accounting for more than 50% of the flux enhancement, with the southward IMF Bz also playing a significant role. Solar wind density at >5/ cm3 contributes to the loss of electron flux. These findings using SHAP are consistent with previous statistical analyses. We also performed a similar SHAP analysis to compare the relative contributions of these input parameters for the electron flux variations between CME- and CIR-driven storms in different L-shell regions. The results show that southward IMF is more effective for flux enhancement in CIR-driven storms and lower L-shell regions compared to CME-driven storms and larger L-shell regions. The diagnostic of the radiation belt variation using XAI not only improves the forecasting skill with AI but also enhances our understating of parameter dependencies on the radiation belt flux variations.