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Prediction of MeV electron flux throughout the outer radiation belt by multivariate autoregressive model

SAKAGUCHI, Kaori[1*] ; NAGATSUMA, Tsutomu[1] ; SPENCE, Harlan[2] ; REEVES, Geoffrey[3]

[1]National Institute of Information and Communications Technology, [2]University of New Hampshire, [3]Los Alamos National Laboratory

The radiation belts are consisted of relativistic energy electrons in MeV range. The electron flux in the outer belt is highly variable depending on both solar wind and magnetospheric conditions. Enhanced fluxes sometimes cause deep dielectric charging on spacecraft and therefore satellite anomaly happens after the discharge. Prediction of such MeV electron variations is needed for safety operation of the satellite in the near Earth's orbit, but the physical processes of acceleration, loss, and transport of relativistic electrons are not fully understood so far. Japanese space weather information center at NICT has developed a multivariate autoregressive (AR) model for the prediction of electron flux at geostationary orbit (GEO). The model can estimates future flux variations by a few days lagging response of solar wind parameter changes [Sakaguchi et al., 2013]. Now, we have developed new models to predict electron flux variation throughout the outer radiation belt at L=3?6. Observation data of 2.3 MeV electrons in 2012-2014 by Van Allen Probes are used as predictor time series variate. The appropriate combinations of explanation variate are examined and selected respectively for each of L value (ΔL=0.2) model among geomagnetic indices (AE, Kp, Dst) as well as solar wind parameters (speed, BZ, BS, Pdyn). The combinations of these variates systematically change according to L-value shift. In the presentation, we show the estimation method of multivariate AR coefficient matrixes and discuss about estimated combinations of explanation variate. Also we show past prediction results that were validated by observation data based on two skill scores of prediction efficiency and persistence.

Keywords: radiation belt, prediction, Van Allen Probes