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The system identification development of local time dependent electron flux models for geostationary orbit

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At Geosynchronous Earth Orbit (GEO), electrons fluxes with energies up to several hundred keV, can vary by several orders magnitude in Magnetic Local Time (MLT). This study develops Nonlinear AutoRegressive eXogenous (NARX) models that account for the spatial variation in MLT for three different electron flux energy ranges: 40 keV, 150 keV and 475 keV. This is difficult for system identification and machine learning techniques, since the electron flux data is sparse at different MLT's. GOES 13, 14, and 15 data were binned by MLT and a separate NARX model was deduced for each MLT bin using solar wind variables as the inputs to the NARX model. These models were then conjugated into one spatiotemporal forecast model.