



Empirical model of Equatorial ElectroJet (EEJ) using long-term observations from the Indian sector

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The Equatorial Electrojet (EEJ) is one of the important near-earth space weather phenomena which exhibits significant diurnal, seasonal and solar activity variations. This paper investigates the EEJ variations at diurnal, seasonal and solar cycle time scales from the Indian sector and portrays a new empirical EEJ field model developed using the observations spanning over nearly two solar cycles. The Method of Naturally Orthogonal Components (MNOC), also known as Principal Component Analysis (PCA), was employed to extract the dominant patterns of principal diurnal, semi-diurnal, and ter-diurnal components contributing to the EEJ variation. The amplitudes of these diurnal, semi-diurnal, and ter-diurnal components in EEJ are found to vary significantly with the season and solar activity. The seasonal and solar activity dependencies of these principal components are modeled using suitable bimodal distribution functions. Finally, the empirical model for EEJ field was built by combining the principal components with their corresponding modeled amplitudes. This model accurately reproduces the diurnal, seasonal and solar activity variations of EEJ. The modeled monthly mean variations of EEJ field at ground exhibit excellent correlation of 0.96 with the observations with the root mean square error < 5 nT. It also successfully captures the seasonal and solar activity variations of Counter Electrojet (CEJ). Finally, this model named “Indian Equatorial Electrojet (IEEJ) Model” is made publicly available for interested scientific users (https://iigm.res.in/system/files/IEEJ_model.html).

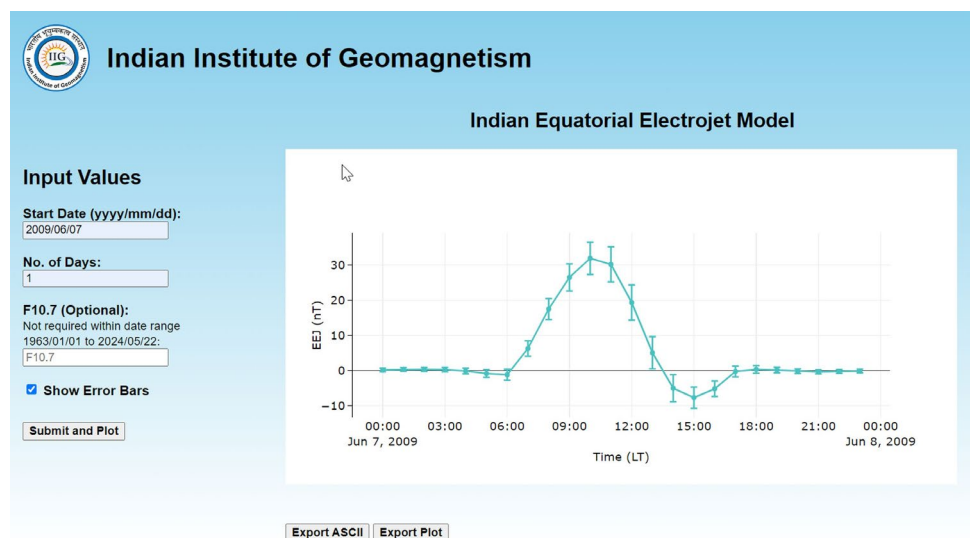


Figure 1. Snapshot of the model's webpage (https://iigm.res.in/system/files/IEEJ_model.html)