

High Intensity Long Duration Continuous Auroral-Electrojet Activity(HILDCAA) in relation to Geomagnetically Induced Current(GIC)

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GIC in the buried pipelines during intense geomagnetic storms has long been a subject of research because of its corroding potentiality to the pipeline material accompanied by the production of telluric current. In this work, for the first time, we have analyzed GIC statistics recorded in Finnish Natural Gas pipeline during three HILDCAA events with different interplanetary sources: CIR storm preceded, ICME storm preceded and Isolated. Despite the weak nature of HILDCAAs in terms of Dst reduction, their cumulative contribution in corrosion process is conjectured to be significant as they occur continuously several days to weeks. Analyzing the result, it is found that continuous fluctuation in GIC is observed throughout the AE intensification during all three events, which corresponds to the alfvanic wave fluctuation during HILDCAAs. However, there is no peak to peak relationship between AE index and GIC. Equivalently, every AE intensification does not necessarily account for the higher GIC amplitudes. We have adopted wavelet analysis and cross correlation methods to study the nature of GIC and its possible correlation with other parameters during HILDCAAs. From discrete wavelet transform we analyzed the singularities associated with the discontinuities present in GIC signal up to the three decomposition levels. Similarly, the result of discrete wavelet transform showed spectral variabilities in GIC with different periodicities.

Keywords: HILDCAA, GIC, Wavelet Analysis, Cross Correlation