



Forecasting geomagnetic storms and GICs from Coronal Holes

Tadhg M. Garton, Peter T. Gallagher, Sean Blake, and Joan Campanya
Trinity College Dublin, Ireland

Solar coronal holes (CH) are regions of open magnetic fields that appear as dark areas on the solar disk in high temperature pass-bands (193\AA) due to their relatively low density and temperature compared to the surrounding closed coronal loops. These regions are associated with fast solar winds that are responsible for variations in the Earth's magnetic field. These variations are known as geomagnetic storms and can cause geomagnetically induced currents (GIC), which can disturb electric power transmission networks. To date, an extensive study of CH properties and associated geomagnetic variations is yet to be performed. Through multivariate statistical methods, such as cluster analysis and principal component analysis, we draw correlations between solar disk CH and geomagnetic storms measured at the Earth's surface, whilst also defining the main parameters that constrain these relationships. By modeling the Irish power transmission network under the influence of CHs, we also quantify the effect of CH to GIC. The provided results help define the main patterns that relate CH and geomagnetic storms, providing valuable information for forecasting geomagnetic storms and GIC caused by coronal holes.