



Spatio-temporal scaling properties of the ground geomagnetic field variations

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Number of earlier studies have demonstrated the scale-free nature of the high latitude temporal magnetic field variations. The majority of these studies have focused on the scaling analysis of auroral geomagnetic activity indices, namely AE, AL and AU indices. The observed scale-free statistics have been associated, for example, with the Self Organized Criticality phenomenon possibly operating in the plasma sheet of the Earth's magnetosphere. However, number of other mechanisms producing the observed statistics have also been proposed.

Recent investigations have revealed the scale-free nature of the auroral phenomenon expressed in terms of auroral emissions. Emissions are produced by the charged particles originating from the magnetic tail of the Earth. These investigations have also shown the importance of the full spatio-temporal, instead of solely temporal or spatial scaling analysis of the data.

In this study, we carry out, for the first time, a spatio-temporal scaling analysis of the high latitude ground geomagnetic field variations. Data from spatially dense, two-dimensional Scandinavian IMAGE magnetometer array are used. The spatio-temporal analysis of the ground magnetic field variations possesses further complications compared, for example, to analysis of the auroral emissions, namely the effects of the field continuation and the geomagnetic induction in the ground. These effects need to be understood before any conclusions from the derived scalings can be made. Here, the distorting effects are investigated in detail and implications of the obtained scalings are discussed.