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Analysis of the Geomagnetic Variations and GPS Scintillations over the Canadian Auroral Zone

Abstract:

A detailed analysis is performed for the geomagnetic data provided by geomagnetic observatories and ionosphere scintillation indices. The hourly ranges (HR) of the geomagnetic field from Canadian geomagnetic observatories in auroral zones: Churchill (58.759° N and 265.912° E), Sanikiluaq (56.5° N and 280.8° E), and Yellowknife (62.480° N and 245.518° E) are compared with the ionosphere scintillations from GPS receivers. For GPS stations co-located with the observatories, variation statistics are computed for mapped-to-zenith absolute mean of delta phase rate over 30 sec (mDPR). For comparison with the hourly range of magnetic data, the maximum of mDPR in each hour (mDPRm) was used in evaluation. The analyses of the data includes multiple regression model of scintillation indices vs three geomagnetic components as well as analyses of the model errors. The essential results are that the correlation between scintillation and geomagnetic indices is larger during night time hours; the regression model is dominated by the Z-component of HR; and to a first approximation, mDPRm index is proportional to the square root of HR. These results may be useful in developing a forecast of GPS scintillation in the auroral zone based on magnetic activity.