A study of variation in horizontal geomagnetic field during geomagnetic substorms at different latitudes.

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Introduction

❑ From the space weather point of view, currents are of interest because they can bring new understanding to the induction phenomena causing problems for technological systems on the ground.

❑ The auroral substorms play an important role in the creation of large GIC (Falayi and Beloff, 2012; Falayi and Rabiu, 2012; Pukkinen et al., 2005; Kappenman, 1996).

❑ The geoelectric field can be determined by the ionospheric current, conductivity structure of the Earth, and the proximity of the power system to the auroral zones. It is important to note, however, that the ionospheric current differs depending on where one is situated on the Earth.

Purpose of the study

❑ To study the interrelationship between the maximum value of time derivatives of the horizontal geomagnetic field (Max dH/dt) and maximum value of horizontal geomagnetic field (Max H). Also, monthly and hourly variations of maximum value of time derivatives of the horizontal geomagnetic field (Max dH/dt) and maximum value of the horizontal geomagnetic field (Max H) were also investigated.

Methodology

The substorm onsets are divided into those that occur during storm time conditions (Dst<−40 nT) were considered and this activity level defines substorm events. 138 substorms events were obtained from IMAGE magnetometer data from Northern Europe, using Dst to determine the substorm events of varying strengths for five stations (Addis Ababa, Abisko, Bangui Hermanus and Nurmijarvi).

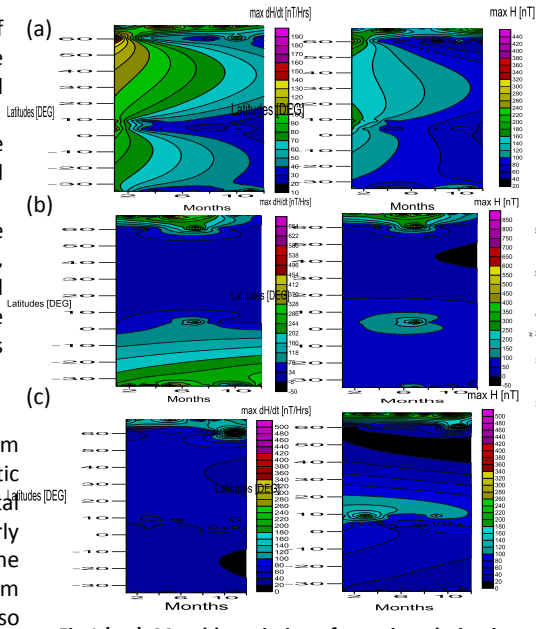

Fig 1 (a-c): Monthly variation of max time derivatives of horizontal geomagnetic field (max dH/dt) and max horizontal component of geomagnetic field (H) for 1999, 2000 and 2001 respectively.

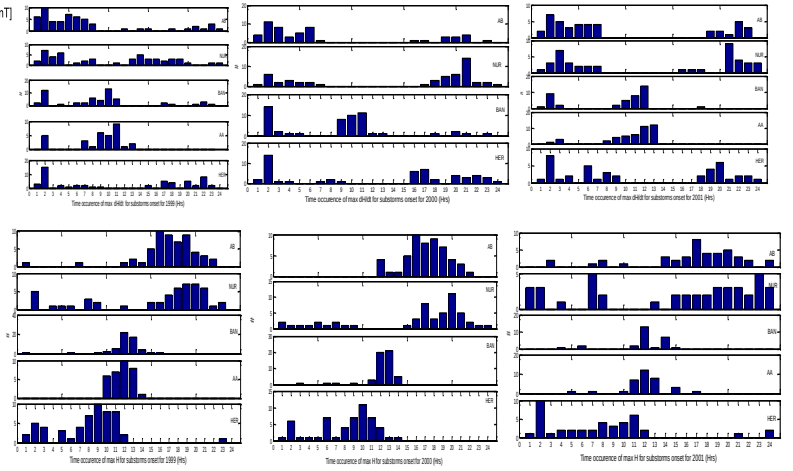

Fig2: Hourly variation of max time derivatives of horizontal geomagnetic field (max dH/dt) and max horizontal component of geomagnetic field (H) for 1999, 2000 and 2001 respectively.

Discussion of Result and Conclusion

❑ Correlation coefficients are high for all the stations. This indicates a strong relationship between the dH/dt and H. The difference clearly shows that the variation may be associated with latitude impulsive disturbance driven by electrojet intensifications.

❑ The values of max dH/dt increases with increasing latitude at the auroral and decreases at toward the equator.

❑ Autumn and Spring have the highest values of max dH/dt and max H due to IMF-effect which increases the solar wind-magnetosphere interaction might also cause more geomagnetic activity during Autumn and Spring, also when the Earth is favorably connected to the solar wind from the active solar regions as equinoctial increase in solar wind speed.

❑ The variability occurrence of max ΔH was noticeable during daytime at local noon of AA and BAN. AA and BAN stations are located in the equatorial region.

❑ Max dH/dt activity is high around the early morning hours and night time hours, vanishes around noon time at high attitudes (Abisko and Nurmijarvi). While max H occurrence for substorm onset occur during the nighttime at Abisko and Nurmijarvi.

❑ Reasons that may be responsible for these nighttime variations amongst includes asymmetric ring currents in the magnetospheric currents, magnetospheric effects like the westward ring current even during fairly quiet periods, also variations due to disturbances suggesting possible non-ionospheric origin.

Table 1: Shows regression analysis of H and dH/dt from 1999-2001

Station	Codes	1999 r	1999 R^2	2000 r	2000 R^2	2001 r	2001 R^2
Addis Ababa	AA	0.7068,	0.4996	-	-	0.6812,	0.4640
Abisko	AB	0.8238,	0.6787	0.6875,	0.4728	0.6956,	0.4838
Bangui	BAN	0.7234,	0.5233	0.9331,	0.8708	0.6722,	0.4186
Hermanus	HER	0.6456,	0.4168	0.6462,	0.4175	0.7765,	0.6030
Nurmijarvi	NUR	0.7079,	0.5037	0.8365,	0.6974	0.8108,	0.6575