THE ABNORMAL QUIET DAYS IN SQ (H) IN MID AND LOW LATITUDES REGIONS

F. N. Okeke

Department of Physics & Astronomy. University of Nigeria. Nsukka

Abstract. From the analysis and study of abnormal quiet days (AQDs) at mid and low latitudes locations, it was found that there is difference between the characteristics of phase variability Sq (H) of the low latitude locations. This suggests that the origin and cause of AQDs are of different sources in the two latitude regions. The AQDs events are independent of local time and could be of extra-terrestrial origin. The lunar contribution as seen from the analysis carried out has insignificant effects on the AQDs in both latitudes.

1. INTRODUCTION

Brown and Williams [1] introduced the concept of AQDs and Brown [2.3] expanded it. AQDs have also been defined as days on which the diurnal maximum of H occurred outside the time interval of 0930-1230 hr LT [1.4]. Butcher [5] and Brown [6.7] also investigated the nature and the causes of AQD events. Brown and Butcher [8] also investigated the features in relation to its application to the prediction of the forthcoming sunspot maximum. Last et al. Sastri [9] also carried out some studies on AQDs in a low latitude region. Sastri [10] carried out similar work to that of Brown and Williams [1] using data of equatorial stations showing that the morphology of AQDs at these latitudes are distinctly different from that of mid-latitudes. They concluded that the difference in the characteristics of the phase variability of Sq (H) between equatorial and mid-latitudes locations suggests that the origin of the AQDs is different in the two regions. In this paper. it is of interest to inquire whether there is any difference in the characteristics of the phase variation between mid-latitude and low latitude locations. It is also important to investigate if there is significant contribution due to lunar effect.

2. DATA ANALYSIS

The published hourly values of H recorded at the Tesino geomagnetic observatory in 1992 [geomag. lat. 46.2°N. geo. long. 11.7° and at geomag. lat 46.5°N geomag. long. 93.5°] and at Alibag [geo. lat. 18.63°N. geo. long. 72.87° and geomag. lat. 9.5°N and geomag. long. 143.6°E] were used as the mid and low latitude locations respectively. The mean hourly values of H were evaluated for all the months of the year for all the international chosen quiet days. Since these H values contain contributions from both solar quiet. daily variations due to lunar effects were filtered out using the Fourier series analysis of each daily variation. after [10]. The resultant variation left is due mainly to the solar quiet daily variation in Sq (H).

The horizontal component of the solar quiet daily variation at the station is expressed in the Fourier series as follows:

$$f(t) = a_0 + a_1 \cos \omega t + b_1 \sin \omega t + \ldots a_3 \cos \omega t + b_3 \sin \omega t + a_4 \cos \omega t + b_4 \sin \omega t \tag{1}$$

where a_0. a_n and b_n are defined in equation (2) and n runs from 1 to 4 in determining the harmonic coefficients a_1. a_2. a_3. a_4. and b_1. b_2. b_3. b_4.

$$a_0 = \frac{1}{24} \sum_{t=1}^{24} H(t)$$

$$a_n = \frac{1}{12} \sum_{t=1}^{24} H(t) \cos n\omega t \tag{2}$$

$$b_n = \frac{1}{12} \sum_{t=1}^{24} H(t) \sin n\omega t$$

The published hourly values of H from one to twenty-four are used. Then by applying the Fourier series. the values of $f(t)$ H were obtained for the mid and low latitude stations.

From the definition of AQDs according to [1.4]. these are days on which the diurnal maximum of H occurred outside the time interval 0930 - 1230 hr LT. This paper is using this definition of AQDs.

The AQDs occurred in the months of August on the 14th and 17th day between 15-20 hr LT and 15-16The AQDs occurred in the months of August on the 14th and 17th day between 15-20 hr LT and 15-16 hr LT respectively in the low latitude region (see Table 1). It also occurred in the months of September and December on the 5th between 15-16 hr LT and on the 28th and 29th day of

3. DISCUSSION

The AQDs occurred in the months of August on the 14th and 17th day between 15-20 hr LT and 15-16 hr LT respectively in the low latitude region (see Table 1). It also occurred in the months of September and December on the 5th between 15-16 hr LT and on the 28th and 29th day of December between 02-05 hr LT and 05 hr LT respectively.

On the other hand, in the mid-latitude stations in almost all the months, the AQDs occurred between 20 hr LT and 02 hr LT. Except for the month of December where there is no clearly defined diurnal maximum of H outside the time interval of 0930-1230 hr LT (Table 2). There is clear evidence of difference in the characteristics of the phase variability of Sq (H), between the mid- and low latitude regions. They are somewhat out of phase. Finally it is clear that the lunar contribution has no significant effect on the AQDs variation.

4. CONCLUSION

The local time variation and spatial extent of the difference between the mid-latitude and low latitude stations suggests that the origin of AQDs is of different sources in the two latitude regions. AQDs event is independent of local time and should be of extra-terrestrial origin. The contribution due to lunar effect is not significant.
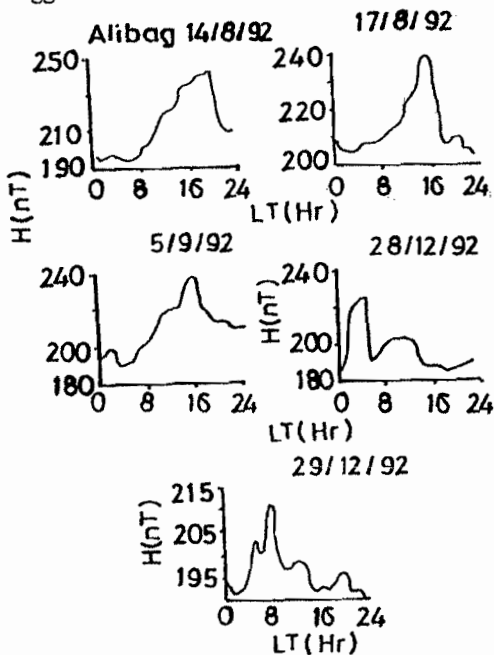
Acknowledgements

Fig.1: Abnormal quiet days variations of H for low-latitude station 1992

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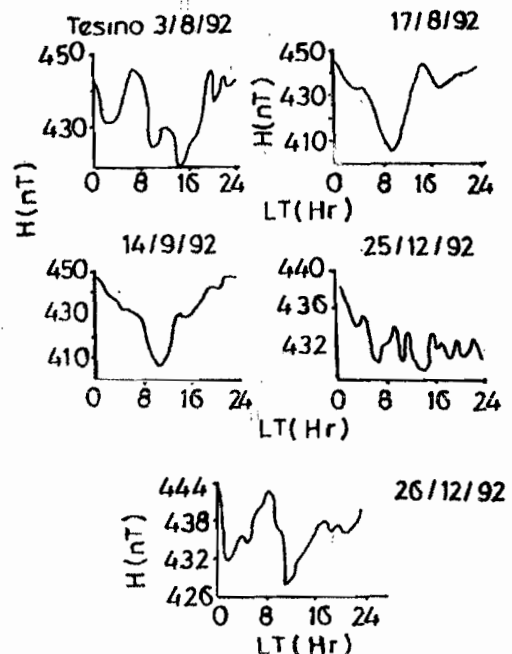10. Chapman, S, and Bartels, J. (1940): Geomagnetism, Claredon Press, Oxford.

Fig.2: Abnormal quiet days variations of H for mid-latitude station 1992