Solar Quiet [H] Field Characteristics at Alibaug India, During Solar Cycle 23

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***Abstract*: Quiet day's variations in the Earth's magnetic field [Sq current system] are analysed for the Alibaug sector using the data derived from World Data Centre.**
This is the presentation of the variation of the Earth's magnetic field [Sq-H] during the solar cycle 23, at Alibaug [geographic latitude 18.62^0 and longitude 72.87^0 and geomagnetic latitude 10.36^0 and longitude 146.54^0]. Alibaug observatory is located in Maharastra, India, as a function of solar cycle and seasons. At Alibaug, the solar cycle variation of the amplitude of the daily variation of the H component is correlated to the F.10.7 cm solar radiation 0.74. This correlation factor is greater than the correlation factor obtained in two observatories located at the same magnetic latitudes in other longitude sectors: at Tamanrasset in the African sector 0.42, geographic latitude 22.79^0 and San Juan in the American sector 0.03, geographic latitude 18.38^0.

***Keywords*: F.10.7 index, Solar cycle, Solar Quiet (Sq.)**

INTRODUCTION:

SOLAR CYCLE:-

The solar cycle or solar magnetic activity cycle has a period of about 11 years. The cycle is observed by counting the frequency and placement of sunspots visible on the Sun. Solar variation causes changes in the space weather and to some degree weather and climate on the Earth. It causes a periodic change in the amount of irradiation from the Sun that is experienced on the Earth.

SOLAR RADIO FLUX:

Emission from the Sun at (radio) wavelength is due primarily to coronal plasma trapped in the magnetic fields overlying active regions. The F10.7 index is a measure of the solar radio flux per unit frequency at a wavelength of 10.7 cm, near the peak of the observed solar radio emission. F10.7 is often expressed in SFU or solar flux units. It represents a measure of diffuse, non radiative heating of the coronal plasma trapped by magnetic fields over active regions, and is an excellent indicator of overall solar activity levels. The solar F10.7 cm record extends back to 1947, and is the longest direct record of solar activity available, other than sunspot-related quantities.
Sunspot activity has a major effect on long distance radio communications particularly on the shortwave bands although medium wave and low VHF frequencies are also affected. High levels of sunspot activity lead to improved signal propagation on higher frequency bands, although they also increase the levels of solar noise and ionospheric disturbances. These effects are caused by impact of the increased level of solar radiation on the ionosphere.
It has been proposed that 10.7 cm solar flux can interfere with point-to-point terrestrial communications.

SOLAR CYCLE 23:

Solar cycle 23 was the 23rd solar cycle since 1755, when recording of solar sunspot activity began. The solar cycle lasted 12.6 years, beginning in May 1996 and ending in December 2008. The maximum smoothed sunspot number [monthly number of sunspots averaged over a twelve month period] observed during the solar cycle was 120.8, and the minimum 1.7. There were a total of 805 days with no sunspots during this cycle.

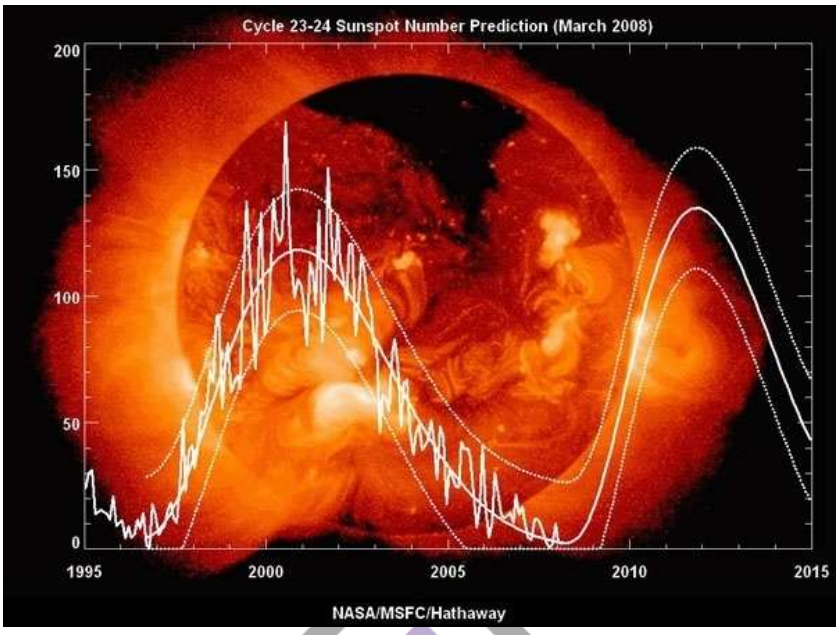


Figure 2: Solar Cycle 23 [1996-2008]

SQ CURRENT FORMATION & SOURCE:

Since several centuries the Earth's magnetic field is the object of scientific studies in various topics of geophysics as it integrates the influence of many physical processes. The Earth's magnetic field data were used and are still used to study ionosphere electric currents, magnetosphere electric currents, as well as atmospheric tides, ocean tides, seismicity etc. in this report we are concerned by the mean daily regular variation of Earth's magnetic field Sq observed during magnetic quiet days.

The existence of a conductive layer around the Earth was established by ionosonde and later on by rocket. In the past and still now the Sq variations were and are still intensively analyzed in all longitude sectors. The Sq field strongly varies as a function of latitude and longitude. It is important to recall here that the equivalent current systems Sq deduced from ground magnetic variations is only a proxy of real ionosphere electric currents. Sq is based on the assumption of 2-D planetary cells.

Large scale [time and space], equivalent current systems Sq are a good tool to study large scale ionospheric electric currents. In this work we analyze the Sq-H of Alibag [India] during the solar cycle 23 in order to characterize it.

RESULTS:

DATA SET & DATA ANALYSIS:

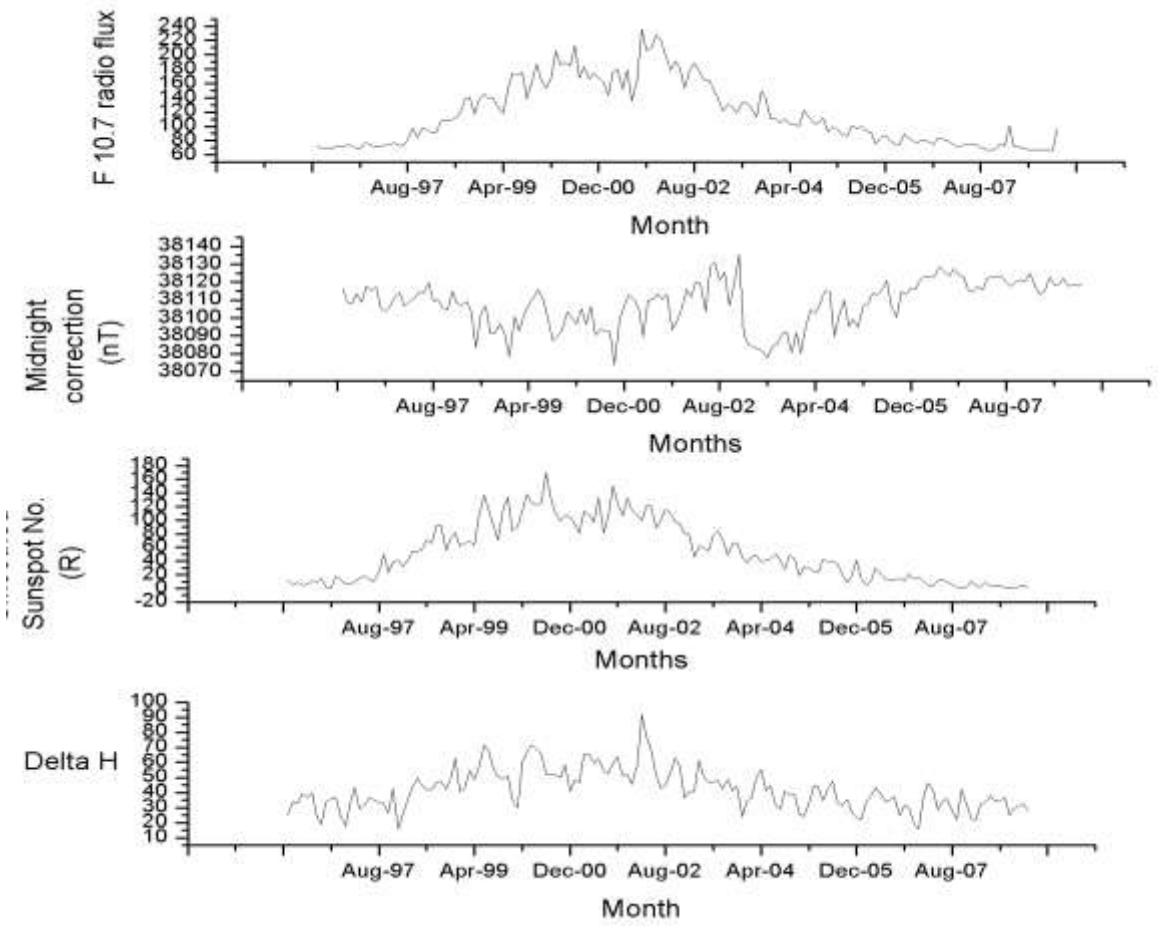
The data used are the daily regular variation of the Earth's magnetic field recorded at Alibag during the solar cycle 23 (lasting from 1996 to 2006). The data of H component of earth's magnetic field during the five quite solar days of each month was collected from (http://www.wdciig.res.in/select1.asp). The monthly averaged sunspot and radio flux data were collected from (http://cdaweb.gsfc.nasa.gov).

In data analysis we have done the following steps:

1) First we arranged the data and setup the readings in local time (LT) of Alibag observatory which were in the universal time (UT) format.
2) We took the data of first five geomagnetic quite days of each month of solar cycle 23.
3) We did the mid-night correction. In the magnetosphere currents are also present during the night time. So to avoid their effect we did the night time correction (ΔH). The average H value of 23:00 and 00:00 hr used.
4) The following variations studied in this work:

a) Sunspots no. Vs solar cycle period.
b) [ΔH] Vs solar cycle period.
c) $F_{10.7}$ solar flux Vs solar cycle period.
d) Area of delta H Vs solar cycle period.

Following graphs shows a good correlation between the corresponding parameters:



CONCLUSIONS:

I) During the solar maximum degree of ionisation in the ionosphere increases hence as a result sq field also enhances. Analysing the relation of Solar Cycle vs Sq Field variation [ΔH], we found the correlation of 0.77 between them which can be expected.

Rest of the co-relations are as follows:

a) Correlation coefficient between midnight time correction & F.10.7 index is -0.36906.

b) Correlation coefficient between delta H & F.10.7 index is 0.75223

REFERENCES:

[1] Data from World Data Centre

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