

SUMMARY OF REPORT
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A WAVELET APPROACH TO VARIATIONS IN THE SOLAR ACTIVITY AND SPACE WEATHER

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Solar wind can affect the geomagnetic environment, producing different geomagnetic phenomena which can be detected or observed on earth's surface. Any variations in the solar activity, whether periodic or otherwise, are well reflected in the solar wind parameters. Solar wind velocity, particle density, interplanetary magnetic field (IMF) carried by the solar wind, etc. are affected at active times. Solar wind, being an electrified magnetised bunch of particles, definitely affects the geomagnetic field too.

The main objective of the study was to identify various periodicities in solar variations and in space weather parameters. Solar wind parameters like velocity, particle density, interplanetary magnetic field, etc., and space weather parameters like the geomagnetic field (reflected by AE, AL and Dst indices) were used.

The time series data was analyzed using Fourier and wavelet transforms.

Major Findings of the Study

The major findings of the study, based on the analysis of the data, are summarized below.

1. While considering a solar wind parameter time series of nearly 50 years, it is evident that three groups of fluctuations will be seen, the long-term, medium-term and short-term peaks. The long and medium periods are having a transit limit of about 1 year while medium and short periods are having a transit limit of nearly 27 years
2. Most of the geomagnetic indices and solar wind parameters show characteristic peaks at 11, ~5.5, and ~1.1 years.

3. Auroral indices such as AE and AL and Disturbance storm time index (Dst) are having significant peaks at 11 years, 5 years, 1 year, 180 days, 27 days, 13.5 days, 8.8 days and 6.6 days along with a diurnal peak.
4. The spectral widths of short periods are narrow in IMF B_z and wider in other solar wind parameters. The short term oscillations are more pronounced during the sunspot maximum while in solar wind parameters, they are stronger during the descending phase of solar cycle.

Studies on Space weather processes and a possible prediction mechanism are of great significance. Space weather events cause very high magnetic fields, particle fluxes, electric currents, etc. in the near earth space. All the artificial satellites used for communication, forecasting, remote sensing, etc., thus, have great risk of being in the exposed outer space, where the space weather events can easily strike. This will cause damage, either completely or partially, to the satellite electronics and solar panels, resulting in huge loss. Human life today is very much dependent on satellites. Social needs of long distance communication, agriculture, weather forecasting, etc. are almost impossible without satellites. India is one of the pioneers in satellite technology and has large number of satellites in orbits for different purposes. Present study will enhance our ideas of possible risks and precautionary measures to the satellite world. This in turn will contribute to the enhancement of social and technological status of the people.

Other space weather impacts like damages to electric and telecommunication installations over earth, risks to air passenger, etc. are also of great concern. And studies on space weather will add to develop measures for prediction and reduction of these risks.