Solar Activities and Its Impact on Space Weather

Article *in* Proceedings of the International Astronomical Union · February 2018

DOI: 10.1017/S1743921318001606

4 authors:

Drabindra Pandit
St. Xavier's College
23 PUBLICATIONS 8 CITATIONS

N. P. Chapagain
Tribhuvan University
129 PUBLICATIONS 593 CITATIONS

Binod Adhikari
St. Xavier's College
103 PUBLICATIONS 316 CITATIONS

Roshan Kumar Mishra
University of Maryland, Baltimore County
33 PUBLICATIONS 72 CITATIONS

Long-Term Datasets for the Understanding
of Solar and Stellar Magnetic Cycles
Proceedings IAU Symposium No. 340, 2018
D. Banerjee, J. Jiang, K. Kusano & S. Solanki, eds.

doi:10.1017/S1743921318001606

Solar Activities and Its Impact on Space Weather

Drabindra Pandit[1,2,3], Narayan P. Chapagain[2], Binod Adhikari[1,3] and Roshan K. Mishra[1]

[1]Dept. of Physics, St. Xavier's College, Tribhuvan University
Maitighar, Kathmandu, Nepal

[2]Dept. of Physics, Patan Multiple Campus, Tribhuvan University
Patandhoka, Lalitpur, Nepal

[3]Central Dept. of Physics, Tribhuvan University
Maitighar, Kathmandu, Nepal

email: drabindrapandit087@gmail.com, npchapagain@gmail.com, binod.adhi@gmail.com, roshanmishra.phy@gmail.com

Abstract. The Sun is an active star and its magnetic field fluctuates from a fraction of a second to a long period of time. The solar wind, CME, solar prominence, solar flares, solar particle and solar filament are the direct result of solar magnetic activity effects on the interplanetary space, Earth's magnetosphere and ionosphere. The intensity of irruption of these phenomena from the Sun's surface depends upon its phases. The extreme events affect technology both in space and on the ground.The data obtained from series of observations can help to predict solar activities and safekeeping to the space technology. In this study the cross correlations between IMF Bz, solar wind velocity(Vsw) and interplanetary electric field(Ey) with AE and SYM-H are studied. The results reveal that strong geomagnetic disturbances have high impact on the components of space weather than weak disturbances have.

Keywords. Interplanetary space, Earth's magnetosphere, Geomagnetic disturbances etc.

1. Introduction

The Sun has nearly 11 year of solar cycle which has maximum, minimum, ascending and descending phases. It is more active during maximum phases of solar cycle where it has maximum sunspots number and during minimum phases it is less active and has minimum number of sunspots. During active phases of the Sun tremendous amount of plasma and magnetic field are released into interplanetary space (Parker 1958), which interacts with the Earth's magnetosphere and a part of plasma particles and their kinetic energy enters into magnetosphere resulting into geomagnetic storm (Gonzalez *et al.*, 1987),substorm, auroral and Australian borealis in the northern and southern sky respectively that ultimately affect the technology borne in space or on the ground (Eastwood *et al.*, 2017). The parameters used to study their strength are solar wind parameters and geomagnetic indices (Adhikari *et al.*, 2017).

2. Result and Discussion

During intense magnetic storm the southward component of interplanetary magnetic field (IMF Bz) is strong and there occurs magnetic reconnection between this field and geomagnetic field, which produces open field lines, allowing mass, energy and momentum pervade into the Earths magnetosphere. Such events affect more on intense storm day than during quiet day.

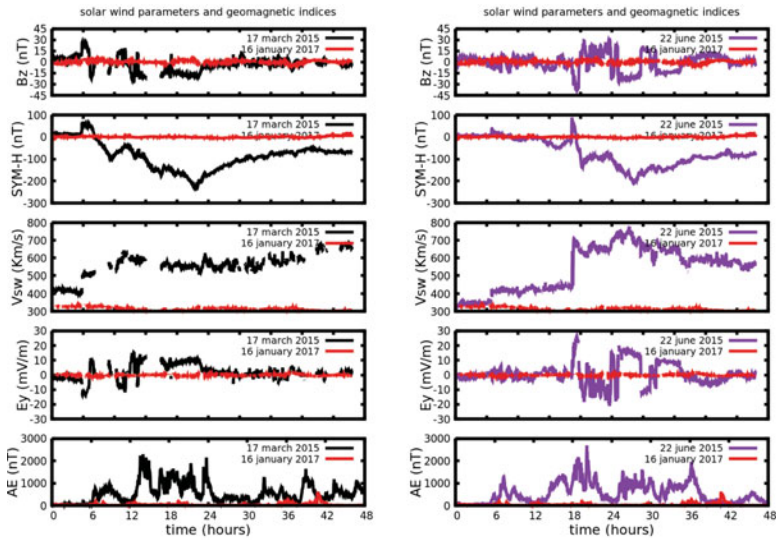

Figure 1. The panel from top to bottom show the variation of interplanetary magnetic field (Bz in nT), SYM-H (nT), solar wind speed (Vsw in Km/s), interplanetary electric field (Ey in mV/m), Aurora index (AE in nT) on 17 March 2015 intense storm and 16 January 2017 quiet day (left) and 22 June 2015 intense storm and 16 January 2017 quiet day (right) respectively.

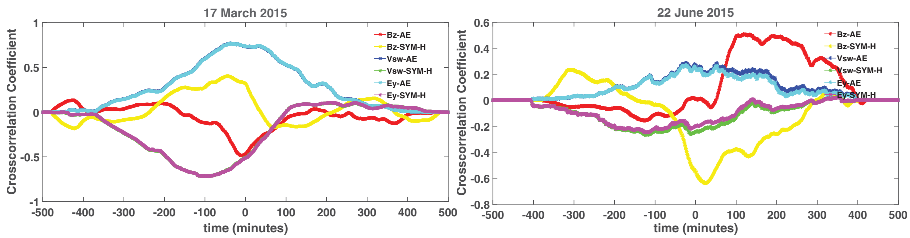

Figure 2. Showing variation in cross-correlation coefficients versus time(min) for Bz(nT)-AE(nT), Bz(nT)-SYM-H(nT), Vsw(Km/s)-AE(nT), Vsw(Km/s)-SYM-H(nT), Ey(mV/m)-AE(nT), Ey(mV/m)-SYM-H(nT) on 17 March 2015 (left) and 22 June 2015 (right) respectively.

3. CONCLUSION

During geomagnetic storms, the interaction occurs between the Sun's and the Earth's magnetic field. Energy and charged particles are injected into the Earth's magnetosphere, which decrease the Earths magnetic field and affect the ground and space-based technologies. It is also found that cross correlations between Vsw-AE and Ey-AE are positive and between Ey-SYM-H is negative whereas the cross correlations between Bz-AE, Bz-SYM-H and Vsw-SYM-H vary with time, taking positive and negative values.

References

Parker, E. N. 1958, *Astrophysical Journal*, 128, 664

Gonzalez, W. D. & Tsurutani, B. T. 2018, *Planet Space Sci.*, 1987, 35,1101

Eastwood, J. P., Biffis, E., Hapgood, M. A., Green, L., Bisi, M. M., Bentley, R. D.,Wicks, R., Mckinnell, L. A., & Gibbs, M. and Burnett, C. 2017, *Risk Analysis*, 2

Adhikari, B., Mishra, R. K., Pandit, D., & Bhatterai, B., Chapagain N. P. 2017, *JIST*, 22 (1), 45