RESEARCH PAPER | Physics | Volume : 2 | Issue : 1 | October 2012 | ISSN - 2249-555X

Super Strong Geomagnetic Storms and their Relation with Energetic Solar Features and Disturbances in Solar wind Plasma Parameters

KEYWORDS | Geomagnetic Storms. Halo and Partial Halo Coronal Mass Ejections. Interplanetary Shocks

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ABSTRACT *Coronal mass ejections are most energetic solar events that eject huge amount of mass and magnetic fields into the heliosphere and are widely recognized as being responsible to generate storms in solar wind plasma parameters and geomagnetic storms in the magnetosphere of the earth. We have studied geomagnetic storms≤-125nT observed during the period of 1997-2011 with coronal mass ejections, X ray solar flares and disturbances in solar wind plasma parameters. We have obtained scatter plots between magnitude of super strong geomagnetic storms with magnitude of peak values of southward component of Interplanetary Magnetic Field (IMFBz), total IMF B, peak values of solar wind velocity and pressure. We have found that 92.68% super strong geomagnetic storms are associated with halo and partial halo coronal mass ejections .Positive correlation has been found between magnitude of super strong geomagnetic storms and speed of associated coronal mass ejections . From the study of super strong geomagnetic storms and disturbances in interplanetary magnetic field, solar wind velocity and pressure. We have determined positive co-relation between magnitude of super strong geomagnetic storms and peak values of total IMF B and southward component of interplanetary magnetic field Bz with correlation coefficient 0.65, 0.71 respectively. Positive correlation has also been found between magnitude of super strong geomagnetic storms and peak values of solar wind plasma velocity and pressure with correlation coefficient .43, 38 respectively.*

INTRODUCTION

The geomagnetic disturbances are the current topic of research because of scientific interests and practical reasons [2]. Progress in their study and understanding during last dozen years is very impressive due to efforts of many groups and individuals. The important contribution to the new information about physical conditions on the Sun, in the interplanetary space and in magnetosphere system related to large geomagnetic disturbances during 23rd solar cycle has been obtained in Russia using satellites [11].Several scientists have tried to establish relation between properties of various solar features, their interplanetary manifestations and their interplanetary and geomagnetic effects. They have inferred that the major classes of solar activity tend to track the sunspot number during the cycle, including, radio burst, calcium plages, solar flares, filaments, and coronal mass ejections (CMEs) [15]. These solar features are most energetic solar events in the heliosphere and are widely recognized as being responsible for production of large disturbances in solar wind, transient interplanetary shocks and geomagnetic disturbances in geomagnetic field [1,3]. Coronal mass ejections (CMEs) from the Sun are the dominant interplanetary phenomena that cause magnetic disturbances at the Earth. The CMEs, depending on their shock front velocities, can compress the dayside magnetosphere up to a few Earth radii, but their geoeffectiveness is more associated with an intense southward interplanetary magnetic field (IMF) component, which permits an efficient transfer of energy from the perturbed solar wind to the Earth magnetosphere through magnetic reconnection [5]. A detailed analysis about the ability of CMEs to generate geomagnetic disturbances has been made by Cane et al [3] .They have showed that CMEs which are Earth directed and have an intense southward magnetic field component can produce geomagnetic disturbances .They have also concluded that , only about 50% of the Earth-directed CMEs are responsible for moderate to intense magnetic storms[3,16]. Geomagnetic disturbances are also intensified when there is a superposition of two or more CMEs with intense and long duration south magnetic component [6]. Some scientists have studied ICMES and geomagnetic disturbances and observed a strong association between interplanetary CMEs and interplanetary shocks [9] and interplanetary shocks and interplanetary shocks and resulting geomagnetic disturbances . Liu, et al [8] has analyzed active regions to explore the relationship between magnetic configurations of active regions and geomagnetic disturbances. Each active region was found to be associated with multiple full-halo coronal mass ejections (CMEs). They have demonstrated that, although full-halo CMEs may originate from the same active region, it is not necessary for them to have similar geoeffectiveness, depending on the magnetic configurations actually involved in the corresponding flare activities. This implies that (1) the flares, CMEs, and geomagnetic disturbances are closely related magnetically, as already suggested by many others scientists .Correiaa and de Souzaa [4] have present the identification of solar coronal mass ejection (CME) sources for selected major geomagnetic storms(disturbance storm index–Dst≤100 nT). They have inferred that full halo CMEs originating from active regions associated with X-ray solar flares and propagating in the western hemisphere, cause strong geomagnetic disturbances. Mcallister. and Crooker. [10] have studied effects of solar and heliospheric phenomena on geomagnetic field .They have analyzed geomagnetic activity index, Dst, solar wind data, and solar coronal images. Most of the geomagnetic disturbances are found to be associated with passage of the sector boundaries in the interplanetary magnetic field .Some scientists have investigated the conditions in the solar wind, which cause magnetic disturbances [17,18].In the usual quasistationary solar wind the magnetic field lies in the ecliptic plane and it does not contain at all a considerable and long-term Bz component of the IMF sufficient for inducing a magnetic disturbances . However, some disturbed types of the solar wind streams and, first of all, such as magnetic clouds (MC) and compression regions at the boundary of a slow and fast streams of the solar wind (the co- rotating interaction region—CIR), can contain a large and prolonged Bz component of the IMF, including that of southward orientation, which results in the magnetic disturbances(17,18,7 ,13] .Several investigators have studied geomagnetic disturbances with various solar and heliospheric phenomena and inferred that CMEs associated with solar flares seem to be more geoeffective Wang, et al [16] .Shrivastava [12] have examined the solar origin of the geoeffective CMEs and their interplanetary effects, namely solar wind speed, interplanetary shocks and the southward component of the interplanetary parameters. They have found that full halo CMEs associated with strong flares and originating from a favorable location, i.e. close to the central meridian and low and middle latitudes are the most effective for producing intense geomagnetic disturbances .Yurchyshyn et al [19] have studied structure of magnetic field in NOAA active regions associated interplanetary ejecta and geomagnetic storms they have found good correlation between speed of CMEs and strength of magnetic field in an interplanetary ejecta and magnitude of geomagnetic disturbances .They have also found good correspondence between directions of the helical magnetic fields in interplanetary ejecta in the source active regions .They have concluded that CME speed appears to be associated with the strength of the IMF and thus the magnitude of the geomagnetic storms. Veselovsky et al [14] have briefly present the selected results obtained up to now by the Russian scientific groups regarding powerful solar ejections as main causes of geomagnetic disturbances in the near-Earth space. They have inferred that the strongest perturbations on the Sun and in the near-Earth space responsible for large geomagnetic disturbances. In this investigation I have studied super strong geomagnetic storms≤ -125nT for the period of 1997 to 2011 with coronal mass ejections,X-ray solar flares, disturbances in solar wind plasma parameters to know the physical process mainly responsible to generate super strong geomagnetic storms.

II-Experimental Data

In this investigation hourly Dst indices of geomagnetic field have been used over the period 1997 to 2007 to determine onset time, maximum depression time, magnitude of geomagnetic storms. This data has been taken from the NSSDC Omni web data system which been created in late 1994 for enhanced access to the near earth solar wind, magnetic field and plasma data of omni data set, which consists of one hour resolution near earth, solar wind magnetic field and plasma data, energetic proton fluxes and geomagnetic and solar activity indices. The data of coronal mass ejections (CMEs) have been taken from SOHO – large angle spectrometric, coronagraph (SOHO / LASCO) and extreme ultraviolet imaging telescope (SOHO/EIT) data. To determine disturbances in interplanetary magnetic, hourly data of average interplanetary magnetic field has been used, these data has also been taken from Omni web data(http;//omniweb.gsfc.nasa.gov/form/dxi.html)). The data of X ray solar flares radio bursts, and other solar data, solar geophysical data report U.S. Department of commerce, NOAA monthly issue and solar STP data (http://www.ngdc.noaa.gov/stp/solar/solardataservices.html.) have been used.

Table No 1-Association of Super strong geomagnetic storms with coronal mass ejections and X-ray solar flares observed during the period of 1997-2011

	Geomagnetic Storms ≥-125 nT			S0lar Flares		CMES			
S. NO.	Date	Onset time in dd(hh)	Magnitude in nT	Start time in dd(hh)	Class	Date	types H/P	Speeds km/ sec.	
1	02.05.98	02(09)	-203	29(17)	M-68	29(16.58)	H	1374	
2	06.08.98	06(02)	-139	03(04)	B-57	nd	nd	nd	
3	26.08.98	26(11)	-143	23(09)	M-22	nd	nd	nd	
4	25.09.98	25(00)	-203	23(07)	M-71	nd	nd	nd	
5	07.11.98	07(11)	-139	05(03)	C-54	05(02.02)	H	380	
6	08.11.98	08(20)	-126	05(19)	M-84	05(20.24)	H	1118	
7	13.11.98	13(00)	-129	10(07)	C-33	10(06.18)	P	286	
8	18.02.99	18(03)	-125	16(03)	M-32	na	na	na	
9	22.09.99	22(18)	-182	20(06)	C-28	20(06.06)	H	604	
10	22.10.99	22(00)	-214	19(05)	C-29	19(05.50)	P	753	
11	11.02.00	11(07)	-132	08(09)	M-13	08(09.30)	H	1079	
12	06.04.00	06(16)	-282	04(15)	C-97	04(16.32)	H	1188	
13	24.05.00	24(00)	-151	22(01)	C-63	22(01.50)	H	649	
14	15.07.00	15(15)	-308	14(10)	X-57	14(10.54)	H	1674	
15	12.08.00	12(01)	-214	09(15)	C-23	09(16.30)	H	702	
16	17.09.00	17(20)	-197	16(04)	M-59	16(05.18)	H	1215	
17	03.10.00	03(23)	-156	30(18)	M-10	30(18.06)	P	703	
18	28.10.00	28(21)	-126	25(09)	C-40	25(08.26)	H	770	
19	05.11.00	05(10)	-150	03(19)	C-32	03(18.26)	H	291	
20	26.11.00	26(22)	-127	24(15)	X-23	24(15.30)	H	1254	
21	19.03.01	19(11)	-150	18(04)	B-58	18(02.26)	H	752	
22	31.03.01	31(04)	-379	28(02)	M-17	28(01.27)	H	427	
23	11.04.01	11(15)	-269	09(15)	M-79	09(15.54)	H	1192	
24	21.10.01	21(16)	-178	19(01)	X-16	19(01.27)	H	558	
25	28.10.01	28(01)	-142	25(15)	X-13	25(15.26)	H	1092	
26	05.11.01	05(19)	-297	04(16)	X-10	04(16.35)	H	1810	
27	24.11.01	24(06)	-223	22(20)	M-38	22(20.30)	H	1443	
28	17.04.02	17(11)	-149	15(03)	M-12	15(03.50)	H	720	
29	06.09.02	06(09)	-159	04(14)	C-16	04(13.31)	P	513	
30	01.10.02	01(04)	-156	30(02)	M-21	na	na	na	
31	16.06.03	16(10)	-136	14(05)	M-15	14(05.30)	P	1215	
32	17.08.03	17(17)	-171	14(22)	C-46	14(20.06)	H	378	
33	28.10.03	28(06)	-384	27(08)	M-27	27(08.30)	P	1322	
34	20.11.03	20(02)	-461	18(09)	M-45	18(08.05)	H	1660	
35	22.01.04	22(05)	-144	20(07)	M-61	20(00.06)	H	965	
36	24.07.04	24(11)	-198	22(06)	M-91	na	na	na	
37	07.11.04	07(20)	-376	04(09)	C-63	04(09.54)	H	653	
38	07.05.05	07(20)	-126	05(20)	C-78	05(20.30)	H	1180	
39	15.05.05	15(05)	-293	13(16)	M-80	13(17.12)	H	1689	
40	29.05.05	29(22)	-150	26(13)	B-75	26(15.06)	H	586	
41	24.08.05	24(08)	-219	22(01)	M-26	22(01.31)	H	1194	
42	31.08.05	31(12)	-138	29(18)	B-56	29(10.54)	H	1600	
43	11.09.05	11(02)	-127	09(19)	X-62	09(19.48)	H	2257	
44	14.12.06	14(21)	-143	13(02)	X-34	13(02.54)	H	1774	
-No any super strong geomagnetic storms has been observed from the period of 14-12-2006toDec2011									

These data (http://www.ngdc.noaa.gov/stp/solar/solardataservices.html.)

Volume : 2 | Issue : 1 | October 2012 | ISSN - 2249-555X

Table No 2-Association of Super strong geomagnetic storms with disturbances in solar wind plasma parameters observed during the period of 1997-2011

Geomagnetic Storms ≥-125 nT			IMFB (nT)		IMFBz (nT)		VELOCITY		PRESSURE	
Date	Onset time in dd(hh)	Magnitude in nT	Start time in dd(hh)	Maximum IMF	Start time in dd(hh)	Maximum IMF	Start time in dd(hh)	Maximum velocity in Km/s	Start time in dd(hh)	Maximum Pressure npa
02.05.98	02(09)	-203	01(21)	20.5	02(03)	-11.6	01(10)	651	01(20)	9.48
06.08.98	06(02)	-139	06(02)	21.3	06(02)	-19.3	06(01)	428	06(01)	11.26
26.08.98	26(11)	-143	26(04)	18.9	26(21)	-10.2	26(01)	847	26(05)	6.53
25.09.98	25(00)	-203	24(21)	28.7	25(01)	-17.9	24(23)	839	24(23)	12.55
07.11.98	07(11)	-139	07(19)	35.4	07(22)	-19.7	07(07)	537	07(07)	7.41
08.11.98	08(20)	-126	07(20)	35.4	07(20)	-11.6	08(01)	639	08(02)	14.39
13.11.98	13(00)	-129	12(22)	20.2	13(00)	-16.6	12(14)	412	12(14)	9.69
18.02.99	18(03)	-125	18(00)	28.3	18(05)	-21.8	17(22)	673	18(00)	10.68
22.09.99	22(18)	-182	22(10)	8.7	22(23)	-4.4	22(08)	602	22(11)	18.55
22.10.99	22(00)	-214	21(00)	35.8	21(23)	-30.7	21(09)	504	21(22)	27.54
11.02.00	11(07)	-132	11(23)	20.6	12(07)	-16.4	11(02)	505	11(01)	4.36
06.04.00	06(16)	-282	06(10)	31.4	06(16)	-27.3	06(15)	589	06(12)	19.6
24.05.00	24(00)	-151	23(15)	32.1	23(16)	-24.1	23(16)	631	23(16)	27.97
15.07.00	15(15)	-308	15(08)	51.9	15(17)	-49.4	15(13)	1010	15(12)	30.15
12.08.00	12(01)	-214	11(17)	33.6	12(05)	-28.7	11(16)	671	11(20)	10.34
17.09.00	17(20)	-197	17(14)	39.5	17(15)	-23	17(15)	839	17(13)	25.54
03.10.00	03(23)	-156	03(00)	18.4	04(03)	-20.2	02(23)	461	03(16)	4.09
28.10.00	28(21)	-126	28(18)	18.8	28(09)	-16.5	28(05)	415	28(18)	11.35
05.11.00	05(10)	-150	04(23)	14.2	04(15)	-5	04(11)	594	04(18)	3.66
26.11.00	26(22)	-127	26(08)	27.7	26(21)	-10.8	26(03)	623	26(11)	23.61
19.03.01	19(11)	-150	19(09)	21.5	19(23)	-18.8	19(08)	490	na	na
31.03.01	31(04)	-379	30(21)	47.1	31(03)	-44.7	30(19)	716	31(02)	38.76
11.04.01	11(15)	-269	11(09)	34.5	11(18)	-20.5	11(12)	732	11(10)	24.47
21.10.01	21(16)	-178	21(13)	28.4	21(16)	-16.4	21(10)	676	21(13)	26.9
28.10.01	28(01)	-142	27(22)	19.5	27(22)	-14.5	28(01)	502	27(23)	5.29
05.11.01	05(19)	-297	05(12)	65.6	06(18)	-64	05(14)	426	05(17)	14.39
24.11.01	24(06)	-223	24(04)	56.9	24(10)	-27.8	24(03)	946	24(02)	70.02
17.04.02	17(11)	-149	17(07)	30.4	17(07)	-18.1	27(06)	611	17(09)	14.84
06.09.02	06(09)	-159	na	na	na	na	05(12)	457	05(12)	1.8
01.10.02	01(04)	-156	01(06)	24.8	01(06)	-21.8	01(00)	413	30(11)	10.73
16.06.03	16(10)	-136	15(17)	14.4	16(09)	-9.7	15(12)	594	16(02)	6.78
17.08.03	17(17)	-171	17(00)	22.2	18(02)	-15.9	17(13)	530	17(12)	9.18
28.10.03	28(06)	-384	28(01)	19.2	28(01)	-10.2	27(22)	809	27(22)	5.88
20.11.03	20(02)	-461	20(05)	55	20(11)	-50.9	20(02)	703	19(20)	16.26
22.01.04	22(05)	-144	21(21)	25	22(10)	-14.9	22(00)	666	22(00)	15.17
24.07.04	24(11)	-198	24(05)	21.9	24(22)	-18.5	24(04)	600	23(22)	12.25
07.11.04	07(20)	-376	07(12)	47.8	07(22)	-44.9	07(09)	730	07(17)	32.75
07.05.05	07(20)	-126	07(12)	16.6	07(18)	-12.5	07(17)	565	07(16)	12.92
15.05.05	15(05)	-293	15(01)	54.2	15(05)	-38	14(23)	959	14(22)	23.5
29.05.05	29(22)	-150	29(01)	19.2	30(05)	-16.1	29(08)	540	29(09)	7.17
24.08.05	24(08)	-219	24(04)	52.2	24(05)	-38.3	24(00)	707	24(10)	21.3
31.08.05	31(12)	-138	31(03)	18.6	31(04)	-16.9	31(07)	414	31(08)	12.52
11.09.05	11(02)	-127	10(21)	18.2	11(00)	-6.4	na	na	na	na
14.12.06	14(21)	-143	14(11)	17.9	14(22)	-14.7	14(06)	896	14(09)	13.45
No any super strong geomagnetic storms has been observed from the period of 14-12-2006toDec2011										

These data has been taken from http://omniweb.gsfc.nasa.gov/form/dx1.html

1-Statistical Relation of Geomagnetic Storms with Coronal Mass Ejections.

In this study we have associated super strong geomagnetic storms ≤-125nT observed during the period of 1997 to 2011 with coronal mass ejections, X-ray solar flares and disturbances in solar wind plasma parameters. The data of observed super strong geomagnetic storms and associated coronal mass ejections are given in Table 1- and the data of super strong geomagnetic storms and associated disturbances in solar wind plasma parameters are given in Table 2 . From data analysis given in Table 1, it is observed that the number of super strong geomagnetic storms≤-125, observed during the period of 1997-2011 is 44. Out of 44 super strong geomagnetic storms, we have no data of CME for 03 events for association. Out of 41 super strong geomagnetic storms 38(92.68%) are found to be associated with coronal mass ejections (CMEs).The association rate of halo and partial halo coronal mass ejections have been found 84.21 % and 15.79% respectively. Positive correlation with correlation coefficient has been found between magnitude of super strong geomagnetic storms and speed of associated CMEs. Statistically calculated co-relation co-efficient is. 0.22 between these two events.

To see how the magnitude of super strong geomagnetic storms are correlated with the speed of associated CMEs , a scatter diagram have been plotted between the magnitude of super strong geomagnetic storms and speed of associated CMEs . Positive co-relation has been found between magnitude of super strong geomagnetic storms and speed of associated CMEs. Statistically calculated co-relation co-efficient is. 0.22 between these two events.

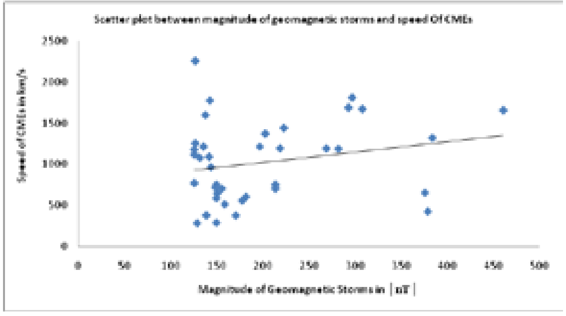

Fig 1-Shows scatter plot magnitude of geomagnetic storms and speed of associated CMEs.

2-Geomagnetic Storms with X- Ray Solar Flares Associated with Coronal Mass Ejections.

From the data analysis of super strong geomagnetic storms and X ray solar flares, it is observed that super strong geomagnetic storms are closely related to X ray solar flares of different categories. We have identified 44 super strong geomagnetic and all the super strong geomagnetic storms have been found to be associated with X-ray solar flares of different categories . 07(15.91%) super strong geomagnetic storms are found to be associated with X class, 20(45.45%) with M class 13 (29.54%) with C class and 04 (9.1%) with B class X- ray solar flares .

3-Geomagnetic Storms with Disturbances in Interplanetary Magnetic Field.

From the data analysis of super strong geomagnetic storms and associated disturbances in interplanetary magnetic field given in Table 2, We have observed that 43out of 44 super strong geomagnetic storms are associated with jump in interplanetary magnetic field (JIMF) events. To see how the magnitude of super strong geomagnetic storms are correlated with the peak values of associated JIMF events, a scatter diagram have been plotted between the magnitude of super strong geomagnetic storms and maximum peak value of JIMF events Fig.2.From the fig it is clear that maximum super strong geomagnetic storms which have large magnitude are associated with such JIMF events which have relatively large peak value. Positive co-relation has been found between magnitude of super strong geomagnetic storms and magnitude of peak value of associated JIMF events. Statistically calculated co-relation co-efficient is. 0.65 between these two events.

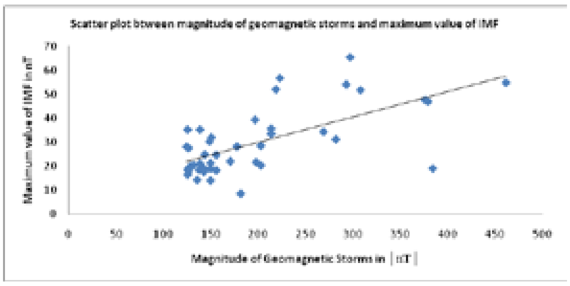

Fig 2-Shows scatter plot magnitude of geomagnetic storms and jump peak value of JIMF events.

4-Geomagnetic Storms with Disturbances in southward components of Interplanetary Magnetic Field.

From the data analysis of super strong geomagnetic storms and associated disturbances in southward components of interplanetary magnetic field given in Table 2, we have observed that 43out of 44 super strong geomagnetic storms are associated with jump in southward components of interplanetary magnetic field (JIMFBz) events. To see how the magnitude of super strong geomagnetic storms are correlated with the peak values of associated JIMFBz events, a scatter diagram have been plotted between the magnitude of super strong geomagnetic storms and maximum peak value of JIMFBz events fig 3.From the fig it is clear that maximum super strong geomagnetic storms which have large magnitude are associated with such JIMFBz events which have relatively large peak value. Positive co-relation has been found between magnitude of super strong geomagnetic storms and magnitude of peak value of associated JIMFBz events. Statistically calculated co-relation co-efficient is. 0.71 between these two events.

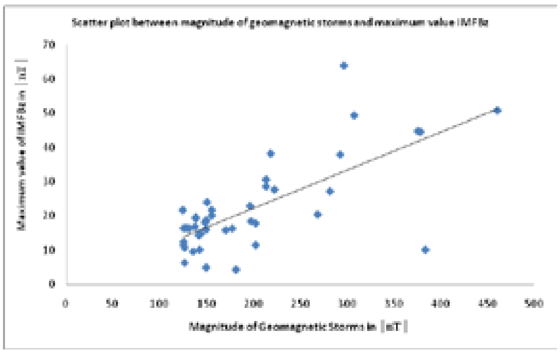

Fig 3-Shows scatter plot magnitude of geomagnetic storms and jump peak value of JIMFBz events.

5-Geomagnetic Storms with Disturbances in solar wind plasma velocity

From the data analysis of super strong geomagnetic storms and associated disturbances in solar wind plasma velocity given in figure 2, we have observed that 43out of 44 super strong geomagnetic storms are associated with jump in solar wind plasma velocity JSWV events. To see how the magnitude of super strong geomagnetic storms are correlated with the peak values of associated JSWV events, scatter diagram have been plotted between the magnitude of super strong geomagnetic storms and maximum peak value of JSWV events fig.4.From the fig it is clear that maximum super strong geomagnetic storms which have large magnitude are associated with such JSWV events which have relatively large peak value. Positive co-relation has been found between magnitude of super strong geomagnetic storms and magnitude of peak value of associated JSWV events. Statistically calculated co-relation co-efficient is. 0.43 between these two events.

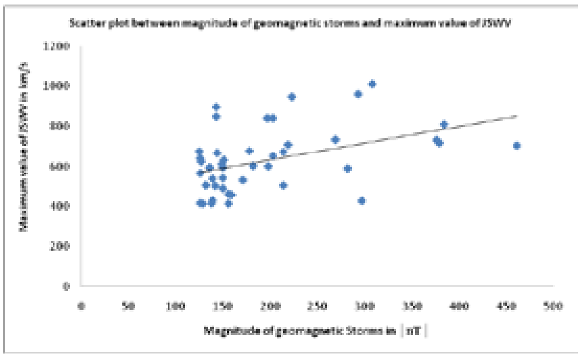

Fig 4-Shows scatter plot magnitude of geomagnetic storms and jump peak value of JSWV events.

6-Geomagnetic Storms with Disturbances in solar wind plasma velocity

From the data analysis of super strong geomagnetic storms and associated disturbances in solar wind plasma pressure given in figure 2, we have observed that 42out of 44 super strong geomagnetic storms are associated with jump in solar wind plasma pressure JSWP events. To see how the magnitude of super strong geomagnetic storms are correlated with the peak values of associated JSWP events, a scatter diagram have been plotted between the magnitude of super strong geomagnetic storms and maximum peak value of

JSWP events Fig.5-From the fig it is clear that maximum super strong geomagnetic storms which have large magnitude are associated with such JSWP events which have relatively large peak value. Positive co-relation has been found between magnitude of super strong geomagnetic storms and magnitude of peak value of associated JSWP events. Statistically calculated co-relation co-efficient is. 0.38 between these two events.

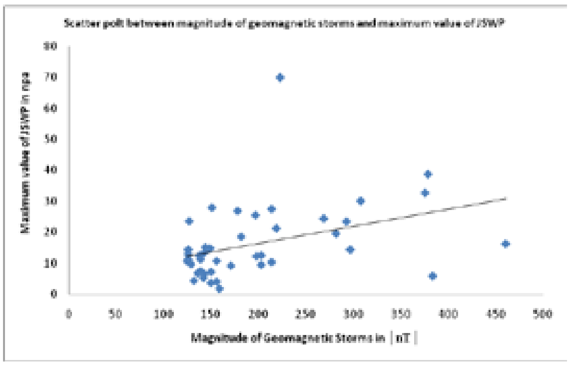

Fig 5Shows scatter plot magnitude of geomagnetic storms and jump peak value of JSWP events.

IV-Conclusion

In my study we have concluded that the super strong geomagnetic storms closely related with disturbances in interplanetary magnetic field southward component of interplanetary magnetic field, solar wind plasma velocity and pressure .From the analysis of super strong geomagnetic storms with coronal mass ejections and X ray solar flares, it is concluded that super strong geomagnetic storms are closely related to coronal mass ejections and X-ray solar flares. Positive co-relation has been found between magnitude of super strong geomagnetic storms and maximum (peak) value of average interplanetary magnetic field of associated JIMF events. Statistically calculated co-relation co-efficient is 0.65 between these two events. Positive co-relation has been found between magnitude of super strong geomagnetic storms and magnitude of maximum (peak) value of associated JIMFBz events. Statistically calculated co-relation co-efficient is 0.71 between these two events. Positive co-relation has been found between magnitude of super strong geomagnetic storms and magnitude of maximum (peak) value of associated JSWV events. Statistically calculated co-relation co-efficient is 0.43 between these two events. Positive co-relation has been found between magnitude of super strong geomagnetic storms and magnitude of maximum (peak) value of associated JSWV events. Statistically calculated co-relation co-efficient is 0.38 between these two events. From the above results it is concluded that coronal mass ejections associated with X-ray solar flares and disturbances in interplanetary magnetic fields are key factor to generate super strong geomagnetic storms.

Acknowledgement
The author would like to thank Prof. P.K Shukla, S.K.Nigam and B.P.Chandra for valuable suggestions. The author is grateful to OMNIWEB and SOHO data group whose data have been used in this study

REFERENCES

[1]-Burton, R. K., McPherron, R. L., & Russell, C. T. (1975). An Empirical Relationship Between Interplanetary Conditions and Dst:J. Geophys. Res. 80(31), 4204-4214, | .[2]-Bothmer, V.(2006), Solar System Update :The solar atmosphere and space weather, in: Blondel, P., Mason, J. (Eds.), , Springer, Berlin, IX + 329 pp., p.1, | [3]-Cane, H. V., Richardson, I. G., & St. Cyr, O. C.(2000), Coronal mass ejections, interplanetary ejecta and geomagnetic storms:Geophys. Res. Lett. 27, 3591-3594, | [4]-Correiaa, E. Souzaa R.V. de (2005), Identification of solar sources of major geomagnetic storms: Journal of Atmospheric and Solar-Terrestrial Physics 67 1702-1705, | [5]-Gonzalez,W.D., & Tsurutani, B. T. (1987) ,Criteria of interplanetary parameters causing intense magnetic storms :Planet. Space Sci., 35, 1101, | [6]-Gonzalez, W.D., Tsurutani, B.T., Lepping, R.P., Schwenn, R., (2002), Interplanetary phenomena associated with very intense geomagnetic storms: Journal of Atmospheric and Solar-Terrestrial Physics 64, 173-181, | [7]-Huttunen, K.E.J., Koskinen, H.E.J., and Schwenn, R., (2002) ,Variability of magnetospheric storms driven by different solar wind perturbations: J. Geophys. Res. Vol. 107, ,A7, 1121-1128, | [8]-Liu, Y. Webb, D. F. and Zhao. X. P. (2006), Magnetic Structures of Solar Active Regions, Full-Halo Coronal Mass Ejections, and Geomagnetic Storms: Astrophysical Journal, 646:1335-1348, | [9]-Manoharan, P. K., Gopalaswamy, N., Yashiro, S., Lara, A., Michalek, G., Howard, R. | (2004), Influence of Coronal Mass Ejection interaction on the Propagation of Interplanetary Shocks: J. Geophysics. Res 109, A06109, | [10]-Mcallister.A.H.and Krooker.N.U .(1997) Coronal mass ejections, corotating interaction regions, and geomagnetic storms: Geophysical monograph Vol ,99, 303, 279, | [11]-Sadovnichy, V.A., Panasyuk, M.I., Bobrovnikov(2007), First Results of Investigating the Space Environment on board the Universitetskii-Tatyana Satellite: Cosmic Res.(2007) 45, 273-286 , | [12]- Srivastava, N. & Venkatakrishnan, P.(2004), Solar and interplanetary sources of major | geomagnetic storms during 1996–2002: J. Geophys. Res., 109, A10103,1-13, | [13]-Veira, L.E.A., Gonzalez, W.D., Echer, E., and Tsurutani,B.T., (2004), Storm-intensity | criteria for several classes of the driving interplanetary structures :Solar Physics, Vol. 223, 245-258, | [14]-Veselovsky M.I. Panasyuk a, Yu.I. Yermolaev L.M. Zelenyi (2009),Strong perturbations on the Sun and in the heliosphere leading to large geomagnetic storms: Similar and individual characteristics: Advances in Space Research 43, 537-541, | [15]-Webb, D.F. & Howard, R.A. (1994), The Solar Cycle Variation of Coronal Mass Ejections and the Solar Wind Mass Flux: J. Geophys. Res. 99, 4201-4220, | [16]-Wang, Y.M., Ye, P.Z., Wang, S., Zhou, G.P., Wang, J.X.,(2002), A statistical study on the geoeffectiveness of Earth-directed coronal mass ejections from March 1997 to December 2000 :Journal of Geophysical Research 107(A11), 1340, | [17]-Yermolaev, Yu.I. ,Yermolaev, M.Yu., (2002), StatisticalRelationships between Solar, Interplanetary, and Geo_magnetospheric Disturbances, 1976–2000 :Kosm. Issled., Vol. 40,(1) 3-16, | [18Yermolaev, Yu.I., Yermolaev, M.Yu., and Nikolaeva,N.S. ,(2005b), Comparison ofinterplan-etary and magnetospheric conditions for CIR-induced and ICME-induced magnetic storms:European Geosciences Union. Geophysical Research Abstracts, Vol. 7. 1064, | [19]Yurchyshyn, Vasyl Qiang,NU.Valentyna Abrahmenko (2005), Structure of magnetic fields in NOAA active regions 0486 and 0501 and in the associated interplanetary ejecta: Space Weather Space Weather ,3,No8,So8Co2