Coronal Mass Ejections And Disturbances In Solar Wind Plasma Parameters In Relation With Geomagnetic Storms

P.L.Verma[1], Puspraj Singh[2] and Preetam Singh[3]

[1]Department of Physics, Govt.Vivekanand P.G. College Maihar Satna M.P.India, [2]Research Scholar, A.P.S.University Rewa M.P.India. [3]Research Scholar, Govt. P.G.College Satna M.P.India.

e-mail: pl_verma2003@yahoo.com

Abstract. Coronal Mass Ejections (CMEs) are the drastic solar events in which huge amount of solar plasma materials are ejected into the heliosphere from the sun and are mainly responsible to generate large disturbances in solar wind plasma parameters and geomagnetic storms in geomagnetic field. We have studied geomagnetic storms, (Dst ≤-75nT) observed during the period of 1997-2007 with Coronal Mass Ejections and disturbances in solar wind plasma parameters (solar wind temperature, velocity, density and interplanetary magnetic field) .We have inferred that most of the geomagnetic storms are associated with halo and partial halo Coronal Mass Ejections (CMEs).The association rate of halo and partial halo coronal mass ejections are found 72.37 % and 27.63 % respectively. Further we have concluded that geomagnetic storms are closely associated with the disturbances in solar wind plasma parameters. We have determined positive co-relation between magnitudes of geomagnetic storms and magnitude of jump in solar wind plasma temperature, jump in solar wind plasma density, jump in solar wind plasma velocity and jump in average interplanetary magnetic field with co-relation co-efficient 0 .35 between magnitude of geomagnetic storms and magnitude of jump in solar wind plasma temperature, 0.19 between magnitude of geomagnetic storms and magnitude of jump in solar wind density, 0.34 between magnitude of geomagnetic storms and magnitude of jump in solar wind plasma velocity, 0.66 between magnitude of geomagnetic storms and magnitude of jump in average interplanetary magnetic field respectively. We have concluded that geomagnetic storms are mainly caused by Coronal Mass Ejections and disturbances in solar wind plasma parameters that they generate.

1. Introduction

Coronal Mass Ejections (CMEs) are the drastic solar events in witch huge amount of solar plasma materials are ejected into the heliosphere from the sun and are mainly responsible to generate large disturbances in solar wind plasma parameters and geomagnetic storms in geomagnetic field. CMEs from the Sun drive solar wind (SW) disturbances in terms of magnetic field, speed and density, which in turn cause geomagnetic disturbance in Earth [14].It has been established by now the main cause of geomagnetic storms is believed to be the large IMF structure which has an intense and long duration southward magnetic field component, *Bz* [3,10 ,]. They interact with the Earth's magnetic field and facilitate the transport of energy into the Earth's atmosphere through the reconnection process.

Several investigators have studied geomagnetic storms with various solar features, solar wind parameters and inferred that CMEs which are the energetic solar features and associated with active regions are responsible for the most geoeffective solar wind disturbances and, therefore, the largest storms and are well associated with geomagnetic storms [1,9,12,13] .Enhanced solar wind speeds and southward magnetic fields associated with interplanetary shocks and ejecta are known to be important causes of storms [4,10]. Mcallister and Crooker [7] have studied effects of solar and heliospheric phenomena on geomagnetic field. They have concluded that major geomagnetic storms, both recurrent and non recurrent, are the result of the combined effects of CMEs and CIRs.Correiaa and De Souza [2] have presented the identification of solar coronal mass ejection (CME) sources for selected major geomagnetic storms. 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 storms. Gopalswamy et al. [5] have studied magnetic clouds ,coronal mass ejections and geomagnetic storms, they have found that 86% magnetic clouds are associated with full and partial halos coronal mass ejections .The remaining 14% of magnetic clouds are associated with non-halo CMEs originating from close to the disk center. They have concluded that magnetic clouds associated with partial halo and halo coronal mass ejections are most potential candidates for production of geomagnetic storms .they have further concluded that magnetic clouds associated with non halo CMEs may also cause geomagnetic storms . Verma et al [11] have studied geomagnetic storms Dst < - 50nT observed during the period of 1997-2006, with halo and partial halo coronal mass ejections associated with X-ray solar flares of different categories and concluded that they have concluded that majority of the observed geomagnetic storms are found that halo and partial halo CMEs associated with X ray solar flares are most potential candidates for production of geomagnetic storms.Michalek, G.et al [8] have concluded that halo coronal mass ejections (HCMEs) originating from regions close to the center of the sun are likely to be geoeffective. They have showed that, only fast halo CMEs (with space velocities higher than ~1000 km/s) and originating from the Western Hemisphere close to the solar center could cause intense geomagnetic storms. Gopalswamy [6] has studied the role of halo and partial halo CMEs in producing geomagnetic storms. He has reviewed the results obtained by previous investigators and concluded that the generation of geomagnetic storms rates can be readily explained by the different definition of halo CMEs used by different authors. Partial halos are less energetic and generally originate far from the disk center, so most of them behave similar to the nongeoeffective CMEs and hence most of the partial halo CMEs may not produce geomagnetic storms. He has inferred that halo CMEs originating close to the disk center or very much effective in producing geomagnetic storms.

2. Experimental Data

In this investigation, hourly Dst indices of geomagnetic field have been used over the period 1997 through 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 has 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 solar wind plasma parameters, hourly data of solar wind plasma velocity density temperature average interplanetary magnetic field has been used and these data has also been taken from omni web data also.

3. Data Analysis and Results

The association between geomagnetic storms < –75nT and coronal mass ejections (CMEs), and disturbances in solar wind plasma parameters for the period 1997 to 2007 are given in Table No.1. We have 124 geomagnetic storms in our list in which we have no data of CMEs for association. From the data analysis it is observed that 76out of 120 (84.93%) geomagnetic storms < –75nT are found to be associated with coronal mass ejections. We have 124 geomagnetic storms in our list in which the CME data for association is available for 120 geomagnetic storms. We have further observed that the majority of related CMEs are halo CMEs.We have 76 geomagnetic storms, which are associated with coronal mass ejections out of which 55 geomagnetic storms (72.37%) are related to the halo coronal mass ejections. Only 21 out of 76 (25.81%) geomagnetic storms are found to be associated with partial halo coronal mass ejections. From the study of geomagnetic storms with disturbances in solar wind plasma parameters i.e. jump in solar wind plasma temperature (JSWT), jump in solar wind density (JSWD) jump in solar wind plasma velocity and jump in average interplanetary magnetic field, it is inferred that geomagnetic storms of higher magnitudes are found to be associated with such JSWT, JSWD, JSWV and jump in average interplanetary magnetic field events, which have relatively higher jump magnitude of temperature, density velocity, and average interplanetary magnetic field .We have determined positive co-relation between magnitudes of geomagnetic storms and magnitude of jump in solar wind plasma temperature, jump in solar wind plasma density, jump in solar wind plasma velocity and jump in average interplanetary magnetic field with co-relation co-efficient 0 .35 between magnitude of geomagnetic storms and magnitude of jump in solar wind plasma temperature, 0.19 between magnitude of geomagnetic storms and magnitude of jump in solar wind density, 0.34 between magnitude of geomagnetic storms and magnitude of jump in solar wind plasma velocity, 0.66 between magnitude of geomagnetic storms and magnitude of jump in average interplanetary magnetic field respectively. We have concluded that geomagnetic storms are mainly caused by Coronal Mass Ejections and disturbances in solar wind plasma parameters that they generat.

Table – Association of Geomagnetic Storms with Coronal Mass Ejections and Disturbances in Solar Wind Plasma Parameters

	Geomagnetic Storm			Temparature		Density		Velocity		IMFB (nT)		CMEs		
S. NO.	Date	Onset time in dd(hh)	Magnitude in nT	Start time in dd(hh)	Jump Magnitude in Degree kelvin	Start time in dd(hh)	Jump Magnitude in N/cc	Start time in dd(hh)	Magnitude of Jump In Km/s	Start time in dd(hh)	Magnitude in nT	Date(hh. mm)	types H/P	Speeds km/ sec.
1	10.01.97	10(04)	-85	10(00)	83898	10(00)	6.4	09(23)	69	09(21)	13.5	na	na	na
2	26.02.97	26(23)	-85	26(21)	136171	26(12)	11.6	26(20)	97	26(14)	10.1	na	na	na
3	10.04.97	10(21)	-88	10(16)	169574	10(16)	20.3	10(10)	153	10(17)	7.8	07(14.27)	H	878
4	16.04.97	16(07)	-79	16(11)	326450	16(08)	33.2	16(03)	200	16(12)	9.8	na	na	na
5	21.04.97	21(12)	-101	21(03)	18607	20(21)	26.7	21(07)	57	21(11)	7.4	na	na	na
6	15.05.97	15(04)	-113	15(01)	308796	14(22)	15.7	15(01)	120	15(01)	19.4	12(05.30)	H	464
7	07.06.97	07(06)	-81	06(09)	120542	06(20)	9.2	06(19)	47	07(23)	10.6	na	na	na
8	03.09.97	03(18)	-103	02(21)	97676	03(12)	12.6	02(21)	107	02(18)	16.2	na	na	na
9	01.10.97	01(02)	-100	01(00)	144646	30(20)	15.2	30(20)	122	02(00)	10.9	28(01.08)	H	369
10	10.10.97	10(17)	-109	10(02)	36728	10(09)	25.3	10(13)	40	10(01)	9.3	na	na	na
11	06.11.97	06(23)	-105	06(02)	150720	06(17)	14.3	06(21)	135	06(19)	13	04(06.10)	H	785
12	22.11.97	22(10)	-106	22(04)	395681	22(06)	21.3	22(08)	177	21(19)	24.1	19(12.27)	H	150
13	30.12.97	30(04)	-80	30(03)	106297	30(00)	27.4	29(22)	58	30(08)	6.5	na	na	na
14	06.01.98	06(15)	-83	06(02)	126983	06(13)	19.1	06(12)	114	06(09)	16.3	na	na	na
15	17.02.98	17(14)	-105	17(02)	38149	17(02)	9.1	17(04)	48	17(04)	16.2	na	na	na
16	10.03.98	10(13)	-110	na	na	na	na	10(04)	228	10(01)	18.3	na	na	na
17	21.03.98	21(09)	-76	21(02)	291106	21(06)	16.3	21(03)	295	21(07)	6.5	18(07.33)	P	636
18	02.05.98	02(09)	-203	01(19)	326112	01(19)	9.6	01(10)	255	01(21)	14.2	29(16.58)	H	1374
19	26.06.98	26(00)	-92	25(15)	70984	25(12)	5.4	25(15)	97	25(15)	6.6	na	na	na
20	06.08.98	06(02)	-139	05(22)	21176	06(01)	32.2	06(01)	66	06(02)	13	nd	nd	nd
21	26.08.98	26(11)	-143	26(01)	2034319	25(22)	6	26(01)	449	26(04)	14	nd	nd	nd

22	25.09.98	25(00)	-203	24(23)	731981	24 (14)	11.5	24(23)	403	24(21)	18.8	nd	nd	nd
23	19.10.98	19(02)	-111	19(07)	173366	18(08)	55.9	18(18)	113	18(17)	23.1	na	na	na
24	07.11.98	07(11)	-139	07(00)	250723	07(05)	8.8	07(07)	42	07(19)	27.1	05(02.02)	H	380
25	08.11.98	08(20)	-126	08(14)	56923	08(02)	21.3	08(01)	173	07(20)	26.9	05(20.24)	H	1118
26	13.11.98	13(00)	-129	12(14)	39633	12(13)	28.5	12(14)	96	12(22)	11.3	10(06.18)	P	286
27	13.01.99	13(11)	-105	13(06)	55728	13(09)	22.8	13(09)	96	13(09)	14.1	nd	nd	nd
28	18.02.99	18(03)	-125	17(23)	450164	18(00)	10.2	17(22)	292	18(00)	20.8	na	na	na
29	28.02.99	28(17)	-94	28(12)	55926	28(02)	17.8	28(04)	30	27(15)	8.8	na	na	na
30	16.04.99	16(21)	-90	16(07)	68434	16(08)	45.7	16(10)	86	16(15)	20.1	na	na	na
31	12.09.99	12(09)	-78	12(01)	363153	12(03)	31.4	12(02)	204	12(12)	4.2	10(07.54)	P	1467
32	22.09.99	22(18)	-182	22(07)	295048	22(02)	37	22(08)	248	22(10)	1.7	20(06.06)	H	604
33	22.10.99	22(00)	-214	22(01)	511615	21(22)	29.7	21(09)	104	21(00)	27.7	19(05.50)	P	753
34	10.11.99	10(22)	-89	10(15)	98797	10(20)	1.1	10(16)	58	10(04)	3.2	na	na	na
35	12.12.99	12(18)	-77	12(15)	660214	12(14)	10.2	12(15)	332	13(04)	5.2	na	na	na
36	11.01.00	11(15)	-77	11(12)	285691	11(05)	8.3	11(12)	193	11(10)	7.5	na	na	na
37	22.01.00	22(16)	-96	21(23)	112347	22(00)	20.2	22(00)	72	22(04)	10.6	na	na	na
38	11.02.00	11(07)	-132	11(01)	157720	11(01)	6.3	11(02)	89	11(23)	14.3	08(09.30)	H	1079
39	06.04.00	06(16)	-282	06(15)	325941	06(12)	26.6	06(15)	221	06(10)	26.5	04(16.32)	H	1188
40	15.04.00	15(19)	-81	na	na	na	na	na	na	16(11)	10.8	13(21.30)	P	613
41	17.05.00	17(00)	-86	16(10)	134851	16(23)	11.1	16(21)	128	17(21)	4.8	na	na	na
42	24.05.00	24(00)	-151	23(20)	413126	23(16)	26.6	23(16)	113	23(15)	24.8	22(01.50)	H	649
43	08.06.00	08(15)	-89	08(03)	781686	08(08)	15.8	08(08)	253	08(05)	19.1	06(15.54)	H	1119
44	26.06.00	26(02)	-80	25(21)	172586	25(18)	4.1	25(19)	93	25(23)	7.8	25(07.54)	P	1617
45	15.07.00	15(15)	-308	15(08)	1452345	15(08)	16.9	15(13)	400	15(08)	45.2	14(10.54)	H	1674
46	19.07.00	19(19)	-95	19(14)	244724	19(11)	6.4	19(11)	113	19(11)	11	na	na	na
47	12.08.00	12(01)	-214	11(18)	651965	11(20)	8.3	11(16)	266	11(17)	24.1	09(16.30)	H	702
48	17.09.00	17(20)	-197	17(13)	803820	17(13)	28.9	17(15)	298	17(14)	34.1	16(05.18)	H	1215
49	03.10.00	03(23)	-156	03(14)	15645	03(16)	5.2	02(23)	82	03(00)	12.9	30(18.06)	P	703
50	13.10.00	13(14)	-100	13(02)	173385	12(23)	18.7	12(21)	139	12(19)	12	09(23.50)	H	798
51	28.10.00	28(21)	-126	28(13)	102142	28(07)	32.6	28(05)	101	28(18)	10.1	25(08.26)	H	770
52	05.11.00	05(10)	-150	04(17)	303563	04(22)	1.8	04(11)	193	04(23)	4.8	03(18.26)	H	291
53	10.11.00	10(07)	-102	10(05)	1925089	10(05)	9.8	09(23)	341	10(05)	8.2	08(04.50)	H	474
54	26.11.00	26(22)	-127	26(08)	552597	26(11)	29.3	26(03)	252	26(08)	24.2	24(15.30)	H	1254
55	19.03.01	19(11)	-150	na	na	na	na	19(08)	196	19(09)	15.2	18(02.26)	H	752
56	22.03.01	22(14)	-81	22(14)	101413	22(15)	9.2	22(03)	33	22(10)	15.1	20(03.26)	P	478
57	27.03.01	27(21)	-86	27(06)	290035	27(17)	18	27(10)	216	27(15)	16	24(20.50)	H	906
58	31.03.01	31(04)	-379	30(22)	666839	30(19)	31.2	30(19)	315	30(21)	43.8	28(01.27)	H	427
59	11.04.01	11(15)	-269	11(10)	729729	11(10)	23	11(12)	233	11(09)	30.1	09(15.54)	H	1192
60	18.04.01	18(01)	-106	17(22)	272566	17(22)	24.9	17(23)	162	17(23)	18.9	15(14.06)	P	1199
61	22.04.01	22(00)	-106	21(13)	54930	21(15)	23.1	21(15)	37	21(21)	9.6	20(10.06)	P	1160
62	17.08.01	17(17)	-102	17(08)	299070	17(10)	23.4	17(09)	264	17(07)	28	15(23.54)	H	1575
63	11.10.01	11(17)	-76	11(14)	544030	11(11)	21.8	11(16)	198	11(08)	21.3	09(11.30)	H	973
64	21.10.01	21(16)	-178	21(15)	422395	21(13)	16.4	21(10)	360	21(13)	21.7	19(01.27)	H	558
65	28.10.01	28(01)	-142	28(00)	178222	27(20)	8.9	28(01)	145	27(22)	12.8	25(15.26)	H	1092
66	31.10.01	31(14)	-104	31(08)	63658	31(10)	19.5	31(12)	62	31(18)	7.8	30(03.30)	P	1005
67	05.11.01	05(19)	-297	05(10)	105551	05(09)	31.4	05(14)	141	05(12)	51.2	04(16.35)	H	181

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68	24.11.01	24(06)	-223	24(03)	2292789	24(02)	40	24(03)	504	24(04)	51.2	22(20.30)	H	1443
69	02.02.02	02(02)	-77	01(03)	82946	01(03)	15	01(20)	104	01(20)	5.4	na	na	na
70	05.02.02	05(10)	-79	04(23)	135988	04(14)	26.7	05(06)	339	04(21)	10.7	02(14.54)	P	362
71	23.03.02	23(16)	-91	23(09)	82810	23(06)	8.7	23(06)	86	23(11)	2.2	20(17.54)	H	603
72	17.04.02	17(11)	-149	17(08)	353020	17(09)	25	27(06)	286	17(07)	23.2	15(03.50)	H	720
73	11.05.02	11(13)	-103	11(06)	193268	11(07)	48.2	11(08)	100	11(05)	13.3	08(13.50)	H	614
74	23.05.02	23(12)	-89	23(03)	1187414	22(15)	13.7	23(03)	468	22(23)	33.4	22(03.50)	H	1557
75	01.08.02	01(23)	-105	01(03)	292141	01(22)	15.7	01(22)	88	01(01)	7.4	29(23.30)	P	360
76	18.08.02	18(22)	-110	18(11)	484987	18(15)	11.2	18(16)	171	18(18)	9.1	16(12.30)	H	1585
77	04.09.02	04(02)	-102	04(00)	226235	na	na	04(00)	77	03(07)	9.1	na	na	na
78	06.09.02	06(09)	-159	06(03)	26868	05(12)	1.4	05(12)	26	na	na	04(13.31)	P	513
79	01.10.02	01(04)	-156	30(09)	71897	30(09)	29.3	01(00)	53	01(06)	4	na	na	na
80	24.10.02	24(00)	-88	23(22)	436899	23(19)	13.4	24(07)	308	24(00)	5.1	na	na	na
81	20.11.02	20(16)	-79	19(23)	138265	20(11)	4.5	20(07)	9	20(22)	22.2	na	na	na
82	21.11.02	21(02)	-122	21(01)	401981	20(16)	40.7	20(20)	318	20(22)	22.2	19(03.06)	P	938
83	09.05.03	09(09)	-78	09(00)	488764	09(01)	5.3	08(20)	153	09(04)	6.6	06(15.50)	P	345
84	27.05.03	27(23)	-118	27(00)	277056	27(11)	4.6	27(17)	207	27(04)	3.5	na	na	na
85	02.06.03	02(02)	-85	01(14)	365794	01(13)	5.9	01(14)	158	01(22)	3.7	31(02.30)	H	1835
86	16.06.03	16(10)	-136	15(13)	100632	16(02)	8.2	15(12)	100	15(17)	5	14(05.30)	P	1215
87	11.07.03	11(00)	-109	11(03)	516059	10(03)	9.9	10(16)	28	11(03)	3.5	na	na	na
88	26.07.03	26(17)	-75	26(19)	413471	26(14)	28.5	26(10)	446	26(12)	23.4	na	na	na
89	17.08.03	17(17)	-171	17(09)	224467	17(12)	11.1	17(13)	105	17(00)	16.5	14(20.06)	H	378
90	28.10.03	28(06)	-384	28(08)	979536	28(01)	6.2	27(22)	373	28(01)	9.6	27(08.30)	P	1322
91	04.11.03	04(08)	-90	04(04)	947434	04(02)	11.5	04(04)	266	04(01)	13.4	02(09.30)	H	2036
92	20.11.03	20(02)	-461	20(05)	487107	19(20)	14.4	20(02)	262	20(05)	48.1	18(08.05)	H	1660
93	22.01.04	22(05)	-144	22(00)	501487	21(23)	13.1	22(00)	210	21(21)	19.7	20(00.06)	H	965
94	11.02.04	11(10)	-107	11(06)	51108	11(04)	19.8	11(13)	320	11(09)	13.6	na	na	na
95	09.03.04	09(13)	-76	09(11)	556729	09(08)	11.5	09(09)	368	09(13)	10.8	07(10.34)	P	395
96	03.04.04	03(14)	-113	03(07)	80343	03(08)	18.2	03(08)	125	03(23)	10.1	na	na	na
97	05.04.04	05(12)	-77	05(09)	421082	05(04)	9.6	05(10)	215	05(00)	2.3	na	na	na
98	16.07.04	16(22)	-84	16(20)	300586	16(21)	6.4	16(21)	165	16(20)	10.8	na	na	na
99	22.07.04	22(00)	-106	22(08)	507727	22(06)	13.7	22(09)	312	22(14)	10.4	20(13.31)	H	710
100	24.07.04	24(11)	-198	24(00)	472606	23(22)	14.6	24(04)	113	24(05)	16.3	na	na	na
101	30.08.04	30(02)	-119	29(14)	47028	29(06)	10.5	29(06)	50	29(23)	5.9	na	na	na
102	07.11.04	07(20)	-376	07(10)	786124	07(03)	54.1	07(09)	386	07(12)	38.8	04(09.54)	H	653
103	07.01.05	07(12)	-94	07(05)	104824	07(08)	25.1	07(03)	85	07(07)	15.3	05(15.30)	H	735
104	16.01.05	16(20)	-117	16(09)	93358	16(09)	15.9	16(09)	8.4	17(07)	31.1	15(06.30)	H	2049
105	21.01.05	21(19)	-103	21(04)	640871	21(11)	28.4	21(14)	403	21(15)	24.8	19(08.29)	H	2020
106	04.04.05	04(11)	-86	04(04)	429669	03(16)	17.2	04(02)	297	04(21)	5.9	na	na	na
107	11.04.05	11(17)	-77	11(13)	281023	na	na	11(09)	198	11(16)	13.1	09(13.50)	P	542
108	07.05.05	07(20)	-126	07(18)	866682	07(10)	39.2	07(17)	215	07(12)	10.7	05(20.30)	H	1180
109	15.05.05	15(05)	-293	15(02)	883346	14(22)	15	14(23)	545	15(01)	48.4	13(17.12)	H	1689
110	20.05.05	20(04)	-101	19(18)	26401	19(18)	16.6	19(16)	33	20(06)	5.7	16(13.50)	P	405
111	29.05.05	29(22)	-150	29(12)	247526	29(12)	11.3	29(08)	172	29(01)	9.1	26(15.06)	H	586
112	12.06.05	12(17)	-109	12(09)	228070	na	na	12(02)	202	12(07)	18.6	na	na	na
113	22.06.05	22(23)	-92	na	na	na	na	na	na	23(04)	14.2	na	na	na
114	10.07.05	10(11)	-100	10(00)	290138	09(20)	16.1	09(19)	140	10(02)	15.7	07(17.06)	H	683
115	17.07.05	17(06)	-77	17(00)	108021	16(15)	7.4	16(16)	89	17(12)	6.8	14(10.54)	H	211

														5
116	24.08.05	24(08)	-219	24(03)	408410	23(20)	23.1	24(00)	295	24(04)	43.1	22(01.31)	H	1194
117	31.08.05	31(12)	-138	31(18)	145193	31(08)	278	31(07)	68	31(03)	10.8	29(10.54)	H	1600
118	11.09.05	11(02)	-127	na	na	na	Na	na	na	10(21)	13	09(19.48)	H	2257
119	27.12.05	27(14)	-77	27(11)	470574	27(06)	26.9	27(09)	336	27(05)	15.9	na	na	na
120	04.04.06	04(10)	-90	na	na	na	Na	03(13)	180	05(06)	6.6	na	na	na
121	14.04.06	14(10)	-111	13(17)	356943	13(10)	11.4	14(01)	165	13(14)	10.9	na	na	na
122	29.11.06	29(22)	-77	29(06)	73161	29(17)	10.1	30(01)	17	29(04)	11	na	na	na
123	14.12.06	14(21)	-143	14(03)	779800	14(05)	7.7	14(06)	575	14(11)	13.9	13(02.54)	H	1774
124	20.11.07	20(07)	-77	20(08)	234743	20(06)	8.7	20(20)	222	19(21)	14	na	na	na

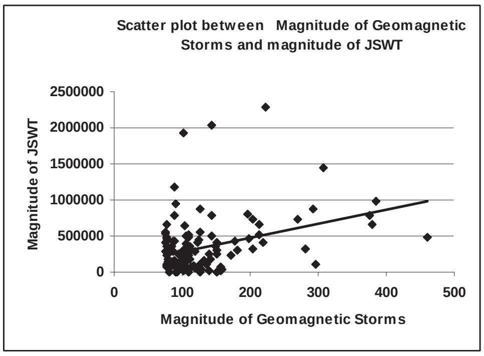
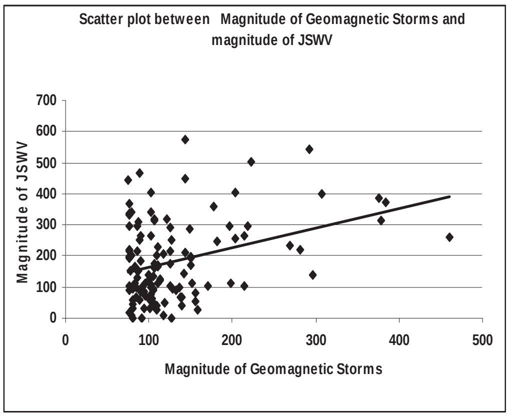


Figure-1 Shows Scatter plot between magnitude of geomagnetic storms and magnitude of Jump in solar wind plasma temperature (JSWT) showing positive correlation with correlation coefficient 0.35

Figure-2 Shows Scatter plot between magnitude of geomagnetic storms and magnitude of Jump in solar wind plasma density (JSWD) showing positive orrelation with correlation coefficient 0.19



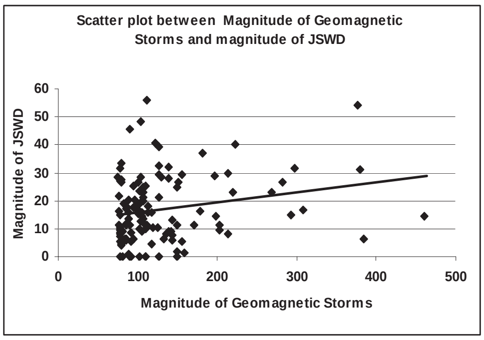


Figure 3-Shows Scatter plot between magnitude of geomagnetic storms and magnitude of Jump in solar wind plasma velocity (JSWV) showing positive correlation with correlation coefficient 0.34

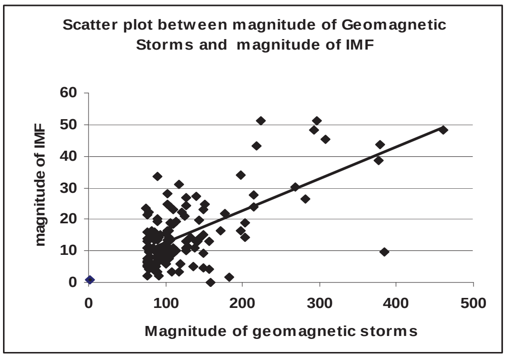


Figure 4-Shows Scatter plot between magnitude of geomagnetic storms and magnitude of Jump in average interplanetary magnetic field (IMF) showing positive correlation with correlation coefficient 0.66

4. Conclusion

From our study 76 out of 120 geomagnetic storms < -75nT have been identified as being associated with coronal mass ejections (63.33%), 55out of 76 have been identified as being associated with halo

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coronal mass ejections and 21out of 76 as being associated with partial halo coronal mass ejections The association rates for halo and partial halo CMEs are found 72.37% and 27.63% respectively. The positive correlation between magnitude of geomagnetic storms and magnitude of jump in solar wind plasma temperature, density velocity, and average interplanetary magnetic fields suggest that coronal mass ejections and disturbances in solar wind plasma parameters play crucial role in producing geomagnetic storms.

References

[1] Cane, H. V., Richardson, I. G., & St. Cyr, O. C., Geophys. Res. Lett., 27, 3591, 2000.
[2] Correiaa, E. R.V. de Souzaa Journal of Atmospheric and Solar-Terrestrial Physics 67, 1705, 2005
[3] Echer, E M V Alves and W D Gonzalez, Solar Phys. 221, 361,2004.
[4] Gosling, J. T., McComas, D. J., Phillips, J. L., and Bame, J. J. Geophys. Res.,96, 7831, 1991
[5] Gopalswamy, N., S. Akiyama, S. Yashiro, G. Michalek, and R. P. Lepping, J. Atm. Sol. Terr. Phys., 70, 245, 2008.
[6] Gopalswamy N.Letter Earth Planets Space, 61, 1–3, 2009
[7] Mcallister.A.H.and Krooker.N.U Geophysical monograph Vol 99 (303 279-289, 1997
[8] Michalek, G. Gopalswamy, N. Lara, A Yashiro, S Space. Weather, Volume 4, Issue 10th, 2006.
[9] St. Cyr, O.C. et al. J. Geophys. Res. **105**, 18,169–18, 185, 2000
[10] Tsurutani, B T Gonzalez, W D F Tang, S I Akasofu and E J Smith, J. Geophys. Res. 93, 8519, 1988.
[11] Verma P.L. Tripathi A.K. & Sharma ,Sushil J. Plasma Fusion Res. SERIES, Vol. 8 Page 221-225, 2009.
[12] Webb, D. F., Cliver, E. W., Crooker, N. U., St. Cyr, O. C., & Thompson, B. J., J. Geophys. Res., 105, 7491, 2000.
[13] Zhao, X. P., & Webb, D. F., J. Geophys. Res., 108, 1234, DOI: 10.1029/ 2002JA009606, 2003.
[14] Zhang .G.Dere.K.P.Astrophysical Journal,Vol 582,520,2003