

Study of CME-ICME properties during geomagnetic storms of SC 24

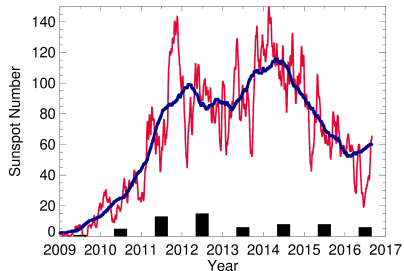
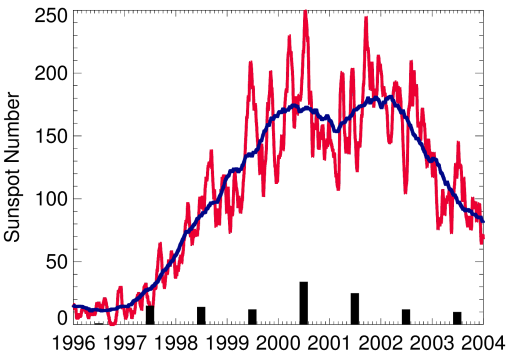
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June 1, 2017



SC24 - Low activity



Summary of events

(based on Richardson and Cane catalog-www.srl.caltech.edu/ACE/ASC/DATA/level3/icmetable2.htm)

	Disturbance (Date Time)	ICME Plasma/Field Start, End (Date Time)		V_ICME (km/s)	Dst (nT)	V_transit (km/s)	CME First Appearance (Date Time)		CPA (deg)	Angular Width (deg)	Linear Speed (km/s)	2nd-order Speed at final height (km/s)	2nd-order Speed at 20 Rs (km/s)	A (m/s ²)	MPA [deg]
1	2006/04/13 11:41	2006/04/13 15:00	2006/04/14 07:00	520	-98	540	2006/04/10	06:06:04	232	251	183	312	381	6.5	313
2	2006/08/19 11:31	2006/08/20 13:00	2006/08/21 16:00	400	-79	620	2006/08/16	16:30:04	Halo	360	888	905	896	1.9	161
3	2006/12/14 14:14	2006/12/14 22:00	2006/12/15 13:00	740	-162	1180	2006/12/13	02:54:04	Halo	360	1774	1622	1573	-61.4	193
4	2006/12/16 17:55	2006/12/01 17:00	2006/12/17 17:00	580	-53	980	2006/12/14	22:30:04	Halo	360	1042	1039	1041	-0.4	248
5	2007/11/19 18:11	2007/11/19 23:00	2007/11/20 12:00	460	-59	437	2007/11/15	18:50:04	279	199	125	158	204	1.3	329
6	2010/04/05 08:26	2010/04/05 12:00	2010/04/06 14:00	640	-81	910	2010/04/03	10:33:58	Halo	360	668	658	661	-1	171
7	2010/04/11 13:04	2010/04/12 01:00	2010/04/12 15:00	410	-67	520	2010/04/08	04:54:07	249	160	264	235	179	-2.2	235
8	2010/05/28 02:58	2010/05/28 19:00	2010/05/29 17:00	360	-80	500	2010/05/24	14:06:05	Halo	360	427	492	474	3.8	280
9	2010/08/03 17:41	2010/08/04 10:00	2010/08/01 05:00	530	-74	740	2010/08/01	13:42:05	Halo	360	850	1309	0	247	84
10	2011/08/05 17:51	2011/08/06 22:00	2011/08/07 22:00	540	-115	1100	2011/08/04	04:12:05	Halo	360	1315	1074	1208	-41.1	298
11	2011/09/09 12:42	2011/09/10 03:00	2011/09/10 15:00	470	-75	680	2011/09/06	23:05:57	Halo	360	575	589	582	1.1	300
12	2011/09/17 03:43	2011/09/17 14:00	2011/09/18 06:00	430	-72	550	2011/09/14	00:00:05	334	242	408	452	457	3.2	302
13	2011/09/26 12:34	2011/09/26 20:00	2011/09/28 15:00	580	-118	...	2011/09/24	12:48:07	Halo	360	1915	2254	2089	79.6	78
14	2012/01/22 06:11	2012/01/22 23:00	2012/01/23 07:00	450	-71	670	2012/01/19	14:36:05	Halo	360	1120	1499	1390	54.1	20
15	2012/03/08 11:03	2012/03/09 03:00	2012/03/11 07:00	550	-145	1220	2012/03/07	00:24:06	Halo	360	2684	2379	2594	-88.2	57
16	2012/03/15 13:06	2012/03/15 17:00	2012/03/16 10:00	680	-88	960	2012/03/13	17:36:05	Halo	360	1884	2054	1987	45.6	286
17	2012/06/16 20:19	2012/06/16 23:00	2012/06/17 12:00	440	-86	770	2012/06/14	14:12:07	Halo	360	987	977	983	-1.2	144
18	2012/07/08 08:00	2012/07/01 09:00	2012/07/09 14:00	410	-78	480	2012/07/04	17:24:04	Halo	360	662	553	0	-37.6	124
19	2012/07/14 18:09	2012/07/15 06:00	2012/07/17 05:00	490	-139	850	2012/07/12	16:48:05	Halo	360	885	1092	2265	195.6	158
20	2012/09/30 23:05	2012/10/01 01:00	2012/10/01 02:00	370	-122	590	2012/09/28	00:12:05	Halo	360	947	716	817	-27.1	251
21	2012/10/08 05:16	2012/10/08 18:00	2012/10/09 12:00	390	-109	730	2012/10/05	02:48:05	258	284	612	885	804	21.2	202
22	2012/10/31 15:38	2012/11/01 01:00	2012/11/02 03:00	340	-65	440	2012/10/27	16:48:05	Halo	360	317	508	483	9.1	350
23	2012/11/12 23:11	2012/11/13 08:00	2012/11/14 03:00	380	-108	530	2012/11/09	15:12:08	175	276	559	601	603	4	157
24	2013/03/17 05:59	2013/03/17 15:00	2013/03/19 16:00	520	-132	890	2013/03/15	07:12:05	Halo	360	1063	1247	1161	25.8	112
25	2013/07/12 17:14	2013/07/13 05:00	2013/07/01 15:00	430	-73	563	2013/07/09	15:12:09	Halo	360	449	382	290	-7.7	174
26	2013/10/02 01:54	2013/10/02 23:00	2013/10/03 22:00	470	-67	800	2013/09/29	22:12:05	Halo	360	1179	1142	1164	-5.3	343
27	2013/10/08 20:20	2013/10/09 09:00	2013/10/01 11:00	480	-62	780	2013/10/06	14:43:22	Halo	360	567	710	822	21.5	10
28	2014/09/12 15:53	2014/09/12 22:00	2014/09/14 02:00	600	-75	920	2014/09/10	18:00:05	Halo	360	1267	950	1119	-51.6	175
29	2015/03/17 04:45	2015/03/17 13:00	2015/03/18 05:00	560	-223	840	2015/03/15	01:48:05	Halo	360	719	611	682	-9	240
30	2015/06/24 13:29	2015/06/25 10:00	2015/06/26 06:00	550	-86	960	2015/06/22	18:36:05	Halo	360	1209	1065	1147	-25.1	358
31	2015/08/15 08:29	2015/08/15 21:00	2015/08/16 08:00	500	-84	640	2015/08/12	14:48:05	221	204	647	688	687	4.8	234
32	2015/09/07 14:00	2015/09/01 08:00	2015/09/09 15:00	460	-98	620	2015/09/04	22:12:04	218	56	386	341	329	-3.1	230
33	2015/09/20 06:04	2015/09/21 08:00	2015/09/22 01:00	510	-75	850	2015/09/18	05:00:06	201	131	823	1196	1030	35.5	188
34	2015/11/06 18:18	2015/11/07 06:00	2015/11/08 16:00	500	-96	810	2015/11/04	14:48:04	Halo	360	578	550	701	10.1	288
35	2015/12/19 16:16	2015/12/20 03:00	2015/12/21 20:00	400	-170	540	2015/12/16	09:36:04	Halo	360	579	629	487	-6.7	334
36	2015/12/31 00:50	2015/12/31 17:00	2016/01/02 11:00	440	-117	690	2015/12/28	12:12:05	Halo	360	1212	1243	1228	4.6	163
37	2016/01/18 21:57	2016/01/19 10:00	2016/01/01 21:00	370	-104	440	2016/01/14	23:24:05	Halo	360	191	227	286	2.3	234
38	2016/04/14 07:35	2016/04/14 09:00	2016/04/15 04:00	420	-59	460	2016/04/10	11:12:05	26	136	543	547	547	0.4	25



General Properties CMEs/ICMEs SC24

CME linear speed: 125 – 2684 km/s

Mean CME linear speed: 855 km/s

CME 2nd order speed at final height: 158 – 2379 km/s

Mean CME 2nd order speed at final height: 892 km/s

CME 2nd order speed at 20 R_⊙: 286 – 2265 km/s

Mean CME 2nd order speed at 20 R_⊙: 877 km/s

A: -88.2 – 247 km/s²

ICME speed: 340 – 740 km/s

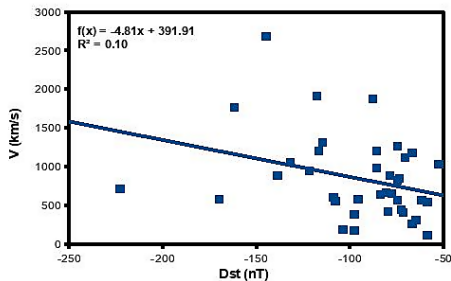
ICME mean speed: 478 km/s

V_{transit}: 437 – 1220 km/s

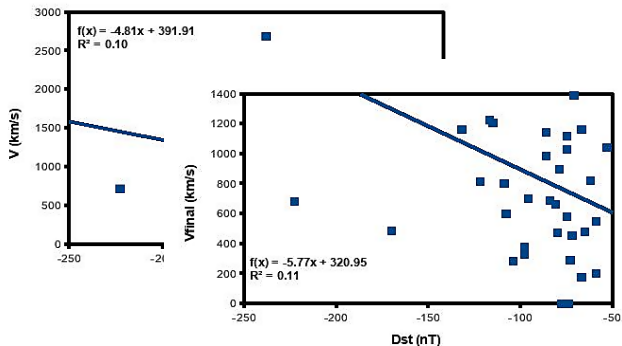
Mean V_{transit}: 709 km/s



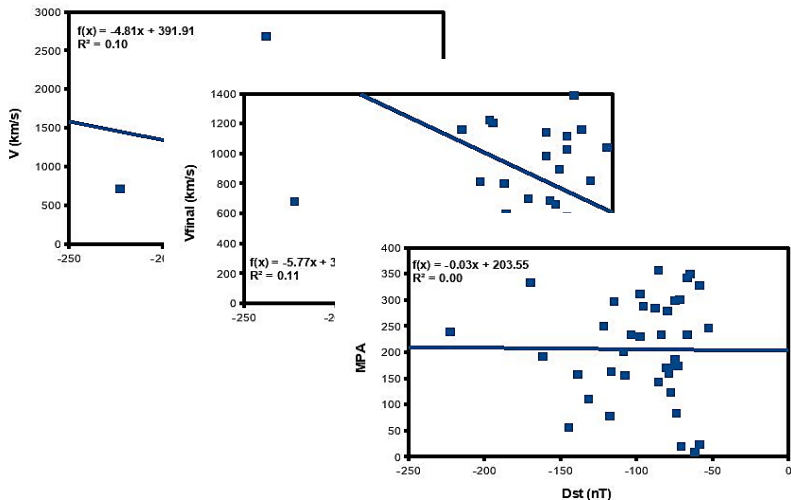
CMEs - statistics



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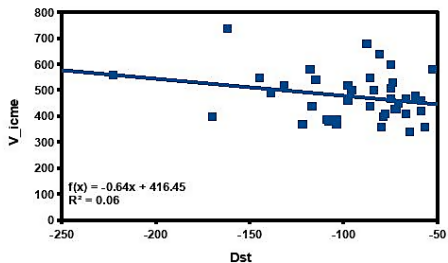


CMEs - statistics



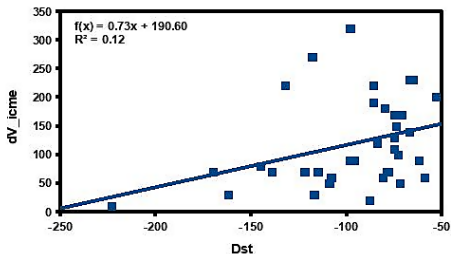
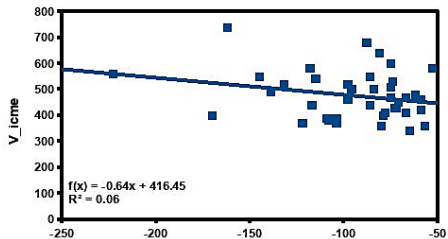
ROAS 1994

ICMEs - statistics

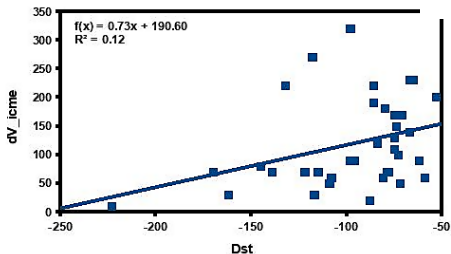
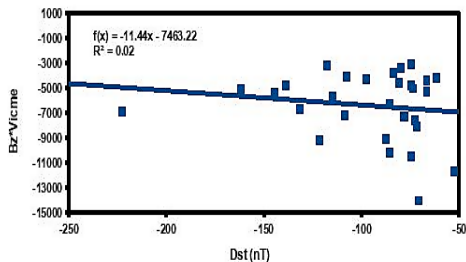
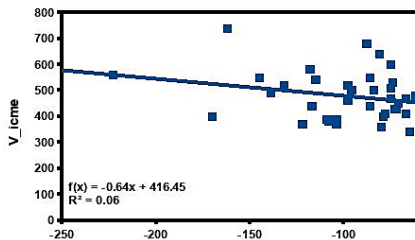


1848 1994

ICMEs - statistics

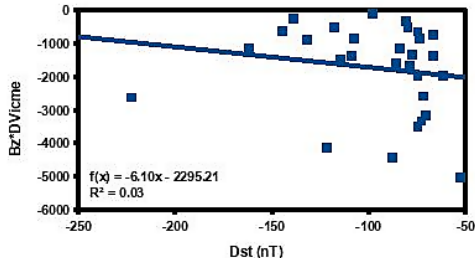
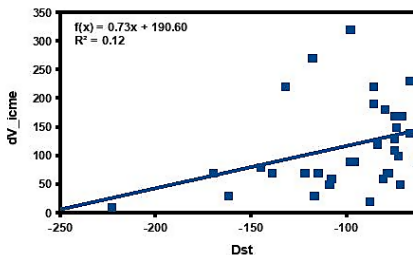
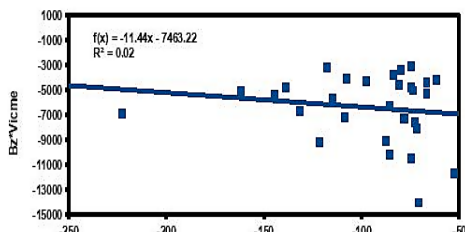
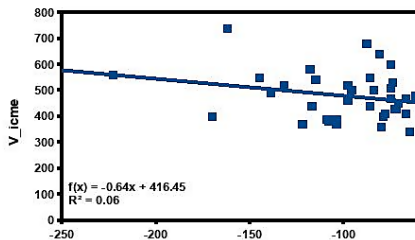


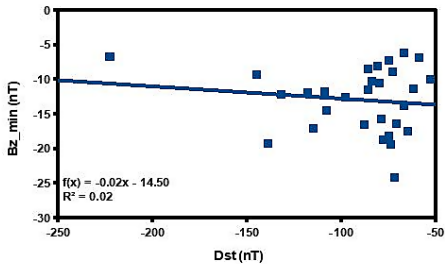
ICMEs - statistics

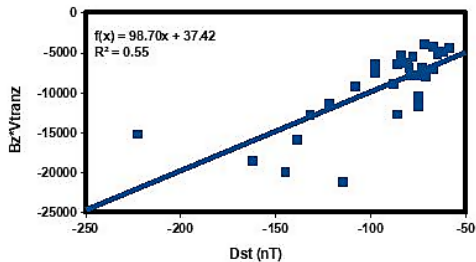
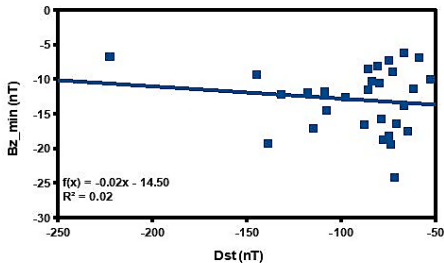


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ICMEs - statistics







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CME - 4 Aug 2011 - Halo

First appearance in LASCO C2: 04:12:05 UT

Linear speed: 1315 km/s

2nd-order Speed at final height: 1074 km/s

MPA: 298

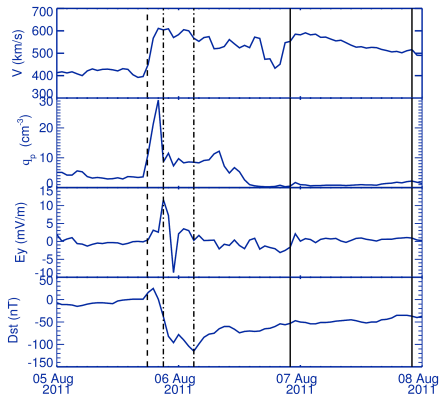
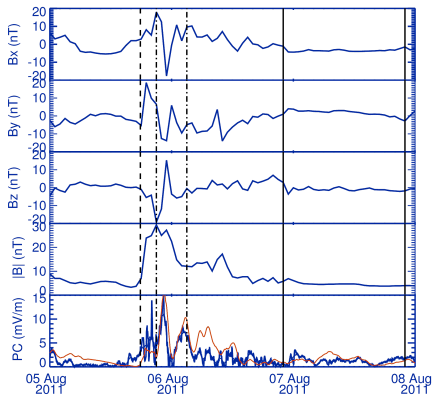
Source:

Flare M9.3 – 03:41, 03:37, 04:04 UT

N16W51



ICME – 6-7 Aug 2011



CME - 10 Sep 2014 - Halo

First appearance in LASCO C2: 18:00:05 UT

Linear speed: 1267 km/s

2nd-order Speed at final height: 950 km/s

MPA: 175

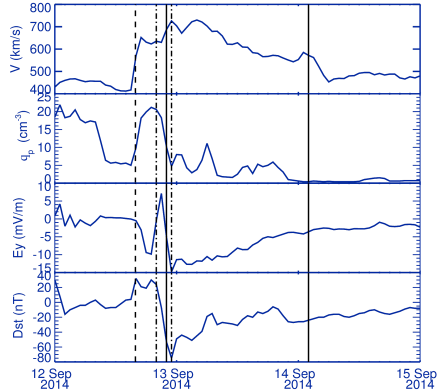
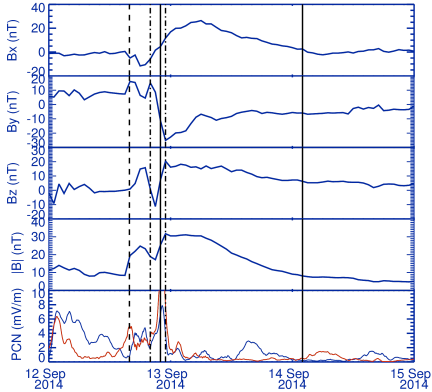
Source:

Flare X1.6 – 17:21, 17:45, 18:20 UT

N14E02



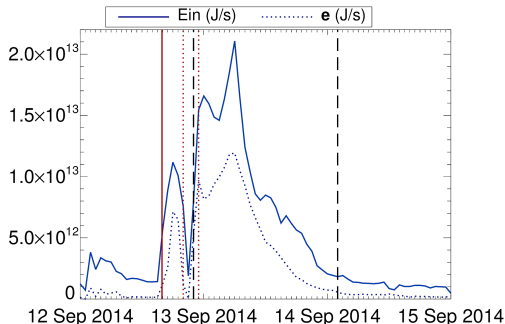
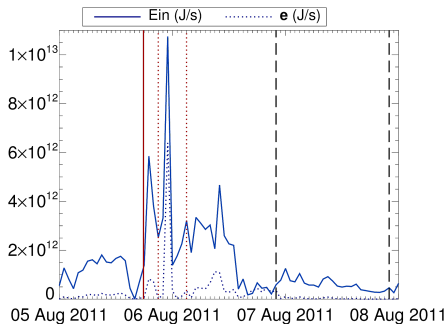
ICME – 12-14 Sep 2014



All data except PC – OMNI ; PC – pcindex.org



Energy transfer from solar wind to magnetosphere



E_{in} – Wang et al. (2014) ; ϵ – Akasofu (1981)



Summary

- Lower geo-effective solar activity for SC24
- Different peaks for geo-effective CMEs for SC24/SC23
- Any separate property of CME does not show good correlation with Dst
- Any separate property of ICME does not show good correlation with Dst; some correlation for DV
- Product $B_z * V_{\text{transit}}$ good correlation!
- Main phase of GS correlates with PC peak
- Similar CMEs - very different energy transfer process!



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Acknowledgments

Joint project “Solar wind during the period of a deep minimum and its impact on the geomagnetic activity” Romanian and Bulgarian Academy

Thank you!

