



Anomalies from Solar Events

In response to CGMS Permanent Action 4

NOAA-WP-04 provided an update of the solar activities from high proton events of solar flares and Coronal Mass Ejections (CMEs). These occurrences were associated with energetic proton events of Solar Cycle 23 as it approaches its minimum, which is expected to occur during the first half of 2007. Information was provided on major activities observed from September 2005 through August 2006. Several major solar flares and geomagnetic storms occurred even as the solar cycle continued beyond the solar maximum observed around the year 2000. It is typical for energetic electron fluxes to increase during the declining phase of the solar cycle as recurrent coronal holes produce regular intervals of high-speed solar winds that interact with the geomagnetic field. During the summary period, very high flux levels were observed 17 – 19 September 2005 and 17 – 18 April 2006.

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1.0 Introduction

This paper documents significant space weather for the period September 2005 – August 2006. Previous CGMS papers have addressed in more detail the status of Cycle 23, and what follows is an update of CGMS XXXII NOAA-WP-04.

2.0 Significant Late-Cycle Events

A few episodes of major space weather activity occurred during the summary period, even as Cycle 23 approached solar minimum, which is expected to occur during the first half of 2007. Table 1 illustrates activity observed from September 2005 to August 2006, with shading highlighting the months of major activity, which are discussed in more detail below. Of particular interest was the significant activity that occurred during September 2005.

Table 1: Summary of Space Weather Events

	X-ray Events		>2 MeV Events		Proton Events		Geomagnetic Storms		
	M-class	X-class	Days > 1.0E+03	F10.7	>10 SPE	>100 SPE	Ap	Major	Severe
Sep-05	26	10	27	91	1	1	21	2	1
Oct-05	0	0	13	77	0	0	7	0	0
Nov-05	7	0	10	86	0	0	8	0	0
Dec-05	4	0	11	91	0	0	7	0	0
Jan-06	0	0	8	84	0	0	6	0	0
Feb-06	0	0	6	77	0	0	6	0	0
Mar-06	0	0	8	75	0	0	8	0	0
Apr-06	4	0	5	89	0	0	11	1	0
May-06	0	0	3	78	0	0	8	0	0
Jun-06	0	0	16	77	0	0	9	0	0
Jul-06	1	0	4	76	0	0	7	0	0
Aug-06	0	0	11	79	0	0	10	0	0

September 2005

In September, activity rose to high to very high levels due to major flare activity from Region 808 (S09, L = 232, class/area, Fkc/1430 on 09 September). This large, magnetically complex region produced 23 major flares, including 10 X-class flares; making it one of the most prolific flare producers of Cycle 23. The largest flare was an X17/3B on 07 September, which spawned SPE at >10 MeV and >100 MeV as well as a CME. A severe geomagnetic storm occurred during 11 September due to a CME associated with an X6 flare on 09 September. Major geomagnetic storms occurred during 12 – 13 September, also associated with X-flare/CME activity from Region 808. Flare activity returned to low levels on 18 September following a period of decay in Region 808. The region quietly crossed the west limb on 20 September.

December 2005

Space weather activity increased to moderate to high levels on 02 December due to 4 M-class flares from Region 826 (S02, L = 249, class/area, Ekc/490 on 02 December), two of which reached the major flare category (M6 and M7). The major flare activity followed a period of rapid development in Region 826. Activity decreased to low levels on 03 December as the region entered a decay phase.

April 2006

Space weather activity increased to moderate to high levels during April due to M-class flare activity from Regions 865 (S11, L = 113, class/area, Dkc/620 on 04 April) and 875 (S10, L=115, class/area, Dki/480 on 25 April). Region 865 produced two short-lived, low-level M-class flares on 06 April. Activity rose to high levels by virtue of an M7 flare from Region 875 on 27 April. Activity subsided to low levels on 28 April. A major geomagnetic storm was observed on 14 April, most likely associated with a co-rotating interacting region (perhaps complicated by the presence of transient flow).

3.0 Energetic Electron Activity

It is typical for energetic electron fluxes to increase during the declining phase of the solar cycle as recurrent coronal holes produce regular intervals of high-speed solar winds that interact with the geomagnetic field. During the summary period, electron flux levels were observed at high levels ($1.0E+3$ pfu) about 33% of the time. Very high flux levels ($5.0E+04$ pfu) were observed during 17 – 19 September 2005 and 17 – 18 April 2006.

4.0 REFERENCES

NOAA/NCEP/SWPC Preliminary Report and Forecast of Solar Geophysical Data (PRF): PRF 1566, 06 September 2005 – PRF 1618, 05 September 2006.