



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 latter half of 2008. Information was provided on major activities observed from September 2006 through July 2007. A single episode of major space weather activity occurred during the summary period. 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. Electron flux levels reached high levels at geosynchronous orbit on about 55% of the days during the period. Very high flux levels occurred on 14 December 2006.

Summary of Major Space Weather Activity

1.0 Introduction

This paper documents significant space weather for the period September 2006 – July 2007. Previous CGMS papers have addressed in more detail the status of Cycle 23, and what follows is an update of NOAA-WP-04 as presented at CGMS-34.

2.0 Significant Late-Cycle Events

A single episode of major space weather activity occurred during the summary period as Cycle 23 continued its approach toward solar minimum, which is expected to occur during the latter half of 2008. Table 1 lists activity observed from September 2006 to July 2007, with shading highlighting the month of major activity (December 2006); which is discussed in more detail below.

Table 1: Summary of Space Weather Events

| | X-ray Events | | >2 MeV Events | F10.7 | Proton Events | | Geomagnetic Storms | | |
|---------------|--------------|----------|----------------|-------------|---------------|----------|--------------------|----------|----------|
| | M-class | X-class | Days > 1.0E+03 | | >10 SPE | >100 SPE | Ap | Major | Severe |
| Sep-06 | 0 | 0 | 18 | 77.8 | 0 | 0 | 7 | 0 | 0 |
| Oct-06 | 0 | 0 | 22 | 74.3 | 0 | 0 | 8 | 0 | 0 |
| Nov-06 | 0 | 0 | 14 | 86.3 | 0 | 0 | 8 | 0 | 0 |
| Dec-06 | 5 | 4 | 25 | 84.5 | 2 | 3 | 14 | 1 | 0 |
| Jan-07 | 0 | 0 | 26 | 83.5 | 0 | 0 | 9 | 0 | 0 |
| Feb-07 | 0 | 0 | 17 | 77.8 | 0 | 0 | 7 | 0 | 0 |
| Mar-07 | 0 | 0 | 18 | 72.2 | 0 | 0 | 8 | 0 | 0 |
| Apr-07 | 0 | 0 | 12 | 72.4 | 0 | 0 | 9 | 0 | 0 |
| May-07 | 0 | 0 | 15 | 76.0 | 0 | 0 | 7 | 0 | 0 |
| Jun-07 | 10 | 0 | 11 | 76.0 | 0 | 0 | 6 | 0 | 0 |
| Jul-07 | 0 | 0 | 6 | 74.0 | 0 | 0 | 7 | 0 | 0 |

December 2006

Activity increased to high levels in December due to major flare activity from Region 930 (S05, L = 010, class/area Dki/680 on 12 December). Region 930 rotated into view on 4 December and produced 5 major flares before it departed the disk on 18 December. The major flares included an X9/2n on 05 December, an M6/Sf and X6/3b on 06 December, an X3/4b on 13 December, and an X1/Sf on 14 December. The X9/2n, X3/4b, and X1/Sf flares were associated with SPE at >10 and >100 MeV. The >10 MeV SPE associated with the X9/2n flare lasted almost 6 days and reached a peak of 1980 pfu on 7 December. Two of the major flares, the X3/4b and X1/Sf, also produced geo-effective CME. The CME impact associated with the X3/4b flare resulted in major to severe geomagnetic storms during 14 – 15 December (Categories G2 (Moderate) to G4 (Severe) on the NOAA Space Weather Scales). The CME impact associated with the X1 flare did not result in significant geomagnetic activity.

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. Electron flux levels reached high levels ($1.0E+3$ pfu) at geosynchronous orbit on about 55% of the days during the period. Very high flux levels ($5.0E+04$ pfu) occurred on 14 December 2006.

4.0 REFERENCES

NOAA/NCEP/SEC Preliminary Report and Forecast of Solar Geophysical Data (PRF):
PRF 1618, 05 September 2006 – PRF 1666, 07 August 2007.