PROBA-2 Splinter:
SWPC Space Weather Products from GOES/SXI and /XRS

Curt A. de Koning

Chris Balch

GOES Xray Flux (5 minute data) Begin: 2013 Nov 6 0000 UTC

Updated 2013 Nov 8 03:35:12 UTC   NOAA/SWPC Boulder, CO USA
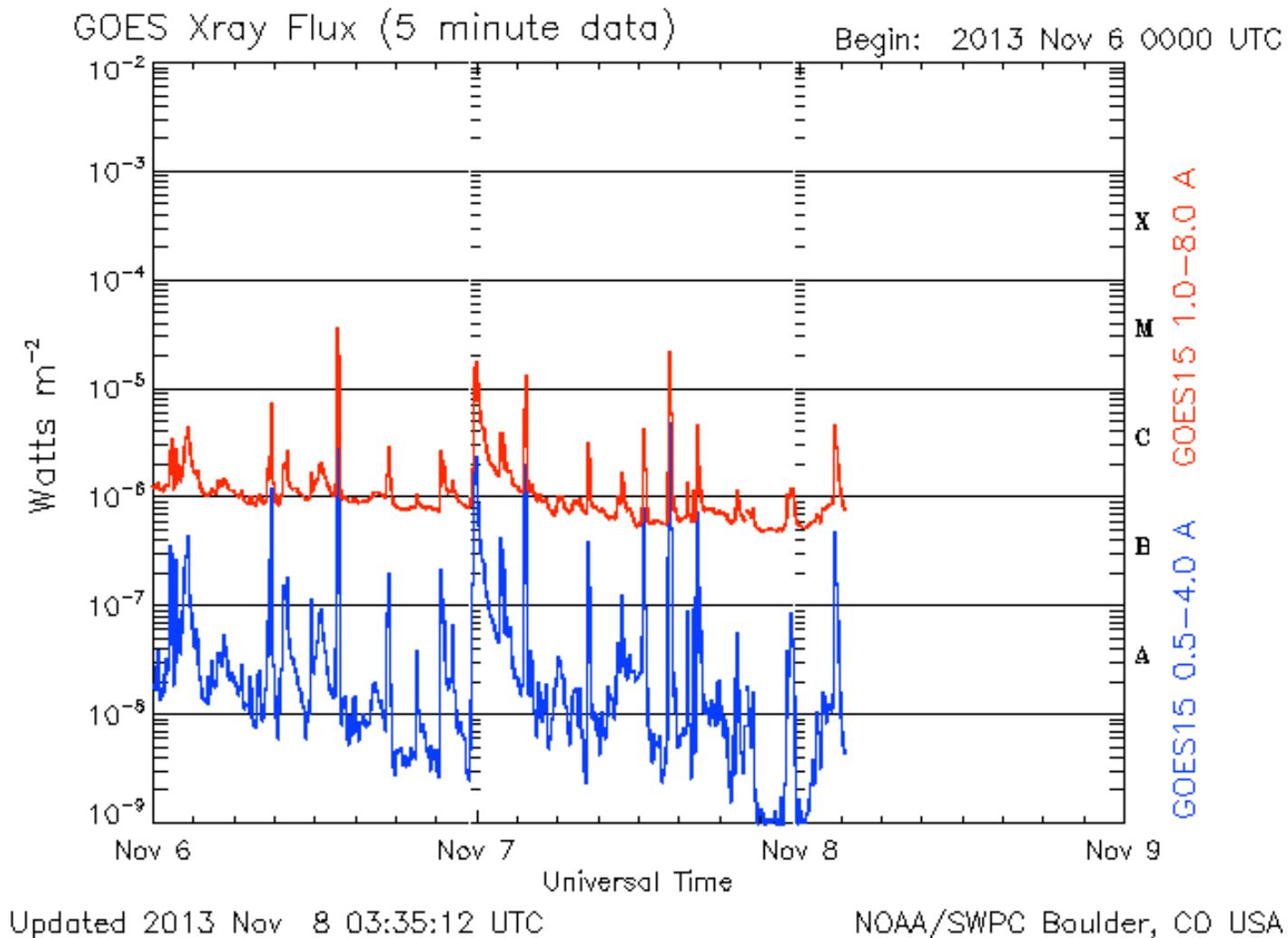
GOES X-ray Sensor (XRS)

► there are two XRS instruments on each GOES satellite

► short channnel (0.05–4 nm) & long channel (0.1–0.8 nm)

► 3 second sample rate but 1 minute data generally used in operations

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- ► SWPC's primary instrument for monitoring and measuring flares:
  - provides the foundation for the C-, M-, and X-class flare classification system;
  - algorithms detect the start, max, and end of events;
  - the data are highly reliable;
  - there is backup redundancy.
- ► SWPC produces daily probabilities for C-, M-, and X-class events
  - XRS serves as the ground truth for what actually occurred

GOES X-ray Sensor (XRS)

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- ▶ XRS can be used to classify an event as long duration:
  - in general, long-duration X-ray events are well correlated with CME's so this is a way to detect that an eruptive event has occurred.
- ▶ SWPC uses statistical models to relate proton peak flux to the time-integrated X-ray flux observed during a flare:
  - the time integral of X-ray events is *felt* to be indicative of the energetics of an eruptive event – *subjective!*

GOES X-ray Sensor (XRS)

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- ► SWPC keeps records of X-ray events and the associated region which produced them;
- ► this builds a flare history and climatology database;
- ► climatology in turn is used to guide the flare prediction for regions based on their sunspot classification.

GOES X-ray Sensor (XRS)

► XRS provides a key input for the D-RAP model that characterizes HF absorption when flares occur:

- D-RAP (D Region Absorption Prediction model) depicts the D region at high latitudes where it is driven by particles, as well as low latitudes where photons cause prompt changes;
- conditions in the D region of the ionosphere have a dramatic effect on high frequency (HF) communications and low frequency (LF) navigation systems

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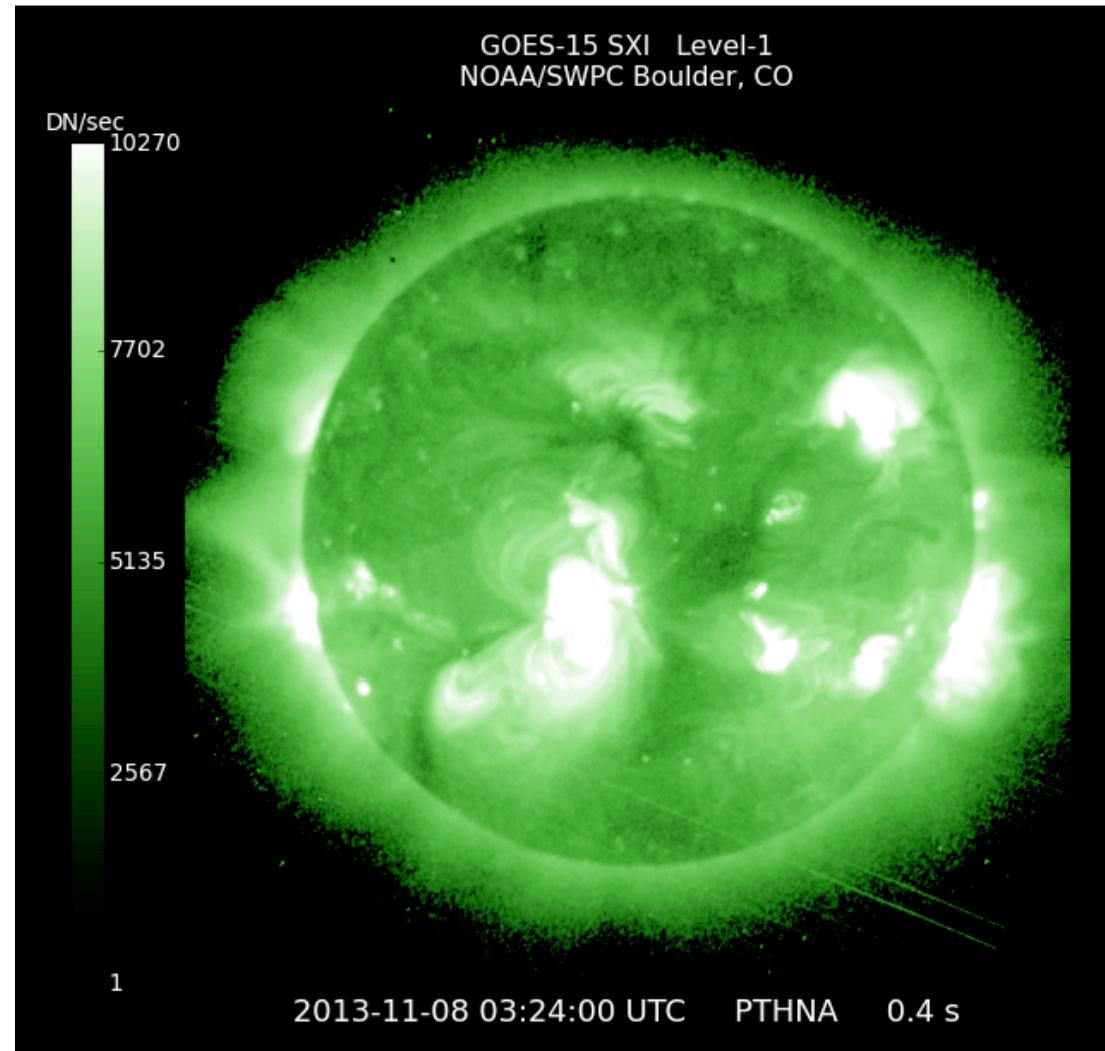
GOES Solar X-ray Imager (SXI)

▶ full-disk, 512×512 images of the Sun with 5 arcsec pixels

▶ one minute cadence

▶ images the Sun at several wavelength between 0.6–6 nm (soft X-ray to extreme UV)

► SXI is very good for locating the source of X-ray events;
  • the source is needed to create forecasts for geomagnetic storms and energetic proton events.
► SXI will show post-eruptive reconnecting loop arcades:
  • a well known signature of a CME.

GOES Solar X-ray Imager (SXI)

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- ► SXI shows coronal holes:
  - a key input to the geomagnetic forecast.
- ► SWPC compares images over time to see how coronal holes are evolving;
  - the comparison can be made from day to day as well as over several solar rotations.
- ► Generally speaking, one gets 'sense' of the busiest and most rapidly growing solar active regions by viewing animations of SXI imagery.

GOES Solar X-ray Imager (SXI)

► SWPC had hoped to use SXI to detect sheared coronal magnetic field structures, such as 'sigmoid-like' regions, that indicate coronal loops in non-potential configurations.

GOES Solar X-ray Imager (SXI)

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