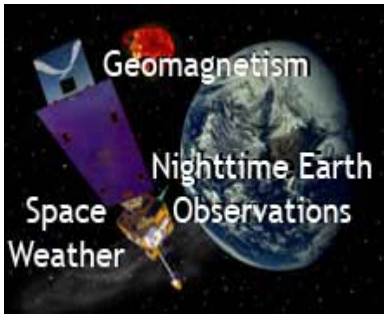

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Solar Flare data in H-Alpha and X-ray wavelengths

Solar Flares

A solar flare is a short-lived sudden increase in the intensity of radiation emitted in the neighborhood of sunspots. For many years it was best monitored in the H-alpha wavelength and occurs in the chromosphere, though occasionally white light flares are seen in the photosphere. In modern times the solar X-ray wavelengths are monitored via satellite for solar flares. Flares are characterized by a rise time of the order of minutes and a decay of the order of tens of minutes. The total energy expended in a typical flare is about 10**30 ergs; the magnetic field is extraordinarily high, reaching values of 100 to 10,000 gauss. Optical flares in H-alpha are usually accompanied by radio and X-ray bursts, and occasionally by high-energy particle emissions. The optical brightness and size of the flare are indicated by a two-character code called "importance." The first character, a number from 1 to 4, indicates the apparent area. For areas of less than 1, an "S" is used to designate a subflare. The second character indicates relative brilliance: B for bright, N for normal and F for faint. A general discussion of solar flares is found in Svestka's, SOLAR FLARES (1976). The National Geophysical Data Center (NGDC) holds archives for about 80 stations, covering the period 1938 to the present. Currently 5 stations send their data to NGDC Boulder on a routine monthly basis -- the current main observing emphasis for Space Weather has transitioned to Coronal Mass Ejections (CMEs) which directly impact the Earth's geomagnetic field. Solar flares impact the Earth's upper atmosphere and can eject high energy particles that can cause satellite failures. The flare reports are processed and published in the monthly report "Solar-Geophysical Data" and in a different format in the IAU "Quarterly Bulletin on Solar Activity."

1. **Solar H-alpha Flare events** -- 1980-present; earlier data 1938-1999 NASA SPDS & NOAA ESDIM Data Rescue

   Download Data

   The basic reports sent monthly from the observatories (as soon as possible after the end of the month) consist of data for each flare or subflare and a day-by-day table of times when the sun was under observation by photographic, electronic or visual patrol. The table gives as many of the following measurements as possible: time of beginning; time of maximum brightness; time of any prominent secondary maxima; time of end (all times in UT); area at time of maximum brightness (square degrees of solar disk correct for foreshortening); importance class of flare (IAU 1964 report, updated in 1975); heliographic coordinates of center of gravity of flare at maximum brightness; whether the above information is taken from photographic, electronic or visual data; also, where available, give maximum width, and end of every observing period of each day, distinguishing any gaps of 5 minutes or more. Photographic patrols indicate the normal interval between

exposures; visual patrols (without photographic patrol) indicate whether continuous or intermittent and specify the normal interval.

2. **Solar H-alpha Flare patrol observations from a worldwide network,** 1955-present ---- Download Data
3. **Solar X-ray Flares** from the **GOES** satellite 1975 to present and from the **SOLRAD** satellite 1968-1974 ---- Download Data

   For GOES x-ray events: The event starts when 4 consecutive 1-minute Xray values have met all three of the following conditions -- a.) All 4 values are above the B1 threshold and b.) All 4 values are strictly increasing and c.) The last value is greater than 1.4 times the value which occurred 3 minutes earlier. The maximum is the time when the flux value reaches maximum. The maximum flux value (the event size) is the flux, as defined by the C-M-X scale, at the time of maximum. The event ends when the current flux reading returns to 1/2 the 'peak' (peak is the sum of the flux at maximum plus the flux value at the start of the event).

   Listing of **hard X-ray solar flare data sources** -- various satellites.
4. **Flare Index** ---- Download Data
   - **Solar H-alpha Flare Index** -- 1976-present, Kandilli Solar Observatory
   - **The Comprehensive Flare Index** (cfi) 1955-1980 was developed by Helen W. Dodson and E. Ruth Hedeman, McMath-Hulbert Solar Observatory. The first description is printed in WDC-A for STP's Report UAG-14, "An Experimental, Comprehensive Flare Index and Its Derivation for 'Major' Flares, 1955-1969." Subsequent volumes of cfi indices for more recent years are given in Reports UAG-52 (1970-1974) and UAG-80 (1975-1979).

     Five measures of flare importance are added to obtain the cfi:

     1. Sudden Ionospheric Disturbance importance (scale 0 - 3);
     2. H-alpha flare importance (scale 0-3);
     3. 10.7 cm solar radio flux magnitude (characteristic of log of flux);
     4. Solar radio spectral type (Type II=1, Continuum=2, and Type IV with duration greater than 10 minutes=3; and
     5. Magnitude of 200 MHz flux (characteristic of log of flux).