Printed: 02 September 2012 (WFD)

Readme: Composite Views of the Sun

Composites

Solar composite drawings and images are used to describe and discern various solar features observed either daily or throughout a full solar rotation. The full sun drawings included here were provided by numerous solar observatories and represent the painstaking efforts of solar physicists and operators to provide some context to daily solar disk observations obtained from solar telescopes viewing the sun in white light and within several spectral emission wavelengths. Synoptic maps, on the other hand, are an attempt to describe the entire sun in terms of features that are quasi-static on a 27-day solar rotation.

AVAILABLE DATASETS

Dataset: Solar Imagery – Composites – Full Sun Drawings (1947 – present)

Description: Full sun drawings are a form of synoptic analysis drawings, also known as Neutral line (NL) drawings which provide a comprehensive daily view of the sun for relevant solar feature of interest. To a somewhat limited extent depending on the provider the discerned features include neutral lines, coronal hole boundaries, active regions, plage, filaments and prominences. Also included are specific details about the coronal hole polarity, active region numbers, flare probabilities for each region and the proton event probabilities for each region. Brief descriptions of interesting solar features interest include:

Active Regions – Active regions of the sun are localized areas on the Sun with intense magnetic fields. The strongest magnetic fields provide energy for solar flares and coronal mass ejections (CMEs).

Coronal holes (X-Ray and He 10830) – Coronal holes are unipolar magnetic regions that are the source of high speed solar winds. Coronal holes appear dark when seen in UV or X-rays, because they have a very low density. Traditionally, coronal holes have been identified from He I 10830A observations which can be made from ground based observatories.

Faculae – Bright regions (little torches) of strong magnetic fields appearing in the photosphere and chromosphere usually

Filaments/Prominences (H-alpha) – Filaments (on disk) and prominences (at the limb) are meta-stable regions of high density suspended in the low density corona. These are considered meta-stable because they can erupt becoming a coronal mass ejection but sometimes they just fade away. When they erupt they then become a geomagnetic storm threat. These eruptions are usually slow and don't often drive very large storms.

Neutral Lines (Magnetogram) – Any time the magnetism field on the Sun organizes itself into large structures of one magnetic polarity or the other, there must be a 'neutral line' at the boundary of the magnetic polarity. In active regions, neutral lines are associated with flaring and in the quiet sun filaments/prominences will lie along the neutral lines.

Plage – Most of an active region's area is usually occupied by plage and whereas sunspots appear dark, plage shows up as bright areas surrounding sunspots. It is due to plage that the sun is brighter at solar maximum than at solar minimum. Areas of plage have strong magnetic fields, but the field is not as highly organized as it is in sunspots.

Links to data providers and additional information:

- Boulder NOAA Space Weather Prediction Center
- Fraunhofer *unknown*
- IGY-D1 NOAA National Geophysical Data Center
- IGY-D2 NOAA National Geophysical Data Center
- Northwestern *unknown*
- Wendelstein University Observation Munich

Dataset Status: Active.

Dataset: Solar Imagery – Photosphere – Synoptic Maps (CR1512 – present)

Description: Solar synoptic maps usually refer to assembled composites recorded over a full solar rotation of about 27 days. Synoptic maps can be derived from single wavelength images or from multi-wavelength images highlighting solar features of interest (see above). Images for this dataset were provided by numerous solar observatories. The Boulder H-alpha (6563 A) synoptic maps, or charts, were first developed by McIntosh as an outgrowth of efforts to infer solar magnetic fields. These McIntosh synoptic charts identify regions of positive and negative magnetic polarity separated by a magnetic neutral line. Superposed on many of the maps are the locations of coronal holes observed in X-rays and from HeI spectro-heliograms at 10830 A. Features of interest evident at various wavelengths include;

3934 A (Calcium, Ca II K-line) – used to monitor structures in the lower chromosphere, in particular faculae which are clearly discerned in Ca II but less so in white-light images (only near the limb) and not in H-alpha

5303 A (Iron, Fe XIV) – Monitor the chromosphere

5694 A (Calcium, Ca XV) – Ca XV emissions from the sun are used to detect coronal hot spots. Also referred to as the solar yellow line

6374 A (Iron, FE X) – Monitor the chromosphere

6563 A (Hydrogen, H-alpha); chromospheric imaging of solar flares, sunspots, plage, filaments and prominences, also chromospheric network

10830 A (Helium, He I); preferred wavelength to image coronal holes which are not as readily apparent in Ca II and H-alpha

Links to data providers and additional information:

- Kislovodsk Pulkovo Observatory – seeking permission
- Kitt Peak Kitt Peak National Observatory
- McIntosh NOAA Space Weather Prediction Center
- Sac Peak National Solar Observatory
- Wilcox The Wilcox Solar Observatory

Dataset Status: Active.

References:

Topka, K. P.; Tarbell, T. D.; Title, A. M. (1997). "Properties of the Smallest Solar Magnetic Elements. II. Observations versus Hot Wall Models of Faculae". *Astrophysical Journal* **484** (1): 479–486.