

A freely available 4-yr database of synchronic full-sun EUV and coronal hole maps

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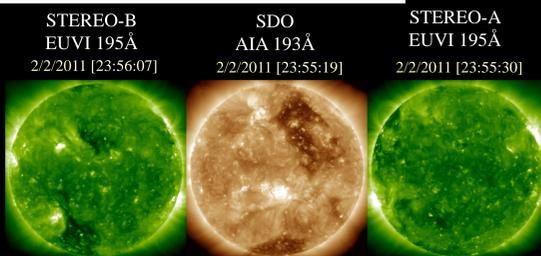


PROCESSING PIPELINE

Caplan et al, ApJ, 823, 53 (2016)

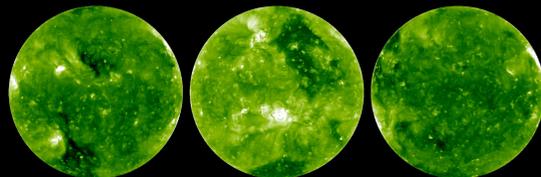
(1) DATA ACQUISITION

- Obtain level-1 preprocessed EUV disk images using SolarSoftWare in IDL
- They are selected within a maximum of 30 minutes of each other (typically within 30 seconds)
- Images are checked for bad data through header information and visual inspection



(2) PSF DECONVOLUTION

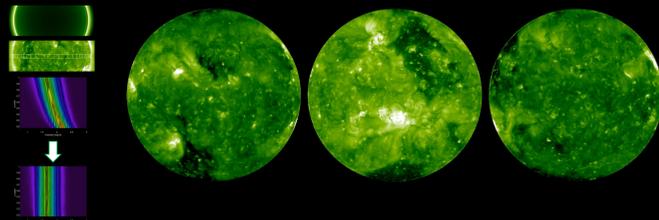
- Diffraction/scattered light causes photons to bleed from brighter structures into coronal holes
- This can be eliminated through deconvolution with a point-spread function (PSF)
- We use the following PSFs:
 STA/STB: Shearer et al. ApJ, 749, L8 (2012)
 AIA: Produval et al. ApJ, 765, 144 (2013)
- Deconvolution done with a GPU-accelerated SGP algorithm provided by Prato et al. A&A 539, A133 (2012)



(3) LIMB-BRIGHTENING CORRECTION

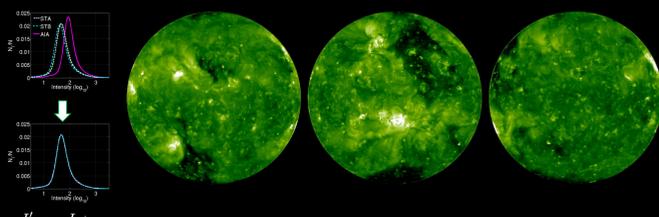
- Limb-brightening causes equivalent structures to brighten away from disk-center towards the limb
- We extract radial intensity data to formulate corrections for such variations
- The extracted data is limited in latitude so each radial bin "sees" the same structures. Values are collected over 1 year to avoid rotational variations
- Histograms of the averaged radial bins are used to find the optimal factors for an image transformation such that they match the disk-center histogram

$$I'(\mu) = \beta(\mu) I(\mu) + \gamma(\mu) \quad \mu = \cos \theta$$



(4) INTER-INSTRUMENT TRANSFORMATIONS

- Flattening each instrument's image to each other helps in unifying coronal hole detection parameters and allows for a better synchronic EUV map
- Intensity values over the disk (limited to the combined visible latitudes and time-shifted to match central meridian angles) are collected over 1 year of data
- Optimal image transformation factors are found which best modify the histograms of STEREO-B and AIA data to match that of STEREO-A



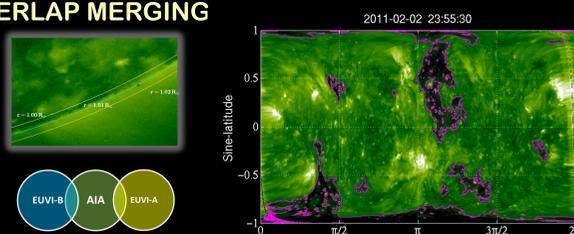
(5) CORONAL HOLE DETECTION

- Our pre-processing allows the use of simplified segmentation algorithms
- EZSEG: Iterative dual-threshold region growing
- Simple, fast, and modular
- Implemented in Fortran with OpenMP and c with CUDA

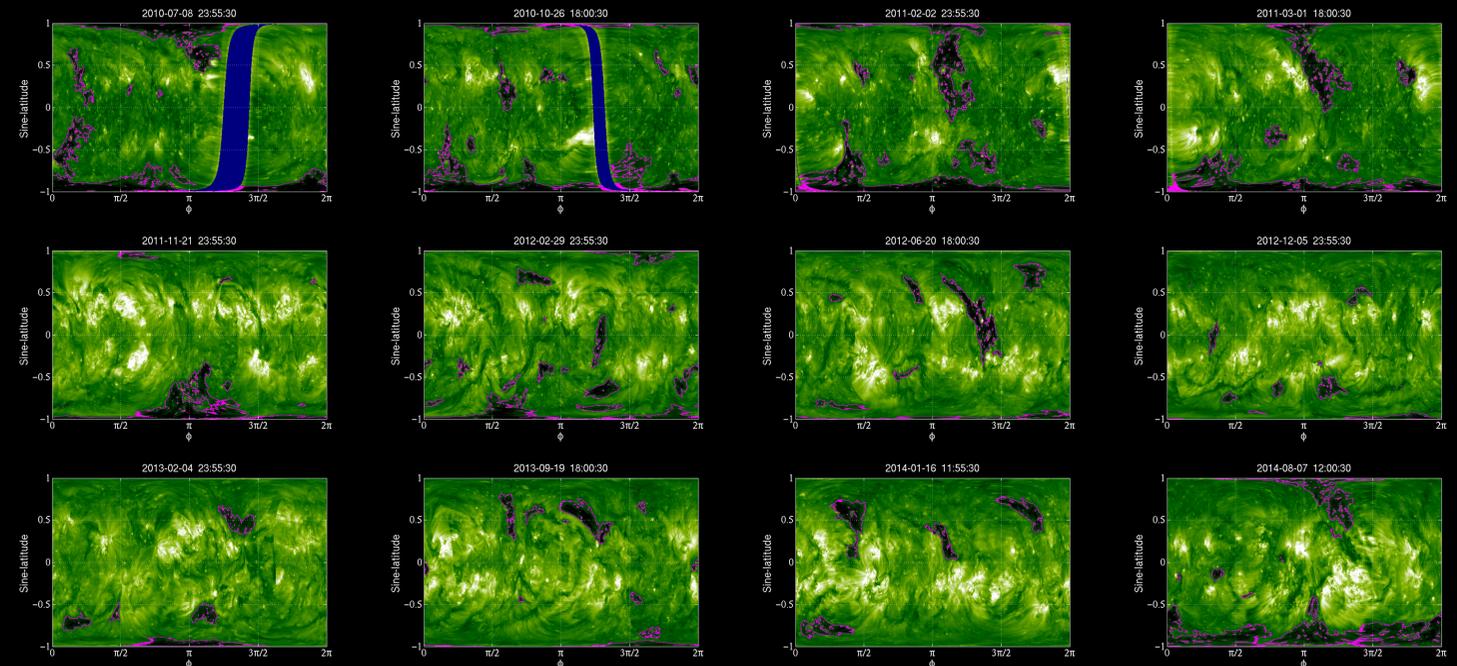


(6) MAP PROJECTION AND OVERLAP MERGING

- We project each EUV and CH disk image onto a sine-latitude-phi map keeping in mind near-limb distortions
- We take into account apparent line-of-sight coronal radius to avoid positional shifts in combined map
- Overlapping regions are merged using a mu-limited, minimum-intensity criteria



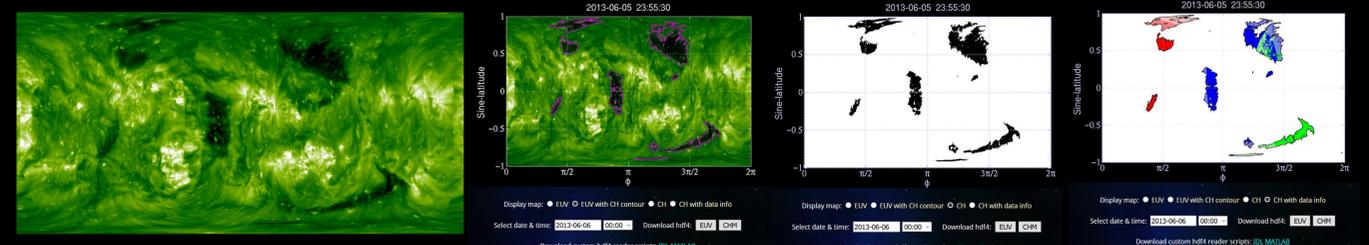
EXAMPLE MAPS



THE DATABASE

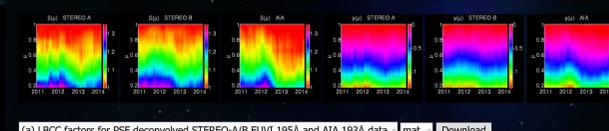
www.preds-ci.com/chd

4-yr of maps at 6-hr cadence (June 2010 to Aug. 2014)



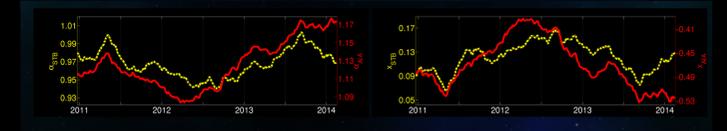
Preprocessing data

Limb-brightening correction (LBC)



(a) LBC factors for PSF deconvolved STEREO-A/B EUVI 195A and AIA 193A data mat Download

Inter-instrument transformations (IIT)



(a) IIT factors for limb corrected PSF deconvolved STEREO-A/B EUVI 195A and AIA 193A data ascii Download

Software

- [EUV2CHM: An all-in-one coronal hole detection example](#)
- [EZSEG: Image segmentation code modules](#)
- [EUV_GEN_PREPROC: EUV pre-processing data generation](#)
- [MATLAB script package \(Advanced\)](#)

[Download EUV2CHM](#)

[Download EZSEG](#)

[Download EUV_GEN_PREPROC](#)