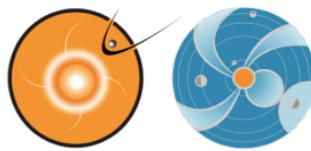


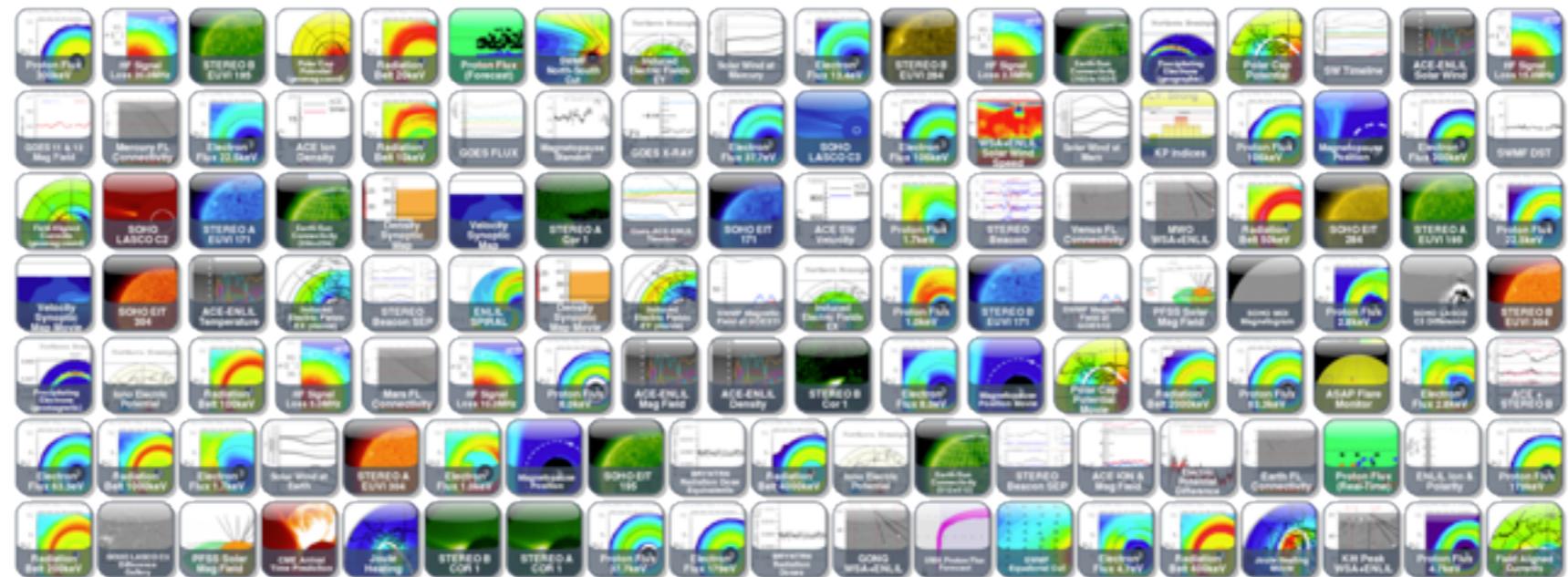
Monitoring Space Weather with iSWA

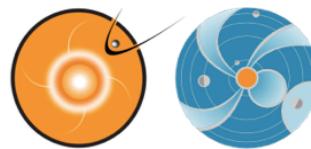


Introduction

Monitoring Space Weather with iSWA

- iSWA — Integrated Space Weather Analysis System
- Allows forecasters to customize a space weather monitoring layout
- <https://iswa.gsfc.nasa.gov>

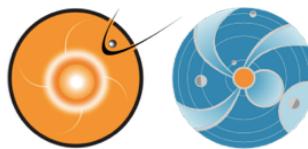




Introduction iSWA Imagers

- **SDO AIA for the earth facing solar surface**
- **SOHO LASCO coronagraphs for CMEs**
- **STEREO-A EUVI for far-sided solar surface**
- **STEREO-A coronagraphs**
- **Magnetic Connectivity Solarscape Viewer**

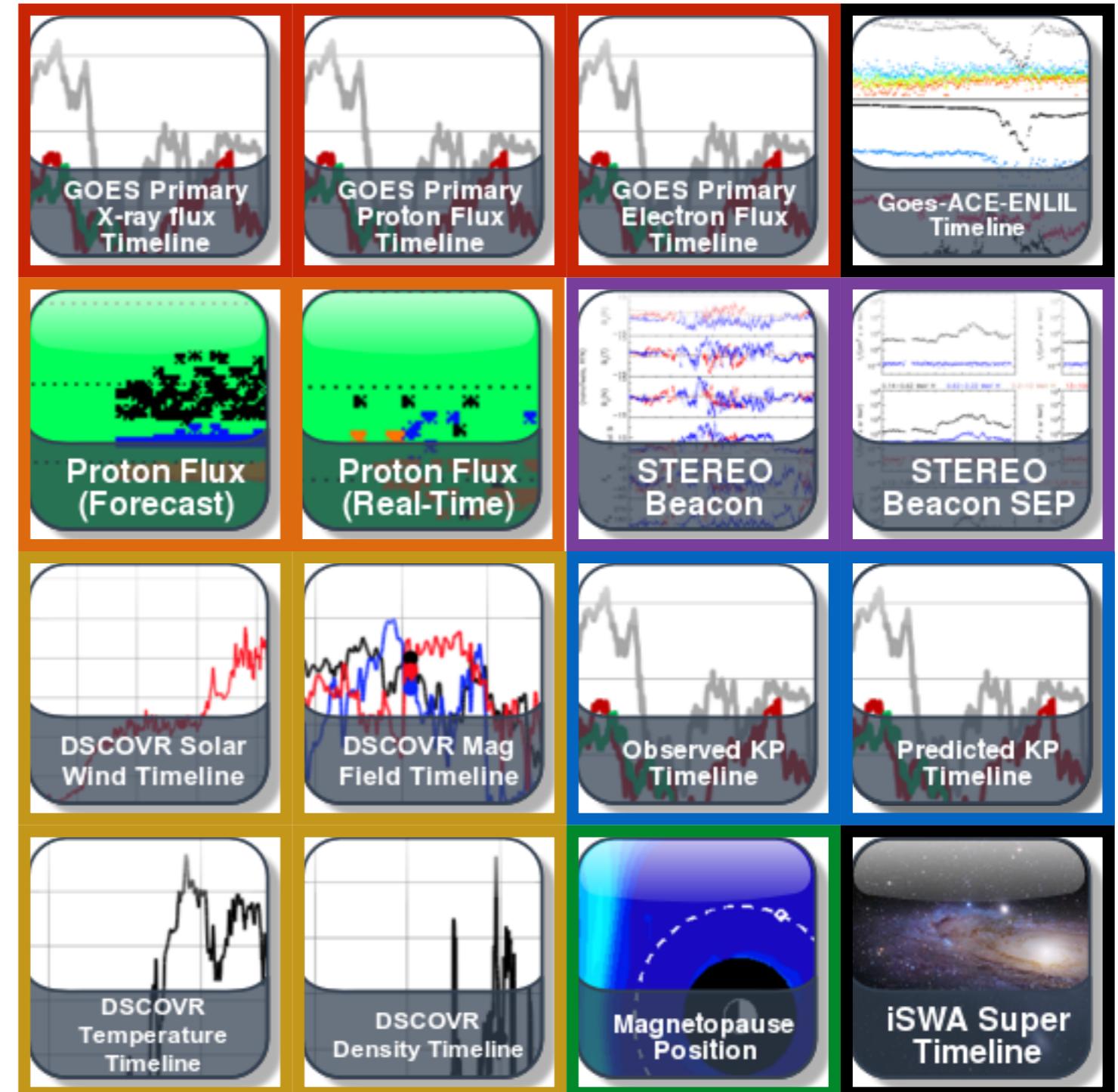


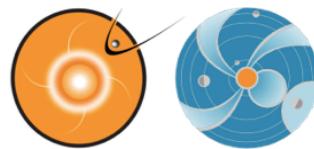


Introduction

iSWA Graphs/Timelines

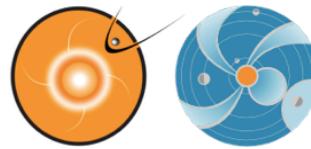
- **GOES (X-ray, Proton, & Electron Fluxes)**
- **SOHO/COSTEP Proton Flux (Real-time & Forecast)**
- **DSCOVR Solar Wind (Speed, Magnetic Field, Temperature, & Density)**
- **SWMF Magnetopause Standoff Position**
- **K_p (Observed & Predicted)**
- **STEREO Beacon (Solar Wind & SEP)**
- **...and more!**





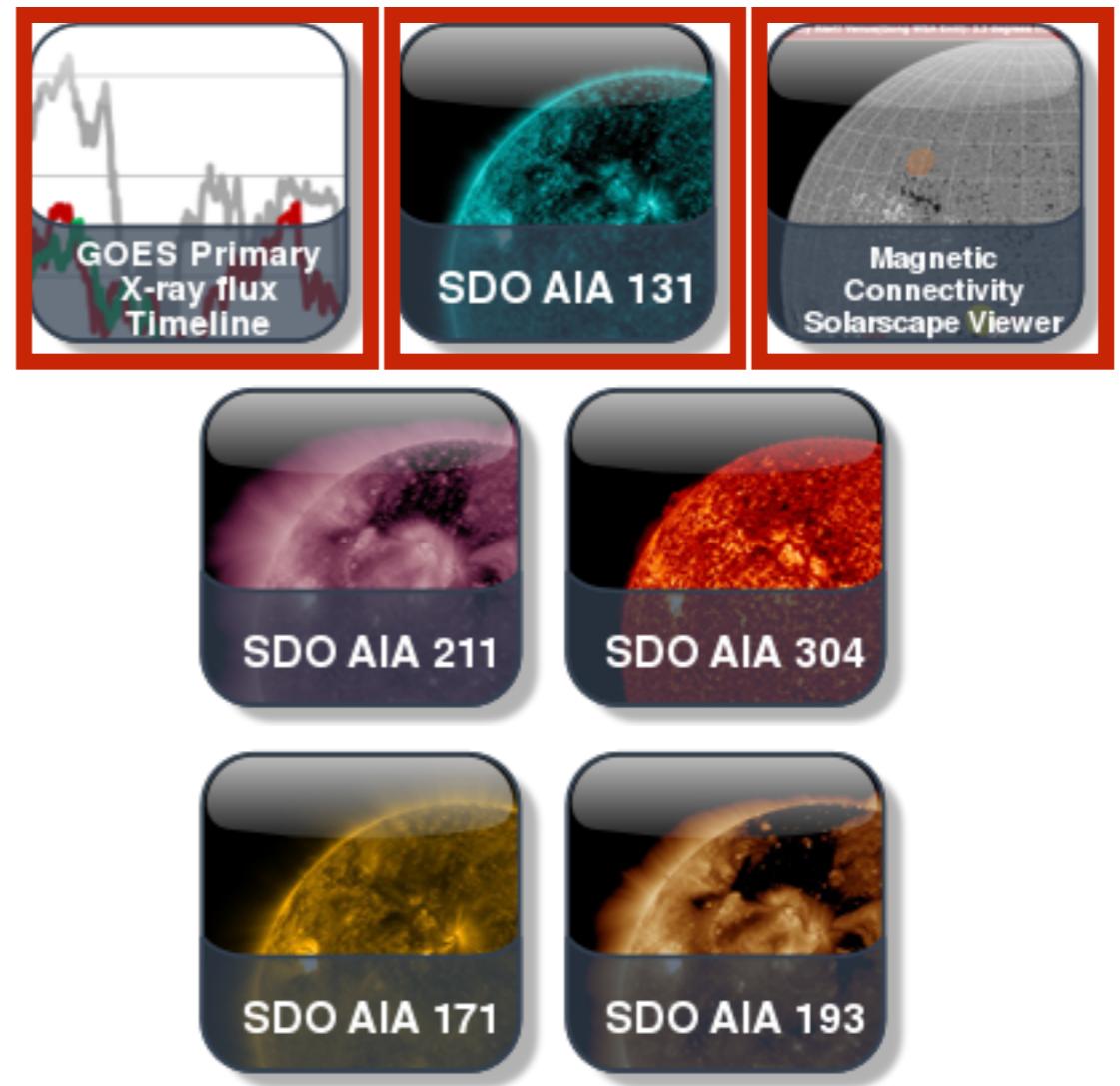
Outline

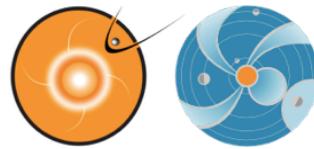
- Solar Cygnets
 - Monitoring flares, eruptions, & CMEs
- Heliosphere Cygnets
 - Monitoring solar energetic particles, CME arrivals, and high speed stream arrivals
- Magnetosphere Cygnets
 - Monitoring geomagnetic storms, radiation belt enhancements, and magnetopause crossings
- Demonstration
 - Following the course of the June 21st 2015 CME



Solar Cygnets: Solar Flares

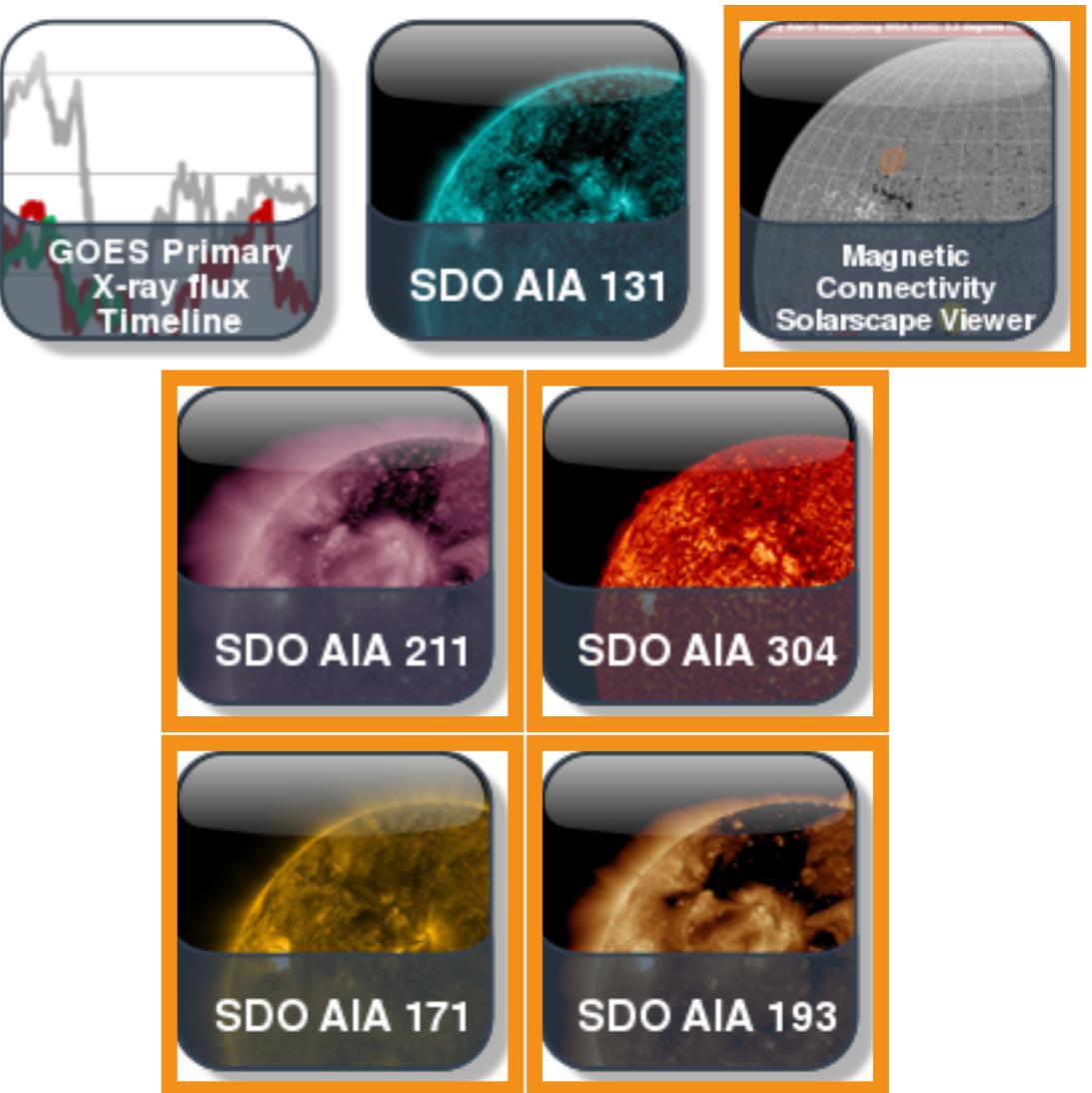
- GOES 0.1-0.8 nm X-rays — flares
 - Threshold: 5×10^{-5} W/m² (M5.0)
- SDO AIA imagery — flares, eruptions, & coronal holes
 - 193 Å — EUV waves, dimming, post-eruption arcades, off limb (field lines)
 - 171 Å — off limb (field lines), post-eruption arcades
 - **131 Å — flares**
 - 211 Å — coronal holes
 - 304 Å — filaments
- Magnetic Connectivity Solarscape Viewer
 - SDO backgrounds, lat/lon grid, active region labels, and magnetic connectivity

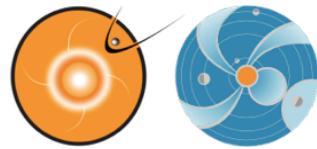




Solar Cygnets: Eruptions & Coronal Holes

- GOES 0.1-0.8 nm X-rays — flares
 - Threshold: 5×10^{-5} W/m² (M5.0)
- **SDO AIA imagery — flares, eruptions, & coronal holes**
 - 193 Å — **EUV waves, dimming, post-eruption arcades, off limb (field lines)**
 - 171 Å — **off limb (field lines), post-eruption arcades**
 - 131 Å — flares
 - 211 Å — **coronal holes**
 - 304 Å — **filaments**
- **Magnetic Connectivity Solarscape Viewer**
 - **SDO backgrounds, lat/lon grid, active region labels, and magnetic connectivity**

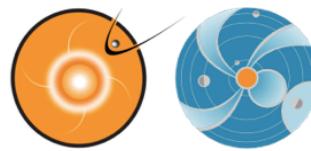




Solar Cygnets: Coronal Mass Ejections (CMEs)

- SOHO LASCO C2 & 3 imagery — CMEs
 - C2 — 1.5 to 6 solar radii
 - C3 — 3.5 to ~30 solar radii
 - Threshold: measured ≥ 500 km/s and modeled to impact Earth OR measured ≥ 800 km/s and modeled to impact other location
- STEREO A EUVI 195 Å imagery — flares, eruptions, & coronal holes
- STEREO A COR2 imagery — CMEs
 - Threshold: measured ≥ 500 km/s and modeled to impact Earth OR measured ≥ 800 km/s and modeled to impact other location
- www.SolarMonitor.org (not on iSWA)
 - lat/lon grid and active regions

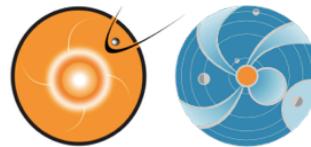




Solar Cygnets: STEREO-A

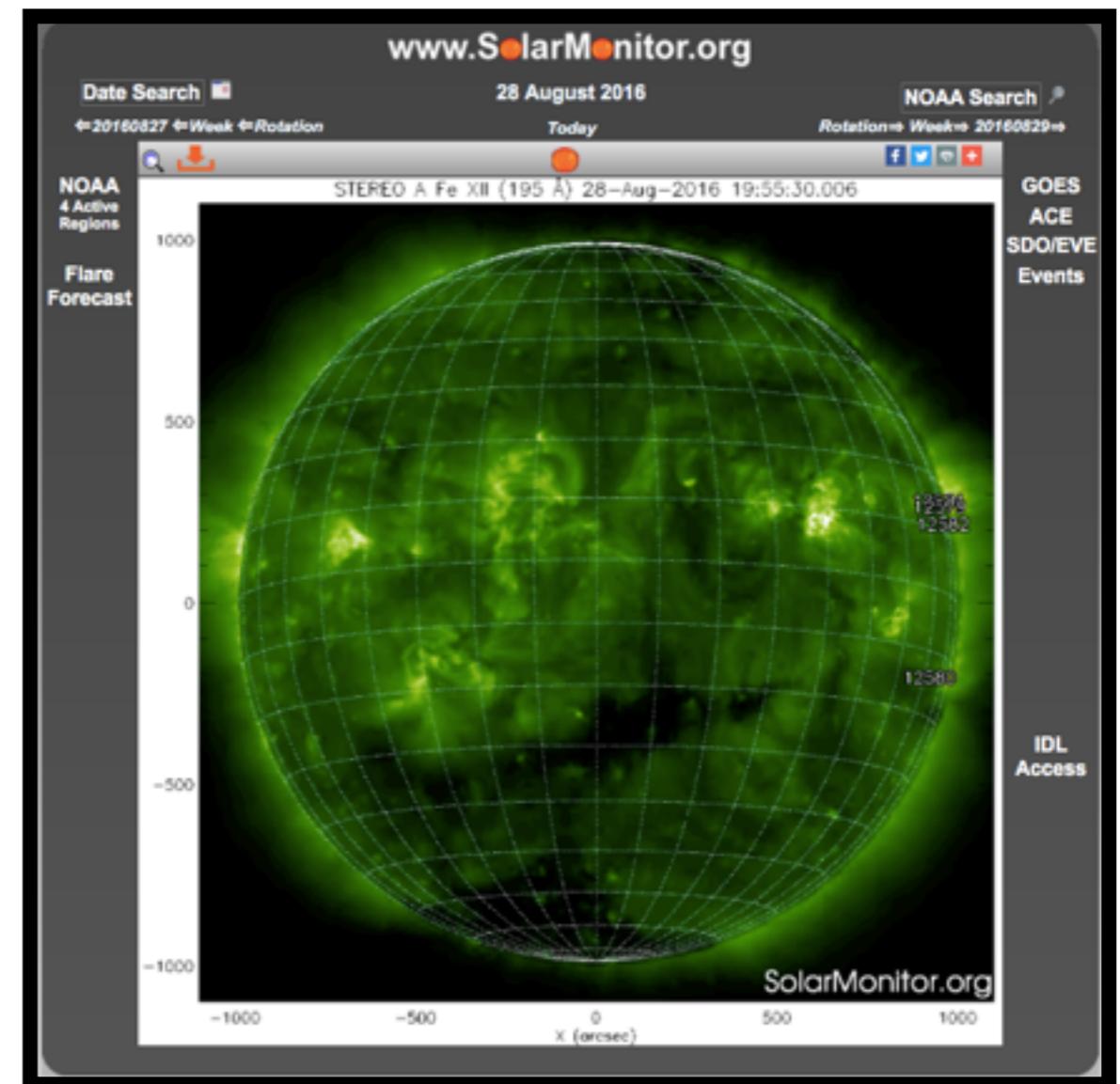
- SOHO LASCO C2 & 3 imagery — CMEs
 - C2 — 1.5 to 6 solar radii
 - C3 — 3.5 to ~30 solar radii
 - Threshold: measured ≥ 500 km/s and modeled to impact Earth OR measured ≥ 800 km/s and modeled to impact other location
- **STEREO A EUVI 195 Å imagery — flares, eruptions, & coronal holes**
- **STEREO A COR2 imagery — CMEs**
 - **Threshold: measured ≥ 500 km/s and modeled to impact Earth OR measured ≥ 800 km/s and modeled to impact other location**
- www.SolarMonitor.org (not on iSWA)
 - lat/lon grid and active regions

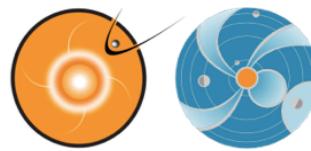




Solar Cygnets: STEREO-A

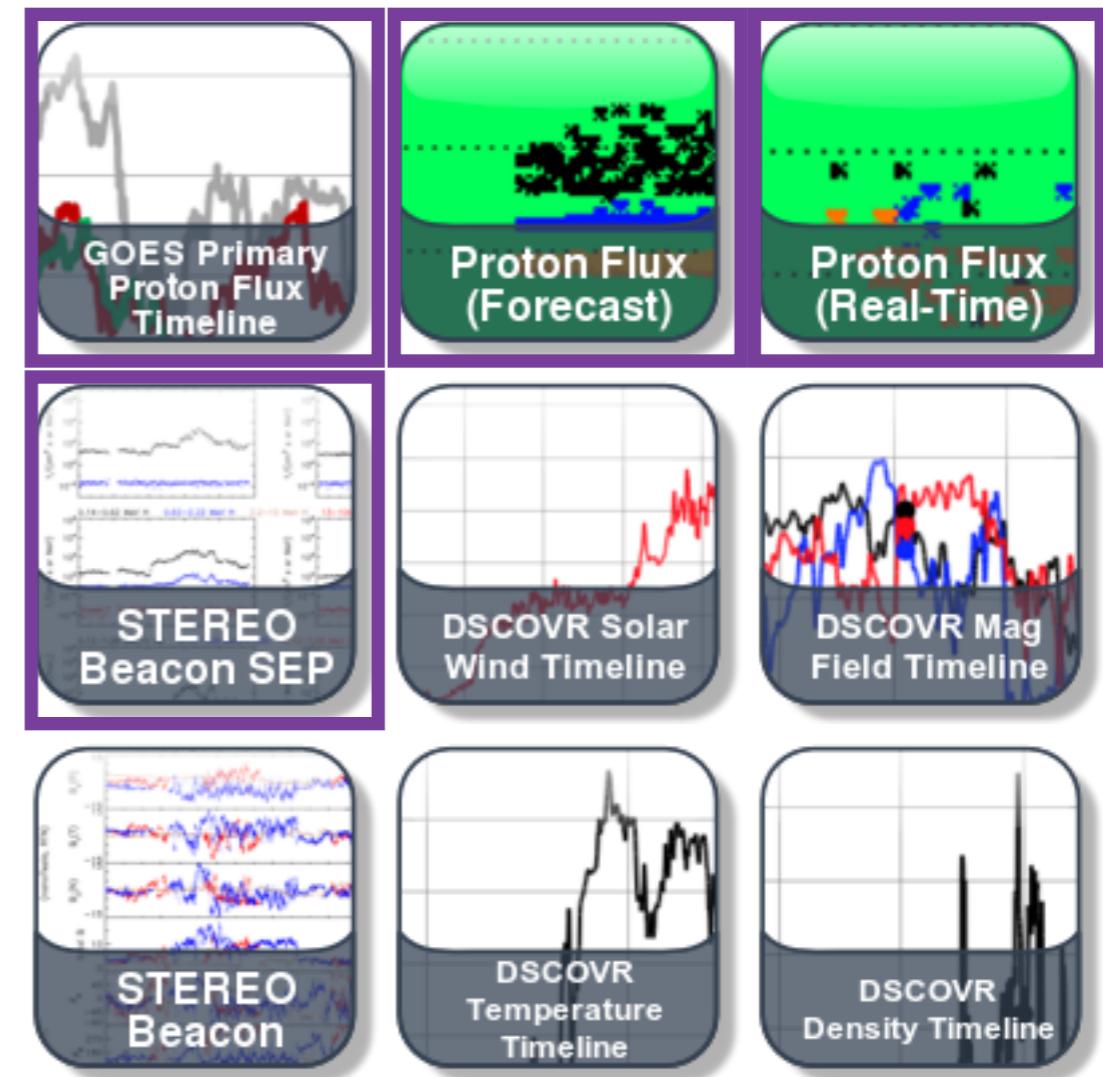
- SOHO LASCO C2 & 3 imagery — CMEs
 - C2 — 1.5 to 6 solar radii
 - C3 — 3.5 to ~30 solar radii
 - Threshold: measured ≥ 500 km/s and modeled to impact Earth OR measured ≥ 800 km/s and modeled to impact other location
- STEREO A EUVI 195 Å imagery — flares, eruptions, & coronal holes
- STEREO A COR2 imagery — CMEs
 - Threshold: measured ≥ 500 km/s and modeled to impact Earth OR measured ≥ 800 km/s and modeled to impact other location
- www.SolarMonitor.org (not on iSWA)
 - lat/lon grid

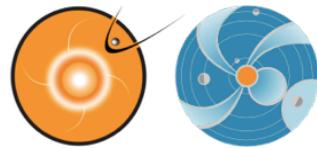




Heliosphere Cygnets: Solar Energetic Particles

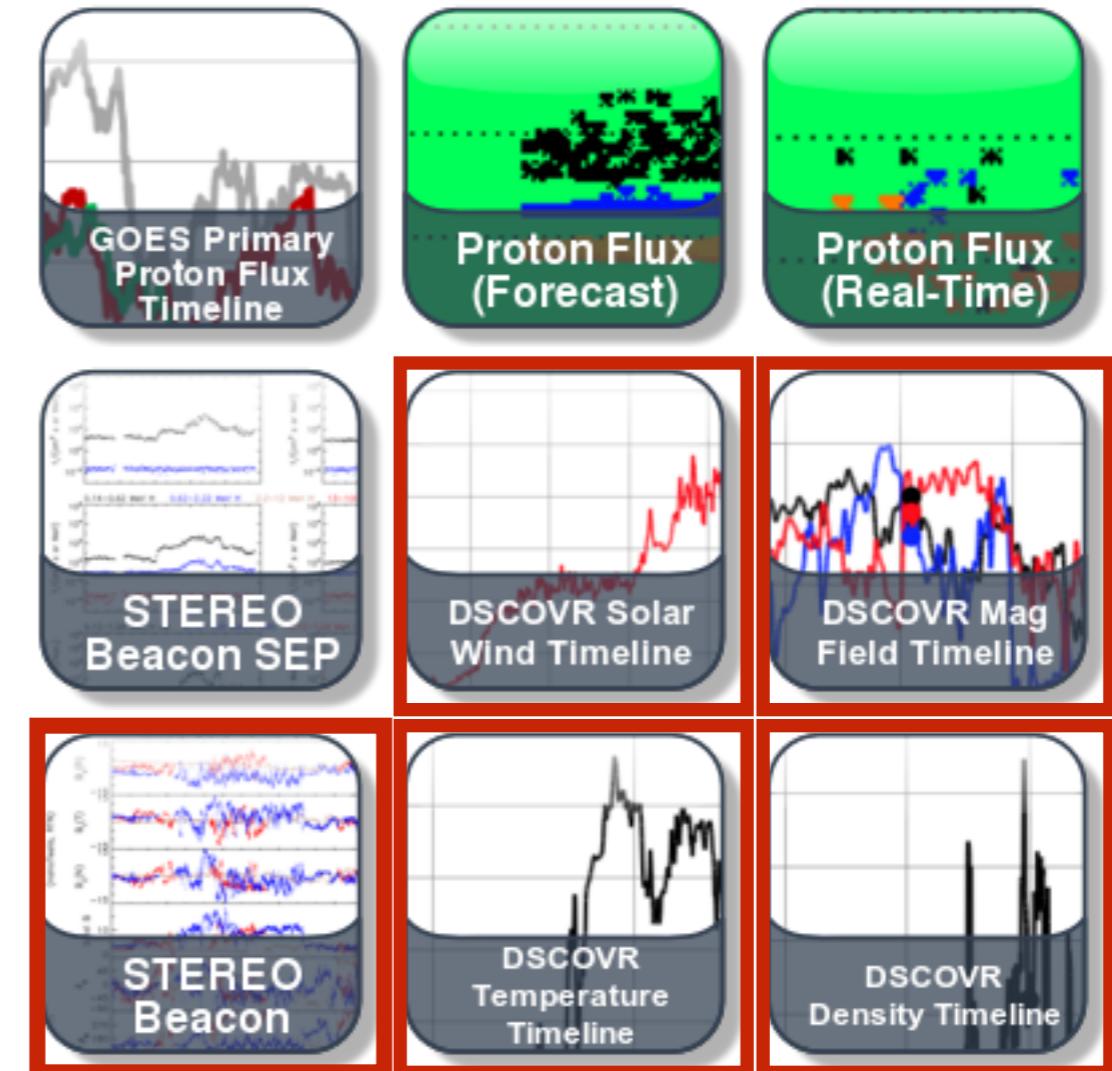
- GOES > 10 MeV and > 100 MeV protons
 - Threshold: > 10 MeV above 10 pfu and/or > 100 MeV above 1 pfu
- SOHO COSTEP > 15.8 MeV proton channels
 - Threshold: 10^{-1} pfu/MeV
- RELEASE forecast for > 15.8 MeV proton channels
 - Threshold: 10^{-1} pfu/MeV
- STEREO A and B 13-100 MeV protons
 - Threshold: 10^{-1} pfu/MeV

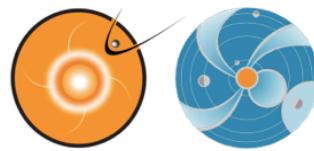




Heliosphere Cygnets: Interplanetary Shocks/Arrivals

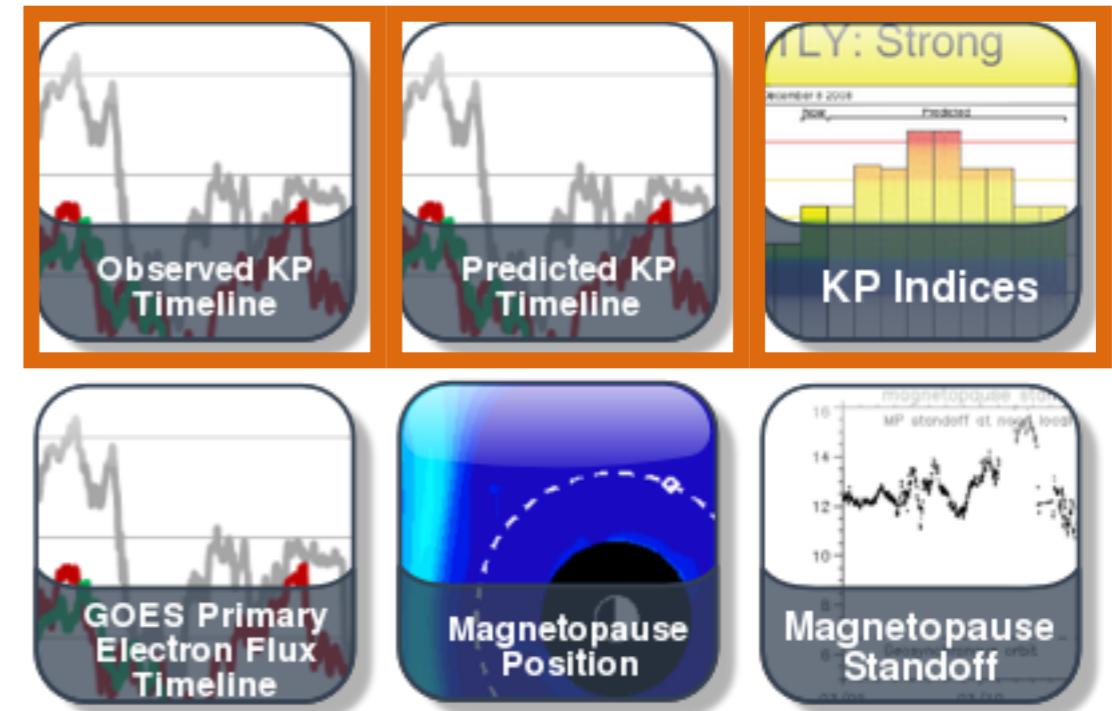
- DSCOVR
 - speed, magnetic field, temperature, & density
 - Threshold: significant shock passage at L1 (about $>= 10$ nT amplitude jump)
- STEREO A IMPACT/PLASTIC
 - speed, magnetic field, temperature, & density

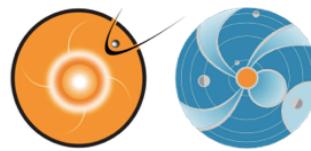




Magnetosphere Cygnets: Geomagnetic Storms

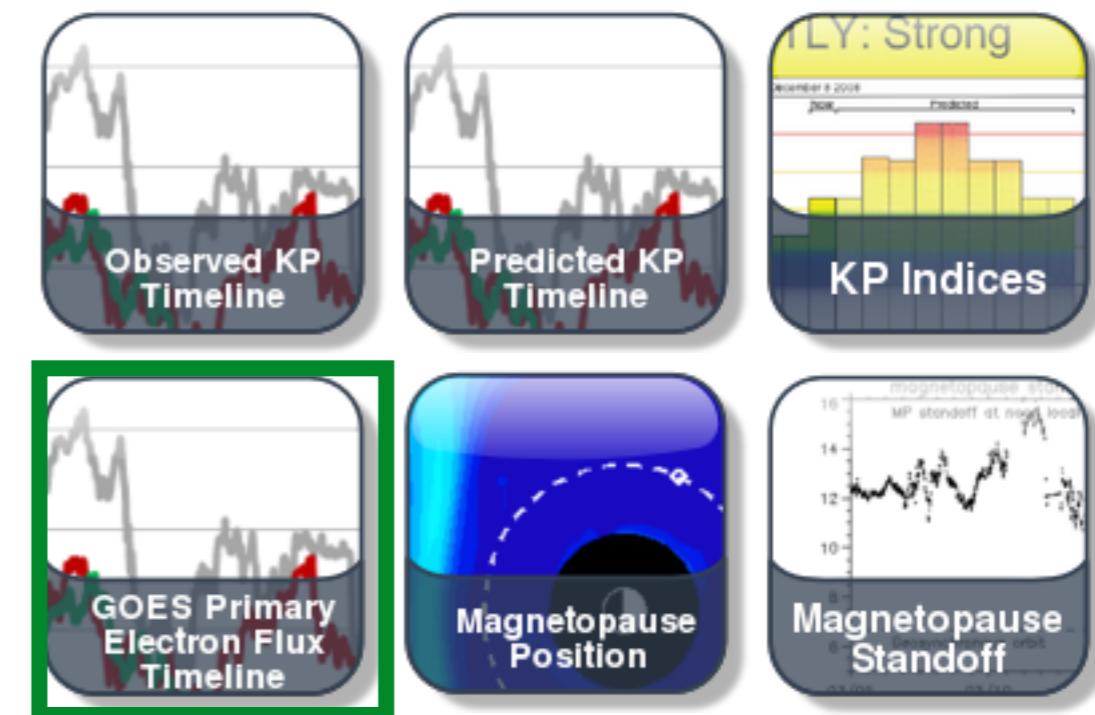
- **Kp index**
 - level (0 to 9) of geomagnetic activity in the Earth's magnetosphere
 - Threshold: ≥ 6 (or larger than previous alert)
- GOES > 0.8 MeV electrons
 - state of the Earth's outer radiation belt
 - Threshold: 10^5 pfu (or 70-80 % from the threshold two days after)
- Modeled magnetopause standoff distance
 - location of the boundary between magnetospheric and solar wind plasma
 - Threshold: 6.6 Re

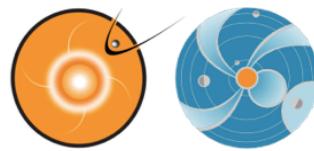




Magnetosphere Cygnets: Radiation Belt Enhancement

- Kp index
 - level (0 to 9) of geomagnetic activity in the Earth's magnetosphere
 - Threshold: ≥ 6 (or larger than previous alert)
- GOES > 0.8 MeV electrons
 - state of the Earth's outer radiation belt
 - Threshold: 10^5 pfu (or 70-80 % from the threshold two days after)
- Modeled magnetopause standoff distance
 - location of the boundary between magnetospheric and solar wind plasma
 - Threshold: 6.6 Re

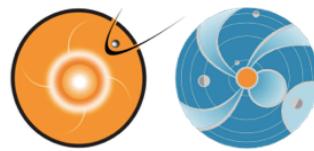




Magnetosphere Cygnets: Magnetopause Crossing

- Kp index
 - level (0 to 9) of geomagnetic activity in the Earth's magnetosphere
 - Threshold: ≥ 6 (or larger than previous alert)
- GOES > 0.8 MeV electrons
 - state of the Earth's outer radiation belt
 - Threshold: 10^5 pfu (or 70-80 % from the threshold two days after)
- **Modeled magnetopause standoff distance**
 - **location of the boundary between magnetospheric and solar wind plasma**
 - **Threshold: 6.6 Re**

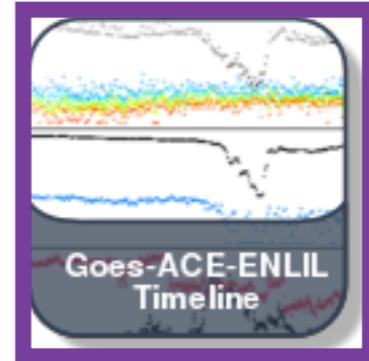




Other Useful Cygnets

- **CCMC SWAN Space Weather Timeline Ensemble**

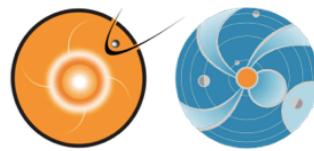
- **Quick check of flare, SEP, radiation belt, and solar wind conditions**



- iSWA Super Timeline

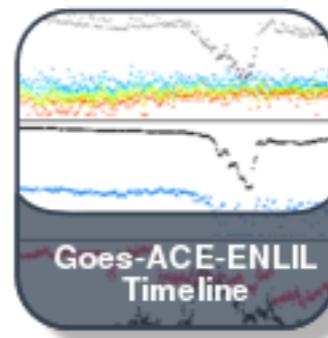
- Make interactive plots of static cygnets
 - Plot SWMF Magnetopause Standoff Position with geosynchronous orbit
 - Plot CCMC-Predicted Kp with NOAA-Kp

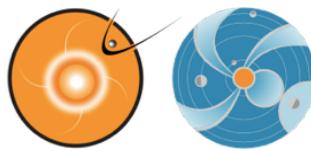




Other Useful Cygnets

- CCMC SWAN Space Weather Timeline Ensemble
 - Quick check of flare, SEP, radiation belt, and solar wind conditions
- **iSWA Super Timeline**
 - **Make interactive plots of static cygnets**
 - **Plot SWMF Magnetopause Standoff Position with geosynchronous orbit**
 - **Plot CCMC-Predicted K_p with NOAA-K_p**





Activities

- iSWA basics demo
 - adding cygnets and navigating category tabs, using the super timeline, setting time periods locally and globally, and saving your layout
- Monitoring Space Weather with iSWA Assignment