STEREO Space Weather Group Update

Space Weather Group Website:

- **Website updated last October:**
  http://secchi.nrl.navy.mil/index.php?p=SpaceWeather
  Webmaster is Lynn McNutt of NRL/SECCHI

- **Contains background on SWx, SWx-related meetings, PI SWx, tools/projects, references & links**

- **Could maintain a list of URLs/links that all PI teams could use**
  * Example is the LMSAL EUVI site: http://secchi.lmsal.com/EUVI/
  * Sam Freeland (LMSAL) is updating the 'Latest Events" site to include at least SECCHI data
  * Will link this to SSWx site; also to a new SWx Events page

- **Maintain member list with email addresses**

- **Tools/Projects list**
  Need updates from each team
  Interactions with STEREO Teams & SSC

SPACE WEATHER TOOLS

Geometric Localization of STEREO CMEs   (V. *Pizzo & D. Biesecker, 2004; NOAA*)
Tool utilizing a series of LOS's from two views to define the location, shape, size & velocity of CME. To be automated & used to decide whether & when CME will impact Earth.

WSA Model Predictions *(N. Arge, J. Luhmann, D. Biesecker; AFRL, UCB, NOAA; Arge & Pizzo, 2000)*
The Wang-Sheeley-Arge and ENLIL 3D MHD solar wind models will be integrated. Provide routine predictions of vector solar wind velocity, density, temp. & mag. polarity anywhere desired. Also a joint AFRL/CISM/SEC project.

CME Detection:
CACTUS – Computer Aided CME Tracking *(E. Robbrecht & D. Berghmans, 2005; ROB)*
Near-realtime tool for detecting CMEs in SECCHI images. Outputs: QL CME catalog w/measures of time, width, speed; NRT CME warnings. Successfully tested on SOHO LASCO CMEs. Test version available at http://sidc.oma.be/cactus.

SEEDS – Solar Eruptive Event Detection System *(J. Zhang et al.,; GMU)*
Tool for detecting, classifying & analyzing CMEs in SECCHI images. Outputs: Automatic CME catalog w/measures of time, width, speed; NRT CME warnings. Being tested on LASCO CMEs.

On-board Automatic CME Detection Algorithm *(E. De Jong, P. Liewer, J. Hall, J. Lorre & R. Howard) ; JPL, NRL*
Algorithm based on feature tracking which uses 2 successive images to determine whether or not a CME has occurred. Algorithm to be run on board spacecraft.

CME-Related Features Detection:

Computer Aided EUVI Wave and Dimming Detection
(O. Podladchikova, D. Berghmans, A. Zhukov; ROB;
   Podladchikova & Berghmans, 2005)
NRT tool for detecting EUV waves & dimming regions. Tested on SOHO EIT images.

Velocity Map Construction *(J. Hochedez, S. Gissot; ROB)*
Program to analyze velocity flows on SECCHI images; detect CME onsets & EUV waves; NRT warnings of fast CMEs; reconstruct 3D velocity maps of CMEs from 2D maps from each STEREO.

Automatic Solar Feature Classification *(D. Rust, P. Bernasconi; JHU/APL)*
Tool for detecting and characterizing solar filaments and sigmoids Recognition & Classification in solar images.
Goal is to meas. magnetic helicity parameters & forecast eruptions using filaments & sigmoids.

SPACE WEATHER – ENABLING PROJECTS

Identifying and Tracking CMEs with the Heliospheric Imagers *(R. Harrison, C. Davis; RAL)*
Produced simulations to show model CMEs can be identified & tracked with HIs. Use triangulation to measure speed & direction of CMEs & forecast their Earth arrival.

Structural Context of Heliosphere Using SMEI Data *(D. Webb, B. Jackson; BC/AFRL, UCSD; Jackson et al., 2006)*
Use analyses of SMEI images to provide structural context of the heliosphere for COR2 & HI. Also provide complementary observations of transient disturbances.

Interplanetary Acceleration of ICMEs *(M. Owens; BU)*
Construct acceleration profiles of fast ICMEs over a large heliocentric range using multi-point HI to understand the forces acting on ejecta. Improve predictions of arrival times of ICMEs at Earth.

Relationship Between CMEs and Magnetic Clouds *(S. Matthews; MSSL)*
Assess the potential geoeffectiveness of CMEs based their association with magnetic clouds. What particular characteristics lead to production of a magnetic cloud?

3D Structure of CMEs (*V. Bothmer, H. Cremades, D. Tripathi; MPI, Ger., Cambridge, UK; Cremades & Bothmer, 2004*)
Program to compare analysis of SECCHI images on the internal magnetic field configuration & near-Sun evolution of CMEs with models based on SOHO observations. Forecast flux rope structure; 3D visualization of CMEs.

DATA BROWSERS AND VIEWERS

STEREO Science Center Real-Time Data Pages *(W. Thompson et al)*
Main public site fro viewing R/T STEREO data.
  http://stereo-ssc.nascom.nasa.gov/beacon/beacon_secchi.shtml

Solar Weather Browser *(B. Nicula, D. Berghmans, R. van der Linden; ROB)*
User-friendly browser tool for finding & displaying solar data & (SWB) context information. Available at http://sidc.oma.be/SWB/

STEREO Key Parameters *(C. Russell & IMPACT, PLASTIC & SWAVES teams; UCLA)*
An easily browseable Merged Key Parameter data display including the in-situ & SWAVE radio data from STEREO.

Carrington Rotation In-situ Browser *(J. Luhmann, P. Schroeder UCB)*
Browser for identifying in-situ events & their solar sources at CR-time scales.
Includes near-Earth (ACE) data sets for third point views & image movies from SECCHI & near-Earth (SOHO).
See: http://sprg.ssl.berkeley.edu/impact/data_browser.html.

JAVA-3D Synoptic Information Viewer *(J. Luhmann, P. Schroeder UCB)*
JAVA-3D applet for viewing 3D Sun & solar wind sources based on synoptic solar maps & potential field models of the coronal magnetic field.

Radio and CME Data Pages *(M. Pick et al.)*
Ground radio imaging and spectra; movies; S-WAVES SECCHI summary CMEs (NRL); Use standard html browsers. See: http://secchirh.obspm.fr.

Incorporating Data from Other Sources

- *Existing Data:* **ACE, Wind WAVES & EPACT (MeV protons), SOHO, TRACE, SXIs, Hinode, Ulysses, SMEI, IPS**

- *Future Data:* **SDO, MWA/IPS (Faraday rotation), new heliospheric imagers, Sentinels/Solar Orbiter, FASR**
> **Are special arrangements needed?**
> **How to combine in-situ & imaging data?**

- **At SEC Leslie Mayer will work on incorporating the STEREO locations into WSA model. Doing as part of generalization of WSA code:**
> *** Both mag field expansion factor and the minimum angular distance → open field footpoint to nearest coronal boundary determined by tracing individual field lines down to surface. These two quantities used in an empirical formula to calculate solar wind speed.**
> *** The solar wind speed and coronal mag field values determined for each sub-Earth point (at 5 Rs) are then used to predict SW parameters at L1 using 1D kinematic SW model.**
> *** Generalizing code so model can be fed orbital coordinates of other spacecraft (e.g., STEREO A & B or ULYSSES) or planets and SW parameters predicted at those locations too.**

Should take 2-3 months
> **Will resemble standard output at:** http://www.sec.noaa.gov/ws
> > **With STEREO A & B added, either 3 on 1 or as 3 separate plots**

Space Weather Events pages

- Based on old ISTP Sun-Earth Connection Events site:
  http://www-istp.gsfc.nasa.gov/istp/events/

Example: 2000 Events

Sun-EARTH Connection Event: July 14-16, 2000
X-Class Flares and Fast moving Earth-directed CME. The aurora reached as far south as Georgia (although not visible as during daylight) and Great Britain.

Sun-EARTH Connection Event: June 6-9, 2000
Large flares and a high speed halo CME - but no geoactivity.

Sun-EARTH Connection Event: April 4-7, 2000
Large Geophysical event causing the aurora to be visible as far south as the Carolinas.

- Will contain an event summary, online data & links to other data
  Example: IMPACT Event page for Dec. 2007
  Need to incorporate or link other STEREO data:
    Beacon (quicklook)
    SECCHI & SWAVES imagery
    PLASTIC & IMPACT in-situ plots

NOAA/SEC Beacon Update
(Doug Biesecker)

Strategy for Beacon tools:
- **The tools being developed at SEC are for internal use.**
    - **External customers can be accommodated if SEC management approves.**
- **Ingesting the EUVI jpg images for couple of weeks.**
    - **The jpgs are used in a basic movie tool at SEC.**
- **EUVI 195A images have been used to issue Coronal Hole Reports (a daily product)**

Status of Beacon Data
- **Ingest of the PLASTIC and IMPACT cdf files pending (possibly March 22/23).**
- **SECCHI fits files to be ingested soon.**
    - *** Would like the SSC to be producing jpg versions of the COR1, COR2, HI1, HI2 data as well, but still working with SECCHI to determine the optimum binning/compression.**
    - *** NRL did upload a new plan on March 19, binning COR2 a bit more and using less compression, but have not assessed the new images.**
    - *** HI1 data looks promising, but HI2 data very noisy and may require more work.**

- **For Solar Wind plotting (Plasma- Plastic; Mag fields & Particles- Impact)**
    - *** Using same ACE RTSW dynamic plots page ideas (http://www.sec.noaa.gov/ace/)**
    - *** So far, the only plots developed are 2, 6, 24 hour Solar Wind (n, V, T).**
    - **Basic plots: Mag field & Plasma, Low Energy Electrons & Protons, & HighEnergy Protons at 2, 6, 24 hours.**
    - **Then add 3 and 7 day plots.**

Outside Interest
- **AFWA interested in some of these tools.**
- **Spitzer Space Telescope folks very interested in STEREO-B proton fluxes.**

PLASTIC-A Solar Wind Plasma 6-hour Test Plot
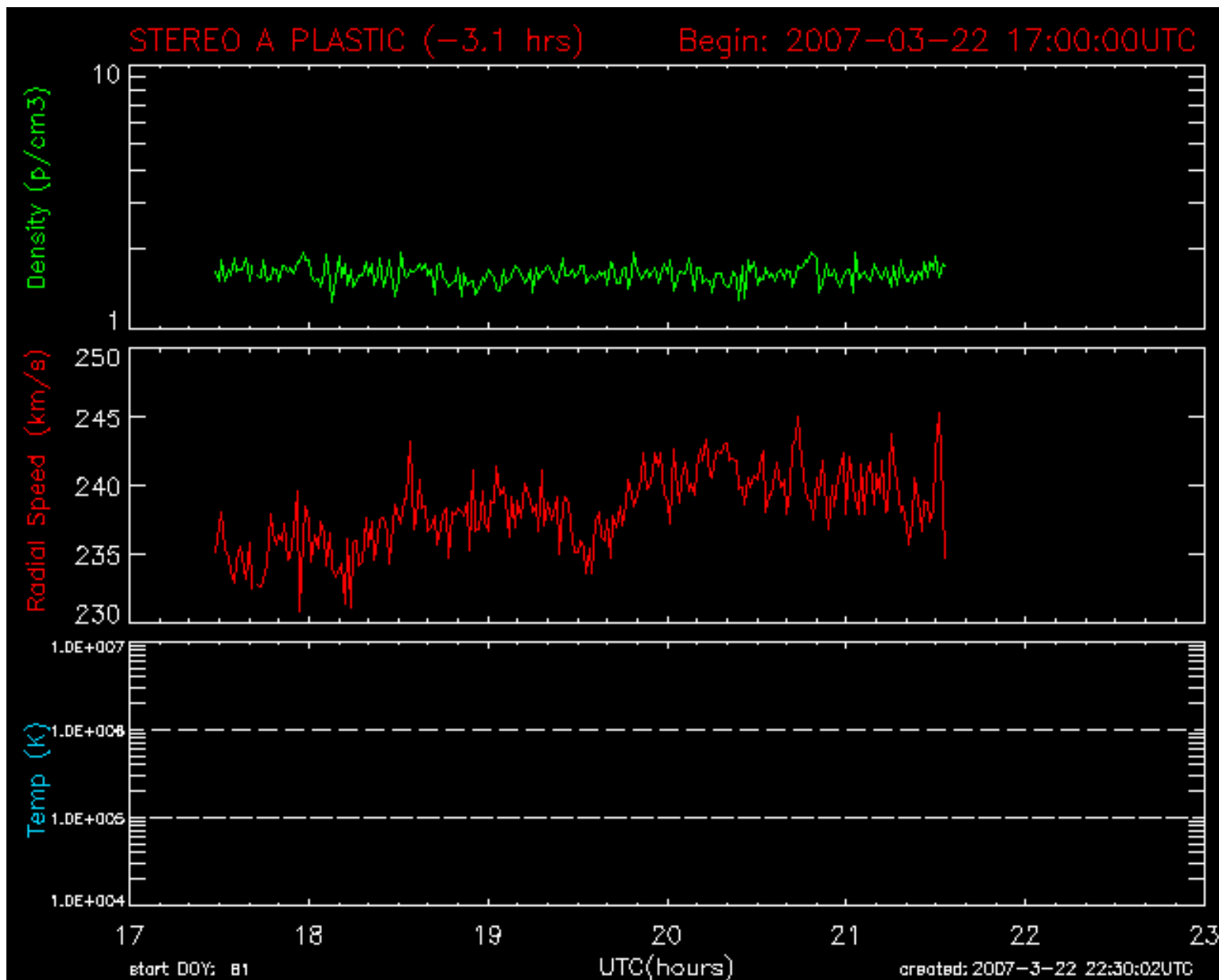
Update continued

How to use SWAVES data/displays for space weather?
- **- with imaging & in-situ experiments (PLASTIC)**

CCMC use of STEREO data as inputs to models
- **- Clearly has space weather context**

Future SWx meetings:
- **- Updates at all SWGs & SECCHI Consortia**
- **- Do we want a separate SWx workshop sometime?**

Interfaces with:
- **- 3D Reconstruction & Visualization Team**
- **- Virtual observatories**
- **- IHY (add CIPs related to STEREO data & analyses)**
- **- Outreach aspects**
    - **With NASA EP/O & PAO efforts; Press Releases?**
    - **Separate SWx Poster (thru NRL)?**
    - **Possibly a feature article in Space Weather journal**