

STEREO Space Weather Group update

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ISR, Boston College and Air Force Research Laboratory

**STEREO SWG-20
27-29 October 2009
Meredith, NH**

- **Group leaders: Dave Webb & Doug Biesecker**
- **Website contains background on SWx, SWx-related meetings, PI SWx studies, tools/projects, references & links**
- **Member list with email addresses**
 - **Currently have ~120 members**
 - **Please provide updated addresses!**
 - **Contact me to join: david.webb@hanscom.af.mil**
 - **Can send your emails via: spaceweather@cronus.nrl.navy.mil
(but please contact me first)**
- **Maintain a list of URLs/links that all PI teams can use**
 - **Recently added more STEREO CME/event catalog links**
 - **Feedback please!**
- **Maintain reference list of key SWx papers**
 - **Feedback please!**
- **Tools/Projects list**
 - **Feedback: Need updates from each team**



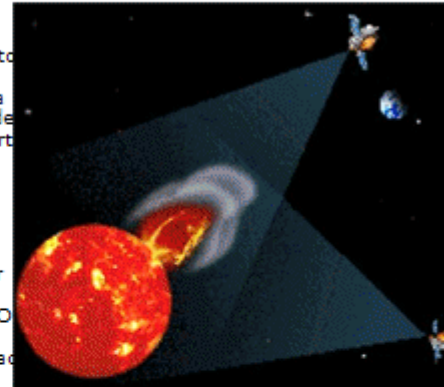
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13-15 Dec 2006
19-22 May 2007
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COR1 CME Catalog
EUVI Event Catalog
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NASA STEREO The Sun in 3D
NOAA STEREO Beacon Plots
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STEREO Modeling:
CCMC STEREO Support
CISM
Predsci MHDWEB
SECCHI 3D R&V
STEREO IMPACT Modeling
UCSD SWx Forecast
WSA Predictions: L1(ACE)
WSA Predictions: STEREO
Related Links
ACE
AF SWx Ctr of Excellence
ESA SWx Program
GOES SXI
Hinode
Intl. Heliophysical Year
LESIA Radio Monitor
LMSAL Latest Events
NASA Living With a Star
NOAA SWPC
NSF Natl. SWx Program

THE STEREO SPACE WEATHER GROUP

Welcome to the Home page of the STEREO Space Weather Group. The intent is that this be an open web site, where anyone from the scientific community can follow our efforts to prepare computer programs, modeling efforts and research studies in preparation to use the STEREO observations as a tool for Space Weather. We also invite scientists from outside the SECCHI or STEREO consortia to join in the group's effort. We describe below the procedure to join the Space Weather group.

There are now two coordinators of the STEREO Space Weather group: David Webb, the SECCHI Space Weather Coordinator and a Co-I on the SECCHI Heliospheric Imager experiment, and Doug Biesscker, of the NOAA Space Environment Center and NOAA's coordinator of the STEREO Beacon data. This site is intended to be the repository of all pertinent details and information related to the STEREO Space Weather efforts. Our activities are closely coordinated with the STEREO Science Center at [GSFC](#) where the Beacon data will reside. Our site will be updated as new information and revisions dictate. A general discussion of Space Weather, the role of coronal mass ejections, and the use of the STEREO instruments for space weather is [HERE](#). We recently completed a chapter on STEREO Space Weather that will appear in the STEREO Instrument book. The current version is [HERE](#).



The overall purpose of the Space Weather Group is to help coordinate space weather efforts involving the STEREO mission and its instruments, including that of individual team members, and to help coordinate those efforts that lead to tools and products that can be tested and used before and after the STEREO launch. The STEREO real-time Beacon is a major STEREO effort having Space Weather implications. Other activities of the group include incorporating and interfacing STEREO data and space weather activities with: (1) Imaging and in-situ data from other existing space missions such as ACE, Wind, SOHO, Ulysses, GOES-12 SXI, the Transition Region and Coronal Explorer (TRACE) and Solar Mass Ejection Imager (SMEI), and ground-based observations such as interplanetary scintillation (IPS), optical line and broadband and radio emission, and future missions planned for the STEREO timeframe, such as Solar-B, GOES-13 SXI, and the Solar Dynamics Observatory (SDO); (2) The Geospace community to understand the coupling of and responses to CMEs and other transient disturbances by encouraging and participating in space weather campaigns; (3) The Community Coordinated Modeling Center (CCMC) and other simulation and modeling groups to use STEREO data as input to space weather models; (4) The SECCHI 3D Reconstruction and Visualization Team to develop models that have a space weather context; (5) The various virtual observatories that are being developed; (6) The International Heliophysical Year (IHY) program in 2007-08; (7) Meetings and workshops involving space weather; and (8) NASA's PAO EP/O and other outreach activities.

last updated 03/09/2009

<http://secchi.nrl.navy.mil/spwx/>

STEREO Space Weather Event Pages

- Contains an event summary, online data, modeling & links to other data
- First two STEREO SWx event s were 13-15 Dec. 2006 & 19-22 May 2007
- Additional events added
 - Called Sun-STEREO Events.
 - Is a CME observed by SECCHI imagers on one or both S/C that later hits one of them (sometimes incl. L1/Earth) as detected in-situ. These form special class of SWx-type events that give us details on ICME propagation and internal structure characteristics.
- Need your **feedback** on these Event pages!
 - Incorporate or link to other STEREO data:
 - Beacon (NRT quicklook)
 - SECCHI & SWAVES imagery
 - PLASTIC & IMPACT in-situ data
 - Modeling/simulation results
 - Need more geo inputs!
 - Try to incorporate new events/pages soon after events occurrence
 - Need any missing events, new data links, revisions/corrections



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Sun-STEREO Events

INTRODUCTION

Despite being in solar activity minimum, there have been a number of events in which a CME observed at the Sun by one or both STEREO spacecraft passes over one of them (or the Earth) as detected from in-situ data. These form a special class of space weather-type events that can provide information on the characteristics of the geometry, propagation and internal structure of ICMEs. Important to this study are the remote imaging observations from the SECCHI Heliospheric Imagers (HIs) and, occasionally, also from the Solar Mass Ejection Imager (SMEI) in Earth orbit.

We call these Sun-STEREO (Earth) Connection Events. Here is the current list of such events with some notes about them and references to analysis results. The first two events are well known and have their own pages on this site. If there is sufficient interest and data available for the other events, we will produce separate pages on them as well. The list is very preliminary and will be updated as necessary. Please send additions/corrections/comments on these events to David.Webb@hanscom.af.mil.

Sun-STEREO (Earth) Connection Events

2006 Dec. 13-15

Two X-flares/CMEs near sun center; ICME/flux rope/SEPs at Earth. The only true STEREO (Earth) space weather event so far. See <http://secchi.nrl.navy.mil/spwx/index.php?p=20061213event>

2007 May 19-22

Two events near Sun center observed with Hinode and STEREO. 3D views of filament eruptions and loops. Magnetic cloud/flux rope observed at STEREO and Earth. Includes radio observations. See <http://secchi.nrl.navy.mil/spwx/index.php?p=20070519event>

2007 November 14-18

Three separate events over several days, including one at Sun center observed by LASCO, SECCHI and SMEI. 3D modeling and heliospheric density structure. Howard and Tappin (2008)

2008 February 4-8

See next: Wood et al. (2009a)

2008 June 2-6

This and the above events were followed from initiation at the Sun, until interaction with one of the STEREO spacecraft. The earlier dates in the time span (Feb 4, Jun 2) are the days on which the eruptions occurred, while the second dates (Feb 8, Jun 6) are the days when the interaction with STEREO occurred.

2008 April 26

This event near sun center had a fast CME and EUV wave seen by SECCHI on both STEREO's A and B, and also detected in-situ by ACE and by STEREO-B. 3D shape modeling, velocity, etc.

2008 May 17

Another Sun-STEREO interaction event. Wood et al. (2009b)

2008 June 6

Magnetic cloud at STEREO B

More Updates

- **STEREO Modeling link added for the NOAA SWPC website of plots of 1- to 7-day advanced solar wind speed predictions using the Wang-Sheeley-Arge (WSA) model for comparison with in-situ STEREO Beacon data:**
<http://helios.swpc.noaa.gov/WSA/STEREO/index.html>
 - Similar to the original WSA plots for L1-ACE, which also include predictions of the IMF and are linked here.
 - Thanks to Leslie Mayer and Nick Arge
- **STEREO-B now at the L5 point, allowing us to use ST-B as a pathfinder for a possible SWx monitor mission.**
 - View & study CMEs aimed Earthward, e.g., compare HI views with those from SMEI at Earth.
 - ST-B also views beyond Earth-facing east limb and can view activity-producing regions for forecasting.
 - Feature article submitted to SWx journal.
- **Updates at SSC Beacon browse site (Bill Thompson):**
http://stereo-ssc.nascom.nasa.gov/beacon/beacon_secchi.shtml
 - Running diff HI-2 images/movies from the regular data stream. Shows sunward half of full HI-2 field.
 - Time-elongation plots ("J-plots") from COR-2 and HI-1 running differences: CMEs, streamers and other features can be tracked.
 - Heliographic, Earth-view synoptic maps from the latest SECCHI-A and -B EUVI beacon images; Demonstrate how much of Sun STEREOs now view!

More Updates

- NOAA SWPC Beacon Data: <http://www.swpc.noaa.gov/stereo/>
 - NRT 6 hr. to 30 d. plots of data from in-situ instruments, PLASTIC & IMPACT: Measurements of solar wind plasma, particles, magnetic field & SEPs.
 - Each plot title has the corotation time a structure at ST-B will take to arrive at L1 (ACE - or L1 to STEREO-A). Based on calculated ST-B/L1 spacecraft angular and radial separations for most recent wind speed observed at ST-B.

Thank you!

SPACE WEATHER TOOLS

General:

- ❖ **Geometric Localization of STEREO CMEs** (*V. Pizzo & D. Biesecker, 2004; NOAA*)
- ❖ **WSA Model Predictions** (*N. Arge, J. Luhmann, D. Biesecker; AFRL, UCB, NOAA; Arge & Pizzo, 2000*)
Leslie Mayer work, SWPC, incorporating STEREO locations into the WSA model. Will resemble standard output at: <http://www.swpc.noaa.gov/ws/> but w/ ST A & B added

CME Detection:

- ❖ **CACTUS – Computer Aided CME Tracking** (*E. Robbrecht & D. Berghmans, 2005; ROB*)
Latest COR2 runs at <http://sidc.oma.be/cactus/>
- ❖ **SEEDS – Solar Eruptive Event Detection System** (*J. Zhang et al.,; GMU*)
Being tested/used on LASCO & SECCHI CMEs:
<http://spaceweather.gmu.edu/seeds/index.php>
- **On-board Automatic CME Detection Algorithm** (*E. De Jong, P. Liewer, J. Hall, J. Lorre & R. Howard*) ; *JPL, NRL* Not implemented?

CME-Related Features Detection:

- ❖ **Computer Aided EUVI Wave and Dimming Detection**
(*O. Podladchikova, D. Berghmans, A. Zhukov; ROB; Podladchikova & Berghmans, 2005*)
Tested on SOHO EIT images: <http://sidc.oma.be/nemo/>. SECCHI soon?
- **Velocity Map Construction** (*J. Hochedez, S. Gissot; ROB*)