

IMPACT Status and Data Updates

SWG, Meredith, NH,
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for the IMPACT team*

IMPACT Instrument Status Highlights

- SWEA bias voltage has been changed to *include* low energy electron contributions from unanticipated spacecraft-related secondaries (now sweeps from 1 to 2000eV instead of 8 to 2000 eV, low energies provide indirect estimate of thermal core electron densities)
- *No* instruments experienced significant changes due to flight software load-related spacecraft resets
- MAG offsets slowly drifting but manageable
- SEP instruments (SEPT, LET, SIT, HET) operating nominally

SWEA instrument status

- Instrument charging on tophat ($\sim -4\text{V}$)
 - ⇒ SW electrons $<45\text{eV}$ suppressed
 - No direct electron core distribution measurement possible 🙅
 - At low energies secondary electrons predominate 👍
 - Excellent SW electron halo and strahl measurements 👍
 - Sweeps now moved back to 1 eV to obtain low energy secondary electron data for core proxy measurements
- Data products
 - Calibrated SW electron energy spectra (45 - 2000 eV) 👍
 - Pitch angle distributions 👍
 - Moments $>45\text{eV}$: density, temperature, heat flux vector 👍
 - Halo properties 👍
 - Core density proxy: full time series after 2007 January 👍
 - Core temperature proxy: 2007Jan - 2008Febr and after 2009Apr 👍

SEP SUITE Status Summary

SEPT, SIT, LET and HET Operating Status

All SEP instruments continue to operate nominally with all housekeeping and detector rates nominal through the most recent data.

The spacecraft resets and associated turnoffs went smoothly. There were no measureable effects

There is a hope that such incidents happen only when necessary. In addition to data loss there is always a risk (especially in SIT) in bringing up the high voltage.

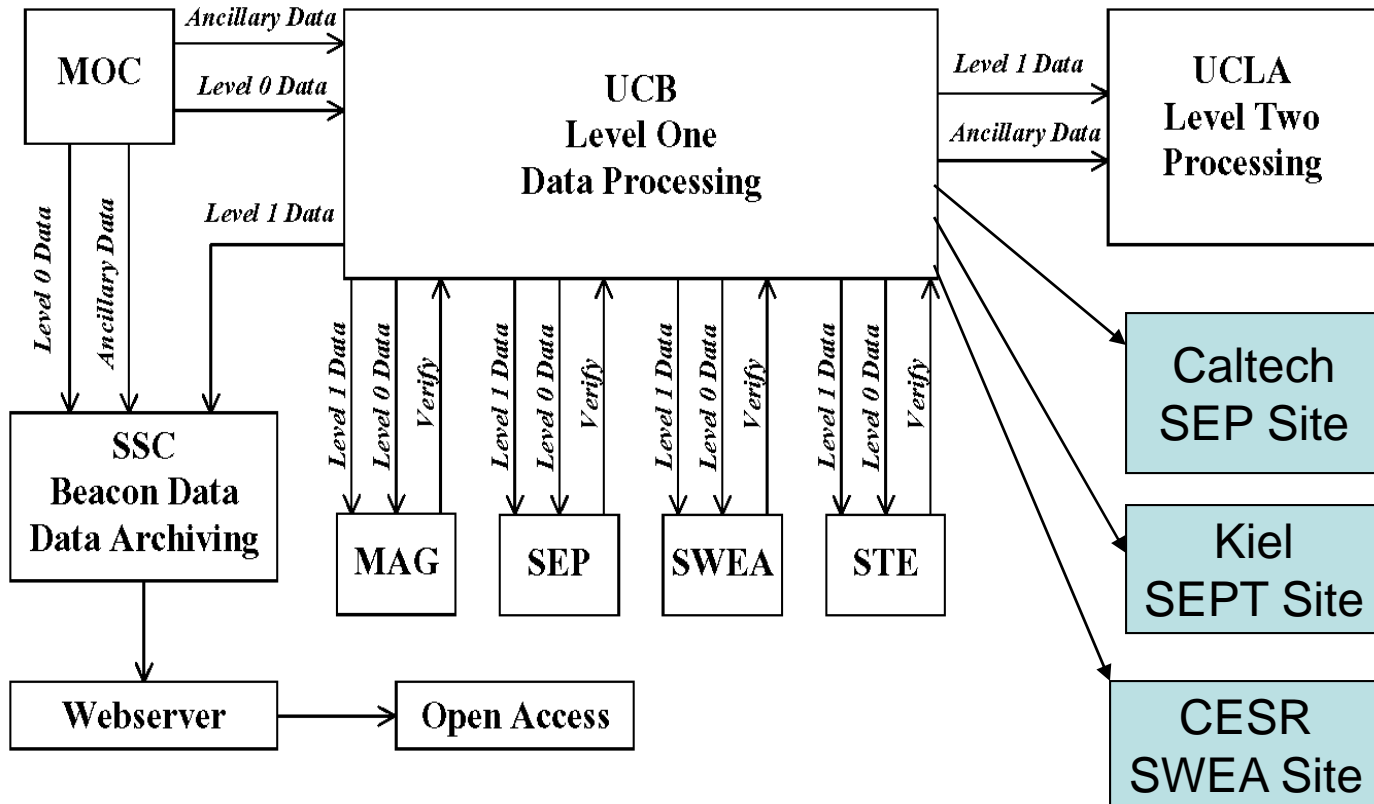
Minor changes to SEPT operations (next slide)

- SEPT changes during 2009
 - Threshold changes for SEPT aboard STEREO A:
 - Threshold changes commanded on September 29, 15:00 UT
 - The changes affect the lower energy bins of the proton telescope pointing sunward and the electron telescopes pointing sunward and northward.
 - Threshold changes for SEPT aboard STEREO B:
 - Threshold changes commanded on September 29, 14:45 UT and October 8, 11:14 UT.
 - The changes affect the lower energy bins of the proton telescope pointing northward and the electron telescopes pointing sunward and southward.
 - These threshold changes reduced the noise and corrected cross-talk problems in the lower energy border of the spectrum

- Problems / Failures

- Bug in level 1 CDF files generation software. An offset of minus 33 seconds was found in the level 1 data files. This offset, related to UTC leap seconds, affects CDF data files with version V05 or previous. The bug was corrected in March 2009, current version is V06
- No major problems or failures in SEPT instrument during 2009
- No problems observed after s/c reset operations on May 12 (STEREO-B) and August 4 (STEREO-A)
- Instrument providing data almost uninterruptedly since January 2007

Overall IMPACT Data Flow



Update on SEP-suite data@CALTECH additions/improvements in 2009

SEP data available online@CALTECH website:

<http://www.srl.caltech.edu/STEREO/index.html>

LET 10-minute and 27-day averaged-data are now available, in addition to the previously-available 1-minute, hourly, and daily averages.

http://www.srl.caltech.edu/STEREO/Level1/LET_public.html

SEPT ASCII data files with 1 minute, 10 minute, 1 hour and 1 day time resolution will be available publicly soon (currently in beta-test).

A new version (July 2009) of the HET electron and proton data are now available, in 1-minute, 15-minute, and hourly averages.

http://www.srl.caltech.edu/STEREO/Level1/HET_public.html

An interactive plotting tool for SIT browse plots is available:

<http://www.srl.caltech.edu/STEREO/scripts/mksitmpanel.cgi?LATEST=1>

We continue to provide attitude and orbit data in convenient ASCII formats

IMPACT SEPT data@Kiel

- Data products
 - Level 1 data files generated routinely (UCB). Now available through July 31, 2009.
 - Level 2 ASCII files available online with 1 min, 10 min, 1 hour and 1 day time resolution (still in beta version, further testing needed):
http://www2.physik.uni-kiel.de/data/stereo/sept/level2_beta/
 - A variety of SEPT browse plots are available online (1 min, 10 min and 1 hour resolution):
<http://www2.physik.uni-kiel.de/stereo/browseplots/>

SWEA@CESR data products

- Public
 - <http://stereo.cesr.fr>
 - present: plots of E spectra, PADs, moments >45eV (routinely produced by at CESR)
 - future: + ASCII (produced at CESR) and CDF (produced by SSL UCB), halo fit results, core density and temperature proxies
 - <http://stereo.cesr.fr/clweb>
 - processing software and SWEA binary data on server
 - access by requesting password

UCLA Data Roles and Responsibilities

- Level 1 MAG Data
 - Download Level 0 data from UCB site.
 - Determine offsets and remove them from data.
 - Correct for “stepping” x-sensor on STEREO A.
 - Rotate data into RTN coordinates.
 - Average data to 8 Hz (as necessary), to 1 Hz.
 - Provide web service for plots at 32 Hz (as available), 8 Hz, 1 Hz in S/C and RTN coordinates.
 - Send copies of data to UCB in CDF format.
- Level 2 Data
 - Average magnetometer data to 1 min, 10 min, 1 hour in S/C and RTN coordinates.
 - Integrate magnetometer data with Plastic 1-minute data and provide web server for integrated data set.
 - Provide web server at 1-minute resolution (and longer as appropriate) for other IMPACT sensors (not done yet).
- Level 3 Data
 - Provide lists of solar wind events and their properties.

Current Status: Level 1 Magnetic Field@UCLA

- Access: Go to <http://aten.igpp.ucla.edu/ssc/stereo>
 - Click on heliocentric_level1_magnetic_field
- Status: Launch through August 31, 2009
 - 1 Hz, 8 Hz, 32 Hz magnetometer data in RTN and S/C coordinates
- Parameters: Plots and ASCII files for
 - B_X , B_Y , B_Z , $|B|$
 - B_X/B , B_Y/B , B_Z/B , $|B|$, cone angle, clock angle
- Why the delay in the appearance on the website?
 - We do not receive any data until 30 days after a full month is received. We do not receive September data until the beginning of November. Then it requires a couple of weeks or more to process it. If you need current data, use the Space Weather Beacon data.

Current Status: Level 2 Data@UCLA

- Access: Go to <http://aten.igpp.ucla.edu/ssc/stereo>
 - Click on level2_plasma_and_magnetic_field
- Status: Magnetic field launch through June 30, 2009
 - 1 min, 10 min, 1 hr, RTN and S/C
 - Plasma data: February 15, 2007 – March 31, 2009 STEREO A
March 1, 2007 – March 31, 2009 STEREO B
 - Parameters: Currently serving a limited set of available parameters: V_p , N_p , T_p .
Calculating Entropy, Beta, Total Pressure
 - Plans: Will expand plasma data display options shortly

Current Status: Level 3 Event Lists@UCLA

- Access
 - Go to <http://aten.igpp.ucla.edu/ssc/stereo/>
 - Click on Level 3 Event lists http://www-ssc.igpp.ucla.edu/forms/stereo/stereo_level_3.html
- Status
 - Lists of interplanetary coronal mass ejections (ICMEs), stream interaction regions (SIRs), and interplanetary shocks, available through March 31, 2009
- ICMEs
 - Start and stop time, maxima of total perpendicular pressure (Pt), magnetic field intensity and solar-wind speed, speed variation across the ICME, group classification of ICMEs according to the Pt profile, comments
- SIRs
 - Start and stop time, occurrence time of maximum Pt, maxima of Pt magnetic field intensity, and proton number density, maximum and minimum solar-wind speed
- Interplanetary shocks
 - Time, ratio of magnetic field intensity of downstream to upstream, shock normal angle, ratio of plasma thermal pressure to magnetic pressure, magnetosonic Mach number, availability of 32-Hz data, forward/reverse shock and comments

Future Data Server Plans@UCLA

- Expand capability of level 2 web server
 - More PLASTIC parameters
 - SWEA data
 - SEP data
- Comments welcome

Current IMPACT Level 1 Data Holdings@UCB

Instrument	1 st Date (A)	1 st Date (B)	Last Date
MAG	2006 Nov 2	2006 Nov 2	2009 Aug 31
SWEA	2006 Oct 28	2006 Oct 28	2009 Apr 15
STE	2006 Oct 28	2006 Oct 28	2009 Aug 31
LET	2006 Nov 14	2006 Nov 13	2009 Aug 31
SEPT	2006 Dec 12	2006 Dec 12	2009 Jul 31
SIT	2007 Mar 15	2007 Mar 15	2009 Jun 30
HET	1min, 15 min and 1hour averages through 2009 Mar 31		

IMPACT website/data access@UCB

Summary by Month										
Month	Daily Avg				Monthly Totals					
	Hits	Files	Pages	Visits	Sites	KBytes	Visits	Pages	Files	Hits
Oct 2009	2912	2801	1658	43	296	54492651	390	14923	25213	26208
Sep 2009	976	796	427	37	582	22120590	1118	12824	23909	29284
Aug 2009	886	612	476	35	639	39880536	1108	14783	19002	27479
Jul 2009	739	646	415	30	605	19709882	953	12889	20054	22928
Jun 2009	35738	35586	7179	54	527	116397805	1632	215370	1067595	1072155
May 2009	71859	71752	13313	99	607	402073110	3088	412715	2224322	2227648
Apr 2009	72450	72271	12394	108	924	786405579	3243	371832	2168137	2173504
Mar 2009	71044	70686	12660	112	612	960587947	3486	392463	2191282	2202394
Feb 2009	70706	70397	12475	113	546	293585779	3186	349320	1971127	1979781
Jan 2009	67934	67662	11448	90	529	191276508	2813	354895	2097545	2105964
Dec 2008	68333	64595	9288	77	5219	244492289	2416	287939	2002448	2118344
Nov 2008	67785	61568	7539	104	9882	446948393	3140	226185	1847061	2033564
Totals						3577971069	26573	2666138	15657695	16019253

Delivered Since Last Update

- HET 1 min, 15 min and 1 hour data in ascii
- More “Level 2” merged Key Parameters (1 min) – currently includes MAG, PLASTIC Moments
- “Level 3” Event lists (Shocks, SIRs, ICMEs...)
- Improved boom browse plots with added SWEA electron heat flux pitch angle spectrograms
- New Burst mode triggers – longer bursts with more SWEA and MAG data
- CDAW-served IMPACT MAG, SWEA and LET Level 1 files
- VHO-served IMPACT MAG data. Soon to have SWEA and LET.

IMPACT Team and collaborator publications appeared since last SWG (partial list)

Topical areas include:

Solar wind sources and structure

Solar wind waves/generation

Interplanetary magnetic reconnection signatures

Shocks and associated waves

ICMEs

CIR-related energetic particles

SEPs

Effects of the weak cycle 23 minimum

E. Kilpua, et al., Multispacecraft Observations of Magnetic Clouds and Their Solar Origins between 19 and 23 May 2007, *Solar Physics*, Volume 254, Issue 2, pp.325-344, 2009.

E. Kilpua et al., Small Solar Wind Transients and Their Connection to the Large-Scale Coronal Structure, *Solar Physics*, Volume 256, Issue 1-2, pp. 327-344 , 2009.

Moestl, C., et al., Multispacecraft recovery of a magnetic cloud and its origin from magnetic reconnection on the Sun, *Journal of Geophysical Research*, Volume 114, doi: 10.1029/2008JA013657, 2009.

Y. Liu, et al., Coronal Mass Ejections and Global Coronal Magnetic Field Reconfiguration, *Astrophysical Journal Letters*, Volume 698, Issue 1, pp. L51-L55, 2009.

Y. Liu, et al., Relationship Between a Coronal Mass Ejection-Driven Shock and a Coronal Metric Type II Burst, *Astrophysical Journal Letters*, Volume 691, Issue 2, pp. L151-L155, 2009.

C.O. Lee, et al., Effects of the Weak Polar Fields of Solar Cycle 23: Investigation Using OMNI for the STEREO Mission Period, *Solar Physics*, Volume 256, Issue 1-2, pp. 345-363, 2009.

L.K. Jian, et al., Ion Cyclotron Waves in the Solar Wind Observed by STEREO Near 1 AU, *Astrophysical Journal Letters*, Volume 701, Issue 2, pp. L105-L109, 2009.

S. Eriksson, et al., Asymmetric shear flow effects on magnetic field configuration within oppositely directed solar wind reconnection exhausts, *Journal of Geophysical Research*, Volume 114, doi: 10.1029/2008JA013990, 2009.

C. Moestl, et al., Optimized Grad – Shafranov Reconstruction of a Magnetic Cloud Using STEREO- Wind Observations, *Solar Physics*, Volume 256, Issue 1-2, pp. 427-441, 2009.

J.G. Luhmann, Solar Wind Sources in the Late Declining Phase of Cycle 23: Effects of the Weak Solar Polar Field on High Speed Streams, *Sol. Phys.*, doi: 10.1007/s11207-009-9354-5, 2009.

C.T. Russell et al., An unusual current sheet in an ICME: Possible association with C/2006 P1 (McNaught), *Geophys. Res. Lett.*, v.36, doi: 10.1029/2009GL037615, 2009.

C.T. Russell, et al., STEREO observations of shock formation in the solar wind, *Geophysical Research Letters*, Volume 36, doi:10.1029/2008GL036337, 2009.

R. Bucik et al., STEREO Observations of Energetic Ions in Corotating Interaction Regions During the May 2007 Solar Events, Sol. Phys., doi: 10.1007/s11207-009-9415-9, 2009.

R. Bucik et al., On acceleration of <1 MeV/n He ions in the corotating compression regions near 1 AU: STEREO observations, Annales Geophysicae, Volume 27, Issue 9, 2009, pp.3677-3690, 2009.

G.M. Mason et al., In situ Observations of CIRs on STEREO, Wind, and ACE During 2007 – 2008, Solar Physics, Volume 256, Issue 1-2, pp. 393-408, 2009.

P. Ruan et al., Multiple-spacecraft study of an extended magnetic structure in the solar wind, Journal of Geophysical Research, Volume 114, doi: 10.1029/2008JA013769, 2009.

A. Klassen et al., STEREO/SEPT observations of upstream particle events: almost monoenergetic ion beams, Annales Geophysicae, Volume 27, Issue 5, 2009, pp.2077-2085, 2009.

R. Gomez-Herrero, et al., Recurrent CIR-accelerated ions observed by STEREO SEPT, Journal of Geophysical Research, Volume 114, doi: 10.1029/2008JA013755, 2009.

R.A. Mewaldt et al., STEREO Observations of Energetic Neutral Hydrogen Atoms During the 2006 December 5 Solar Flare, *Astrophysical Journal Letters*, Volume 693, Issue 1, pp. L11-L15, 2009.

A.C. Cummings, et al., Radial and latitudinal gradients of anomalous cosmic ray oxygen in the inner heliosphere, *Geophysical Research Letters*, Volume 36, doi: 10.1029/2009GL039851, 2009.

D. Baker et al., Signatures of interchange reconnection: STEREO, ACE and Hinode observations combined, *Annales Geophysicae*, Volume 27, Issue 10, 2009, pp.3883-3897, 2009.

C. Foullon, et al., The Apparent Layered Structure of the Heliospheric Current Sheet: Multi-Spacecraft Observations, *Sol. Phys.*, doi: 10.1007/s11207-009-9452-4, 2009.

P. Louarn, et al., On the Temporal Variability of the "Strahl" and Its Relationship with Solar Wind Characteristics: STEREO SWEA Observations, *Sol. Phys.*, doi: 10.1007/s11207-009-9402-1, 2009.

B. Lauvraud, et al., Observation of a Complex Solar Wind Reconnection Exhaust from Spacecraft Separated by over $1800 R_E$, *Solar Physics*, Volume 256, Issue 1-2, pp. 379-392, 2009.

C.T. Russell, et al., STEREO observations of upstream and downstream waves at low Mach number shocks, *Geophysical Research Letters*, Volume 36, doi:10.1029/2008GL036991, 2009.

L.K. Jian, et al., Multi-Spacecraft Observations: Stream Interactions and Associated Structures, *Sol. Phys.*, doi: 10.1007/s11207-009-9445-3, 2009.

T. von Roseninge, et al., The Solar Energetic Particle Event of 14 December 2006, *Solar Physics*, Volume 256, Issue 1-2, pp. 443-462, 2009

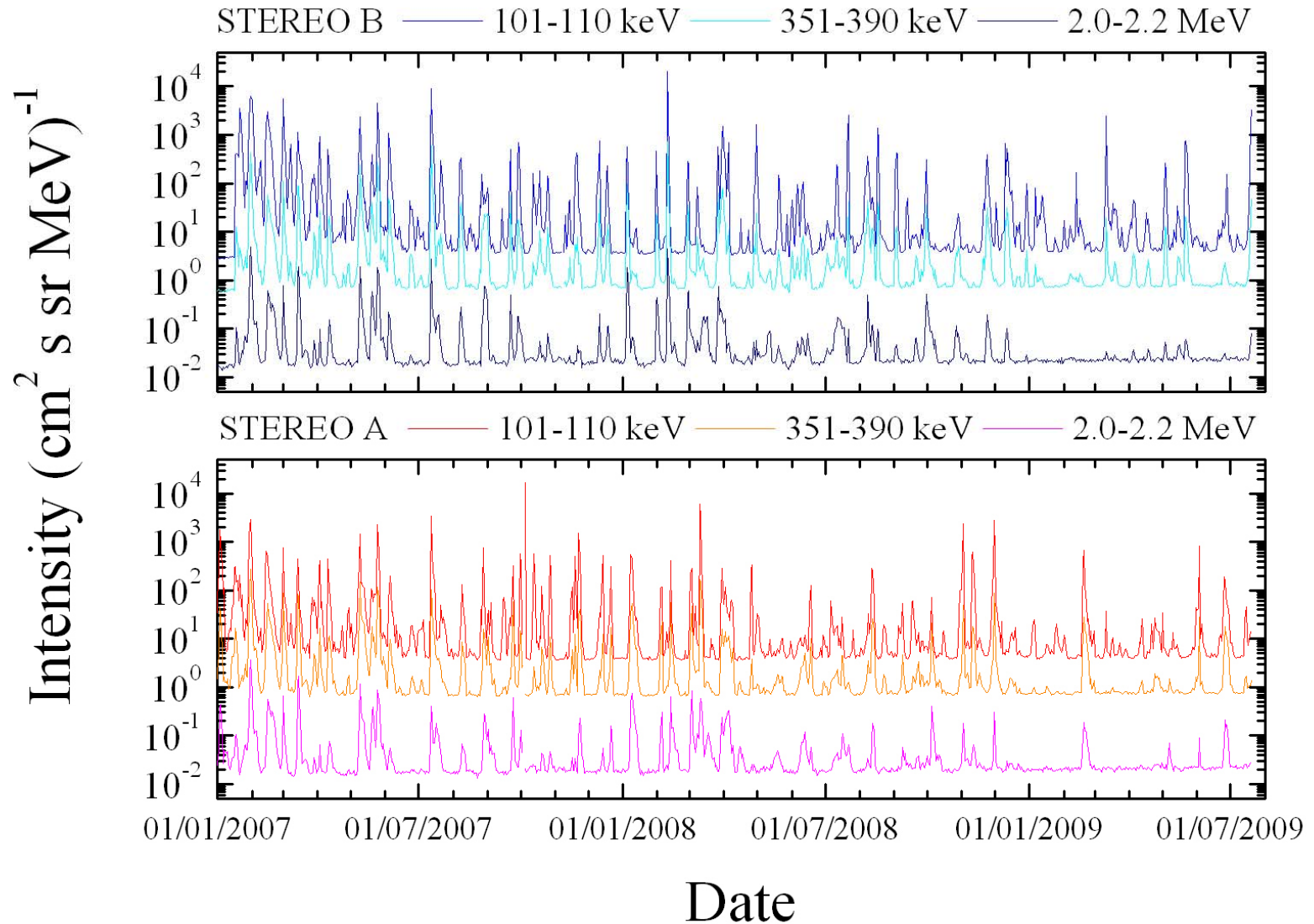
Hsieh, J., et al., A Re-Interpretation of STEREO/STE Observations and Its Consequences, *Astrophysical Journal Letters*, Volume 694, Issue 1, pp. L79-L82, 2009

A sampling of observational
updates

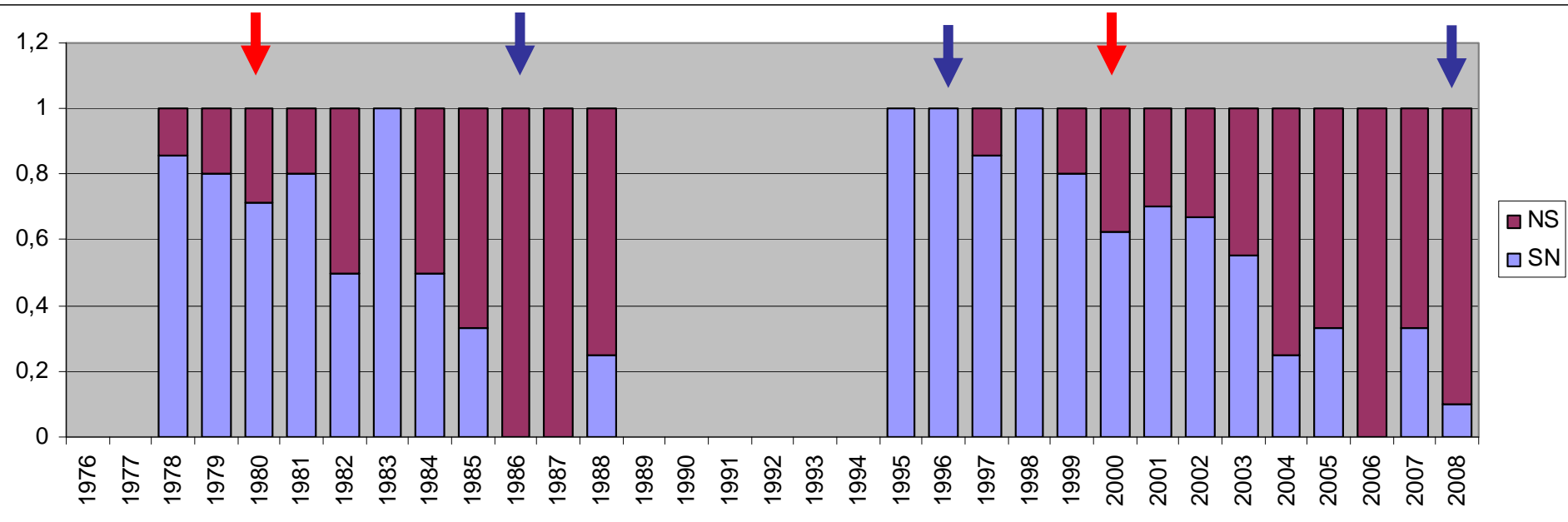
IMPACT SEPT accumulated time series (as of October 19, 2009)

CIR and small SEP events

SEPT Ion intensities 1-day avg



(Bucik et al.)



solar maximum solar minimum

ICMEs

1978-2002: Li et al., 2004, J. Atmospheric and Solar Terrestrial Physics

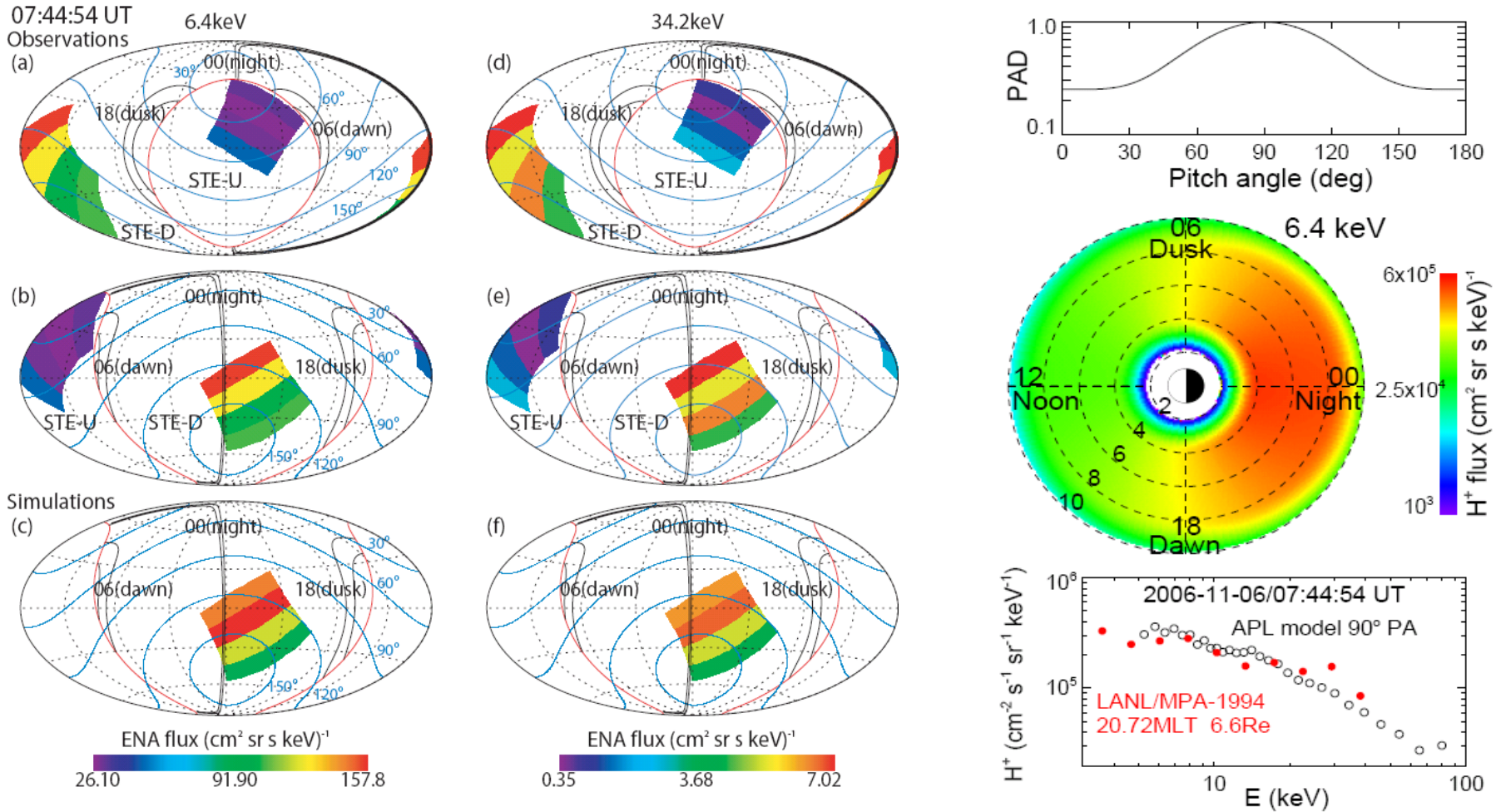
2007-2008: Kilpua et al., 2009, Submitted to Annales Geophysicase

ICME MAGNETIC CLOUD POLARITY

(Kilpua and Li et al.)

IMPACT/STE observations

Energetic Neutral Atom Imaging of Ring Currents from STEREO/STE



- **First low-energy (< 26 keV) detection of ring current ENAs from low Earth orbit**
- **First demonstration of ring current injection in a very weak (DST ≥ -8nT) substorm**
(Wang et al.)