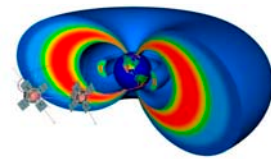




# Data Products / Data Workshop, 15 May 2012

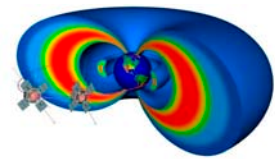
## EFW Content



- Introduction – (5 minutes)
- Brief Discussion of [Mission-level Data Products](#) captured to date (update at end of the workshop). Includes scope discussion (cross instrument?) – Appendix. (10 minutes).
- High-level discussion of [scenarios for data use](#) (Appendix) – (10 minutes)
- Brief presentation of [Baseline science operations](#) plan for each team. Including answer to Data Scenario #1: How do instrument team members access / analyze their own data – (5 minutes each, total of 30 minutes): EMFISIS, EFW, ECT, RPS, RBSPICE
- Very brief presentations on some possible [non-team resources](#): Gateway, SPDF, VIRBO. (2 slides, < 4 minutes each; total of no more than 15 minutes)
- The meat of the Workshop: Project Science team will lead an interactive session asking teams and non-team participants how they will respond to each scenario; seeking to [chart routes to data access and gaps in service](#). Teams can respond with impromptu slide & web presentations as we go through each Data Use scenario (Slide 4) one at a time. (2-3) hours). SWG members are encouraged to poll their team members for planned studies prior to the meeting, and describe these at the meeting.
- Broad discussions on: What is missing? What do we need to fix? How will we fix it? Who will fix it?
- Discussion / Real-time editing to updating the list of Data products that all users need (Discussion / clarification / expansion of the table on the next slide).



# EFW SOC Status (1)



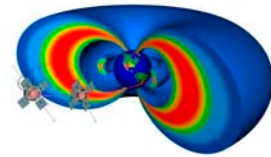
- Producing L1 from M-SIM-3 L0 and real-time PTP (L1 and L1-INT).
- M-SIM-2 and -3 (and eventually -4) L1 CDFs present at nominal URL: <http://themis.ssl.berkeley.edu/data/rbsp/>

```
L rbspa
  L L1
    L eb1
      L 2012
      L 2013
        L Rbsp{a,b}_l{1,2}_{dqd}_YYYYMMDD_vNN.cdf
        L ...
      L 2014
    L Eb2
    L Esvy
    L Fbk
    L ...

  L l1_int
L rbspb
```



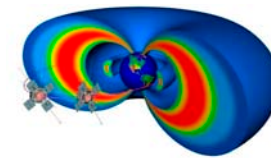
## EFW SOC Status (2)



- L1 validation ongoing.
- L2 production in IDL/TDAS just starting.
- ICY/SPICE incorporation to IDL/TDAS just starting.
- EFW website development just starting.



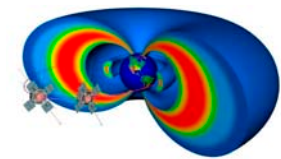
# RBSP-EFW Data Products



Data Product	Notes	Coverage	Analogous THEMIS Data Product (and coverage)
E_SVY	32 samp/s; EDC12, EDC34, EDC56 (U,V, W)	Continuous	EFF (<50%)
V_SVY	16 samp/s; V1..V6.	Continuous	VAF (<50%)
MAG_SVY	64 samp/s; MAG U, V, W (disabled).	Contingency for EMFISIS-MAG	FGM
FB	Filter Bank; 2 channels, pk and avg, 8-s cadence; E12DC (U), SCMU.	Continuous	FBK
SPEC	FFT Power Spec; 7 channels, 8-s cadence; 10% df/f (64 bins); E12AC (U), E56AC (U), SCM U,V,W	Continuous.	FFT
XSPEC	FFT Cross Spec; 2 channels, 8-s cadence.	Continuous.	None.
E, B Spin Fit	12-s (spin period) cadence; E12DC (U), MAGU.	Continuous.	EFS, BFS
Burst1	512 samp/s: EDC, V1..V6, SCM.	7.5% (~1.8 hr/day, or 40 min/orbit)	PBurst - EFP, VAP, SCP.
Burst2	16384 samp/s: V1AC..V6AC.	0.1% (~80 s/day, or ~30 s/orbit).	Wburst – EFW, VAW, SCW.
Housekeeping	Various rates; Instrument SOH, Burst Memory Parameters, etc.	Continuous	HSK



# RBSP-EFW Data Access (TDAS)

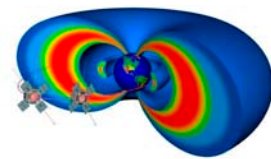


Access Routine	Quantities Accessed	Analogous THEMIS Access Routine
RBSP_EFW_LOAD_WAVEFORM	E_SVY, V_SVY, MAG_SVY; EB1, VB1, MSCB1; EB2, VB2, MSCB2.	THM_LOAD_EFI
RBSP_EFW_LOAD_FB	FB.	THM_LOAD_FBK
RBSP_EFW_LOAD_SPEC	SPEC.	THM_LOAD_FFT
RBSP_EFW_LOAD_XSPEC	XSPEC.	n/a.
RBSP_EFW_LOAD_FIT	E, B Spin Fit.	THM_LOAD_FIT.
RBSP_EFW_LOAD_HSK	Housekeeping.	THM_LOAD_HSK (EFI only).
RBSP_LOAD_EMFISIS	EMF MAG (proof of concept)	



# Preliminary list of data-use scenarios

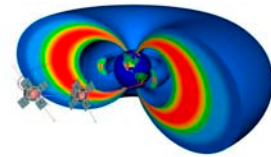
## [Details on follow-on slides](#)



1. How do members of an instrument team look at, access, and analyze their own data?
2. Outside Researcher / Student wishing to access RBSP data
3. Survey RBSP data (both “insider” and “outsider” access)
4. Targeted access (insider and outsider access)
5. Access to large volumes of data (insider and outsider access)
6. Space Weather Event (insider and outsider access)
7. Question: What other scenarios should we consider?



# Scenario #1 - EFW



How do members of an instrument team look access and analyze their own data?

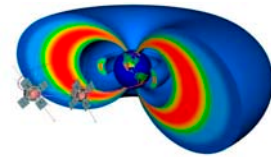
- **Nominal EFW Instrument Ops planning two weeks ahead:**
  - This week, planning what will need to happen two weeks hence.
  - Commanding what will need to happen this coming week.
- **EFW PI and Tohban reporting weekly to EFW Ops:**
  - Summary of data processing and data quality.
  - Any requests for special ops from RBSP or EFW Science Teams.
- **Daily:**
  - TOHBAN and/or PI checking internal L1 and L2 summary plots of EFW data from previous day for validation (IDL/TDAS).
  - Upon validation, approve new L2 data for public availability.
  - Upon data availability, generate EFW Summary plots that make use of other instruments' data.
  - Compile any B1 playback requests.
  - Compile any special command requests.
  - Provide requests to EFW Ops for submission to command queues.







## Scenario #2 - EFW

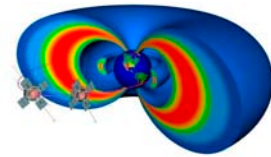


Outside Researcher / Student wishing to find out about RBSP data and whether it would be useful for his or her study.

- Probably has no idea where to begin search.
  - **SDP links to individual instrument web pages or SSR content; e.g.: THEMIS Mission pages and instrument descriptions, data products, caveats.**
  - <http://themis.ssl.berkeley.edu/instruments.shtml>
  - [http://themis.ssl.berkeley.edu/instrument\\_efi.shtml](http://themis.ssl.berkeley.edu/instrument_efi.shtml)
  - [http://themis.ssl.berkeley.edu/efi\\_modes.shtml](http://themis.ssl.berkeley.edu/efi_modes.shtml)
  - [http://themis.ssl.berkeley.edu/efi\\_non-ideal.shtml](http://themis.ssl.berkeley.edu/efi_non-ideal.shtml)



## Scenario #2 – EFW (con't)

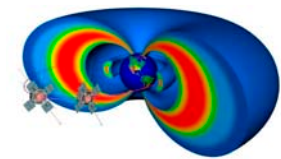


Outside Researcher / Student wishing to find out about RBSP data and whether it would be useful for his or her study.

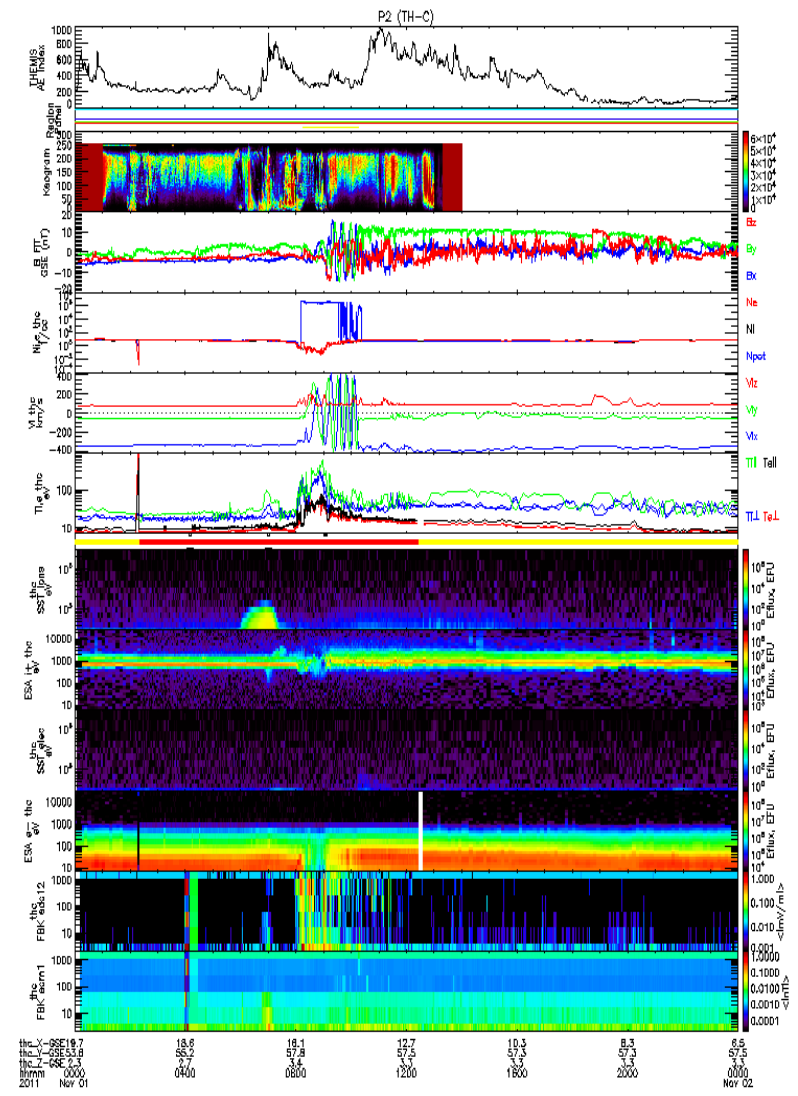
- May only want the simplest of survey plots or tools- just to know something is there. Wants to know time periods when data is available. Needs brief description of mission, instruments and modes. May want to know about orbits, conjunctions, and where the spacecraft are at particular times (**TIPSOD or Equivalent (TBR)**).
  - **EFW shall produce static daily (24-hr, 00-24 UTC) and orbit (inbound and outbound, ~4.5-hr each (TBR)) summary plots which include fields and particle data, one for each Observatory utilizing IDL/TDAS software (PNG or equivalent format).**
  - **Summary plots will include x-axis labels that include both UTC and Magnetic Coordinates, either from ICY/SPICE or ECT Grand Ephemerides.**
  - **EFW shall provide AUTO PLOT templates for L2 EFW data products (waveform, spectral, instrument mode and data availability (B1, B2)).**
  - **RBSP Mission shall provide necessary data to NASA to allow for the use of TIPSOD or equivalent for browsing of orbits, conjunctions, residence on regions of interest, etc.**



# Scenario #2: Description: EFW L2 Summary Plot

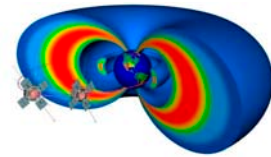


- Vector estimate of Eperp in geophysically-relevant inertial (e.g. GSE) or corotating (e.g. SM), both with a basic VxB subtraction (uses EMFISIS-MAG).
- Vector estimate of dB (uses EMFISIS-MAG and model B, or an analogous EMFISIS L2 data product).
- Estimate of SC floating potential.
- Filter Bank and FFT SPEC and XSPEC spectral data.
- Indication of EFW operational mode (sensor biasing table, burst trigger config, AXB illumination status, etc.).
- Indication of EFW Burst1 collection and Burst2 collection and playback.
- Omni-directional (TBR) energy-time spectrograms of differential energy or number flux from ECT-HOPE, ECT-MagEIS, ECT-REPT, RBSPICE, and RPS (species as relevant).





## Scenario #3 - EFW

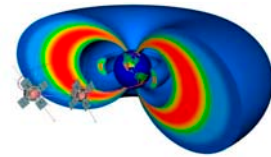


### Survey RBSP data (both “insider” and “outsider” access)

- Go through hundreds of plots whose parameters the user sets.
- Would like parameters from multiple instruments.
- Possibly would like to plot with data from ACE or other available data.
- Need flexibility on time scales: one hour, one day, or one orbit per page
- Set all the Y axes the same and choose the same fixed color bar.
- Need easy access to orbit plots to see where the spacecraft were at times of each event (**TIPSOD or equivalent?**)
- Result may be a detailed list of events that I find.
- **The USER shall download IDL/TDAS package, which shall include crib sheets demonstrating the loading, display, and manipulation of EFW data products, as well as the TDAS generic interface to the other RBSP instrument team data products (e.g. RBSP\_LOAD\_EMFISIS()).**
- **Alternatively, if extant L2 data products sufficient, USER can utilize AUTO PLOT templates from S2 to build custom views desired.**
- **Defining and keeping track of “events” and “event quality” up to USER.**



## Scenario #4 - EFW

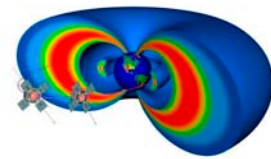


### Targeted access (insider and outsider access)

- Possibly running a campaign with certain time periods or spatial regions of interest
- Need to know about conjugacy. For example, map of Earth with spacecraft footprints. Possible conjugacy with other spacecraft (proximity)
- Plot data versus time, and also radial distance, L shell or  $L^*$ , Local Time, etc.
- Mark on the plots information concerning non-RBSP activities (e.g. BARREL)
- Question: Other characteristics of this scenario?
- **Same as S3.**



## Scenario #5 - EFW

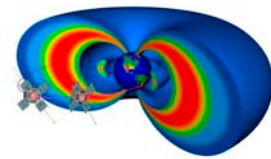


Access to large volumes of data (insider and outsider access)

- Scenario 5a: Detailed case studies using the highest resolution data from multiple instruments
- Scenario 5b: Automated search for and analysis of multiple events over months or years using multiple data sets.
- Need to download “everything” and create large data base(s).
- User may create own higher level parameters and distributions.
- Question: Other characteristics of this scenario?
  
- **Same as S3.**



## Scenario #6 -EFW



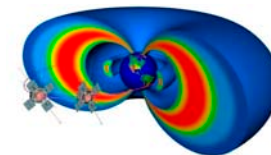
### Space Weather Event (insider and outsider access)

- External organizations call and ask whether we saw anything related to the flare on the sun.
- A geosynchronous spacecraft just died. Need to know NOW whether it was space weather.
- Question: Is this simply a “Space Weather Broadcast” issue (answered by quick examination of the latest downlinked and automatically processed data), or is a more complete / comprehensive analysis needed?
- **EFW TOHBAN or PI can respond to a query of this sort with latency of less than 1 day using internal L1 and L2 EFW data (equiv. to SWX, plus rest of Survey waveform and spectral data products).**
- **If SWX data is publically available, then EFW TOHBAN or PI can respond more rapidly, interpreting the EFW SWX data (vector E and SC\_POT) as required by Project Science Team (TBR).**



# Sample List of Data Products to be Updated

## This has not been updated from last telecom



### Particles

Electron Intensity versus Energy and time  
Electron Intensity versus Pitch Angle and time  
P, He, O Intensity versus Energy and time  
P, He, O Intensity versus Pitch Angle and time  
P, He, O Intensity versus Gyrophase and time  
Selected E, P, He, O energy spectra  
Selected E, P, He, O pitch angle distributions  
Selected P, He, O gyrophase distributions  
**Electrons:** N, I, P, IE moments  
**P, He, O:** N, V, I, P, IE moments  
HOPE distribution functions  
E, P, He, O PSD versus momentum or energy  
E, P, He, O PSD versus adiabatic invariants  
Meta-Data showing when Instrument Modes are used (a plotable parameter?)

### Waves:

E-Spectra (components) vs. time with critical frequency lines overlaid (gyro; gyro/2; plasma)  
B-Spectra (components) vs. time with critical frequency lines overlaid (gyro; gyro/2; plasma)  
Selected E-spectra (components) at specific times  
Selected B-spectra (components) at specific times  
Wave estimate of Ne  
Meta-Data showing when HTR data is available (a plotable parameter?)

### Magnetic Field

Cartesian / Spherical / GSE / GSM Components  
ULF Wave Spectral Components vsus time  
Selected ULF Wave Spectral Components

### Electric field

SC Potential and N  
E-vector: 3 components; Cartesian / GSE / GSM  
E-vector: 2 components + 3rd component from  $E \cdot B = 0$   
ULF Wave Spectra Components versus time  
Selected ULF Wave Spectral Components