

# SWx Data Center for Asia Region

[ydpark@kasi.re.kr](mailto:ydpark@kasi.re.kr)



**Young-deuk Park**  
Korea Astronomy and Space Science Institute



# 한국천문연구원

Korea Astronomy & Space Science Institute

Principal Researcher  
Space Science Research Division

**Young-Deuk PARK, Ph.D**

61-1, Whaam-dong, Yuseong-gu,  
Daejeon 305-348, Korea

TEL : +82-42-865-3256

FAX : +82-42-861-5610

E-mail : ydpark@kasi.re.kr



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-  Introduction
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-  SDO and RBSP for SWx
-  SDO data center 4 Asia

# Introduction



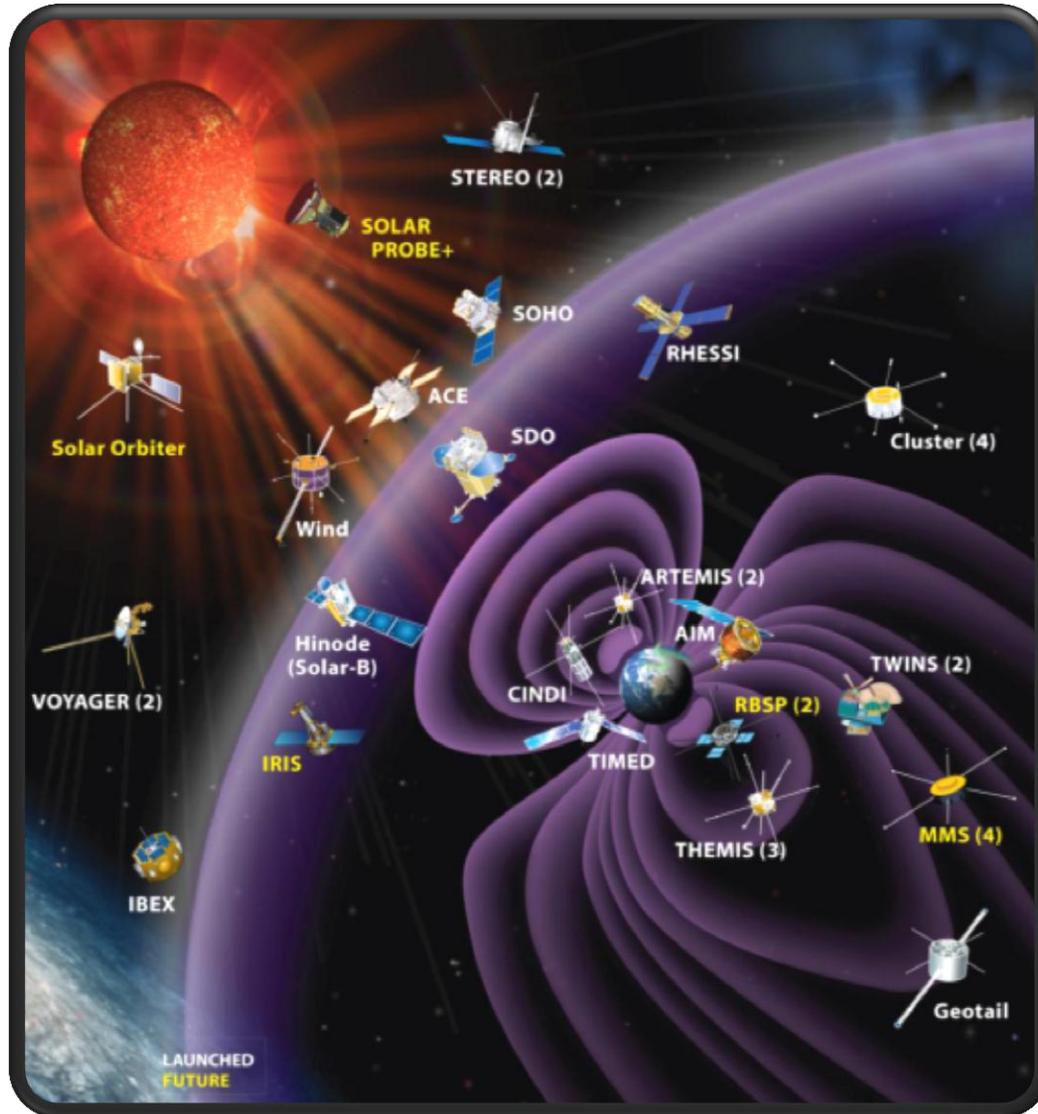
**21 century is space era and space weather is important as much as weather on the ground human life.**

**Solar activity is the main source of the space weather so we need to monitoring the solar activity in detail**

**We have to the responsibility as space scientist, predict the space weather and minimize the global disaster.**



# Human effort to space weather prediction



Enough Obs. Data

How to select Data for your research

How to get the Data for your research



우주환경 모니터링 시스템 (Space Weather Monitoring System) overview panels showing various data feeds and satellite imagery.

### 우주환경 모니터링 시스템

Space Weather Monitoring System

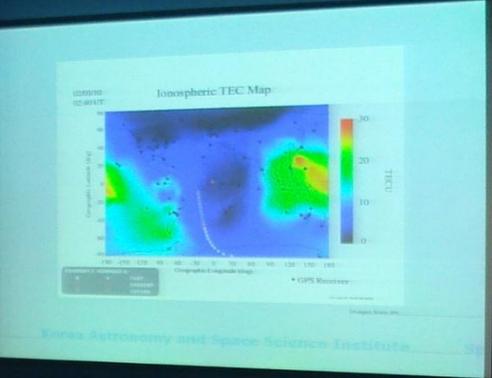
UW	2.0	방사능 (nSv/h)
SW	3.2	방사능 (nSv/h)
UV	3.2	방사능 (nSv/h)

Space Weather Forecast

SW 3 Day Prediction

Time	SW	UV	UV
Today	3.2	3.2	3.2
Tomorrow	3.2	3.2	3.2
Day After	3.2	3.2	3.2

Check Arrival Time at the Earth



우주환경 모니터링 시스템 (Space Weather Monitoring System) detailed data panels.

### 행자재도 위성용 우주환경 감시

행자재도 위성용 우주환경 감시 (Space Weather Monitoring for Spacecraft)

### 극광포 우주방사선 감시

극광포 우주방사선 감시 (Auroral Region Cosmic Radiation Monitoring)

1 11:43AM

# **Data Center : General**

# Data Center : General



- One of the main concerns is **business continuity**
  - Provide a reliable infrastructure for IT operations
- Information security
  - Secure environment which minimizes the chances of a security breach
  - Keep high standards for assuring the integrity and functionality of its hosted computer environment
- The equipment may be used to:
  - Operate and manage a carrier's telecommunication network
  - Provide data center based applications directly to the carrier's customers
  - Provide hosted applications for a third party to provide services to their customers
  - Provide a combination of these and similar data center applications

# High performance DC



## Standardization/consolidation:

- Reduce the number of data centers a large organization may have.
- Reduce the number of hardware, software platforms, tools and processes
- Organizations :
  - **provide increased capacity and performance.**
  - **easier to manage.**

## Virtualize:

- Helps to lower capital and operational expenses, and energy consumption.
- Virtualization technologies are also used to create virtual desktops

## Automating:

- Automating tasks :
  - **provisioning, configuration, patching, release management and compliance.**
- Automating tasks make data centers run more efficiently.

## Securing:

- Security of physical infrastructures.
- Physical security, Network security, and Data and User security



# Data Center Condition

- **Storage**
- **Easy to Data Select and Translate**
- **Perfect information**
- **Free from any jamming environments**
- **Co-work between similar research group – synergy effect**
- **Contribute the research fields**

# SWx DC in Asia

❖ [http://www.ips.gov.au/World\\_Data\\_Centre](http://www.ips.gov.au/World_Data_Centre)

The screenshot shows the homepage of the World Data Centre. At the top, there is a navigation bar with the Australian Government logo and the Bureau of Meteorology name. The main header includes 'Radio and Space Weather Services' and a search bar. Below the header, there is a secondary navigation bar with links to various services and a forecast status bar showing 'FORECAST SOL: Moderate', 'MAG: Normal', and 'ION: Normal'. The main content area is divided into a left sidebar with a table of contents and a main content area. The sidebar lists sections like 'Data Display and Download', 'Data Catalogue', 'Related Sites', and 'Section Information'. The main content area features the 'World Data Centre' logo, a brief description of the service, a list of bullet points, and a 'Request Form' link. The footer contains copyright information and links to 'About IPS', 'Feedback', 'Contact Us', etc.

**Australian Government**  
**Bureau of Meteorology**

**Radio and Space Weather Services**

Home | Space Weather | Satellite | Geophysical | Solar | HF Systems | Products and Services | Educational | World Data Centre

**World Data Centre** Looking for something? Site Search

Home - World Data Centre FORECAST SOL: Moderate MAG: Normal ION: Normal Thursday, Sep 06 2012 12:29 UT

**World Data Centre:**

The **IPS Radio and Space Service** is a member of **ICSU World Data System**. The World Data Centre (WDC) for Solar-Terrestrial Science (STS) is a part of and operated by **IPS Radio and Space Services**, a program within the Bureau of Meteorology (BOM) of Australian Government. The centre operates in Sydney, New South Wales, Australia.

- The IPS Radio and Space Services is a member of ICSU World Data System.
- The WDC for STS is part of the IPS Radio and Space Services.
- The data sets listed here are a subset of IPS holdings made possible through BOM support.
- The WDC for STS only holds archived data files owned by IPS. For real time data and images, please visit the corresponding sections listed in the navigation bar above.
- Click here for the IPS Data Policy ([HTML File](#))([PDF File](#)).
- [WDC Help Page](#) lists all resources available in this section, including downloadable data files, softwares and data catalogue information.

Several hundred Gigabytes of Ionospheric, Magnetometer, Spectrograph, Cosmic Ray data and Solar images are available for direct download under the FTP Download section. These areas are continually growing, with the addition of new data types, downloadable tools and data from new locations. Please see [Latest News](#) for updates

Clicking on a data type listed under the **Data Display and Download** section in the left column will bring up a multi-function plotting applet for that data set. Selective download is available for most of these data types via this tool.

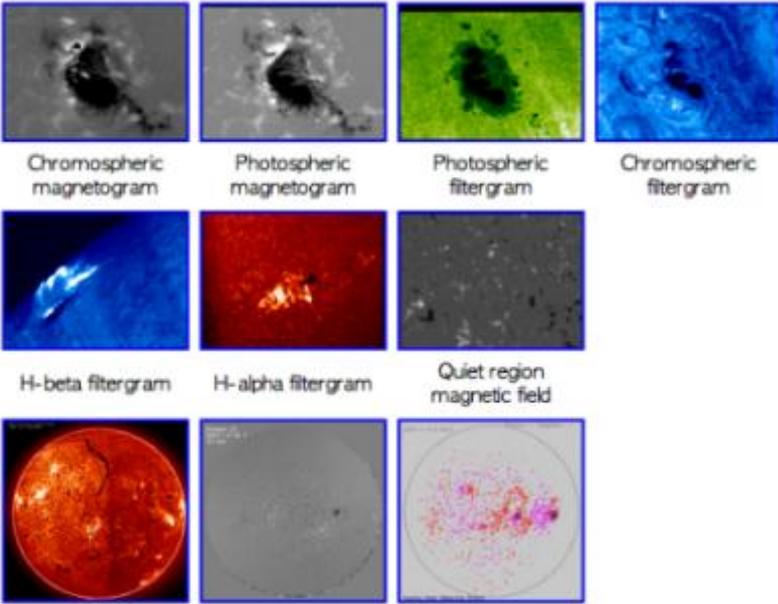
For special data requests, please use the [Request Form](#)

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# SWx DC in Asia

❖ [http://sun.bao.ac.cn/observation/obsdata\\_e.html](http://sun.bao.ac.cn/observation/obsdata_e.html)



Chromospheric magnetogram      Photospheric magnetogram      Photospheric filtergram      Chromospheric filtergram

H-beta filtergram      H-alpha filtergram      Quiet region magnetic field

full disk H-alpha image      full disk longitudinal magnetogram      full disk vector magnetogram

[Data Query Form](#)

[ETP-Archive](#)

[Halpa Video in real time](#)

For more information contact  
H.Q. Zhang, Y.Y. Deng, W. Li, Sh.D. Bao, M. Zhang, G.H. Lin

# SWx DC in Asia

❖ <http://magdas2.serc.kyushu-u.ac.jp/datausage/index.html>



## Requesting Data and Rules for Usage

### How To Get Data from SERC

We define some terms as follows:

**First Party...Space Environment Research Center, Kyushu University, Japan.**

**Second Party...A location that is hosting MAGDAS-II instrument.**

**Third Party...All others.**

Second Party has the privilege to access 1-second realtime or corrected data of its station or stations.

Second Party also has the privilege to access 1-minute realtime data of its station or stations.

And Second Party has the privilege to access 1-minute corrected data of all the stations of the First Party.

Data can be accessed via the ftp site of the First Party.

Data can be accessed via the ftp site of the First Party:

corrected data of all the stations of the First Party.

And Second Party has the privilege to access 1-minute

# SWx DC in Asia

❖ <http://magdas2.serc.kyushu-u.ac.jp/datausage/index.html>

\*\*\*\*\* Data Request Form \*\*\*\*\*

TO THE ATTENTION OF PROF. K. YUMOTO  
1. Professor of Kyushu University, Japan.  
2. PI of the MAGDAS Project  
3. Director of SERC

Please print very clearly:

Your Name: \_\_\_\_\_

Your Position: \_\_\_\_\_

Your Institute: \_\_\_\_\_

Your telephone or fax number:  
(please include country code) \_\_\_\_\_

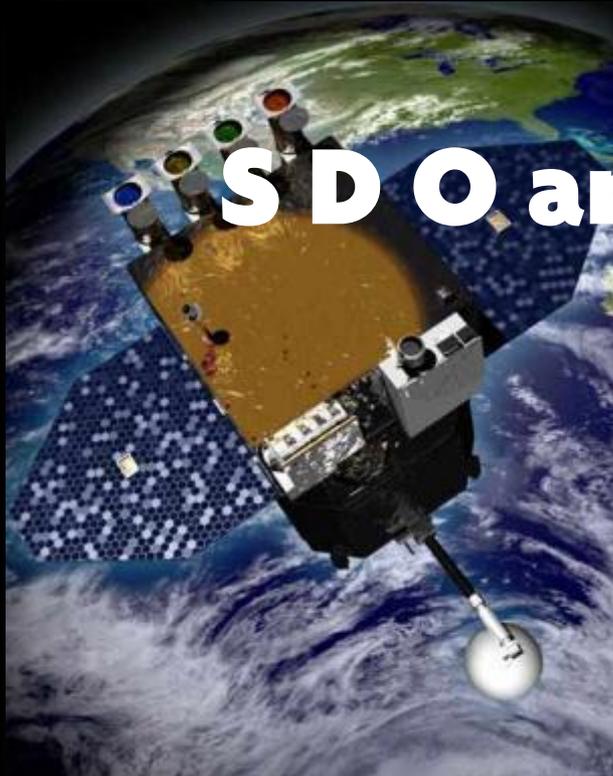
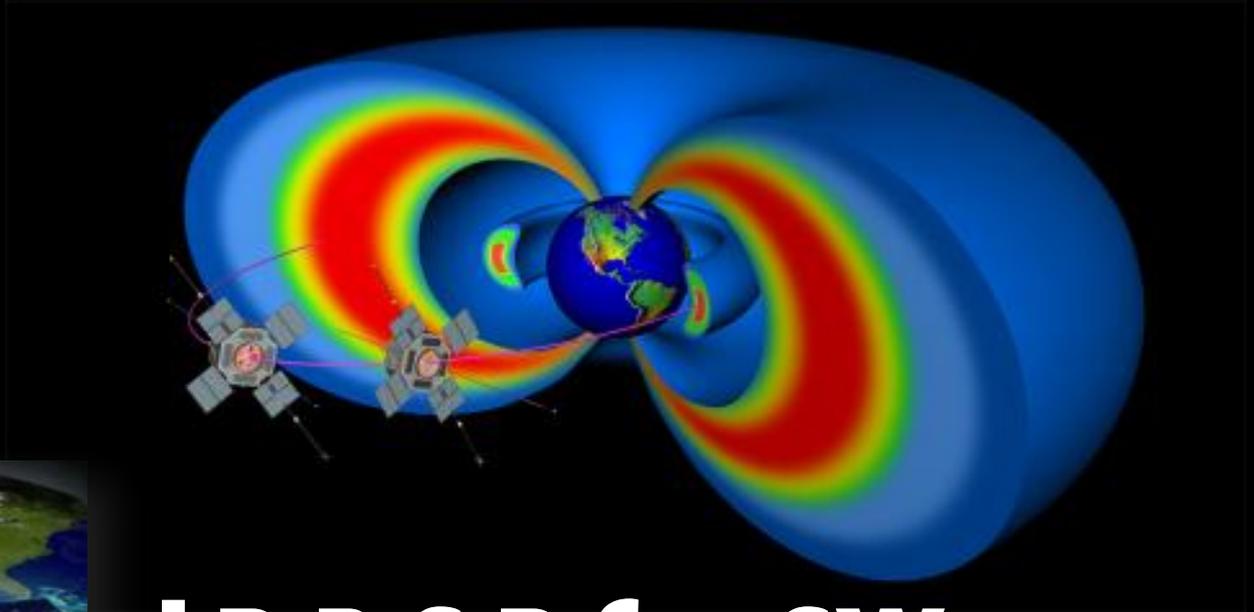
Your email address: \_\_\_\_\_

Purpose of Request Data:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

# SWx DC in Asia

❖ <http://sos.kasi.re.kr/english/data.php>

The screenshot shows the website for the Solar and Space Weather Research Group (SOS) at KASI. The page has a white background with a red header bar. The SOS logo is in the top left, and 'KOREAN | KASI' is in the top right. The header bar contains the text 'DATA | Solar and Space Weather Research Group'. A left sidebar lists navigation options: HOME, MEETINGS, PEOPLE, RESEARCH, INSTRUMENT, DATA, PUBLICATIONS, OUTREACH, LINK, and CONTACT US. The main content area is divided into three sections: 'Space Weather Monitoring' with sub-items 'Space Weather Monitoring System', 'Sunspot Number & Energetic particle Monitoring', and 'Solar Wind & Dst index Monitoring'; 'Space Weather Data' with sub-items 'KASI Data Browse', 'KASI Data FTP (ID:sec / PW:pub)', and 'KASI Magnetic Cloud List'; and 'Space Weather Daily Forecast Report'. At the bottom left is the KASI logo and text: 'KASI KOREAN ASTRONOMY AND SPACE SCIENCE INSTITUTE'.



# **S D O and R B S P for SWx**

# SDO and RBSP

- What is SDO



Launched on  
11 February 2010



Helioseismic and  
Magnetic Imager



EUV Variability  
Experiment



Atmospheric Imaging  
Assembly

# SDO and RBSP Science

## Mission Science Objectives of SDO

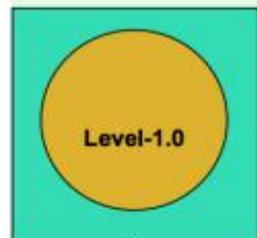
1. Solve the mechanisms of 11-year cycle of solar activity
2. How is active region magnetic flux synthesized, concentrated, and dispersed across the solar surface?
3. Magnetic reconnection on small scales
  - ✧ How significant is it in coronal heating
  - ✧ Accelerating the solar wind
4. Where do the observed variations in the Sun's EUV spectral irradiance arise, and how do they relate to the magnetic activity cycles?
5. What magnetic field configurations lead to the CMEs, filament eruptions, and flares that produce energetic particles and radiation?
6. Can the structure and dynamics of the solar wind near Earth be determined from the magnetic field configuration and atmospheric structure near the solar surface?
7. Reliable forecasts of space weather and climate, activity occur.



# AIA Processing Pipeline and Standard Products



## AIA data



## HMI data

- Far-side activity map
- Line-of-Sight Magnetic Field Maps
- Vector Magnetic Field Maps
- Coronal magnetic Field Extrapolations
- Coronal and Solar wind models
- Brightness Images

## EVE data

- Full-Sun spectra
- Light-curve metadata

## HPKB meta-data

- Active regions
- Coronal dimmings
- Filaments
- Filament eruptions
- Flares
- Sunspots
- Coronal oscillations
- Emerging flux
- New event classes
- Community-provided events

## Browse/ Level-2 products

- Tracked AR-area movies
- Event summary movies

"Sun by date" & HPKB

- (E)UV light curves
- EUV synoptic maps
- 4 global DEM maps/day
- 3-temp movies 4 frames/h
- Low-res full-Sun summ.

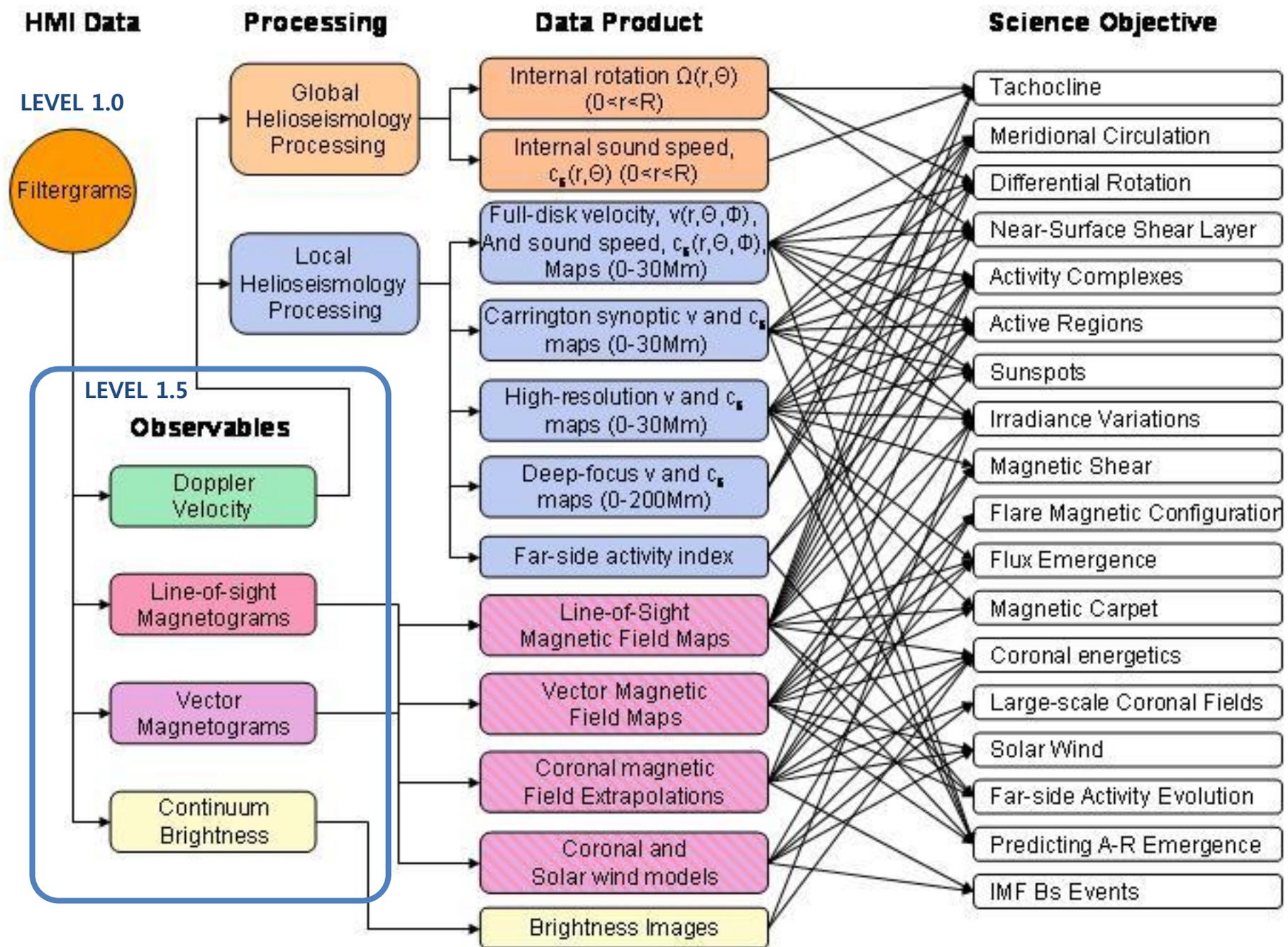
- Comparisons of NLFFF or MHD models with EUV coronal images
- PFSS-EUV comp. 4/day

Segmentation maps:  
AR, EF, QS, CH (4/day)  
Carrington & Disk maps

## Inspection and Science analysis

## AIA science tasks

- 3D coronal configuration
- Mapping coronal free energy
- Unstable configurations
- Life-cycle of atm. field
- (E)UV contributors
- Properties of EUV features
- Models of EUV irradiance
- Predicting EUV irradiance
- Transient initiation
- Transient evolution
- Early CME evolution
- Particle acceleration
- Corona-heliosphere coupling
- Solar-wind energetics
- CME propagation
- Vector fields and flows
- Transverse coronal waves
- Longitudinal coronal waves
- Probing corona with waves
- Field Topology & wave prop.
- HMI events search
- EVE events search
- Other events search



**HMI Science Analysis Pipeline**

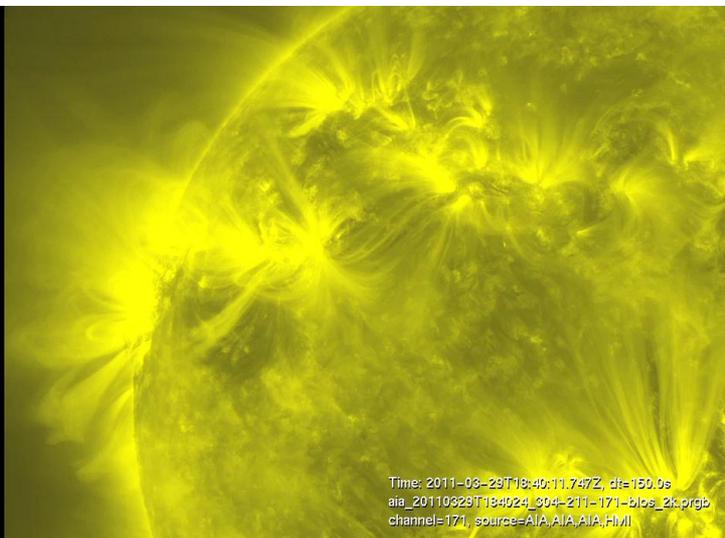
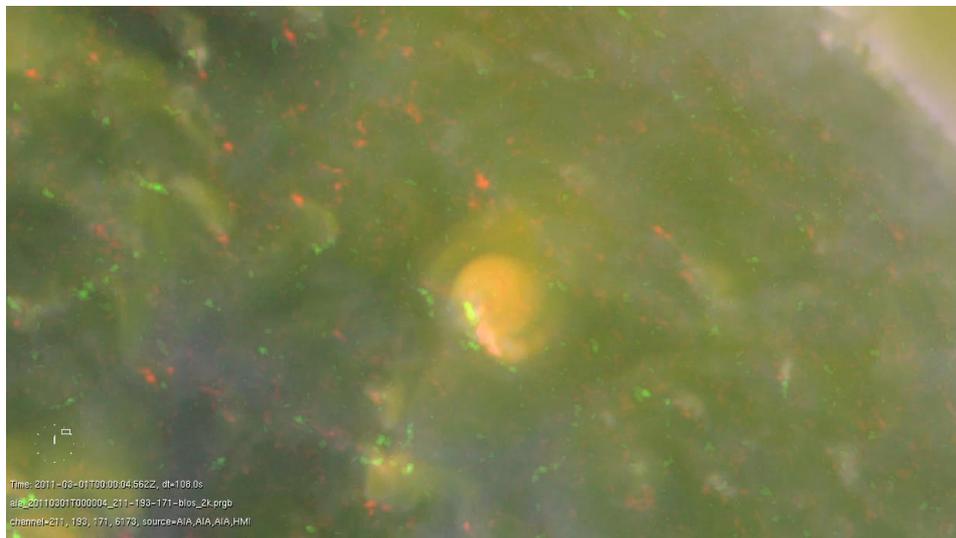


# 1) **AIA Flares** (Period: 2010-04-24 ~ 2011-04-09)

- ✧ Average time period per each flare: 10~20 min -> average 15 min
  - ≥**GOES C-class**: 437 flare events
  - ≥**GOES M-class**: 55 flare events
  - ≥**GOES X-class**: 2 flare events

## 2) Eruption Events

- ✧ 243 Events (among the events, there is a same event but for different wavelengths)
- ✧ Event period : several hours (1-10 hours)



### 3) Coronal Jet :

- ❖ 131 events
- ❖ Event period : ~ 1hr : 211, 171, 304 A

### 4) Spray Surge

- ❖ 85 events, Event period: ~ 1hr
- ❖ Typical wavelength : 304 A, multi wav: 211, 171

### 5) Filament

- ❖ 1 event/day, Event period: 24 hr
- ❖ Main wavelength: 304 A, multi wav: 211, 171, 193 A

### 6) Filament Eruption

- ❖ 361 events : 1 event/day, Event period: ~5 hr
- ❖ Main wavelength: 304A, multi wave: 211, 193, 171 A

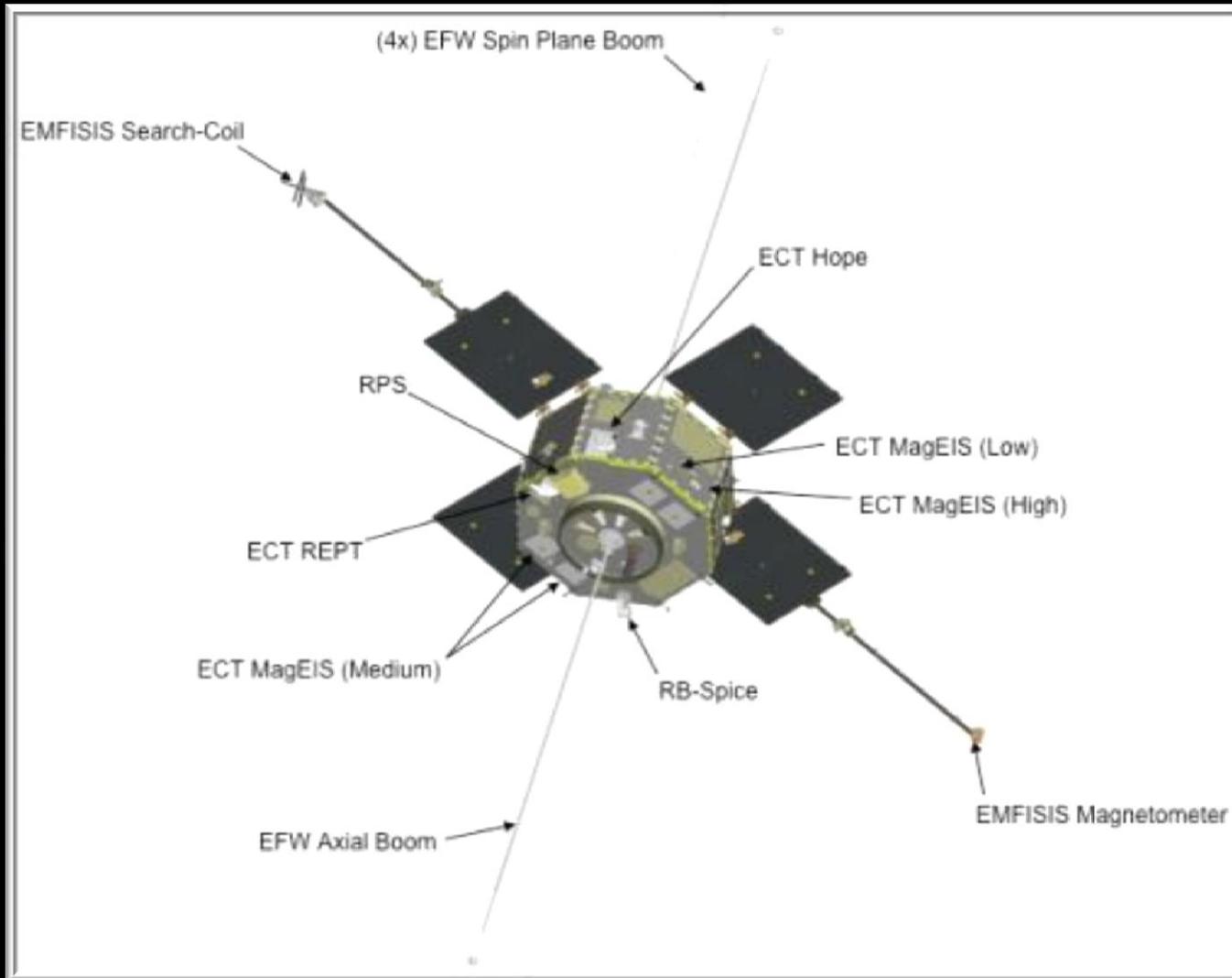
### 7) Filament Activation

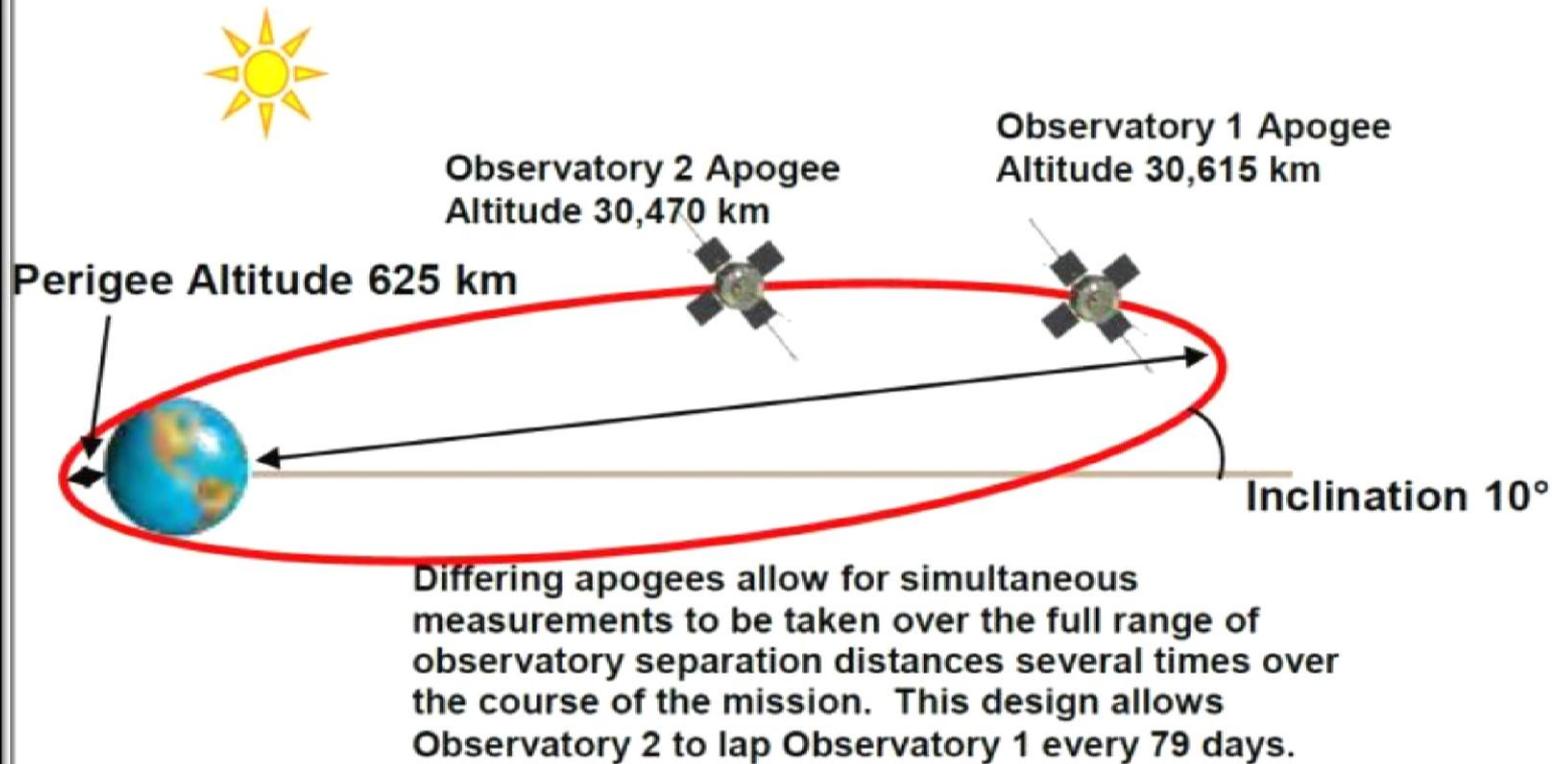
- ❖ 120 events : 10 days per 1 month, Event period : 5 hours
- ❖ Main wavelength: 304 A, multi wavelength : 211, 193(304), 171 A

- ❖ Eye capture ~ 0.1% of real activity
- ❖ Eye estimate : 0.5Gb/day

- What is RBSP

# RBSP Mission





- Spin stabilization (5 rpm)
  - spin axes pointing sun
- Orbit : 620 ~ 30,500 km
  - inclination: 10°
  - (THEMIS: 1.5 x 10 Re)

▪ **Period: 9h**

- Time scale comparable to the storm development

# RBSP payloads

Investigation	Instruments	PI
Energetic Particle Composition and Thermal Plasma Suite (ECT)	Helium Oxygen Proton Electron Spectrometer(HOPE) Magnetic Electron Ion Spectrometer (MagEIS) Relativistic Electron Proton Telescope (REPT)	H. Spence UNH
Electric and Magnetic Field Instrument Suite and Integrated Science (EMFISIS)	Low-Frequency Magnetometer (MAG) High-Frequency Magnetometer and Waveform Receiver(Waves)	C. Kletzing University of Iowa
Electric Field and Waves Instrument for the NASA RBSP Mission (EFW)	Electric Field and Waves Instrument for the NASA RBSP Mission(EFW)	J. Wygant University of Minnesota
Radiation Belt Storm Probes Ion Composition Experiment (RBSPICE)	Radiation Belt Storm Probes Ion Composition Experiment (RBSPICE)	L. Lanzerotti New Jersey Institute of Technology
Proton Spectrometer Belt Research (PSBR)	Relativistic Proton Spectrometer (RPS)	D. Byers NRO

# The broad objective of RBSP



- ❖ Which Physical Processes Produce Radiation Belt Enhancement Events?
- ❖ What Are the Dominant Mechanisms for Relativistic Electron Loss?
- ❖ How do Ring Current and other geomagnetic processes affect Radiation Belt Behavior?

# Application of RBSP data

## 📍 Satellite Operation

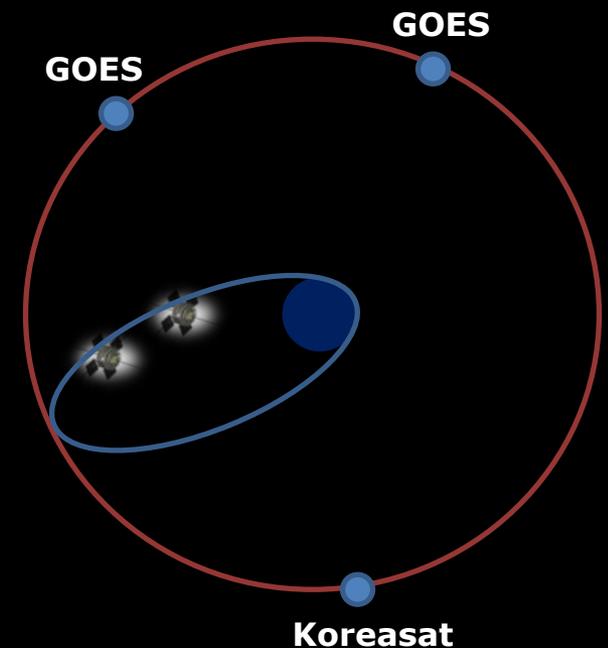
- ~100 keV electrons are source of spacecraft anomaly (*Choi et al. 2011*).
- NOAA-GOES satellite is not useful.

## 📍 Aviation

- Warning radiation risk

## 📍 Radio communication

- Monitoring ring current will provide information for ionosphere disturbance.





# **SDO & RBSP Data Center in KASI**



# Why should KASI construct KDC for SDO?

- ◉ **For solar and space weather research**
  - High cadence and high resolution data
  - Combine to FISS and HINODE
- ◉ **Very large data size**
  - It is not easy to successfully download large scientific data of SDO from NASA.
  - It is totally impossible through public network.
- ◉ **For space weather applications**
  - Real time or quasi real time SDO data



# Data Centers for SDO

 UCLan,  
United Kingdom

 SDO at SIDC  
ROB, Belgium

 IAS,  
France

 GDC for SDO  
DLR, Germany



**KDC for SDO**  
KASI , Korea 

**JSOC (AIA and HMI)**  
Stanford Univ. and  
LMSAL, USA



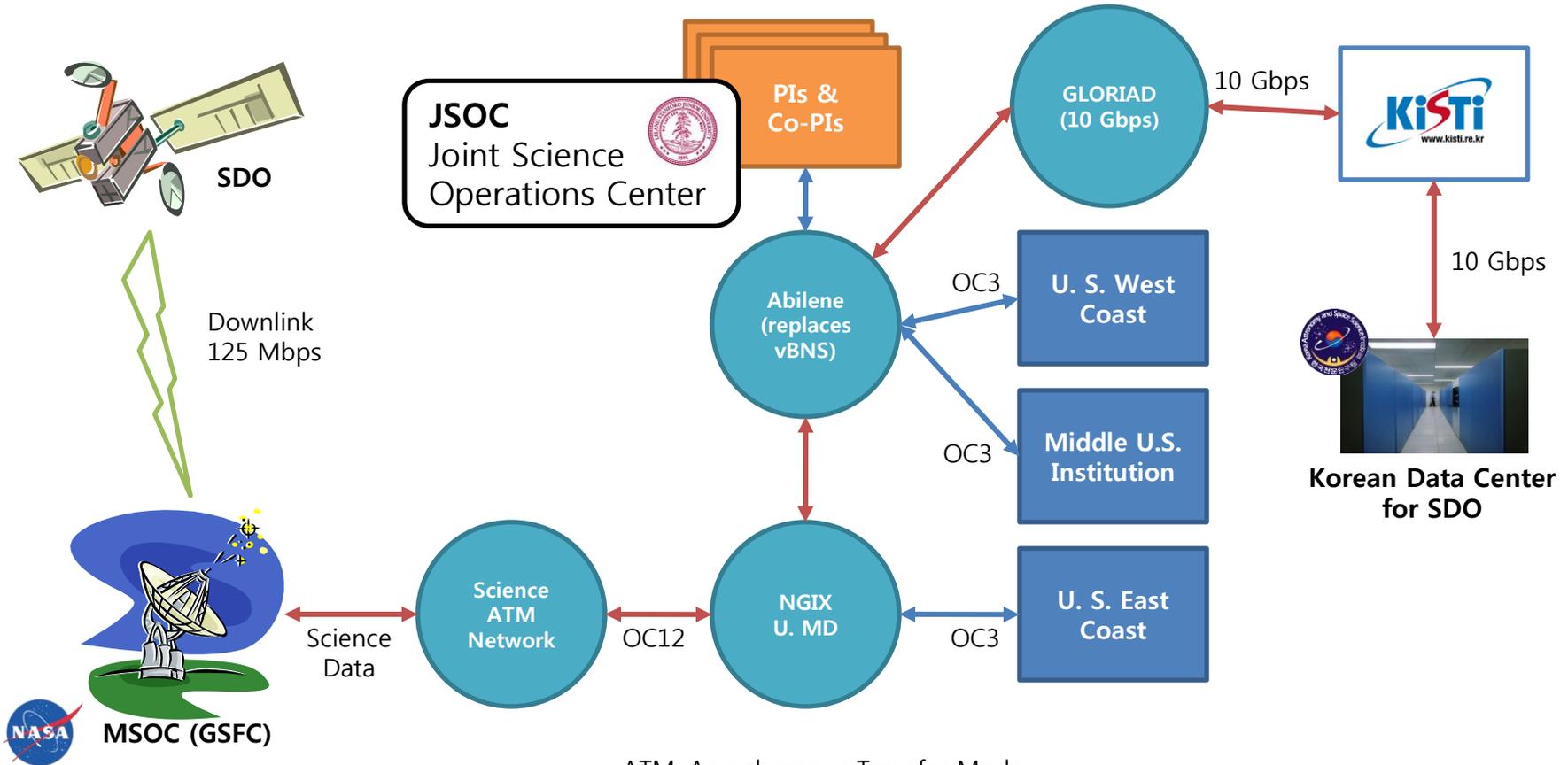
**EVE**  
Univ. of Colorado  
at Boulder, USA



DLR, Deutsches Zentrum für Luft- und Raumfahrt  
(German Aerospace Center)  
GDC, German Data Center  
IAS, Institut d'Astrophysique Spatiale  
JSOC, Joint Science Operations Center

KDC, Korean Data Center  
LMSAL, Lockheed Martin Solar and Astrophysics Lab  
ROB, Royal Observatory of Belgium  
SIDC, Solar Influences Data Center  
UCLan, University of Central Lancashire

# NASA-JSOC-KASI Network



ATM, Asynchronous Transfer Mode  
 GLORIAD (Global Ring Network for Advanced Application Development)  
 MSOC, Mission and Science Operations Center  
 NGIX, Next Generation Internet eXchange  
 OC, Optical Carrier (OC3: 155 Mbps, OC12: 622 Mbps)  
 U. MD, University of Maryland  
 vBNS, very-high-performance Backbone Network System



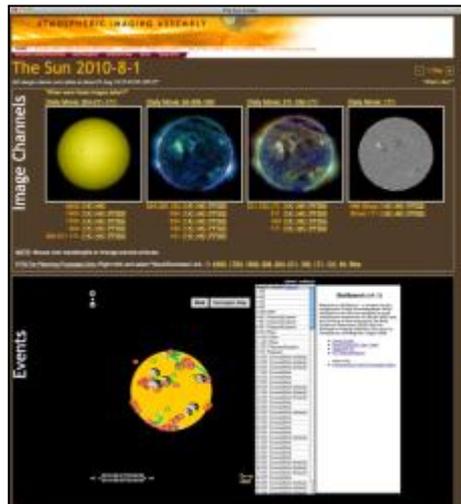
# SDO Data Browse



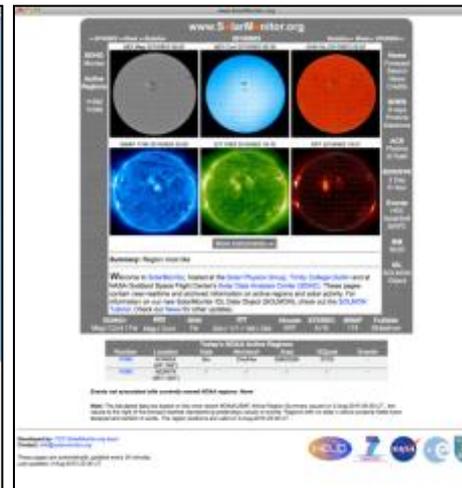
The Sun Now



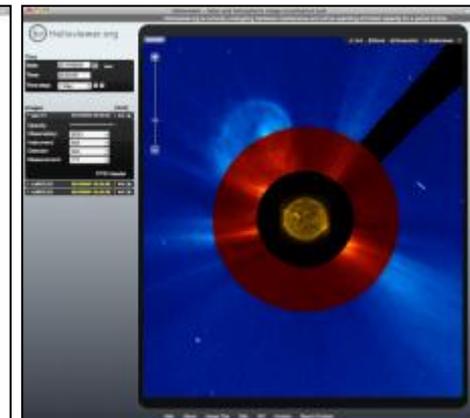
The Sun Today



Solar Monitor



Heliviewer



- The Sun Now : <http://sdo.gsfc.nasa.gov/data/>
- The Sun Today : <http://sdowww.lmsal.com/>
- Solar Monitor : <http://solarmonitor.org/>
- Heliviewer : <http://heliviewer.org/>
- JHeliviewer : <http://jheliviewer.org/>

JHeliviewer



# iSolSearch, LMSAL

- HEK (Heliophysics Events Knowledgebase)
- Daily summary of the solar state
- Events and features
- Multi-thermal images
- Links to detailed descriptions
- Firefox 3.0+, Safari 3.2+, Chrome

The screenshot displays the iSolSearch interface for the date 2010-5-4. The main heading is "ATMOSPHERIC IMAGING ASSEMBLY" and "The Sun 2010-5-4". A central yellow solar disk is annotated with various event markers. To the right, a search results table lists events with columns for time, event type, and location. Below the solar disk, a section titled "Image Channels" shows four panels of solar images in different wavelengths, each with associated numerical data.

Search results	15. Ekl. General News
6. AR 11063	A new sunspot group is the southern hemisphere is visible.
7. AR 11068	
8. AR 11067	
9. AR 11066	
9. AR 11065	
10. AIA Flare	
11. Fl. Filamentation	
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Image Channels

4500: [1024] 4096	604 336 180: [1024] 4096	211 180 171: [1024] 4096	HMI 03000: [1024] 4096
1800: [1024] 4096	604: [1024] 4096	211: [1024] 4096	03000: 171: [1024] 4096
1700: [1024] 4096	308: [1024] 4096	180: [1024] 4096	
304: [1024] 4096	180: [1024] 4096	171: [1024] 4096	
304 211 171: [1024] 4096	131: [1024] 4096		

# FESTIVAL



<http://www.ias.u-psud.fr/stereo/festival/>

- IDL-based browser
- Open source
- Dynamic composite images
- Solar Data : SECCHI/STEREO, EIT/SOHO, LASCO/SOHO, NRH, MkIV, TRACE, XRT
- Output : PS, JPEG, MPEG, AVI, etc

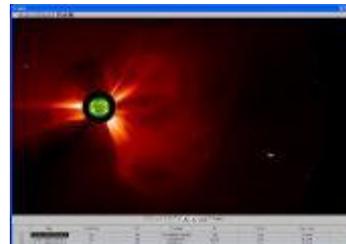
The upgrade version will support SDO .



Selecting data



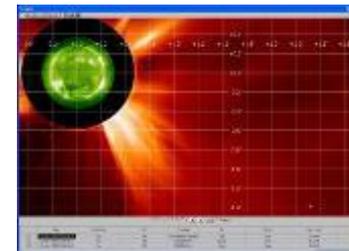
Combining solar data



Adjusting contrast



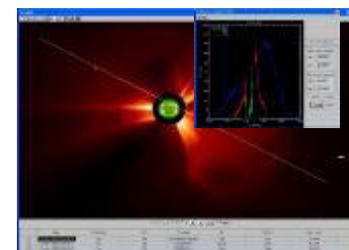
Zooming and panning



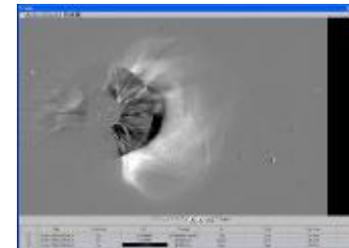
Adding grid of coordinates



Applying mask filters



Drawing a profile



Running difference

# How to Get AIA and HMI Data



## Lookdata Tool

JSOC Lookdata

JSOC Data Explore Info and Export

Requests Pending

1. Find list of datasets

2. Pick series to use

35 Series match this selection filter:

## Cutout Service

LMSAL > Programs > Heliosphysics Coverage Registry (HCR)

Cutout Request Form

Start Date: 2018-10-19

Start Time: 16:00

End Date: 2018-10-19

End Time: 17:00

Wavelength: AIA

Series: hmi\_cutout\_service

## Virtual Solar Observatory

Virtual Solar Observatory

Search for Solar Physics Data Products:

Search by time interval.

Search based on physical observables.

Search based on instrument or data archive.

Search based on instrument / source or provider dependent.

Search based on a spectral range.

Search based on common terms used to describe data products.

VSO Documentation

Documentation for Scientists, Programmers and Data Producers, including Changes, FAQs, and contact info.

Help us Improve VSO

VSO © Home | NSO | Stanford

- Lookdata Tool : <http://jsoc.stanford.edu/ajax/lookdata.html>
- Cutout Service : LMSAL
- VSO : <http://vso.nso.edu/>

# KASI SDO Website( sdo.kasi.re.kr )



Home Introduction Data Gallery

KDC for SDO

The Sun Now  
Browse Data  
Other resauce

Korean Data Center for Solar Dynamics Observatory

KASI and NASA signed LOA (a letter of agreement) in order to cooperate space science research. According to [more](#)

## KDC for SDO

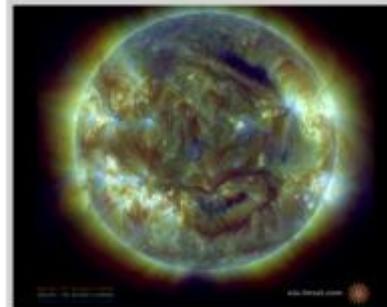
After arrival, the spacecraft spent several months using a technique called aerobraking, which involved dipping into the Martian atmosphere to adjust its orbit. In February 2002, science operations began.

## Data

- Discovery sessions during the SVA encompassed multiple teams at Redbox.
- 4096 PFSS 2048 PFSS 1024 PFSS 512 PFSS 48 hr MPEG
- Commercial Spaceflight - 60 Day Report, June 29, 2011
- EUVI / AIA 195 Stonyhurst Heliographic
- Commercial Market Assessment (CMA) for Crew and Cargo Systems, April 2011 (742K PDF)

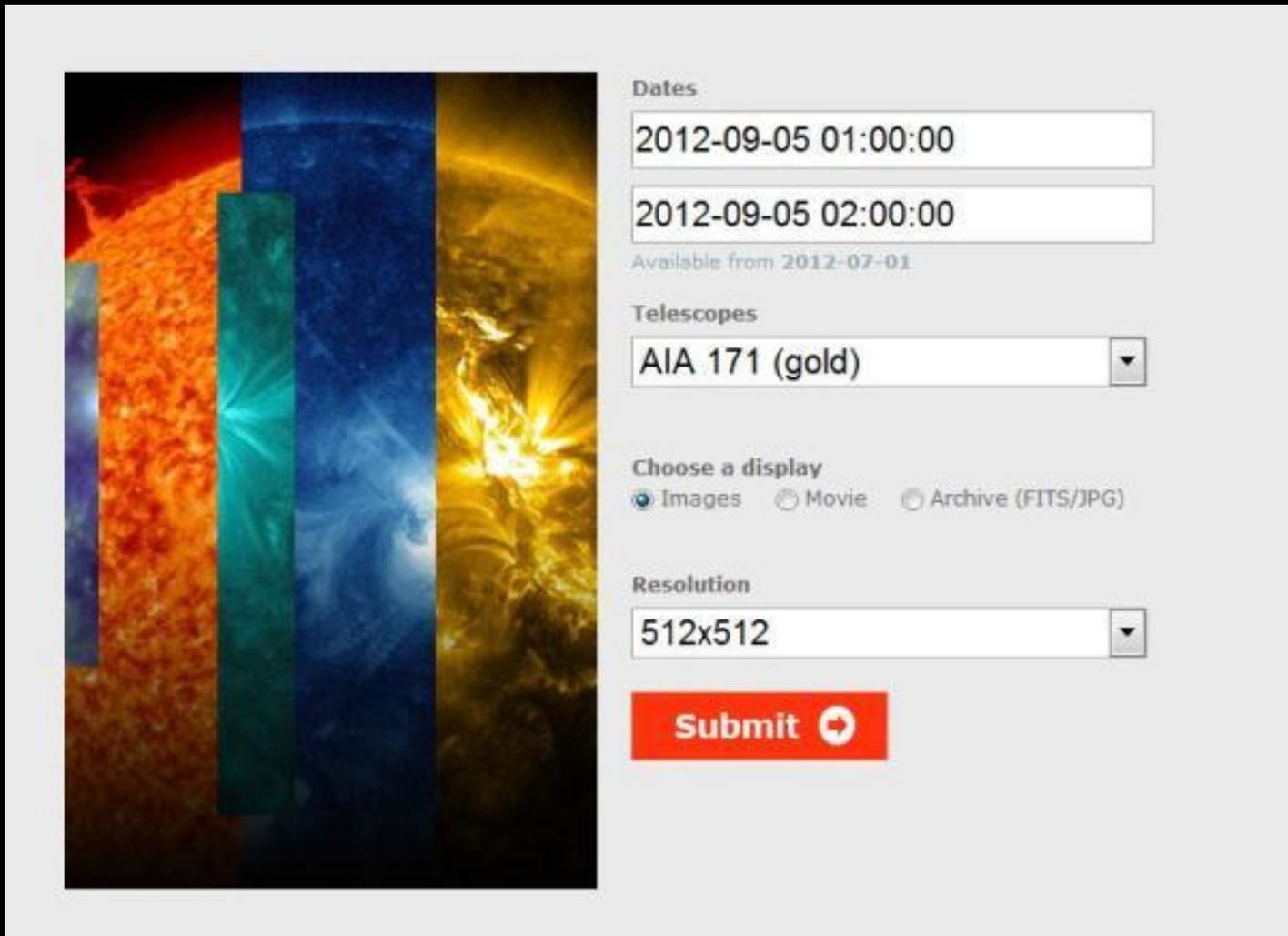
[Browse Data](#)

## The Sun Now



Courtesy of NASA/SDO and the AIA, EVE, and HMI science teams. Korean Data Center for SDO, Korea astronomy & space science institute, 776 Daedeokdae-ro, Yuseong-gu, Daejeon, 305-348, Rep. of Korea

# KASI SDO Website( sdo.kasi.re.kr )



The screenshot displays the KASI SDO website interface. On the left, there is a vertical strip of four solar images in different colors: red, blue, green, and yellow. To the right of the images are several search and filter options:

- Dates:** Two input fields showing the date and time: "2012-09-05 01:00:00" and "2012-09-05 02:00:00". Below these is the text "Available from 2012-07-01".
- Telescopes:** A dropdown menu currently set to "AIA 171 (gold)".
- Choose a display:** Three radio buttons: "Images" (selected), "Movie", and "Archive (FITS/JPG)".
- Resolution:** A dropdown menu currently set to "512x512".
- Submit:** A red button with the text "Submit" and a circular arrow icon.

# KASI SDO Website



1. Based on NASA SDO + LMSAL web-design
2. Provide same type of Lookdata Tool in Stanford
3. Provide solar viewer S/W like Jhelioviewer
4. Large amount library
5. Connect to VSO
6. Open : Jan. 1<sup>st</sup> 2013    <http://sdo.kasi.re.kr>

# Research power of KASI

- # of group members : 26
- 71 SCI papers by 7 scientist during last 3 yrs. from 2009 to 2011
- Solar physics (30), Space science(41)
- Strong part : CME, solar flare, ionosphere.
- Weak point : space weather model,  
MHD simulation in solar physics.

- **Scientific Joint Group** by using SDO and RBSP data
- **WE ARE WELCOME TO CO-WORK PARTNER IN ANYTIME**
- <http://sos.kasi.re.kr/>



**THANK YOU**

# RBSP First Science Endeavors

- ❖ What issues can be resolved about strong and weak whistler mode interactions and their roles in electron energization and loss in the first 3 months?
- ❖ What issues can be resolved about the large scale dynamics and structure with just the first few major geomagnetic storms?
- ❖ What issues can be resolved about the source, structure, and dynamics of the inner ( $L < 2$ ) ion and electron belts in the first 3 months?

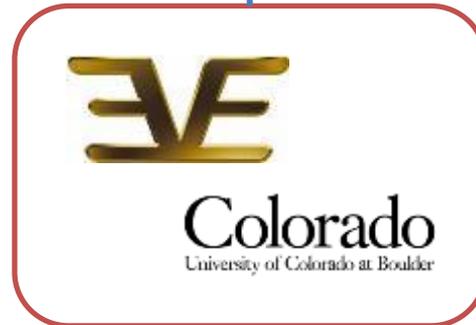
# SDO, Solar Dynamics Observatory



Launched on 11 February 2010



**Helioseismic and  
Magnetic Imager**



**EUV Variability  
Experiment**



**Atmospheric Imaging  
Assembly**

# SDO Data Size



Instruments	Mbps	MB/day
HMI	25	270,000
AIA	50	540,000
EVE SIM	1	10,800
Coronagraph	1	10,800
UV/EUV Spectrometer	30	324,000
Photometric Mapper	5	54,000
Vector Magnetograph	5	54,000
<b>Total</b>	<b>117</b>	<b>1,263,600</b>



※ Source : SDO Science Definition Team Report, 43 page

- One Day : 1.2 TB/day
- One Year : 438 TB/year
- Five Years : 2.1 PB

# Data Products from AIA



- Data at **Level 0** are images that have been constructed from **the raw telemetry stream**.
- Data at **Level 1.0** are images that have been converted from Level 0, with processing including **bad-pixel removal, despiking and flat-fielding**. All higher-level products for AIA are based on Level 1.0 data.
- Data at **Level 1.5** are images that have been adjusted to **a common 0.6'' plate scale, and that share common centers and rotation angles**, but are not exposure-time corrected

# Data Products from HMI



- Data at **Level 0** are images that have been constructed from **the raw telemetry stream**.
- Data at **Level 1.0** are images that have been converted from Level 0, with processing including **bad-pixel removal, flat-fielding, and quality assessment checks**, but otherwise not having undergone any irreversible data alterations.
- Data at **Level 1.5** are images of the **physical observables (Dopplergrams, magnetograms, and continuum images)**, which were constructed from the individual Level 1.0 filtergrams.
- Data at **Level 2** have been **irrevocably filtered, time-sequence-merged, Fourier-transformed or otherwise changed** from Level 1.5 data in a way that is irreversible. Level 2 products include intermediate products for later production of mission science data products, such as helioseismic inferences of solar subsurface flows.

# Korea-Japan Network



- Korean Network (KOREN, 10 Gbps)
- Japanese Network (JGN2plus, 10 Gbps)
- International Network

- APII : Asia Pacific Information Infrastructure
- GLORIAD : Global Ring Network for Advanced Application Development

