

DONKI
Database of Notifications, Knowledge, and Information

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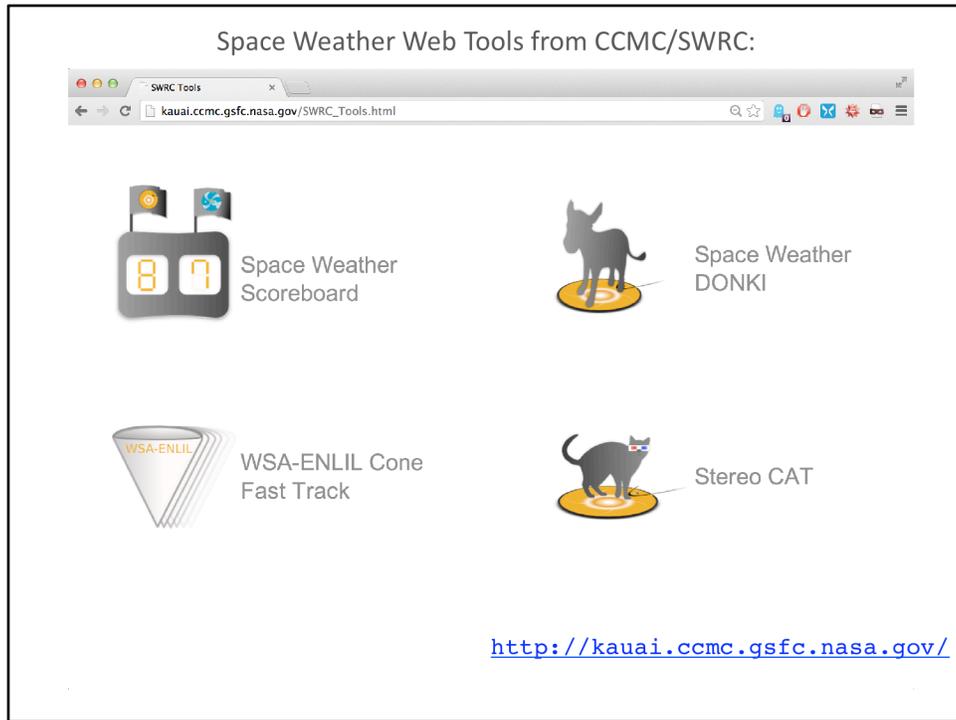
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Feedback and suggestions are welcome!

<http://kauai.ccmc.gsfc.nasa.gov/DONKI>

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This presentation about DONKI: it is a space weather database of notifications, knowledge and information developed by the CCMC/SWRC.



This is a screenshot of the kauai CCMC webpage, which shows some of the space weather web tools available from the CCMC/SWRC.

Space Weather Web Tools from CCMC/SWRC:

The screenshot shows a web browser window with the title "Space Weather Tools" and the URL "kauai.ccmc.gsfc.nasa.gov/SWRC_Tools.html". Below the browser window, four tools are displayed in a 2x2 grid:

- Space Weather Scoreboard:** Represented by an icon of a scoreboard with two digital displays.
- Space Weather DONKI:** Represented by an icon of a donkey standing on a yellow circular base. This tool is circled in green.
- WSA-ENLIL Cone Fast Track:** Represented by an icon of a white cone with "WSA-ENLIL" written on it.
- Stereo CAT:** Represented by an icon of a black cat standing on a yellow circular base.

<http://kauai.ccmc.gsfc.nasa.gov/>

Today we are going to look at the Space Weather DONKI.

Before DONKI

- Blogs for Daily space weather activity
 - Difficult to Search
 - Difficult to describe a chain of events
 - Difficult to disseminate
 - What we want to get away from: <http://screencast.com/t/750Ci2aKM>
- Static email lists for notifications
 - Manually generated following templates
 - Tedious and Error-prone

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Before the DONKI system the SWRC was using blog software to keep daily logs of space weather activity. It was difficult to search, difficult to describe space weather event chains. There was also static templates which were manually edited and mailing lists for notifications which could lead to errors.



DONKI
 Database of Notifications, Knowledge, and Information

- Catalog of space weather phenomena.
- Chronicles the daily interpretations of space weather observations, simulation results, forecasting analysis, and notifications.
- Key component of the forecaster tool suite, developed to address space weather needs of NASA missions.
- Online tool for dissemination of forecasts, notifications, and archiving event-focused information (automatic dissemination coming soon)
- Intelligent linkages, relationships, cause-and-effects between space weather activities
- Comprehensive search functionality to support **anomaly resolution** and **space science research**:
 - Space weather activity archive (flares, CME parameters and simulation results, SEPs, geomagnetic storms, radiation belt enhancements) with links between activities
 - GSFC space weather notification and weekly report archive
- Enables remote participation by students, world-wide partners, model and forecasting technique developers

Demo: <http://kauai.ccmc.gsfc.nasa.gov/DONKI>

At its foundation DONKI is basically catalog of space weather phenomena.

The system allows us to chronicles the daily interpretations of space weather observations, simulation results, forecasting analysis, and notifications, made by forecasters at the SWRC.

DONKI is a key component of the forecaster tool suite, developed to address space weather needs of NASA missions.

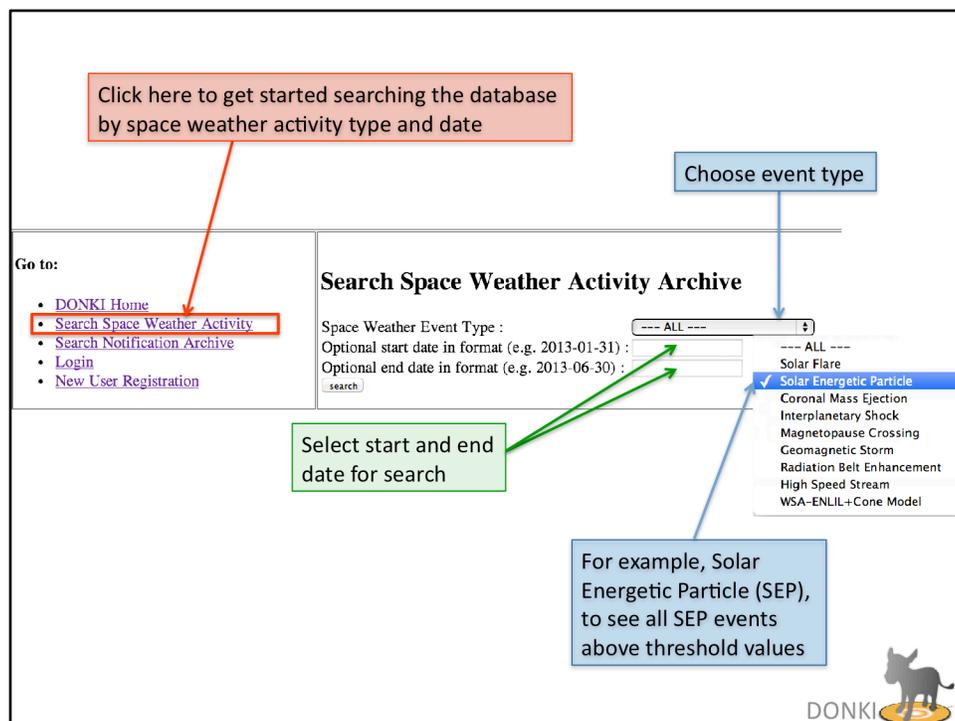
It is an online tool for dissemination of forecasts, notifications for NASA missions (automatic dissemination, with different thresholds is coming soon).

It also serves to archive event-focused information along with intelligent linkages, relationships, cause-and-effects between space weather activities, for example SEPs associated with CMEs and flares.

DONKI is a comprehensive search functionality to support **anomaly resolution** and **space science research**:

- It serves as a space weather activity archive (flares, CME parameters and simulation results, SEPs, geomagnetic storms, radiation belt enhancements) with links between activities
- Also as a GSFC space weather alert and weekly report archive

DONKI also enables remote participation by students, world-wide partners, model and forecasting technique developers



Here is a screenshot of DONKI to show what you would see if you clicked “search space weather activity” in the sidebar.

This gives you a search form that allows you to search by event type and date. If you leave the end date blank, the current date is assumed. Leaving both the start and end date blank will search all events in the database (2010-present).

Solar flares are listed for M5 and above using GOES X-ray data.

Solar energetic particle events are listed for GOES: when the > 10 MeV proton flux exceeds 10 pfu, or >100 MeV proton flux exceeds 1pfu; SOHO COSTEP: when the one or more of the > 15.8 MeV protons channels exceeds $10^{(-1)}$ pfu/MeV; or STEREO 13-100 MeV protons exceeds $10^{(-1)}$ pfu/MeV .

CMEs are generally above 500 km/s and the parameters shown are determined using real-time beacon data and the StereoCAT tool.

Magnetopause crossings are determined from the magnetopause location from the SWMF model using ACE input data.

Geomagnetic storms are listed for Kp 6 and above storms, using the NOAA real time Kp index.

Radiation belt enhancements listed for when the GOES > 0.8 MeV integral electron flux is above 10^5 pfu, typically during high speed streams

High speed streams are listed generally for changes in solar wind velocity of > 100 km/s which show stream interaction region signatures in-situ.

WSA-ENLIL+Cone model results(and input parameters) are shown for all CMEs modeled by the SWRC.

Search Space Weather Activity Archive

Space Weather Event Type :

Optional start date in format (e.g. 2013-01-31) :

Optional end date in format (e.g. 2013-06-30) :

Event Type	Activity ID	SEP Event Time	Associated Instrument
Solar Energetic Particle	2013-05-13T04:12:00-SEP-001	2013-05-13T04:12Z	STEREO B: IMPACT 13-100 MeV
Solar Energetic Particle	2013-05-13T18:02:00-SEP-001	2013-05-13T18:02Z	STEREO B: IMPACT 13-100 MeV
Solar Energetic Particle	2013-05-15T13:25:00-SEP-001	2013-05-15T13:25Z	GOES13: SEM/EPS >10 MeV
Solar Energetic Particle	2013-05-22T15:05:00-SEP-001	2013-05-22T15:05Z	GOES13: SEM/EPS >10 MeV
Solar Energetic Particle	2013-05-22T15:05:00-SEP-002	2013-05-22T15:05Z	GOES13: SEM/EPS >100 MeV
Solar Energetic Particle	2013-05-22T15:30:00-SEP-001	2013-05-22T15:30Z	SOHO: COSTEP 15.8-39.8 MeV

For example, Solar Energetic Particle (SEP), lists all SEP events above threshold values at various locations.

All columns are sortable!
(click column headings)



Here is a screenshot of some search results when looking for SEP events during the month of May in 2013. The left column, event type, can be clicked for more information about each SEP event. The activity ID and SEP Event Time in UT (columns 2 and 3) corresponds to the time the threshold was crossed for each instrument, show in the last column.

All columns are sortable by clicking column headings.

Go to:

- [DONKI Home](#)
- [Search Space Weather Activity](#)
- [Search Notification Archive](#)
- [Login](#)
- [New User Registration](#)

Search Space Weather Activity Archive

Space Weather Event Type :

Optional start date in format (e.g. 2013-01-31) :

Optional end date in format (e.g. 2013-06-30) :

- ALL ---
- Solar Flare
- Solar Energetic Particle
- Coronal Mass Ejection
- Interplanetary Shock
- Magnetopause Crossing
- Geomagnetic Storm
- Radiation Belt Enhancement
- High Speed Stream
- ✓ WSA-ENLIL+Cone Model

For another example, select "WSA-ENLIL+Cone Model" to see all CME simulations in a certain date range.

DONKI

Here is another screenshot of the search page, this time let's search for WSA-ENLIL +Cone simulation results.

Search Space Weather Activity Archive

Space Weather Event Type :

Optional start date in format (e.g. 2013-01-31) :

Optional end date in format (e.g. 2013-06-30) :

[Generate Report for WSA-ENLIL+Cone Inputs](#)

Selecting "WSA-ENLIL +Cone Model" lists all CME simulations in a certain date range.

All columns are sortable! (click column headings)

Model Name	Model Completion Time	CME Input(s)	Predicted Earth Impact	Predicted Other Location(s) Impact
WSA-ENLIL+Cone	2013-05-03T09:33Z	<ul style="list-style-type: none"> CME: 2013-05-02T14:36:00-CME-001(CME Analysis) 	No or little impact to Earth.	
WSA-ENLIL+Cone	2013-05-03T18:07Z	<ul style="list-style-type: none"> CME: 2013-05-03T18:00:00-CME-001(CME Analysis) 	No or little impact to Earth.	Spitzer: 2013-05-06T14:32Z
WSA-ENLIL+Cone	2013-05-04T12:48Z	<ul style="list-style-type: none"> CME: 2013-05-03T18:00:00-CME-001(CME Analysis) CME: 2013-05-03T22:36:00-CME-001(CME Analysis) 	No or little impact to Earth.	Spitzer: 2013-05-06T06:39Z STEREO B: 2013-05-06T16:39Z
WSA-ENLIL+Cone	2013-05-04T13:52Z	<ul style="list-style-type: none"> CME: 2013-05-03T18:00:00-CME-001(CME Analysis) CME: 2013-05-03T22:36:00-CME-001(CME Analysis) 	No or little impact to Earth.	Spitzer: 2013-05-06T15:31Z
WSA-ENLIL+Cone	2013-05-05T11:58Z	<ul style="list-style-type: none"> CME: 2011-05-24T11:24:00-CME-001(CME Analysis) 	Earth Shock Arrival Time = 2011-06-01T02:38Z Duration of disturbance (hr) = Minimum magnetopause standoff distance: Rmin(Re) = 6.6 Possible Kp index: (kp)90=1 (kp)135= (kp)180=5	

Here is a screenshot of some search results when looking for WSA-ENLIL+Cone model results during the month of May in 2013. More details about each simulation (including input parameters, impact times, simulation animations, and timelines) can be found by clicking the model name column link. The second column shows the time the simulation completed (UT). The third column lists the CMEs in the simulation. You can click the CME for information about it. The last two columns show the predicted Earth impact, other locations impact times, if any.

All columns are sortable by clicking column headings.

Search Space Weather Activity Archive

Space Weather Event Type :

Optional start date in format (e.g. 2013-01-31) :

Optional end date in format (e.g. 2013-06-30) :

[Generate Report for WSA-ENLIL+Cone Inputs](#)

Shows impact prediction summary for each simulation

Model Name	Model Completion Time	CME Input(s)	Predicted Earth Impact	Predicted Other Location(s) Impact
WSA-ENLIL+Cone	2013-05-03T09:33Z	<ul style="list-style-type: none"> CME: 2013-05-02T14:36:00-CME-001(CME Analysis) 	No or little impact to Earth.	
WSA-ENLIL+Cone	2013-05-03T18:07Z	<ul style="list-style-type: none"> CME: 2013-05-03T18:00:00-CME-001(CME Analysis) 	No or little impact to Earth.	Spitzer: 2013-05-06T14:32Z
WSA-ENLIL+Cone	2013-05-04T12:48Z	<ul style="list-style-type: none"> CME: 2013-05-03T18:00:00-CME-001(CME Analysis) CME: 2013-05-03T22:36:00-CME-001(CME Analysis) 	No or little impact to Earth.	Spitzer: 2013-05-06T06:39Z STEREO B: 2013-05-06T16:39Z
WSA-ENLIL+Cone	2013-05-03T13:52Z	<ul style="list-style-type: none"> CME: 2013-05-03T18:00:00-CME-001(CME Analysis) CME: 2013-05-03T22:36:00-CME-001(CME Analysis) 	No or little impact to Earth.	Spitzer: 2013-05-06T15:31Z
WSA-ENLIL+Cone	2013-05-05T11:58Z	<ul style="list-style-type: none"> CME: 2011-05-24T11:24:00-CME-001(CME Analysis) 	Earth Shock Arrival Time = 2011-06-01T02:38Z Duration of disturbance (hr) = Minimum magnetopause standoff distance: Rmin(Re) = 6.6 Possible Kp index: (kp)90=1 (kp)135= (kp)180=5	

The third column lists the CMEs in the simulation. You can click the CME for information about it. The last two columns show the predicted Earth impact, other locations impact times, if any.

Search Space Weather Activity Archive

Space Weather Event Type :

Optional start date in format (e.g. 2013-01-31) :

Optional end date in format (e.g. 2013-06-30) :

[Generate Report for WSA-ENLIL+Cone Inputs](#)

Click here to get full simulation results and graphics for a given run.

Model Name	Model Completion Time	CME Input(s)	Predicted Earth Impact	Predicted Other Location(s) Impact
WSA-ENLIL+Cone	2013-05-03T09:33Z	<ul style="list-style-type: none"> CME: 2013-05-02T14:56:00-CME-001(CME Analysis) 	No or little impact to Earth.	
WSA-ENLIL+Cone	2013-05-03T18:07Z	<ul style="list-style-type: none"> CME: 2013-05-03T18:00:00-CME-001(CME Analysis) 	No or little impact to Earth.	Spitzer: 2013-05-06T14:32Z
WSA-ENLIL+Cone	2013-05-04T12:48Z	<ul style="list-style-type: none"> CME: 2013-05-03T18:00:00-CME-001(CME Analysis) CME: 2013-05-03T22:36:00-CME-001(CME Analysis) 	No or little impact to Earth.	Spitzer: 2013-05-06T06:39Z STEREO B: 2013-05-06T16:39Z
WSA-ENLIL+Cone	2013-05-04T13:52Z	<ul style="list-style-type: none"> CME: 2013-05-03T18:00:00-CME-001(CME Analysis) CME: 2013-05-03T22:36:00-CME-001(CME Analysis) 	No or little impact to Earth.	Spitzer: 2013-05-06T15:31Z
WSA-ENLIL+Cone	2013-05-05T11:58Z	<ul style="list-style-type: none"> CME: 2011-05-24T11:24:00-CME-001(CME Analysis) 	Earth Shock Arrival Time = 2011-06-01T02:38Z Duration of disturbance (hr) = Minimum magnetopause standoff distance: Rmin(Re) = 6.6 Possible Kp index: (kp)90=1 (kp)135= (kp)180=5	 DONKI

More details about each simulation (including input parameters, impact times, simulation animations, and timelines) can be found by clicking the model name column link.

Full simulation results for the selected run:

CME input parameters are listed for each activity ID (click ID for more CME information)

WSA-ENLIL+Cone Model with Completion Time: 2013-05-04T12:48Z

Model Inputs:
[2013-05-03T18:00:00-CME-001](#) with [CME Analysis](#): Lon.= -89.0, Lat.=18.0, Speed=760.0, HalfAngle=60.0, Time21.5=2013-05-03T22:30Z
[2013-05-03T22:36:00-CME-001](#) with [CME Analysis](#): Lon.= -86.0, Lat.= -18.0, Speed=520.0, HalfAngle=22.0, Time21.5=2013-05-04T05:37Z

Model Outputs:

Earth Impact:
No or little impact to Earth.

Other Location(s) Impact:
 Spitzer with estimated shock arrival time 2013-05-06T06:39Z
 STEREO B with estimated shock arrival time 2013-05-06T16:39Z

Impact prediction times

Inner Planets Link = http://iswa.gsfc.nasa.gov/downloads/20130503_223000_anim.tim-den.gif
 Inner Planets Link = http://iswa.gsfc.nasa.gov/downloads/20130503_223000_anim.tim-vel.gif
 Inner Planets Link = http://iswa.gsfc.nasa.gov/downloads/20130503_223000_anim.tim-den-Stereo_A.gif
 Inner Planets Link = http://iswa.gsfc.nasa.gov/downloads/20130503_223000_anim.tim-den-Stereo_B.gif
 Inner Planets Link = http://iswa.gsfc.nasa.gov/downloads/20130503_223000_anim.tim-vel-Stereo_A.gif
 Inner Planets Link = http://iswa.gsfc.nasa.gov/downloads/20130503_223000_anim.tim-vel-Stereo_B.gif
 Timelines Link = http://iswa.gsfc.nasa.gov/downloads/20130503_223000_ENLIL_CONE_timeline.gif
 Timelines Link = http://iswa.gsfc.nasa.gov/downloads/20130503_223000_ENLIL_CONE_Kp_timeline.gif

Links to simulation movies and plots



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Here is an example of what you would see after clicking the model name column link. At the top you see the CMEs, and their input parameters for each CME in the simulation. You can click on the CME activity ID (the CME start time) to see more information about the CME (for example other measurements, comments). At the model you see the model outputs. The impact times are shown if there was a detected impact at Earth or other locations. The simulation animations are linked at the bottom along with timeline plots.

DONKI also shows intelligent linkages, relationships, cause-and-effects between space weather activities

Search Space Weather Activity Archive

Space Weather Activity Type :

Optional start date in format (e.g. 2013-01-31) :

Optional end date in format (e.g. 2013-06-30) :

For example, search for solar flares during May 2013, and click here for more information on the M5.0 flare

Event Type	Activity ID	FLR Start Time	Associated Instrument	FLR Peak Time	FLR End Time	Class	Source Location
Solar Flare	2013-05-03T17:29:00-FLR-001	2013-05-03T17:29Z	GOES15: SEM/XRS 1.0-8.0	2013-05-03T17:32Z		M5.7	N15E85
Solar Flare	2013-05-13T01:53:00-FLR-001	2013-05-13T01:53Z	GOES15: SEM/XRS 1.0-8.0	2013-05-13T02:17Z		X1.6	N10E89
Solar Flare	2013-05-13T15:40:00-FLR-001	2013-05-13T15:40Z	GOES15: SEM/XRS 1.0-8.0	2013-05-13T16:05Z		X2.8	N10E89
Solar Flare	2013-05-14T01:00:00-FLR-001	2013-05-14T01:00Z	GOES15: SEM/XRS 1.0-8.0	2013-05-14T01:11Z		X3.2	N10E89
Solar Flare	2013-05-15T01:10:00-FLR-001	2013-05-15T01:10Z	GOES15: SEM/XRS 1.0-8.0	2013-05-15T01:48Z		X1.2	N11E63
Solar Flare	2013-05-22T12:30:00-FLR-001	2013-05-22T12:30Z	GOES15: SEM/XRS 1.0-8.0	2013-05-22T13:38Z		M5.0	N13W75



Here is a screenshot of search results for flares detected by GOES which are M5 and above during the month of May 2013. If you are interested in the M5.0 flare, you can click on the “solar flare” link in the first column.

More details and relationships for the M5.0 flare:

Solar Flare
 Start Time: 2013-05-22T12:30Z (GOES15: SEM/XRS 1.0-8.0)
 Peak Time: 2013-05-22T13:38Z
 End Time:
 Intensity: M5.0 class
 Source region N13W75
 Activity ID: 2013-05-22T12:30:00-FLR-001 (version 2)
 Note:
 Submitted on 2014-02-03T19:49Z by Leila Mays

A Notification with ID [20130522-AL-001](#) was sent on 2013-05-22T15:30Z

All directly linked activities:

2013-05-22T13:24:00-CME-001
2013-05-22T15:05:00-SEP-001
GOES13: SEM/EPS >10 MeV
2013-05-22T15:05:00-SEP-002
GOES13: SEM/EPS >100 MeV
2013-05-22T15:30:00-SEP-001
SOHO: COSTEP 15.8-39.8 MeV

Click the notification ID to see a copy of the flare notification.

Related events are listed at the bottom. This flare was associated with a CME and also an SEP event near Earth

Click on the activity IDs for information on the CME or SEPs.



This will lead you to more information about the flare, including the start, peak, and end time, source location and associated active region if any. If a notification was sent for this flare, you can click on the message ID to get to the full text of the flare notification.

At the bottom you will see “all directly linked events,” if the forecaster has determined that this flare was related to any other space weather activities, it will appear here. You can click on any of the activity IDs to get more information on any of the directly linked events.

The screenshot shows the 'Search Space Weather Notification Archive' page. On the left, a 'Go to:' menu lists links: DONKI Home, Search Space Weather Activity, Search Notification Archive (highlighted with a red box), Login, and New User Registration. The main search area includes a dropdown for 'Notification for Space Weather Event Type' (set to '--- ALL ---'), two optional date input fields for start and end dates, and a search button. A dropdown menu is open, showing event types: Solar Flare, Solar Energetic Particle, Coronal Mass Ejection, Interplanetary Shock, Magnetopause Crossing, Geomagnetic Storm, Radiation Belt Enhancement, and SW Report. The '--- ALL ---' option is selected. The DONKI logo, featuring a donkey, is in the bottom right corner.

Alternatively, search the notification database by space weather activity type and date

Choose event type, or weekly report

Go to:

- [DONKI Home](#)
- [Search Space Weather Activity](#)
- [Search Notification Archive](#)
- [Login](#)
- [New User Registration](#)

Search Space Weather Notification Archive

Notification for Space Weather Event Type :

(Optional) Search start date from (e.g. 2013-01-31) :

(Optional) Search end date to (e.g. 2013-06-30) :

Select start and end date for search

- ALL ---
- Solar Flare
- Solar Energetic Particle
- Coronal Mass Ejection
- Interplanetary Shock
- Magnetopause Crossing
- Geomagnetic Storm
- Radiation Belt Enhancement
- SW Report

For example, select ALL to list all notification types and weekly reports.

DONKI 

Alternatively, search the notification database by space weather activity type and date. Select start and end date for search

For example, select ALL to list all notification types and weekly reports.

Search Space Weather Notification Archive

Notification for Space Weather Event Type :

(Optional) Search start date from (e.g. 2013-01-31) :

(Optional) Search end date to (e.g. 2013-06-30) :

Message ID	Sent Date	For SW Event(s)	Sent By
20130514-AL-003	2013-05-14T04:55Z	CMEAnalysis CME	Dan Comberiate
20130514-AL-002	2013-05-14T03:50Z	CMEAnalysis CME	Dan Comberiate
20130514-AL-001	2013-05-14T01:45Z	FLR	Dan Comberiate
20130513-AL-008	2013-05-13T19:15Z	CMEAnalysis CME	Dan Comberiate
20130513-AL-007	2013-05-13T18:35Z	SEP	Dan Comberiate
20130513-AL-006	2013-05-13T18:20Z	CMEAnalysis CME	Dan Comberiate
20130513-AL-005	2013-05-13T16:25Z	FLR	Dan Comberiate
20130513-AL-004	2013-05-13T06:00Z	CMEAnalysis CME	Dan Comberiate
20130513-AL-003	2013-05-13T05:20Z	CMEAnalysis CME	Dan Comberiate
20130513-AL-002	2013-05-13T04:55Z	SEP	Dan Comberiate
20130513-AL-001	2013-05-13T02:52Z	FLR	Dan Comberiate
20130508-7D-001	2013-05-08T16:06Z	Report	chiu wiegand
20130503-AL-001	2013-05-03T18:20Z	FLR	Dan Comberiate
20130501-7D-001	2013-05-01T22:15Z	Report	chiu wiegand

Selecting ALL lists all notification types and weekly reports in a certain date range.

Click on the message ID to see a copy the notification.

All columns are sortable!
(click column headings)



Here is a screenshot of an example of search results of all notification types for the first two weeks of May 2013. You can click on the message ID to see a full text copy of the notification. You can also click on the event type in the third column to go directly to the page for that space weather activity.



<http://kauai.ccmc.gsfc.nasa.gov/DONKI/>

*Example: [2013-05-22 M7.3 flare](#) and related activity,
[2012-03-07 X5.4 flare](#).*

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DONKI - Caveats

- Data entry for past events (using logs and alert archives) was performed by students:
 - Could be errors, mostly due to typos, or duplicate entries
 - We are adding data quality flags to indicate whether entries have been “checked”
 - Entries from Aug 2013 onwards is mostly verified.
- Search filters combinations will be added in the near future
- More data export options coming (suggestions?)

- CME measurements are made in real-time, with limited data.

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There are some caveats to consider when using DONKI

- Data entry for past events (using logs and alert archives) was performed by students:
 - Could be errors, mostly due to typos, or duplicate entries
 - We are adding data quality flags to indicate whether entries have been “checked”
 - Entries from Aug 2013 onwards is mostly verified.
- Older ENLIL simulations from 2010- May 2011 have not yet been entered (different format), coming soon.
- Search filters combinations will be added in the near future
- More data export options coming (suggestions?)

- CME measurements are made in real-time, with limited data.

The screenshot shows the DONKI web application interface. On the left is a sidebar with a 'Stream' section containing various options like 'Add Event Chain', 'Add Flare', 'Add CME', etc. The main content area displays a list of event chains, each with a timeline visualization and associated data fields. A donkey logo is positioned in the top right corner of the interface.

DONKI Future Directions

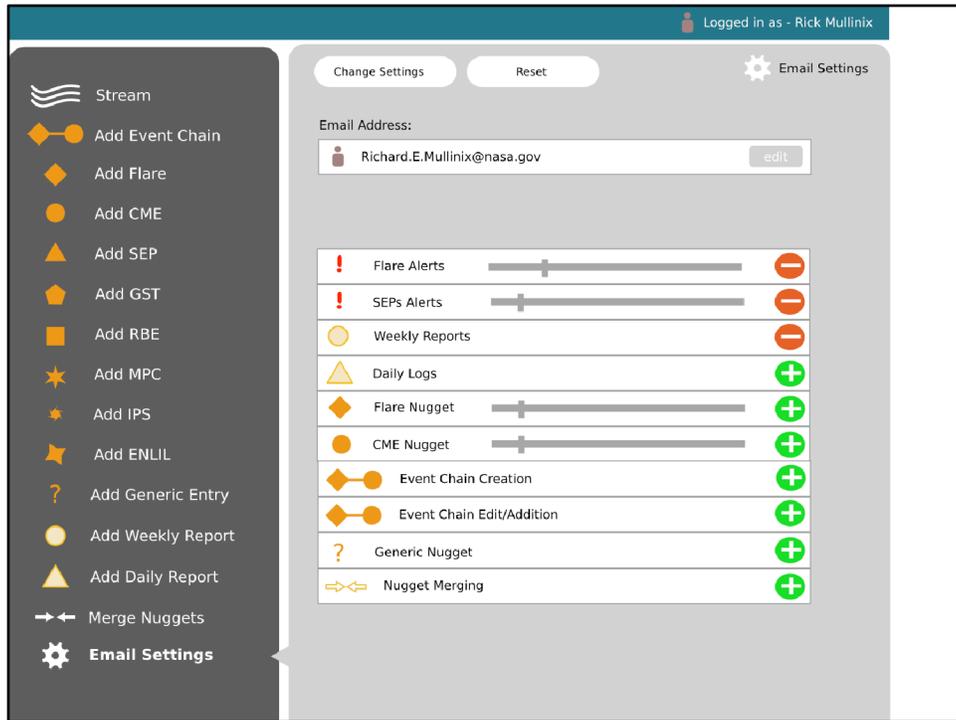
- Search with filters will be added in the near future
- More data export options
- Clear flags indicating data quality

DONKI Future Directions. We are currently considering implementing the following:

- Search with filters will be added in the near future
- More data export options
- Clear flags indicating data quality

And a GUI to easily browse space weather chains of events.

Linking with the CCMC runs on request database for specific space weather events is also planned.



In the future the system would allow personalized notifications and thresholds.