M. Leila Mays

Software developers: Chiu Wiegand (lead), Rick Mullinix
and the CCMC/SWRC team

June 2016

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

Feedback and suggestions are welcome!

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NASA GSFC Community Coordinated Modeling Center (CCMC) Tools

CME Scoreboard

Space Weather DONKI

WSA-ENLIL Cone Fast Track

Stereo CAT

Space Weather Web Tools from CCMC/SWRC

http://kauai.ccmc.gsfc.nasa.gov/
NASA GSFC Community Coordinated Modeling Center (CCMC) Tools

CME Scoreboard

Space Weather DONKI

WSA-ENLIL Cone Fast Track

Stereo CAT

Space Weather Web Tools from CCMC/SWRC
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
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 \textit{anomaly resolution} and \textit{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: \url{http://kauai.ccmc.gsfc.nasa.gov/DONKI}
Click here to get started searching the database by space weather activity type and date

Choose event type

Select start and end date for search

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

<table>
<thead>
<tr>
<th>Event Type</th>
<th>Event Time (UT)</th>
<th>Associated Instrument</th>
<th>Directly Linked Event(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar Energetic Particle</td>
<td>2013-05-13 04:12</td>
<td>STEREO B: IMPACT 13-100 MeV</td>
<td>2013-05-13T01:53:00-FLR-001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>FLR Type: X1.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2013-05-13T02:54:00-CME-001</td>
</tr>
<tr>
<td>Solar Energetic Particle</td>
<td>2013-05-13 18:02</td>
<td>STEREO B: IMPACT 13-100 MeV</td>
<td>2013-05-13T15:40:00-FLR-001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>FLR Type: X2.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2013-05-13T16:18:00-CME-001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>FLR Type: X1.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2013-05-15T02:18:00-CME-001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>FLR Type: M5.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2013-05-22T13:24:00-CME-001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>FLR Type: M5.0</td>
</tr>
<tr>
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<td></td>
<td></td>
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<td>FLR Type: M5.0</td>
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<tr>
<td></td>
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<td></td>
<td>2013-05-22T13:24:00-CME-001</td>
</tr>
</tbody>
</table>

All columns are sortable! (click column headings)
For another example, select “WSA-ENLIL+Cone Model” to see all CME simulations in a certain date range.
### Selecting “WSA-ENLIL+Cone Model”

Lists all CME simulations in a certain date range.

All columns are sortable! (click column headings)

<table>
<thead>
<tr>
<th>Model Name</th>
<th>Model Completion Time</th>
<th>CME Input(s)</th>
<th>Predicted Earth Impact</th>
<th>Predicted Other Location(s) Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>WSA-ENLIL+Cone</td>
<td>2013-05-03T09:33Z</td>
<td>• CME: 2013-05-02T14:36:00-CME-001(CME Analysis)</td>
<td>No or little impact to Earth.</td>
<td></td>
</tr>
<tr>
<td>WSA-ENLIL+Cone</td>
<td>2013-05-03T18:07Z</td>
<td>• CME: 2013-05-03T18:00:00-CME-001(CME Analysis)</td>
<td>No or little impact to Earth.</td>
<td>Spitzer: 2013-05-06T14:32Z</td>
</tr>
<tr>
<td>WSA-ENLIL+Cone</td>
<td>2013-05-04T12:48Z</td>
<td>• CME: 2013-05-03T18:00:00-CME-001(CME Analysis)</td>
<td>No or little impact to Earth.</td>
<td>Spitzer: 2013-05-06T06:39Z</td>
</tr>
<tr>
<td>WSA-ENLIL+Cone</td>
<td>2013-05-04T13:52Z</td>
<td>• CME: 2013-05-03T18:00:00-CME-001(CME Analysis)</td>
<td>No or little impact to Earth.</td>
<td>STEREO B: 2013-05-06T16:39Z</td>
</tr>
</tbody>
</table>

- **Duration of disturbance (hr)**
- **Minimum magnetopause standoff distance:** $R_{\text{min}}(\text{Re}) = 6.6$
- **Possible Kp index:**
  - (kp)90=1
  - (kp)135=5
  - (kp)180=5
Shows impact prediction summary for each simulation

<table>
<thead>
<tr>
<th>Model Name</th>
<th>Model Completion Time</th>
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<td>2013-05-03T18:07Z</td>
<td>• CME: 2013-05-03T18:00:00-CME-001(CME Analysis)</td>
<td>No or little impact to Earth.</td>
<td>Spitzer: 2013-05-06T14:32Z</td>
</tr>
<tr>
<td>WSA-ENLIL+Cone</td>
<td>2013-05-04T13:52Z</td>
<td>• CME: 2013-05-03T18:00:00-CME-001(CME Analysis)</td>
<td>No or little impact to Earth.</td>
<td>Spitzer: 2013-05-06T15:31Z</td>
</tr>
</tbody>
</table>

Earth Shock Arrival Time = 2011-06-01T02:38Z
Duration of disturbance (hr) = 6.6
Minimum magnetopause standoff distance: Rmin(Re) = 6.6
Possible Kp index:
(kp)90=1
(kp)135=0
(kp)180=5

DONKI
### Search Space Weather Activity Archive

**Space Weather Event Type:**
- **WSA-ENLIL+Cone Model**

**Optional start date in format (e.g. 2013-01-31):**
- 2013-05-03

**Optional end date in format (e.g. 2013-06-30):**
- 2013-05-31

**Generate Report for WSA-ENLIL+Cone Inputs**

<table>
<thead>
<tr>
<th>Model Name</th>
<th>Model Completion Time</th>
<th>CME Input(s)</th>
<th>Predicted Earth Impact</th>
<th>Predicted Other Location(s) Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>WSA-ENLIL+Cone</td>
<td>2013-05-03T09:33Z</td>
<td>- CME: 2013-05-02T14:36:00-CME-001(CME Analysis)</td>
<td>No or little impact to Earth.</td>
<td></td>
</tr>
<tr>
<td>WSA-ENLIL+Cone</td>
<td>2013-05-03T18:00:07Z</td>
<td>- CME: 2013-05-03T18:00:00-CME-001(CME Analysis)</td>
<td>No or little impact to Earth.</td>
<td>Spitzer: 2013-05-06T14:32Z</td>
</tr>
<tr>
<td>WSA-ENLIL+Cone</td>
<td>2013-05-04T12:48Z</td>
<td>- CME: 2013-05-03T18:00:00-CME-001(CME Analysis)</td>
<td>No or little impact to Earth.</td>
<td>Spitzer: 2013-05-06T06:39Z</td>
</tr>
<tr>
<td>WSA-ENLIL+Cone</td>
<td>2013-05-04T13:52Z</td>
<td>- CME: 2013-05-03T18:00:00-CME-001(CME Analysis)</td>
<td>No or little impact to Earth.</td>
<td>STEREO B: 2013-05-06T16:39Z</td>
</tr>
<tr>
<td>WSA-ENLIL+Cone</td>
<td>2013-05-04T11:58Z</td>
<td>- CME: 2013-05-03T18:00:00-CME-001(CME Analysis)</td>
<td>No or little impact to Earth.</td>
<td>Spitzer: 2013-05-06T15:31Z</td>
</tr>
</tbody>
</table>
Duration of disturbance (hr) = Minimum magnetopause standoff distance: Rmin(Re) = 6.6
Possible Kp index:
(kp)90=1
(kp)135=5
(kp)180=5

Full simulation results for the selected run:

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

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

Links to simulation movies and plots:
- Timelines Link = http://iswa.gsfc.nasa.gov/downloads/20130503_223000_ENLIL_CONE_timeline.gif
DONKI also shows intelligent linkages, relationships, cause-and-effects between space weather activities.

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

<table>
<thead>
<tr>
<th>Event Type</th>
<th>Activity ID</th>
<th>FLR Start Time</th>
<th>Associated Instrument</th>
<th>FLR Peak Time</th>
<th>FLR End Time</th>
<th>Class</th>
<th>Source Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar Flare</td>
<td>2013-05-14T01:00:00-FLR-001</td>
<td>2013-05-14T01:00Z</td>
<td>GOES15: SEM/XRS 1.0-8.0</td>
<td>2013-05-14T01:11Z</td>
<td></td>
<td>X3.2</td>
<td>N10E89</td>
</tr>
</tbody>
</table>
More details and relationships for the M5.0 flare:

**Solar Flare**
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.
Alternatively, search the notification database by space weather activity type and date.

Choose event type, or weekly report.

Select start and end date for search.

For example, select ALL to list all notification types and weekly reports.
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)
Demo: DONKI

Database of Notifications, Knowledge, and Information

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

Future Directions

• Search with filters will be added in the near future
• More data export options
• Flags have been added to indicate data quality