

# Tracking a Killer Storm

This activity will track a space weather event that occurred due to solar activity on April 3, 2010. The five links below are different “layouts” that use the iSWA (Integrated Space Weather Awareness, <http://iswa.ccmc.gsfc.nasa.gov>) web application. Each layout shows the observations and simulation results for a specific space environment domain (solar, solar corona, solar wind, earth magnetosphere, and ionosphere) as it is impacted by the event. These layouts include: a solar photosphere and near corona, the solar corona, observations and model results for the solar wind model near Earth, model results and observations showing geomagnetic effects, and observations and models for the ionosphere.

Use the layouts, along with the wiki help pages (<http://iswa3.ccmc.gsfc.nasa.gov/wiki>) and the glossary page (<http://iswa3.ccmc.gsfc.nasa.gov/wiki/index.php/Glossary>) to answer the questions associated with each layout.

## Expert Groups

Divid up into “Expert Groups” to analyze one of the layouts.

Each “Expert Group” will analyze one layout. For each cygnet in the layout use the Wiki and Glossary entries above to answer the following questions.

- What data are you looking at?
- Does the cygnet show observational data or simulation results?
- If it is data, how is it collected? If it is simulation results, what model was used?
- What is the axes plotted? What is the scale? Does the scale change if you are looking at multiple time steps?
- What is this data used for? How do you interpret the data shown in the cygnet?

## Solar Corona

[http://iswa.ccmc.gsfc.nasa.gov/lswaSystemWebApp/index.jsp?](http://iswa.ccmc.gsfc.nasa.gov/lswaSystemWebApp/index.jsp?i_1=5&l_1=496&t_1=589&w_1=502&h_1=524&s_1=2010-04-03%2012:00:00.0_1_10_3&i_2=137&l_2=-4&t_2=589&w_2=500&h_2=524&s_2=2010-04-03%2008:00:00.0_1_10_3&i_3=139&l_3=1001&t_3=586&w_3=501&h_3=520&s_3=2010-04-03%2008:06:00.0_1_10_3&i_4=32&l_4=251&t_4=281&w_4=940&h_4=300&s_4=2010-04-04%2011:32:05.0_0_10_3)

[i\\_1=5&l\\_1=496&t\\_1=589&w\\_1=502&h\\_1=524&s\\_1=2010-04-03%2012:00:00.0\\_1\\_10\\_3&i\\_2=137&l\\_2=-4&t\\_2=589&w\\_2=500&h\\_2=524&s\\_2=2010-04-03%2008:00:00.0\\_1\\_10\\_3&i\\_3=139&l\\_3=1001&t\\_3=586&w\\_3=501&h\\_3=520&s\\_3=2010-04-03%2008:06:00.0\\_1\\_10\\_3&i\\_4=32&l\\_4=251&t\\_4=281&w\\_4=940&h\\_4=300&s\\_4=2010-04-04%2011:32:05.0\\_0\\_10\\_3](http://iswa.ccmc.gsfc.nasa.gov/lswaSystemWebApp/index.jsp?i_1=5&l_1=496&t_1=589&w_1=502&h_1=524&s_1=2010-04-03%2012:00:00.0_1_10_3&i_2=137&l_2=-4&t_2=589&w_2=500&h_2=524&s_2=2010-04-03%2008:00:00.0_1_10_3&i_3=139&l_3=1001&t_3=586&w_3=501&h_3=520&s_3=2010-04-03%2008:06:00.0_1_10_3&i_4=32&l_4=251&t_4=281&w_4=940&h_4=300&s_4=2010-04-04%2011:32:05.0_0_10_3)

- 1) Do all sunspots have active regions associated with them?
- 2) Are all active regions associated with sunspots?
- 3) How would you define an solar active region? What characteristics does it have?
- 4) When does a solar flare occur? What criteria do you use to define the solar flare event?

## Coronagraphs

[http://iswa.ccmc.gsfc.nasa.gov/lswaSystemWebApp/index.jsp?i\\_1=15&l\\_1=505&t\\_1=543&w\\_1=502&h\\_1=513&s\\_1=2010-04-03%2015:42:00.0\\_1\\_20\\_3&i\\_2=205&l\\_2=1010&t\\_2=541&w\\_2=506&h\\_2=513&s\\_2=2010-04-03%2012:54:00.0\\_1\\_10\\_3&i\\_3=207&l\\_3=1&t\\_3=544&w\\_3=503&h\\_3=515&s\\_3=2010-04-03%2012:54:00.0\\_1\\_10\\_3&i\\_4=115&l\\_4=268&t\\_4=298&w\\_4=910&h\\_4=258&s\\_4=0](http://iswa.ccmc.gsfc.nasa.gov/lswaSystemWebApp/index.jsp?i_1=15&l_1=505&t_1=543&w_1=502&h_1=513&s_1=2010-04-03%2015:42:00.0_1_20_3&i_2=205&l_2=1010&t_2=541&w_2=506&h_2=513&s_2=2010-04-03%2012:54:00.0_1_10_3&i_3=207&l_3=1&t_3=544&w_3=503&h_3=515&s_3=2010-04-03%2012:54:00.0_1_10_3&i_4=115&l_4=268&t_4=298&w_4=910&h_4=258&s_4=0)

- 1) Three spacecraft are taking these images. Where are the three spacecraft relative to each other?
- 2) When does the CME first appear in these images? Are the images consistent from one to the other?
- 3) Is the CME Earth bound? How can you tell?

## Solar Wind

[http://iswa.ccmc.gsfc.nasa.gov/lswaSystemWebApp/index.jsp?i\\_1=261&l\\_1=28&t\\_1=323&w\\_1=640&h\\_1=410&s\\_1=2010-04-03%2018:02:02.0\\_0\\_10\\_3&i\\_2=267&l\\_2=693&t\\_2=325&w\\_2=640&h\\_2=410&s\\_2=2010-04-03%2017:16:00.0\\_0\\_10\\_3&i\\_3=48&l\\_3=214&t\\_3=1053&w\\_3=911&h\\_3=678&s\\_3=2010-04-07%2004:10:02.0\\_0\\_10\\_3&i\\_4=297&l\\_4=169&t\\_4=741&w\\_4=940&h\\_4=300&s\\_4=2010-04-03%2017:16:00.0\\_0\\_10\\_3](http://iswa.ccmc.gsfc.nasa.gov/lswaSystemWebApp/index.jsp?i_1=261&l_1=28&t_1=323&w_1=640&h_1=410&s_1=2010-04-03%2018:02:02.0_0_10_3&i_2=267&l_2=693&t_2=325&w_2=640&h_2=410&s_2=2010-04-03%2017:16:00.0_0_10_3&i_3=48&l_3=214&t_3=1053&w_3=911&h_3=678&s_3=2010-04-07%2004:10:02.0_0_10_3&i_4=297&l_4=169&t_4=741&w_4=940&h_4=300&s_4=2010-04-03%2017:16:00.0_0_10_3)

- 1) In terms of the solar wind plasma parameters, what are the signatures of the passage of a CME? Note the date and time
- 2) Based on the model results describe the global shape of the April, 2012 CME? How does it change the global magnetic field structure of the Heliosphere?
- 3) Based on the model results, roughly what solar angle of the heliosphere is affected by the CME?
- 4) Compare the model results timeline plot of the density and velocity to the ACE measurements of the solar wind. What does the model get right and what is missing?

## Magnetosphere

[http://iswa.gsfc.nasa.gov/lswaSystemWebApp/index.jsp?i\\_1=41&l\\_1=904&t\\_1=313&w\\_1=495&h\\_1=416&s\\_1=2010-04-05%2010:00:00.0\\_1\\_30\\_3&i\\_2=125&l\\_2=115&t\\_2=801&w\\_2=596&h\\_2=412&s\\_2=2010-04-06%2023:56:00.0\\_0\\_10\\_3&i\\_3=39&l\\_3=903&t\\_3=792&w\\_3=493&h\\_3=409&s\\_3=2010-04-06%2023:00:00.0\\_0\\_10\\_3&i\\_4=43&l\\_4=74&t\\_4=314&w\\_4=792&h\\_4=443&s\\_4=2010-04-05%2011:00:00.0\\_1\\_30\\_3&i\\_5=1&l\\_5=555&t\\_5=1243&w\\_5=500&h\\_5=400&s\\_5=2010-04-06%2019:16:53.0\\_0\\_10\\_3](http://iswa.gsfc.nasa.gov/lswaSystemWebApp/index.jsp?i_1=41&l_1=904&t_1=313&w_1=495&h_1=416&s_1=2010-04-05%2010:00:00.0_1_30_3&i_2=125&l_2=115&t_2=801&w_2=596&h_2=412&s_2=2010-04-06%2023:56:00.0_0_10_3&i_3=39&l_3=903&t_3=792&w_3=493&h_3=409&s_3=2010-04-06%2023:00:00.0_0_10_3&i_4=43&l_4=74&t_4=314&w_4=792&h_4=443&s_4=2010-04-05%2011:00:00.0_1_30_3&i_5=1&l_5=555&t_5=1243&w_5=500&h_5=400&s_5=2010-04-06%2019:16:53.0_0_10_3)

- 1) What are the indicators in the model results of the passage of the CME?
- 2) What are the effects on the magnetosphere?
- 3) Why might space craft in geosynchronous orbit be affected?

## **Ionosphere and Radiation Belt**

[http://iswa.gsfc.nasa.gov/lswaSystemWebApp/index.jsp?](http://iswa.gsfc.nasa.gov/lswaSystemWebApp/index.jsp?i_1=73&l_1=32&t_1=329&w_1=621&h_1=452&s_1=2010-04-08%2012:56:00.0_0_10_3&i_2=86&l_2=662&t_2=311&w_2=680&h_2=449&s_2=2010-04-05%2012:00:00.0_1_100_3&i_3=102&l_3=174&t_3=791&w_3=400&h_3=400&s_3=2010-03-05%2014:48:00.0_1_100_3)

[i\\_1=73&l\\_1=32&t\\_1=329&w\\_1=621&h\\_1=452&s\\_1=2010-04-08%2012:56:00.0\\_0\\_10\\_3&i\\_2=86&l\\_2=662&t\\_2=311&w\\_2=680&h\\_2=449&s\\_2=2010-04-05%2012:00:00.0\\_1\\_100\\_3&i\\_3=102&l\\_3=174&t\\_3=791&w\\_3=400&h\\_3=400&s\\_3=2010-03-05%2014:48:00.0\\_1\\_100\\_3](http://iswa.gsfc.nasa.gov/lswaSystemWebApp/index.jsp?i_1=73&l_1=32&t_1=329&w_1=621&h_1=452&s_1=2010-04-08%2012:56:00.0_0_10_3&i_2=86&l_2=662&t_2=311&w_2=680&h_2=449&s_2=2010-04-05%2012:00:00.0_1_100_3&i_3=102&l_3=174&t_3=791&w_3=400&h_3=400&s_3=2010-03-05%2014:48:00.0_1_100_3)