



2016 Space Weather Bootcamp 7-17 June 2016



The 4th SW REDI Summer Bootcamp provides a unique opportunity to explore the burgeoning field of space weather! It includes nearly two weeks of training, with the first week focusing on the fundamentals of space weather and the second week on intensive forecaster training. In addition, one-to-one discussions with CCMC scientists on special research topics or specific space weather user needs are possible throughout the



Lecturers:

Ms. Anna Chulaki	Dr. Yaireska Collado-Vega
Dr. Leila Mays	Dr. Karin Muglach
Dr. Antti Pulkkinen	Dr. Sandro Taktakishvilli
Dr. Barbara Thompson	Ms. Chiu Wiegand
Dr. Yihua Zheng	Dr. Chigo Ngwira

All staff members at CCMC and all members of
SWRC team

SW REDI Program at CCMC
NASA Goddard Space Flight Center
Greenbelt, MD20723

<http://ccmc.gsfc.nasa.gov/support/SWREDI/bootcamp/>

Agenda

Week 1 (in Room 183A)

Tuesday: 6/7/2016

- 9:00 – 9:15 Welcome and Introduction (Masha Kuznetsova)
- 9:15 – 10:00 Introduction to space weather I (Antti Pulkkinen)
- 10:00– 10:30 Daily Space Weather Tagup (forecaster on-duty)
- 10:40 – 11:00 break
- 11:00 – 11:40 Introduction to space weather II (Antti Pulkkinen)
- 11:40 – 12:00 homework
- 12:00 – 1:30 lunch (and mingle)
- 1:30 – 2:00 Sun and its activity (Sandro Taktakishvilli)
- 2:00 – 2:10 Q&A
- 2:10 – 2:40 Flare, CMEs and their impacts (Sandro Taktakishvilli)
- 2:40 – 2:50 Q&A
- 2:50 – 3:05 break
- 3:05 – 3:35 Solar Energetic Particles (SEPs) and their impacts (Barbara Thompson)
- 3:35 – 3:40 Q&A
- 3:40 – 4:10 Solar Energetic Particles (SEPs) and their impacts (Barbara Thompson)
- 4:10 – 4:20 Q &A
- 4:20 – 5:00 Quick start of iSWA (Yari Collado-Vega)
- 5:00 – 5:10 break
- 5:10 – 6:00 homework (Antti and Sandro)

Week 1
Wednesday 6/8/2016

- 9:00 – 10:00 Lower coronal signatures of CMEs (Karin Muglach)
- 10:00 – 10:20 Daily space weather tag-up (forecaster on-duty)
- 10:20 – 10:30 break
- 10:30 – 10:45 Q&A with Karin
- 10:45 – 11:45 Coronal holes and high speed streams (Karin Muglach)
- 11:45 – 12:00 Q&A
- 12:00 – 1:30 lunch (and mingle)
- 1:30 – 2:00 Space Weather in Earth's Magnetosphere I (Yari Collado-Vega)
- 2:00 – 2:10 Q&A
- 2:10 – 2:40 Space weather in Earth's Magnetosphere II (Yari Collado-Vega)
- 2:40 – 2:45 Q&A
- 2:45 – 2:55 break
- 2:55 – 3:30 Space Weather in Earth's Magnetosphere III (Yari Collado-Vega)
- 3:30 – 4:30 *CCMC Interns only*: Meeting with Teresa
Others: break
- 4:30 – 5:00 Examples of iSWA layouts for different applications (Yihua Zheng)
- 5:10 – 5:20 break
- 5:20 – 6:00 homework (Karin and Yihua)

Week 1
Thursday 6/9/2016

- 9:00 – 10:00 homework
- 10:00 – 10:20 Daily space weather tag-up (forecaster on-duty)
- 10:20 – 10:50 Space Weather in the ionosphere-thermosphere: overview (Chigo Ngwira)
- 10:50 – 11:00 Q&A
- 11:00 – 11:15 break
- 11:15 – 11:45 Space Weather in the ionosphere-thermosphere: satellite drag (Chigo Ngwira)
- 11:45 – 12:00 Q&A
- 12:00 – 1:30 lunch (and mingle)
- 1:30 – 2:10 Realtime modeling of CMEs using the WSA+Enlil+Cone model (Sandro Taktakishvili)
- 2:10 – 2:20 Q&A
- 2:20 – 2:50 Space weather impacts on satellites: Part I (Yihua)
- 2:50 – 3:00 Q&A
- 3:00 – 3:15 break
- 3:15 – 3:45 Space weather impacts on satellites: Part II (Yihua)
- 3:45 – 3:50 Q&A
- 3:50 – 4:00 break
- 4:00 – 4:45 Space Weather Scoreboard (Karin, Chiu Wiegand)
- 4:45 – 5:00 Q &A
- 5:10 – 6:00 homework (Chigo and Sandro)

Week 1
Friday 6/10/2016

- 9:00-10:00 Introduction to the DONKI space weather database (Yari Collado-Vega)
- 10:00-10:20 Daily space weather tagup (forecaster on duty)
- 10:20-10:30 break
- 10:30 – 12:30 Space weather decision dashboard (Antti Pulkkinen)
- 12:30 – 2:30 Lunch
- 2:30 – 3:15 Space weather models running in real-time or forecasting mode (Yihua Zheng)
- 3:15 -3:20 Q&A
- 3:20 – 4:20 Part 1: CME analysis with StereoCAT for space weather (Barbara Thompson)
- 4:20 – 4:30 break
- 4:30 – 6:00 CME measurement hands-on workshop (Barbara and Yihua)

Week 2 (6/13/2016 – 6/17/2016)

Track A: Intensive Space Weather Forecaster Training (*Rm 183A*)

Track B: Research Topic Discussions / How to use CCMC Tools in Research (*CCMC Lab – Room 261*)

Week 2
Track A: SW Forecaster Training

in Room 183A
Monday 6/13/2016

- 9:00-10:00 FastTrack ENLIL Simulation Interface (Anna Chulaki)
- 10:00 – 10:20 Daily tagup (forecaster on duty)
- 10:20-10:30 break
- 10:30-12:00 Part 2: CME analysis StereoCAT for Space Weather: Limitations (Leila Mays)
- 12:00 – 1:30 lunch break
- 1:30 – 6:00 CME measurement hands-on workshop (Leila Mays)

Tuesday 6/14/2016

- 9:00-10:00 CME measurement with SWPC_CAT workshop I (Leila and Sandro)
- 10:00-10:20 Daily space weather tagup (forecaster on duty)
- 10:20-10:30 break
- 10:30-12:00 CME measurement workshop II (Leila and Yihua)
- 12:00 – 1:30 Lunch
- 1:30 – 2:30 Ensemble CME measurement workshop (Leila, Karin)
- 2:30 – 4:00 CMEs and SEPs (Nat Gopalswamy)
- 4:00 – 6:00 Ensemble CME measurement workshop (Leila, Karin)

Wednesday 6/15/2016

- 9:00-10:00 CME measurement workshop (Leila)
- 10:00-10:20 Daily tagup (forecaster on duty)
- 10:20-10:30 break
- 10:30-12:00 CME measurement workshop (Leila)
- 12:00 – 1:00 lunch
- 1:00 -3:00 CME measurement workshop (Leila and Yihua)
- 3:00 – 4:00 *CCMC interns only*: Lecture 1 in Library (bldg 21)
- *Others*: break
- 4:00-6:00 Space weather forecasting with DONKI (Leila Mays,

Week 2
Track A: SW Forecaster Training

Thursday 6/16/2016

- 9:35-12:00 *Optional Tour of Goddard Space Flight Center*
(meeting at entrance to Bldg 8 - glass doors - at 9:35am)
- 12:00 – 1:30 **Lunch**
- 1:30-1:50 Daily space weather tagup (forecaster on duty)
- 1:50-3:30 Forecasting Checklist and Logs (DONKI) (Leila Mays, Chiu Wiegand)
- 3:30-3:45 break
- 3:45 – 6:00 Notification assignments (Leila Mays)

Friday 6/17/2016

- 9:00-11:00 **Bootcamp evaluation**
- 9:00-10:30 Notification assignments
- 10:00-11:00 Tag up (forecaster on duty; Matt West)
- 11:00 – 12:00 Bootcamp certificate ceremony
- 12:00-1:30 **Lunch (optional lunch with CCMC group at Gah Rham Korean buffet)**
- 12:00 – Track A ends

Week 2
Track B: Research Topic Discussions / How To Use

Monday 6/13/2016

- 9:00-10:00 Tour of models at the CCMC (Masha Kuznetsova)
- 10:00-11:00 Hands-on Magnetosphere ROR Exercises (Masha)
- 11:00 -12:00 Inner Magnetosphere Runs on Request (Yihua)
- 2:30 – 3:30 What Kameleon can do for you? (Asher Pembroke)
- 3:45 – 5:30 Hands-on Ionosphere RoR Exercises (Ja Soon Shim)

Tuesday 6/14/2016

- 9:00-10:00 Kinetic Simulation Tools at the CCMC (Yi-Hsin Liu)
- 10:00-2:30 (*with breaks*) Heliosphere ROR (Peter, Sandro)
- 2:30 – 4:00 CMEs and SEPs (Nat Gopalswamy) – in Room 183A

Wednesday 6/15/2016

- 9:00-10:00 CCMC tools/demos (Rick, Chiu, Justin)
- 10:00 - 10:30 discussion with Yihua about your research interest and finding a matching mentor if needed
- 10:45 - 11:45 Meeting with NASA scientist - Dr. David Sibeck
- 1:30 - 2:30 Meeting with NASA scientist/CCMC Director (Masha)
- 2:45 - 4:00 CCMC tools/demos (Asher/Lutz, Sebastian, Michael)
4:20 — 6:00 participating in track A or playing with tools

Thursday 6/16/2016

- 9:35-12:00 **Optional Tour of Goddard Space Flight Center**
(meeting at entrance to Bldg 8-glass doors- at 9:35am)
- Meeting with NASA/GSFC scientists — inspiration for selecting research topics:
- 2:00 – 3:30 Spiro Antiochos — Science of CMEs
- 3:30 – 5:00 Antti Pulkkinen — Science of Geomagnetically Induced Currents

Friday 6/17/2016

- 9:00-11:00 Bootcamp evaluation; work on research topics
- 11:00 – 12:00 Bootcamp certificate ceremony
- 12:00-1:30 **Lunch (optional lunch at Gah Rham Korean buffet)**
- 12:00 Track B ends

Supplementary Materials

Books:

- Clark, S., The Sun Kings: The Unexpected Tragedy of Richard Carrington and the Tale of How Modern Astronomy Began, Princeton University Press, 2007.(light read)
- “An Introduction to Space Weather”, 2008, by Mark Moldwin, Cambridge (ISBN-13 978-0521711128) -- lower undergraduate level, non-science major
- “Understanding Space Weather and the Physics Behind it”, 2011, by Delores Knipp, McGraw Hill Company (ISBN-13: 978-0073408903) -- upper undergraduate level

Online:

- <http://ccmc.gsfc.nasa.gov/support/SWREDI/swredi.php> (assignments are posted here)
- iSWA
- <http://iswa.gsfc.nasa.gov>
- iSWA Cygnet Glossary
- http://iswa3.ccmc.gsfc.nasa.gov/wiki/index.php/Full_iSWA_Cygnet_List
- iSWA Space Weather Glossary
<http://iswa3.ccmc.gsfc.nasa.gov/wiki/index.php/Glossary>
- StereoCAT: <http://ccmc.gsfc.nasa.gov/analysis/stereo/>
- DONKI: <http://kauai.ccmc.gsfc.nasa.gov/DONKI/>
- http://www.nasa.gov/mission_pages/sunearth/spaceweather/index.html
- <http://www.exploratorium.edu/spaceweather/>
- <http://www.spaceweathercenter.org/>
- <http://rbjp.jhuapl.edu/science/spaceWeather.php>
- <http://legacy-www.swpc.noaa.gov/primer/primer.html>
- <http://www.swpc.noaa.gov/about-space-weather>

- NASA Space Weather Research Center
- <http://swrc.gsfc.nasa.gov>
- CUA Space Weather Academy:
- www.youtube.com/user/CUASpaceWeather

Useful reading material:

Sun Primer: Why NASA Scientists Observe Sun in Different Wavelengths

- http://www.nasa.gov/mission_pages/sunearth/news/light-wavelengths.html
- *Something New Under the Sun*
- [http://www.smithsonianmag.com/science-nature/something-new-under-the-sun-937411/Carrington-class CME Narrowly Misses Earth](http://www.smithsonianmag.com/science-nature/something-new-under-the-sun-937411/Carrington-class-CME-Narrowly-Misses-Earth)
- http://science.nasa.gov/science-news/science-at-nasa/2014/02may_superstorm/
- http://www.nasa.gov/mission_pages/stereo/news/fast-cme.html - related.
- *The effects of space weather on aviation*
- http://science.nasa.gov/science-news/science-at-nasa/2013/25oct_aviationswx/

Cancer and spaceflight

- http://www.aerospaceamerica.org/Documents/AerospaceAmerica%20PDFs%20-%202014/May%202014/Feature1_AA_May2014.pdf