



CCMC/SWRC **SW/REDI** 2-week Course Plan

Space Weather Research, Education and Development Initiative (SW/REDI)

Course Description: Space weather refers to the ever-changing conditions in space. While it sometimes bears similarities to terrestrial weather, it can also be strikingly different. Space weather is an emerging field of space science, with the goal of better understanding how varying conditions in space can affect society and technological assets in space and on the ground. In a society permeated by technology that is sometimes vulnerable to space weather effects, the field is becoming increasingly important.

Space weather occurs throughout our solar system, as well as other solar systems. This course, however, will mainly focus on space weather phenomena relevant to Earth, as these have the most significant impact on our endeavors.

This two-week intensive course will be distinguished by the use of iSWA (<http://iswa.gsfc.nasa.gov>) and incorporation of NASA/SWRC (<http://swrc.gsfc.nasa.gov>) operational experience. It will cover the following topic areas.

- Maker/driver of space weather – Sun and solar activity
- Space weather domains (Sun, heliosphere, magnetosphere, ionosphere, atmosphere) and how they interact and interconnect
- Space weather impacts (on satellite, communication, navigation, astronauts in space, power grid and pipelines, airline passengers, etc).
- Current forecasting capability and methods
- In-depth CME analysis tool
- Decision dashboard for forecasters

Design/structure of the course: The first week of the course will cover the fundamentals/basics of space weather. The second week of the course is designed to be flexible in order to meet participants' needs. Two options will be provided: one focusing on hands-on training projects that will provide valuable experience for those seeking to become independent entry-level forecasters; and the other dedicated to specific space weather related research topics.

Who should participate: This intense two-week course is intended for motivated undergraduate students, advanced high school students, and others interested in learning how to be an independent space weather forecaster. The other purpose of the course is to serve as the prerequisite to those college-level students wishing to pursue a school year

internship opportunity in space weather research to fulfill academic requirements. It is also appropriate for scientists and others new to space weather seeking a global perspective of space weather, as well as those aiming to broaden their research topics.

Course Schedule (as of June 7)

Time: (June 3 – 7, 2013 and June 10 – 14, 2013)

Week 1 (June 3-7, 2013)

June 3, 2013 Monday

Orientation (full day)

June 4, 2013 Tuesday

9:00 -9:20 Welcome and introduction (Marlo)

9:20 – 10:20 Lesson 1 – Introduction of space weather (overview) – learning main concepts (flares, CMEs, etc), involved domains, types of storms and their main drivers (Rebekah)

10:20 -10:35 break

10:35 – 11:05 Quick start of iSWA (Marlo)

11:05 – 11:20 daily tag-up (Michel, Josh, Erin)

11:20 – 12:05 Lesson 2 - Sun and its activity (Sandro)

12:05 – 1:10 lunch break

1:10 – 2:20 Lesson 3 – flares and CMEs in more details (Sandro)

2:20 -- 3:20 Lesson 4 SEPs (Rebekah)

3:20 – 3:35 break

3:35 – 6:00 daily self-review (finish homework assignments)/group discussion/Q&A

June 5, 2013 Wed.

9:00 – 09:40 Intro of WSA+ENLIL (Sandro)

09:40 -- 12:00 (with break +daily SWx tagup) Lesson 4 – CME analysis tool (Leila)
tag-up (group 1, 2, summary by Michel/Josh/Erin)

1:00 -2:00 Lesson 5 – Coronal holes and high speed solar wind streams (Leila)

2:00 – 2:15 break

2:15 – 4:00 Lesson 6 – space weather in the Earth's magnetosphere (Masha and Yihua)

4:00 – 4:15 break

4:15 – 6:00 daily review/homework/group discussion/Q&A

June 6, 2013 Thursday

9:00 -10:00 Lesson 7 – Space weather in ionosphere-thermosphere I (Yihua)

10:00 – 10:20 break

10:20 – 11:40 (includes daily SWx tagup) Lesson 8 – Space weather in ionosphere-thermosphere II (Yihua)

11:40 – 1:00 lunch

1:00 – 2:00 Lesson 9 – iSWA (integrated space weather analysis) tool (Marlo)

2:00 – 6:00 daily review/finish homework assignments, etc.

June 7, 2013 Friday

Morning (9:00-11:00) Lesson 10 – iSWA layout for SWx tag-up (Leila)

11:00 -12:00 self-study

12:00 – 1:00 lunch

Afternoon

1:00 – 2:00 Homework/practice

(2:00-4:00) Lesson 11 – Forecasting capability/limitations (Antti/Yihua)

3:00 – 5:00 Daily review, etc

June 10, 2013 Monday

9-10:30 review/practice/self study

10:30 – 10:45 break

10:45 – 12:00 review/practice

12:00 – 1pm lunch

1:00 – 2:00 Practice/hands on activities

2:00 - 4:00 Lesson 12/13 – Space weather impacts (Yihua)

4:00 – 6:00 daily review/practice

Homework:

- Design your own iSWA layout including products of all alert types

- Mockup drill/training as a primary space weather forecaster – compose and send out all alert messages during the 15 March 15, 2013 solar storm (do the March 7 – March 11, 2012 period if you like challenges)

Week 2 (June 11-14, 2013)

a. For Space Weather Forecasters

June 11, 2013 Tuesday

9:00 – 12:00 (with a break)

Lessons 14 -16: In-depth CME analysis tool (Leila)

Examples

12:00 - 1:00 Lunch

1:00 – 4:00 Lessons 17-19: Decision dashboard for forecasters (Yihua)

4:00 – 6:00 daily discussion/questions for mentors/completing homework

June 12 -14, 2013 Wed – Friday

9:00 -12:00 pm Hands-on training (past events analysis)

examples: March 15, April 11, May 13 – 14, 2013 events

1:00 – 4:00 pm June 13

Lesson of Space weather log and DONKI database demo

Observe on-duty forecasters and try to lead daily space weather tag-up

Compose space weather notification messages and familiar with the process

b. For those interested in Space Weather Research

June 11 – 14, 2013 Monday - Friday

Lessons: 17-20: different space weather related research topics (TBD) and selection

Reading about existing literature in the topic of interest

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://www.nasa.gov/mission_pages/sunearth/spaceweather/index.html

<http://www.exploratorium.edu/spaceweather/>

<http://www.spaceweathercenter.org/>

<http://rbsp.jhuapl.edu/science/spaceWeather.php>

<http://www.swpc.noaa.gov/primer/primer.html>

http://www.esa-spaceweather.net/spweather/BACKGROUND/PHYS_PROC/physics.html

NASA Space Weather Research Center

<http://swrc.gsfc.nasa.gov>

CUA Space Weather Academy:

www.youtube.com/user/CUASpaceWeather