CCMC as a Resource For Space Weather Program At CUNY/QCC

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QUEENSBOROUGH COMMUNITY COLLEGE (QCC)
OF THE CITY UNIVERSITY OF NEW YORK (CUNY)

THE 9TH ANNUAL CCMC WORKSHOP
COLLEGE PARK, MARYLAND
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Why Space Weather?

-Sounded cool & sexy

-Relevant to students because of technology

-NASA (still a great draw!)

-Tons of data

-Models that help with visualization

-Great way to teach physics without scaring students too much!

QCC Space Weather Research and Education Program

Main Goal

Design and implement an integrated research and education program in solar, geospace and atmospheric physics under the **umbrella discipline of space weather** to engage community college students in research.

Specific Objectives

1. Provide QCC students with research opportunities in space weather as early as their first year.
2. Develop educational materials in solar and atmospheric physics (space weather).
3. Increase the number of students, especially underrepresented minorities, that transfer to 4-year STEM programs.
4. Incorporate evidenced-based practices that ensure project's success.

The City University of New York (CUNY)

CUNY, located in New York City, is USA's largest urban public university. It provides high-quality, accessible education for more than **269,000 degree-credit students** and **247,000 adult, continuing and professional education students** at 24 campuses across New York City.

Excelsior Scholarship– Free Tuition at CUNY

The City University of New York (CUNY)

- 11 Senior Colleges
- 7 Community Colleges
- The Graduate School and University Center
- Macaulay Honors College
- CUNY Graduate School of Journalism
- CUNY School of Law at Queens College
- CUNY School of Professional Studies
- CUNY School of Public Health
- CUNY Medical School

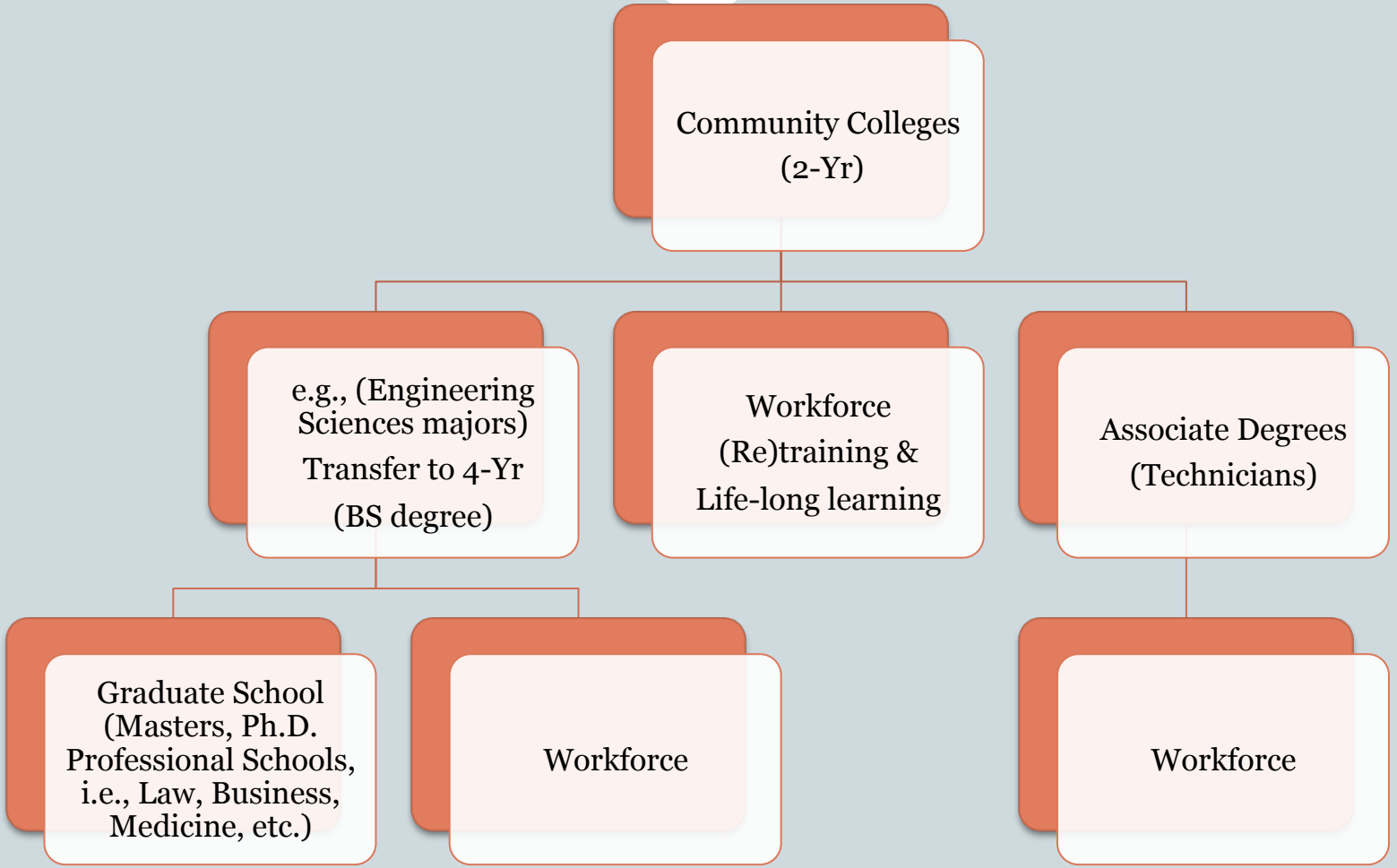
Community Colleges

"Community colleges…. are an American invention that put publicly funded higher education at close-to-home facilities, beginning nearly 100 years ago with Joliet Junior College…"

- 1,167 public and independent community colleges
- 1,600 when branch campuses are included.

American Association of Community Colleges
(AACC, 2018)
http://www.aacc.nche.edu/

Community Colleges



People

- CUNY/QCC- Physics Department (M. Chantale Damas, Paul Marchese)
- CUNY/City College of New York– Electrical Engineering Department (Ahmed Mohamed, Roger Dorsinville)
- CUNY/York- Physics Department (Kevin Lynch, Jim Popp)
- NASA Goddard Space Fight Center
  CCMC:(Masha Kuznetsova, Yihua Zheng, Chigomezyo Ngwira*, Karin Muglach*, Anna Chulaki, Yaireska M. Collado-Vega, Leila Mays, & CCMC Staff); non-CCMC (Marilia Samara, Robert Michell)
- Prince George's Community College (Neeharika Thakur)
- University of Colorado at Boulder (Delores Knipp)

Students have access to a diverse group of mentors

* CUA

Students

Main criteria: Interest and Motivation

- Enrollment at a community college*
- At QCC- recruited as early as 1st year
- Little background in physics- (first semester of Calculus-based physics & calculus)
- From diverse groups
- Underrepresented population (minorities & women)

*For Summer Program, also have 4-yr college students

Funding

Main funding:

1. **National Science Foundation (NSF) EAGER* (Geosciences Directorate; 2015-2017)**
2. **NASA MUREP MC3I Program (2016-2019)**

Other sources:

- CUNY/Medgar Evers College NSF Research Experience for Undergraduates (REU) Program
- CUNY/QCC REU Program
- NASA New York Space Grant for Community College Partnership program
- The City of New York Mayor's Office--CUNY Research Scholars Program for Community College Students
- Department of Education MSEIP

*Early Concept Grants for Exploratory Research

QCC Space Weather Research Program

A year-long research experience with two experiential learning opportunities :

1. During academic year, students are enrolled in a modified course-based introductory research experience **(CURE) (independent study)** where they learn the basics of space weather (1st semester) and gain research skills (2nd semester).
2. During the summer, students are placed in research internships at partner institutions (independent)

Students who return to QCC from their summer experience continue with their research in fall semester.

Course Resources

Developed online materials/graphical user interface: textbooks, lecture-tutorials, journal articles, videos, etc.)
Use mainly CCMC tools and materials, Science@NASA, NOAA SWPC, space weather.com, spaceweatherlive.com, etc.:

- Basic –intro to materials (can be used by non-science majors)
- Intermediate (include data analysis & intro to research)
- Advanced (covers material more in-depth, students choose research projects)

Course Format

- Students meet 3 to 6-hours/week as a class
- Students work in groups (mainly) and independently
- Students meet individually with faculty mentors

In addition to receiving credit for doing research, students also receive a stipend (~$500-750/semester)

Data

1. Work with large data sets
2. Know where data come from (satellites & groud-based instruments)
3. Where to get data (NASA, NOAA, etc.)
4. Use of historical (archival) data & real-time
5. Data analysis using mainly MS Excel & Matlab (statistical analysis, etc.)

Space Weather Education Modules

Tracking Solar Flares

Pre-Lab Activities

Introduction: What You need to know before you do this activity. In addition to the links given below, you are also expected to do your own research to answer some of the questions below.

A. Electromagnetic Spectrum

Learn More

Data

Class Activity

Plotting of Sunspot Numbers

In this activity, you will be ploting the Sunspot Number vs Year.

Yearly Mean Sunspot Numbers

Up to 1944, yearly means were calculated as the average of the 12 monthly means; since 1945 yearly means have been calculated as the average of the daily means.

Year	Sunspot number	Year	Sunspot number	Year	Sunspot number	Year	Sunspot number	Year	Sunspot number
1700	5	1701	11	1702	16	1703	23	1704	36
1705	58	1706	29	1707	20	1708	10	1709	8
1710	3	1711	0	1712	0	1713	2	1714	11
1715	27	1716	47	1717	63	1718	60	1719	39
1720	28	1721	26	1722	22	1723	11	1724	21
1725	40	1726	78	1727	122	1728	103	1729	73
1730	47	1731	35	1732	11	1733	5	1734	16
1735	34	1736	70	1737	81	1738	111	1739	101
1740	73	1741	40	1742	20	1743	16	1744	5
1745	11	1746	22	1747	40	1748	60	1749	80.9
1750	83.4	1751	47.7	1752	47.8	1753	30.7	1754	12.2
1755	9.6	1756	10.2	1757	32.4	1758	47.6	1759	54.0
1760	62.9	1761	85.9	1762	61.2	1763	45.1	1764	36.4

iSWA Tutorials

Contents print all

INTEGRATED SPACE WEATHER ANALYSIS SYSTEM (iSWA)

About iSWA

- ISWA is a flexible, turn-key, Web-based dissemination system for NASA-relevant space weather information that combines forecasts based on the most advanced space weather models with concurrent space environment information. iSWA is customer-configurable and adaptable for use as a powerful decision-making tool. The system offers an unprecedented ability to analyze the present and expected future space weather impacts on NASA's human and robotic missions.

Sample iSWA layout

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Summer Internship Program

Students spend 10 weeks at partner institutions and get a $5000 stipend (plus housing & transportation).

- Community Coordinated Modeling Center (NASA Goddard) (forecasting*, research & software development)
- CUNY
- BNL (1)

*forecasters have the opportunity to be paid to continue forecasting during the academic year.

NASA CCMC Space WREDI Bootcamp

- All participating students are required to attend the space weather bootcamp at CCMC
- Fully funded

https://ccmc.gsfc.nasa.gov/support/SWREDI/bootcamp/

View Opportunity

View Opportunity

Opportunity Info

Opportunity Title: Geomagnetic storm impact on magnetosphere and ionosphere

Opportunity Type: Internship

Opportunity Description/Objective (specific student assignment): Storm-time energy dissipation at geomagnetic high-latitude regions can lead to profound changes of the global quiet-time upper atmosphere. These upper atmospheric changes can in-turn increase (positive) or decrease (negative) the large-scale electron density in the ionosphere. The goal of this project is to perform a characterization of solar wind, magnetosphere and ionosphere physical quantities during storm-times. Opportunity will involve data progress, analysis, and visualization.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): Student(s) expected to give an oral or poster presentation at GSFC. Student(s) will be required to write a short research report.

Student's Computer and/or Special Skills: Experience with Matlab/IDL/Python/C++ programming will be added advantage.

Comments: Background in Physics/Astronomy/Physical science required.

Session and Student Info

Session(s): Summer 2018

This opportunity is for how many students per session? 5

Desired student academic level(s) at the time the opportunity would begin:
(Note: Freshman-Senior refer to college students, not high school)

College - Freshman
College - Sophomore
College - Junior
College - Senior

Academic discipline(s) that interested students should be studying.

Science - Astronomy
Science - Physical Science
Science - Physics
Other - Education

Work Site Location

NASA Center/Facility Name: Goddard Space Flight Center (GSFC)

- OR -

Non-NASA Facility Name: Catholic University of America

View Opportunity

View Opportunity

Opportunity Info

Opportunity Title:	Space Weather Forecasting Summer Internship
Opportunity Type:	Internship
Opportunity Description/Objective (specific student assignment):	This opportunity is about space weather forecasting and research for undergraduate students (rising sophomore, junior or freshmen in summer 2018), majoring or thinking to major in physics and astronomy. Internship will take place at NASA Goddard Space Flight Center, at the Community Coordinated Modeling Center (CCMC) (http://ccmc.gsfc.nasa.gov). If selected for this internship you will spend the summer training to be a space weather forecaster and have the opportunity to continue as a paid part-time remote forecaster throughout the academic school year. WHAT IS SPACE WEATHER? Our society depends on technology such as communication satellites and the power grid, but these technologies are vulnerable to space weather effects caused by the Sun's activity. WHAT IS Space Weather FORECASTING? Space weather forecasting at CCMC includes monitoring the Sun for solar flares and eruptions and making predictions on how these activities may impact NASA missions throughout the solar system. We also monitor and forecast the solar wind at Earth and changes in the Earth's magnetic field due to solar storms. WHO IS CCMC? CCMC provides researchers with access to space weather models through web-based simulation services and also evaluates space weather prediction models. Additionally, the CCMC space weather team provides space weather services to NASA missions using real-time simulations. WHY IS THIS INTERNSHIP UNIQUE? Students will attend a "space weather bootcamp" during the first week of the internship. These lectures will provide a basic knowledge of space weather and forecasting, without going into detailed physics. The following few weeks will be focused on hands-on space weather forecaster procedures training and mock space weather event analysis. The students will work as a group to carry out forecasting duties throughout the summer. For the second half of the internship students will perform short space weather research projects in groups. This internship may differ from others in this respect - the focus will be mostly on space weather forecaster training, and less on research. However, this internship provides a broad perspective on the field of space weather and a chance to interact with many different scientists. WHO ARE WE LOOKING FOR? This is an opportunity for highly-motivated and qualified undergraduate students (rising sophomore, rising junior or rising freshmen in summer 2018) who want to learn how to be a space weather forecaster.
Expected opportunity outcome (i.e. research, final report, poster presentation, etc.):	After successfully completing this summer internship, students will have a chance for a paid part-time (8-16 hours/week) space weather forecasting internship throughout the year (working remotely). After a trial period, remote student forecasters will be expected to work independently with access to an on-call scientist. Interns will also present their research at the GSFC intern poster session at the end of internship.
Student's Computer and/or Special Skills:	Students should show a strong work ethic, excellent analytical and computer skills, attention to detail, good teamwork and ability to work under time pressure.
Comments:	Preference will be given to the applicants who are available and interested to continue for the year-round forecasting opportunity.

Sample research Project at CCMC

Title: Study of geomagnetic field response to solar wind forcing.

Description: Interactions between the solar wind and the Earth's magnetosphere manifest many important space weather phenomena. For example, space weather-driven geomagnetically induced currents (GICs) that can disrupt operation of electrically conducting technological systems. The threat of adverse impacts on critical technological infrastructure, like power grids, oil and gas pipelines, and communication networks, has sparked renewed interest in extreme space weather. In this project, students analyzed geomagnetic and solar wind data to study the response of the Earth's magnetic field to changes in dynamic pressure. At the end of the project, students prepared and presented a poster at the NASA Intern Poster Session and at the 2017 AGU Fall Meeting.

Sample research Project at CCMC (cont.)

Method

Students worked with several data sources:

- 1.The interplanetary solar wind data was obtained from Coordinated Data Analysis Web (cdaweb.sci.gsfc.nasa.gov); the satellite ACE was used
- 2. The geomagnetic field data was obtained from the Real-Time Magnetic Observatory Network [INTERMAGNET] database (www.intermagnet.org).

Sample research Project at CCMC (cont.)

Published abstract (* = student)

Seunghoon Kim*, Xin Li*, M. Chantale Damas, Chigomyezo Ngwira (2017), Study of Geomagnetic Field Response to Solar Wind Forcing, Abstract ED11D-0148 presented at 2017 Fall Meeting, AGU, New Orleans, LA, 11-15 Dec.

15 AGU & AMS Presentations

Summer (2017): 8 Student presentations at AGU (10 students):

- Ariane Katrina Marchese, Marilia Samara, Robert Michell (2017), Quantifying Temporal and Spatial Characteristics of Pulsating Aurora (2017), Abstract SM41A-2669 presented at 2017 Fall Meeting, AGU, New Orleans, LA, 11-15 Dec.
- Sara Negussie et al., Is the Solar Magnetic Field Getting Weaker? (2017), Abstract ED11D-0151 presented at 2017 Fall Meeting, AGU, New Orleans, LA, 11-15 Dec.
- Mathew Allen Garcia, Karin Muglach, Oscillations In Emerging Active Regions on the Sun (2017), Abstract ED11D-0152presented at 2017 Fall Meeting, AGU, New Orleans, LA, 11-15 Dec.
- Brianna Frechette, M. Leila Mays, Validation of the Kp Geomagnetic Index Forecast at CCMC (2017), Abstract ED11D-0147 presented at 2017 Fall Meeting, AGU, New Orleans, LA, 11-15 Dec.
- Saif Sultan, Alden Jules, Paul Marchese, M. Chantale Damas (2017), An Investigation of Interplanetary Structures for Solar Cycles 23 and 24 and their Space Weather Consequences. Abstract ED11D-0150 presented at 2017 Fall Meeting, AGU, New Orleans, LA, 11-15 Dec.
- Yang He*, Karin Muglach (2017), The Magnetic Evolution of Coronal Hole Bright Points, Abstract ED11D-0146 presented at 2017 Fall Meeting, AGU, New Orleans, LA, 11-15 Dec.
- Seunghoon Kim*, Xin Li*, M. Chantale Damas, Chigomyezo Ngwira (2017), Study of Geomagnetic Field Response to Solar Wind Forcing, Abstract ED11D-0148 presented at 2017 Fall Meeting, AGU, New Orleans, LA, 11-15 Dec.
- David Buitrago and Raul Armendariz (2017), Inverse Flux versus Pressure of Muons from Cosmic Rays (2017), Abstract ED11D-0149 presented at 2017 Fall Meeting, AGU, New Orleans, LA, 11-15

Outcomes

- ✓ Exposure to scientists; real data
- ✓ Research skills
- ✓ Communication skills (oral, written)
  - ✓ Abstract, scientific paper, ppt presentation (oral), poster
- ✓ Computer skills (programming-Python, C++, Matlab, etc.)
- ✓ How to critique each other's work
- ✓ Attend and present at a scientific meeting
- ✓ Part of a community—support, help and mentor each other

Do I want to do this?

Challenges

- Start program from scratch
- Preparedness of students (math & science skills) (e.g., students have not had E&M or are just taking the first semester of calculus-based physics.
- Have students for only one year or maybe two.
- Time: heavy teaching load (4-5 courses/semester) plus research and committee work
- Funds to travel and pay students (always writing grants!!)
- Look for and foster research collaborations

Challenges

- Research projects that are manageable & at student's level, yet challenging
- Competition for students' time (courses, work, family, clubs, etc.)
- **Sustainability (Can we continue without the money? YES and NO)**

Total number of Participants

Spring 2015- Spring 2018: 39 students participated (eight dropped out)

Non-QCC: 4

4-Yr: 3

Males: 30 **Females: 9**

Summer program (2015-2017):

- NASA/CCMC (12 students): 4 forecast; 8 research
- CUNY: 9 research
- Brookhaven (BNL): 1

Acknowledgement

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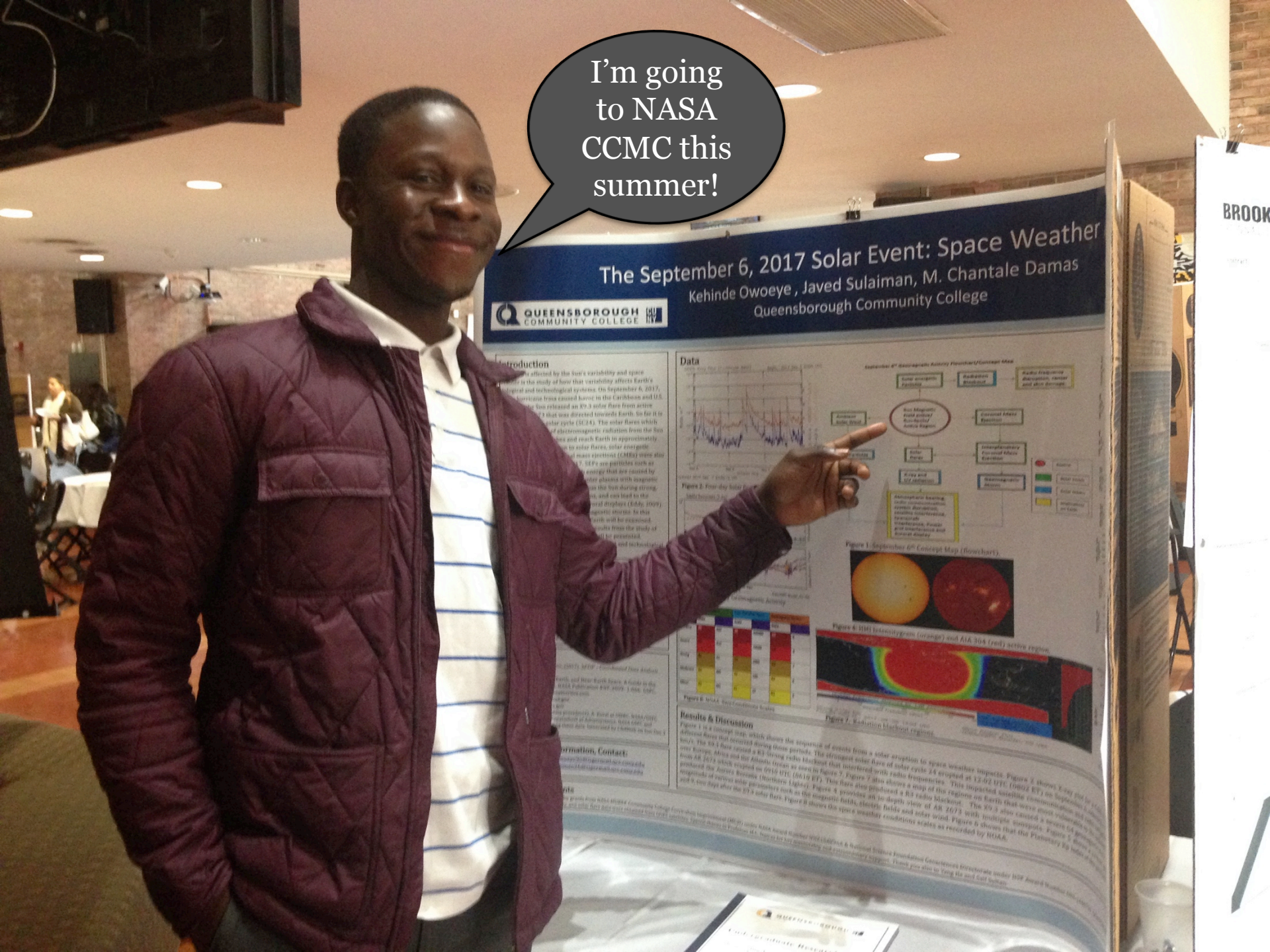
  - The CUNY Research Scholars Program & QCC Physics Department for travel funds.
- We would like to thank the CCMC Team for all of their support.
- We would also like to thank NASA Goddard Space Flight Center Data Facility (CDAWeb) for providing data; Space Weather.com; Spaceweatherlive.com, NOAA SWPC; Science@NASA Science


I'm going to NASA CCMC this summer!
The September 6, 2017 Solar Event: Space Weather
Kehinde Owoeye , Javed Sulaiman, M. Chantale Damas
Queensborough Community College
QUEENSBOROUGH COMMUNITY COLLEGE
Data
Results & Discussion