JPSS – Students Professional and Academic Readiness with Knowledge in Satellites (JPSS-SPARKS) :

A unique research and training model to create a diverse STEM workforce in NOAA mission related sciences

Shakila Merchant[1], Murty Divakarla[2], Mike Wilson[2], Mitch Goldberg[3] and Reza Khanbilvardi[1]

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[2]IMSG, Inc., College Park, MD
[3]NOAA-JPSS, 10210 Greenbelt Road Suite 800, Lahnam, MD 20706

November 28, 2016
CICS - Science Conference
ESSIC, University of Maryland, College Park, MD

NOAA Cooperative Remote Sensing Science and Technology (NOAA-CREST) 2001-2016

Now known as CSC Earth System Science & Remote Sensing Technologies (2016-2021)

- Education & Workforce Development

- Science, Engineering & Technology

Funded by the NOAA Educational Partnership Program with Minority Serving Institutions (EPP/MSI)

Assigned to NOAA -NESDIS

NOAA CREST Education Mission….

To <u>advance environmental literacy</u> and promote a <u>diverse workforce</u> in ocean, coastal, great lakes, weather, and climate sciences, <u>encouraging stewardship</u> and increasing informed decision making for the nation.

A future workforce, reflecting the diversity of the Nation, skilled in science, technology, engineering, mathematics, and other disciplines critical to NOAA's mission.
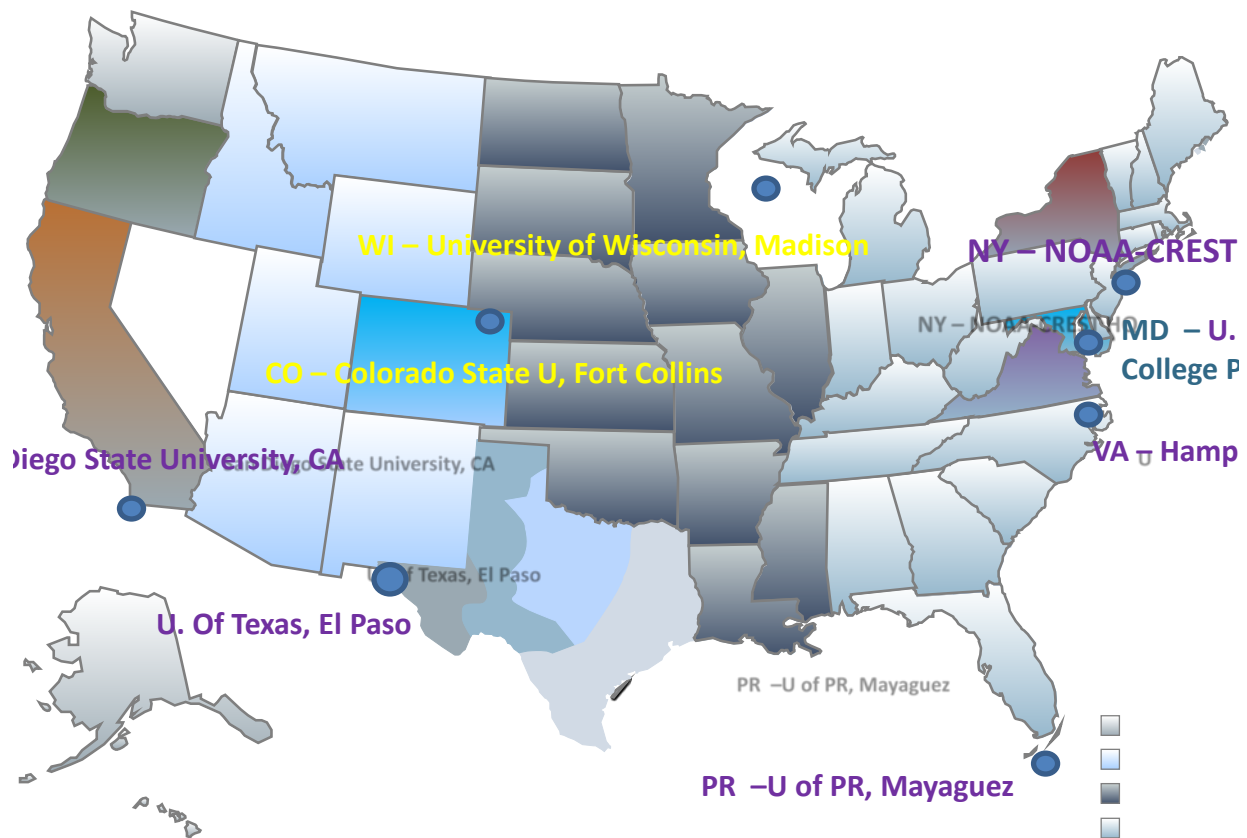
NOAA HEADQUARTERS ORGANIZATION

Science & Social Science →

← **Education and Workforce**

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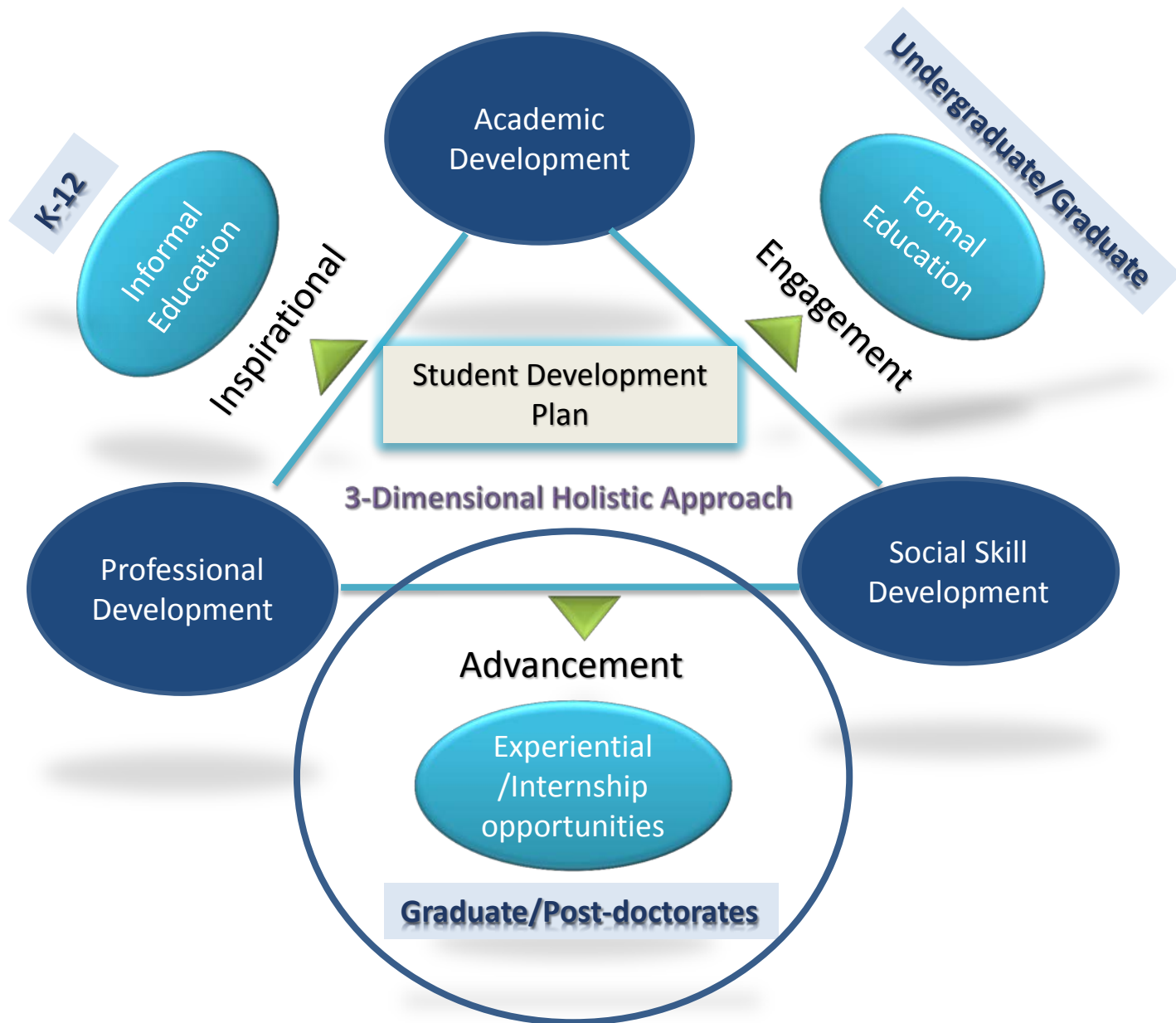Deputy Assistant Administrator
Laura Furgione

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RADM David A. Score

Deputy Director for Operations and Deputy Director, NOAA Corps
RDML Anita Lopez

Deputy Assistant Administrator for Programs and Administration
Thomas D. Crowley

OMAO ORGANIZATION

Key: (A) = Acting   Last updated: 11/4/16

K-12

Undergraduate/Graduate

Academic Development

Informal Education

Formal Education

Inspirational

Engagement

Student Development Plan

3-Dimensional Holistic Approach

Professional Development

Social Skill Development

Advancement

Experiential /Internship opportunities

Graduate/Post-doctorates

CREST GRADUATES – Success stories

Federal, Other Government Agencies

Martin Yapur (2002)
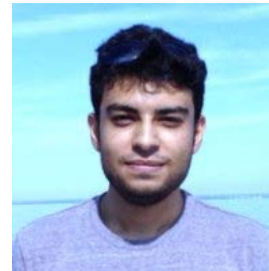
Michael Edwards (2004)

Kwan-yin Kong (2006)

Marco Vargas (2006)

Lilybeth Colon(2010)

**Lina Cordero
(Patent Office)**

**Soe Hliang
(Patent Office)**

**Amir Ibrahim
(NASA Goddard Center)**

CREST GRADUATES – Success stories

Federal Contractors

Daniel Comorazamy (NOAA)

Chowdhury Nazmi (Noblis - NOAA)

Julius Adenihun (NOAA-NGI)

Narges Shahroudi (NOAA JCSDA)

Industries and Labs

Leona Charles (2008) Northrop Grumman

Ankur Agarwala (Northrop Grumman)

Nikisa Jordan (2010)

Ruhul Amin (2012) BioOptSense

Juan Arevalo (2006) Michael Baker, Inc. NY

Industries and Labs

David Daniel
(Cloudera –
Software
Developer)

Ioannis Ioannou
(Morgan Stanley IG)

Gary Bouton
(Citi)

Jose Infante Corona
(AMEC Construction)

Crae Sosa
Homer Logistics

Academia

Viviana Vladutescu,

M. Z. Rahman,
LaGGC, CUNY

Yasser Hassebo ,

Faculty at LaGCC,
CUNY

Kibrewossen
Tesfagiorgis, BMCC

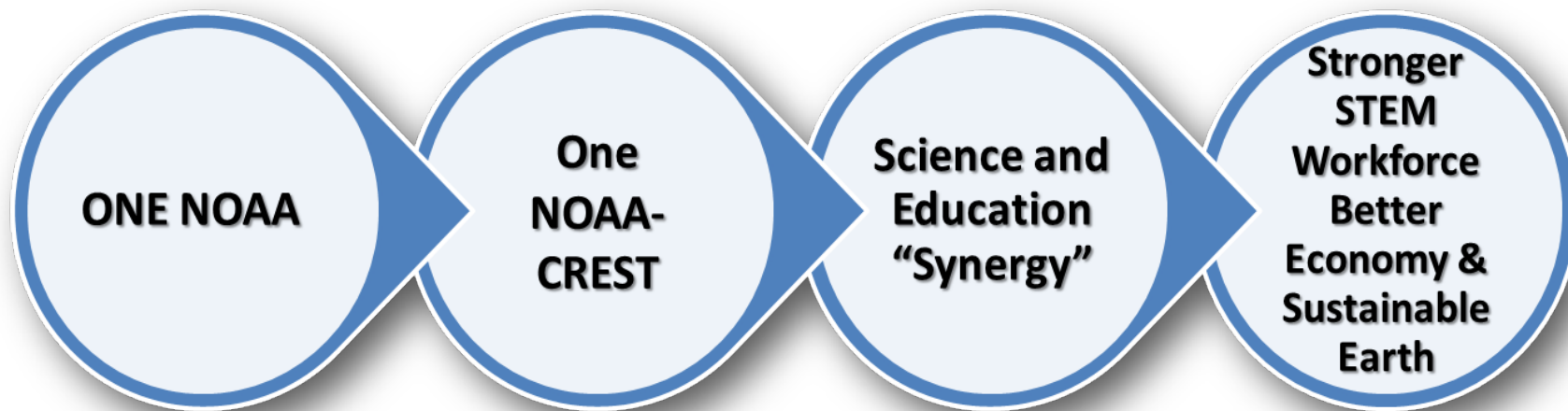Dugwon Seo , QCC

Jonathan Munz ,
UPRM

Employers that hired CREST Students (Partial List)

Federal/ State/Local Agencies	Federal Contractors	Industries	Academia/ University	Private /Env. Companies
NOAA, NASA, DOC/NIST	US Army of Aberdeen Proving Ground	Raytheon	City University of New York	Goldman Sachs Other fortune companies
EPA	Defense Contractors (IIT)	Northrop Grumman	University of Maryland, College Park (CICS)	Baker International
NAVY	Army Research Lab	IIT, NY	University of Maryland, Baltimore County	EnTech Engineering, P.C
US Army Corps	NAVEA, Navy	ConEdison, NY	University of Wisconsin, WI (CIMSS)	Arecibo Lab, PR
Fire Department, NY, NYDEP	NOAA and NASA contractors		Penn State University	Battelle Memorial Institute
Food & Drug Administration (FDA)			U. Of P. Rico, Aguadilla	Wakefern
			Utah State U, Salt Lake City	SHARP, USA
				TYCO, Eng Co.

Impacted more than **700 students**, **70% of which are from the underrepresented minority community.**

Coastal Resilience ◉ Atmospheric Hazards ◉ Water Prediction ◉ Surface Fluxes

9 CREST graduates are currently working at NOAA

ONE NOAA → **One NOAA-CREST** → **Science and Education "Synergy"** → **Stronger STEM Workforce Better Economy & Sustainable Earth**

Recruitment Analysis Data System (RADS) positions represents federal positions that have been vetted through WFM and may be advertised on USAJobs.com

RADS Positions
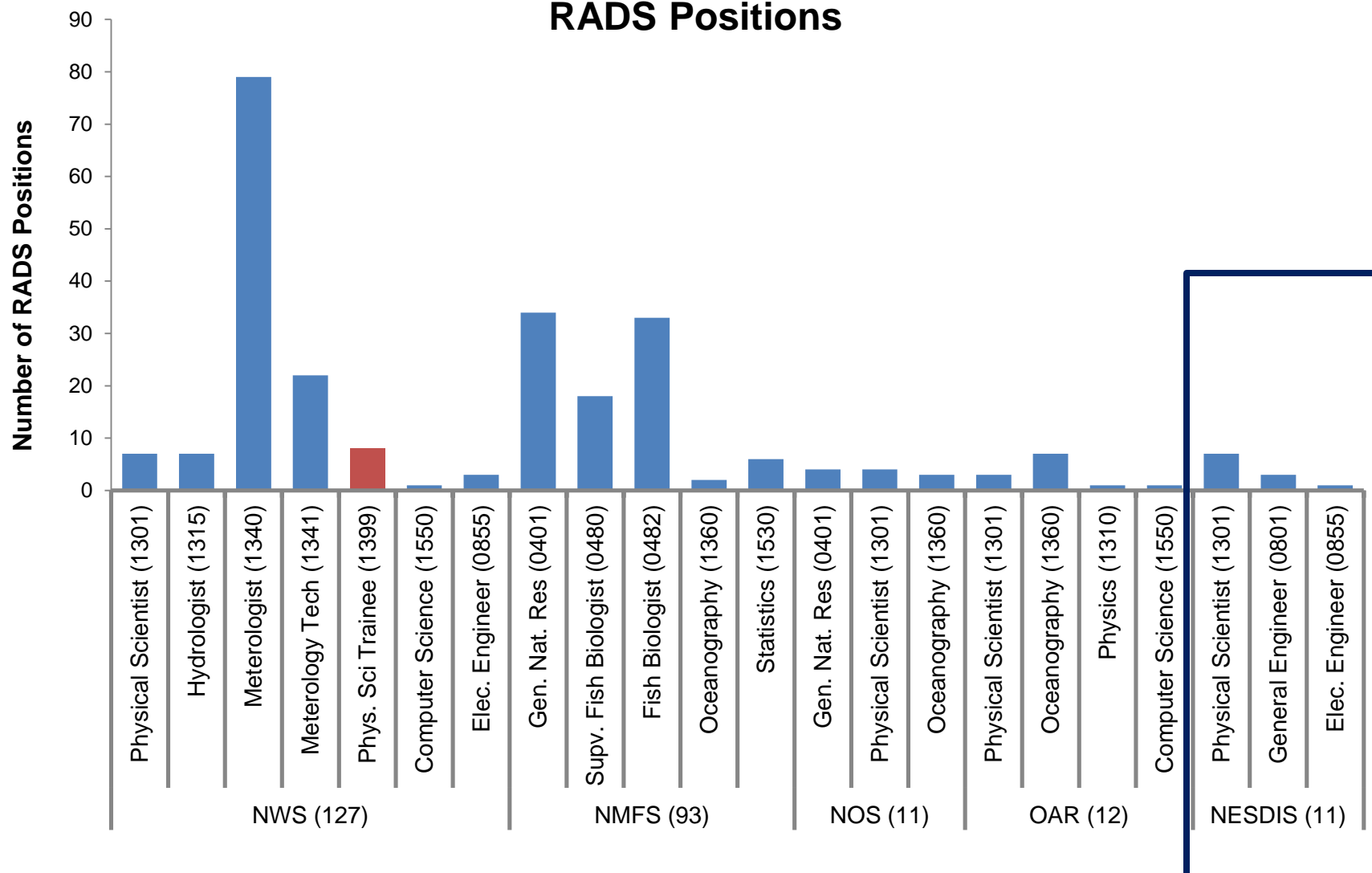
Source: NOAA Office of Education –Rotational Assignment Report 2015

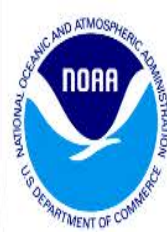JPSS–STUDENTS PROFESSIONAL & ACADEMIC READINESS WITH KNOWLEDGE IN SATELLITES (SPARKS)

CREST JPSS OUTREACH AND EDUCATION

Why, When and How

2012-2013 Mitch Goldberg, Chair of the NOAA CREST Advisory Board

2014 7th Biennial Education and Science Forum, UMES, MD
Private Sector Jobs Panel Session

National Oceanic and Atmospheric Administration
Educational Partnership Program
7th Biennial Education and Science Forum
Registration Is Over

UNIVERSITY of MARYLAND
EASTERN SHORE

2014-15 JPSS funding for Workforce Training in NOAA/JPSS sciences

Federal

Academia

Private Sectors

Diverse Workforce

JPSS **+** NOAA-CREST/CUNY **+** IMSG, MD **=** **Next Gen JPSS Scientists**

AMS 2015 sparked the
JPSS SPARKS

February 2016 kickoff at CICS, UMD

A unique Partnership between Federal, Academia and Private Sector in Diversity and Inclusion Initiative
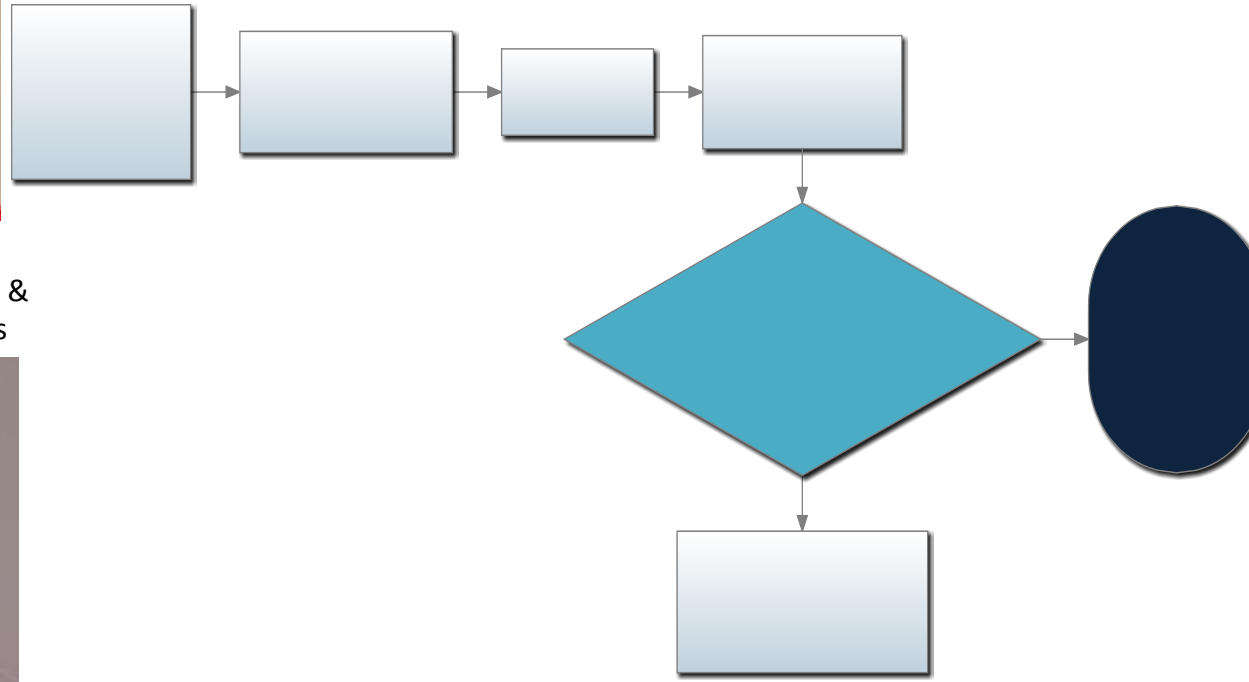
David Melecio-Vazquez, PhD Candidate, Mech. Engineering

Cassandra Calderon, Masters Student, Earth & Atmospheric Sciences

Elius Etienne, PhD Candidate, Civil Engineering

Ivan Valerio, Masters Student, Electrical Engineering

Expected Outcome:

- **Increased knowledge-base on NOAA related sciences - climate, weather and Oceans.**
- Scientific **publication and presentation** at national level conferences such as AGU, AMS, IGARS, IEEE, SPIE, NOAA CoRP and NOAA-CREST Annual Symposium.
- Build a robust pathway to STEM and **NOAA JPSS related workforce**
- **Increased job-skill sets** particularly in NOAA-JPSS related science and missions.
- **Increased collaborations** between NOAACREST/University Faculty members and NOAA (JPSS) Scientists, IMSG and its other stakeholders.

Summer Training housed at IMSG and ESSIC/CICS June-August 2016

IMSG

- **Training/Workshop Design**
  - Dr. Murty Divakarla, Dr. Mike Wilson, Tom King, Shanna Sampson, Dr. Valerie Mikles, and Dr. Bigyani Das

IMSG Implementation

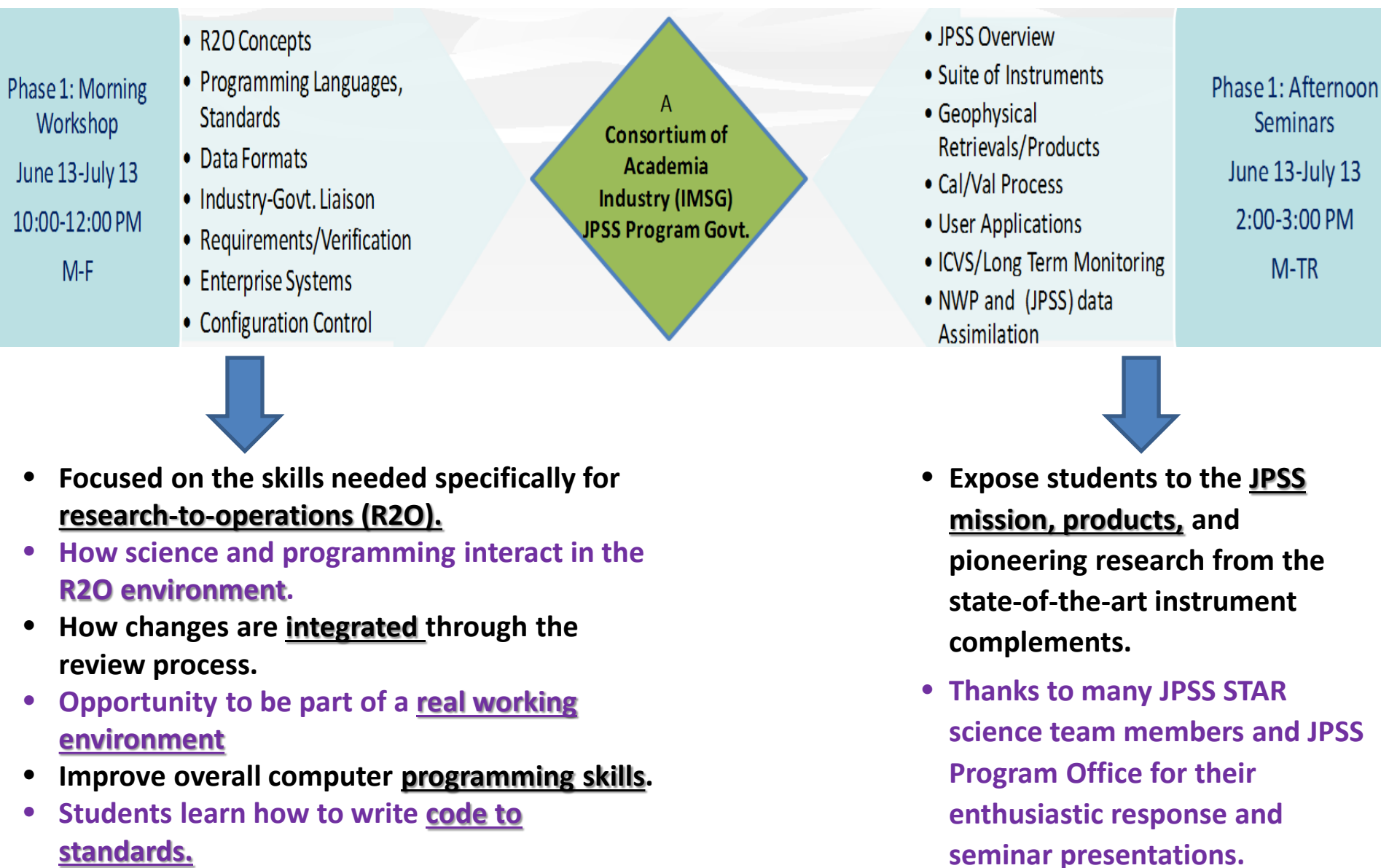- **Technical Team Lead: Dr. Mike Wilson   Convener: Dr. Valerie Mikles**
  - Contributors: Dr. Mike Wilson, Tom King, Dr. Anil Kapahi, Claire McCaskill, Dr. Valerie Mikles, Yunhui Zhao, Dr. Murty Divakarla, Dr. Bigyani Das, Zhuo Zhang, and Shanna Sampson

CICS Partnership

- Thanks to **Dr. Fernando Miralles-Wilhelm, Dr. Hugo Berbery**
- Staff/Logistics Coordination – Debra Baker, and CICS IT team

CUNY/CREST-IMSG Training Program

- ## Phase 1: First 4 weeks
  - IMSG teams with JPSS Program/STAR scientists provided student training.

- ## Phase 2: Week #5 and beyond
  - Students focused on their research ideas with mentors.

| Phase 1: Morning Workshop

June 13-July 13

10:00-12:00 PM

M-F | • R2O Concepts
• Programming Languages, Standards
• Data Formats
• Industry-Govt. Liaison
• Requirements/Verification
• Enterprise Systems
• Configuration Control | A
Consortium of Academia Industry (IMSG) JPSS Program Govt. | • JPSS Overview
• Suite of Instruments
• Geophysical Retrievals/Products
• Cal/Val Process
• User Applications
• ICVS/Long Term Monitoring
• NWP and (JPSS) data Assimilation | Phase 1: Afternoon Seminars

June 13-July 13

2:00-3:00 PM

M-TR |

- **Focused on the skills needed specifically for research-to-operations (R2O).**
- **How science and programming interact in the R2O environment.**
- **How changes are integrated through the review process.**
- **Opportunity to be part of a real working environment**
- **Improve overall computer programming skills.**
- **Students learn how to write code to standards.**

- **Expose students to the JPSS mission, products, and pioneering research from the state-of-the-art instrument complements.**
- **Thanks to many JPSS STAR science team members and JPSS Program Office for their enthusiastic response and seminar presentations.**

IMSG-JPSS Training Participants
- Cassandra Calderella
- David Melecio-Vazquez
- Elius Etienne
- Ivan Valerio

GRTSP Fellows, and Contractors benefited from the Training
- Steven Buckner, Hampton U
- Equisha Glenn, CUNY
- Tracey Dorian (IMSG)

GRTSP Interns part of this presentation
- Carlos Luis Pérez Díaz, CUNY
- Equisha Glenn, CUNY

Participation at the
JPSS Annual Science Team Meeting (August 8-12, 2016)

Thermal Boundary Layer Retrievals over the Washington D.C. Metro Area using NUCAPS-EDR

David Melecio-Vazquez

Mentor(s): Dr. Mark Liu, STAR & Dr. Nicholas Nalli, IMSG
Affiliation: IMSG-CUNY Student Training Program
dmeleci00@citymail.cuny.edu

Objectives of this poster:

- Evaluation of Boundary Layer Retrievals.

- Observation of Vertical Profiles During Convective Boundary Layer Conditions.

Future/Ongoing Work:

- Observe urban-rural temperature differences in space: horizontal and vertical using NUCAPS-EDR profiles.

[1] NUCAPS-EDR Field-of-Views (red) and the RAOB launch path (blue) over the Washington D.C. Metro Area.

[2] Surface virtual potential temperature, θ_v, interpolated over the Washington D.C. metro area.

NUCAPS-EDR for 20120610 : θ_v at P(mb) = 1013.948
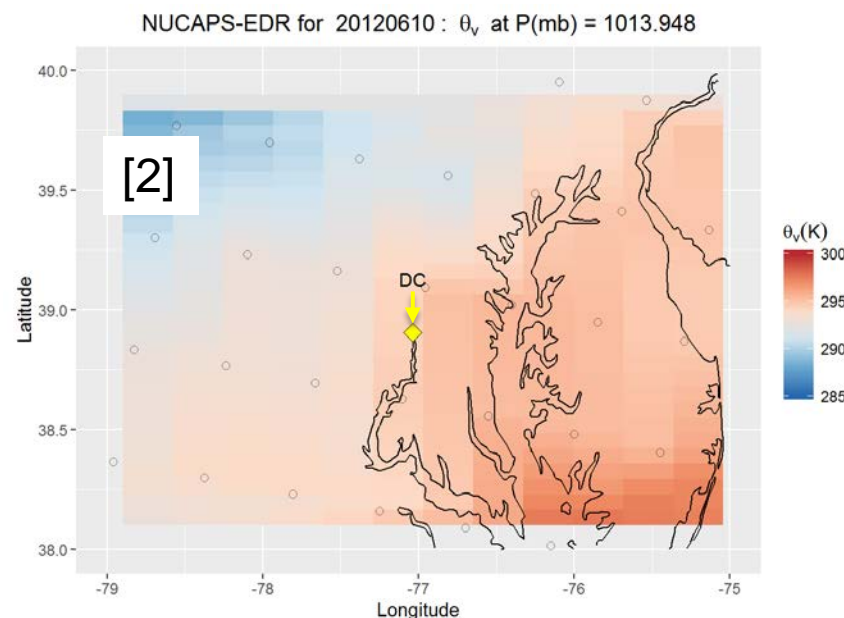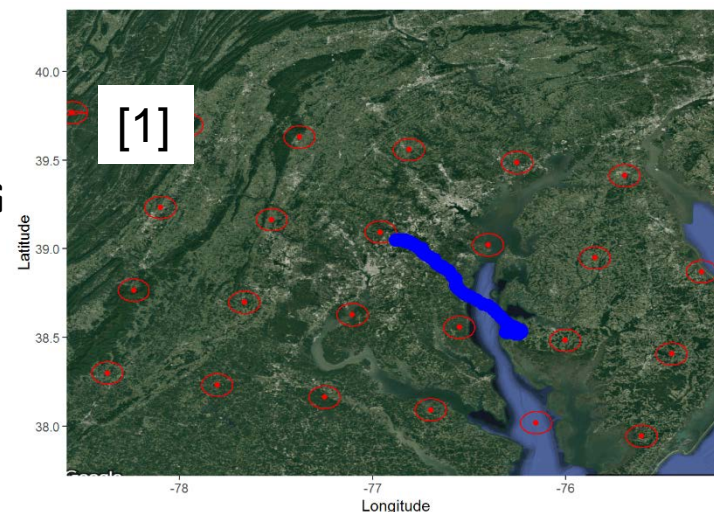
Validation of Suomi NPP OMPS-LP Ozone Measurements

Steven Buckner
Mentor: Dr. Larry Flynn, STAR
**Affiliation: NOAA-CREST/Hampton University SSIO**
stevenb1@umbc.edu

Objectives of this poster:

- Show validation of OMPS Limb Profiler ozone volume mixing ratio measurements by comparing them to MLS
  - Daily Global Averages
  - Collocation Comparisons

Future/Ongoing Work:

- Long-term comparisons and statistics

- Using OMPS/MLS validation to later validate SAGE III ISS when it launches in November, 2016
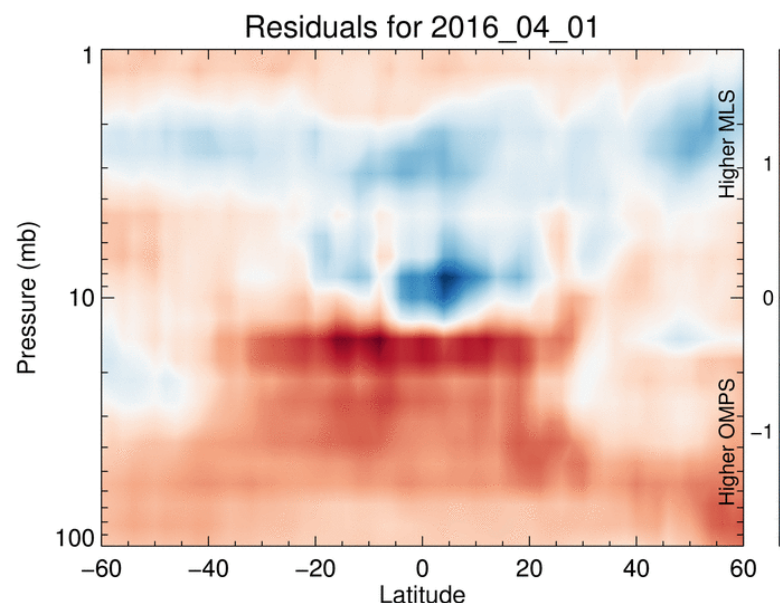
Daily global average residual measurements for April, 2016

Validation of SMAP Soil Moisture Data using Field Measurements in New York

Cassandra Calderella
Mentor: Dr. Xiwu Zhan, STAR
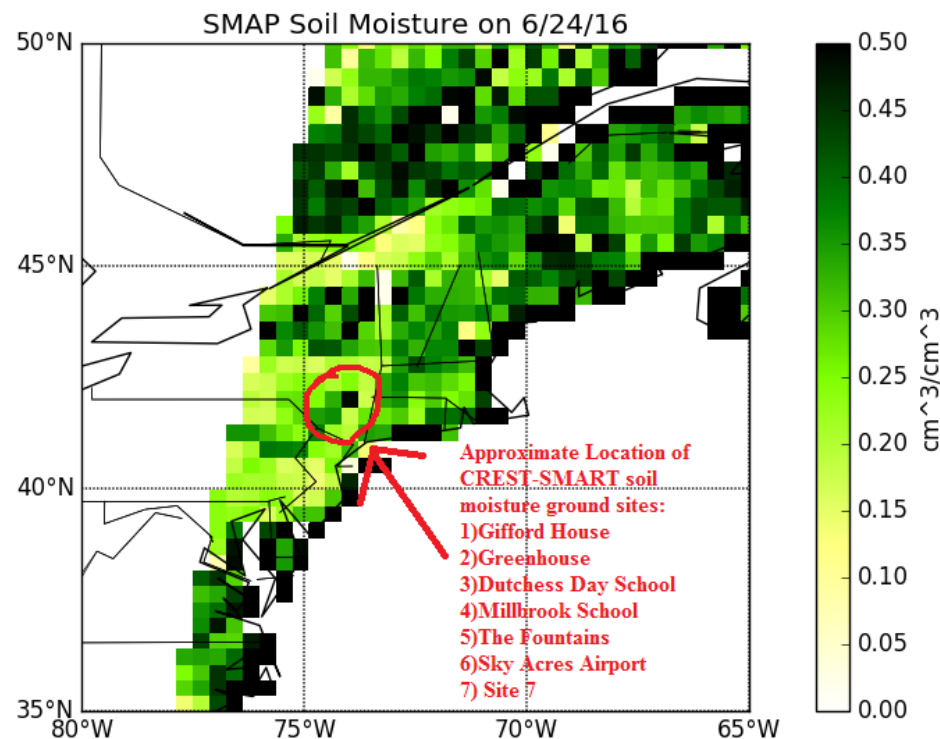## Affiliation: IMSG-CUNY Student Training Program

ccalder001@citymail.cuny.edu

Objectives of this poster:

- Collect in situ data from CREST-SMART ground stations.

- Collect soil moisture data from SMAP for the same latitudes and longitudes as the ground stations.

- Perform statistical analysis for data validation.

Future/Ongoing Work:

- Apply the same validation technique using field measurements in Puerto Rico (NRCS' SCAN Network)

- Repeat the process with other satellite instruments such as SMOS and GCOM-W1.

SMAP Level 3 Soil Moisture in the Northeast, showing the location of the CREST-SMART ground stations.

Detecting spatiotemporal changes in vegetation using polar orbiting satellite data for the past 35 years - Case study: Haiti.

Elius Etienne
**Mentor: Dr. Felix Kogan, STAR**
Affiliation: IMSG-CUNY Student Training Program, eetienn000@citymail.cuny.edu

Objectives of this poster:

o Detecting the trend in vegetation for different period of the year

o Validate the findings with ground based data

Future/Ongoing Work:

o Expand the work to larger regions/countries and detect the trend in vegetation across latitudes (north-south transect).

Slope – SMN TS (week '12' of each yr) – [1982 – 2015]
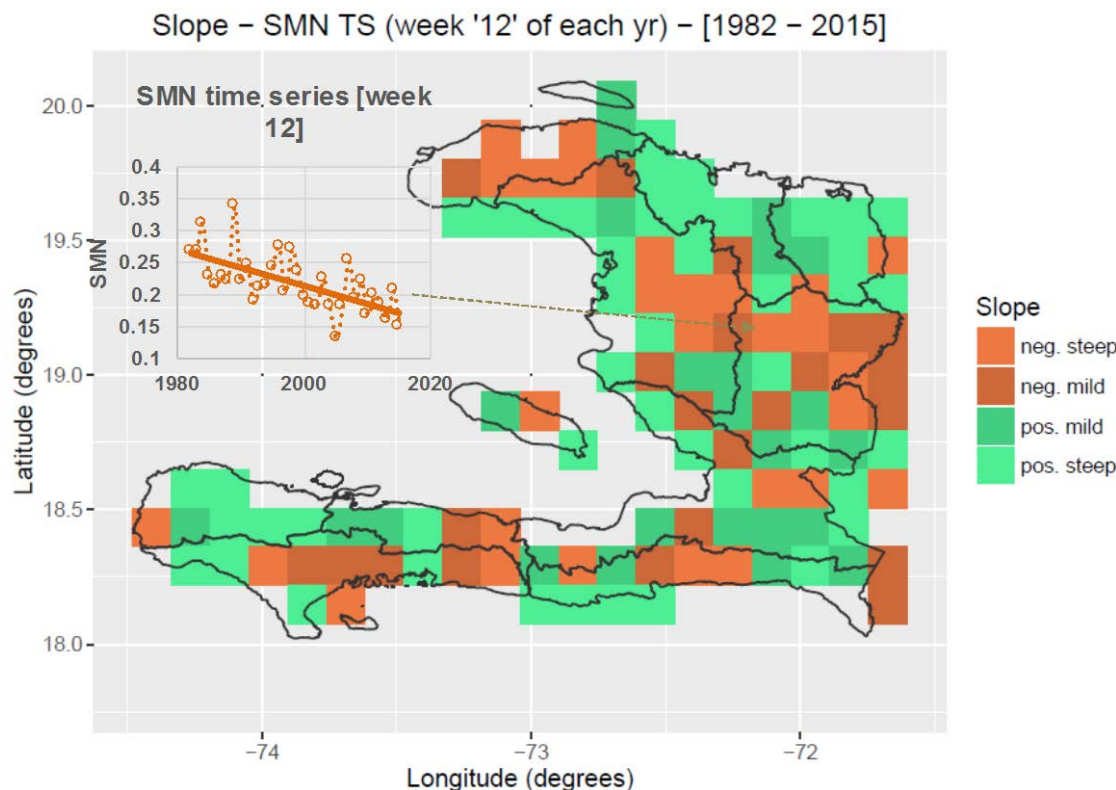
An evaluation of the VIIRS radiative signal from the Fort McMurray fire

Ivan F. Valerio

Mentor: Dr. Ivan Csiszar, STAR

**Affiliation: IMSG-CUNY Student Training Program**

valerioif@gmail.com

Objectives of this poster:
- Observe signals detected by VIIRS SDR
- Determine pixels with saturation
- Apply statistical analysis
- Comparison of various bands observing the same event

Future/Ongoing Work:
- Observe other possible cases of pixel saturation
- Generate more statistics to a wider set of events, and determine saturation level
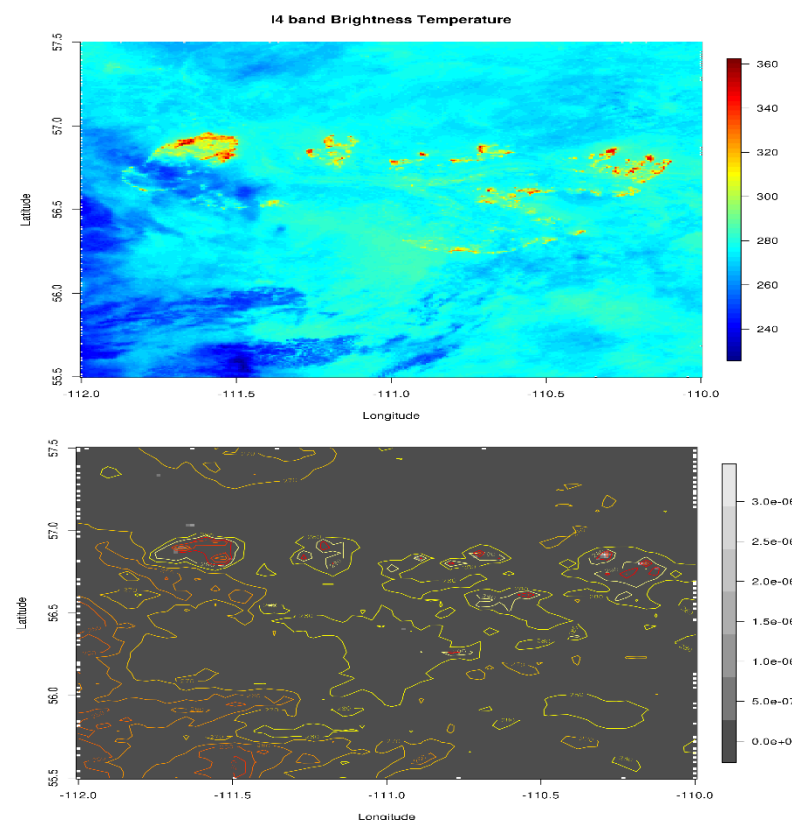
Figures on brightness Temperature distribution on McMurray fire site

MiRS and HUT Snow Microwave Emissivity Comparison with In Situ Microwave Emissivity from CREST-SAFE and SSMIS retrievals

Carlos Luis Pérez Díaz

**Mentors: Quanhua "Mark" Liu and Christopher Grassotti (STAR)**

Graduate Research and Training Scholarship Program

Objectives of this poster:

- Compare MiRS and HUT snow MW emission retrievals with in situ derived snow MW emission at CREST-SAFE for winter 2015

- Validate SSMIS analytic MW emission retrievals with in situ derived snow MW emission at CREST-SAFE for selected cases of the 2015 time series

Future/Ongoing work:

- Quantitative comparison between MiRS and HUT for winter 2015

- Integrating snow wetness onto MiRS for snow MW emission simulations

Evaluation Metrics
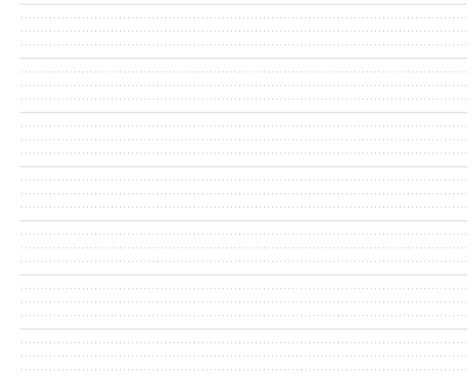
- Metrics were given during Week #1 and Week #5.

- Week #1 served as a baseline to adjust planned lectures, and Week #5 tested knowledge immediately after workshops ended.

- Students already showed knowledge of Linux and Python Programming

- We were able to build from the basic understanding to language-specific skills

Pre-Test & Post-Test Surveys

	Activities	Week 1	Week 5
1	General Program Knowledge of the JPSS Mission	10%	100%
2	Coding in Fortran 90, C++, and PERL.	10%	75%
3	Coding Standards/Configuration Management	0	50%
4	Algorithm Change Process	0	25%

Increased knowledge-based - JPSS Mission & Coding ability.

Mentor Feedback

- **Primarily positive feedback from mentors about students:**
  o Individual students were praised as self-motivated, organized, knowledgeable, and skilled programmers.
  o Mentors were either satisfied with the mentor time they had or wanted even more time for student interaction.

- **Mentors had orientation suggestions for next year, including:**
  o Providing and teaching JPSS visualization software
  o Teaching presentation skills (oral, poster, etc.)
  o Encouraging a mix of workshop and mentorship duties for students from Day 1 of their mentorships to extend the duration of mentor interaction.

- Students echoed many of these suggestions at the ends of their internships.

Outcomes and Impacts

Students' **Increased knowledge-base on NOAA related sciences** and how NOAA does its job in keeping the society well informed about extreme weather events and other events related to **climate, weather and Oceans.**

Scientific **publication and presentation** at national level conferences such as AGU, AMS, IGARS, IEEE, SPIE, NOAA CoRP and NOAA-CREST Annual Symposium.

Build a robust pathway to STEM and **NOAA JPSS related workforce**

Increased job-skill sets particularly in NOAA-JPSS related science and missions.

Increased collaborations between NOAACREST/University Faculty members and NOAA (JPSS) Scientists, IMSG and its other stakeholders.

Increased visibility of JPSS satellite program among scientific and particularly **student's community** that directly aligns with NOAA's missions of Weather Ready Nation; healthy coasts, resilient coastal communities, and adapting and mitigating climate change.

Take Home!

- **IMSG-CUNY put their best foot forward to strengthen the ability of the young generation STEM Professionals for job-ready training in NOAA (JPSS) related Sciences**

- **Students learnt more <u>outside of academic learning environment</u>**
    - State-of-the art JPSS instruments
    - Algorithms for Sensor and
    - Environmental Data Records (SDR/EDRs), and
    - Product applications.
    - Programming languages
    - Research into operations.

- Best **practice and synergy** between Private Sectors-Government-Academia

JPSS Education Proving Ground (Future Plans)

- **Increase Workforce in NOAA mission related STEM fields** (contractors – IMSG/MOUs)

- **Create core-competency curriculum** - in form of seminars/online course by NOAA federal and affiliates

- **K12 curriculum & outreach** – **interactive games using UNITY** (JPSS satellites) engagement/ inspiration/ pipelining and recruitment

- **Scale up** the JPSS SPARKS to other CREST partners and Universities perhaps other NOAA CSCs

- Expand and include other core-competencies – **Data Assimilation** (Forecast Models); **Radiative Transfer Algorithms** (Fast Models); **Algorithm Support** – Coding, Testing, Improvements and Integration; **Scientific Stewardship** (Data Archiving, Integrated Products; and **Remote Sensing** [MW/IR] (Ocean, Water, Land, Atmosphere – Air Quality, Vegetation, Droughts, and Fires)

- Explore similar outreach activity/training for other satellite programs (**GOES-R**).

Thank You

JPSS Program Office

NCWCP Scientists who delivered talks on JPSS Science and Data Products

JPSS Program Office, NCWCP Scientists who delivered talks on JPSS Science and Data Products, and Valuable Advice to Students	
Mitch Goldberg, JPSS Program	Fuzhong Weng, STAR
Arron Layns, JPSS Program	Denis Tremblay, (SDPI)
Lihang Zhou, STAR	Larry Flynn, STAR
Walter Wolf, STAR	Shobha Kondragunta, STAR
Jaime Daniels, STAR	Ivan Csiszar, STAR
Corey Guastini, EMC	Jeff Key, STAR
Wesley Ebisuzaki, NCEP	Ralph Ferraro, STAR
Changyong Cao, STAR	Lori Brown, (SCI)
Many IMSG Scientists on Programming, Research, CM	Ninghai Sun, (STAR)

Thank you

Questions