Data/Time: August 12-23, 2013 10:00 AM – 3:00 PM
Location: FIU Modesto A. Maidique Campus, Room PC 442

PI: Haiyan Jiang, FIU Department of Earth & Environment (Office PC 342B)
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Co-I: Robert Rogers, NOAA Hurricane Research Division (HRD)
Evaluator: Stephanie Doscher, FIU Office of Global Learning Initiatives

Graduate Student Leaders (Office PC 329):

Cheng (Emmy) Tao   Email: ctao003@fiu.edu
Margie Kieper   Email: mkiep001@fiu.edu
Yongxian (Isaac) Pei   Email: ypei002@fiu.edu

Selected Undergraduate Student Interns:

Alannah Irwin
Albert Betancourt
Amanda Zapata
Juan Pena
Nathassha Astorga
Stephanie De Souxa
Yamil Perez

Objectives:
1) Increase the participation of minorities and women in the field of meteorology and remote sensing
2) Offer direct research experience for undergraduate students
3) Enhance presentation skills of students who are minorities and women
4) To inform participants about NASA's mission activities and graduate fellowship/internship opportunities, and meteorology career opportunities requiring skills in acquisition, processing, and interpretation of NASA remote sensing data
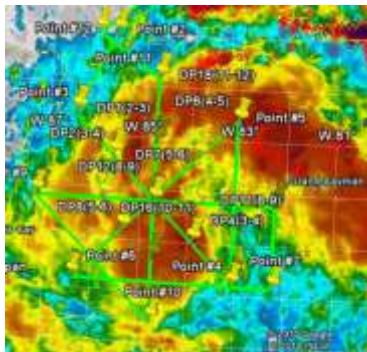
Introduction:

Hurricanes are the number one natural disaster in Florida. Before making landfall, a hurricane usually generates and evolves over ocean for a period of 1-15 days. Therefore, NASA's satellite and aircraft remote sensing data sets play a vital role in monitoring and forecasting hurricanes. However, these remote sensing data, acquired at great expense and made freely available to the scientific community, are not being used to their full potential due to the lack of opportunities to learn basic skills needed to access and analyze the data for hurricane prediction. In addition, government organizations and private companies in meteorology are also in need of skilled works who can interpret air-borne and space-borne remote sensing data for forecasts of hurricanes and other weather systems.

It is also of utmost importance for minority-serving institutions to retain students in the related field. Therefore, the central goal of this Internship is to provide a new summer education and research program for undergraduate students at Florida International University (FIU), to provide learning and research experiences for the future workforce, and thereby to engage more Americans in NASA's mission and to strengthen the future workforce of NASA, other government agencies, and private companies.

Internship Description:

The internship is a combination of lectures, labs, a trip to HRD, a guest speaker, and the final research project and presentation. Detailed descriptions of each aspect of the program are listed below:

1. Lectures:

Designed to be interactive and informative to build a background of essential Tropical Cyclones and Remote Sensing knowledge needed to conduct scientific research. Students are expected to interact during lecture when questions are posed and ask questions on topics they do not understand:

1) Research and Presentation Skills: Monday 8/12
-Introduction to the Scientific Method
-Importance of asking questions
-Using sources, searching for journal articles, citations
-Making good arguments
-Creating figures and visual images
-PowerPoint: proper and improper usage
-Speaking clearly, eye contact
-Handout final presentation rubric and explain evaluation criteria

2) Satellite Remote Sensing I: Tuesday 8/13
-Why use satellites, benefits of satellites compared to ground-based measurements
-Definition of remote sensing, Active vs. Passive sensors

-Electromagnetic Spectrum, wavelength, frequency

-Properties of visible, IR, and microwave spectrum

-Planck's Law: What is Brightness Temperature and how to calculate it

-Interpreting visible Images

-Interpreting IR images

-Interpreting WV images

3) Tropical Cyclones: Wednesday 8/14

-Climatology and historical tracks

-Saffir-Simpson Scale

-3D Structure and Flow Balances

      (Show cross-sections of pressure/rain/wind speed similar to a recon pass)

-6 conditions required for formation

-Genesis (Easterly Waves, Monsoonal Trough)

-Properties of intensifying TCs

-Maximum potential intensity

-Properties of weakening/landfall TCs (shear, landfall, EWC, cold water, extratropical transition)

-Estimating intensity from Satellites: Dvorak Technique

4) Satellite Remote Sensing Part II: Thursday 8/15

-More details on the Microwave Spectrum

-Scattering: Rayleigh/Mie/Geometric Optics

-Microwave Precipitation Estimation (Passive)

-Vertical structure of clouds

-Ocean vs. Land

-Polarization

-Overview of important satellites: TRMM, AMSU, SSMI, WindSat

-Absorption Bands/Channel Selection

-Total Precipitable Water (TPW), comparison to Water Vapor IR imagery

-Saharan Air Layer

-Precipitation Radar, comparison to ground-based radar

-Image interpretation: 37 GHz, 85 GHz, Rain rate—emphasize relation to RI

-Sea surface temperature

-Satellite derived surface wind speed/direction

5) Interpreting Microwave Satellite Imagery

-Relation between 37 GHz color imagery and intensity changes

-Uses for 85 GHz and surface wind vector products

-Interpreting aircraft recon data messages

6) Forecasting/Modeling: HWRF, SHIPS RI Index—Monday 8/19

-Data collection and observation in the tropics

-Data analysis and assimilation

-Brief overview of numerical model fundamentals

-Ensembles

-Factors that influence motion and intensity

-Statistical models

-The role of forecasters and the NHC

-HWRF overview with sample output

-SHIPS RI overview with sample output

7) Inner Core Dynamics: Hot towers and Eyewall Replacement Cycles/Relation to RI—Tuesday 8/20

- Sensible heat and Latent heat

- Basics of Tropical Cyclone Structure and Flows

- Convective Structure of the Eyewall Region

- Rainbands

- Stratiform Precipitation Region

- Maximum Potential Intensity (MPI)

- Convective Eyewall Cycles/Eyewall Replacement Cycle

- Rapid Intensification (RI)

- Convective bursts/Hot tower

2. Labs:

During the first week, we will have two lab activities to help the group practice for the final research project. Students are encouraged to work together and will have about 2 hours to complete the lab activity. At the end of the lab, everyone will present their results in a brief PowerPoint presentation to the group and take questions.

Lab 1: Using IDV to access and analyze GOES satellite data
Objectives:
-Become familiar with using a software package (IDV) to view satellite images
-Understand the differences between Visible, IR, and Microwave Imagery
-Observe the influence of dry air and wind shear on TC intensity
-Measure brightness temperature values of IR imagery
-Read surface observations and compare to satellite imagery

Lab 2: TC Image Websites
Objectives:
-Become familiar with online resources and image searching tools
-Interpret different types of satellite imagery
-Learn about the variety of different types of TCs and the best images to use with each characteristic

Friday 8/16: HRD Trip
-Meet at FIU, PC 324 at 9:30 AM
-We will drive as a group to HRD and return to FIU by 3:00 PM
-The Hurricane Research Division (HRD) is a part of the NOAA Atlantic Oceanographic and Meteorological Laboratory (AOML) located in Miami Florida. HRD is one of the most sophisticated labs dedicated to hurricane research. FIU is collaborated with HRD and University of Miami in meteorology through a newly formed research center called CIMAS (Cooperative Institute for Marine and Atmospheric Studies). HRD is engaged in advancing the basic physical understanding and improving the forecasts of hurricanes and tropical meteorological systems. A key aspect of HRD's activity is its annual field program of flights aboard NOAA's research aircraft.
-Robert Rogers will lead the HRD tour, including a tour of the facilities and an overview of how to access HRD's aircraft data. In addition, we will listen to a research presentation from Robert Rogers and listen in on the daily tropical map discussion.

Guest speakers:
Guest Seminar: Dr. Hugh Willoughby, Monday Aug. 19th
Guest Seminar: Dr. Ping Zhu, Wednesday Aug. 21th
Guest Seminar: Dr. Haiyan Jiang, Thursday Aug. 22th
Graduate student presentations: Margie Kieper, Monday Aug. 19th

Second Week: Final Project/Presentation:
-The final research project and presentation will provide direct and hands-on research experiences in remote sensing applications in hurricane monitoring and have the students become interested in applying NASA remote sensing technologies to address meteorology problems relevant to an actual career at NASA.
-A list of relevant hurricane cases from the last several years has been selected. The students will each choose one topic, although students with similar topics should work closely together. The goal of the project is to generate a series of analyses in terms of the relationship between remote sensing parameters of hurricanes and the storm intensity and intensity change. Each student will be expected to produce scientific results about how the hurricane intensity is associated with the remote sensing parameters during the storm's life time. Each student will present their research results on the last day of the 2-week program in a 10 minute presentation similar to a research seminar or conference (about 8-10 minute presentation, 2 minutes for questions.
-The presentations will start at 1 PM on Friday, August 23rd in Room PC 442. You are free to invite friends and family if you wish. There will be a reception afterwards in room PC 442 at approximately 3:00 PM.

Lunch:
Lunch will be provided in the conference room, PC344. We have lots of flexibility for ordering and we will take suggestions on the first day.

Stipend
The student stipend is $200 for participating in the internship. It should show up as a tuition adjustment or possibly a direct deposit if you are employed by FIU. Let us know if you do not receive the stipend by September 1st.

Evaluation of the Program:
-Impacts of the proposed program will be evaluated with a detailed evaluation plan in consultation with the associate director (Stephanie Doscher) of FIU Office of Global Learning Initiatives
-The evaluation will include a pre and post survey
-Students will be provided feedback from their performance via evaluation rubrics which are designed to help the students improve on their research and presentation skills

Expectations:
Judging by your applications, all of you are planning on a career in the sciences, mostly in meteorology. Some of you have extensive background in meteorology, both in courses taken and in outside experience. Others have a passion for the subject but are still in the early stages of meteorological coursework. We expect that motivation and interest will not be an issue. Everyone is required to be here for all the planned activities unless you have made (or will make) arrangements with us.

We hope that you will make use of both individual strengths and teamwork. Because of the diverse backgrounds of the group, it is hoped that everyone will work together to understand the material. Although some of the activities may resemble a class, the ultimate goal is not to pass quizzes or tests, but to work together to increase your understanding of Tropical Cyclones and Remote Sensing.

As your leaders, we also hope that it will be a learning experience for us as well. We will be looking for feedback throughout the program, please feel free to comment at any time on the effectiveness of the program and what can be improved for next year, or even for subsequent days. Finally, have fun and meet new friends!!!

Schedule:

Week 1
Monday August 12:
10:00-11:00: **Featured Talk:**
> Dr. Haiyan Jiang: Program introduction, NASA's mission activities and graduate/internship
> opportunities
11:00-12:00: Lecture (BY *Dr. Haiyan Jiang*): Scientific research skills, presentation skills
12:00-12:30: Icebreaking activity
12:30-1:00: Lunch (all lunches in PC 344-B which is located in the department office)
1:00-3:00: -Program evaluation rubrics and portfolios
> -Pre-survey
** Every Day 3:00-4:00:** Optional "Office Hours" to review the material, answer questions, and help out
anyone that missed some of the lectures due to class commitments.

Tuesday August 13:
10:00-11:30: Lecture 1 (BY *Yongxian Pei*): Satellite Remote Sensing Part 1: Introduction, Visible, IR,
Water Vapor images
11:30-12:30: Introduce Lab I: satellite images using IDV
12:30-1:00: Lunch
1:00-2:30: Continue Lab I
2:30-3:00: Students will present images from Lab I to group (about 5 minutes per student)

Wednesday August 14:
10:00-11:30: Lecture 2 (BY *Margie Kieper*): Tropical Cyclones
11:30-12:30: Introduce/begin Lab II: Online TC resources
12:30-1:00: Lunch
1:00-3:00: Continue Lab II

Thursday August 15:
10:00-11:30: Lecture 3 (BY *Cheng Tao*): Satellite Remote Sensing Part II
11:30-12:30: Continue working on Lab II
12:30-1:00: Lunch
1:00-2:30: Finish Lab II
2:30-3:00: Groups will present images from lab to group (about 5 minutes per group)

Friday August 16 (switched with Tuesday August 20's schedule):
10:00-3:00: Group visit to HRD, meet in PC 442 by 9:00 AM, and return to FIU by 3:00.

Week 2
Monday August 19:
10:00-11:00: **Featured Talk:**

Dr. Hugh Willoughby: Hurricanes in the 21 Century

11:00-11:30: **Graduate Student Talk:**

Margie Kieper: 1969 Category 5 Hurricane Camille: What A Modern-Day Understanding of

Hurricane Structure Reveals

11:30-12:30: Forecasting/Modeling, Intro to HWRF, SHIPS RI, and NHC forecasts
12:30-1:00: Lunch
1:00-3:00: Introduce final project, choose cases

Tuesday August 20 (HRD Visit, switched with Friday August 16's schedule):
10:00-11:00: Lecture 4 (BY *Cheng Tao*): Inner Core Dynamics: Eyewall Replacement Cycles and Hot towers/Relation to RI
11:00-12:30: Continue working on final project
12:30-1:00: Lunch
1:00-3:00: Final project

Wednesday August 21:
10:00-11:00: **Featured Talk:**

Dr. Ping Zhu: Hurricane forecast: Basics and Challenges

Rest of day: Work on final project

Thursday August 22:
10:00-11:00: **Featured Talk:**

Dr. Haiyan Jiang: The TRMM Tropical Cyclone Precipitation Feature database

Rest of day: Work on final project

Friday August 23:
10:00-11:00: Final preparations for presentations. Space will be available to practice if desired
11:00-12:30: Evaluation/Post-survey
12:30-1:00: Lunch
1:00-3:00: Student presentations. Location: Room PC 442.
3:00-4:00: Post-internship discussion/celebration in conference room PC 344B