

## SAMANTHA R. BALLARD

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PhD Candidate, University of Miami  
Department of Applied Marine Physics/Ocean Sciences

### CURRENT POSITION

#### University of Miami

Doctoral Graduate Research Assistant

Miami, FL

August 2015- Present

Scientist studying air-sea physics with a focus in coastal areas and momentum transfer (wind, waves, turbulence, clouds, temperature etc.). Experience in algorithm development, satellite data analysis, image processing, computational modeling and data science. Proficient skills utilizing synthetic aperture radar, nautical radar, active and passive remote sensing instruments, air and space-borne radar, satellites, atmospheric and oceanic models, and other instrumentation. Scientific programming and software development knowledge in Matlab, Python, FORTRAN and IDL. General research interests are in computer vision, remote sensing, modeling, data science and machine learning for Earth science (specifically atmosphere and ocean), planetary (space) science, and defense applications. Scientific research interests include wind-wave interactions, atmospheric waves, hurricanes and severe weather, heat and momentum transfer, coastal processes, clouds/precipitation, weather/climate forecasting.

### EDUCATION

#### University of Miami

PhD, Applied Marine Physics/Ocean Sciences

Miami, FL

Current

#### Pennsylvania State University

BS, Meteorology. Chi Epsilon Pi

University Park, PA

May 2015

### COMPUTER LANGUAGES

Python, Matlab, FORTRAN, IDL

### GRANTS/AWARDS

#### 3<sup>rd</sup> Place in Earth Science for NASA Goddard's Summer Intern Poster Competition

NASA Goddard

#### Dean's Freshman Scholarship

Pennsylvania State University

#### Chelius Family Scholarship in Meteorology

Pennsylvania State University

**Hans A. Panofsky Meteorology Scholarship**  
Pennsylvania State University

## RESEARCH/WORK EXPERIENCE

**PhD Graduate Research Assistant** Miami, FL  
University of Miami, Advisor: Dr. Hans Graber, Dr. Roland Romeiser August 2015 – Present

Coastal Land Air Sea Interaction (CLASI) Experiment Monterey Bay, CA

- Exploring air-sea interactions, turbulence, etc. in the coastal marine atmospheric boundary layer of Monterey Bay, California
- **Goal:** Combination of in-situ and remote sensing instruments to improve the Navy's Coupled Ocean Atmosphere Mesoscale Prediction System (COAMPS) forecast model
- Primary experience with remote sensing satellite-based radar called Synthetic Aperture Radar (SAR) to study wind, waves etc., turbulence and other air-sea interactions
- Additional experience with coastal tower (anemometers), radiosondes, polarimetric cameras, buoys, ship wind and wave measurements, and forecast model
- Scientific analysis involves programming with MATLAB and Python perform mathematical transforms, statistical analysis, data manipulation and analysis, image processing and data visualization, and to develop algorithms to improve forecasting of air-sea parameters with models and satellites
- Improved coastal SAR wind retrieval algorithm
- Experience with atmospheric/oceanic model forecast and satellite data (SAR, NASA/NOAA) evaluation, analysis and depiction
- Mathematical transform analysis from in-situ, satellite and model wind data
- Applications to hurricane forecast research

**NASA JPL Climate Workshop** Remote COVID (Pasadena, CA)  
June 2020

- Satellite Observations and Climate Models
- Topics included: Satellite Remote Sensing, The Climate System, Climate Statistics, Monitoring sea level from space, Large Scale Dynamics, CMIP/IPCC Process and Model Diagnostics, Climate Models: Atmospheric Physics, Observations for Components of the Water Cycle; Modeling/Assimilation, Atmospheric Passive Remote Sensing, Climate Models: Ocean and Ice Physics, Land Surface Physics, Atmospheric Composition and Retrieval Theory, Data-Assimilation
- Final Project/Presentation: Variability of Clouds and Precipitation

- Used NASA MODIS cloud imagery, Global Precipitation Climatology Project (GPCP), ECMWF reanalysis, CGCM3 model from Meteorological Research Institute (Japan) (MRI-CGCM3), CM5 model from the French Centre National de la Recherche Scientifique (CNRM-CM5), and CM3 model from GFDL (GFDL-CM3) data to explore the spatial distribution, inter-annual and inter-seasonal trends of clouds, radiative effects and precipitation and their relationship to large scale atmospheric and oceanic circulation from observations. Furthermore, comparing the variability found in the observations to global climate model simulations.

### **Miami Dade County Sea Turtle Principal Investigator**

Miami, FL  
May-Oct 2020

Vegetation Predation, a High Dunes vs. Berm Sea Turtle Nest Case Study: Exploring the Climatological and Topographic Effects on Nest Incubation Times in Miami Dade County, FL

- Supervising undergraduate student
- Exploring topographic and climatological effects on sea turtle nesting in Miami
- **Goal:** explore never before documented and poorly understood vegetation predation events and analyze relationships between atmospheric and beach conditions, incubation times and nesting locations to aid sea turtle conservation efforts and monitor erosion/climatological variations on Miami Beach
- **1<sup>st</sup> case study:** Vegetation Predation
- **2<sup>nd</sup> case study:** High Dunes vs Berm Nests
- **Field work:** photo documentation, laser beach surveys with handheld and drone capabilities, handheld meteorological measurements, use of NOAA tower/tidal stations

### **Miami Dade County Sea Turtle Conservation Program Permit Holder**

Miami, FL  
May-Oct 2020

Vegetation Predation, a High Dunes vs. Berm Sea Turtle Nest Case Study: Exploring the Climatological and Topographic Effects on Nest Incubation Times in Miami Dade County, FL

- Florida Wildlife Commission (FWC) research permit obtained for project
- Individual research permits obtained for each Miami beach: Key Biscayne, Haulover, Miami Beach, Golden Beach and Fisher Island
- Permit approved for field work: photography, in-situ and drone beach survey measurements, and sea turtle survey data access

### **Miami Dade County Sea Turtle Survey Volunteer**

Miami, FL  
May-Oct 2020

- Track/nest identification of 3 sea turtle species: loggerhead, green and leatherback
- In-situ data collection
- Excavation and documentation of nest after hatched

### **CAPA Heat Watch Experiment**

Miami, FL  
June-July 2020

- Provided high-resolution descriptions of urban heat across the ambient environment through a coordinated data-collection campaign with local communities and organizations in Miami to monitor heat waves
- **Goal:** collect data for machine learning algorithm production of high resolution urban heat maps morning, afternoon and evening for climate resilience and adaption, urban planning, community, urban greening and public health
- **Field Work:** temperature and humidity sensors attached to car windows are used for data collection, preplanned routes within 9 polygons in Miami were assigned using Google maps and followed 3 times per day (6-7 AM, 3-4 PM, 7-8 PM) for 4 different days
- **Data analysis:** temperature and humidity data are inputted into machine learning algorithms to produce heat maps

### **CAPA Heat Watch Weather Forecaster**

Miami, FL  
June-July 2020

- Weather is a crucial part of the experiment, high temperature days with minimal rain and cloud cover are needed and accurate forecasting is required
- Forecasts for each of the 3 times on data collection days are produced
- Advised decisions on data collection cancelations and reschedule for each time on each data collection day due to rain/ cloud cover

### **NASA Goddard Intern**

Synthetic Aperture Radar (SAR) Processing

Greenbelt, MD

Preliminary P-Band Wind Retrieval Algorithm using EcoSAR

June-August 2017

- Developed 1<sup>st</sup> successful P-Band SAR wind retrieval algorithm developed in Python using NASA's airborne radar, EcoSAR

### **NASA Advanced Computing for Earth Sciences (ACES) Bootcamp**

University of Virginia  
June 2017

- 2.5 week bootcamp in Python, Fortran, and Super Computing (as well as other computer science topics like visualization, cloud computing, AI/machine learning etc.)

### **R/V Revelle Cruise Researcher**

FLEAT (Flow Encountering Abrupt Topography)

Koror, Palau  
May 2016

- Measured surface waves and small-scale flow patterns generating over the island-ridge system from ship-mounted X-band radar
- Used Doppler information to compute surface currents and wind speed

**National Weather Service Meteorology Intern**  
National Weather Service (NOAA)

University Park, PA  
January 2015- May 2015

- Used Python and GRADs to create graphics for case studies on winter storms affecting Pennsylvania in Winter, 2015
- Observed and helped with weather/hydrological forecasting shifts and radio/web broadcasts and updates

**Solar and Space Physics REU**  
University of Colorado Boulder

Boulder, CO  
June 2014 –August 2014

- Research with Southwest Research Institute to automatically detect coronal mass ejections and other space weather research
- Programmed using IDL and HI (Heliospheric Imager) data from NASA's STEREO mission
- Created/Enhanced algorithm to automatically detect CMEs

**Broadcast Meteorology Intern**  
Fox 45 News

Baltimore, MD  
May 2013-August 2013

- Worked with morning meteorologist Jonathan Meyers
- Assisted with radio and on-screen forecasts
- Assisted in creation of weather forecasts and updated web information and social media posts
- Created resume reel of on-screen forecasts

## TEACHING EXPERIENCE

**Lab Coach/ Python Coding Instructor**  
Integrated Marine Program and College Training (IMPACT) Program

Miami, FL  
Summer 2020

- Lab mentor for underprivileged, underrepresented incoming high school senior students
- Zoom format due to coronavirus
- Students shadowed for 6 weeks during the summer to learn more about atmospheric and oceanic sciences
- Lectures on air sea interactions, hurricanes, wave tank, remote sensing and satellites, weather forecasting, clouds, space weather, etc.
- Research project: utilizing NASA satellite data, comparing atmospheric and oceanic effects across the world's oceans

**Lab Coach/ Python Coding Instructor**  
Integrated Marine Program and College Training (IMPACT) Program

Miami, FL  
Summer 2019

- Lab coach for underprivileged, underrepresented incoming high school senior students
- Students shadowed for 6 weeks during the summer working on a research project
- Designed project based off of PhD research and python
- Taught Intro to Python for data science, scientific programming, machine learning (AI), and data visualization
- Students learned how to code, analyze and visualize scientific air-sea data from buoys, models and satellites
- Utilized NASA satellite data
- Final Presentation: Exploring the Air and Sea in Time and Space Using Buoy, Model and Satellite Data with Python

**Math/Science/Test Prep Elementary, Middle School and High School Tutor**  
Tutorial Resources

Miami, FL  
Fall 2017-Present

**Forecasting Teaching Assistant**  
Weather Forecasting (ATM 243)  
University of Miami

Miami, FL  
Spring 2018

**Oceanography Teaching Assistant**  
Physical Oceanography (MSC 301)  
University of Miami

Miami, FL  
Fall 2016

**Climate Teaching Assistant**  
Understanding Global Climate Change (METEO 469)  
Pennsylvania State University

University Park, PA  
Spring 2015

**Advanced Math Tutor (College Level)**  
Differential Equations (MATH 251)  
Pennsylvania State University

University Park, PA  
Fall and Spring 2014

**Math Tutor (Elementary School Level)**  
5<sup>th</sup> Grade

Severn, MD  
Summer 2014

## PUBLICATIONS

S. Ballard, C. Fussell, E. Warren “Vegetation Predation, a High Dunes vs. Berm Sea Turtle Nest Case Study: Exploring the Climatological and Topographic Effects on Nest Incubation Times in Miami Dade County, FL” In Preparation

S. Ballard, H. Graber, D. Flagg, M. Caruso and R. Romeiser “Quantitative Inter-Comparison of SAR and COAMPS Model-Derived Air Sea Momentum Parameters” *Journal of Geophysical Research*. In Preparation

S. Ballard, H. Graber, N. Laxague, M. Caruso and R. Romeiser “Advanced Extraction of Turbulent Scales for a New Technique Quantifying Air Sea Interaction Parameters” *Journal of Geophysical Research*. In Preparation

S. Ballard, X. Hao, H. Graber, M. Caruso and R. Romeiser “LES Modeling of 3-D Winds Using Synthetic Aperture Radar Surface Roughness Variations” *Journal of Geophysical Research*. In Preparation

S. Ballard, H. Graber, N. Laxague, M. Caruso and R. Romeiser “Exploring the Relationship Between SAR-Derived Wind Speeds and Surface Roughness Length Over the Ocean through Wavelet Analysis” *2019 IEEE International Geoscience and Remote Sensing Symposium (IGARSS)*, Japan, 2019

S. Ballard, H. Graber, M. Caruso and R. Romeiser “Comparison of X-Band SAR and COAMPS Model Wind Fields and Other Air Sea Interaction Parameters in Monterey Bay,” *2018 IEEE International Geoscience and Remote Sensing Symposium (IGARSS)*, Valencia Spain, 2018  
doi: 10.1109/IGARSS.2018.8518950

S. Ballard, H. Graber and M. Caruso, "Coastal surface wind measurements derived from SAR," *2017 IEEE International Geoscience and Remote Sensing Symposium (IGARSS)*, Fort Worth, TX, 2017, pp. 3629-3631.  
doi: 10.1109/IGARSS.2017.8127785

## CONFERENCES AND OTHER PRESENTATIONS

**AGU Ocean Sciences Meeting (Oral)** San Diego, CA  
*New Technique for Quantifying Air-Sea Interactions Using High Resolution SAR Imagery* Feb 2020

**International Geoscience and Remote Sensing Symposium (IGARSS) (Oral)** Japan  
IEEE Geoscience and Remote Sensing Society July 2019  
*Exploring the Relationship between SAR-Derived Wind Speeds and Surface Roughness Length over the Ocean through Wavelet Analysis*

**European Space Agency’s Living Planet Conference (Oral)** Milan, Italy  
May 2019  
*A Wavelet Technique to Derive Turbulent Air-Sea Structures near the coast from High Resolution SAR*

**American Geophysical Union Annual Meeting (AGU) (Poster)** Washington DC  
December, 2018

*Characterizing Turbulent Air-Sea Interaction Phenomena in Coastal Environments by Wavelet Analysis of SAR-Derived Wind Fields*

**International Geoscience and Remote Sensing Symposium (IGARSS)** Valencia, Spain  
IEEE Geoscience and Remote Sensing Society July 2018  
Technical Program Chair: Remote Sensing of Coastal Areas II

**International Geoscience and Remote Sensing Symposium (IGARSS) (Poster)**  
IEEE Geoscience and Remote Sensing Society July 2018  
*Comparison of X-Band SAR and COAMPS Model Wind Fields and Other Air-Sea Interaction Parameters in Monterey Bay*

**AGU Ocean Sciences Meeting (Poster)** Portland, OR  
*Coastal Applications of Wind and Wave Retrieval Using Synthetic Aperture Radar* Feb 2018

**AGU Ocean Sciences Meeting (Poster)** Portland, OR  
*A Preliminary P-Band Wind Retrieval Algorithm Using EcoSAR* Feb 2018

**Naval Research Lab (Oral)** Washington, DC  
*Wind and Wave Retrievals Using Nautical Radar and SAR* Sept 2017

**NASA Goddard Summer Intern Poster Competition** Greenbelt, MD  
*A Preliminary P-Band Wind Retrieval Algorithm Using EcoSAR* August 2017

**International Geoscience and Remote Sensing Symposium (Poster)** Forth Worth, TX  
IEEE Geoscience and Remote Sensing Society July 2017  
*Coastal Surface Wind Measurements Derived from SAR*

**NASA Goddard Intern Presentation (Oral)** Greenbelt, MD  
*Wind and Wave Retrievals Using SAR* July 2017

**NOAA National Hurricane Center (Oral)** Miami, FL  
*SAR Applications in Tropical Cyclones* January 2017

## OTHER PROFESSIONAL EXPERIENCE

**Office of Naval Research Project Meeting** Monterey Bay, CA  
Presentation of research with CLASI (PhD project) collaborators May, 2018

**International Society for Photogrammetry and Remote Sensing (ISPRS) Technical Commission III Symposium Reviewer** Beijing, China  
*Developments, Technologies and Applications in Remote Sensing* Jan 2018

**Mentoring Physical Oceanography Women to Increase Retention (MPOWIR)** Miami, FL  
Monthly mentorship group for women in oceanography 2016-Present



**Weather Bug Private Sector Mentorship Program**  
American Meteorological Society

MD  
2014-2015

**Undergraduate Leadership Workshop**  
UCAR/NCAR

Boulder, CO  
June, 2014

**Student Assistant for AMS 94rd annual meeting**  
American Meteorological Society

Atlanta, GA  
February 2014

**Student Assistant for AMS 93rd annual meeting**  
American Meteorological Society

Austin, TX  
January 2013

**Forecasting and Communications Shifts**  
Campus Weather Service

University Park, PA  
2012-2013

- Produced and recorded radio and TV broadcasts of Pennsylvania weather forecasts every week

## PROFESSIONAL MEMBERSHIPS

Mentoring Physical Oceanography Women to Increase Retention (MPOWIR)  
American Meteorological Society (AMS)  
Institute of Electrical and Electronics Engineers (IEEE)  
American Geophysical Union (AGU)