

SAMANTHA R. BALLARD

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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, 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, heat and momentum transfer, weather and 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

3rd 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

Miami Dade County Sea Turtle Conservation Program Mentor/Researcher 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

- 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
- **1st case study:** Vegetation Predation
- **2nd 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 eggs 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 1st 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

Koror, Palau

FLEAT (Flow Encountering Abrupt Topography)

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

University Park, PA

National Weather Service (NOAA)

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

Boulder, CO

University of Colorado Boulder

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

Baltimore, MD

Fox 45 News

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)

Miami, FL

Fall 2016

University of Miami

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)

5th 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, 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

S. Ballard, H. Graber, M. Caruso and R. Romeiser (2018), “Coastal Applications of Wind and Wave Retrieval Using Synthetic Aperture Radar”, *2018 Ocean Sciences Meeting*, Portland, OR, 12-16 Feb.

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

PROFESSIONAL/CONFERENCE 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

	September 2017
NASA Goddard Intern Presentation (Oral) <i>Wind and Wave Retrievals Using SAR</i>	Greenbelt, MD July 2017
NOAA National Hurricane Center (Oral) <i>SAR Applications in Tropical Cyclones</i>	Miami, FL January 2017

OTHER PROFESSIONAL EXPERIENCE

Office of Naval Research Project Meeting Presentation of PhD research with CLASI (PhD project) collaborators	Monterey Bay, CA May, 2018
International Society for Photogrammetry and Remote Sensing (ISPRS) Technical Commission III Symposium Reviewer <i>Developments, Technologies and Applications in Remote Sensing</i>	Beijing, China Jan 2018
Mentoring Physical Oceanography Women to Increase Retention (MPOWIR) Monthly mentorship group for women in oceanography	Miami, FL 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
<ul style="list-style-type: none"> 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)