SAMANTHA R. BALLARD

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

CURRENT POSITION

University of Miami   Miami, FL
Doctoral Graduate Research Assistant   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   Miami, FL
PhD, Applied Marine Physics/Ocean Sciences   Current

Pennsylvania State University   University Park, PA
BS, Meteorology. Chi Epsilon Pi   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 Predication 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

- o 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
- **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, Haluover, 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 heath
- **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   Miami, FL
Integrated Marine Program and College Training (IMPACT) Program   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   Miami, FL
Integrated Marine Program and College Training (IMPACT) Program   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   Miami, FL
Tutorial Resources   Fall 2017-Present

Forecasting Teaching Assistant
Weather Forecasting (ATM 243)   Miami, FL
University of Miami   Spring 2018

Oceanography Teaching Assistant   Miami, FL
Physical Oceanography (MSC 301)   Fall 2016
University of Miami

Climate Teaching Assistant   University Park, PA
Understanding Global Climate Change (METEO 469)   Spring 2015
Pennsylvania State University

Advanced Math Tutor (College Level)   University Park, PA
Differential Equations (MATH 251)   Fall and Spring 2014
Pennsylvania State University

Math Tutor (Elementary School Level)   Severn, MD
5th Grade   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   MD
American Meteorological Society   2014-2015

Undergraduate Leadership Workshop   Boulder, CO
UCAR/NCAR   June, 2014

Student Assistant for AMS 94rd annual meeting   Atlanta, GA
American Meteorological Society   February 2014

Student Assistant for AMS 93rd annual meeting   Austin, TX
American Meteorological Society   January 2013

Forecasting and Communications Shifts   University Park, PA
Campus Weather Service   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)