UNIVERSITY OF MIAMI
ROSENSTIEL SCHOOL of MARINE & ATMOSPHERIC SCIENCE

Cooperative Institute for Marine and Atmospheric Studies
Rosenstiel School of Marine and Atmospheric Science
University of Miami
4600 Rickenbacker Causeway, Miami, FL 33149

CIMAS Cooperative Institute for Marine and Atmospheric Studies

To: National Oceanic & Atmospheric Administration
Line Office: OAR/CPO
Program: FY 2013 Joint Hurricane Testbed
Attn: Program Manager: Dr. Jiann-Gwo Jiing
Telephone: 305-229-4443
E-mail: Jiann-Gwo.Jiing@noaa.gov

From: Peter Ortner
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4600 Rickenbacker Causeway
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CIMAS Adm. Contact: Isabel Castro icastro@rsmas.miami.edu

The attached proposal is being submitted to you for your consideration by a NOAA Cooperative Institute. Should you recommend funding for this proposal, we request that the funding be transferred through our current NOAA cooperative agreement # NA10OAR4320143. The NOAA contact (described below) for this cooperative agreement should be contacted immediately if this proposal is accepted for funding.

Title of Proposal: Guidance on Observational Undersampling over the Tropical Cyclone Lifecycle

Principal Investigator(s): David Nolan

Proposal #: R1300099

Period of Performance: 08/01/2013 – 07/31/2015

Funding (by year, if multi-year): Year 1: $59,394; Year 2: $60,621; Total: $120,015

Task #: 3

Theme(s): 2: Tropical Weather

NOAA Goal: 1. To understand and predict changes in climate, weather, oceans, and coasts
2. Weather-Ready Nation

DUNS #: 152764007 EIN# 59-0624458 Congressional District: 18

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Please answer all questions

1. Is there a former DOC employee working for the CI host institution who represented or will represent the host institution before DOC or another Federal agency regarding this proposal? ☒Yes ☐No
2. Does this award include any sub award to a Minority Serving Institution? ☐Yes ☒No
3. Does the proposed award require any non-federal employees or sub awardees to have physical access to Federal premises for more than 180 days or to access a Federal information system ? ☐Yes ☒No
4. Is PROGRAM INCOME anticipated being earned during performance of this project? ☐Yes ☐No
5. Will a VIDEO be created for public viewing be part of this project? ☐Yes ☒No
6. Will DOC/NOAA owned equipment be provided to any investigator for use outside a Federal location for this project? ☐Yes ☒No
7. Are any permits required to conduct this project? ☐Yes ☒No
(If yes, please provide the name of the issuing agency and the permit number.)

New Proposal

RESEARCH PROPOSAL SUBMITTED
TO THE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)
Joint Hurricane Testbed (JHT) Program

TITLE: Guidance on Observational Undersampling over the Tropical Cyclone Lifecycle

PERFORMANCE PERIOD: August 1, 2013 – July 31, 2015

AMOUNT REQUESTED:
Year 1: AOML: $30,744 University of Miami: $59,394 Total: $90,138
Year 2: AOML: $30,221 University of Miami: $60,621 Total: $90,842

SUBMITTING DATE: December 7, 2012

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New Proposal

RESEARCH PROPOSAL SUBMITTED
TO THE
NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION (NOAA)
JOINT HURRICANE TESTBED (JHT) PROGRAM

Atlantic Oceanographic and Meteorological Laboratory
4301 Rickenbacker Causeway
Miami, Florida 33149

University of Miami Rosenstiel School of Marine and Atmospheric Science
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Guidance on Observational Undersampling over the Tropical Cyclone Lifecycle

PRINCIPAL INVESTIGATORS: Eric W. Uhlhorn, NOAA/AOML/Hurricane Research Division
David S. Nolan, University of Miami/RSMAS

PERFORMANCE PERIOD: August 1, 2013 – July 31, 2015

JHT AMOUNT REQUESTED: Year 1: $90.0K ($30.7K AOML, $59.3K UM)
Year 2: $90.8K ($30.2K AOML, $60.6K UM)

SUBMITTING DATE: December 7, 2012

Endorsements:

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New proposal to

National Oceanic & Atmospheric Administration (NOAA)
Joint Hurricane Testbed (JHT) Program

for

Guidance on Observational Undersampling over the Tropical Cyclone Lifecyle

by

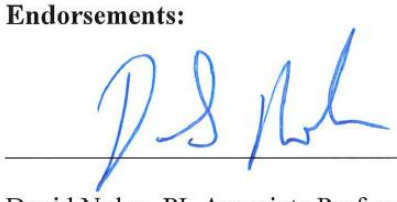
University of Miami
Rosenstiel School of Marine & Atmospheric Science
4600 Rickenbacker Causeway
Miami, FL 33149

PRINCIPAL INVESTIGATOR: David Nolan

PERIOD OF ACTIVITY: August 1, 2013 – July 31, 2015

AMOUNT REQUESTED: Year 1: $59,394
Year 2: $60,621
Total: $120,015

Endorsements:



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Guidance on Observational Undersampling over the Tropical Cyclone Lifecycle

Principal Investigators: Eric W. Uhlhorn, NOAA/AOML/Hurricane Research Division
David S. Nolan, University of Miami/RSMAS

B. Abstract

A hurricane's intensity is defined by the maximum one-minute sustained wind speed at any location in the storm. Recent efforts have documented a relationship between the highest directly observed wind speed and the maximum 1-minute wind in a simulated hurricane. Results suggested that, due to undersampling, the highest observed wind underestimates the intensity by approximately 5-10%, which is generally supportive of the National Hurricane Center's practice that assumes it is unlikely the maximum 1-minute wind is observed. The results were drawn from a high-resolution simulation of Hurricane Isabel, focusing primarily on a period when the storm was intense, highly symmetric, and fairly steady state.

More recently, a high-resolution simulation of a complete hurricane life cycle has been developed. The simulation reproduces genesis from an easterly wave, tropical storm formation, rapid intensification, the mature stage, and recurvature into the North Atlantic. The structure of the simulated hurricane compares remarkably well to various composite data sets accumulated from NOAA research aircraft. The output from this simulation, with full fields saved every 6 minutes over the 13 day period, has been documented and archived.

Utilizing observation-simulation methodologies already developed in previous research studies, this data set provides an opportunity to extend the previous findings of the effects of undersampling to a broader range of intensities, storm sizes, and structures. Product deliverables shall be general guidance for NHC Hurricane Specialists on estimates of maximum wind observational undersampling over a full hurricane lifecycle. In addition, we propose to develop simulation tools for alternative observation systems (e.g., dropwindsondes, flight-level winds, space-borne scatterometers, airborne Doppler radar winds), from which cyclone intensity estimation biases may be quantified, where applicable.

C. Statement of Work

C.1 Project duration: 2 years

C.2 Project description

Background and prior work

Periodically issuing estimates of hurricane intensity is a primary operational requirement for the National Hurricane Center. The intensity of a hurricane is determined by the maximum sustained surface wind speed, which the U.S. National Weather Service defines as: ``the highest one-minute average wind (at an elevation of 10 meters with an unobstructed exposure) associated with a weather system at a particular point in time.” Modern aircraft reconnaissance observation systems remain limited in their capabilities to simultaneously measure at both the required resolution and over a sufficiently large area to have confidence that the peak wind is directly observed. Due to the limited spatial sampling of surface winds in TCs, forecasters often assume that the observed peak wind speed value is somewhat less than the true peak wind speed in the eyewall (Landsea et al. 2004) and a National Hurricane Center official intensity estimate may be somewhat higher than the highest observed wind over a flight to account for this undersampling.

To help understand the potential discrepancy, Uhlhorn and Nolan (2012) examined the relationship between the highest observed surface wind speed and the maximum one-minute sustained surface (10 m) wind speed anywhere in the storm. Since it is believed that the maximum wind speed in a hurricane is rarely directly observed, the methodology consisted of simulating stepped frequency microwave radiometer (SFMR, Uhlhorn et al. 2007) surface wind observations in a high-resolution numerical model. An example of the vast spatial scale difference between observations and the hurricane eyewall is shown in Fig. 1, which demonstrates the extremely low probability that an aircraft directly encounters the location of the maximum one-minute wind, especially since it has been shown that convective-scale, quasi-transient features are responsible for peak wind in a hurricane.

For each of the 97 one-hourly surface wind fields, the peak value was found and converted to a maximum 1-min average according to calibration procedures developed in Uhlhorn and Nolan (2012), and plotted as a time series by the solid red line in Fig. 2. An approximate Best Track intensity is indicated by a six-hour running mean of the model's peak 1-min wind speed (blue line in Fig. 2). For each flight, a maximum ``observed'' wind speed was also found (Fig. 2 green line) and compared to the model 1-min averaged peak wind speed at the time of observation.

Compared to a running mean of the maximum 1-min wind, the highest wind observed over a mission was 7.8 ± 1.2% weaker. In only two out of the 120 total simulated missions (1.7%) was the highest wind found equal to or greater than a six-hour running mean of the peak 1-min wind.

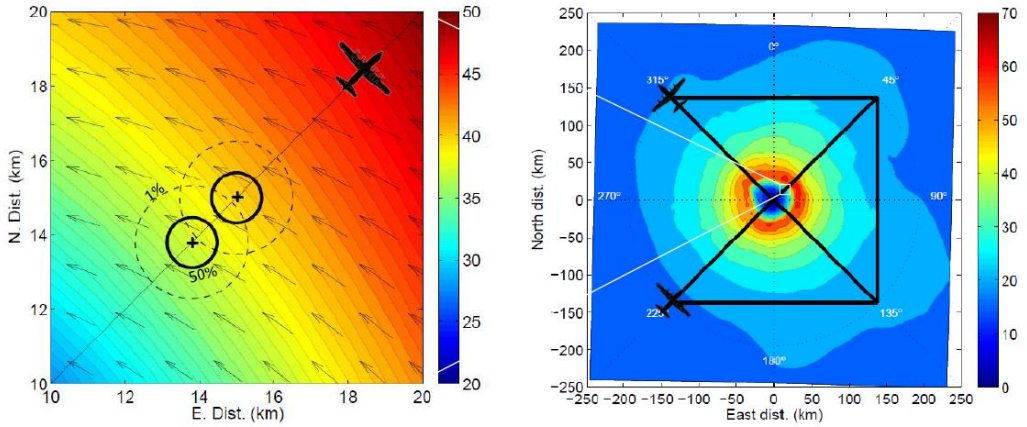

Figure 1: SFMR footprint superimposed on model wind field in the NE eyewall (left), and repeated figure-4 flight track relative to wind field from entire inner-most grid. In the left panel, vectors are plotted at every grid location, and half-power and 1% power footprints are shown. Two footprints are spatially separated by a distance equivalent to 10-s of flight time, correponding to the expected temporal averaging of observations. In the right panel, the aircraft enters the pattern from the SW, and exists to the NW. The white square corresponds to the eyewall region blown up in the left panel.

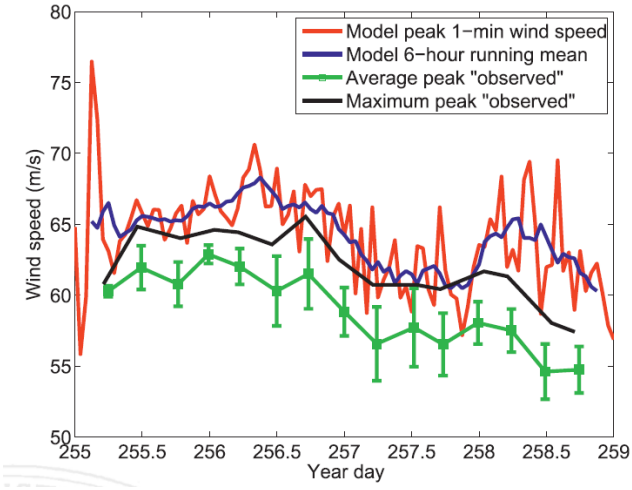

Figure 2: Figure-4 experiment results, plotted as wind speed (m/s) time series over the full 96-hour simulation period. Red curve is maximum model value at each hour, blue curve is a running 6-hour average, green curve is maximum (mean and 95% confidence interval) ``observed'' wind speed for each simulated flight, and black curve is maximum of eight simulated flights initiated at the same time but at varying azimuths. The large variations in peak 1-min wind speed early in the simulation period are a result of model spin-up and adjustment.

While these results provided some clarification on relationships between wind observations and hurricane intensity, this Hurricane Isabel (2003) case represented a fairly specific situation of an intense, highly symmetric, and steady state hurricane (Nolan et al. 2009a,b). Therefore it

remains unclear if these results can be generalized to other stages of a TC lifecycle. For example, it was found that rapidly-evolving, small-scale convective features embedded within the eyewall were directly responsible for the maximum 1-min wind. This opens the question of undersampling to asymmetric storms in which convection is confined to one portion of the eyewall. Many other situations in which to quantify undersampling can be envisioned, such as TC genesis, rapid intensification, eyewall replacement, mid-latitude baroclinic interaction, and landfall. As the aforementioned phenomena were not previously examined in the context of wind undersampling, a novel high-resolution simulation of a hurricane life cycle has been developed, as described below. The primary objective of this proposal is to extend previous results to various stages of TC development, and therefore provide more general guidance for interpretation of observations relative to the true storm intensity.

In addition, alternative observation instruments are available for analyzing TC intensity (e.g., GPS dropwindsondes, buoys, scatterometers) that were not considered in the previous study. Possible experiments include: simulating dropsondes deployed within the eye to quantify extrapolation of minimum central pressure for sondes that report significant surface winds, indicating a sonde missed the storm center location; simulating relatively limited moored data buoy observations for interpretation of intensity; and use of scatterometers for determining tropical depression formation.

The WRF/ECMWF Hurricane Nature Run

The WRF/ECMWF Hurricane Nature Run is a 13 day simulation of the life cycle of a North Atlantic hurricane from before genesis to recurvature (Nolan et al. 2012). This simulation was generated to provide synthetic data for OSSEs that will test the effectiveness of both new observation systems and new data assimilation schemes in improving operational hurricane forecasts. For compatibility with related global model OSSEs, the hurricane nature run is not a simulation of a hurricane that actually occurred. Rather, it is a down-scaled simulation of a hurricane that occurs during a 13 month global OSSE nature run previously generated with the ECMWF model (Reale et al. 2007). This ECMWF nature run has already been validated against observed climatology including the characteristics of its simulated North Atlantic hurricane season. The hurricane nature run was generated using the Weather Research and Forecasting Model (WRF) version 3.2.1, with the output of the ECMWF nature run as initial and boundary conditions for a domain that covers the tropical North Atlantic with 27 km grid spacing. Model resolution and parameterizations far beyond the current capabilities of operational models were used. These include multiple, vortex-following grids nested down to 1km horizontal grid spacing; 60 vertical levels; a double-moment microphysics scheme with 6 water species; and

the most updated longwave and shortwave radiation schemes called every 6 minutes on all grids.

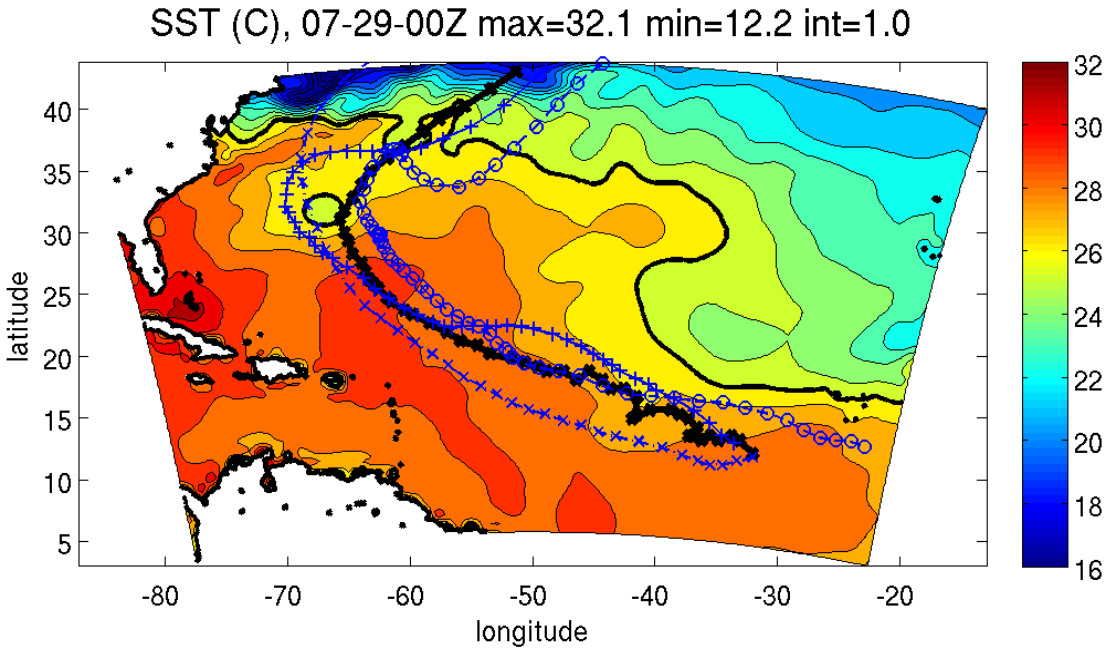

Figure 3: Model domain, SST, and track (black x's) for the hurricane simulated by the ECMWF and WRF nature runs. Also shown are the tracks of three "analog" storms that occurred at similar times in their respective hurricane seasons (July and early August): Irene (2005) (+), Bertha (2008) (o), and Bill (2009) (x). The thickened contour is the 26°C isotherm.

Since the hurricane nature run does not depict an actual event, it cannot be validated by comparisons to specific observations. Rather, it has been validated by comparison to composited observations that have been accumulated from hundreds of research flights into dozens of hurricanes. The nature run was found to have an excellent pressure-wind relationship (by comparison to the pressure-wind formulas of Knaff and Zehr 2007), very realistic boundary layer structure (by comparison to the boundary layer composites of Zhang et al. 2011), and a fairly realistic distribution of simulated reflectivities (by comparison to the observational results in Rogers et al. 2007). Extensive documentation of the strengths and weaknesses of the WRF hurricane nature run will be available in a journal article currently in preparation.

Figure 4 shows the minimum surface pressure, and maximum surface wind speed of the hurricane, as represented in the original ECMWF nature run and the WRF nature run. The simulation shows genesis, tropical storm formation, rapid intensification, and a mature period of several days during which the pressure falls due to expansion of the outer wind field. The evolution of the wind field can be seen in the radius-time Hovmoller diagrams of azimuthal-mean wind speed and vertical velocity at z = 2km. Rapid intensification is followed by an eyewall replacement cycle, and then a long period of nearly constant RMW.

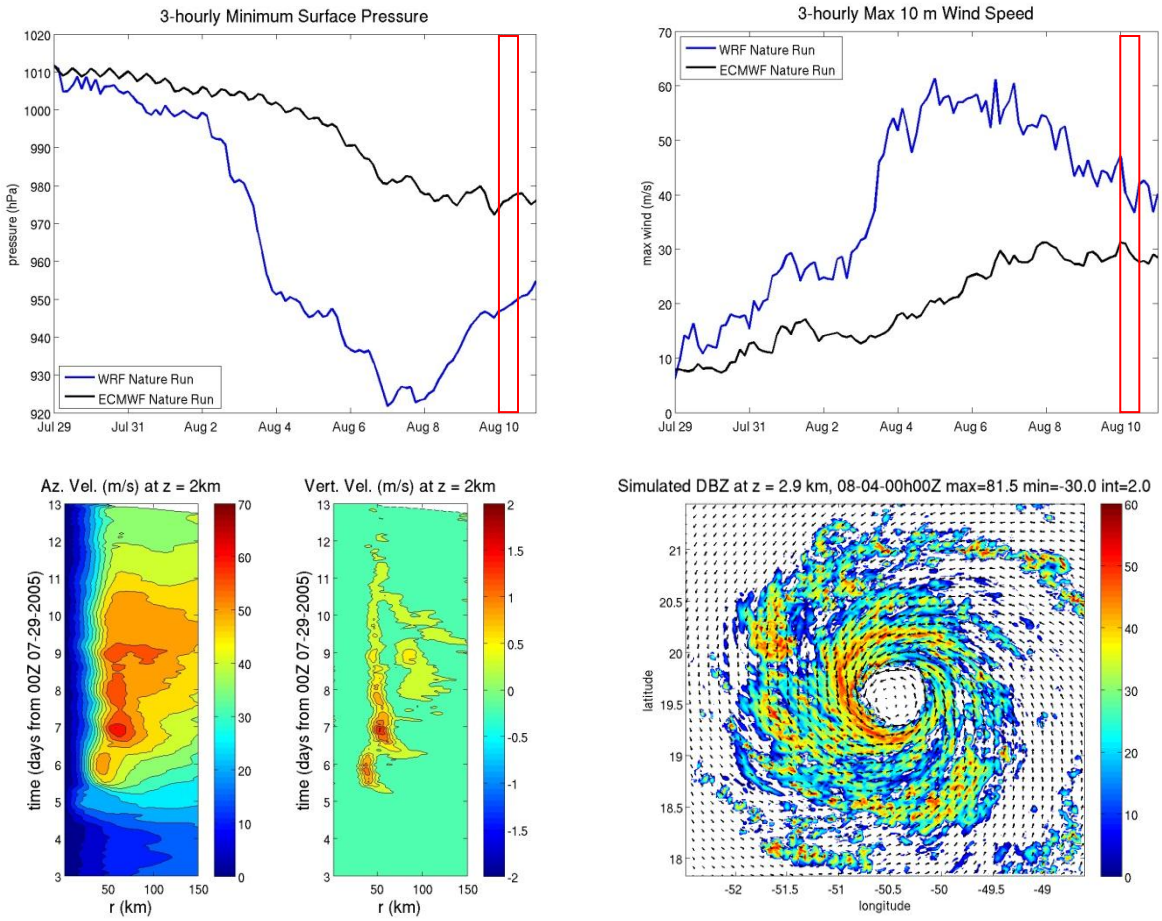

Figure 4: Evolution and structure of the WRF nature run hurricane. Upper left: 3-hourly minimum surface pressure; upper-right: 3-hourly maximum surface wind speed; lower-left: radius-time Hovmoller diagrams of azimuthal-mean tangential wind and vertical wind at z = 2 km; lower-right: simulated reflectivity and surface wind vectors (every 10 grid points) at the end of the rapid intensification period. In the top 2 panels, the red rectangles indicate the period from which preliminary results are shown in Fig. 5.

Another important aspect of the hurricane nature run is the quantity and frequency of model data that has been stored. Every state variable, all diagnosed variables, and all physics tendencies have been saved every 30 minutes on the 27km, 9km, and 3km grids, and every 6 minutes on the 1km grid. In addition, several 6 hours periods of surface data only (e.g., 10 meter winds, rain rates, surface stress) have been generated with output every 10 seconds. These data sets will allow for calibration of the instantaneous winds to 1-minute mean winds during different phases (and intensities) of the storm evolution. The 6-minute output from the 1km grid will allow for more realistic evolution of the three-dimensional wind field as simulated aircraft move through the storm.

At the present time a second hurricane nature run is under development. This case simulates a tropical depression moving over the greater Antilles, which then turns northward, rapidly

intensifies, and makes landfall on the Florida coast north of Tampa. If this simulation passes validation it will be available to test undersampling effects in more complex environments.

Preliminary Results

As a demonstration of potential capability, a simulation experiment has been performed on the first nature run using the methodology previously applied for the Hurricane Isabel case. A ten-hour period near the end of the simulation, in which the simulated cyclone was weakening and becoming highly asymmetric, is examined. Eight simulated flights are initiated at the same time, but at various azimuth angles around the storm. The highest observed wind varies between 36 and 40 m/s, and is found at different times, ranging over nearly 5 hours (Fig. 5). As compared to the maximum 1-min wind speed, this represents an average 6 m/s underestimate (14 %).

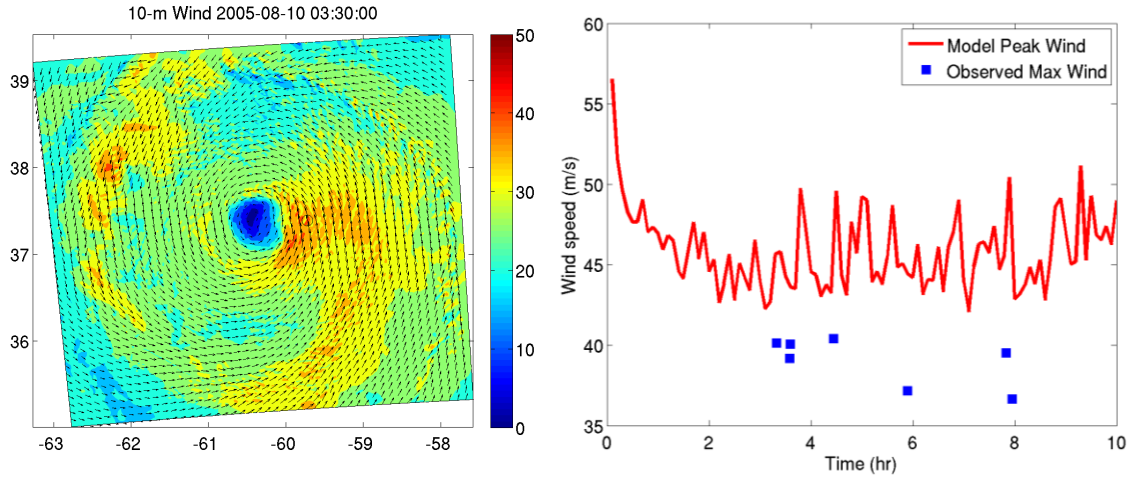

Figure 5: Nature run surface wind field from inner-most (1 km) grid for one output time during period over which experiment was conducted (left panel) and experiment results (right panel). In the left panel, vector arrows are plotted at 1/10 resolution, and the circle indicates location of maximum wind. In the right panel, the red curve is the model maximum wind speed every six minutes, and blue squares are the highest observed wind speed for each of the eight simulated flights. Note that each flight begins at the same time, however the time at which the highest wind observed varies considerably.

Summary

An underestimation by in-situ measurements of actual peak intensity in tropical storms and hurricanes has been presumed in operational practices for some time. The recent work of Uhlhorn and Nolan (2012) supports this practice, and provides a framework for further tests of the degree of undersampling in various storm types. If supported, this project will apply this framework to simulated cyclones over a range of stages and intensities, ultimately providing guidance for the most likely underestimate of peak wind speeds associated with a variety of collective observing systems.

References

Knaff, J. A. and R. M. Zehr (2007): Reexamination of tropical cyclone wind–pressure relationships. *Wea. Forecasting*, **22**, 71-88.

Landsea, C. W., et al. (2004): A reanalysis of Hurricane Andrew's Intensity. *Bull. Amer. Metor. Soc*., **85**, 1699-1712.

Nolan, D. S., et al. (2009a): Evaluation of Planetary Boundary Layer Parameterizations in Tropical Cyclones by Comparison of In Situ Observations and High-Resolution Simulations of Hurricane Isabel (2003). Part I: Initialization, Maximum Winds, and the Outer-Core Boundary Layer. *Mon. Wea. Rev*., **137**, 3651-3674.

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Reale, O., et al. (2007): Preliminary evaluation of the European Centre for Medium-Range Weather Forecasts' (ECMWF) Nature Run over the tropical Atlantic and African monsoon region. *Geophys. Res. Lett*., **34**, L22810, 6 pp.

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Uhlhorn, E. W. and D. S. Nolan (2012): Observational Undersampling in Tropical Cyclones and Implications for Estimated Intensity. *Mon. Wea. Rev*., **140**, 825-840.

Uhlhorn, E. W., et al. (2007): Hurricane Surface wind measurements from an operational Stepped Frequency Microwave Radiometer. *Mon. Wea. Rev*., **135**, 3070-3085.

Zhang, J. A., et al. (2011): On the characteristic height scales of the hurricane boundary layer. *Mon. Wea. Rev*., **139**, 2523-2535.

C.3 Work Plan

Year 1

The nature run will require an extensive calibration to relate maximum simulated winds to the maximum one-minute sustained wind speed, as required for operations. This calibration procedure consists of analyzing high-frequency model output wind field. Our first-year efforts will focus initially on calibration over several periods of the simulation. Simulated SFMR surface wind experiments will then be conducted to provide preliminary undersampling results.

Year 2

In the second year, we plan to develop instrument simulation tools and conduct experiments to describe undersampling statistics using alternative observations, including GPS dropwindsondes, data buoys, and scatterometers. These efforts will culminate in a project deliverable in the form of tabulated guidance on observational undersampling in several hurricane observing scenarios.

C.4 Timeline

Aug 2013 – Mar 2014:	Develop calibration statistics
Mar 2014:	Present results at IHC
Apr – July 2014:	Conduct simulated SFMR experiments over nature run life cycle
Aug 2014 – Mar 2015:	Develop alternative instrument simulation tools
Mar 2015:	Present results at IHC
Apr – July 2015:	Conduct experiments using alternative instrumentation
July 2015:	Provide final report including guidance metrics

C.5 Schedule and needs for expected travel

March 2014	PIs travel to Interdepartmental Hurricane Conference
March 2015	PIs travel to Interdepartmental Hurricane Conference

Additional on-site visits to NHC for coordination and consultation, as necessary, are at no cost to JHT.

C.6 JHT staff requirements

All work is expected to be performed at the PIs' home institutions. No JHT staff assistance is anticipated.

D. Budget

AOML

			Budget Year 1		Budget Year 2	
			JHT		JHT	
			Requested		Requested	
			mm	Amount	mm	Amount
Personnel						
AOML	E. Uhlhorn (PI)		1.0	$ 7,493	1.0	$ 7,867
AOML	B. Barry (IT support)		0.5	$ 4,965	0.5	$ 5,214
Subtotal				$ 12,458		$ 13,081
Fringe Benefits				$ 3,862		$ 4,186
Total Salaries and Fringe Benefits				$ 16,320		$ 17,267
Indirect Costs				$ 8,323		$ 8,979
Total Labor Costs				$ 24,644		$ 26,246
Travel	Meetings			$ 3,600		$ 3,600
Other (Matlab licence and maint.)				$ 2,500		$ 375
Total				$ 30,744		$ 30,221

JHT costs consist of 1.0 months for E. Uhlhorn to provide project supervision, and assist in simulation code development and conducting experiments. B. Barry (0.5 months) will provide AOML computer support for the PI. Travel costs are for E. Uhlhorn to attend Interdepartmental Hurricane Conference.

University of Miami

	YEAR 1			YEAR 2			
	months	%	AMOUNT	months	%	AMOUNT	TOTALS
Principal Investigator:							
David Nolan	1.0	8%	11,104	1.0	8%	11,659	22,763
Research Staff							
Brad Klotz	4.0	33%	17,824	4.0	33%	17,973	35,797
TOTAL SALARIES			28,928			29,632	58,560
Fringe Benefits - Faculty			2,421			2,542	4,963
Fringe Benefits - Staff			6,310			6,362	12,672
TOTAL SALARIES & FRINGE BENEFITS			37,659			38,536	76,195
Travel Domestic			3,600			3,600	7,200
Other Direct Costs:							
Technical supplies			800			800	1,600
Computer/Connect charges			365			365	730
Modified Total Direct Costs:			42,424			43,301	85,725
Facilities & Administrative Costs		40.0%	16,970			17,320	34,290
TOTAL PROJECT COSTS			59,394			60,621	120,015

The budget for the University of Miami requests one month of salary support for Dr. Nolan and 4 months of salary support for Mr. Brad Klotz who is already a full-time CIMAS employee. Dr. Nolan will provide access to and guidance for the use of the WRF hurricane nature run data set and will provide leadership in the analysis and dissemination of the results. Once the undersampling methods have been finalized by Dr. Uhlhorn and Dr. Nolan, Mr. Klotz will perform the large majority of the work of performing the observing system experiments. The UM budget also requests travel funds for Dr. Nolan and Mr. Klotz to attend the IHC meeting for each of the two years of the proposal, and additional expenses for the replacement of hard drives and computer and internet support at UM.

F. Curriculum Vitae

Abbreviated CV for Eric Uhlhorn

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Education

- Ph.D., Meteorology and Physical Oceanography, University of Miami, May 2008.
- M.S., Physical Oceanography, Florida Institute of Technology, Dec. 1996.
- B.S., Meteorology, Florida State University, May 1993.

Employment

- Research Meteorologist, NOAA/AOML/Hurricane Research Division, Miami, FL, July 2006 – present.
- Senior Research Associate III, University of Miami/Cooperative Institute for Marine and Atmospheric Studies (AOML), Miami, FL, Mar. 2000 – July 2006.
- Systems Analyst, Booz-Allen and Hamilton (AOML), Miami, FL, Nov. 1998 – Mar. 2000.
- Research Associate, SSAI, Inc., Greenbelt, MD, July 1997 – Nov. 1998.
- Graduate Research Assistant, Florida Institute of Technology, Melbourne, FL, June 1994 – July 1997.
- Systems Analyst, PRC, Inc., Reston, VA, May 1993 – June 1994.

Recent and Relevant Publications

Uhlhorn, E. W. and L. K. Shay: Loop current mixed layer energy response to Hurricane Lili (2002). Part II: Idealized numerical simulations. *J. Phys. Oceanogr*., in review.

Cione, J. J., E. A. Kalina, J. Zhang, and E. W. Uhlhorn: Observations of air-sea interaction and intensity change in hurricanes. *Mon. Wea. Rev*., in review.

Winterbottom, H. R., E. W. Uhlhorn, and E. P. Chassignet (2012): A design and an application of a regional coupled atmosphere-ocean model for tropical cyclone prediction. *J. Adv. Modeling Earth Sys.*, **4**, M10002, 17pp.

Zhang, J. and E. W. Uhlhorn (2012): Hurricane sea-surface inflow angle and an observation-based parametric model. *Mon. Wea. Rev.*, **140**, 3587-3605.

Uhlhorn, E. W. and L. K. Shay (2012). Loop current mixed layer energy response to Hurricane Lili (2002). Part I: Observations. *J. Phys. Oceanogr.*, **42**, 400-419.

Uhlhorn, E. W. and D. S. Nolan (2012). Observational undersampling in tropical cyclones and implications for estimated intensity. *Mon. Wea. Rev.*, **140**, 825-840.

El-Nimri, S. F., W. L. Jones, E. W. Uhlhorn, C. Ruf, J. Johnson, P. Black (2011): An improved C-band ocean surface emissivity model at hurricane-force wind speeds over a wide range of incidence angles, *Geosci. Rem. Sens. Lett.*, **7**, 641-645.

Powell, M. D., E. W. Uhlhorn, and J. D. Kepert (2011): Reply to comments on Estimating maximum surface winds from hurricane reconnaissance measurements, *Wea. Forecasting*, **26**, 777-779.

Shay, L. K., B. Jaimes, J. Brewster, P. Meyers, C. McCaskill, E. Uhlhorn, F. Marks, G. R. Halliwell Jr., O.-M. Smedstad, and P. Hogan (2011): Airborne ocean surveys of the Loop Current complex from NOAA WP-3D in support of Deepwater Horizon oil spill. Liu, Y. A, et al. (Eds.). Monitoring and modeling of the Deepwater Horizon oil spill: A record-breaking enterprise. *Geophys. Monogr. Series*, **195**, AGU, Washington DC, 271 pp.

Powell, M. D., E. W. Uhlhorn, and J. D. Kepert (2009): Estimating maximum surface winds from hurricane reconnaissance measurements, *Wea. Forecasting*, **24**, 868—883.

Halliwell, G. R. Jr., L. K. Shay, S. D. Jacob, O. M. Smedstad, E. W. Uhlhorn (2008): Improving ocean model initialization for coupled tropical cyclone models using GODAE nowcasts, *Mon. Wea. Rev.*, **136**, 2576—2591.

Uhlhorn, E. W., P. G. Black, J. L. Franklin, M. Goodberlet, J. Carswell and A. S. Goldstein (2007). Hurricane surface wind measurements from an operational stepped-frequency microwave radiometer. *Mon. Wea. Rev.*, **135**, 3070-3085.

Jiang, H., E. Zipser, P. Black, F. Marks and E. Uhlhorn (2006): Validation of rain rate measurements from the Stepped-Frequency Microwave Radiometer. *J. Atmos. Sci.*, **63**, 252-267.

Uhlhorn, E.W., and P.G. Black (2003): Verification of remotely sensed sea surface winds in hurricanes. *J. Atmos. Oceanic Tech.*, **20**, 99-116.

Awards and Honors

- American Meteorological Society Special Award, 2010.
- NOAA/OAR Best Paper, nominated, 2008, 2009, 2011.
- NOAA bronze medal award, 2008.
- American Meteorological Society Banner I. Miller award, 2008.
- NOAA bronze medal award (Group), 2007.

Field Research Experience

- NOAA Intensity Forecasting Experiment (IFEX) Director, 2009.
- NOAA Intensity Forecasting Experiment (IFEX) 2005-present.
- ONR/Coupled Boundary Layer and Air Sea Transfer (CBLAST) 2002-2004.
- NOAA/NSF Hurricane Air-Sea Interaction (HARSIN) Experiment 2002.
- NOAA/HRD Hurricane Field Program 1998-Present.

Professional

- Member, American Meteorological Society, 1995-present.

Abbreviated CV for David S. Nolan

Associate Professor
Division of Meteorology and Physical Oceanography
Rosenstiel School of Marine and Atmospheric Science
University of Miami
4600 Rickenbacker Causeway
Miami, Florida 33149
Phone: (305) 421-4930 Fax: (305) 421-4696
email: *dnolan@rsmas.miami.edu*

Born: April 19, 1969
Citizenship: USA

Education:

Harvard University, Graduate School of Arts and Sciences, Cambridge, Massachusetts.
Ph.D. in Earth and Planetary Sciences, completed October, 1996.
Advisor: Brian Farrell.
Thesis: *Axisymmetric and Asymmetric Vortex Dynamics in Convergent Flows.*

Harvard College, Cambridge, Massachusetts.
B.A., Physics, *cum laude* 1990.

Experience:

06/08 - Present:	*Associate Professor, Division of Meteorology and Physical Oceanography, Rosenstiel School of Marine and Atmospheric Science, University of Miami.*
07/02 - 05/08:	*Assistant Professor, Division of Meteorology and Physical Oceanography, Rosenstiel School of Marine and Atmospheric Science, University of Miami.*
07/01 - 06/02:	*Visiting Scientist, Program in Atmospheric and Oceanic Sciences, Princeton University.*
11/98 - 06/01:	*Postdoctoral Associate, Department of Atmospheric Science, Colorado State University.*
11/96 - 11/98:	*Visiting Postdoctoral Fellow, Mathematics Department, Computing Sciences Directorate, Lawrence Berkeley National Laboratory.*

Related Publications:

Nolan, D. S., and M. G. McGauley, 2012: Tropical cyclogenesis in wind shear: Climatological relationships and physical processes. *Cyclones: Formation, Triggers, and Control*. K. Oouchi and H. Fudeyasu, eds., Nova Science Publishers, Happauge, New York, 270 pp.

Uhlhorn, E. W., and D. S. Nolan, 2012: Observational undersampling in tropical cyclones and its impact on estimated intensity. *Mon. Wea. Rev.*, **140**, 825-840.

Stern, D. P., and D. S. Nolan, 2012: On the height of the warm core in tropical cyclones. *J. Atmos. Sci.*, **69**, 1657-1680.

Nolan, D. S., D. P. Stern, and J. A. Zhang, 2009: Evaluation of planetary boundary layer parameterizations in tropical cyclones by comparison of in-situ data and high-resolution simulations of Hurricane Isabel (2003). Part II: Inner-core boundary layer and eyewall structure. *Mon. Wea. Rev.*, **137**, 3675-3698.

Nolan, D. S., J. A. Zhang, and D. P. Stern, 2009: Evaluation of planetary boundary layer parameterizations in tropical cyclones by comparison of in-situ data and high-resolution simulations of Hurricane Isabel (2003). Part I: Initialization, maximum winds, and the outer core boundary layer. *Mon. Wea. Rev*., **137**, 3651-3674.

Other Publications:

Kelly, D. L., D. Letson, F. Nelson, D. S. Nolan, and D. Solis, 2012: Evolution of subjective hurricane risk perceptions: A Bayesian approach. *Journal of Economic Behavior and Organization*, **81**, 644-663.

McGauley, M. G., and D. S. Nolan, 2011: Measuring environmental favorability for tropical cyclogenesis by statistical analysis of threshold parameters. *J. Climate.*, **24**, 5968-5997.

Rappin, Eric D., David S. Nolan, and Kerry A. Emanuel, 2010: Therodynamic control of tropical cyclogenesis in environments of radiative-convective equlibrium with shear. *Q. J. Roy. Meteorol. Soc.,* **136**, 1954-1971.

Fierro, A. O., R. F. Rogers, F. D. Marks, and D. S. Nolan, 2009: Impact of cloud resolving horizontal grid spacing on simulated tropical cyclone structure with emphasis on microphysics and kinematic fields. *Mon. Wea. Rev.*, **137**, 3717-3743.

Nolan, David S., Eric D. Rappin, and Kerry A. Emanuel, 2007: Tropical cyclogenesis sensitivity to environmental parameters in radiative-convective equilibrium. *Q. J. R. Meteorol. Soc.*, **133**, 2085-2107.

Service:

Academic Chair for the Division of Meteorology and Physical Oceanography, 2003-2006.

University of Miami representative to the UCAR President's Advisory Council on University Relations, 2008-present.

International Committee for Dynamical Meteorology, 2010-present.

Hurricane Forecasting Improvement Program Scientific Review Committee, 2012-present.

Graduate and Postdoctoral Advisors:

Brian F. Farrell (Harvard University)

Alexandre J. Chorin (U. C. Berkeley)

Michael T. Montgomery (Colorado State University)

Recent Collaborators:

Scott Braun (NASA-Goddard), Kerry A. Emanuel (MIT), Alexandre Fierro (LANL), Daniel Hodyss (NRL), James P. Kossin (NOAA/SSEC), Brian Mapes (RSMAS), Frank Marks (NOAA/HRD), Melinda Peng (NRL), Eric D. Rappin (RSMAS), Caroline Reynolds (NRL), Robert Rogers (NOAA/HRD), Chris Rozoff (UW-Madison), Jason Sippel (NASA-Goddard), Chris D. Thorncroft (U. Albany), Eric Uhlhorn (NOAA/HRD) Chi-dong Zhang (RSMAS), Fuqing Zhang (Penn. State), Jun A. Zhang (NOAA/HRD).

Graduate Students and Post-Docs advised:

Yumin Moon, M.S. 2007, PhD 2012; Daniel Stern, Ph.D., 2010; Michael McGauley, PhD 2012; Daniel Hodyss, Post-doc, 2003-2005; Eric Rappin, Post-Doc, 2005-2007.

G. Current and Pending Federal Support

AOML

Investigator	Status	Project Title	Funding Source	Total Amount	Time (months per year)
E. Uhlhorn (PI)	Current	Improved SFMR surface wind measurements in intense rain conditions	JHT	$80.4k (2nd of 2 year)	1.0 (in-kind)
E. Uhlhorn (PI)	Pending	Verification of HWRF intensity forecasts using a novel multi-scale intensity metric	JHT	$126.9 (2 years)	1.0 (in-kind)

University of Miami

David Nolan – Current and Pending

Current Funding:

1. Title: Using NOGAPS Singular Vectors to Diagnose Large-scale Influences on Tropical Cyclogenesis (Co-PI)
   Agency: Office of Naval Research
   Award Period Covered: 01/01/09 – 12/31/12
   Amount Funded: $487,713
   Person Months: 0.5
   Location of Project: University of Miami/RSMAS

2. Title: Further Development of Observing System Simulation Experiments for Unmanned Aircraft Systems in Hurricanes
   Agency: NOAA
   Award Period Covered: 10/01/2011 – 08/31/2013
   Amount Funded: $74,960
   Person Months: 1.0
   Location of Project: University of Miami/RSMAS

3. Title: Collaborative Research: Understanding Tropical Cyclone Evolution in Wind Shear through a Synthesis of Observational Data Sets and Idealized Simulations
   Agency: NSF
   Award Period Covered: 09/15/2011 – 08/31/2014
   Amount Funded: $465,491
   Person Months: 1.0
   Location of Project: University of Miami/RSMAS

4. Title: Collaborative Research: Tropical Waves and Intertropical Convergence Zones in Simulations with Explicit Convection
   Agency: NSF
   Award Period Covered: 02/15/2012 – 1/31/2014
   Amount Funded: $269,465
   Person Months: 1.0
   Location of Project: University of Miami/RSMAS

5. Title: Collaborative Research: Advanced Model Diagnostics of Tropical Cyclones Inner-Core Structure Using Aircraft Observations (Co-PI)
   Agency: NOAA
   Award Period Covered: 01/01/2012 – 12/31/2013
   Amount Funded: $98,979
   Person Months: 1.0
   Location of Project: University of Miami/RSMAS

6. Title: Evaluating Global and Regional Observing System Simulation Experiments for Hurricanes
   Agency: NOAA
   Award Period Covered: 09/01/2012 – 08/31/2013
   Amount Funded: $102,367
   Person Months: .75
   Location of Project: University of Miami/RSMAS

Pending Funding:

1. Title: Regional Precipitation Downscaling with NU-WRF and Application to South Florida Water Management (Co-PI)
   Agency: NASA
   Proposed Time Period: 01/01/2013 – 12/31/2016
   Requested Funds: $921,817
   Person Months: .50
   Location of Project: University of Miami/RSMAS

2. Title: Advancing Understanding of the Tornado Vortex Through Numerical Simulations of Increasing Complexity and Evaluation of Observing Systems
   Agency: NSF
   Proposed Time Period: 04/01/2013 – 03/31/2017
   Requested Funds: $665,418
   Person Months: 1.00
   Location of Project: University of Miami/RSMAS

3. Title: Guidance on Intensity Guidance
   Agency: NOAA
   Proposed Time Period: 07/01/2013 – 06/30/2015
   Requested Funds: $82,257
   Person Months: .50
   Location of Project: University of Miami/RSMAS

4. Title: Guidance on Observational Undersampling over the Tropical Cyclone Lifecycle ***This Proposal***
   Agency: NOAA
   Proposed Time Period: 07/01/2013 – 06/30/2015
   Requested Funds: $120,015
   Person Months: 1.0
   Location of Project: University of Miami/RSMAS

OMB Number: 4040-0004
Expiration Date: 03/31/2012

Application for Federal Assistance SF-424

* 1. Type of Submission:	* 2. Type of Application:	* If Revision, select appropriate letter(s):
☐ Preapplication	☒ New	
☒ Application	☐ Continuation	* Other (Specify):
☐ Changed/Corrected Application	☐ Revision	

* 3. Date Received:	4. Applicant Identifier:
12/07/2012	

5a. Federal Entity Identifier:	5b. Federal Award Identifier:

State Use Only:

6. Date Received by State:	7. State Application Identifier:

8. APPLICANT INFORMATION:

* a. Legal Name: University of Miami

* b. Employer/Taxpayer Identification Number (EIN/TIN):	* c. Organizational DUNS:
590624458	1527640070000

d. Address:

* Street1:	4600 Rickenbacker Causeway
Street2:	
* City:	Miami
County/Parish:	
* State:	FL: Florida
Province:	
* Country:	USA: UNITED STATES
* Zip / Postal Code:	33149-1031

e. Organizational Unit:

Department Name:	Division Name:

f. Name and contact information of person to be contacted on matters involving this application:

Prefix:	Ms.	* First Name:	Fernande
Middle Name:			
* Last Name:	Saintilis		
Suffix:			

Title: Research Administration, Team Manager

Organizational Affiliation:

* Telephone Number:	305-421-4181	Fax Number:	305-421-4876

* Email: fsaintilis@miami.edu

Application for Federal Assistance SF-424

*** 9. Type of Applicant 1: Select Applicant Type:**

O: Private Institution of Higher Education

Type of Applicant 2: Select Applicant Type:

Type of Applicant 3: Select Applicant Type:

* Other (specify):

*** 10. Name of Federal Agency:**

Department of Commerce

11. Catalog of Federal Domestic Assistance Number:

11.459

CFDA Title:

Weather and Air Quality Research

*** 12. Funding Opportunity Number:**

NOAA-OAR-OWAQ-2013-2003469

* Title:

FY 2013 Joint Hurricane Testbed

13. Competition Identification Number:

2297052

Title:

14. Areas Affected by Project (Cities, Counties, States, etc.):

Add Attachment | Delete Attachment | View Attachment

*** 15. Descriptive Title of Applicant's Project:**

Guidance on Observational Undersampling over the Tropical Cyclone Lifecycle

Attach supporting documents as specified in agency instructions.

Add Attachments | Delete Attachments | View Attachments

Application for Federal Assistance SF-424

16. Congressional Districts Of:

* a. Applicant: FL-18 | b. Program/Project: FL-18

Attach an additional list of Program/Project Congressional Districts if needed.

Add Attachment | Delete Attachment | View Attachment

17. Proposed Project:

* a. Start Date: 08/01/2013 | * b. End Date: 07/31/2015

18. Estimated Funding ($):

* a. Federal	120,015.00
* b. Applicant	0.00
* c. State	0.00
* d. Local	0.00
* e. Other	0.00
* f. Program Income	0.00
* g. TOTAL	120,015.00

*** 19. Is Application Subject to Review By State Under Executive Order 12372 Process?**

☐ a. This application was made available to the State under the Executive Order 12372 Process for review on .

☐ b. Program is subject to E.O. 12372 but has not been selected by the State for review.

☒ c. Program is not covered by E.O. 12372.

*** 20. Is the Applicant Delinquent On Any Federal Debt? (If "Yes," provide explanation in attachment.)**

☐ Yes ☒ No

If "Yes", provide explanation and attach

Add Attachment | Delete Attachment | View Attachment

21. *By signing this application, I certify (1) to the statements contained in the list of certifications and (2) that the statements herein are true, complete and accurate to the best of my knowledge. I also provide the required assurances** and agree to comply with any resulting terms if I accept an award. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties. (U.S. Code, Title 218, Section 1001)**

☒ ** I AGREE

** The list of certifications and assurances, or an internet site where you may obtain this list, is contained in the announcement or agency specific instructions.

Authorized Representative:

Prefix: Ms. | * First Name: Fernande

Middle Name:

* Last Name: Saintilis

Suffix:

* Title: Research Administration, Team Manager

* Telephone Number: 305-421-4181 | Fax Number: 305-421-4876

* Email: fsaintilis@miami.edu

* Signature of Authorized Representative: Fernande Saintilis | * Date Signed: 12/07/2012

BUDGET INFORMATION - Non-Construction Programs

OMB Number: 4040-0006
Expiration Date: 06/30/2014

SECTION A - BUDGET SUMMARY

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. FY 2013 Joint Hurricane Testbed	11.459	$	$	$ 120,015.00	$	$ 120,015.00
2.						
3.						
4.						
5. Totals		$	$	$ 120,015.00	$	$ 120,015.00

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Prescribed by OMB (Circular A -102) Page 1

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY (1)	(2)	(3)	(4)	Total (5)
	FY 2013 Joint Hurricane Testbed	N/A			
a. Personnel	$ 28,928.00	$ 29,632.00	$	$	$ 58,560.00
b. Fringe Benefits	8,731.00	8,904.00			17,635.00
c. Travel	3,600.00	3,600.00			7,200.00
d. Equipment	0.00				
e. Supplies	800.00	800.00			1,600.00
f. Contractual					
g. Construction					
h. Other	365.00	365.00			730.00
i. Total Direct Charges (sum of 6a-6h)	42,424.00	43,301.00			$ 85,725.00
j. Indirect Charges	16,970.00	17,320.00			$ 34,290.00
k. TOTALS (sum of 6i and 6j)	$ 59,394.00	$ 60,621.00	$	$	$ 120,015.00
7. Program Income	$	$	$	$	$

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SECTION C - NON-FEDERAL RESOURCES

(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e)TOTALS
8.	$	$	$	$
9.				
10.				
11.				
12. TOTAL (sum of lines 8-11)	$	$	$	$

SECTION D - FORECASTED CASH NEEDS

	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	$ 59,394.00	$ 14,848.50	$ 14,848.50	$ 14,848.50	$ 14,848.50
14. Non-Federal	$				
15. TOTAL (sum of lines 13 and 14)	$ 59,394.00	$ 14,848.50	$ 14,848.50	$ 14,848.50	$ 14,848.50

SECTION E - BUDGET ESTIMATES OF FEDERAL FUNDS NEEDED FOR BALANCE OF THE PROJECT

(a) Grant Program	FUTURE FUNDING PERIODS (YEARS) (b)First	(c) Second	(d) Third	(e) Fourth
16. FY 2013 Joint Hurricane Testbed	$ 60,621.00	$	$	$
17.				
18.				
19.				
20. TOTAL (sum of lines 16 - 19)	$ 60,621.00	$	$	$

SECTION F - OTHER BUDGET INFORMATION

21. Direct Charges: 85725

22. Indirect Charges: 34290

23. Remarks: Facilities and Administrative rate for this proposal is based on the Joint Institute Cooperative Agreement rate of 40% MTDC

OMB Number: 4040-0007
Expiration Date: 06/30/2014

ASSURANCES - NON-CONSTRUCTION PROGRAMS

PLEASE DO NOT RETURN YOUR COMPLETED FORM TO THE OFFICE OF MANAGEMENT AND BUDGET. SEND IT TO THE ADDRESS PROVIDED BY THE SPONSORING AGENCY.

NOTE: Certain of these assurances may not be applicable to your project or program. If you have questions, please contact the awarding agency. Further, certain Federal awarding agencies may require applicants to certify to additional assurances. If such is the case, you will be notified.

As the duly authorized representative of the applicant, I certify that the applicant:

1. Has the legal authority to apply for Federal assistance and the institutional, managerial and financial capability (including funds sufficient to pay the non-Federal share of project cost) to ensure proper planning, management and completion of the project described in this application.

2. Will give the awarding agency, the Comptroller General of the United States and, if appropriate, the State, through any authorized representative, access to and the right to examine all records, books, papers, or documents related to the award; and will establish a proper accounting system in accordance with generally accepted accounting standards or agency directives.

3. Will establish safeguards to prohibit employees from using their positions for a purpose that constitutes or presents the appearance of personal or organizational conflict of interest, or personal gain.

4. Will initiate and complete the work within the applicable time frame after receipt of approval of the awarding agency.

5. Will comply with the Intergovernmental Personnel Act of 1970 (42 U.S.C. §§4728-4763) relating to prescribed standards for merit systems for programs funded under one of the 19 statutes or regulations specified in Appendix A of OPM's Standards for a Merit System of Personnel Administration (5 C.F.R. 900, Subpart F).

6. Will comply with all Federal statutes relating to nondiscrimination. These include but are not limited to: (a) Title VI of the Civil Rights Act of 1964 (P.L. 88-352) which prohibits discrimination on the basis of race, color or national origin; (b) Title IX of the Education Amendments of 1972, as amended (20 U.S.C.§§1681-1683, and 1685-1686), which prohibits discrimination on the basis of sex; (c) Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. §794), which prohibits discrimination on the basis of handicaps; (d) the Age Discrimination Act of 1975, as amended (42 U. S.C. §§6101-6107), which prohibits discrimination on the basis of age; (e) the Drug Abuse Office and Treatment Act of 1972 (P.L. 92-255), as amended, relating to nondiscrimination on the basis of drug abuse; (f) the Comprehensive Alcohol Abuse and Alcoholism Prevention, Treatment and Rehabilitation Act of 1970 (P.L. 91-616), as amended, relating to nondiscrimination on the basis of alcohol abuse or alcoholism; (g) §§523 and 527 of the Public Health Service Act of 1912 (42 U.S.C. §§290 dd-3 and 290 ee- 3), as amended, relating to confidentiality of alcohol and drug abuse patient records; (h) Title VIII of the Civil Rights Act of 1968 (42 U.S.C. §§3601 et seq.), as amended, relating to nondiscrimination in the sale, rental or financing of housing; (i) any other nondiscrimination provisions in the specific statute(s) under which application for Federal assistance is being made; and, (j) the requirements of any other nondiscrimination statute(s) which may apply to the application.

7. Will comply, or has already complied, with the requirements of Titles II and III of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (P.L. 91-646) which provide for fair and equitable treatment of persons displaced or whose property is acquired as a result of Federal or federally-assisted programs. These requirements apply to all interests in real property acquired for project purposes regardless of Federal participation in purchases.

8. Will comply, as applicable, with provisions of the Hatch Act (5 U.S.C. §§1501-1508 and 7324-7328) which limit the political activities of employees whose principal employment activities are funded in whole or in part with Federal funds.

9. Will comply, as applicable, with the provisions of the Davis-Bacon Act (40 U.S.C. §§276a to 276a-7), the Copeland Act (40 U.S.C. §276c and 18 U.S.C. §874), and the Contract Work Hours and Safety Standards Act (40 U.S.C. §§327-333), regarding labor standards for federally-assisted construction subagreements.

10. Will comply, if applicable, with flood insurance purchase requirements of Section 102(a) of the Flood Disaster Protection Act of 1973 (P.L. 93-234) which requires recipients in a special flood hazard area to participate in the program and to purchase flood insurance if the total cost of insurable construction and acquisition is $10,000 or more.

11. Will comply with environmental standards which may be prescribed pursuant to the following: (a) institution of environmental quality control measures under the National Environmental Policy Act of 1969 (P.L. 91-190) and Executive Order (EO) 11514; (b) notification of violating facilities pursuant to EO 11738; (c) protection of wetlands pursuant to EO 11990; (d) evaluation of flood hazards in floodplains in accordance with EO 11988; (e) assurance of project consistency with the approved State management program developed under the Coastal Zone Management Act of 1972 (16 U.S.C. §§1451 et seq.); (f) conformity of Federal actions to State (Clean Air) Implementation Plans under Section 176(c) of the Clean Air Act of 1955, as amended (42 U.S.C. §§7401 et seq.); (g) protection of underground sources of drinking water under the Safe Drinking Water Act of 1974, as amended (P.L. 93-523); and, (h) protection of endangered species under the Endangered Species Act of 1973, as amended (P.L. 93-205).

12. Will comply with the Wild and Scenic Rivers Act of 1968 (16 U.S.C. §§1271 et seq.) related to protecting components or potential components of the national wild and scenic rivers system.

13. Will assist the awarding agency in assuring compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (16 U.S.C. §470), EO 11593 (identification and protection of historic properties), and the Archaeological and Historic Preservation Act of 1974 (16 U.S.C. §§469a-1 et seq.).

14. Will comply with P.L. 93-348 regarding the protection of human subjects involved in research, development, and related activities supported by this award of assistance.

15. Will comply with the Laboratory Animal Welfare Act of 1966 (P.L. 89-544, as amended, 7 U.S.C. §§2131 et seq.) pertaining to the care, handling, and treatment of warm blooded animals held for research, teaching, or other activities supported by this award of assistance.

16. Will comply with the Lead-Based Paint Poisoning Prevention Act (42 U.S.C. §§4801 et seq.) which prohibits the use of lead-based paint in construction or rehabilitation of residence structures.

17. Will cause to be performed the required financial and compliance audits in accordance with the Single Audit Act Amendments of 1996 and OMB Circular No. A-133, "Audits of States, Local Governments, and Non-Profit Organizations."

18. Will comply with all applicable requirements of all other Federal laws, executive orders, regulations, and policies governing this program.

19. Will comply with the requirements of Section 106(g) of the Trafficking Victims Protection Act (TVPA) of 2000, as amended (22 U.S.C. 7104) which prohibits grant award recipients or a sub-recipient from (1) Engaging in severe forms of trafficking in persons during the period of time that the award is in effect (2) Procuring a commercial sex act during the period of time that the award is in effect or (3) Using forced labor in the performance of the award or subawards under the award.

* SIGNATURE OF AUTHORIZED CERTIFYING OFFICIAL	* TITLE
Fernande Saintilis	Research Administration, Team Manager
* APPLICANT ORGANIZATION	* DATE SUBMITTED
University of Miami	12/07/2012

Standard Form 424B (Rev. 7-97) Back

FORM **CD-511**
(REV 1-05)

U.S. DEPARTMENT OF COMMERCE

CERTIFICATION REGARDING LOBBYING

Applicants should also review the instructions for certification included in the regulations before completing this form. Signature on this form provides for compliance with certification requirements under 15 CFR Part 28, 'New Restrictions on Lobbying.' The certifications shall be treated as a material representation of fact upon which reliance will be placed when the Department of Commerce determines to award the covered transaction, grant, or cooperative agreement.

LOBBYING

As required by Section 1352, Title 31 of the U.S. Code, and implemented at 15 CFR Part 28, for persons entering into a grant, cooperative agreement or contract over $100,000 or a loan or loan guarantee over $150,000 as defined at 15 CFR Part 28, Sections 28.105 and 28.110, the applicant certifies that to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, 'Disclosure Form to Report Lobbying.' in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure occurring on or before October 23, 1996, and of not less than $11,000 and not more than $110,000 for each such failure occurring after October 23, 1996.

Statement for Loan Guarantees and Loan Insurance

The undersigned states, to the best of his or her knowledge and belief, that:

In any funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this commitment providing for the United States to insure or guarantee a loan, the undersigned shall complete and submit Standard Form-LLL, 'Disclosure Form to Report Lobbying,' in accordance with its instructions.

Submission of this statement is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required statement shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure occurring on or before October 23, 1996, and of not less than $11,000 and not more than $110,000 for each such failure occurring after October 23, 1996.

As the duly authorized representative of the applicant, I hereby certify that the applicant will comply with the above applicable certification.

* NAME OF APPLICANT

University of Miami

* AWARD NUMBER

N/A

* PROJECT NAME

Prefix: Ms.

* First Name: Fernande

Middle Name:

* Last Name: Saintilis

Suffix:

* Title: Research Administration, Team Manager

* SIGNATURE: Fernande Saintilis

* DATE: 12/07/2012