

Southernmost Weather Reporter

**National Weather Service
Weather Forecast Office
Key West, FL**



Southernmost Weather Reporter

National Weather Service • Key West, FL

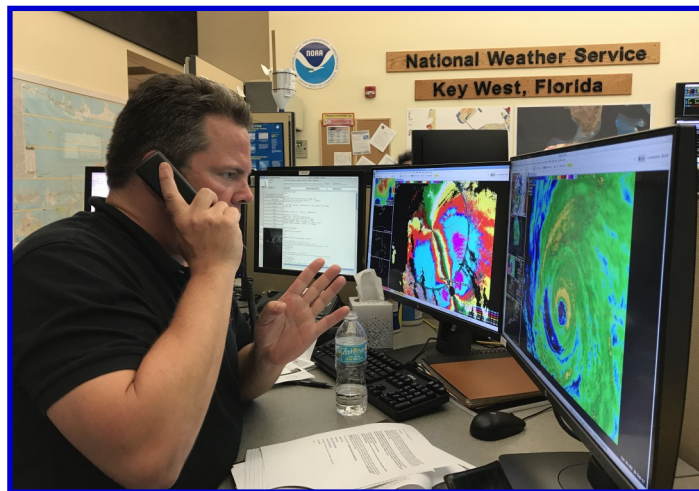
Welcome to the Summer 2019 Edition!

JULY 2019

Welcome to the Summer 2019 Edition of the *Southernmost Weather Reporter*! The staff meteorologists and technicians of your Florida Keys National Weather Service have been busy for the last several months, maintaining our 24/7 operation, and providing weather, water, and climate observations, forecasts, and warnings for the protection of life and property (our mission). In addition, as you will read, we have been working with our partners and customers to boost operational readiness for Hurricane Season 2019. Our ultimate endeavor is the realization of a “Weather Ready Nation”, where society is responsive and resilient to weather, water, and climate events. At the Florida Keys National Weather Service Forecast Office, we work to realize this vision through science and service. The scientific forecast process used daily by our duty forecasters facilitates the development of local knowledge and expertise. We collaborate with our emergency management, water resource, public safety, and military partners year-round to apply that expertise to the plethora of weather-sensitive decisions and actions in the vulnerable communities and adjacent coastal waters along our subtropical archipelago. We take pride in our work to support the fine men and women involved in hazard management and public safety at all levels of government, and in the private sector, with an aim to be their “force multiplier” when they need us most. Enjoy the latest *Southernmost Weather Reporter*!

Sincerely,

Kennard “Chip” Kasper
 Meteorologist-in-Charge
 Florida Keys National
 Weather Service



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National Weather Service Florida Keys Receives Prestigious Award at the 2018 Florida Governor's Hurricane Conference

By: Jon Rizzo



Florida Keys National Weather Service staff members accepting the 2018 achievement award at the Florida Governor's Hurricane Conference

The Florida Keys National Weather Service was recognized for superior public-private achievement during the May 2018 Florida Governor's Hurricane Conference (GHC). Meteorologists from the National Hurricane Center and the seven National Weather Service offices serving Florida attended the annual GHC, helping emergency managers, first responders, and media learn about hurricane impacts, National Weather Service products and services, and lead hurricane decision-making exercises. Most importantly, the GHC serves as a nexus for the National Weather Service to expand and maintain critical contacts at federal, state, and local levels with emergency management, fire rescue, law enforcement, transportation, utilities, non-government recovery organizations, and media.

Your Florida Keys National Weather Service was awarded the 2018 Florida GHC Public/Private Achievement Award, "...for exemplary dedication and efforts during Hurricane Irma." Prior to the devastating impacts from Hurricane Irma, your local National Weather Service meteorologists participated in numerous hurricane preparedness presentations, exercises, and training courses alongside local core partners, including a special course in crisis communications and media response. In the days leading up to and well after Hurricane Irma's impact on the Florida Keys, meteorologists and technicians battled fatigue while remaining adaptable to make quick, solid decisions and maintain support to our local and state responders. As the core of Hurricane Irma approached, meteorologists at the Florida Keys National Weather Service Office provided direct support to the Warning Coordination Meteorologist (WCM). The WCM, detailed to the Monroe County Emergency Operations Center (EOC), provided critical information to enable the EOC to temporarily relocate to a safer facility in Ocean Reef, and provide continuity of operations for life safety services. Public safety messaging flowed continuously from the National Weather Service Office through extensive use of social media and hundreds of media interviews to local radio stations and to national and international media. A single Tweet on Friday, September 8, 2017, earned an audience impression of 13.2 million users. Following the storm, the National Weather Service Office remained a critical hub for the City of Key West, Monroe County, and for state and federal agency responders as limited but continuously-functioning phone communications remained available.

Your National Weather Service was deeply honored to receive this recognition from the Florida emergency management and disaster recovery community, and today stands ready to provide essential weather decision support, warnings and forecasts for the protection of life and property in the Florida Keys.



FASCINATED BY WEATHER? BECOME A SKYWARN STORM SPOTTER!



- ⚡ There are over 350,000 trained SKYWARN spotters across the country. These volunteers help keep the community safe by providing accurate and timely reports of severe weather to the National Weather Service.
- ⚡ SKYWARN classes are announced on our website at www.weather.gov/key as well as on our Facebook and Twitter pages.
- ⚡ SKYWARN training does not have to wait for a scheduled public course. If you would like SKYWARN storm spotter training for your government agency, employees, or homeowner's association in the Florida Keys, please contact Jon Rizzo, our Warning Coordination Meteorologist, at phone number 305-295-1316 extension 223 or email address jonathan.rizzo@noaa.gov.

Recent 2018 Florida Keys National Weather Service Staff Changes

By: Bryce Tyner

In 2018, there were several staff members at the office who moved on to new opportunities, both inside and outside of the Florida Keys National Weather Service:

- Krizia Negron, former Meteorologist, reassigned as a Meteorologist to the National Weather Service in Melbourne, Florida. She completed the transfer to Melbourne in April 2018.
- Bill South, former Lead Meteorologist, accepted a position as a Lead Meteorologist at the National Weather Service in Hanford, California. He completed his service for the Florida Keys in July 2018.
- Melody Lovin, former Meteorologist, accepted a position as a Launch Weather Officer for the 45th Weather Squadron at the Air Force Space Command, located at the Cape Canaveral Air Force Space Station in Cape Canaveral, Florida. She began her new career in September 2018.
- Chris Rothwell, former Meteorologist, was promoted to Lead Meteorologist at the Florida Keys National Weather Service in November 2018.
- Mike Rapsik, former Lead Meteorologist, retired from the National Weather Service in September 2018. Mike's career with the federal government began in 1984 when he joined the U.S. Air Force, giving him a total of 34 years of federal service.
- Chip Kasper, former Lead Meteorologist, was promoted to Meteorologist-in-Charge at the Florida Keys National Weather Service in May 2018.

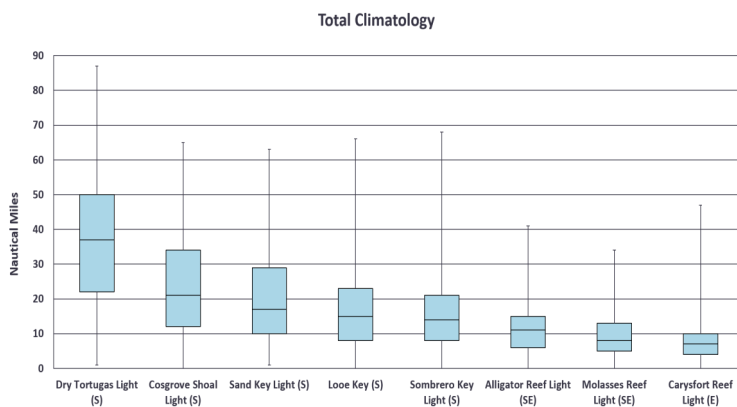
We wish everyone the best of luck in their new adventures!

Summer Research Project Provides Opportunity for Exposure to National Weather Service Day-to-day Operations

By: Caitlin Dirkes

My name is Caitlin Dirkes, and I am a recent graduating senior meteorology student at Florida State University (FSU). I had the opportunity to spend the summer of 2018 as a student volunteer at the Florida Keys National Weather Service (NWS). I grew up with an interest in the marine environment, so it was very fitting that I lived on my family's sailboat during my summer volunteership at the NWS.

I spent time in the office on all rotating shifts to get a feel for the different operations completed at various times of the day. I learned how to prepare and launch the weather balloon and then process the data following the launch. When I wasn't working on my research project or launching the weather balloon, I was shadowing Marine Program Leader and Lead Meteorologist Chris Rothwell. I observed his process of putting together a forecast and learned about the marine community's close relationship with the Florida Keys NWS. I spent a lot of time shadowing other forecasters and soaking up as much information about aviation, marine, and general forecasting as possible. The marine community in the Straits of Florida relies quite heavily on the products and services provided by the Florida Keys NWS, so Chris and Meteorologist-In-Charge Chip Kasper came up with the idea of doing a research project on the Florida Current and its yearly variability.



Total climatology of offshore position of the Florida Current (nautical miles) from eight reference points in the Straits of Florida.

The Naval Oceanographic Office provides regular analyses of the offshore position of the Florida Current in nautical miles from eight reference points in the Straits of Florida. I went through twelve years of archived data from 2006–2018 and condensed it all into a database organized chronologically. We sent the raw data to the Coastal Data Information Program so they could successfully redeploy a malfunctioning wave monitoring buoy. The previous buoy, placed too far south, struggled with the current velocities associated with the Florida Current. From the compiled database, I did a statistical analysis on the north wall's offshore position by year, month, and season, including box and whisker plots and

histograms. The final results were presented to the office during a brown bag seminar. I found that the north wall is generally closer to shore in the winters and summers, with much higher variability for locations west of Key West. Chris and I also collaborated on an abstract highlighting our development of a Florida Current climatology to submit to the 2019 annual meeting of the American Meteorological Society (AMS), which was accepted and turned into a poster presentation. With help and feedback from Chris, I designed the poster remotely from FSU and presented it on behalf of both of us in January at the AMS meeting in Phoenix, Arizona. It was an incredible experience, as I had never done research, collaborated on an abstract, or professionally presented my own project before. Volunteering at the Florida Keys NWS last summer was the perfect introduction to the world of operational meteorology. I have recently been accepted as a graduate student in the meteorology program at FSU, and I look forward to continuing to prepare for my future career in this exciting field of science!

Get to Know Our New Meteorologists: *Why did you decide to become a meteorologist?*

Chris Jacobson, Lead Meteorologist: I was always interested in weather growing up, and I started keeping daily temperature and rainfall records at home early in my high school years. When it was time to decide where I wanted to go to college, I already knew that I wanted to major in meteorology and eventually get into operational forecasting. There was no particular event that I can recall - the weather in Central Georgia where I grew up was pretty undramatic most of the time. I do remember enjoying the rare snowfall events.

Andy Haner, Lead Meteorologist: The choice to become a meteorologist grew from a natural childhood interest in weather. I spent my childhood in the Southwest Florida community of Sarasota. In the summer, I started to wonder why thunderstorms arrived at the same time on many summer afternoons. The explanation I heard about colliding east coast and west coast sea-breezes over the Peninsula was fascinating to me! Hurricanes fascinated me too, and I tried to focus as many high school reports as possible on hurricanes to make reports fun. On Labor Day weekend in 1985, my family had to evacuate for Hurricane Elena as she turned up stationary and spun around for most of that holiday weekend in the northeast Gulf. While the rest of my family tried to forget it all, I was obnoxiously glued to the TV all weekend wanting to hear about every wobble and gyration. In Feb. 1988, my parents arranged for a visit to the National Hurricane Center; I was blown away by the constant availability of looping satellite images, radar images, and so much more.

Bryce Tyner, Meteorologist: I grew up in Virginia Beach, where major snow events are quite rare. In Jan. 1996, when I was in the fourth grade, I recall a major blizzard that was threatening the Mid-Atlantic States. I remember going to bed with it snowing quite heavily outside, with forecasts of up to 12 inches of snow expected with the storm. I woke up to find most of the snow had washed away overnight, as warmer air from the Atlantic resulted in a changeover to rain; meanwhile, towns and cities just to the west of my home did not experience the changeover. I was amazed at how tight the precipitation-type gradient was in the area for this storm, and I knew I wanted to learn more about weather phenomena. My interest in weather was fostered with this event and grew with time.

Luis Ingram-Westover, Meteorologist: I first became interested in weather probably around the 1st or 2nd grade. My father was in the military, and that afforded me the opportunity to experience all types of weather. What really caught my attention was living in the Central Plains and getting to see severe weather. After that I was hooked and started my path to becoming a meteorologist.

William Churchill, Meteorologist: I've had an interest in the atmosphere since before I can remember. I grew up in Southern California where the weather was usually rather tranquil, but the occasional significant weather event really caught my attention. So much so that I became known as the "weather man" to my peers and teachers in middle school. I spent much of my summers growing up watching hurricane coverage on the Weather Channel, as well as obsessing over the reasons why these storms never impacted us in the Southwest U.S. despite our proximity to the Pacific Ocean. However, it was my move during high school to Memphis, Tennessee, that really cemented my career in meteorology. After seeing my first hail-producing severe thunderstorm, I soon became a Storm Spotter for the National Weather Service and started volunteering in the Memphis office shortly thereafter.

Sandy Delgado, Meteorologist: I always wanted to help people and liked science, especially hurricanes. I saw becoming a meteorologist and warning people about inclement weather as a way to accomplish my goals. Growing up in Cuba in the 1990s, there was very little information about everything, but I do remember becoming very aware of the path of Hurricane George in 1998 over eastern and central Cuba, and then Hurricane Irene in 1999, which moved over my hometown in Cuba. Irene occurred a month before I moved to the United States, and I did track it as much as I could, listening to Radio Reloj for the latest updates and also watching the coverage on TV. In 2000, now living in the United States, I was able to learn more about hurricanes and have tracked everyone of them since then.

Get to Know Our New Meteorologists: *Where did you go to school? What were you doing before joining the team at the Florida Keys National Weather Service?*

Chris Jacobson, Lead Meteorologist: I graduated from Florida State University in 1995, and I joined the National Weather Service a few months later. Prior to moving to the Keys, I was a Lead Meteorologist at the National Weather Service office in Honolulu, which also included serving as a Hurricane Specialist at the Central Pacific Hurricane Center. I previously worked at the Florida Keys National Weather Service from 2007-2013, and before that I worked at the Atlanta, Corpus Christi, Los Angeles, and New York City National Weather Service offices.

Andy Haner, Lead Meteorologist: Florida State University was an easy choice for college, since it was the only public in-state school in 1990 with a meteorology program. After graduating in 1994, my National Weather Service career started right here in Florida at the since-closed office in Apalachicola. I then got "Tornado-Alley time" in Tulsa, Oklahoma, from 1995-1999. Prior to joining the Key West team, I spent 19 years as a Meteorologist in the Pacific Northwest. The first three years were in Spokane, Washington, then the final 16 years were in Seattle. During the 16 years in Seattle (2003-2018), I also served as an Incident Meteorologist. Incident Meteorologists are specially trained and equipped for serving at incidents, most commonly serving for one to two week periods at the Incident Command Post for large wildfires.

Bryce Tyner, Meteorologist: I completed my undergraduate and graduate education at North Carolina State University. Before joining the Florida Keys National Weather Service Office, I was working as a researcher at Florida International University. The funding for the project was the Hurricane Forecast Improvement Program (HFIP). In the study, we were examining secondary eyewall formation and eyewall replacement cycles in the HWRF hurricane model. We were also looking at ways to better parameterize convective turbulence in the tropical cyclone eyewall for the HWRF model. The project was in collaboration with several other organizations, including the National Hurricane Center, the Environmental Modeling Center, and the Hurricane Research Division.

Luis Ingram-Westover, Meteorologist: I went to school at Valparaiso University in Northwestern Indiana. After college, I went into the private weather sector in Chicago and worked there for four years. In 2015, I left to pursue a career with the National Weather Service and landed an entry-level position with the National Weather Service office in Anchorage, Alaska. I spent just under two years there and was promoted to Meteorologist at Elko, Nevada. After a while in Elko, I heard about openings in my dream office, Key West. In the fall of 2018, I happily accepted a position as Meteorologist with the Florida Keys office.

William Churchill, Meteorologist: I attended Mississippi State University for my bachelor's degree in Operational Meteorology. I decided to stick around for a couple more years afterwards and received my master's degree in Meteorology/Climatology. While working on my master's, I had the opportunity to complete a Pathways Internship at the National Weather Service office in Seattle. After graduation, I was fortunate enough to start working full-time at the NWS office in Memphis. After two years, I accepted the opportunity to further my career as a Meteorologist at the Florida Keys National Weather Service Office.

Sandy Delgado, Meteorologist: I went to Florida International University (FIU). It was very convenient because it was a few blocks from where I lived with my parents; they still live there! While working on my bachelor's degree in Meteorology, I began to work with Chris Landsea at the National Hurricane Center on the HURDAT Reanalysis Project. After finishing my bachelor's degree, I started my master's at FIU with a thesis focused on the reanalysis of the 1954-1963 Atlantic hurricane seasons. After seven years of working on the reanalysis, the funding ran out in 2017, and I became a Tropical Meteorologist in Houston, Texas, for StormGeo, a private company. I was working the evening shift when the squalls associated with Hurricane Harvey arrived in Houston, causing catastrophic flooding.

Building Partnerships Across the Florida Keys to Enhance Marine Preparedness and Response

By: Christopher Rothwell

In order to build a Weather Ready Nation (WRN) across the Florida Keys, our vulnerable marine community must prepare for and respond appropriately to weather-dependent events. I am the new Marine Program Leader at the Florida Keys National Weather Service (NWS). I have continued the two-pronged, marine preparedness and response approach developed by previous Marine Program Leader, Chip Kasper.

Our first method for building a marine WRN is through outreach with our vulnerable marine community. The battle for marine preparedness is won during the off-season, outside of hurricane season. We are fortunate to have several seafood and ocean festivals across the Florida Keys, including Mote's Ocean Fest, the Gigantic Nautical Flea Market, the Marathon Seafood Festival, and the Key West Seafood Festival. In the spirit of OneNOAA, the Florida Keys NWS teams up with the Florida Keys National Marine Sanctuary to display side-by-side booths at all of these festivals. As with our core partners, relationships are built in person, not only with our colleagues in other National Oceanic and Atmospheric Administration (NOAA) line offices, but also with our diverse, yet vulnerable marine community. Real conversations with our charter boat captains, live-aboards, weekend warriors, ferry operators, longtime residents, and recently moved transplants highlight our strengths and weaknesses in communicating marine weather impacts, and also our customers' successes and gaps in marine preparedness. These conversations have led to our yearly seminars at local marinas and harbors, where liveaboards and harbor masters are provided with yearly training for hurricane preparedness. These seminars will be held at Boca Chica Marina and Boot Key Harbor during late spring and early summer. There is no substitute for sensing the pulse of our customers like marine outreach at community festivals.

Effective hazard management and community response also requires a seamless relationship with our local, state, and federal partners. We have built a close relationship with one of our core partners to sharpen the response side of our marine WRN. The United States Coast Guard (USCG) Sector Key West is home to a bustling Command Center (CC) and several Fast Response and Medium Endurance Cutters. One of our most valued methods for building relationships with our USCG partners is through mutual site visits. The turnover rate for USCG staff is high, which gives the Florida Keys NWS a valuable opportunity to share our local marine weather knowledge to newly enlisted crew and staff in the Sector Key West Area of Operation. We have found a short marine training seminar combined with a tour aboard the cutters, or of the CC, to be a great ice breaker for USCG and the Florida Keys NWS staff. Conversely, we offer a reciprocal tour of our facility to the crew of the cutters and the CC staff. Relationships are built in person, while understanding each other's core operations. When they need us most, we aim to be their force multiplier for effective community response to weather-dependent events.



Florida Keys National Weather Service welcomed staff from the USCG Cutter *Mohawk* on Feb. 12, 2019.



Florida Keys National Weather Service staff visited the USCG Cutter *Mohawk* on Feb. 26, 2019.

New Forecaster Serves as National Weather Service Diversity Ambassador

By: Luis Ingram-Westover

My name is Luis Ingram-Westover and I serve as an ambassador for the National Weather Service (NWS) Lesbian, Gay, Bisexual, Transgender (LGBT) and Hispanic affinity groups. I was inducted as the ambassadors for these two groups in the fall of 2018. As an ambassador, I work with the NWS Equal Opportunity and Diversity Management Division, and the NWS Diversity Council as the “subject matter expert” for my affinity groups. I help to lend guidance to all my fellow NWS workers across the 122 offices within our agency when it comes to issues or topics regarding the LGBT or Hispanic groups. Most recently, I have embarked on a project with the Equal Opportunity and Diversity Management Division (EODMD) to assist the LGBT community within our parent organization, the National Oceanic and Atmospheric Administration (NOAA), and throughout the NWS.

The project is multi-tiered, with the first phase being a presentation to management-level staff across NOAA and the NWS on April 22, 2019. The purpose of the presentation was to help those wanting to become an Ally for the LGBT community find new ways to make the workplace even more inclusive for their fellow workers within NOAA and the NWS.

In addition to my work with EODMD, I have assisted regional projects within the Western Region Diversity Action Committee (WR DAC) for the past two years. My work with WR DAC has included participating in videos for the month of June, which is designated as Pride Month, in which I talk about topics related to the LGBT community.

Billy and Ruthie Wagner Receive National Weather Service’s John Campanius Holm Award



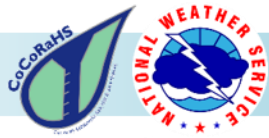
Meteorologist-in-Charge Chip Kasper (right) and Observation Program Leader David Ross (left) present Billy and Ruthie Wagner with the NWS’ John Campanius Holm Award and 35-year Length of Service Awards.

By: David Ross

On Thursday, October 18, 2018, several members of the Florida Keys National Weather Service (NWS) forecast office had the honor of presenting Billy and Ruthie Wagner of Duck Key with the John Campanius Holm Award and 35-year Length of Service Awards, for their unwavering support in providing weather observations.

Since 1982, the Wagners have maintained weather observation records at multiple residences in the Middle Keys. The Wagner family has maintained records through some of the roughest weather conditions the Florida Keys have experienced in the past few decades, including at least fifteen tropical storms or hurricanes.

Billy Wagner, former Senior Director of Monroe County Emergency Management, has been a strong supporter of the NWS and the Florida Keys Weather Forecast Office for decades. His coordination with the NWS while serving as Monroe County Emergency Management Director, and continued support of the local office in retirement, displays his dedication to the NWS mission.



CoCoRaHS: Citizen Science



What is CoCoRaHS?

A community-based network of volunteers working together to measure and map rainfall, hail, and snow (for those up north!)

How is CoCoRaHS data useful?

- Precipitation is important and highly variable
- Data sources are few and rain gauges are far apart
- Used by scientists for warning operations/research

As a CoCoRaHS observer you will need:

- Internet access
- Approved CoCoRaHS rain gauge (available for purchase via their website)
- Site with good exposure
- Be willing to enter rainfall data daily

Observers Needed:

- | | | |
|-------------------|------------------|-------------------|
| • Stock Island | • Sugarloaf Key | • Marathon |
| • Big Coppitt Key | • Summerland Key | • Sombrero Beach |
| • Geiger Key | • Ramrod Key | • Long Key |
| • Baypoint | • Torch Keys | • Upper Matecumbe |
| | • Big Pine Key | • Plantation Key |
| | • No Name Key | • Tavernier |

Sign up at www.cocorahs.org

2018 Florida Keys Climate Summary

By: David Ross

The Florida Keys ended 2018 on a warm note, continuing the trend of above normal month after above normal month. With an average temperature of 79.4°F (1.6°F above normal), Key West tied 2017, 1991, and 1880 for the 3rd warmest year on record. Marathon averaged 79.6°F (1.2°F above normal), ranking as the 5th warmest year on record. The warmest year on record for both of these climate locations is 2015. At Key West, the average annual temperature in 2015 was 79.9°F and at Marathon it was 80.5°F.

Key West and Marathon saw all but four months of the year above the 30-year normal/average temperature (1981-2010). The latter part of the year was the period where both sites were above normal the longest. Key West averaged above normal temperatures for July through December and for Marathon it was September through December. Throughout the year, Key West experienced five months that ranked in the top five warmest on record, and Marathon experienced four such months.

The warmest days recorded last year for Key West were July 19th, 22nd, and 26th, when the average daily temperature was 89.5°F. For Marathon, the warmest day recorded was July 22nd, with an average daily temperature of 90.0°F. The coolest day for both sites was January 18th, when the average temperature at Key West was 57.5°F, and at Marathon it was 55.0°F.

Not only were there warm days last year, there were a lot of warm nights as well. In fact, nearly two-thirds of all temperature records last year were for warm minimum temperatures (*see table below for a breakdown of daily records set or tied*). In addition to the multitude of daily temperature records, there were three monthly records tied over the course of the year. Key West tied the monthly high temperature record of 95°F in September, and Marathon tied the monthly high temperature record of 88°F in December. Key West also tied the monthly warm minimum temperature record of 81°F in November.

While 2018 was a warm year across the board for the Florida Keys, rainfall amounts varied quite a bit for the island chain, ending on the dry side for all locations with below “normal” values (shown below). Key West ended the year with 37.50 inches of rainfall, only a couple of inches below normal (-2.33 inches), whereas Marathon ended up with 31.50 inches, over one foot deficit (-14.67 inches). This deficit ranked Marathon as the 8th driest year on record, the driest being 1989 when only 21.16 inches of rainfall was measured.

The wettest days recorded last year for Key West and Marathon occurred just over a month apart, on April 15th for Marathon when 2.50 inches was measured, and on May 25th for Key West when 3.41 inches was measured. Key West experienced eight days last year with 1 inch or more of rainfall, down slightly from the long-term average of ten days, while Marathon experienced nine such days, also down slightly from the long-term average of eleven days per year.

(Story continued on Page 11)

2018 Florida Keys Climate Summary (continued)

May was the wettest month of the year for both Key West (14.17 inches) and Marathon (9.70 inches), while the driest month of the year for Marathon was February (0.13 inches) and for Key West was April (0.21 inches). This wet May was also enough to take the top spot for wettest May on record for Key West, shattering the previous record of 13.01 inches from 1904. May's rainfall at Marathon was enough to rank as the 4th wettest May on record, almost half a foot shy of the top spot from 1968 with 15.47 inches of rainfall recorded.

On the opposite end of the spectrum, the driest months from 2018 for Key West and Marathon were April and February, respectively. Key West only received 0.21 inches of rainfall in April, ranking outside the top ten driest Aprils on record, and Marathon only received 0.13 inches of rainfall in February, making it the 3rd driest February on record. The driest February on record for the Marathon area is 1955, when only a trace of rainfall was recorded. A trace indicates that rainfall was observed, but that it was not enough to measure.

In other big climate news, effective January 1, 2019, we began tracking daily and monthly climate data records for the Marathon area. This was made possible by combining data from multiple observation locations throughout Marathon, dating back to the 1950s. It is important to note that while these stations have been combined to create a longer period of record for the Marathon area, data gaps do exist and some areas tend to run warmer than others. One example of this is the Marathon ASOS (the official climate site since May 14, 1998), which tends to run warmer due to its proximity to the Overseas Highway and the airport runway.

Observation sites combined for the Marathon area records are indicated below, along with their location and the begin/end date data.

Observation Site (Site ID)	Latitude/Longitude	Begin Date	End Date
Marathon Shores (COOP 085351)	24.73°N/81.05°W	05/27/1950	10/31/1975
Conch Key (COOP 081795)	24.78°N/80.88°W	06/01/1982	09/30/1994
Duck Key (COOP 082441)	24.77°N/80.91°W	10/01/1994	05/13/1998
Marathon Airport (ASOS KMTH)	24.73°N/81.05°W	05/14/1998	Present

Below is a summary of daily records that were either set or tied at Key West and Marathon. Daily records date back to January 1871 for the Key West area and June 1950 for the Marathon area.

RECORDS (Set or Tied)	DAILY TEMPERATURE				DAILY RAINFALL
	Maximum	Low Maximum	High Minimum	Minimum	
Key West	17	0	45	0	4
Marathon	21	2	22	0	6

“One Human Family”: Forecasting in a Diverse Town

By: Sandy Delgado

The Florida Keys National Weather Service (NWS) is located in the diverse town of Key West. The diversity is seen in the weekly festivals and celebrations, or simply by taking a stroll down the famous Duval Street! The “Conch Republic,” made up of the Florida Keys was formed in 1982 in response to a U.S. blockade at Florida City. Every year in April, an Independence Day celebration for the Conch Republic celebrates the island’s diverse and eccentric community, and it is a great display of the uniqueness and independent nature of the Florida Key residents. Furthermore, the official island philosophy of Key West, “One Human Family,” is also a testament to the accepted diversity on the island.

For us at the Florida Keys NWS, diversity is also vital. We have a diverse staff from different corners of the United States and the Caribbean. Our diversity allows for an exchange of ideas and capabilities, encouraging innovation in research and operations. Diversity also nurtures respect among the employees that work daily to achieve the goal of saving lives and property. We live in a world that is constantly changing, and never has it been more important to be active in the social platforms. The majority of people are receiving their weather information through Facebook and Twitter, and we need to be an active force to better serve our customers. In the Florida Keys, English and Spanish are the two prevailing languages. Thus, having a team that can provide services in both languages is also imperative to keeping the population safe when severe weather arises.



Isaac M. Cline Award Winners

By: Kennard “Chip” Kasper

The staff of the National Weather Service in Key West who worked during Hurricane Irma in 2017 were recognized by being selected as the **2018 National Isaac M. Cline Award** recipients! This prestigious award was presented for *“heroic service and leadership before, during, and after Hurricane Irma’s landfall in the Florida Keys and adjacent coastal waters. The Isaac M. Cline Award recognizes operational excellence of line and program staff employees in the delivery of products and services supporting and enhancing the achievement of National Weather Service strategic and operating plans. The awards are named in honor of Isaac M. Cline, one of the most recognized employees in weather service history. Dr. Cline made numerous contributions to the mission of the Weather Bureau. Most noteworthy of his accomplishments were the actions he took during the Galveston Hurricane of 1900, the deadliest weather event in U.S. history. Dr. Cline’s acute understanding of weather conditions and his heroic forecasts and hurricane warnings likely saved thousands of lives. The staff meteorologists and technicians of your Florida Keys National Weather Service Forecast Office worked 24/7 during the threat, landfall, response, and recovery of Hurricane Irma, the first Category 4 hurricane to directly affect Florida Keys communities in 57 years.”*

Be a “Force of Nature” through the Weather-Ready Nation Ambassador Program

By: Jon Rizzo

The Florida Keys are vulnerable to the impacts from extreme events, including devastating hurricanes, tornadoes, and flooding. However, these impacts can be reduced by taking advanced action to help build a Weather-Ready Nation, where communities are better-prepared to plan, protect, and recover from weather-induced disasters.

Your National Weather Service (NWS) is transforming its operations to help the Florida Keys respond appropriately to hazardous weather impacts. Forecast and warning information is being provided to better support emergency managers, first responders, government officials, businesses and the public, to make fast, smart decisions, to save lives and property, and to enhance livelihoods.

Did you know you can also help the Florida Keys become part of the Weather-Ready Nation? If you are interested, the Weather-Ready Nation Ambassador program is for you! Weather-Ready Nation Ambassadors in the Florida Keys commit to working with the NWS and is open to government, non-profit organizations, academic institutions, and private industry. This partnership provides a force multiplier for the National Weather Service and local emergency managers to better educate the public on their weather risks and how best to prepare and respond. This program is free to join and opens a path to learning about weather hazards and preparedness materials to view and download.

To be recognized as a Weather-Ready Nation Ambassador, agencies and organizations commit to:

1. Promoting Weather-Ready National messages and themes with their partners and customers;
2. Engaging with NWS personnel on potential collaboration opportunities;
3. Sharing their success stories of preparedness and resilience;
4. Serving as an example by educating employees on workplace weather preparedness



In response, your Florida Keys NWS can help provide weather hazard outreach materials and help with weather safety seminars, workshops, and exercises. Florida Keys' Ambassadors will be individually recognized on our “Weather-Ready Nation Wall,” located within Florida Keys NWS, where community partners regularly meet and plan with local resident meteorologists.

If you're ready to become a “Force of Nature,” helping the Florida Keys

community learn about weather risks, preparedness, and plan to respond for weather emergencies, consider joining more than 9,000 Weather-Ready Nation Ambassadors across our growing Weather-Ready Nation. You may register online at the following web address:

<http://www.weather.gov/wrn>

2019 Marks the 100th Anniversary of the Great 1919 Keys Hurricane

By: Sandy Delgado

One of the most damaging hurricanes to impact the United States, not just the Florida Keys, moved across the Lower Keys 100 years ago this September. The 1919 hurricane season was generally quiet. Originally, only three tropical cyclones were cataloged. Later, the number was increased to five after a re-analysis of the hurricane season was conducted by a team headed by Dr. Chris Landsea at the National Hurricane Center. The 1919 season is an example that it does not matter how many hurricanes form in a hurricane season, but rather it is how many of them affect land that is important. In 1919, the Florida Keys were still recovering from the impacts of the major hurricanes that hit in 1906, 1909, and 1910. The 1919 Florida Keys Hurricane formed from a tropical wave that likely left the coast of Africa in late August. A tropical depression was identified near Guadeloupe on September 2nd and it intensified into a tropical storm on September 3rd as it passed south of the US Virgin Islands. It made landfall as a weak tropical storm in southwestern Puerto Rico on September 3rd and skirted the northern coast of the Dominican Republic on September 4th. Over the next few days, the tropical storm slowed down over the eastern Bahamas and gradually increased in strength. On September 7th, it became a hurricane and turned to the west-northwest, increasing in forward speed.



Damage at the Key West waterfront due to the storm surge from the 1919 Florida Keys Hurricane

The hurricane quickly gained strength over the central Bahamas, becoming a major hurricane on September 8th. Based on observations from Nassau and Miami, a Storm Warning was issued from Jupiter to Fort Myers, including the Florida Keys, at 10 a.m. on September 8th. The Storm Warning was upgraded to a Hurricane Warning from Jupiter to Key West at 1 p.m. on September 8th. At this time, Nassau was reporting northeast winds of 56 mph. The first squalls likely arrived in the Upper Keys late on September 8th and then spread west across the Florida Keys on September 9th. On September 9th, the hurricane reached Category 4 intensity, with maximum sustained winds of 130 mph. The forward speed of the hurricane decreased as it passed near the Lower Keys late September 9th and early September 10th. It made its closest approach to Key West around midnight of September 9th, passing about 30 miles south. Strong winds, heavy precipitation, and high waves battered Key West and the rest of the Lower Keys. Estimated maximum sustained winds in Key West reached 110 mph around 1 a.m. on September 10th. The winds are only estimated because the anemometer was blown away on the night of September 9th. The slow forward speed of the hurricane caused tropical storm force winds in Key West to last over 24 hours and hurricane force winds to last around 10 hours. Significant damage was reported across Key West. Houses and buildings were wrecked, ships anchored in the harbor were pushed onshore, and trees and poles were blown down. Despite the severity of the hurricane, almost all the deaths occurred at sea. The Spanish steamer *Valbanera* tried to take refuge in Havana Harbor on September 8th, but the high waves made it impossible. The ship was lost when it struck Rebecca Shoals, causing the deaths of 488 people. This remains one of the worst maritime disasters in the Florida Keys.

On the morning of September 10th, the hurricane made landfall in Dry Tortugas with maximum sustained winds of 150 mph, as the storm reached its peak intensity. Over the next few days, the hurricane continued on a general west-northwestward track across the Gulf of Mexico, finally making a devastating landfall in Corpus Christi, Texas, on the afternoon of September 14th. One of the families affected by this hurricane in Corpus Christi was that of the then-young Dr. Robert H. Simpson, a future Director of the National Hurricane Center, and co-creator of the Saffir-Simpson Hurricane Wind Scale. The 1919 hurricane likely had a significant impact on his life that he dedicated most of his life. Dr. Simpson spent much of his career dedicated to understanding and predicting hurricanes.

New Weather Satellite Has Ability to Detect Larger Fires: Can it Benefit the Florida Keys?

By: Andy Haner

What does a weather satellite have to do with real-time wildfire detection? Until the launch of the GOES-16 satellite in 2017, the answer was “very little.”

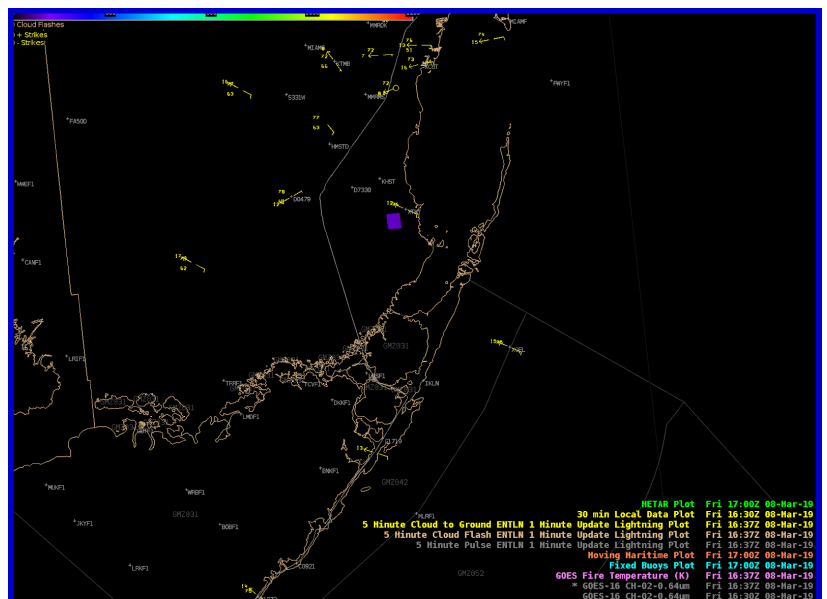
However, the National Oceanic and Atmospheric Administration (NOAA)’s launches of GOES-16 (now GOES-East) in 2017 and GOES-17 (now GOES-West) in 2018 have changed that. These satellites have not only revolutionized our ability to detect and monitor severe weather; they also provide revolutionary new capabilities in real-time wildfire detection!

Why is this? GOES-16 provides three times more spectral resolution than the previous generation of weather satellites. This means the new satellite has more ways of looking at the Earth’s atmosphere, oceans, and land surfaces. This includes a more sensitive shortwave 3.9 micron band, which enables detection of much smaller fire hotspots. For a fire burning at 440 degrees Kelvin (332 degrees Fahrenheit), it now takes only a 15-acre hotspot to be detected (it previously took a 70-acre hotspot to be detected). The satellite can detect an even smaller signature if the fire is hotter or more intense.

Another great benefit of GOES-16 is reduced latency and increased sampling frequency. Forecasters now have access to satellite imagery *just one minute after the image is captured in space!* Plus, during a special scanning mode that is commonly used during severe weather, a new image arrives every minute. It is truly a real-time tool!

For the first time, weather satellites could conceivably be a new “fire lookout” in the sky for the Florida Keys. This has already been the case in other parts of the United States. In the western U.S., where larger wildfires are more common, weather satellites have been the first to detect a number of fires. Compared to human eyesight detection, the satellite has the greatest advantage when thick smoke from other nearby fires hampers humans’ ability to visually see the smoke from a new fire. In contrast, smoke does not get in the way of satellite detection.

On December 18, 2018, a National Weather Service (NWS) Meteorologist in Kentucky working in the middle of the night was the first to alert 911 dispatchers of a fire that turned out to be a barn fire in Adair County, Kentucky, thanks to GOES-16 data! There has even been a documented case of GOES-16 being the first to detect a large house fire in Oklahoma.



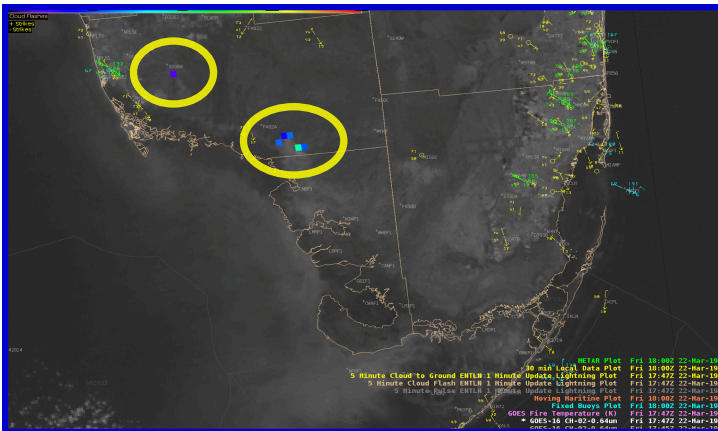
Hot Spot detection (shown by purple dot) in south Miami-Dade County at 11:37 am on Friday, March 8, 2019.

New Weather Satellite Has Ability to Detect Larger Fires: Can it Benefit the Florida Keys? (continued)

Closer to South Florida, fire hotspots are a daily occurrence over Cuba and the southern Florida Peninsula, likely due in part to agricultural burning. Larger prescribed burns are also commonly detected on the Florida Peninsula.

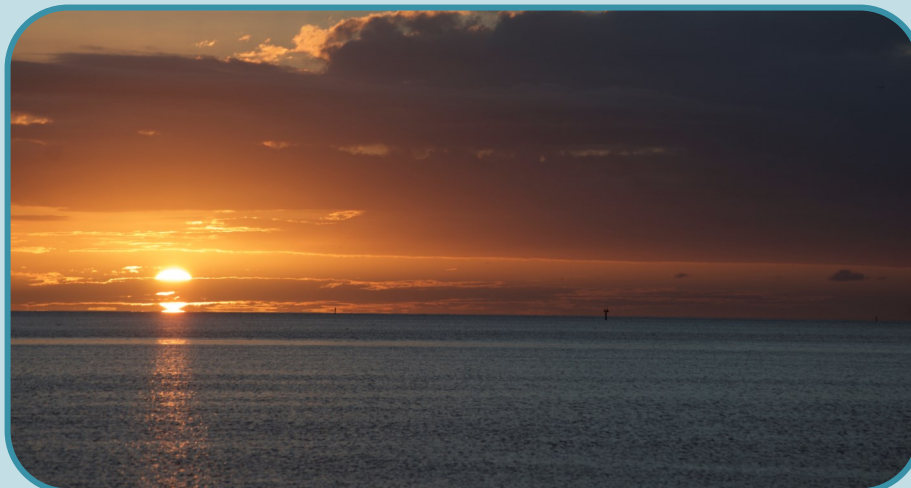
Alongside the other NWS offices in Florida, the Florida Keys NWS is currently evaluating a new tool that automatically alerts forecasters as soon as GOES-16 detects a new hotspot. In the uniquely challenging environment of the Florida Keys, we will be out to answer a few questions:

1. Are fires in the Florida Keys large enough to even be detected by satellite?
If so...
2. Who or what will detect larger fires first: a person calling 911, or GOES-16?
3. Are false alarms an issue?
4. Are satellite hotspot detections reliable and timely enough to send notifications automatically to first responders, without forecaster interaction?



Hotspot detections during prescribed fires over Collier County on March 22, 2019. Smoke is seen drifting off to the south from these fires.

After several months of testing in the Florida Keys, we are still looking for a first success with this tool, but it is also early in the evaluation process. On February 20, there was a brush fire on Big Pine Key that was controlled before becoming large enough for satellite to detect (thankfully!). There has also been one false alarm over North Key Largo. Evaluation of this tool will continue through much of 2019.



2018 Notable Marine Decision Support Services

By: Christopher Rothwell

It has been a busy year for the Florida Keys National Weather Service (NWS) Marine Program while we continue to support our local, state, and federal partners, including other National Oceanic and Atmospheric Administration (NOAA)-line offices. Marine Program Leader Chris Rothwell and Meteorologist-in-Charge Chip Kasper met with the crew of the United States Coast Guard (USCG) cutter *Isaac Mayo* in June 2018 to discuss recent changes to the WFO KEY Marine Program, including a demonstration of the Advanced Weather Interactive Processing System and a tour of our office. In July 2018, Rothwell and Kasper gave a seminar to Boot Key Harbor titled "Hurricane Preparation for Boaters and Live-aboards." The decision to live aboard a sailboat or yacht offers unique challenges when preparing for and responding to tropical cyclone impacts. They were joined by Monroe County Emergency Management Director Marty Senterfitt.

To multiply our marine spotter network and to foster deeper relationships with our NOAA-line offices, Rothwell and Kasper conducted two Marine Spotter Training sessions at the Upper and Lower Region offices of the Florida Keys Marine Sanctuary (FKNMS) during the second and fourth weeks of August 2018. In late August 2018, Kasper, Rothwell, and Warning Coordination Meteorologist Jon Rizzo met with Dave Shen, a NOAA contracted project coordinator for a high resolution hydrographic survey of the FKNMS. They discussed the tropical cyclone warning cycle and contingency plans for their large, multi-hulled survey boats. Rothwell and Kasper met with FKNMS Science Coordinator Andy Bruckner in September 2018 to discuss forecast support for the upcoming R/V *Nancy Foster* cruise. The grounding of the CF/V *San Diego* in October 2018 required daily NWS spot forecasts for a multi-agency response and recovery. Rothwell provided FKNMS Marine Operations Director Chad Stolka valuable daily DSS briefs for his planned voyage from Miami, Florida, to Beaufort, North Carolina, aboard the R/V *Peter Gladding*. Critical voyage decisions and logistics were adjusted based on these briefs, including waiting for the passage of Hurricanes Florence and Michael. And finally, WFO Key West provided daily weather briefs to support the R/V *Nancy Foster's* two-week November research cruise through the FKNMS. The office received glowing accolades from the ship's Commanding Officer and the Principal Science Investigator. CDR G. Mark Miller said, "Thank you all for the great service. Your forecasts have helped make the trip a booming success." FWC scientist Dani Morley commented, "Thank you, WFO Key West! Tomorrow we are pulling back into Key West and offloading all of our gear. We greatly appreciate the support you have provided during this mission!"



NOAA R/V *Nancy Foster*

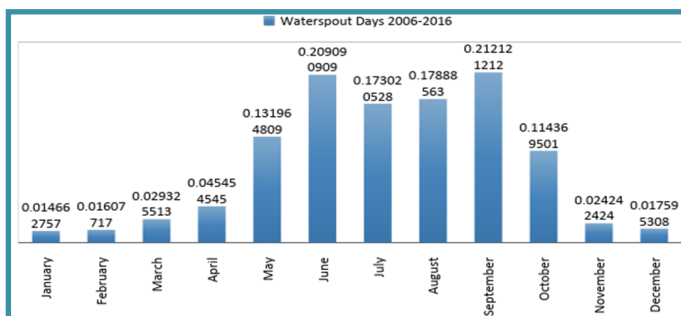
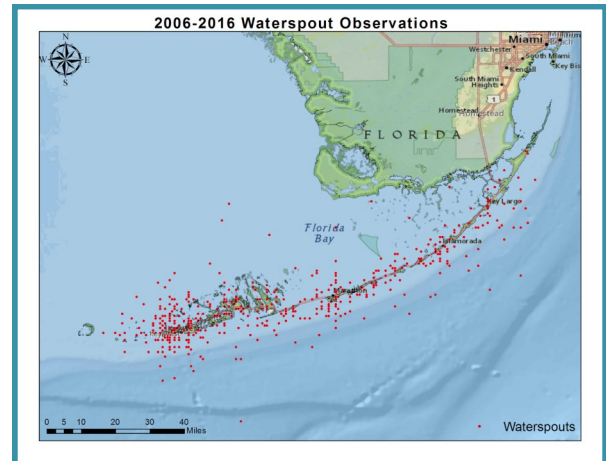
Development of a Predictive Waterspout Index

By: Andy Devanas

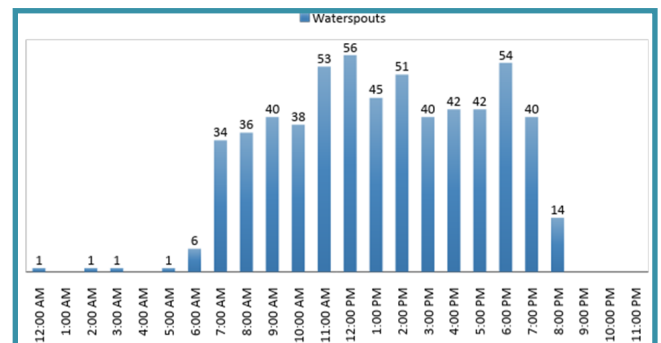
The frequency of waterspouts in the Florida Keys is higher than any other location in the United States and may be one of the highest in the world, with hundreds of waterspouts occurring annually. Waterspouts are a marine hazard and do occasionally come on shore, potentially resulting in damage to coastal structures. Only a fraction of waterspouts is actually observed and recorded. During the Lower Keys Waterspout Project in 1969 conducted by Dr. Joe Golden, at least 400 waterspouts were documented. Dr. Golden estimated that between 50 and 500 waterspouts occur each year over the Florida Keys' coastal waters. Despite Golden's estimates, on average, only 25 waterspouts are reported during the wet season (June-September) in any given year, indicating waterspouts are likely severely underreported. Since waterspouts are relatively small in size, they generally cannot be detected by Doppler radar or by satellite. Therefore, the only way to really know a waterspout has occurred is for someone to observe and report the waterspout. In other words, if it isn't witnessed AND reported, it didn't officially occur because there are currently no other ways to detect them. So, if you do spot a waterspout, please remember to report it to the Florida Keys National Weather Service (NWS).

Florida Keys waterspouts have been reported in every month of the year, although less frequently from October to May. Waterspout formation is noticeably more likely during the wet season, with a primary maximum in June, and more likely from 11 a.m. through 6 p.m.

During the summer months, there are typically minimal day-to-day atmospheric changes (outside of tropical events). This poses a significant challenge to forecasters. How can you differentiate between favorable and unfavorable days for waterspout development if there is little change in the atmosphere? Additionally, since waterspouts are underreported, even accurate forecasts could be considered incorrect if no waterspouts are spotted and reported.



Number of observed waterspout days per month



Number of observed waterspouts by hour

(Continued on Page 19)

Development of a Predictive Waterspout Index (continued)

This forecast difficulty was the impetus for the Key West waterspout study: whether or not there is a statistically significant meteorological difference between days when waterspouts were reported, and days without reports during the summer months. Objective waterspout guidance for the Key West area is limited, and forecasters rely mainly on subjective techniques and empirical rules of thumb to forecast the possibility of waterspout development. Therefore, reliable objective guidance used in combination with available subjective tools would likely aid the forecast process. So, it was decided that the study should be entirely objective; in other words, let the data speak for itself without interjecting what is THOUGHT to be causing a favorable waterspout environment. Eleven years of data from the Florida Keys NWS morning balloon sounding were chosen for this investigation (2006-2016). This data included over 1300 days of which about 260 were waterspout report days (at least one report). This means during the study period, waterspouts occurred about one out of every five days (or 20% of the days) during the summer months. The instrument (called a radiosonde) attached to the balloon, called a radiosonde, measures temperature, moisture, and wind speed/direction, from the surface through approximately one hundred thousand feet (almost 20 miles above us). For each day, over 200 parameters were extracted from the balloon sounding data and used for the study.

Several statistical methods were used to objectively evaluate the data and create a Key West Waterspout Index (KWWI) based on a logistic regression model. Although logistic regression is a very complex statistical method, it can be thought of as a predictive model which evaluates the likelihood of an event occurring (waterspout yes/no). The output from the model is a probability of a waterspout occurring that day (e.g. 30% chance of a waterspout occurring). Since waterspouts occur on about 20% of days in the summer, the index can be a measure of whether conditions are more or less favorable than normal. For instance, a probability of 30% indicates conditions more favorable than normal, whereas a probability from the index of 10% would be less favorable than normal.

Testing and evaluation of the KWWI showed it was indeed able to reliably predict whether waterspouts were more or less likely to occur on any given summer day. The index was then tested against all other known waterspout indices (4 other indices), and was found to significantly outperform all of them. The logistic regression model uses eight of the original 200 some parameters examined, the most important of which is light winds from the ground surface up to about ten thousand feet.

The KWWI percentage is currently not included regularly in any of the Florida Keys NWS public products, but will be at times referenced in the local Area Forecast Discussion at the forecaster's discretion. However, the KWWI will be used in combination with other subjective methods to evaluate the chance of waterspout development. If it appears to be a favorable waterspout day, this will be highlighted in the Hazardous Weather Outlook and/or the short-term weather forecasts.



The work done on this study was published in the peer reviewed journal *Weather and Forecasting* in April of 2018. For any questions or comments on this work, please contact Andy Devanas (andrew.devanas@noaa.gov) at the Florida Keys NWS.

Celebrating the 75th Anniversary of Marathon International Airport

By: Adam Futterman



Florida Keys National Weather Service booth at the 75th Anniversary Celebration for Marathon International Airport

On October 20, 2018, Florida Keys National Weather Service Aviation Program Leader, Adam Futterman, and Warning Coordination Meteorologist, Jon Rizzo, staffed an informational booth at the Florida Keys Marathon International Airport's 75th Anniversary Celebration. Initially opening as a military facility in 1943, the airport in Marathon transitioned to a civilian airport following the conclusion of World War II. During subsequent decades, the airport has been used for both general and commercial aviation, and recently, has been designated as an airport of entry, with a 4,200-square-foot U.S. Customs and Border Protection facility, having

opened in 2016. Futterman and Rizzo met with many partners and stakeholders in the Florida Keys aviation community, including the Southernmost Experimental Aircraft Association (EAA) Chapter 1241, the primary sponsor of the anniversary celebration. The EAA is a nationwide organization consisting of local and regional chapters, with membership including aviation enthusiasts, aircraft builders, and pilots who get together to share ideas, exchange information, encourage safety, and serve the aviation community.

Futterman and Rizzo provided information pertaining to hazardous aviation weather and National Weather Service aviation products and services to numerous attendees. Many visitors asked questions about low-level wind shear, mechanical turbulence, thunderstorms, microbursts, aviation forecasts, and the popular aviationweather.gov website.

We look forward to collaborating with our partners throughout the Florida Keys aviation community to achieve our vision of an "Aviation" Weather-Ready Nation!

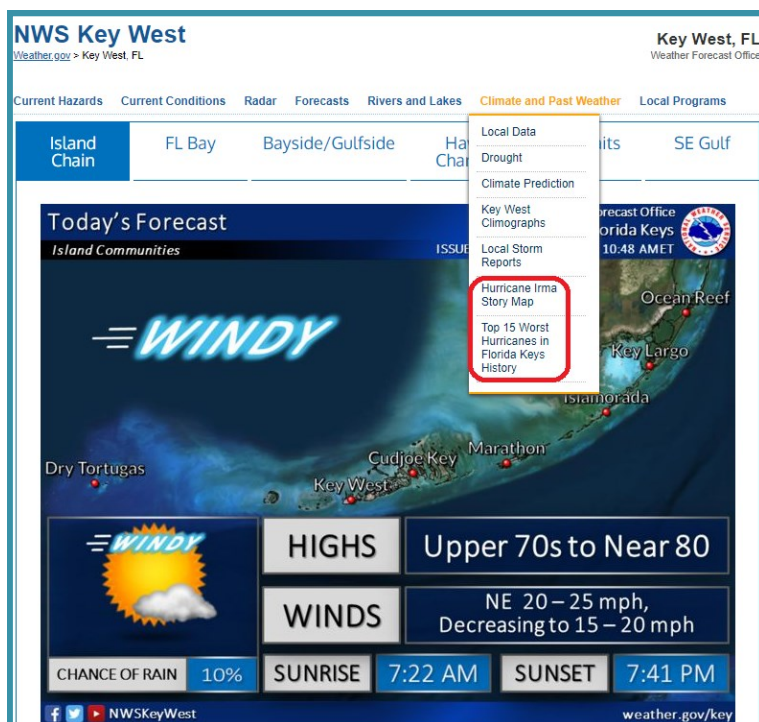
“Let Me Tell You a Story...” Map

By: Melody Lovin

It feels like 2019 just started, but hurricane season is already upon us – and you can never prepare too early if you’re living in the Florida Keys. One of the best ways of mentally preparing oneself is to know what happened in the past. As the saying goes, “those who do not learn history are doomed to repeat it.”

The Florida Keys National Weather Service (NWS) has two unique ArcGIS story maps crafted specifically to the Florida Keys – and they both focus on historical tropical events. You can find these story maps on our website (weather.gov/key) and under the “Climate and Past Weather” section. The two story map links appear at the bottom of the pop-up menu.

The first story map is titled, “The Tale of Hurricane Irma from the Florida Keys.” You can also reach this map via the following link: <https://arcg.is/8bvS5>. This story map is rich with detail, from the meteorological history of Hurricane Irma (2017), to NWS operations prior to and during landfall, to observations (and estimations) of wind, rainfall, and storm surge as it passed. There are five interactive web maps within this story map, so click away, and investigate the storm!



The second story map is titled, “The 15 Worst Hurricanes in Florida Keys History.” You can also reach this map via the following link:

<https://arcg.is/1enunm>. As the title implies, we dug through our meteorological archives and catalogued the hurricanes that had the greatest impact on the Florida Keys. The first hurricane in the story map may surprise you... because it’s a storm that we don’t even have an official track for. Why? Because it formed in September of 1622! While it doesn’t even have a name or a track, it was important because it famously sank the Nuestra Señora de Atocha off the Marquesas Keys – a wreck that Mel Fisher would later discover in search of sunken treasure.

Other storms we included are: The Great Havana Hurricane of 1846, 1906, 1909, Cuba (1910), 1919, Bahamas Hurricane of 1929, Labor Day Hurricane, the two hurricanes of 1948, Donna, Betsy, Georges, Wilma, and of course, Irma. A lot can be learned from the past, and we encourage you to check these story maps out.

How to access the story maps from our website, available at www.weather.gov/key

One of the most surprising things I learned while compiling this information was the fact that three of these storms made landfall in the Keys on the same calendar day, September 10th, which happens to be the climatological peak of the Atlantic Hurricane Season.

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Cover Photograph by David Ross

