Tropical Winds

The Official Newsletter of WFO Miami

David Ross- April 2010

Issue 10 – Spring 2013

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Welcome to the "Tropical Winds" Newsletter. In this issue, we will begin by looking back at the dry season and then look forward to the upcoming Hurricane Season. Remember, it is never too early to prepare, and what better way to do so than reading about South Florida's hurricane climatology and describing our forecast products! Also, we will discuss recent changes we've made to our marine forecast over the past few months that better describe the expected conditions. After an interesting article about airplane contrails, the employee spotlight will wrap up on a happy note.

Happy reading!!!

Weather Summary

Dan Gregoria- February 2013

By David Ross

Looking Back at the Dry Season

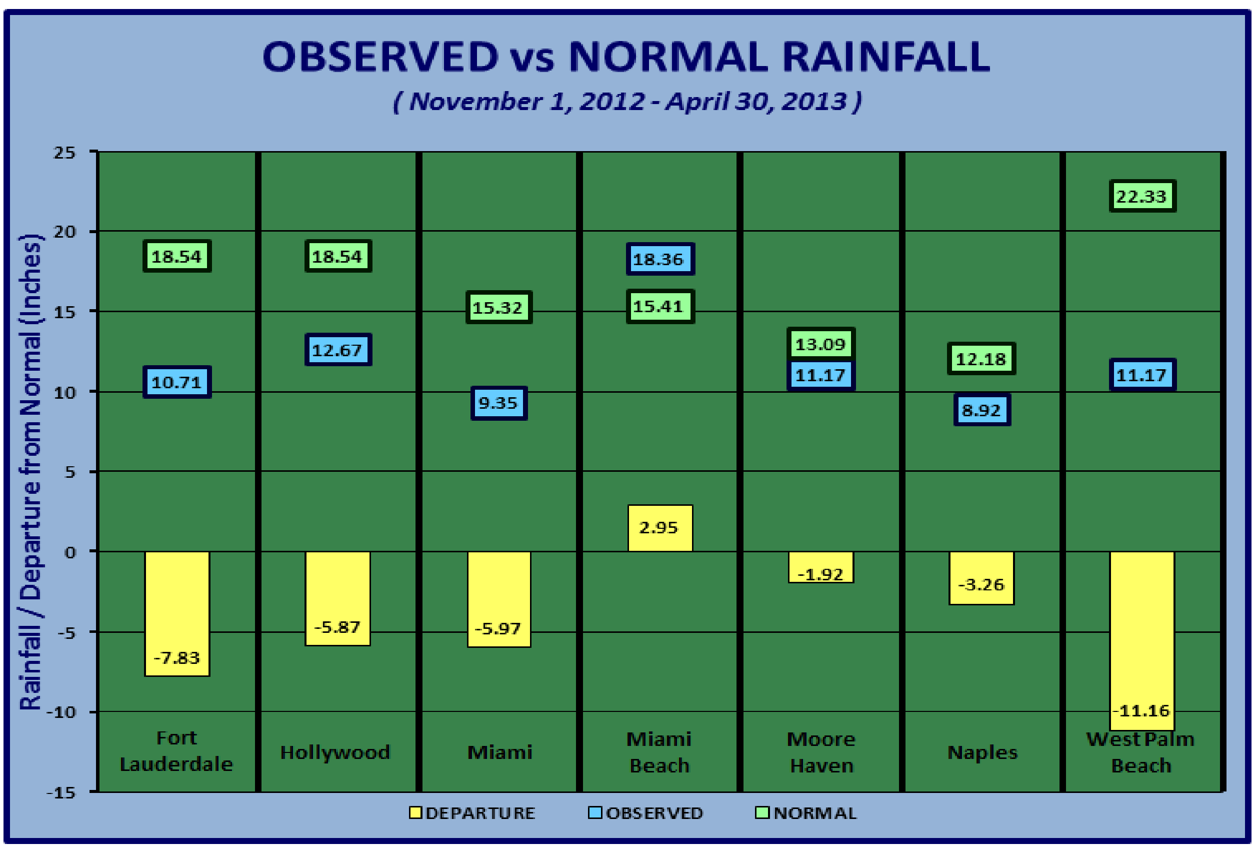
November 2012 – April 2013

While it's been a wet start to May, the lack of rainfall this past dry season has left all 4 of the main climate sites across South Florida with a rainfall deficit. West Palm Beach recorded the least amount of rainfall, ending the 6-month period almost a foot below normal for the season. Juno Beach and Miami Beach COOP sites stand out with regards to excessive rainfall, 30.92" and 18.36" respectively. This rainfall total at Miami Beach allowed it to edge into surplus territory when compared to the normal 6-month rainfall.

Significant rainfall records that were set or tied over the past 6 months include a wet April for Miami Beach and a dry March for Fort Lauderdale. Last month, our COOP site at the Miami Beach Golf Club recorded the wettest April on record for the Miami Beach area, when 11.06" of rainfall was recorded. The previous record for wettest April was 10.46" back in 1960; continuous records date back to 1942. Fort Lauderdale tied March 1977 for 3rd driest March, with only 0.09" of rainfall measured. March 2006 still holds the title as the driest March on record, when only a trace of rainfall was recorded on 3 separate days. A trace of rainfall indicates that rainfall was observed, but it was not a measureable amount.

Additionally, COOP sites at NWS Miami and Juno Beach both reached impressive rainfall totals at the end of 2012. It became the wettest year on record here at NWS Miami, ending the year with 99.42" of rainfall. Previously, the wettest year on record at NWS Miami was 84.15" in 1999, with data at our Sweetwater/FIU location going back to 1996. The annual total at Juno Beach was 101.87", surpassing the 100-inch mark after 7.22" of rain fell during the afternoon/evening of December 11th. Records are not tracked for Juno Beach, due to the short period of observations for this location.

The following graphic depicts the observed and normal 6-month rainfall totals for November through April, in blue and green respectively, and the departure/difference from normal in yellow. To provide a general idea for South Florida, the following sites were used: Fort Lauderdale/Hollywood International Airport, Hollywood, Miami International Airport, Miami Beach, Moore Haven, and Palm Beach International Airport.



Average monthly temperatures, at the four main climate sites, over the past six months ranged from 6.0 degrees Fahrenheit below normal (Naples, March) to 6.2 degrees above normal (Naples, January). The coolest months, as many may remember, were November and March. March averages ranged from 4.6 to 6 degrees below normal. March 2013 now ranks as the 2nd coldest March on record in the Naples area; the coldest is March 2010 when the average monthly temperature was only 63.5 degrees.

Two atmospheric features, the Arctic Oscillation (AO) and North Atlantic Oscillation (NAO), were key players in the cold March that took hold over South Florida. When these two climate patterns go negative during winter months, it typically results in cooler temperatures across the eastern United States. If they both go strongly negative, as was the case this past March, it can lead to longer-lasting cold spells that can extend down the Florida peninsula and to the keys.

A positive AO phase (stronger polar winds) keeps cold air further north. A negative AO phase (weaker, more distorted polar winds) allows cold Arctic air to reach further south than normal. The NAO is positive when the Icelandic Low is strong and negative when the Icelandic Low is weak. The change in the intensity of this low pressure affects the positioning of the jet stream over North America. A negative NAO tends to result in more southerly winter storm tracks, leading to more cold outbreaks for eastern portions of the US, including South Florida. This is a classic example of how our local weather is highly dependent on outside influences, often times even thousands of miles away.

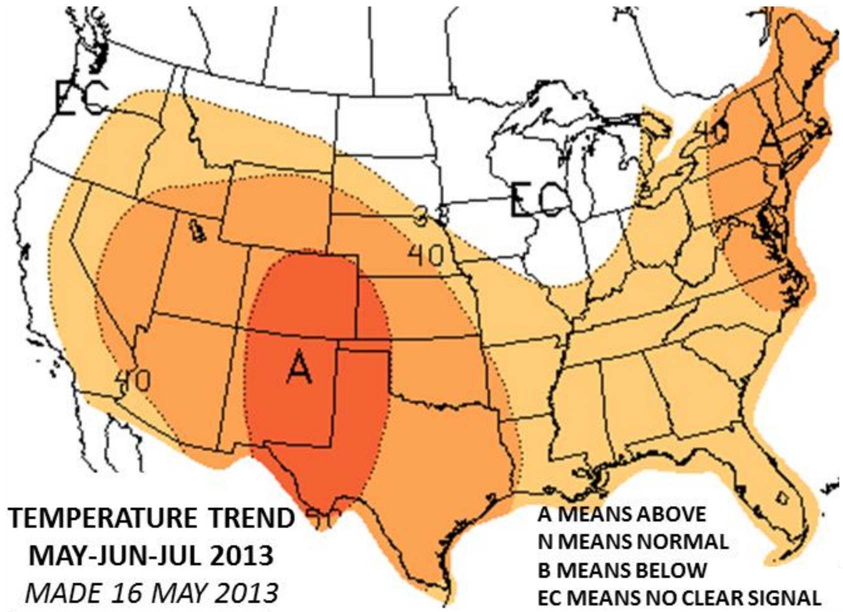
The table below breaks down the average monthly temperature and departure from normal at Fort Lauderdale/Hollywood International Airport, Miami International Airport, Naples Municipal Airport, and Palm Beach International Airport.

Average Monthly Temperature (degrees Fahrenheit) & Departure from Normal
(November 1, 2012 – April 30, 2013)

	Fort Lauderdale		Naples		Miami		West Palm Beach	
	Avg.	**Dep.**	**Avg.**	**Dep.**	**Avg.**	**Dep.**	**Avg.**	**Dep.**
Nov. '12	71.3	-4.2	68.5	-3.6	71.4	-3.5	70.4	-2.4
Dec. '12	72.1	+1.1	68.6	+1.8	71.9	+1.4	70.8	+2.7
Jan. '13	73.0	+4.0	70.7	+6.2	73.2	+5.0	71.8	+6.1
Feb. '13	71.3	+0.4	68.3	+1.4	71.7	+1.5	69.1	+1.3
Mar. '13	67.7	-5.2	64.0	-6.0	68.0	-4.6	65.0	-5.5
Apr. '13	77.4	+1.2	76.3	+3.0	78.0	+2.2	76.6	+2.8
6-Month	**72.1**	**-0.5**	**69.4**	**+0.5**	**72.4**	**+0.3**	**70.6**	**+0.8**

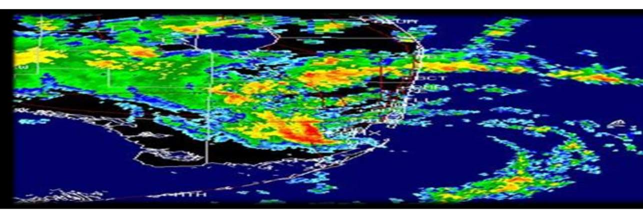
May through July Outlook

The Climate Prediction Center's 3-month forecast depicts an above normal temperature trend for most of the United States, but doesn't have a clear indication on the rainfall trend for South Florida.



Courtesy of the Climate Prediction Center

Hurricane Season



Tropical Storm Bonnie- July 2010

By Kim Brabander and Dr. Pablo Santos

A. South Florida's Tropical Climatology

It is that time of the year again when South Florida residents must be aware of tropical systems that may impact the area during hurricane season. Hurricane season begins on June 1st and runs through November 30th. Those that have lived in the area for just a few years understand the risks from tropical systems, whether they affect the southeast coast, the southwest coast or even the interior portions of the peninsula. During the past century, the majority of South Florida storms have directly impacted the southeast coast, but the

southwest coast is not far behind due to storms that form or move through the western Caribbean Sea and then curve north. Tropical Storm Fay in August 2008 and Hurricane Wilma in October 2005 are the most recent such storms. Over the past 100 years, a total of 14 major hurricanes (Category 3 or greater) have directly affected all or part of the southern Florida peninsula. This number increases to 28 when all hurricanes (Category 1 or greater) are included, and grows to 50 if tropical storms are added to the list. If we count the storms that did not make landfall, but were close enough to cause some form of damage whether from torrential rainfall or severe beach erosion, the number increases to 59. Hurricanes Isaac and Sandy in 2012 are classic examples. The outer bands from Hurricane Isaac, which was centered over the Gulf of Mexico, caused serious and damaging floods in parts of Palm Beach County in late August. Extremely large swells from Hurricane Sandy, centered east of the Bahamas, pounded the beaches of Palm Beach and Broward Counties causing significant beach erosion in late October.

The first major hurricane to hit South Florida after the initial population increase was in 1926. The early development of southeast Florida really began to flourish between the years 1910 to 1925. In that 15 year span, the Miami area grew by nearly 50,000 residents. Few people living along the southeast coast at that time had ever experienced a hurricane. During the real estate boom of this time period, only a tropical storm had affected the southeast coast in 1924. On September 18 1926, a Category 4 storm made landfall near Perrine or about 15 miles south of downtown Miami. Names were not given to tropical storms until 1950, but this storm has been given the title "The Great Miami Hurricane." An anemometer on Miami Beach measured a wind gust of 130 mph before it blew away and an estimated storm surge of 8-11 feet inundated the island. The storm was quite large, and when the eye passed over the downtown area, many people who had sought shelter during the initial part of the storm came out to survey the damage and try to begin clean-up operations. Unfortunately, many people lost their lives in this storm when the back side of the eye soon struck. Many were washed out to sea as they tried to flee Miami Beach for the mainland. A study done in 2008 estimated that if a storm with the same intensity and size were to hit in modern times, monetary losses would be $140-157 billion USD.

The 1926 hurricane stopped much of the growth of southeast Florida and the next several years saw increased hurricane activity. A Category 4 hurricane made landfall in Palm Beach County in September 1928, and this storm became infamous for causing a storm surge on the south side of Lake Okeechobee. At least 2,500 people drowned along the southern lake communities when the dike failed and a wall of water inundated the towns. In September 1929, a Category 3 hurricane brushed the extreme southern tip of the peninsula. Another Category 3 hurricane made landfall in Palm Beach County in early September 1933.

There was a temporary lull again in tropical activity for South Florida during the mid 1930's into the mid 1940's, and the building boom resumed with large population increases. Only one major hurricane directly impacted South Florida in this time frame in 1941. There was however, a well noted major Category 5 hurricane that struck the upper Keys on Labor

Day in 1935. This storm, although very intense, was also very small and had little impact on the Miami area and points to the north. This storm was infamous for having the third lowest pressure ever recorded for a storm in the Atlantic basin and it destroyed the Florida East Coast Railway that had been built by Hendry Flagler and later became what is now the overseas highway U.S. 1. From 1945 to 1950, South Florida was hit multiple times with seven tropical systems of which four of them were major hurricanes. In September 1945, a Category 3 hurricane hit far south Miami-Dade County and is the third strongest Dade County landfalling hurricane on record with damage at $60 million USD. There was one major hurricane in each year from 1947 to 1950 to make landfall in South Florida, with the strongest of these hitting the Broward County coast in September 1947.

In the period since 1950, only four major hurricanes have directly impacted South Florida, which is only half the number that affected the region in the period from 1926 to 1950. Hurricane Donna (September 1960) made landfall along the southwest coast causing major impacts in the Naples to Everglades City area, with a storm surge of 10 feet at Naples and an estimated 7-8 feet inundation along Everglades City streets. The other three were Andrew (August 1992) and Hurricane Jeanne (September 2004) both along the southeast coast, and then Hurricane Wilma (October 2005) along the southwest coast. Hurricane Jeanne actually made landfall in northern Martin County, but caused significant damage in northern Palm Beach County. An exception is Hurricane Betsy in September 1965. Although Betsy was technically an indirect impact making landfall in Key Largo, that placed the southeast coast of the peninsula in the northeast quadrant of the storm. A large storm surge caused nearly all of the land south of Homestead Air Force Base and east of U.S. 1 to be covered by water including Key Biscayne. Most of the streets in Miami Beach facing the ocean and Biscayne Bay were also under water.

Many long term residents of the southeast coast are very familiar with Hurricane Andrew, which made landfall near Homestead on August 24, 1992. This was the only Category 5 storm and the most destructive hurricane to ever strike South Florida. Andrew contained estimated wind speeds of 165 mph right along the southeast Florida coast based on aircraft data, and heavily damaged or completely destroyed over 115,000 homes. The storm was very small and fast moving, so the catastrophic damage was confined to a 20-mile radius around the Homestead area. Still, monetary losses were nearly $30 billion and Andrew caused 15 deaths!

Since 1913, the region has averaged a tropical storm every two years, a category 1 or 2 hurricane every three to four years and a major hurricane every seven to eight years. These averages are purely based on the past 100 years. But the message seems to be clear that South Florida is long overdue for another tropical system whether in the form of a tropical storm or a major hurricane. The last hurricane to directly impact South Florida was Hurricane Wilma and the last major hurricane along the southeast coast was Hurricane Andrew.

It only takes one storm to affect our area with long-lasting impacts. South Floridians need to prepare every year for the possibility of tropical cyclones, the earlier the better!

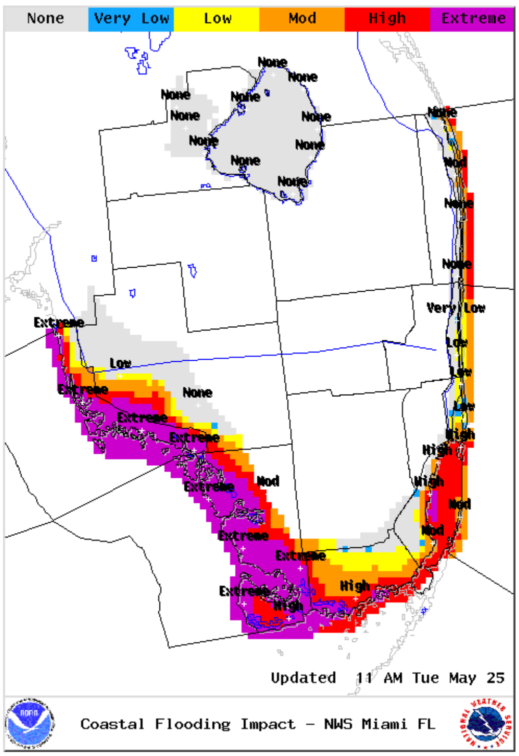
Some useful preparedness sites are:

www.hurricanes.gov/prepare

www.ready.gov/hurricanes

www.readysouthflorida.org

B. Tropical Cyclone Potential Impact Graphics (weather.gov/tcig)



Description: ***When tropical cyclone watches or warnings are issued for my area, what measure of preparation should I take when implementing my emergency action plan?***

The answer to this question is critical toward minimizing the loss of life and property during hurricane and tropical storm situations. Under-preparation can place you at greater risk, while over-preparation can exhaust precious resources and strain livelihoods. So, having prior knowledge of the potential impacts that can occur from tropical cyclone hazards (winds, surge plus tide, inland flooding, tornadoes, and marine) is useful for answering the stated question. The purpose of the Tropical Cyclone Potential Impacts Graphics (TCIG) is to facilitate the proportionate implementation of your emergency action plan based on descriptions of potential impact unique to your area. The intent is to invoke a measured response that is reasonable and responsible by considering the composite of plausible outcomes based on the best forecast and its uncertainty.

When portions of South Florida (area shown in image) are placed under a tropical storm or hurricane watch or warning these graphics will be made available in the following site: weather.gov/tcig. Simply follow Miami South Florida link in that page. They will also be directly and easily accessible from the Miami South Florida Forecast Office website at weather.gov/southflorida. Additional information and documentation on this product can be found at weather.gov/tcig. Graphics will be made available in kml as well as png formats.

Starting around mid-July in 2013, regional mosaics of these graphics in kml format can also be downloaded from this site. From that page you can also find additional information broken down by the aforementioned hazards by clicking over Miami-South Florida and clicking under the hazard name tab (Wind, Coastal Flood (for storm surge plus tide), Inland Flooding, Tornadoes, and Marine).

<u>Example</u>: Using storm surge plus tide as an example (the image above; Very Low Category no longer used), and upon the issuance of a tropical cyclone Watch or Warning, coastal residents might investigate the *Tropical Cyclone Coastal Flood Impact* graphic in the website mentioned above to acquire a sense of the potential impact they are facing and should be preparing for. The example image depicts the potential impact of coastal flooding (e.g., sea water inundation) resulting from storm surge and tide associated with a hypothetical land falling tropical cyclone upon South Florida (e.g., Test Hurricane Suiter, 2009). The context of the event for which this graphic applies is a Category 3 hurricane to make landfall in vicinity of Broward and Palm Beach counties in approximately 48 hours. The potential impact for Lake Okeechobee is not included but it will be in real time cases. Portions of the Southwest Florida coast are depicted under extreme potential impact. As the potential impact level definitions show below, this implies residents should be considering preparing for the potential of catastrophic inundation not necessarily everywhere in that area but somewhere in that area. These graphics will be updated with every advisory. Another factor to consider is how the potential impact is trending from advisory to advisory at your location until the time you must implement your preparedness plan. And remember that we share this information with officials too and they would have a greater indication of the extent to which certain locations are being threatened, as well as those areas in danger of being hardest hit by combined surge and tide waters by coarsely considering the resulting sea water inundation. It is based on this that they ultimately will issue evacuation orders. Please, heed their advice and follow any evacuations orders issued. A similar approach and application is followed with all other hazards for which these graphics depict a potential impact: wind, inland flooding, tornadoes, and marine.

Tropical Cyclone Coastal Flood Impact Definitions

Impact Levels	Description
Extreme	Potential for Extreme Impact: Aggressive preparations should be made for the threat of catastrophic coastal flood damage from sea water. If realized, expect widespread deep inundation within the flood zone, possibly reaching several miles inland. Extreme beach erosion with several new inland cuts. Many large sections of near-shore roads washed out and/or low-lying escape routes severely flooded. A powerful and scouring storm surge and tide greatly accentuated by intense battering wind waves breaching dunes and possibly seawalls in widespread locations resulting in structural damage to shoreline buildings, with several washing into the sea. Damage greatly compounded from considerable floating debris. Extensive damage to marinas, docks, and piers. Numerous small craft broken away from moorings, lifted onshore and stranded. Descriptions are consistent with damage caused by coastal flooding 7 feet or more in depth (above ground level) in hardest hit places.
High	Potential for High Impact: Aggressive preparations should be made for the threat of major coastal flood damage from sea water. If realized, expect large areas of deep inundation within the flood zone. Severe beach erosion. Several sections of near-shore roads washed out and/or low-lying escape routes severely flooded. A powerful and scouring storm surge and tide accentuated by battering wind waves breaching dunes and possibly seawalls in scattered locations resulting in structural damage to shoreline buildings, with a few washing into the sea. Damage compounded by floating debris. Moderate to major damage to marinas, docks, and piers. Many small craft broken away from moorings, especially in unprotected anchorages, lifted onshore and stranded. Descriptions are consistent with damage caused by coastal flooding of 5 to 7 feet in depth (above ground level) in hardest hit places.
Moderate	Potential for Moderate Impact: Preparations should be made for the threat of moderate coastal flood damage from sea water. If realized, expect partial inundation within the flood zone. Major beach erosion. A few sections of near-shore escape roads weakened or washed out, especially in historically vulnerable low spots. Storm surge and tide accentuated by wind waves breaching dunes and possibly seawalls in scattered locations to result in damage to shoreline buildings, mainly in historically vulnerable spots. Moderate damage to marinas, docks, and piers. Several small craft broken away from moorings, especially in unprotected anchorages. Descriptions are consistent with damage caused by coastal flooding of 3 to 5 feet in depth (above ground level) in hardest hit places.
Low	Potential for Low but Concerning Impact: Preparations should be made for the threat of minor to locally moderate coastal flood damage from sea water. If realized, expect partial inundation within the flood zone, especially for low-lying areas. Moderate to locally major beach erosion. Very heavy surf breaching dunes in isolated locations, mainly in historically vulnerable spots. Descriptions are consistent with damage caused by coastal flooding of 1 to 3 feet in depth (above ground level) in hardest hit places.
None	Potential for Little to No Impact: Preparations are not needed as appreciable damage is unlikely. However, rough surf conditions, minor beach erosion, nominal sea water encroachment, and stronger than normal rip currents may still occur.

Note: In all cases, listen to local authorities and obey any evacuation orders for your coastal area. Remember, increasing wind and rising waters can cut off escape routes well in advance of landfall.

David Ross- October 2012

By Alex Gibbs and Evelyn A. Rivera-Acevedo

Enhanced Coastal Waters Forecast for South Florida

The NWS Miami Forecast Office Enhanced Coastal Waters Forecast (CWF) is a new format that NWS Miami is using and should prove to be more efficient marine forecasts. The change involved the addition of wave height forecasts in the product, which includes the "average highest 10 percent of possible wave heights observed at sea".

Example Forecast: **SEAS 5 TO 7 FEET *"WITH OCCASIONAL SEAS UP TO 9 FEET POSSIBLE".***

In the example above, the inclusion of the average highest 10 percent of wave heights has been accounted for in the phrase "WITH OCCASIONAL SEAS UP TO 9 FEET POSSIBLE". Traditionally, the NWS Coastal Waters Forecast only accounts for a range of the expected significant wave heights or the average height of the highest 1/3 of the waves a boater will observe while at sea ("5 TO 7 FEET" in the example above). Provided our mission to protect life and property, we feel that it is critically important that decision makers are made aware of the occasionally higher seas observed at sea, especially for those operating small craft.

You can access the Coastal Water Forecasts from WFO Miami by doing the following:

- **Go to http://weather.gov/miami and click over any of the coastal waters adjacent to South Florida**
- **or simply follow this link: http://www.srh.noaa.gov/productview.php?pil=CWFMFL**

David Ross- April 2011

By Dr. Jeral Estupiñan

Why are aircraft exhaust plumes (or contrails) not always visible in the skies over South Florida?

For a plane to produce a visible exhaust plume or contrail the surrounding air humidity needs to be high enough or the air temperature low enough for condensation to occur. The level of humidity reached depends on the amount of water present in the surrounding air, the temperature of the surrounding air, and the amount of water and heat emitted in the exhaust. Atmospheric temperature and humidity at any given location undergo natural daily and seasonal variations and hence, are not always suitable for the formation of contrails. Because the basic processes are very well understood, contrail formation for a given aircraft flight can be accurately predicted if atmospheric temperature and humidity conditions are known. Contrails (and water droplets) form when the saturation vapor pressure with respect to liquid water is exceeded. They persist when the air is saturated or supersaturated with respect to ice.

After the initial formation of ice, a contrail evolves in one of two ways, again depending on the surrounding atmosphere's humidity. If the humidity is low, below the conditions for ice condensation to occur, the contrail will be short-lived. If the humidity is high, greater than that needed for ice condensation to occur, the contrail will be persistent.

For example, a plane flying at a cruising altitude of 38,000 feet at a temperature of -55^0C and a relative humidity of 59% over Miami will create a short-lived contrail. Typical cruising altitudes of planes range between 30,000 to 45,000 feet. Therefore, changes in the altitude of the plane will have an effect on the formation of contrails. It is possible for a plane to develop a contrail flying at a lower altitude at a warmer temperature than a plane that is flying at a higher and colder temperature with less relative humidity.

The University of Wisconsin has developed this calculator to predict if contrails will form using typical engine efficiencies of commercial aircraft.

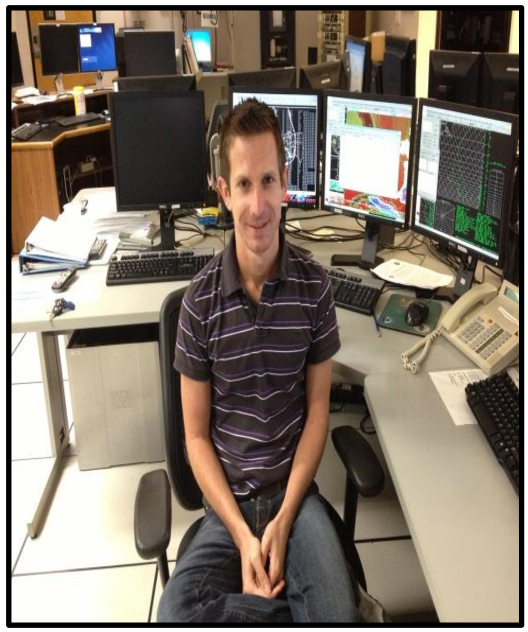
Employee Spotlight

Chris Duke- May 2013

By Evelyn Rivera

Spotlight on… Stephen Konarik, Lead Forecaster

1. How did you get interested in meteorology?
Weather is something I've always been interested in since my earliest memories. I enjoyed watching thunderstorms, cold fronts, and sea breezes approaching from my childhood home in Texas.



2. Where did you go to school?
I received my Bachelor's Degrees in Meteorology and Environmental Studies from Iowa State University. I then earned my Master's Degree in Atmospheric Science from North Carolina State University.

3. What did you do after graduation?
I briefly worked for an environmental consulting firm before obtaining a job with the National Weather Service.

4. What are your aspirations today?
I hope to excel at forecasting weather and warning the public of weather hazardous across South Florida.

5. What's the best/worst part of your job?
The best part of my job is getting to help others while doing something that I love. The worst part is the shiftwork that comes with the job.

6. What do you do when you are not working?
Relaxing with friends or going to the beach … or watching weather!

Thanks for reading!!!

David Ross- October 2012

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