NOAA, NATIONAL WEATHER SERVICE, WEATHER FORECAST OFFICE

Miami, Florida 33165

2010 South Florida Weather Year in Review

Coldest December on Record Concludes Year of Extremes

December 30th, 2010: Temperature and precipitation extremes marked the weather of 2010 across South Florida. A cool and wet January through March was followed by the hottest summer on record, and then concluded with the coldest December on record for the main climate sites in South Florida (details on the above mentioned periods will be included below).

Here are December 2010 temperature averages for select sites (through 7 AM Dec 30th):

Location (beginning of historical record) *	December 2010 Avg Temp (F)	Departure From Normal (F)
Miami Int'l (1895)	60.8	- 9.2
Fort Lauderdale Int'l (1912)	59.6	- 9.9
Palm Beach Int'l (1888)	58.1	-10.3
Naples Regional (1942)	56.9	- 9.4
Miami Beach (1927) **	59.5	-10.4
Moore Haven (1918) **	53.4	-11.1

*** Location of observations for each location have moved since the first year of record, but are representative of the city for record keeping purposes.**

**** Present Miami Beach and Moore Haven temperature data may not be totally comparable to historical data due to difference in time of daily reports which causes double-reporting of low temperatures.**

Complete statistics of the record cold December for all sites above (except Moore Haven) will be provided in Record Reports which will be issued early on Jan 1, 2011.

The main culprit behind the cold temperatures in December 2010 was the same one which caused the cold winter of 2009-2010; a strongly negative North Atlantic Oscillation (NAO) and Arctic Oscillation (AO). When these atmospheric oscillations are in the strong negative phase, they essentially "flip" the weather pattern across North America, with upper-level high pressure and relative warmth over Greenland and Northeastern Canada and upper-level low pressure and cold over the eastern Continental United States, including Florida (Figure 1). This pattern forces the jet stream to plunge south from northern Canada into the southeastern U.S., transporting Arctic air masses into Florida.

A pronounced shift in the ENSO (El Niño Southern Oscillation) phase was noted in 2010, from a strong El Niño, or warm, phase to a borderline strong La Niña, or cold, phase. While this may appear at first glance to be a key contributor to the temperature extremes noted across South Florida during 2010, it is believed that it was the strongly negative NAO and AO, not the ENSO phase, which contributed to the cold temperatures in early and late 2010. A strongly phased NAO/AO operating on shorter time scales can override the longer-term ENSO phase.

As mentioned above, South Florida experienced its hottest summer on record in 2010 (with the exception of Naples which recorded its second hottest recorded summer). Despite the record hot summer, average yearly temperatures at the main climate sites will end up around 1 degree below normal, which will be the coolest calendar year since the early and mid 1980s, and among the top 10 on record (except for Miami). At secondary sites Miami Beach and Moore Haven, it was the coolest year on record (please note caveat below table).

Here are the 2010 temperature averages for the year for the primary climate sites through December 29:

Location (beginning of historical record)	**Avg 2010 Temp (F)**	**Departure From Normal (F)**	**Rank**
Miami Int'l (1895)	75.8	-0.9	52nd coolest (Tied)
Fort Lauderdale Int'l (1912)	74.9	- 1.0	7th coolest
Palm Beach Int'l (1888)	74.1	- 1.2	8th coolest (Tied)
Naples Regional (1942)	73.6	- 0.5	6th coolest
Miami Beach (1927) **	74.1	-1.9	Coolest on record
Moore Haven (1918) **	71.2	- 1.9	Coolest on record

**** Present Miami Beach and Moore Haven temperature data may not be totally comparable to historical data due to difference in time of daily reports which causes double-reporting of low temperatures.**

Some other interesting 2010 temperature statistics:

- **Miami International Airport (MIA)** observed 103 days of temperatures at or above 90 degrees, the 4th most on record. The average number of 90+ degree days per year is 51. MIA also had a record 45 days of low temperatures of 80 degrees or higher, besting the previous record of 39 set in 2009. The average number of 80+ degree low temperature days per year is 13. On the other end of the thermometer, MIA had 6 mornings with low temperatures below 40 degrees. This ties the 5th most number of sub-40 degree days on record. The average yearly number of sub-40 degree days is 2.

- **Fort Lauderdale/Hollywood International Airport (FLL)** observed 9 days of low temperatures below 40 degrees. This ties the 4th most number of sub-40 degree days on record. The average yearly number of sub-40 degree days is 3.

- **Palm Beach International Airport (PBI)** observed 106 days of temperatures at or above 90 degrees, the 8th most on record. The average number of 90+ degree days per year is 56. PBI also had a record 34 days of low temperatures of 80 degrees or higher, crushing the previous record of 17 set in 1900 and 2002. The average number of 80+ degree low temperature days per year is 6. On the other end of the thermometer, PBI had 18 mornings with low temperatures below 40 degrees. This easily breaks the previous record of 10 days set in 1920 and 1981. The average yearly number of sub-40 lows at PBI is 3. Six of the 18 days occurred in December, which breaks the previous monthly record for December of 5 set in 1962.

- **Naples Regional Airport (APF)** observed 125 days of temperatures at or above 90 degrees, the 12th most on record. The average number of 90+ degree days per year is 109. Naples also observed 13 days of low temperatures below 40 degrees. This ties the 5th most number of sub-40 degree days on record. The average yearly number of sub-40 degree days is 3. Eight of the 13 days occurred in December, which breaks the previous monthly record for December of 7 set in 1981.

Precipitation

For the second consecutive year, precipitation amounts varied widely across the region (Figure 2). This was likely due to the lack of large, organized weather disturbances or tropical systems affecting south Florida, primarily during the rainy season. A wetter than normal winter led to a relatively dry April and May, then to a summer which had large variances in rainfall. The rainy season ended two weeks earlier than normal on October 3rd, which led to a drier than normal end to the year and a return to drought conditions over most of south Florida.

The large variances in rainfall during the rainy season are illustrated in the total rainfall values for locations close to each other. For example, Hollywood Waste Water Plant

received almost 20 inches more of rainfall than Fort Lauderdale/Hollywood Airport, a mere 5 miles to the north-northeast. Juno Beach received over 20 inches of rain more than Palm Beach International Airport, only 15 miles to the south.

To further illustrate the unusual nature of the precipitation patterns in 2010, the level of Lake Okeechobee, which typically reaches a peak in October, actually fell during the summer from a peak of around 15 feet in May and was at its yearly low of near 12.5 feet by the end of 2010 (Figure 3). This was due to a relative lack of rainfall in the Lake Okeechobee area, as well as very dry conditions north of the lake across central Florida.

Here are 2010 rainfall totals from around the area (in inches) through 7 AM December 30:

Site	**2010 Precip**	**Departure from Normal**	**Rank**
Miami International	65.10	+ 6.57	36th wettest
Palm Beach International	53.39	- 8.00	31st driest
Fort Lauderdale Int'l	59.44 *	- 4.75	36th driest
Naples Regional	44.61 *	- 7.29	18th driest
Hollywood Water Plant	78.03	+16.58	
Juno Beach	74.05		
Miami Beach	71.01	+24.41	2nd wettest
The Redland (S. Dade)	60.13	- 1.43	
NWS Miami	62.36		
Canal Point (Palm Beach)	59.57		
Big Cypress (Hendry)	51.94		
Ortona	51.41		
Marco Island	51.12		
Immokalee	48.42		
Brighton Res (Glades)	47.02		
Moore Haven	46.15	- 0.29	36th driest

* (Naples cooperative site at Golden Gate Aquatic Complex measured 57.12 inches and Fort Lauderdale cooperative site at Dixie Water Plant measured 68.32 inches)

2010 Tropical Weather

For the fifth consecutive year, South Florida was spared the effects of a hurricane. Two weak tropical systems affected the south Florida peninsula: Tropical Storm Bonnie on July 23 and TD 16/Tropical Storm Nicole in late September. Neither system produced significant impacts of note across the area.

Following is a seasonal breakdown of significant South Florida weather events in 2010:

January – March

An Arctic cold front blasted through south Florida on New Year's Day, ushering in a period of record-setting cold temperatures. West Palm Beach, Naples and Moore Haven set records for their coldest 12-day stretch on record, with Fort Lauderdale and Miami not far behind. The coldest temperatures since 1989 were observed across most areas on January 10th, which followed a day of rain with temperatures in the 30s and 40s (as well as a few unconfirmed reports of sleet and snow).

The cold temperatures didn't stop there. February and March continued several degrees below normal, and the January-March period ended up as the coldest on record for West Palm Beach, Naples and Miami Beach, and in the top 10 coldest for Miami, Fort Lauderdale and Moore Haven.

Impacts of the cold weather on the agricultural community in South Florida were extensive, with a total estimated loss of $590 million. In addition, two deaths and seven injuries were attributed either directly or indirectly to the cold weather in early January.

Coldest temperature readings for the year at the four main climate sites were:

Naples: 32 (Jan 11)
West Palm Beach: 32 (Jan 10 and Dec 14)
Fort Lauderdale: 34 (Jan 10 and Dec 14)
Miami: 35 (Jan 10)

Low temperatures in the 20s were recorded on several mornings over interior sections of south Florida, even as far south as Miami-Dade County on January 10th. The lowest unofficial temperature in south Florida in 2010 was 21 degrees in Palmdale on December 28th.

The wetter and stormier than normal winter kept water levels rather high over south Florida. Three severe thunderstorm events occurred over southeast Florida: February 12th and February 24th when a combination of high winds and hail associated with squall lines produced minor damage; and March 29th when an EF0 tornado ripped through parts of Oakland Park (Broward County). Fortunately, no injuries were reported and minor damage to structures and landscaping was noted. In addition, a few minor flood events took place in February and March in Broward and Palm Beach counties.

June-August

After a warm and dry "spring", temperatures reached all-time record hot levels across almost all of south Florida. A relative lack of cloud cover due to a persistent high

pressure area over the southeast United States was largely to blame for the record heat. The main contributor to the record heat was the overnight low temperature which did not drop below 80 on many days along the east coast and in the upper 70s over interior and western sections (see additional temperature statistics above for more detail).

Hottest temperature readings for the year at the four main climate sites were:

- Miami: 96 (August 15 and 21).
- Fort Lauderdale: 95 (July 10).
- West Palm Beach: 96 (July 12 and 30).
- Naples: 97 (June 12).

Over interior sections, temperatures reached and exceeded the 100 degree mark during several periods this past summer: June 14 and 16, July 8 through 10, July 28 through 31 and August 14 through 20. The highest unofficial temperature reading was 102 degrees at Brighton Reservation in northern Glades County on July 31.

Widespread severe weather occurrences were relatively few in number this past summer, again attributable to the rather stable and dry conditions. Three separate episodes of note occurred during the first week of June, the first two weeks of July and in early and mid August. This last episode featured an EF0 tornado which produced minor damage in the West Boca area of far southern Palm Beach County during the early evening of August 7th.

October-December

An early-season cold front moved through south Florida in the wake of TD 16/Tropical Storm Nicole on September 30th, putting an early end to the rainy season just a few days later on October 3rd. The early onset of the dry season led to a dry fall, which put in motion the drought conditions which cover most of the southern Florida peninsula by year's end. Near normal temperatures were noted in October and November. A strong cold front moved across the area on December 1, which was only the beginning of what is the coldest December on record for south Florida. In contrast to January-March period when short periods of warm weather provided a break from the cold temperatures, almost every day in December had below normal temperatures, making this month the coldest of 2010 and one of the coldest months (regardless of time of year) since the early to mid 1980s.

2010 Severe Weather Statistics

A total of 11 people died as a result of weather related hazards in mainland south Florida in 2010. Rip currents once again led the list with 8 deaths directly attributed to

the “fair weather killer”. As is usually the case, most of the deaths were reported between the months of March and August, although one drowning occurred in November. Two deaths were attributed to the cold weather episode in early January, and one person was killed after falling from a boat in rough seas just offshore Jupiter Inlet.

Surprisingly, no lightning deaths were reported, although a total of 7 people were injured as a direct result of lightning strikes. It was only the third year since 1970 in which no lightning deaths were reported.

In total, 31 people were injured from weather related hazards, 15 of those which were rip current rescues. Only three tornadoes were confirmed over mainland south Florida, the lowest yearly total since 1977. Monetary damage amounts as a result of weather hazards will likely exceed $600 million, most of it coming from severe crop damage during the freezes of January and December.

For the latest weather forecasts and alerts, please visit the National Weather Service Miami/South Florida web site at weather.gov/southflorida.

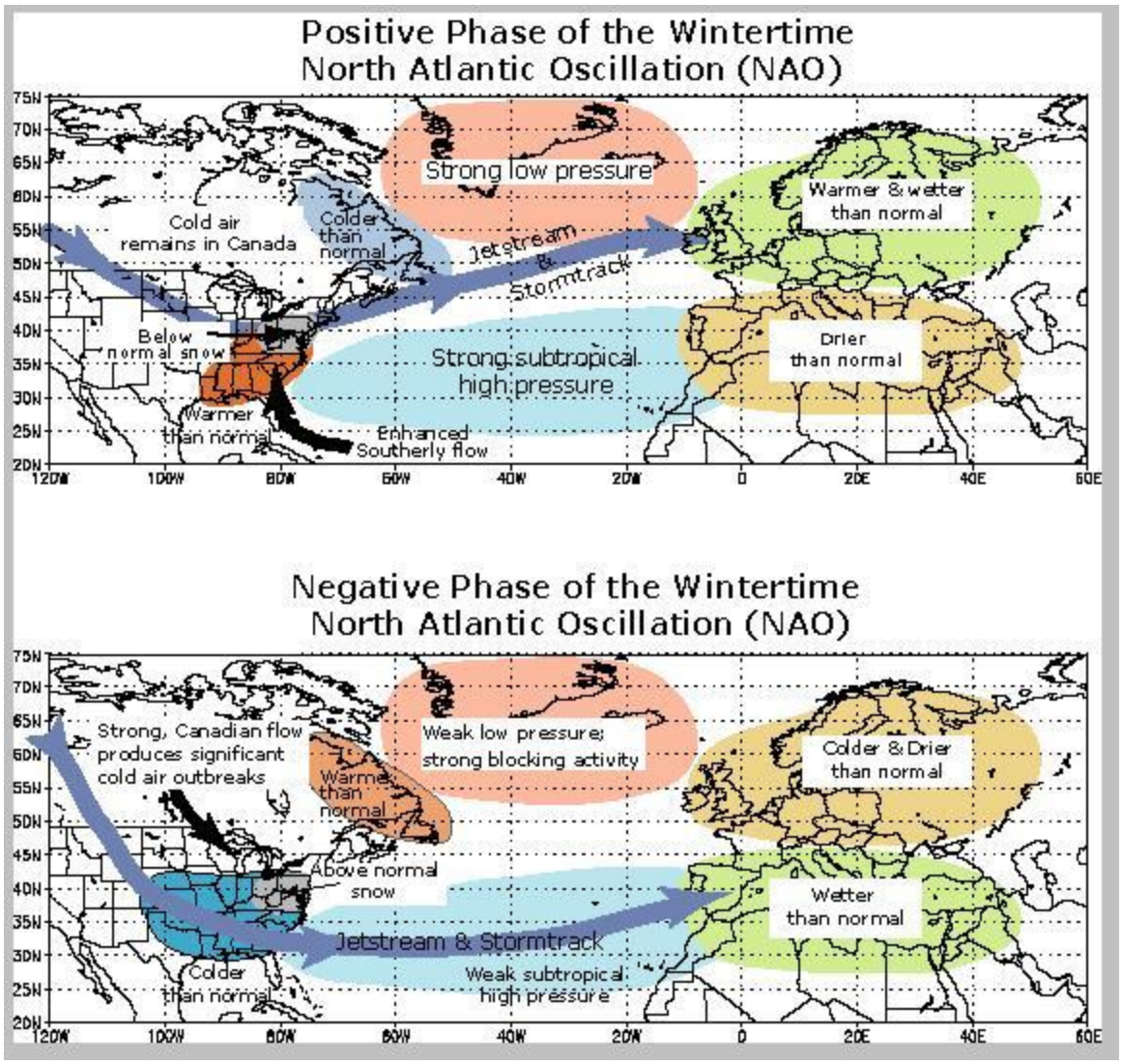

Figure 1: Phases of the North Atlantic Oscillation and their influence on winter weather patterns in the Northern Hemisphere

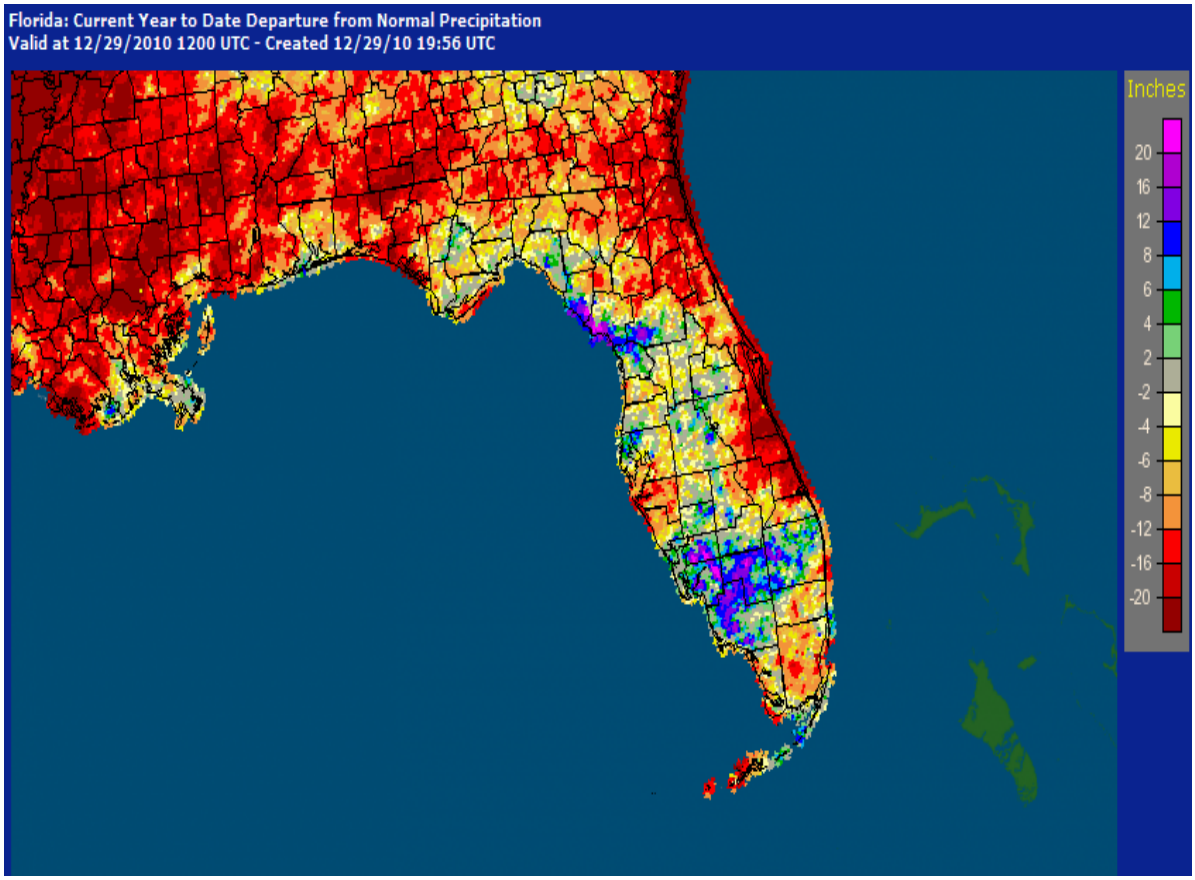

Figure 2: 2010 Departure from normal rainfall in inches as of 7 AM December 29th. Green/blue/purple areas represent above normal rainfall and yellow/orange/red areas represent below normal rainfall

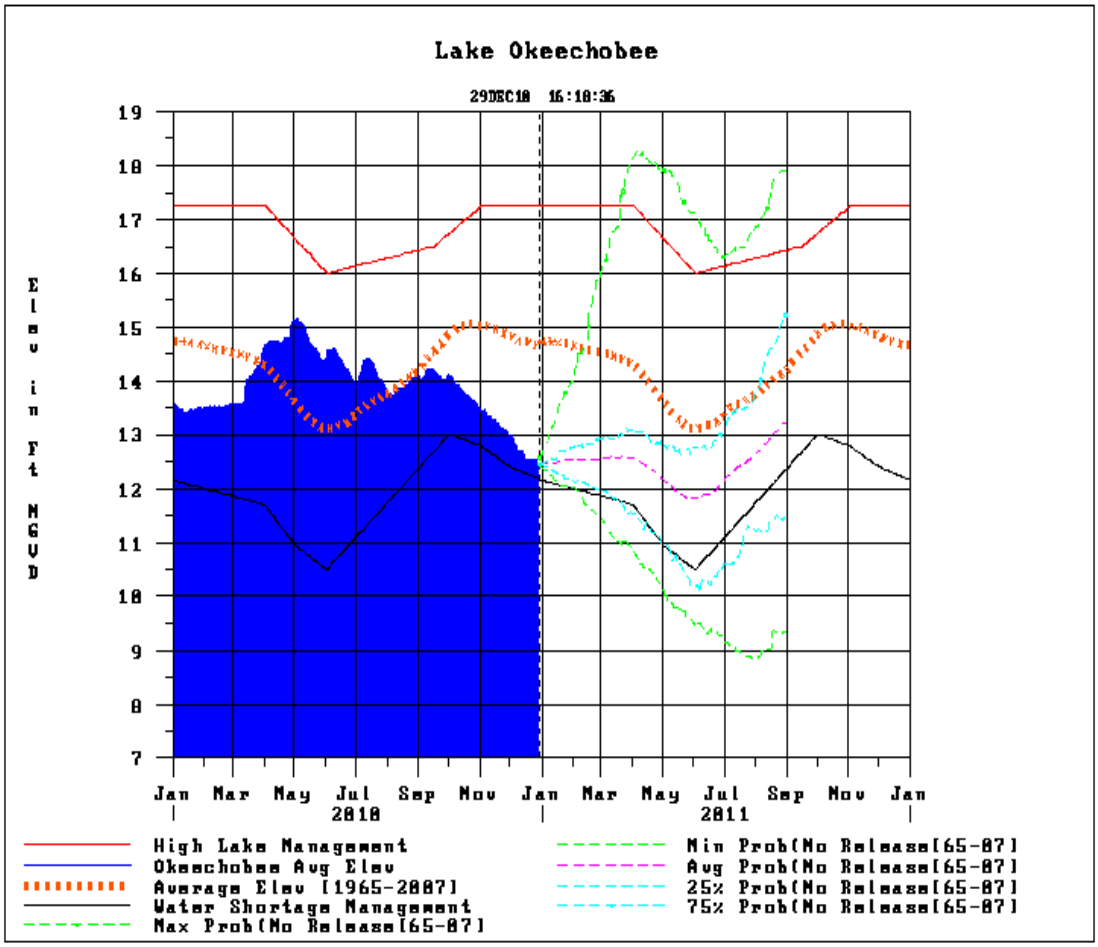

Figure 3: Lake Okeechobee level from January through December 2010.

Figure 4: Frost covering ground and steam rising from the Caloosahatchee River in Moore Haven on December 28th (picture by Angie Snow – Glades County Emergency Management)

Figure 5: Wall cloud associated with severe thunderstorm in Palm Beach on July 4th (picture by John Whitney)

Figure 6: Classic shelf cloud associated with strong thunderstorm wind gusts in the Everglades of Broward County in May 2010 (picture by Kathy Alvarez)