P586 FLORIDA'S UNPRECEDENTED DRY SEASON "SIGNIFICANT TORNADO DROUGHT"

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1. INTRODUCTION

The author has been researching Florida tornadoes since 1989 and documented every known tornado death in Florida history; totaling 207 since the first recorded death in 1882. Significant tornadoes, those of Enhanced Fujita Scale (EF) 2 and greater (WSEC, 2006), are most likely to cause fatalities and serious injuries. They typically occur in Florida under two distinct synoptic scenarios (Hagemeyer, 1997): 1) in the warm sector of extratropical cyclones (ET) associated with a strong jet stream during the dry season (November through April) when strong shear and instability combine to produce supercell thunderstorms; and 2) in outer rainbands in the right front quadrant of tropical or hybrid cyclones in the Gulf of Mexico or northwest Caribbean Sea, during the hurricane season, where very strong low-level shear and convergence can produce rotating storms and at times supercell thunderstorms.

Tornadoes up to EF4 and EF3 strength have occurred in the extratropical and tropical scenarios respectively. 160 tornado deaths have been associated with extratropical cyclones and 38 deaths with tropical/hybrid cyclones. Outside of these two organized tropical and extratropical cyclone scenarios, significant tornadoes and tornado deaths in Florida are extremely rare. During the wet season from May to October only 9 other tornado deaths have occurred in the history of Florida that were not associated with a tropical/hybrid system. The fatalities with these rare, weaker tornado deaths were typically a result of people caught in highly vulnerable locations such as small boats and campers.

Figure 1 shows the monthly number of Florida tornado deaths by synoptic setting and Figure 2 shows the 11 deadliest tornado outbreaks in Florida history. The majority of the dry season tornado deaths have occurred in February, March and April, and the majority of the tropical cyclone tornado deaths have occurred in June, September and October. Indeed, the most recent tornado death in Florida occurred on 24 June, 2012 and was associated with outer rainbands in the right-front quadrant of Tropical Storm Debby in the Gulf of Mexico, a classic example. This was the first tornado death in Florida since March 7, 2008, or 1,570 consecutive days between tornado deaths. Amazingly, this is the longest stretch of consecutive days without a tornado fatality in Florida since before 1925! This period represents a significant and fortuitous "killer tornado drought". Killer tornadoes are unlikely to be missed in the historical record and population bias clearly is not a factor as Florida's population has <u>increased</u> by over 17 million people since 1925, making the lack of fatalities in recent years all the more surprising.

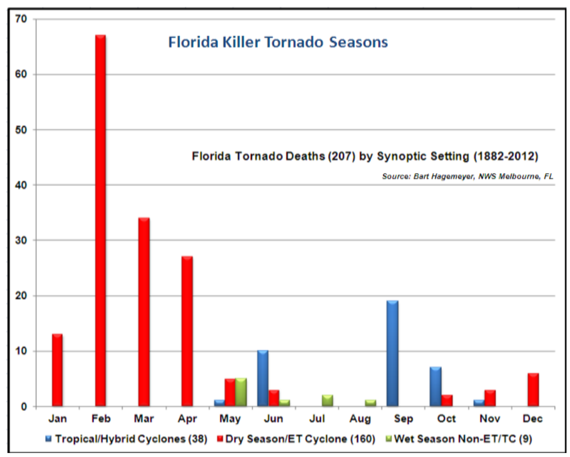


Figure 1. Monthly tornado deaths in Florida from 1882-2012 associated with extratropical (ET) cyclones (red), tropical and hybrid cyclones (blue), and weak wind shear cases without an organized system (green). Updated from Hagemeyer et. al 2010.

Figure 3 shows a plot of Florida yearly population against yearly tornado deaths since 1882 with the five longest periods of consecutive tornado death-free days since 1925 indicated. The most recent period, that is even comparable to this latest tornado death-free period, ended 40 years ago in 1972, also by tornadoes associated with a tropical cyclone in June (Hurricane Agnes). By any measure, this recent tornado death-free period is unprecedented. However, when one considers the dry season significant tornadoes and fatalities as a separate tornado forecast, preparedness and response challenge, and it should be, the tornado death drought continues. The lack of tornado fatalities is not a result of better warning lead time or societal factors, for example, but simply due to the near total lack of significant tornadoes.

DEADLIEST FLORIDA TORNADO OUTBREAKS

Through June 2012

FEBRUARY 1998	42 DEAD	
FEBRUARY 2007	21 DEAD	
MARCH 1962	17 DEAD	
APRIL 1966	11 DEAD	
JUNE 1972	7 DEAD	HURRICANE AGNES
JANUARY 1936	7 DEAD	
SEPTEMBER 2004	6 DEAD	HURRICANE IVAN
SEPTEMBER 1882	6 DEAD	HURRICANE
APRIL 1925	5 DEAD	
OCTOBER 1992	4 DEAD	Un-Named Hybrid
MARCH 1939	4 DEAD	

Source: Bart Hagemeyer, NWS Melbourne, FL

Figure 2. List of the 11 deadliest tornado outbreaks in Florida history (1882-2012) with dry season ET cases shown in black and wet season hybrid/tropical cyclone cases shown in red.

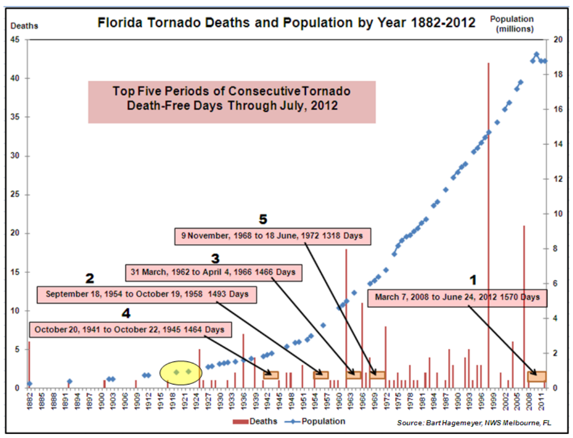
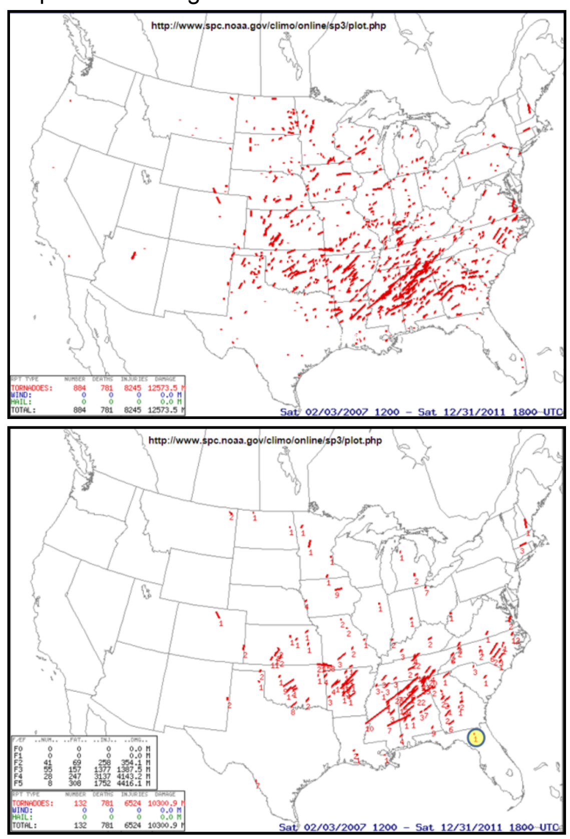


Figure 3. Plots of Florida annual population (blue) and tornado deaths (red) from 1882 through 2012. The 5 longest periods of consecutive tornado death-free days are indicated within the red text boxes.

Since the spring of 2007 there has been an unprecedented minimum in significant tornadoes (≥EF2) during the Florida dry season. Following the Groundhog Day Tornado Outbreak of February 2, 2007 that killed 21 people in central Florida there have been just two significant tornadoes and one tornado death (killed by falling tree) all of which occurred on March 7, 2008, in the five subsequent dry seasons from 2007-2008 to 2011-2012.

Plots of all significant tornadoes (≥EF2, Fig. 4a) and tornado fatalities (Fig. 4b) in the United States from February 3rd, 2007 through December 31st, 2011 clearly illustrate that Florida has fortunately been spared from the devastating tornadoes that have plagued much of the eastern half of the United States in recent years. The two significant south Florida tornadoes shown on figure 4a were associated with Tropical Storm Fay in August 2008, and a tropical disturbance in October 2011.

A closer examination of the tornado data over Florida (Fig. 5) shows the two significant tornadoes in north Florida on March 7th, 2008. There has not been a significant dry season tornado in Florida for an unprecedented four consecutive dry seasons! Another way to put the magnitude of the current tornado drought into perspective is that there has been only <u>one significant tornado day</u> in the Florida dry season since April 2007. This is truly a good thing, but it is important to consider the implications of this unprecedented significant tornado minimum for tornado forecast, preparedness and response challenges.



Figures 4a-b. Plots of significant tornadoes (≥EF2) from February 3, 2007 through December 31, 2011 (figure 4a) and tornado deaths (figure 4b). The location of the one Florida tornado death is highlighted in yellow on figure 4b (from NWS Storm Prediction Center).

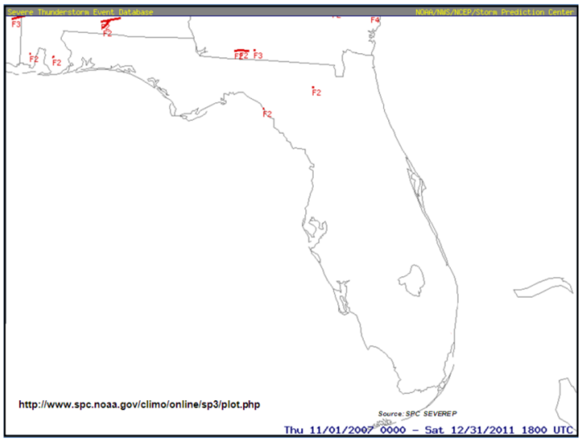


Figure 5. Plot of the two significant tornadoes in Florida reported from the 2007-08 through 2011-12 dry seasons (from NWS Storm Prediction Center). Note: no significant tornadoes were reported in SPC preliminary data for January through April of 2012.

2. ATTRIBUTION OF RECENT DRY SEASON TORNADO DROUGHT

Figure 6 shows the number of reported dry season significant tornadoes for the 1950-51 through 2011-12 seasons. The current significant tornado-free period beginning in early March 2008 is the longest since at least 1950 and will likely continue on November 1, 2012. There is only one other similar case in the tornado record; the period from 5 November, 1988 to 12 March, 1993. There were no significant tornadoes after the first week of the 1988 dry season until very late in the 1993 dry season, almost 5 complete dry seasons. The plot of significant tornadoes reported during this period (Fig. 7) is similar in pattern to Figure 4a with Florida notably lacking in significant tornadoes.

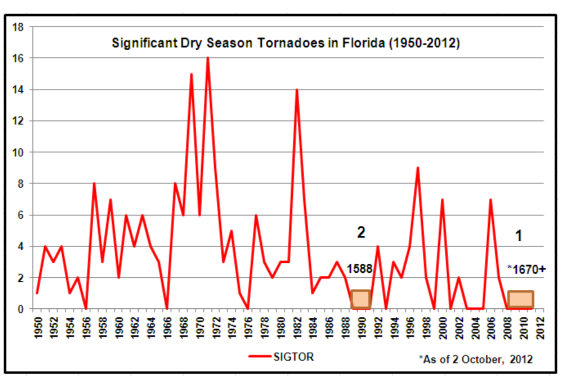


Figure 6. Number of reported significant tornadoes (≥EF2) during the Florida dry season (1950-51 to 2011-12). The two longest periods without a significant dry season tornado are indicated on the chart with the number of days noted.

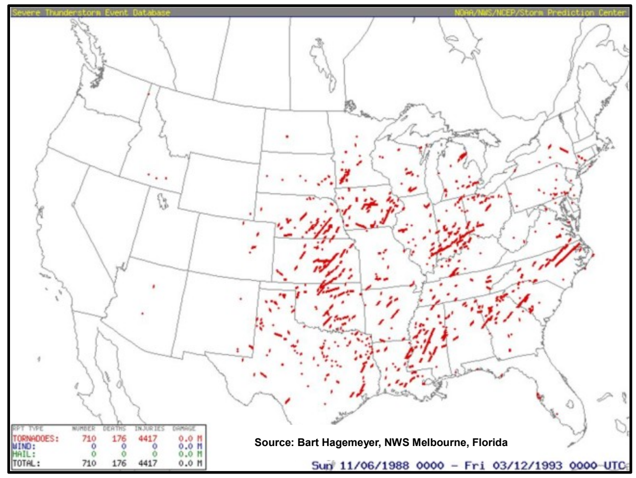


Figure 7. Plot of significant tornadoes (≥EF2) from November 6, 1988 through March 12, 1993. The few significant tornadoes indicated over Florida did not occur in the dry season, but were associated with tropical cyclones. (source: NWS Storm Prediction Center).

To investigate the likely causes of these two most significant tornado droughts, it must first be acknowledged that there are well-known issues regarding the veracity of the tornado database prior to the late 1980's (Doswell and Burgess, 1988). There is a bias toward over-reporting of significant tornadoes and under-reporting weak tornadoes that inflates the significant tornado climatology. In the 39 years from 1950 to 1988 only 3 Florida dry seasons had no significant tornadoes, while in the 23 seasons since 1988, 13 have had no significant tornadoes. It is also noteworthy that 9 of the last 13 dry seasons since 1999 have had no significant tornadoes! It cannot be known for certain if there were any comparable significant tornado droughts prior to the 1980's due to poor documentation; however the occurrence of tornado deaths would appear to argue against such a "drought". Regardless, the two most recent significant events occurred during a period when tornado reporting was reliable. The author has personally been involved in Florida tornado documentation and research since early 1989.

Monthly plots of the NINO 3.4 index from November 2006 through June 2012 (Fig. 8) show that the last five Florida dry seasons have been characterized by four La Niñas , two strong, one moderate and one weak, and one strong El Niño (*note: there is no officially agreed upon criteria for El Niño/La Niña strength, the author uses thresholds of a three-month mean NINO 3.4 index in the dry season of +/- 0.5 to <+/>-1.0 for weak, +/-1.0 to <+/>- 1.5 for* *moderate, and ≥+/≤-1.5 for strong El Niño/La Niña respectively*). The average global sea surface temperature (SST) anomaly for the four La Niña dry seasons on figure 9 show the profound cooling of tropical Pacific waters during this period.

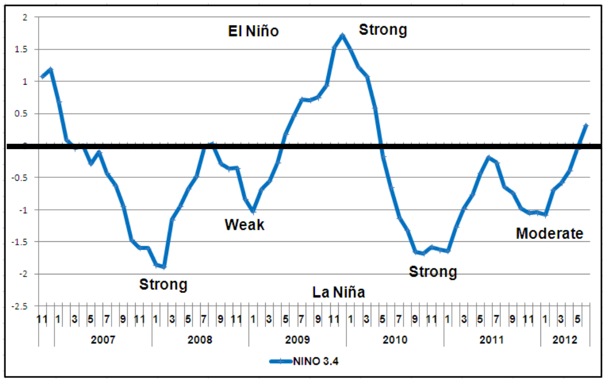


Figure 8. Plot of monthly Nino 3.4 index from November 2006 to June 2012 (source: NWS Climate Prediction Center).

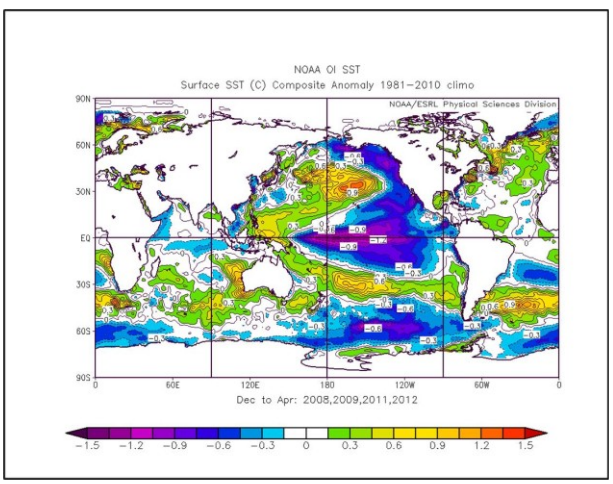


Figure 9. Average December to April sea surface temperature (SST) anomaly for the four La Nina dry seasons of 2007-08, 2008-09, 2010-11, and 2011-12 (source: NOAA).

The author has documented that the phase of the El Niño-Southern Oscillation (ENSO) to a large extent controls Florida dry season weather (Hagemeyer and Almeida, 2003 and 2004). Typically El Niño dry seasons in Florida are colder, wetter, and stormier than normal with an increased risk of severe weather, while La Niña dry seasons are drier and warmer than normal, with an increased risk of drought and wildfire, and a lower than normal risk of severe weather, primarily through their influence on the position and strength of the jet stream and storm track. The average 250 mb mean zonal wind anomaly for December through April for the four recent La Nina dry seasons is shown on figure 10. The influence of La Niña on the position of the dry season jet stream and storm track is clearly evident and typical of the author's research results from prior years. The axis of below normal jet stream strength extending from the eastern Pacific across the Gulf of Mexico and central Florida indicating a northward movement of the winter storm track is the classic La Niña teleconnection for Florida. The composite precipitation anomaly (Fig. 11) for the same period as Figure 10 illustrates the resultant drier than normal winters for the southern tier of the United States as a result of a northerly winter storm track.

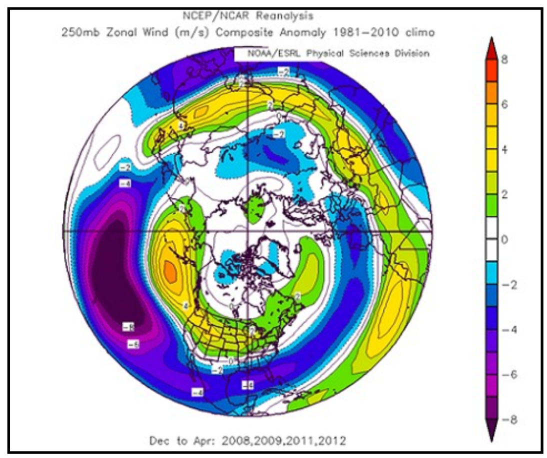


Figure 10. Average December to April 250 mb zonal wind anomaly for the four La Niña dry seasons of 2007-08, 2008-09, 2010-11, and 2011-12.

In contrast to Figure 10, Figures 12a-c show the composite 250 mb mean zonal wind for February and March for the recent 2009-10 El Niño dry season (Fig. 12c) compared to the record El Niños of 1983 (Fig. 12a) and 1998 (Fig. 12b). During the 2009-10 dry season the mean jet stream level winds over Florida set a record for the highest since 1950.

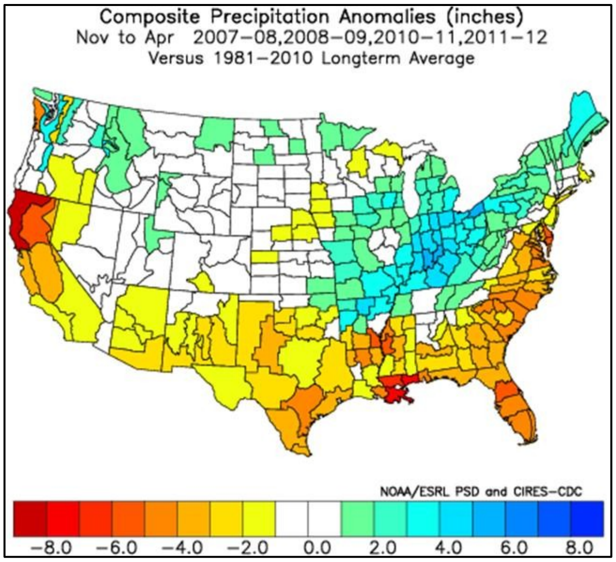
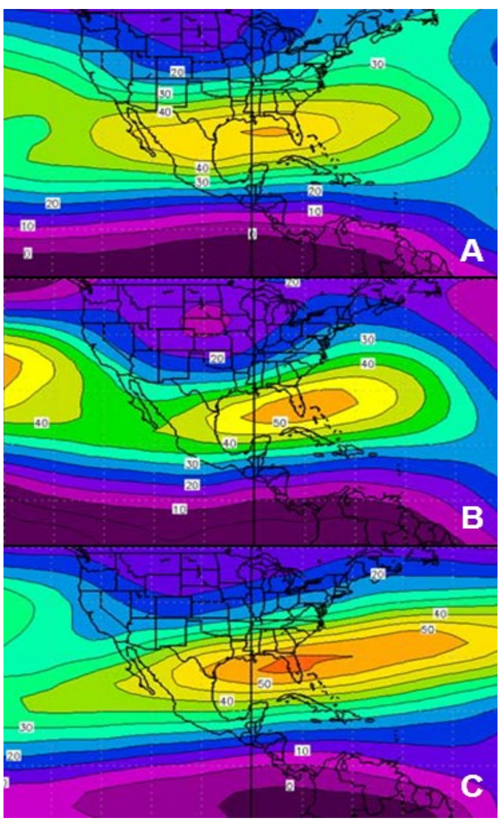
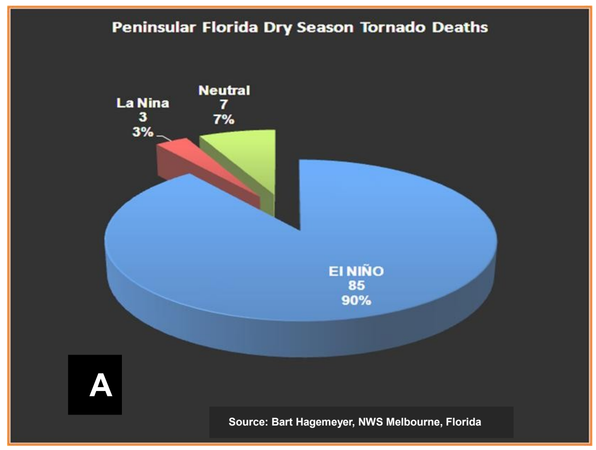


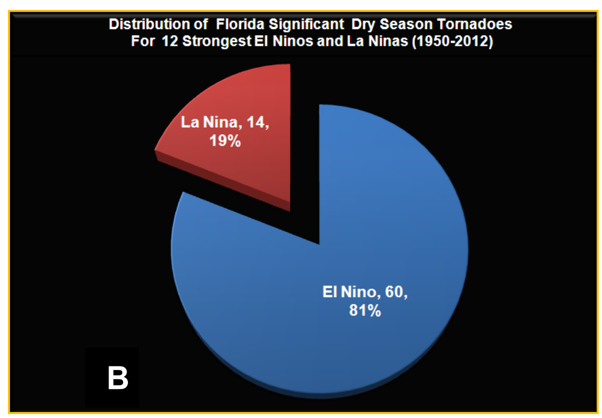
Figure 11. Composite precipitation anomalies for the four La Nina dry seasons of 2007-08, 2008-09, 2010-11, and 2011-12.



Figures 12a-c. 250 mb zonal mean wind (m/s) for February and March 1998 (A), 1983 (B), and 2010 (C). From Hagemeyer 2010 (source: NOAA ESRL).

The influence of El Niño and La Niña on the distribution of Florida dry season significant tornadoes and resulting tornado fatalities is profound. Figure 13 shows the distribution of peninsular Florida tornado deaths since 1950 by ENSO phase, with 90% of the deaths occurring during El Niño dry seasons and only 3% during La Niña dry seasons (see Hagemeyer et. al. 2010 for a detailed discussion of dry season tornado climatology and ENSO phase). All things considered, the fact that no significant tornadoes occurred during four recent La Niña dry seasons in Florida is unusual, but not unexpected. What is unexpected is that no significant tornadoes occurred with a strong El Niño during the 2009-10 dry season!





Figures 13a-b. Peninsular Florida dry season tornado deaths by ENSO phase (south of 30º north, from Hagemeyer et. al. 2010, 13a), and distribution of the 74 significant dry season tornadoes reported in all of Florida during the 12 strongest La Niñas and El Niños (13b).

The El Niño dry season of 2009-10 was unusually stormy as expected and tied the 1997-98 El Niño dry season for the greatest number of extratropical storms (18) in a dry season. However, tornado activity was below normal, and there were no significant tornadoes reported. Indeed, it was the first El Niño dry season without a severe weather–related fatality in Florida since 1971-72. The underlying cause of the lack of severe weather on the seasonal scale was a persistent and extremely strong negative Arctic Oscillation (AO) that brought such cold airmasses to the region that instability in the warm sectors of the passing extratropical cyclones that impacted Florida was severely limited to values below that generally required to produce long-lived supercells. Hagemeyer (2011) and Hagemeyer and Ulrich (2011) provide a detailed discussion of the impact of the negative AO during the 2009-10 El Niño dry season.

Hagemeyer and Almeida (2004) documented the influence of teleconnections such as the AO, North Atlantic Oscillation (NAO), Pacific North American (PNA), and the Madden-Julian Oscillation (MJO) in addition to ENSO. Hagemeyer and Ulrich (2011) and Hagemeyer (2012) found that the AO, in particular, can significantly alter the impacts of ENSO during the dry season even to the point of changing the sign of the expected seasonal temperature and rainfall anomalies. Generally, a strongly positive AO enhances a La Niña and weakens an El Niño while a strongly negative AO weakens La Niña and strengthens El Niño by modifying the jet stream strength and position. Hagemeyer (2008a and b) and Hagemeyer and Ulrich (2011) also have documented that the AO can have great influence – a much greater influence than ENSO - on dry season temperature extremes and thus play a critical role in seasonal stability parameters for thunderstorm development.

Following up on the author's most recent research (Hagemeyer 2012), a comparison of the monthly NINO 3.4 and AO indices for the two greatest significant tornado droughts was made to gain insight into the relationship of ENSO and AO. Figures 14 and 15 show the monthly NINO 3.4 and AO indices for the significant tornado minimum since March 2008 and the November 1988 through March 1993 significant tornado minimum respectively. For the current event (Fig. 14) all four of the La Niña dry seasons where characterized by predominantly, and at times record, positive AO values reinforcing the influence of La Niña while the one strong El Niño season (2009-10) was characterized by all-time record negative AO conditions. The 1988-1993 tornado minimum event is interesting in that it started with the strongest La Niña on record in 1988 followed by two ENSO-neutral dry seasons, a strong El Niño (1991-92) and ended with another neutral dry season (1992-93). Based on ENSO phase alone, four of the five seasons would be expected to experience normal or higher storminess and severe weather potential. However, the monthly AO values were positive for nearly the entire five-season period and were at all-time record positive values during three of the five dry seasons. Indeed, the monthly AO index did not come close to being in the lowest 20 percentile during the five year dry season tornado drought period shown on Figure 15.

The 1991-92 El Niño dry season was interesting in that strong supercell thunderstorms occurred on several days in March 1992 and produced two of the greatest hailstorms in the history of Florida, but no significant tornadoes. Storm scale processes operating on the scale of minutes determine why a tornado might or might not form in a given situation. Clearly the ENSO and the AO do not influence individual mesoscale convective systems or directly influence supercell thunderstorm development or tornadogenesis, but they can enhance or limit the opportunities to produce an environment favorable for severe weather development in the warm sectors of extratropical cyclones on a seasonal scale, especially when their phases are strong and persistent. The persistent extreme phases of the AO likely played a significant role in inhibiting conditions favorable for the development of significant tornadoes on the seasonal scale during the two "significant tornado drought" periods.

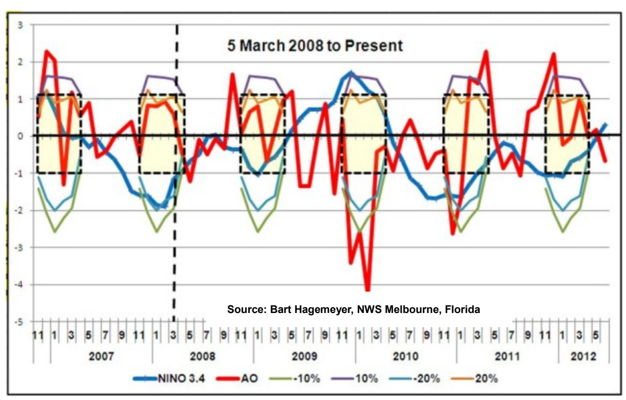


Figure 14. Plots of monthly NINO 3.4 index (blue) and Arctic Oscillation index (red) from November 2006 through June 2012. The bottom and top 10 and 20 percentile thresholds for monthly AO during the dry season are indicated by light green/purple and light blue/orange respectively. The six-month dry seasons are indicated by the dashed rectangles. The beginning time of the current "tornado drought" is indicated by the dashed vertical line.

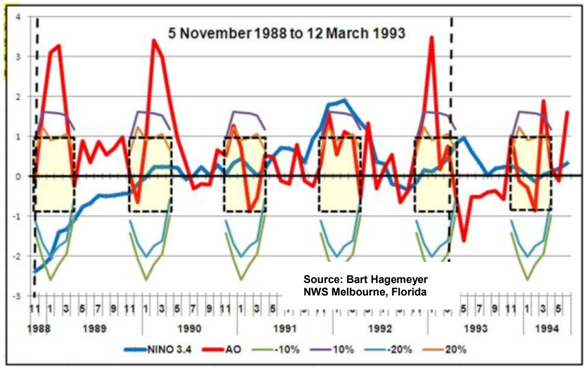


Figure 15. Plots of monthly NINO 3.4 index (blue) and Arctic Oscillation index (red) from November 1988 through March 1993. The bottom and top 10 and 20 percentile thresholds for monthly AO during the dry season are indicated by light green/purple and light blue/orange respectively. The six-month dry seasons are indicated by the dashed rectangles. The beginning and ending times of the "tornado drought" is indicated by the dashed vertical lines.

3. IMPLICATIONS FOR SEASONAL TORNADO FORECASTS

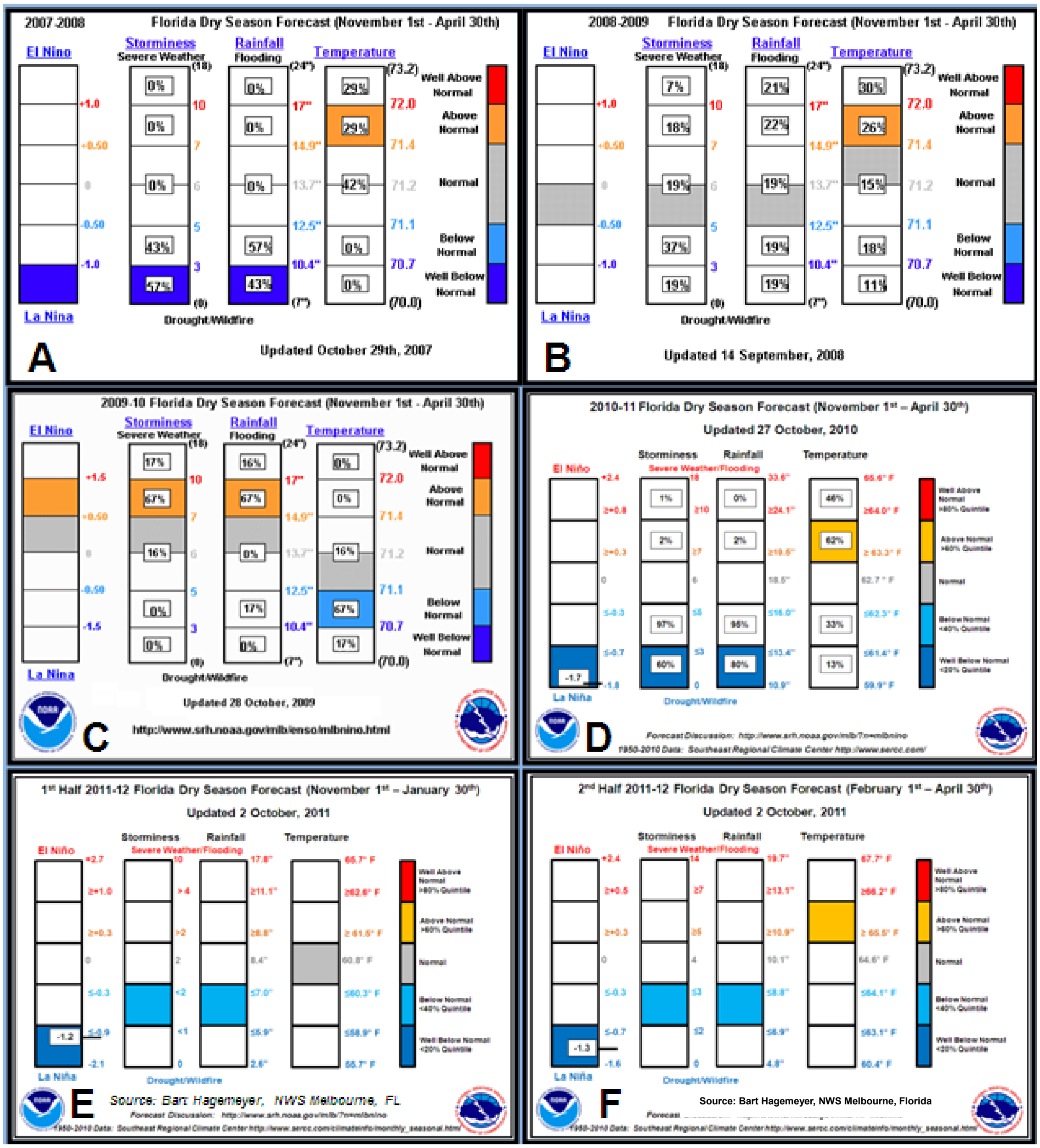
The author began producing experimental forecasts of dry season storminess (i.e. severe weather potential), rainfall and temperature for Florida in 1999, and has produced official forecasts since the 2007-2008 dry season. The forecasts are primarily based on a consensus forecast of the ENSO from models which are available well before the start of the dry season (Hagemeyer and Almeida, 2003). Therefore the actual dry season forecasts of storminess issued in the months prior to the start of the past five dry seasons were correct in predicting below normal activity four times during La Niña conditions, but incorrectly over-forecast severe weather potential in the one El Niño season (Figures 16a-f).

To improve decision-making utility logistic regression forecasts of dry season storminess were developed and improved over the years (Hagemeyer 2006 and 2007). They are useful to illustrate the profound importance of the underlying ENSO forecast on the dry season impacts forecast. Figure 17 adapted from Hagemeyer (2007) shows the critical impact the underlying NINO 3.4 forecast has on the Florida dry season forecast of impact variables such as storminess, temperature and rainfall. In this case, a 1.0 degree increase in the NINO 3.4 index for JFM results in a ~65% increase in the odds of an extremely strong and active jet stream over Florida during FMA, the traditional severe weather season. When it comes to ENSO, strength matters greatly!

Florida is unique, both geographically and meteorologically. The development of significant extratropical storms at Florida's southern latitudes is critically dependent on the location and strength of the jet stream and storm track during the dry season, and thus ENSO. Nearly all severe convective storms that affect Florida in the dry season either develop within the state or move inland from the adjacent coastal waters. While the adjacent coastal waters provide for a ready supply of moist low-level air in winter, it is not necessarily a "high energy" airmass. Florida is not subject to extreme destabilization from the superposition of the elevated mixed layer (EML) or advection of hot surface air and thus extreme Convective Available Potential Energy (CAPE) values that contribute to many explosive severe weather outbreaks over the interior sections of the roughly eastern half of the United States in the late spring and summer. Thus the forecast challenge for Florida dry season severe weather outbreaks is typically a scenario where there is relatively high confidence that favorable jet stream dynamics and low level helicity and shear will be present, but relatively lower confidence that sufficient instability will be available to support supercell thunderstorms (i.e. high shear – low CAPE environment).

Even assuming a perfect ENSO forecast the author (Hagemeyer 2004, 2006, and 2007) has documented the important influences other teleconnections such as the AO/NAO, PNA and MJO can have on dry season storminess, rainfall and temperature, and these teleconnections are not predictable beyond about two weeks. Intraseasonal variability of the AO/NAO, in particular, can be extreme and have profound influences on the seasonal forecasts of storminess and severe weather as demonstrated in Hagemeyer (2011 and 2012) and Hagemeyer and Ulrich (2011).

With regard to the advisability of producing dry season severe weather forecasts, it is useful to consider the seasonal hurricane forecast as an analogy. The Atlantic hurricane season forecast is issued because there is demonstrable skill in its accuracy and value in its application, and the scope of the forecast covers a very large area and does not concentrate on the exact location of impacts or of the type of impacts that might be experienced, be it high wind, tornadoes, storm surge, or flooding. The Florida dry season forecast fits the same scenario, but can be more focused because of the greater inherent predictability of the winter season ET storm track.



Figures 16a-f. Archival forecasts issued before the start of the 2007-08 (a), the 2008-09 (b), the 2009-10 (c), the 2010-11 (d), and the 2011-12 Florida dry seasons(e-f). The dry season forecast was divided into two 3-month periods starting in 2011 (source: http://www.srh.noaa.gov/media/mlb/pdfs/Florida_Dry_Season_Forecast.pdf).

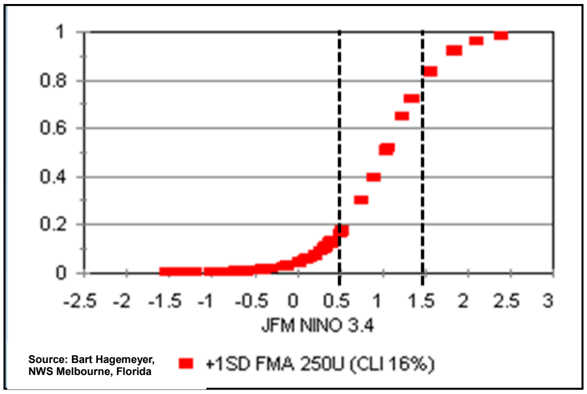


Figure 17. Logistic regression showing probability of the mean FMA 250 mb U wind averaged over Florida exceeding one standard deviation above normal given mean JFM NINO 3.4 (one month lead, from Hagemeyer, 2007).

There is demonstrable skill, the influence of other teleconnections notwithstanding, and value in the prediction of the number of significant dry season extratropical storms that may affect the state. The concept of above or below storminess for Florida is used with the understanding that more passing ET storms increases the likelihood for severe weather, heavy rainfall and cooler temperatures and fewer ET storms during the dry season increases the likelihood of drought, warmer temperatures, and wildfire. Cook and Schaefer (2008) expanded the author's work over a much larger area of the United States, and while reaffirming the influence of ENSO on Florida's wintertime significant tornado climatology they found widely divergent results across individual states to the north.

This relates to the practical consideration that Florida only shares a northern border with two states, which means a seasonal forecast for Florida is unlikely to be a coordination or political issue with its neighboring states, compared to Tennessee, just as an example, which is inland and shares a border with eight other states. Events which impact Tennessee are likely to impact adjoining states as well and a regional seasonal forecast approach would be preferable.

4. CONCLUDING REMARKS

Discussions of the attribution of the current Florida dry season tornado drought and the veracity of the seasonal severe weather forecast are important topics that will ultimately require significantly more research in both the physical and social sciences to advance their development and application. However, of immediate concern is the documented undeniable existence of the current record-breaking significant tornado drought! Although it represents significant intelligence that can be used by the NWS and decision-makers to address education, preparedness, training, resource allocation and management for the upcoming dry season, the droughts very existence represents a significant challenge to succeeding in these efforts.

There is a risk of dry season "killer tornado amnesia". A relatively small percentage of Floridians might remember that as recently as February 2007, 21 people were killed by violent tornadoes over a very small area in central Florida. Hagemeyer et. al. (2010) detailed the significant challenges involved in mitigating Florida dry season tornado casualties. Florida dry season significant tornado outbreaks are much more likely during El Niño conditions and they occur most often late at night or in the early morning, after people have gone to bed making warning receipt and action problematic. A total of three supercell thunderstorms late at night on 22-23 February 1998 and 2 February 2007 (two El Niño dry seasons) caused 63 deaths, or 30% of all known tornado deaths in Florida history! This rarity of occurrence is the classic "low probability-high impact" scenario and results in a motivational challenge to preparedness efforts. The current extended tornado drought makes preparedness even more difficult.

Florida, particularly central Florida, has the greatest density of manufactured homes in the United States. In all but one central Florida county 70-80% of the permanent manufactured housing stock consists of older units built to pre-Hurricane Andrew building codes. There is also a large winter-time population of people living in small trailers, recreational vehicles (RV) and tents at campgrounds and RV parks. The dry season occupancy rate of this vulnerable housing is typically 90 to 100%, representing several million citizens on a typical winter day. The myths documented in Hagemeyer et. al. (2010) are totally at odds with climatology, but are nevertheless hard to dispel, are that summertime is the severe weather season in Florida and that "weak" tornadoes occur in the heat of the afternoon and violent tornadoes happen in "Tornado Alley" or "up north, not down here". The devastating tornado outbreaks of spring 2011 and 2012 north of Florida with virtually no tornado activity occurring in Florida during that time, no doubt reinforced this perception. This intersection of meteorology, climatology and cultural housing practices and cultural beliefs has resulted in very high tornado death tolls in Florida in the past.

The current "tornado drought" represents a rare regional climatic anomaly and consideration of what role climate change may play in its existence and on the Florida tornado climatology in the future is beyond the scope of this brief paper. Extreme intraseasonal and interseasonal variability of ENSO and other major teleconnections, especially the AO/NAO, have no doubt played a major role in the current tornado drought and the 1988-1993 drought. Periods of extreme and/or protracted phases of ENSO and the AO within a dry season and over several consecutive dry seasons are at the root of these two events. However, climate change can alter the climatology of these teleconnections and thus their important influence on Florida. The observation that nine of the thirteen Florida dry seasons since 1999 have had no significant tornadoes is worthy of more investigation.

Finally, the current dry season significant tornado drought documented in this study will end, and tornado fatalities will occur in future dry seasons. The 1988 to 1993 event ended with the March 1993 "Superstorm". As noted after the February 1998 tornado outbreak (Pielke, 2000) and the 2007 tornado outbreak and notably during recent tornado outbreaks north of Florida in 2011 and 2012; accurate severe weather outlooks and timely tornado warnings are not enough. People must have an all hazards action plan, receive the vital information in an actionable form, and implement their unique plans and take appropriate actions to save lives. Toward this end, it is suggested that the NWS offices, the emergency management community, and media partners in the weather enterprise use the knowledge of the current dry season "tornado drought" as a focus for internal and external pre-season outreach and education efforts and in the lead up to developing severe weather scenarios during the dry season to remind citizens to be prepared, for violent killer tornado outbreaks have happened in Florida in the past and they will happen again. While the possibility of weak El Niño during the 2012-13 dry season increases the chances of severe weather in Florida, especially relative to the last two La Niña dry seasons, the simple, primary message should be focused on the lack of significant tornadoes in recent years and the need for the "dusting off" of severe weather plans and getting prepared for severe weather season in Florida!

5. DISCLAIMER

The views expressed are those of the author and do not necessarily represent those of the National Weather Service.

6. REFERENCES

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