



**THE STATE OF FLORIDA
TROPICAL AND NON-TROPICAL SEVERE
WEATHER ANNEX**

**To The State of Florida
Comprehensive Emergency Management Plan**

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THE STATE OF FLORIDA TROPICAL AND NON-TROPICAL SEVERE WEATHER ANNEX

I. INTRODUCTION

A. General

Florida may be considered the most vulnerable state in the nation to the impacts from hurricanes, tropical storms, and tropical depressions – collectively known as tropical cyclones. In addition to tropical cyclones, the State of Florida is vulnerable to numerous other types of severe weather such as tornadoes, drought, various types of flooding, and extreme temperatures, including freezes. The vulnerable geography and environment of the state combined with the subtropical climate create continuous threats from these severe weather events.

B. Purpose and Scope

The Division of Emergency Management has the overall responsibility for coordinating the severe weather response actions of the State Emergency Response Team (SERT). This Annex to the State Comprehensive Emergency Management Plan (CEMP) provides guidance for those response actions, and is designed for use by governmental and nongovernmental organizations that provide support to the Emergency Support Functions (ESFs). Primary and support ESF organizations can utilize this annex to develop Standard Operating Procedures and checklists.

C. Assumptions

The following assumptions are germane to a tropical cyclone or non-tropical severe weather event and do not represent the full array of assumptions that are representative of the state's response to emergencies. A list of general and demographic assumptions can be found in the Basic Plan of the CEMP.

1. The potential for severe weather in Florida exists year round.
2. Response to a severe weather incident will begin at the local jurisdiction level.
3. As severe weather information is received by the State Watch Office (SWO) from the National Weather Service, the SWO will relay the information to the counties and other SERT entities.
4. Because of uncertainties in tropical cyclone intensity forecasting, the State Emergency Response Team will prepare to respond to a tropical cyclone that is one category higher than the official National Hurricane Center forecast.

5. All Florida communities, coastal and inland, are susceptible to impacts from tropical cyclones.
6. Some areas of the state are more vulnerable to storm surge than others.
7. People living in storm surge zones and manufactured housing are the most vulnerable to impacts from tropical cyclones.
8. The strongest winds associated with a tropical cyclone may continue well inland of the coast.
9. Public response to evacuate will vary depending on the perception of the threat.
10. All evacuations will be completed prior to the onset of tropical storm force winds (39-73 mph).
11. A tropical storm can produce as much damage as a hurricane, if not more, particularly in terms of flooding from heavy rain.
12. A large tropical cyclone in the Gulf of Mexico could affect evacuations in other states; evacuations in neighboring states could affect traffic flow and shelter populations in Florida.
13. Tornadoes can occur at any time of the day or night and may strike with little to no warning.

II. SITUATION

A. Description of Hazards - Tropical Weather

Tropical Cyclones: Generally form in the tropics and are accompanied by thunderstorms and a counterclockwise circulation of winds in the Northern Hemisphere. A hurricane has maximum sustained winds of 74 mph or higher while tropical storm winds range from 39 mph to 73 mph. Tropical depressions have maximum sustained winds of 38 mph or less. Tropical cyclones can cause tornadoes, storm surge, high winds, and inland flooding. Based upon the storm intensity, the impacts can vary from minor structural damage to catastrophic statewide impacts.

- **High Winds:** The strongest sustained winds in a tropical cyclone occur close to the center of the storm; however, strong winds do occur in gusts well away from the center. Although major hurricanes (Category 3 or stronger) produce the most wind-related damage, lower category storms, including tropical storms and depressions, can also produce winds strong enough to cause significant damage.

- **Inland Flooding:** A rise in water which inundates land that is not normally covered by water. Tropical cyclones increase the risk level due to storm surge which not only floods the immediate coastal regions but also promotes inland flooding in all tidal water bodies. Flooding may result from heavy rainfall associated with tropical cyclone rain bands that cause a nearby river, lake or stream to overflow its banks, or from standing water which cannot be properly or efficiently drained into nearby soil. Flood waters can cause extensive damage to a few homes or an entire neighborhood or city. Floods primarily cause physical damage to structures and property, but can also contaminate water supplies and damage vegetation.
- **Storm Surge:** Storm surge is an abnormal rise in water level generated by a tropical cyclone, a level above the predicted astronomical tide. It is produced when strong winds from a tropical cyclone push water toward shore. The height of storm surge along a stretch of coastline is dependent upon wind speed, configuration of the continental shelf (shallow slope or steep slope), and bathymetry (depth of the ocean bottom).
- **Tornado:** Tornadoes accompanying tropical cyclones tend to occur in the outermost rain bands, well away from the center of circulation. These tornadoes are usually short-lived and fast-moving. While generally less intense than tornadoes associated with non-tropical severe weather, tornadoes spawned from a tropical cyclone can and have produced substantial damage and deaths.

B. Description of Hazards - Non-Tropical Weather

Drought: A drought is a period of prolonged, abnormally dry weather which causes a serious hydrologic imbalance in the affected area. Long-term lack of rainfall can endanger Florida's agricultural industry and water supply. A prolonged drought may decrease the water table, contribute to an increased occurrence of sinkholes, increase the threat of wildfires, and promote saltwater intrusion of the aquifers which supply much of the state's drinking water.

Flooding: Flooding results from prolonged, heavy rainfall associated with tropical and non-tropical storm systems. Florida's flat terrain and natural water-prone ecosystems promote the pooling of water and inhibit drainage. Small streams and rivers may flood as a result of prolonged rainfall. In the southern regions of the state, drainage is maintained by a complex man-made system of canals and water control systems. Flooding may occur as a result of failure of these water control systems, including the Herbert Hoover Dike surrounding Lake Okeechobee.

Freeze: Freezes in Florida create a threat to the agricultural industry and homeless populations. The state's winter-season vegetable growers historically face a high risk of freeze damage from cold temperatures. Vulnerable crops include citrus and sugarcane crops and commercial foliage (tropical plants, trees, and shrubs). Florida accounts for about one-third of fresh-market supplies of warm-season vegetables during the late fall to early spring period. Therefore, a freeze in Florida can cause substantial disruption in the Nation's supply of vegetables. Additionally, prolonged

freezes can have a detrimental effect on the state's aquaculture industry, specifically fish farming.

Severe Thunderstorm: A thunderstorm is defined by the National Weather Service as any storm that is accompanied by lightning and thunder; however, severe thunderstorms exhibit *at least* one of the following three characteristics: (1) winds of at least 58 miles per hour, (2) hail at least 1 inch in diameter, and (3) a tornado. Although frequent lightning often accompanies severe thunderstorms, it is not a criterion. About 10 percent of the estimated 100,000 thunderstorms that occur each year are classified as severe.

Tornado: A tornado is a violently rotating column of air extending from a thunderstorm to the ground. Tornadoes may appear nearly transparent until dust and debris are picked up or a cloud forms within the funnel. The average forward speed is 30 mph but may vary from nearly stationary to 70 mph while the maximum winds rotating around the tornado can reach more than 200 mph. Waterspouts are tornadoes which form over warm water, typically during the summer months. They can move onshore and cause damage to coastal areas.

Tsunami: A tsunami is an unusually high wave created by an underwater earthquake or volcano. It is, not related to severe weather; however, the impacts are similar to those of the coastal storm surge.

C. Risk Classification and Vulnerability

Tropical Cyclones: The National Hurricane Center (NHC) provides risk classification for specific coastal regions utilizing the following categories:

- **Hurricane Watch:** Indicates the *possibility* of hurricane conditions within 48 hours.
- **Hurricane Warning:** Indicates the *likelihood* of hurricane conditions within 36 hours or less.
- **Tropical Storm Watch:** Indicates the *possibility* of tropical storm conditions within 48 hours.
- **Tropical Storm Warning:** Indicates the *likelihood* of tropical storm conditions within 36 hours or less.

Similar classifications for inland regions (Hurricane Watch/Warning, Tropical Storm Watch/Warning) are provided by the local National Weather Service forecast offices.

The intensity of hurricanes is classified using the Saffir-Simpson Scale:

Storm Category	Wind Speed (mph)
Category 1	74-95
Category 2	96-110
Category 3	111-130
Category 4	131-155
Category 5	155 +

Forty percent of all hurricanes that make landfall in the United States hit Florida. More than 76% of the state's 18 million persons reside in one of the state's 35 coastal counties. While all areas within the state are vulnerable to the impacts of high winds and inland flooding, coastal counties may experience storm surge as well as inland flooding, posing greater risk to human lives. The official hurricane season lasts from June 1 until November 30.

Drought: The severity of a drought depends upon the degree of moisture deficiency, the duration, and the size of the affected area. Droughts may be classified using numerous methodologies, including the U.S. Drought Monitor, Crop Moisture Index, and/or the Keetch-Byram Drought Index. The U.S. Drought Monitor utilizes a numerical scale, D0-D4, to summarize general drought areas by intensity on a national scale. D0 is the least intense while D4 is the most intense. Within the State of Florida, the Department of Environmental Protection and the regional Water Management Districts monitor water supply and flood potential within their regions. On the federal level, numerous agencies participate in drought monitoring, including the U.S. Department of Agriculture (Joint Agricultural Weather Facility and National Water and Climate Center), the National Weather Service's Climate Prediction Center, National Climatic Data Center, and the National Drought Mitigation Center. Florida experiences drought conditions annually. A noteworthy example of such conditions occurred in 2007 when the level of Lake Okeechobee fell below 9 feet. Numerous water shortage restrictions were implemented across South Florida, and there was concern of saltwater intrusion into underground wells that provided drinking water to the metropolitan areas.

Flooding: Based on the type of flood hazard, there are numerous risk classification systems for flood zone identification, river/stream/canal flooding, and dike breach. The National Flood Insurance Program has developed a flood zone identification system for properties within the flood hazard areas. A series of maps are developed for each community detailing the flood hazard areas. This classification system however, does not provide sufficient operational-based information to support real time risk decision making.

The National Weather Service (NWS) issues river forecasts and flood warnings for public safety and protection of agricultural interests. The U.S. Geological Survey (USGS) is the principal source of data on river depth and flow. Within the State of Florida, the Department of Environmental Protection and the regional Water Management Districts monitor water supply and flood potential within their regions. The United States Army Corps of Engineers, in coordination with the South Florida Water Management District, monitors and classifies risk associated with the Herbert Hoover Dike. Storm surge may be evaluated and classified in terms of the size, intensity, and movement of the tropical cyclone, the shape of the coastline, nearshore underwater topography, and the state of the astronomical tides.

The Sea Lake and Overland Surge from Hurricanes (SLOSH) model, developed in conjunction with the Regional Hurricane Evacuation Studies, provides surge flood inundation maps. This detailed information supports local protective action decision making for vulnerable populations in coastal areas.

Since 1970, inland flooding has caused more deaths than any other tropical cyclone hazard, including storm surge. The intensity of rainfall is not proportional to the

intensity of the tropical cyclone itself. In fact, the most prolific rainfall producing tropical cyclones were weaker, slow-moving. Tropical Storm Fay (2008) produced between 20 and 30 inches of rain across Florida as it made quadruple landfalls along the state's Gulf and Atlantic coastlines.

Freeze: When temperatures reach below freezing or wind chill is expected to create a freezing sensation, people, plants, pets, and property in the State of Florida are at risk. In the southern regions of Florida, temperatures and/or wind chill below forty-five degrees may be sufficient to activate local government protective actions. In addition to the actual temperature, when the wind blows, a wind chill (the temperature that it feels like) is experienced on exposed skin. Despite its southern geographic location, the state of Florida experienced sub-freezing temperatures and wind chills on several occasions during the winter months. In January of 2010, record cold spells impacted the state as far south as the Everglades and inland areas of Miami-Dade and Collier Counties. As a result of these freezes, over \$500 million in agricultural damage was reported, along with 2 direct fatalities and 1 injury.

Severe Thunderstorm: According to the National Weather Service, the greatest frequency of thunderstorm occurrence in the United States is in Florida. On average, there are 80-100+ thunderstorm days per year, with many of these thunderstorms becoming severe. Severe thunderstorms accompany the passage of cold and warm fronts, especially from late fall through early spring, but they also occur frequently during the summer months as sea breeze boundaries from the Gulf of Mexico and Atlantic Ocean move inland and interact with the warm and humid air mass over land.

Tornado: Between January, 1950 and April, 2011, the National Climatic Data Center confirmed the touchdown of 3,081 tornadoes in Florida. Data collected over the past 30 years show the state ranked 3rd in the nation in the total number of tornadoes with an average of 64 per year. The same data also shows the state ranked 7th in the total number of killer tornadoes and 5th in the number of tornado-related deaths. Florida's period of significant tornadic activity occurs from February through April as strong cold fronts move through the state from the northwest, but tornadoes in Florida can occur at any time of the year. During the summer, thunderstorms moving inland along sea breeze boundaries can also spawn tornadoes and waterspouts.

The intensity of tornadoes is classified using the Enhanced Fujita Scale (EF Scale), a set of wind estimates based on damage:

EF Number	Estimated Winds (mph)
EF-0	65-85
EF-1	86-110
EF-2	111-135
EF-3	136-165
EF-4	166-200
EF-5	>200

Most tornadoes that strike Florida are generally in the category of EF-0 to EF-3, with winds between 65 and 165 miles per hour; however, two EF-4 tornadoes have been confirmed in Florida since 1950. Florida's tornado climatology demonstrates that strong to violent tornadoes are just as likely to occur during the overnight hours as they are during daylight. Tornadoes that occur overnight are more dangerous as people are unaware of weather warnings relayed by commercial radio or television networks while they sleep. Past tornado outbreaks in Florida have caused a significant number of fatalities. One tornado outbreak killed 42 people in Central Florida in February, 1998, while another killed 21 people in Lake, Volusia, and Sumter counties in February, 2007. Both of these incidents occurred during the overnight hours.

Tsunami: A tsunami is created by an underwater earthquake and currently does not have a distinct risk classification system. Hazards associated with flooding from tsunamis can be divided into primary hazards that occur due to contact with water, secondary effects that occur because of the flooding, such as disruption of services, health impacts such as famine and disease, and tertiary effects such as changes in the coast line.

The threat of a major tsunami or earthquake to Florida's residents and communities is very low. Florida is generally unaffected by these events because the Atlantic Ocean basin does not have the large faults or volcanoes that contribute to most of the catastrophic seismic activity in the Pacific Ocean. In 1886, a 7.7 magnitude earthquake in Charleston, South Carolina caused a slight increase in water height on the Jacksonville, Florida and Mayport, Florida beaches. An earthquake near the Dominican Republic in 1946 caused a slight increase in water height in Daytona Beach, Florida. In 2010, a 7.0 magnitude earthquake struck in Ouest, Haiti. Despite the size and relative proximity of the earthquake, Florida experienced neither property nor physical damage from the event and at no time did a tsunami threaten Florida.

III. CONCEPT OF OPERATIONS

Response operations for tropical cyclones and other non-tropical severe weather events are conducted in accordance with the Basic Plan to the State of Florida Comprehensive Emergency Management Plan (CEMP). All emergencies and disasters begin locally, and initial response actions will be conducted by local jurisdictions. Once local emergency response resources have been expended, or if such resources do not exist, state response resources and assistance may be requested by local jurisdictions. This may involve activation of the State Emergency Operations Center (SEOC) and/or the pursuit of an Executive Order from the Governor. All county Emergency Operations Centers will activate in response to an impending threat on their own jurisdiction or in support of neighboring threatened jurisdictions.

A. Notification and Warning – Tropical Weather

Tropical Cyclones: It is the responsibility of the National Hurricane Center to notify the State Watch Office of an impending tropical cyclone risk which has been

identified and classified. Hurricane and tropical storm watches and warnings are issued by the National Hurricane Center in close coordination with the State Emergency Operations Center and impacted counties. Similarly, the National Weather Service will issue tropical storm and hurricane warnings for inland counties. Both the National Hurricane Center and the National Weather Service distribute the warning data via the National Oceanic and Atmospheric Administration's Weather Wire Service, EM Net, the internet, media, and other mechanisms.

B. Notification and Warning – Non-Tropical Weather

Aside from tropical threats, the National Weather Service (NWS) forecast offices monitor weather conditions 24 hours a day, seven days a week and notify the State Watch Office and county warning points of impending severe weather threats. Hazardous Weather Outlooks are issued daily by local NWS forecast offices to advise emergency managers and the public of potentially hazardous weather and other hazards. Watches and warnings may be issued for severe thunderstorms, tornadoes, freezes, and floods. Warnings for tsunamis may be issued with minimal warning time due to the limited ability to predict earthquakes.

Once the State Watch Office is notified of any severe weather threat, it will initiate its notification procedures in accordance with the *State of Florida Emergency Operations Plan*, a support plan to the State CEMP.

Drought: Numerous federal and state agencies monitor drought conditions over a prolonged period of time. The National Weather Service Forecast Offices, in conjunction with other National Oceanic and Atmospheric Administration agencies, may issue statements associated with drought conditions.

Flooding: Watches, warnings, and advisories for flooding are issued by local National Weather Service forecast offices. In situations involving rivers overflowing their banks, the NWS will issue River Flood Warnings based upon river flooding forecasts from the Southeast River Forecast Center (SERFC).

Freeze: Warnings and watches are issued in the State of Florida when temperatures are expected to reach 32 degrees Fahrenheit or lower for an extended period of time. Hard Freeze Warnings may also be issued. There are no set national criteria for such warnings as individual National Weather Service Forecast Offices establish their own criteria for their respective areas of responsibility. Typically, Hard Freeze Warnings are issued in the southernmost United States, including Florida, when temperatures are expected to reach 26 degrees or lower for several hours.

Severe Thunderstorm: Severe Thunderstorm Watches are issued by the National Weather Service when conditions are favorable for severe thunderstorm development. If a severe thunderstorm is detected, then a Severe Thunderstorm Warning is issued (See II.B on page 3 for severe thunderstorm criteria). Although tornadic development is a criterion for a severe thunderstorm, Tornado Warnings will normally be issued for severe thunderstorms capable of producing tornadoes.

Tornado: The National Weather Service and the Storm Prediction Center monitor tornado threats within the State of Florida. Convective Outlooks are issued to outline

areas where severe thunderstorms may develop and qualifies the degree of risk (i.e. SLIGHT, MODERATE, and HIGH risk areas). Tornadoes may also appear with limited warning time even though conditions favorable for a tornado to develop can be predicted.

Tsunami: Despite the unlikelihood of a tsunami impacting Florida, the National Oceanic and Atmospheric Administration maintains early-detection buoys off the Atlantic seaboard and in the Caribbean Sea. If a potential tsunami is suspected, the West Coast and Alaska Tsunami Warning Center (WCATWC) will issue advisories, watches, or warnings for the appropriate area.

C. Protective Action Decision Making

Under Chapter 252, Florida Statutes, it is the responsibility of each Board of County Commissioners to declare a local state of emergency for their jurisdiction and to order necessary protective actions. The Governor of the State of Florida, however, reserves the right to override local decision making when lives within the State of Florida are threatened. The goal within the state is to relocate all vulnerable populations within hurricane storm surge areas, areas prone to inland flooding, populations residing in unsafe buildings, and persons with special needs. Local governments offer sheltering options and transportation assistance for evacuating their populations. The Governor may also declare a state of emergency throughout the state when severe weather conditions warrant.

Tropical Cyclones: Lengthy hurricane clearance times and limited evacuation routes in Florida mandate proactive evacuation coordination among local, state, and federal public safety agencies far in advance of storm arrival.

Tsunami: Similar to a response to storm surge flooding, local governments may evacuate coastal populations vulnerable to flood inundations, populations along tidal water bodies, and other vulnerable populations that reside in unsafe structures or have special needs. Unlike a storm surge from a hurricane, tsunami waves travel at faster speeds and can impact an area within hours of an earthquake. Such insufficient warning time may significantly impact tsunami evacuations.

Flood: In response to storm surge flooding, local governments may evacuate coastal populations vulnerable to flood inundations, populations along tidal water bodies, and other vulnerable populations that reside in unsafe structures or have special needs. In response to inland flood conditions, local jurisdictions may also choose to evacuate residents in flood prone areas. It is important to note, however, that many inland areas which flood in the State of Florida are not located in pre-identified flood hazard areas. Flooding may be caused by improper stormwater runoff and drainage in all areas of the state. Sufficient warning time should be available for non-tropical inland flood events. The major threat from inland flooding is posed by the inability to judge water depth in urbanized and rural areas, endangering motorists and pedestrians.

Drought: In response to drought conditions, local officials may ban open burning within their local jurisdiction while the Florida Forest Service may ban open burning

on forest lands. The regional Water Management Districts may also issue water restrictions in response to drought conditions.

Freeze: Hazardous freeze conditions may require local governments to activate cold weather shelters for homeless populations and advise their citizens to take appropriate measures to protect themselves, their family, and their pets. Local governments may also notify agricultural interests within their respective jurisdictions to take appropriate protective measures.

Severe Thunderstorms: While warning times may be insufficient, the threat of severe thunderstorms may cause local governments to recommend persons in mobile/manufactured homes and other unsafe structures relocate to a sturdier shelter prior to the arrival of a severe thunderstorm. They may also order or advise jurisdiction-owned vehicles (e.g., school buses) to not operate until the storms have passed.

Tornadoes: While warning time may be insufficient, the threat of tornadoes may cause local governments to recommend persons in mobile/manufactured homes and other unsafe structures relocate to a sturdier shelter prior to the arrival of a tornado or tornadic conditions.

IV. ADDITIONAL REFERENCES

- A. State of Florida Comprehensive Emergency Management Plan
- B. State of Florida Enhanced Hazard Mitigation Plan
- C. State of Florida Emergency Operations Plan
- D. Statewide Regional Evacuation Studies, 2010
- E. State of Florida Recovery Plan
- F. Comprehensive Preparedness Guide (CPG) 101, FEMA, November, 2010

V. AUTHORITIES

- A. "State Emergency Management Act," Chapter 252, Florida Statutes

Figure 1 - STATE EOC ACTIVATION LEVELS AND RESPONSE ACTIONS FOR TROPICAL CYCLONES

EOC Activation Level	Sequence of Events	Actions
Level III - Monitoring	More than 72 hours before landfall	<ul style="list-style-type: none"> • Maintain situational awareness • Conduct weather briefing(s)/conference call(s) as necessary with SERT partners and counties • Draft Executive Order • Conduct meeting with SERT Chief, Operations Chief, Plans Chief, and other appropriate staff to determine if raising the State EOC activation level is warranted
Level II Activation	72-48 hours before landfall	<ul style="list-style-type: none"> • Seek pre-landfall declaration from FEMA • Request FEMA IMAT with designated FCO to report to SEOC • Begin Incident Action Planning • Begin daily SERT briefings in the SEOC • Conduct conference calls with National Hurricane Center/National Weather Service/impacted counties • Deploy SERT Liaisons • Place SMT on standby • Place FEIL on standby • Commence media briefings • Place State Logistics Response Center (SLRC) on Standby • Preposition resources • Ensure alternate SEOC is on standby, if necessary • Assess need for National Guard activation • Ensure EMAC states and FEMA are on standby • Maintain awareness of Executive Order status
Level I Activation	48-24 hours before landfall	<ul style="list-style-type: none"> • Execute Executive Order • Activate SLRC • Activate FEIL • Activate the Continuity of Operations Plan (COOP) if necessary • Place Preliminary Damage Assessment teams on standby for post-landfall deployment • Assess need for non-threatened counties to activate their EOCs in

		support of state and local response
		<ul style="list-style-type: none">• Identify and initiate EMAC requests• Finalize strategies for deploying SMT or F-SERT to impact area post-landfall• Maintain awareness of Executive Order status• Issue Supplemental Orders as required• Begin drafting Presidential Disaster Declaration request• Prepare to initiate post-landfall recovery operations