#### **SKYWARN Severe Weather Spotter Training**

#### You may want to take a picture of this screen

- 1. Register at <a href="mailto:goo.gl/UDCJWu">goo.gl/UDCJWu</a> (case sensitive)
  - Choose "Trained Spotter" as your affiliation
  - Certificate of training sent to your Email
- 2. Download the Weather Spotters Field Guide at go.usa.gov/xnDYC (case sensitive)
- 3. Download our SKYWARN Handout at <a href="mailto:go.usa.gov/xnDrs">go.usa.gov/xnDrs</a>



#### **Daniel Noah**

Warning Coordination Meteorologist National Weather Service – Tampa Bay Area daniel.noah@noaa.gov







#### **National Weather Service**

#### **MISSION**

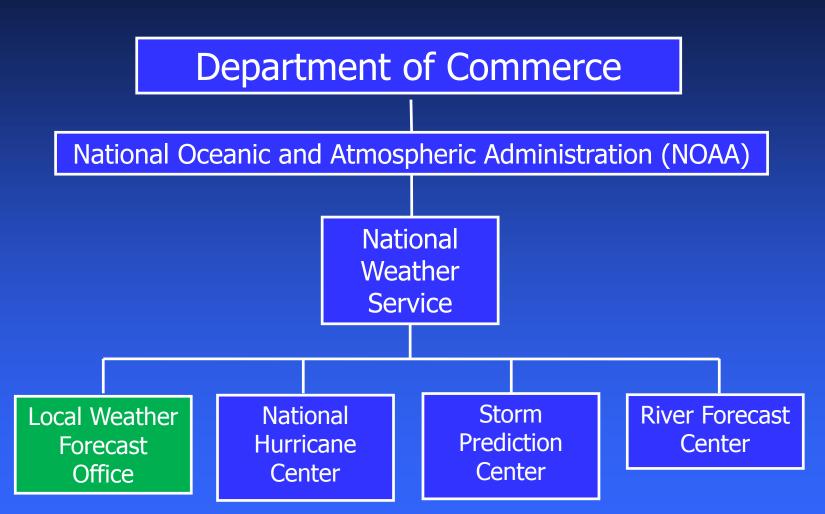


Provide weather, water, and climate data, forecasts and warnings for the protection of life and property and the enhancement of the national economy<sup>1</sup>





### Federal Government Agency



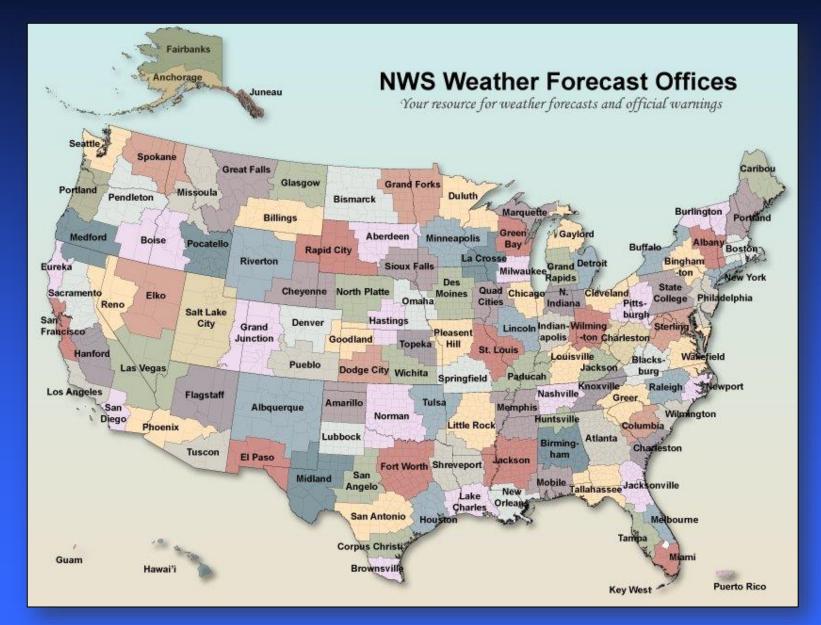




## ttp://weather.go

## NORA NO ATMOSPHERILO VO

#### **Local Weather Forecast Offices**





### NWS Tampa Bay Area Ruskin, FL

- 23 Employees, 17 Meteorologists
- 24 hours a day / 365 days a year
- One of 122 local offices

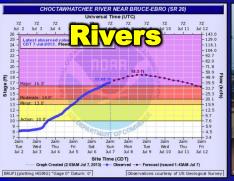


















Thunderstorms

Likely

High: 84 °F

Chance

Thunderstorms

Low: 70 °F

#### 7-DAY FORECAST

Chance

Thunderstorms

Chance

High: 91 °F

Thunderstorms

A 30 percent chance of showers and thunderstorms after 2pm. Patchy fog before 9am Otherwise, partly sunny, with a high near 91. Calm wind becoming south around 5 mph. A chance of showers and thunderstorms. Mostly cloudy, with a low around 70. Southwest wind around 5 mph becoming calm. Chance of precipitation is 30%.

Chance

Thunderstorms

Low: 71 °F

Chance

Thunderstorms

High: 84 °F

A 50 percent chance of showers and thunderstorms. Mostly cloudy, with a high near 84. Calm wind becoming south southeast around 5 mph in the afternoon. New rainfall amounts between a tenth and quarter of an inch, except higher amounts possible in thunderstorms.

Sunday A 40 percent chance of showers and thunderstorms. Mostly cloudy, with a low around 71. South southeast wind around 5 mph. Showers and thunderstorms likely. Cloudy, with a high near 84. South wind 5 to 15 mph. Chance

of precipitation is 60%. A 40 percent chance of showers and thunderstorms. Mostly cloudy, with a low around 70.

Night A 30 percent chance of showers and thunderstorms. Mostly cloudy, with a high near 86.

A 20 percent chance of showers and thunderstorms. Mostly cloudy, with a low around 64. Night

Wednesday A 20 percent chance of showers and thunderstorms. Partly sunny, with a high near 86.

Wednesday Partly cloudy, with a low around 65.

#### NWS Tallahassee, FL

Point Forecast: Last Update: Forecast Valid:

Chance

Thunderstorms

High: 86 °F

3 Miles NNW Tallahassee FL 30.5°N 84.3°W (Elev. 98 ft) 5:02 am EDT Sep 29, 2012 7am EDT Sep 29, 2012-6pm EDT Oct 5, 2012 Forecast Discussion

Slight Chc

Thunderstorms

High: 86 °F

Slight Chc

Thunderstorms

Low: 64 °F



-|- Requested Location Forecast Area Lat/Lon: 30.5°N 84.3°W Elevation: 98 ft

**RADAR & SATELLITE IMAGES** 









### Hazardous Weather Warnings

We issue the warnings you hear on radio and TV











## Members of the Integrated Warning Team



Emergency
Management
and Public
Officials



National Weather Service



America's Weather and Climate Industry (e.g. Media, Private Companies, App Developers)





#### **NOAA** Weather Radio

- Warns of natural and man made hazards
- Alerts you even when you're sleeping!
- New radios can be programmed just for your county











#### www.AlertFlorida.com

Emergency, and/or public safety notifications include:

- Tornadoes/severe weather
- Mandatory evacuations
- Boil water orders
- Gas leaks
- Sexual predator relocation notices
- Critical law enforcement notices
- Hurricanes and hurricane recovery information



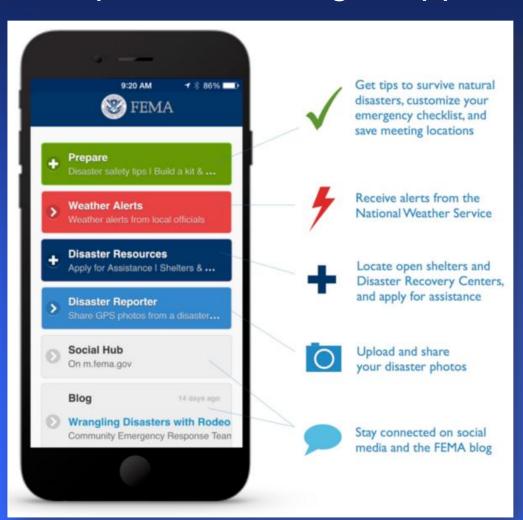


# nttp://weather.gov



#### Free FEMA App

http://www.fema.gov/app







#### SKYWARN for Smart Phones

http://spotternetwork.org



- Experimental
- Advanced SKYWARN replaced with The Spotter Network



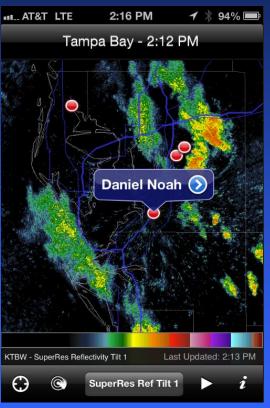
#### Spotter Network provides real-time mapping SN of active spotters and their storm reports across the country at any given moment. Kansas City Cin nati Columbia SaintyLogis Wichita Faye ville Oklahoma City Raleigh Char te Mem STORM SPOTTER Birmingilam Jackson Tallaha ee Antonio Houston Online @ SpotterNetwork.org





#### **Smart Phone Software**

listed at SpotterNetwork.org



iPhone

**Android** 

We may call you to discuss storm you are watching







# http://weather.gov

#### Join Our Network Today!

Member?	Network		Primary Manager	Members
×	(8)	Twin Cities, MN (NWS/MPX)	John Wetter	380
<b>v</b>	(8)	Tampa Bay, FL (NWS/TBW)	Daniel Noah	306
×	(8)	Northern Indiana (NWS/IWX)	Todd Holsten	215
×	(8)	Atlanta, GA (NWS/FFC)	Rob H	208
×	(8)	Norman, OK (NWS/OUN)	WFO Norman	192



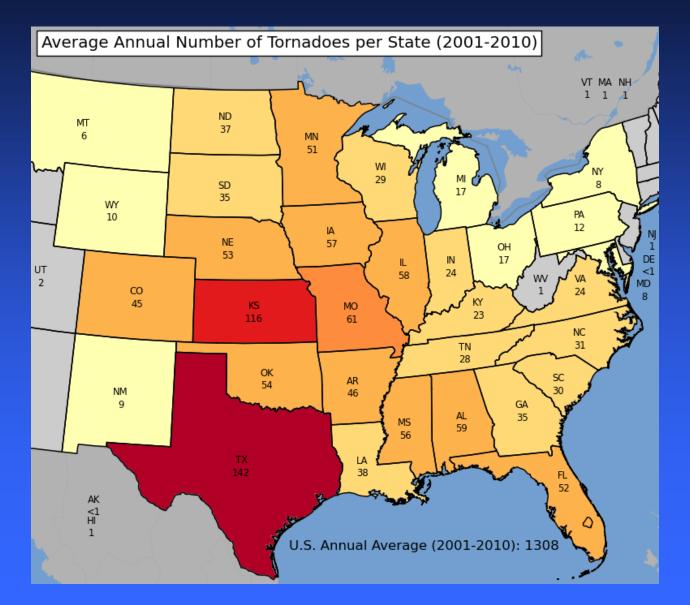


# nttp://weather.gov

## NDATMOSPHERIO VALUE OF STATE OF COMMENT OF COMMENT

#### Florida Ranked #10

For States with the most tornadoes





# http://weather.gov

#### Florida Tornadoes









### When is a Warning Issued?



Radar detects the severe weather



2. Trained SKYWARN severe weather spotter reports severe weather





## ttp://weather.go

## NDAR NO PARAMETERS OF SOME PARAM

#### SKYWARN for Amateur Radio

weather.gov/tampa/wx4tor







#### SKYWARN Training Agenda



Why we need Weather Spotters & how to report severe weather

Safety

Downbursts and Shelf Clouds

Super Cell Thunderstorms

Hurricanes





### Why is the NWS Here Today?

We need your reports to help warn the public



### Call the NWS when you observe:

- Any size hail
- Winds 50+ MPH
- Tornadoes, waterspouts
- 2" per hour rain or flooding

Private Severe Weather Reporting Line 1-800-282-1228





#### Why We Need Spotters

Your reports add credibility, increase public response, and improves warning accuracy







#### Inside the Radar Dome

The dish is 3 stories high



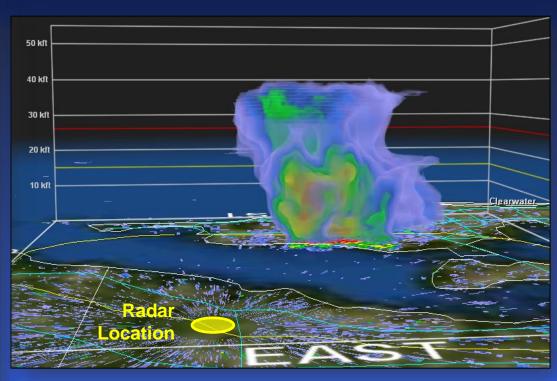




#### Best Data 20-60 Miles from Radar

Too close then can't see tops





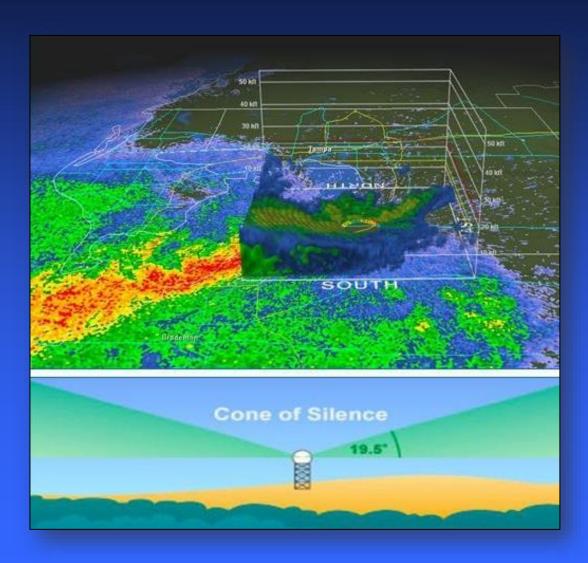
Notice how the top of the storm is cut off, our radar only goes up 19 degrees





#### Radar "Cone of Silence"

Too close then can't see tops

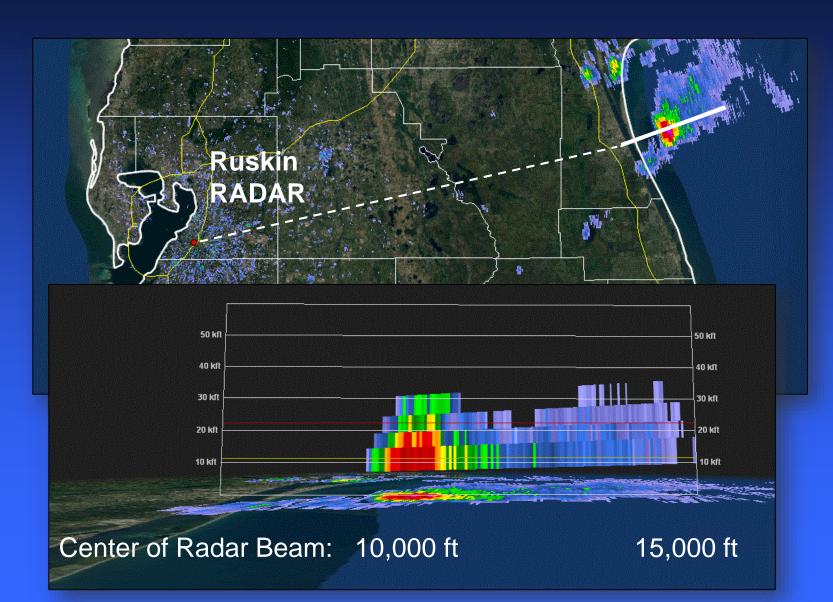






#### RADAR Beam Height

At a distance







### Use the TEL Method to Report

**TEL Method = Time, Event, Location** 



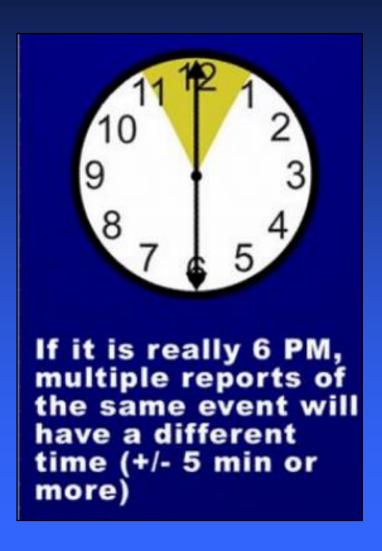
#### **Great Report:**

This is Spotter HIL-46A, at 4:05 PM I drove through golf ball size hail 5 miles north of Ruskin on Highway 41





#### What Time Do You Have?











#### What to Report

**Tornadoes** 



- Be rotation is sustained and persistent in the feature
- "Condensation funnel" in a tornado may not always be in contact with the ground, so look for debris
- Include damage if you are aware of any







#### What to Report

**Funnel Clouds** 



Cape Coral June 11, 2017





#### What to Report

Waterspouts









#### Is This a Tornado?

Ask yourself, is it violently rotating?





It was a Roll Cloud, which is like a Shelf Cloud but is detached from base of the storm.

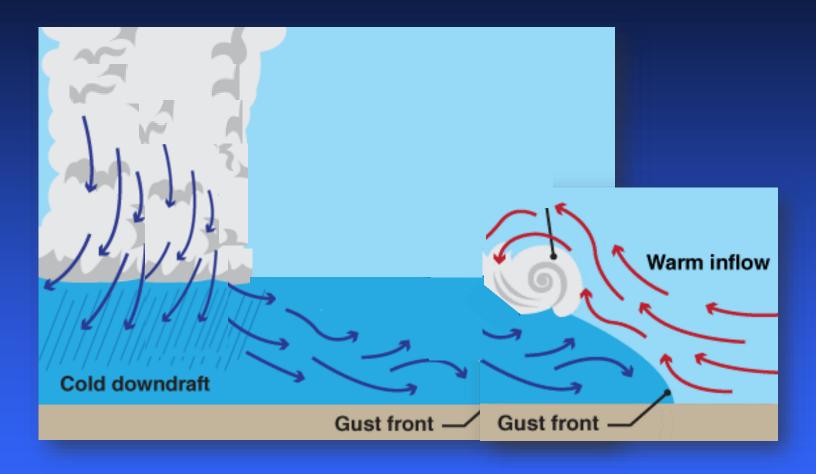
The viewing perspective in the left picture made it look like it extended to the ground, but it is a horizontal cloud.







#### The Roll Cloud









#### Reporting Tornadoes

Give best estimate of your location AND the tornado location







### **Estimating Wind Speed**

- Takes experience (most people over-estimate)
- Avoid "heavy" or "strong" to describe wind



30 - 40 mph	Whole trees in motion
40 - 50 mph	Twigs or small branches breaking
50 - 60 mph	Slight structural damage; Healthy branches breaking
60 - 70 mph	Down or snapped trees; Structural damage







#### Tree Damage



- Is it an isolated tree or limb blown down?
  - Trees can and do blow over in winds 40 to 50 mph



- Have many trees been blown down and/or numerous limbs snapped?
  - Winds > 60 mph





## How Strong was the Wind?

Shingles are rated to 120 mph



Wind combined weight of water in rain can cause 120 mph rated shingles to fail at a lower wind speed





#### How Strong was the Wind?



Light weight, high profile vehicles can flip due to weight of water in heavy rain moving at 50 MPH







## What to Report

Wind Gusts or Damage

 Trees being blown down, damage to power poles, power lines, structures, etc.

 Very small branches or twigs are less important









## Structural Damage



Life/Safety of those impacted comes first

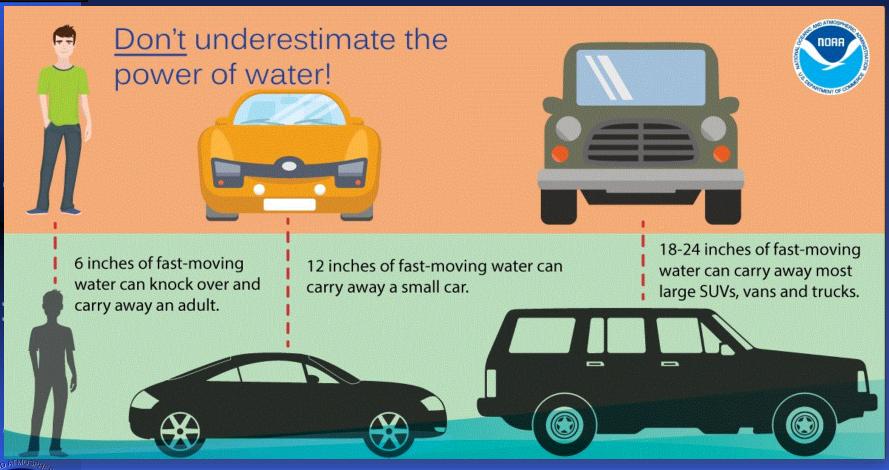
#### Be Specific

- Is roof destroyed or is roof off house?
- Is it an older mobile home or newer one?
- Rough number of homes damaged





# Flooding Dangers









## Flooding & Flood Damage



- How widespread
- How high is water on cars
- Is water getting into homes or businesses?











### Hail Damage





- Report largest hail stone observed
- Measure diameter of longest axis
- Compare size to common objects
- Any damage?









# Estimating Hail Size



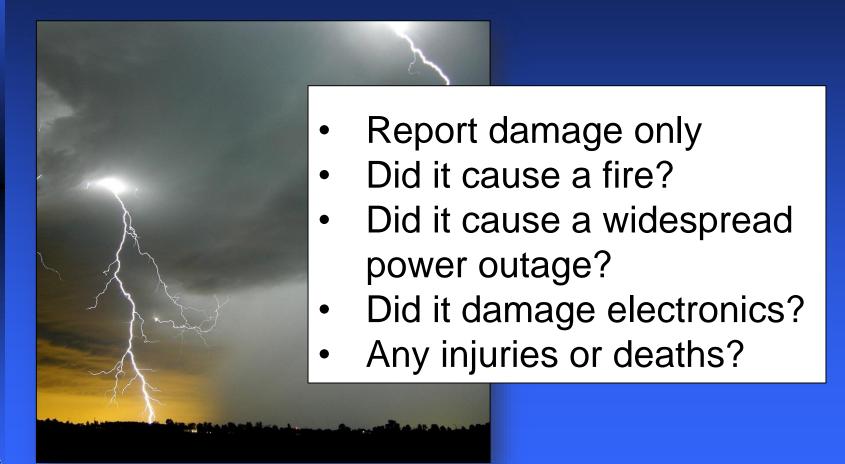
- Best is to measure with ruler
- Second best is to compare to common objects, tends to produce less bias
- Don't report marble size hail because we don't know how big your marbles are







## Reporting Lightning Damage

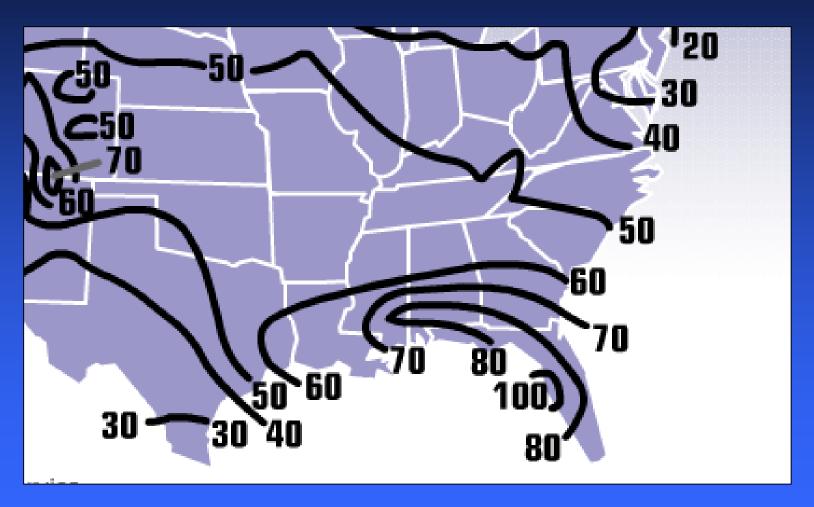








# Number of Days With Thunderstorms per Year







## Lightning Capital of the World

Lake Maracaibo in Venezuela









## Florida Lightning

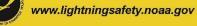
We do not issue warnings for lightning



**STOP** all activities.

Seek shelter in a substantial building or hard-topped vehicle.

Wait 30 minutes after the storm to resume activities.





- Average 9 fatalities and 40 injuries each year
  - 2017: 5 dead, 22 injured
  - 2016: 9 dead, 18 injured
  - 2015: 6 dead, 17 injured
  - 2014: 6 dead, 32 injured
  - 2013: 4 dead, 22 injured

If you can hear thunder, lightning is close enough to strike you! Move immediately to shelter.

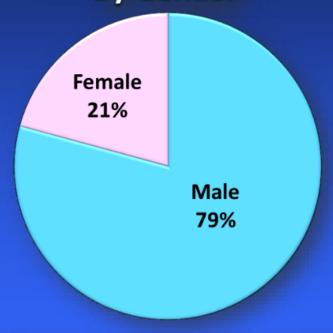






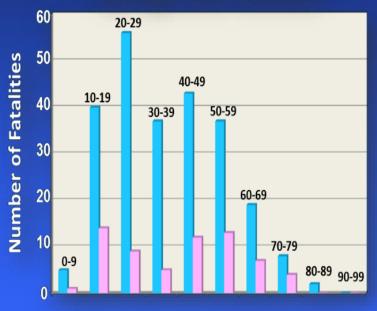
#### Most at Risk

# Lightning Fatalities By Gender



Based on 313 cases from 2006 through 2015

# Lightning Fatalities By Age and Gender



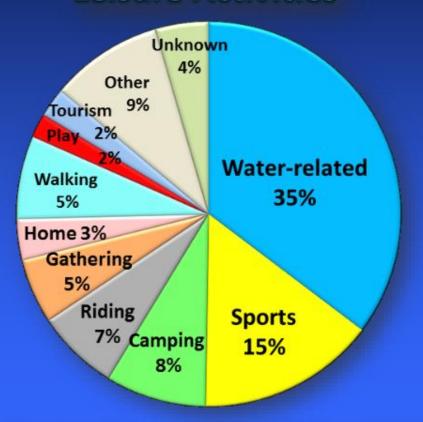
Based on 312 cases from 2006 through 2015





#### Most at Risk

# Lightning Fatalities Leisure Activities



#### Most at Risk

- Male
- 20-29
- Likes to boat, fish, golf, soccer, going to beach, or camping



Based on 201 cases from 2006 through 2015



# It is a MYTH that rubber tires protect you in a vehicle

The metal shell of a vehicle or airplane can protect you from lightning

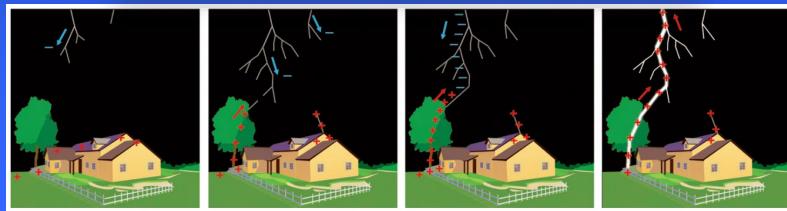




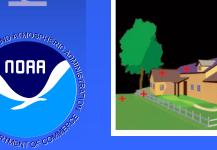


# How Lightning Forms













#### Lightning Strike at Football Game

High School Game in Orlando on 9/13/2013

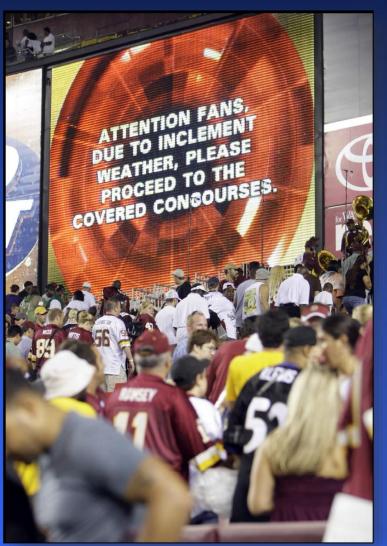








# NFL and NCAA Take Lightning Seriously











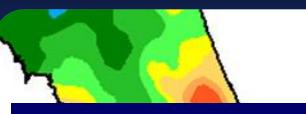
#### Lightning Strikes Fishing Pole







# Lightning Density in Florida

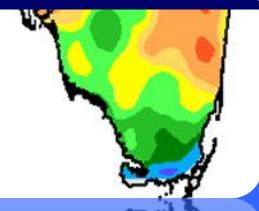


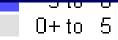
Average Flash Density fl/sq km/yr

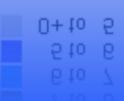
Lee County averages about 37,000 strikes per year

Florida averages 1.4 million

U.S. averages 23 million













#### Report to NWS Ruskin



#### Call when you observe:

- Any size hail
- Winds 50+ MPH
- Tornadoes, waterspouts
- 2" per hour rain or flooding

Private Severe Weather Reporting Line 1-800-282-1228







# Send us Your Damage Photos



Call and we will give you an Email to send them to

We will credit you

We may post them on our social media sites

We may use them for future SKYWARN trainings





Thank you for volunteering for your National Weather Service and your community!







## Basic SKYWARN Training



#### **Training Overview**

- Terms and Safety
- Storm Strength Visual Clues
- Thunderstorm formation
- Supercell thunderstorms
- Large, violent tornadoes
- Hurricanes







## Watch vs. Warning

#### CAUTION

Watch the Sky

#### Watch (e.g. Tornado, Hurricane, Flood, etc.)

 The bad weather could happen but it is not certain



#### Warning (e.g. Tornado, Hurricane, etc.)

- Bad weather has been detected by radar or has been reported
- Find shelter if you are in the path of this storm







#### What is a Severe Thunderstorm?

Can be either one or both

50 Knot Wind58 MPH Wind or Stronger



1 Inch Hail or larger Size of a Quarter



Always measure along the longest axis





#### How Do Thunderstorms Form?

Three ingredients are needed

#### Moisture (water vapor)

- think of this as gasoline

#### Something to lift the moisture

- think of this as a lit match

#### **Unstable Air**

- think of this as blowing oxygen on a fire to get it to burn hot



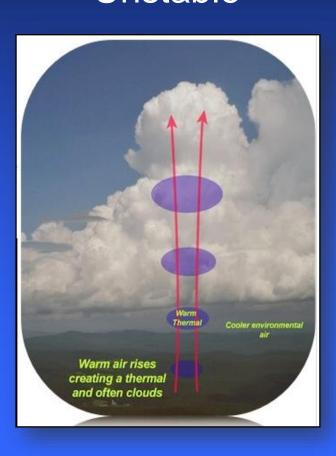




# Atmospheric Instability = Storm Potential

Unstable

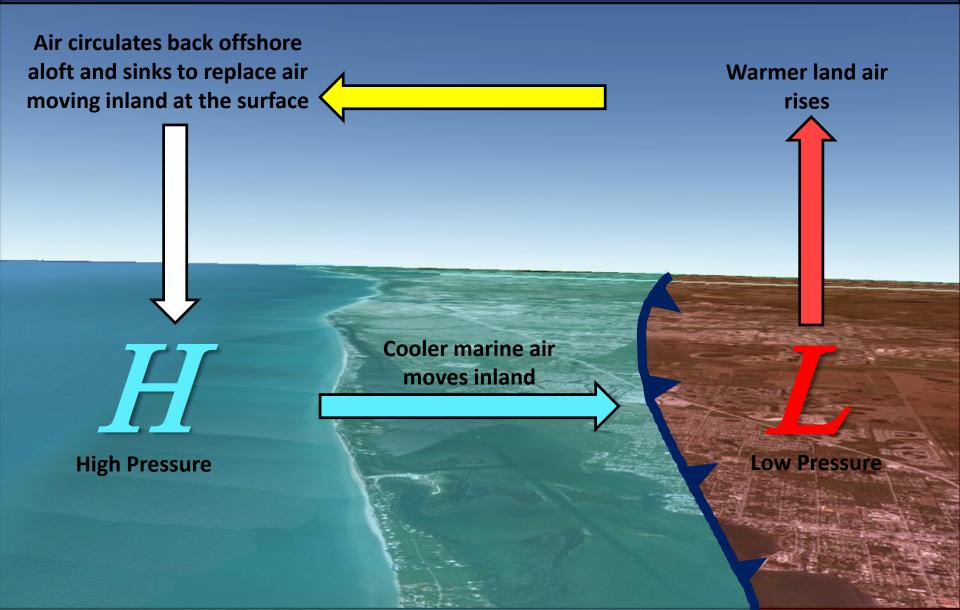
Stable







# Sea Breeze Provides Lift Daylight Hours



#### Localized Sea Breeze Circulations

For Example: The complex coastline around Tampa Bay





#### Source of Lift: Sea Breeze

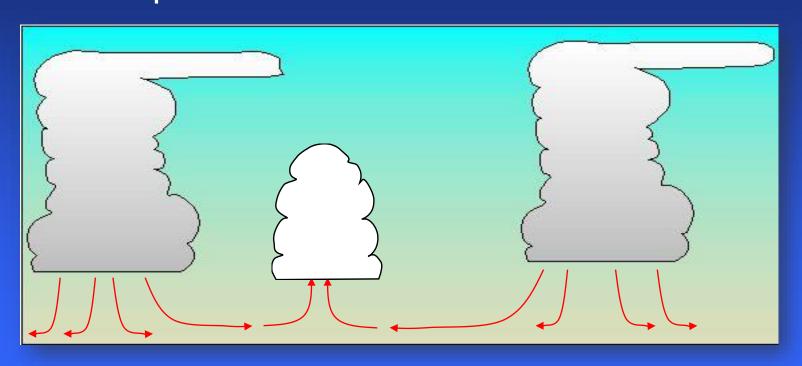






# Another Source of Lift Colliding Thunderstorm Outflow Boundaries

Can provide addition lift for new storms



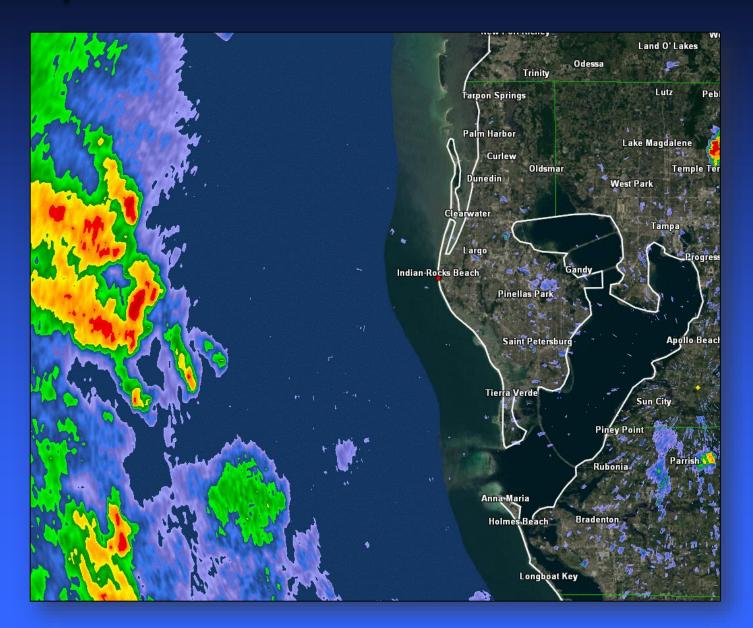




# ttp://weather.gov

# NOAA

#### Loop of Thunderstorm Outflow Boundary





#### 3 Stage of Thunderstorm Life Cycle

- 1. Towering Cumulus Stage
- 2. Mature Stage
- 3. Dissipation Stage

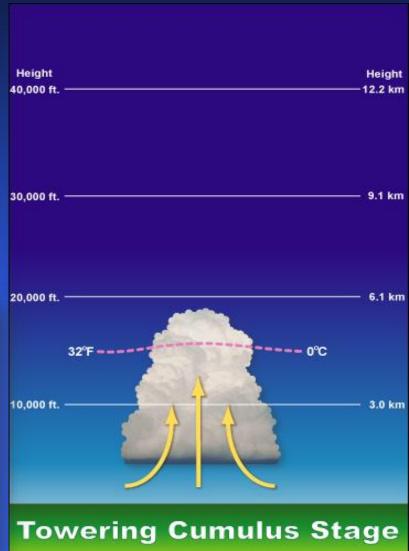


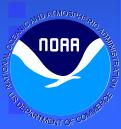


#### **Towering Cumulus Stage**

Rising currents of air are referred to as an updraft. When combined with sufficient moisture, a Towering Cumulus develops







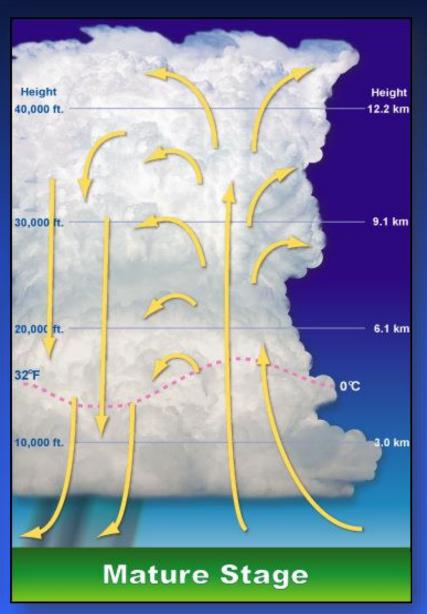




#### Mature Stage of a Thunderstorm

Moisture will condense out of the cloud causing rain and downdraft. The updraft and downdraft co-exist together.







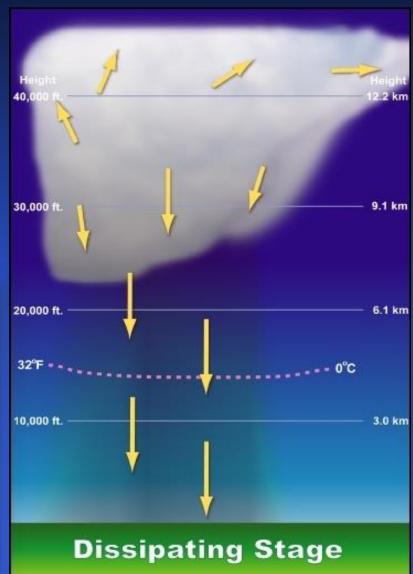




# The Dissipation Stage

The downdraft will eventually overcome the updraft, causing the thunderstorm to weaken.

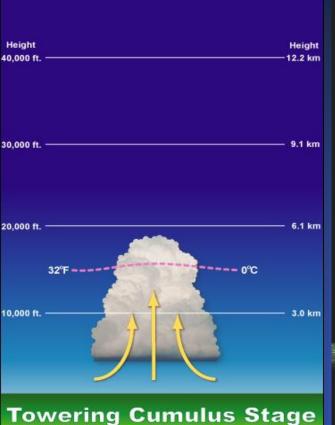


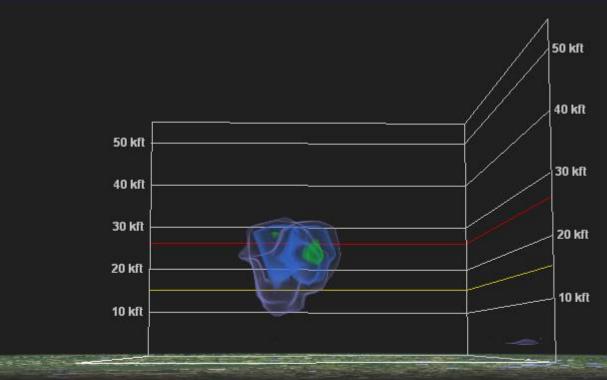






# Radar of Towering Cumulus Stage

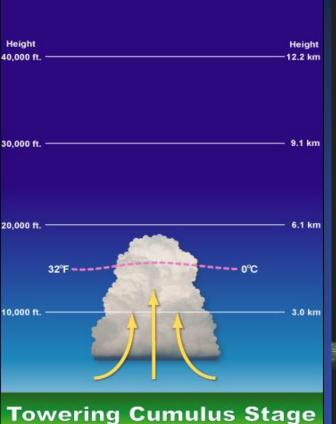


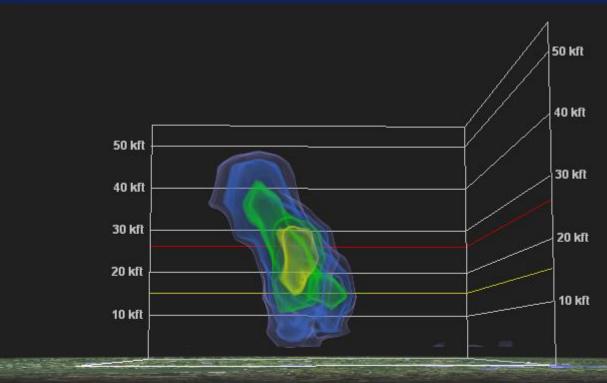






# Radar of Towering Cumulus Stage

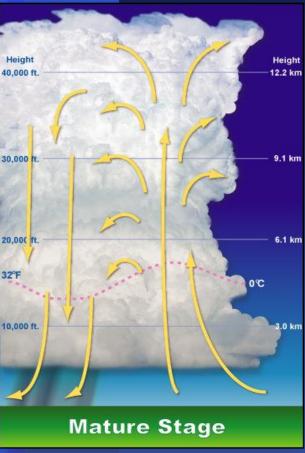


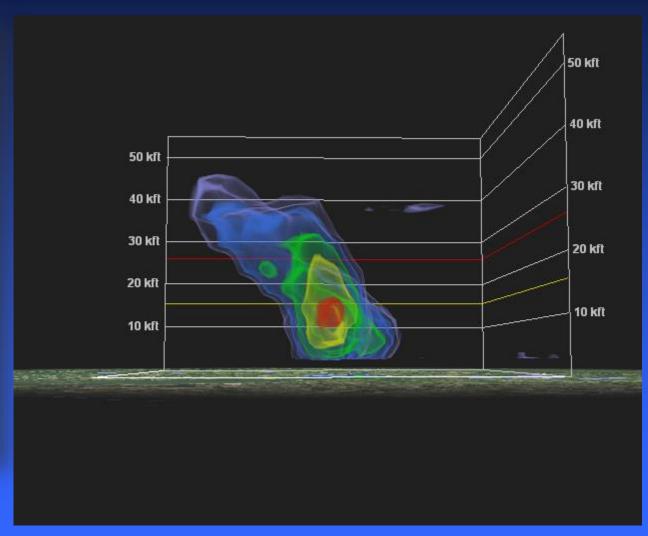






# Radar of Mature Stage

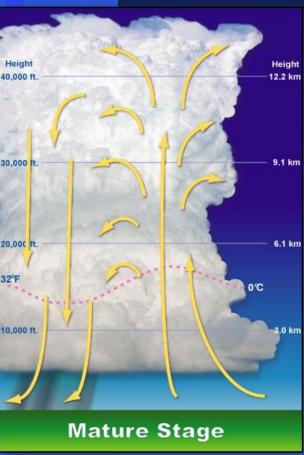


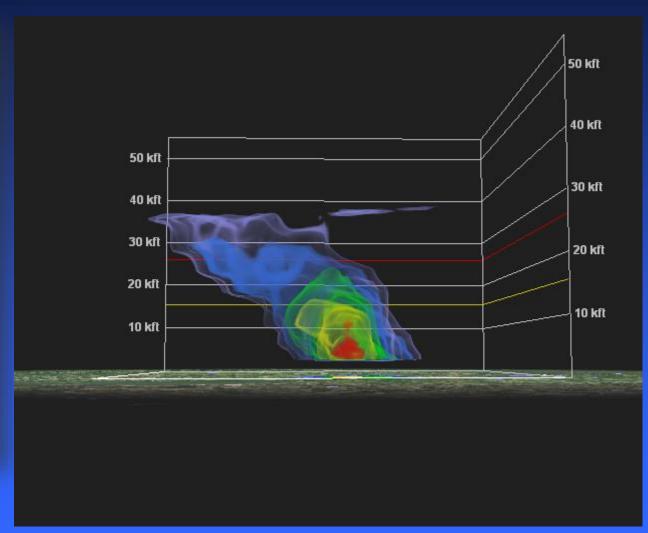






# Radar Mature Cumulus Stage

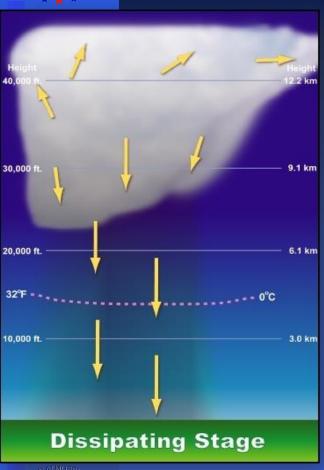


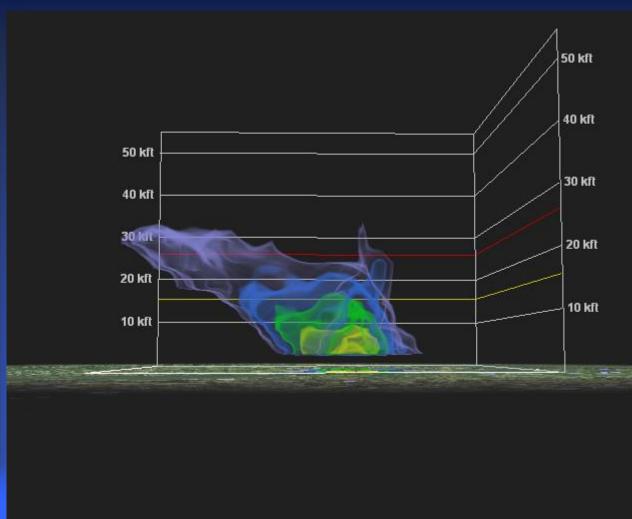






# Radar of Dissipation Stage

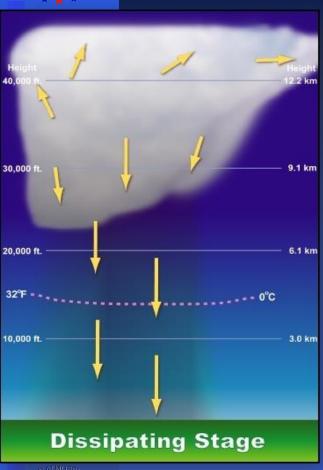


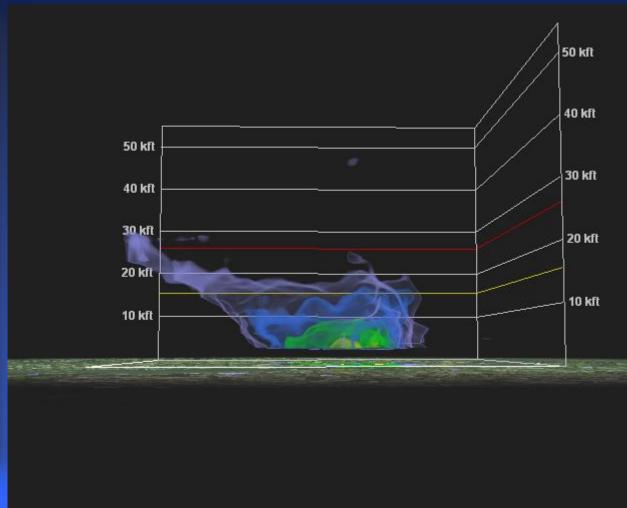






# Radar of Dissipation Stage

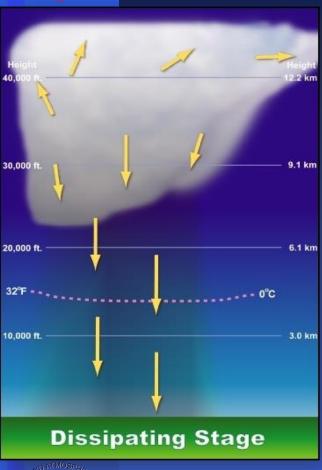


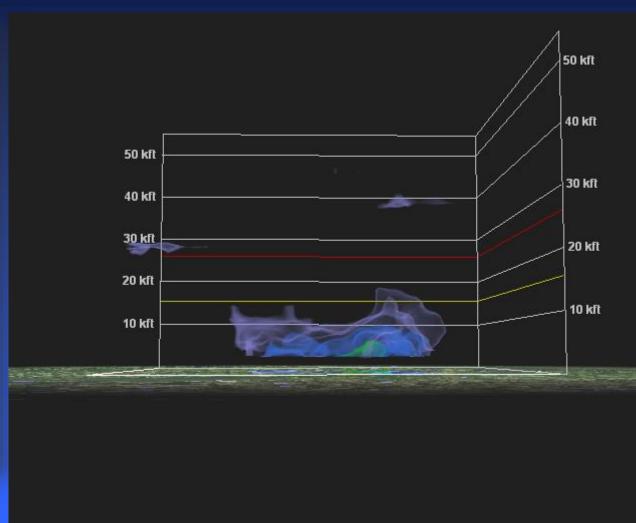






# Radar of Dissipation Stage









# Fast Facts

- One inch of rain over one square mile
  - 17 million gallons of water
  - 145 million pounds
- This is a lot of weight being held aloft by the storm updraft









# Non Severe Downdraft in Tampa









# The Thunderstorm Downburst

### **Microburst**

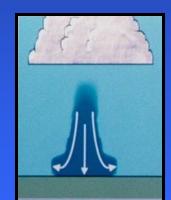




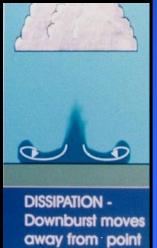




FORMATION -Evaporation and precip. drag forms downdraft



IMPACT -Downdraft quickly accelerates and strikes ground

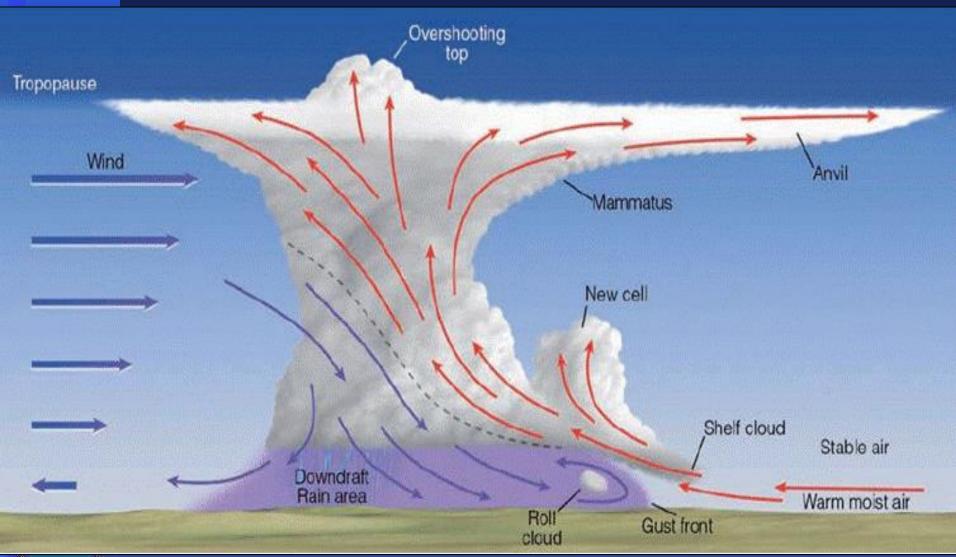


of impact





# The Shelf Cloud





# The Shelf Cloud

Is the observer in warm or cold air?







# **Shelf Cloud**

Lake Okeechobee, FL on August 2015





Jeff Gammons @StormVisuals · Aug 19

Now: Capturing a timelapse of a pretty cool thunderstorm shelf cloud in Okeechobee Co, FL. #flwx







1





# **Shelf Cloud**

Lake Alfred, FL on March 31, 2011







# **Shelf Cloud**

Lido Key near Sarasota – August 7, 2017







# 20+ miles from storm

- Persistent overshooting top
- Broad, thick, defined anvil
- Crisp, hard outline to clouds







# 10-20 miles away

Look At Main Storm Tower



- Look for crisp, hard outlines to clouds
- Cauliflower appearance

Soft and mushy







## Remember How Thunderstorms Form?

Three ingredients are needed

## Moisture (water vapor)

- think of this as gasoline

## Something to lift the moisture

- think of this as a lit match

### **Unstable Air**

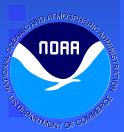
- think of this as blowing oxygen on a fire to get it to burn hot





# What makes supercells different from ordinary thunderstorms?

The answer is Wind Shear

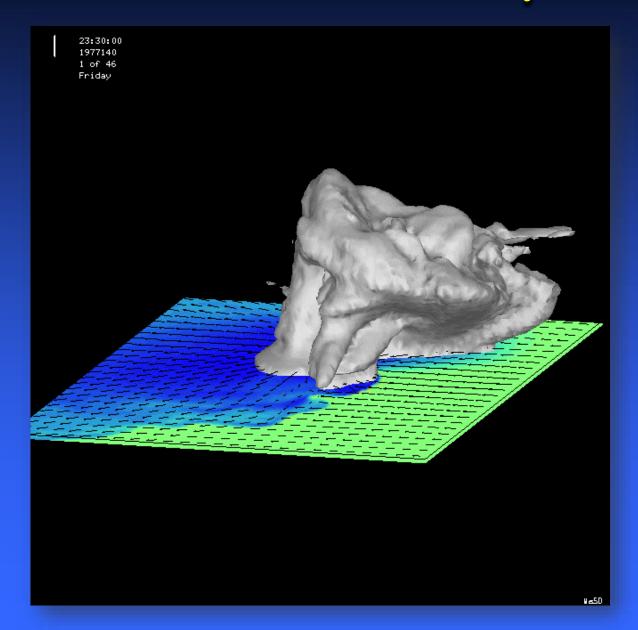




# http://weather.gov

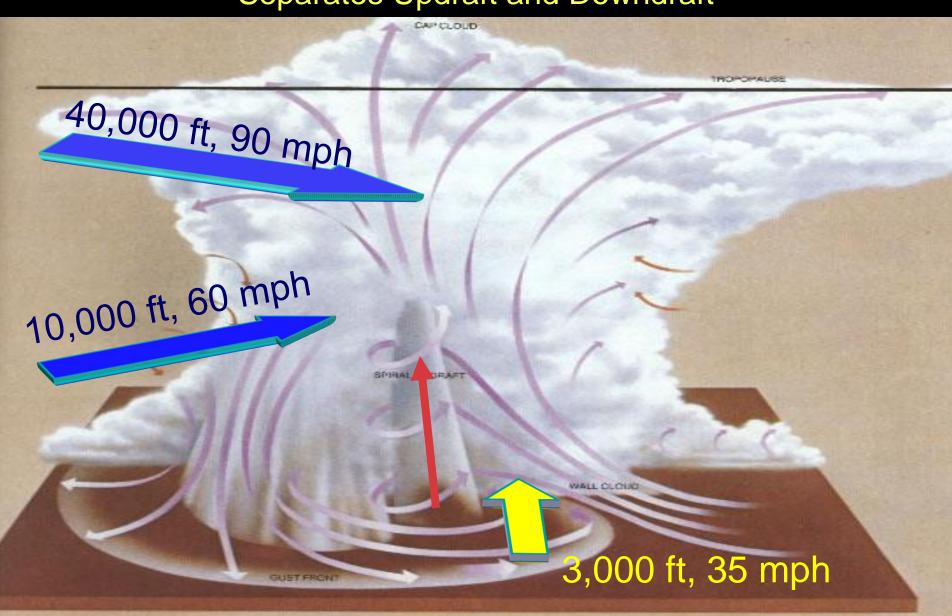
# NORA NOSPHERIO VALUE OF CONNECTION OF CONNEC

# The Thunderstorm Life Cycle



# Wind Shear: Direction and Speed

Separates Updraft and Downdraft







# Updraft in Strong Wind SPEED Shear

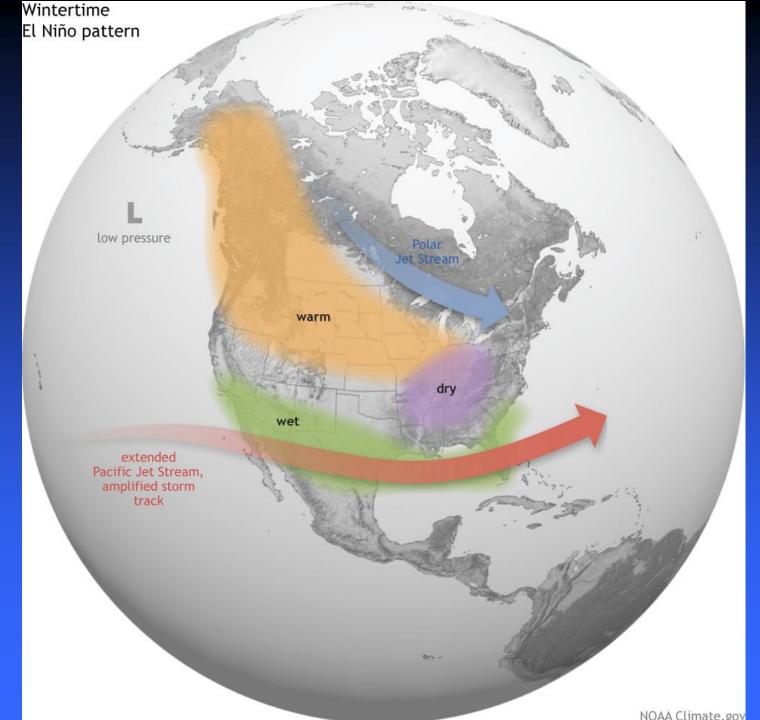






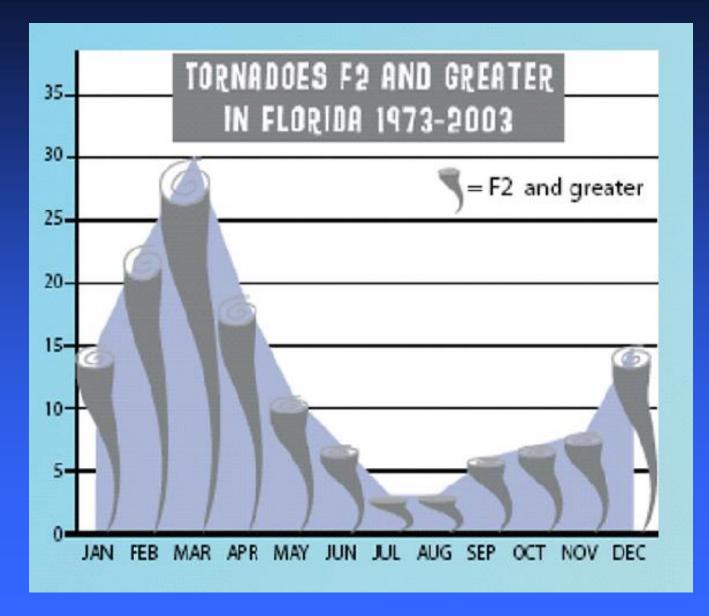
# http://weather.gov







# Most Dangerous Time of Year?

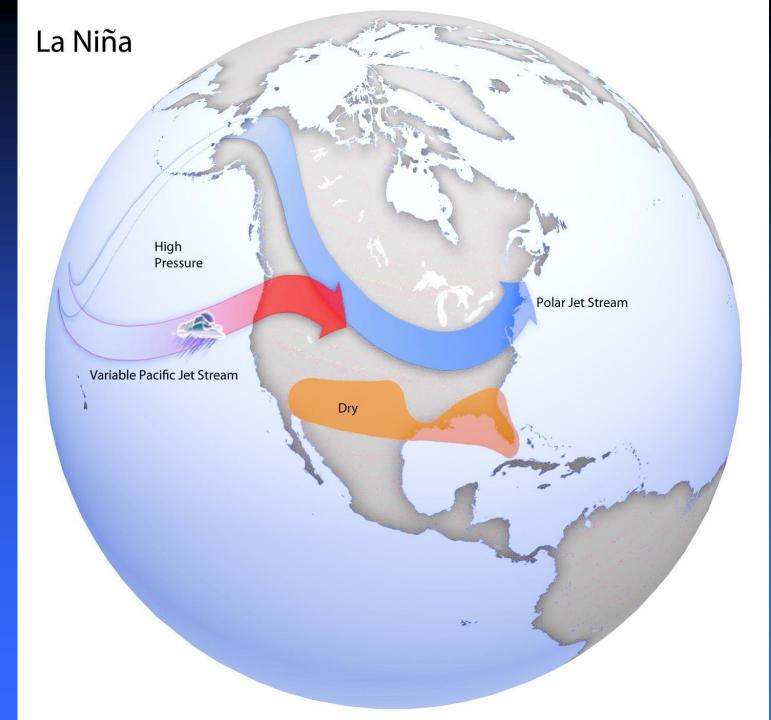






# http://weather.gov









# Florida's Most Deadly Tornado







# Jan 17, 2016 Sarasota F2 Tornado – 127 mph









# Jan 17, 2016 Sarasota F2 Tornado – 127 mph









# Jan 17, 2016 Duette F2 Tornado – 127 mph

2 fatalities, 4 injuries







# Tornado Stairs





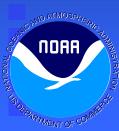


# What if no shelter is available?

Seek shelter before the storms arrive

- Are you in a tornado watch?
- Are storms heading toward your area?

Take your family to a family or friends house until the storm has passed





# Want to know more?

Online training at weather.gov/tampa/skywarn

Take One or Both of these FREE Online SKYWARN Spotter Trainings

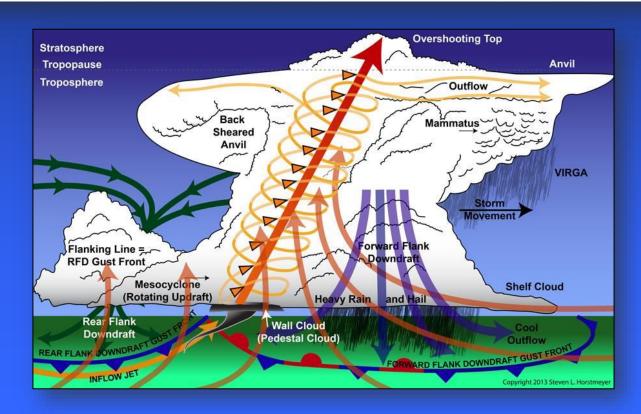


MetEd

http://SpotterNetwork.org

Do this training if you want to do SKYWARN for Smartphones (Experimental)

https://www.meted.ucar.edu/training\_course.php?id=23







# Florida Hurricanes

## daniel.noah@noaa.gov



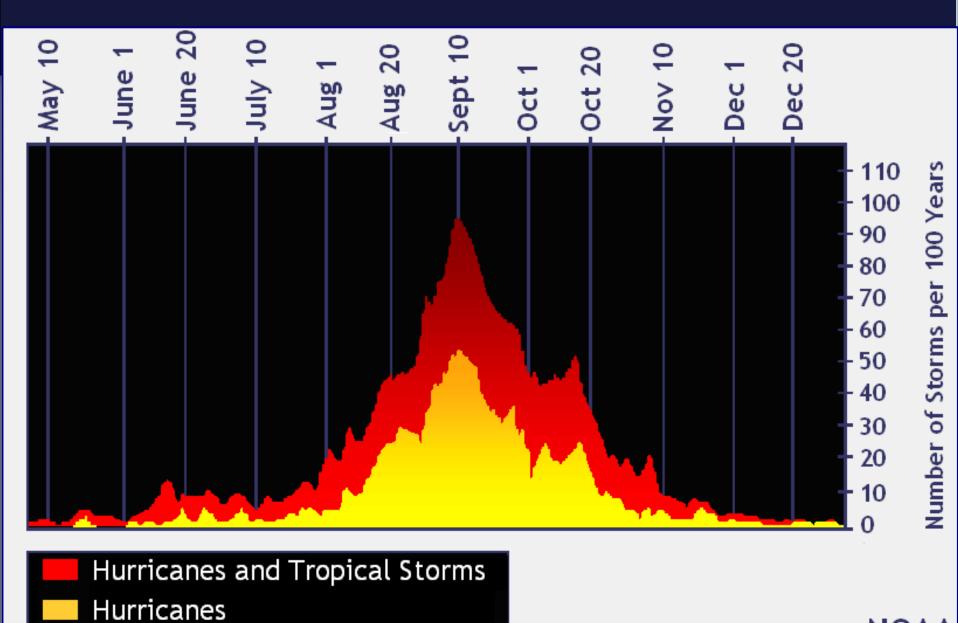








# Hurricanes: When?



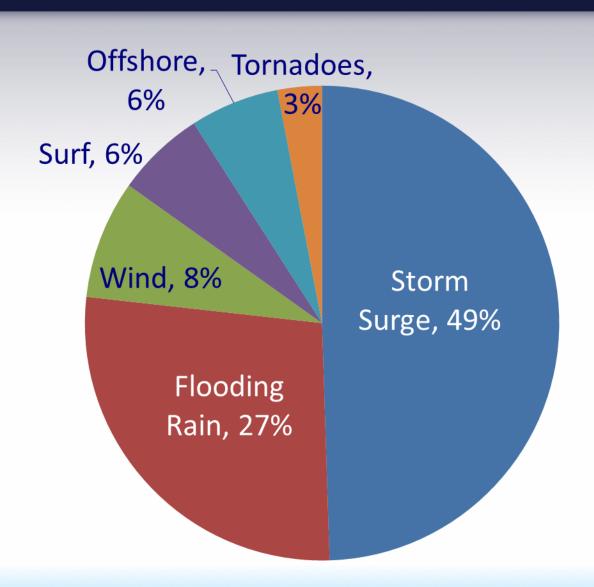
NOAA

# Question

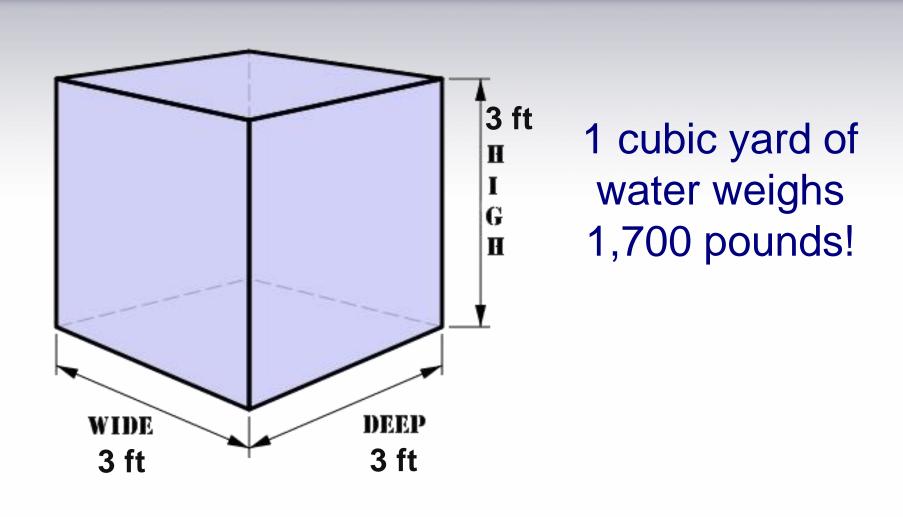
What hurricane hazard has the greatest potential for loss of life and property?

- Flooding from Heavy Rain
- Hurricane Wind
- Storm Surge
- Tornadoes

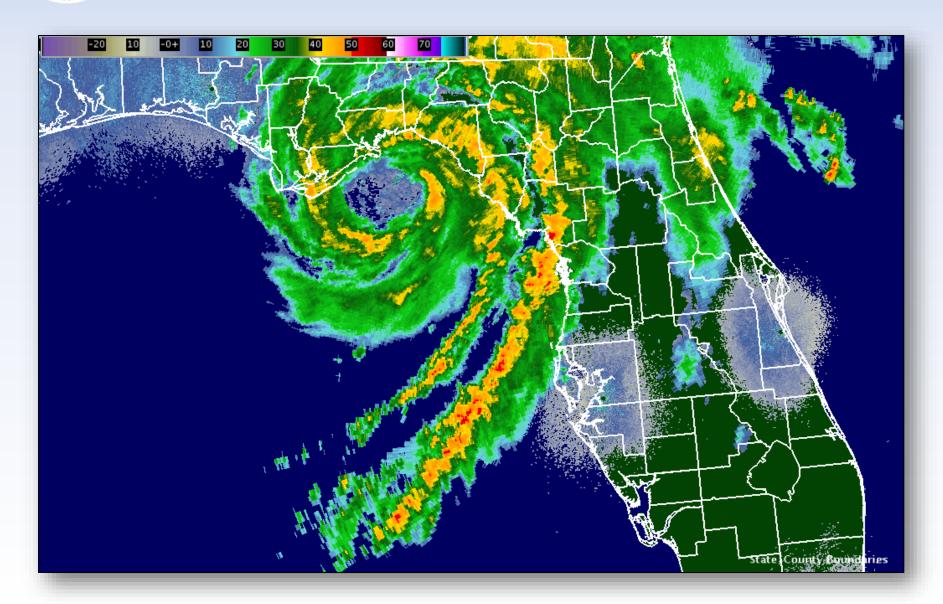
# U.S. Hurricane Fatalities 1963-2015



# Water is Heavy Moving Water can be Deadly



# Radar Loop



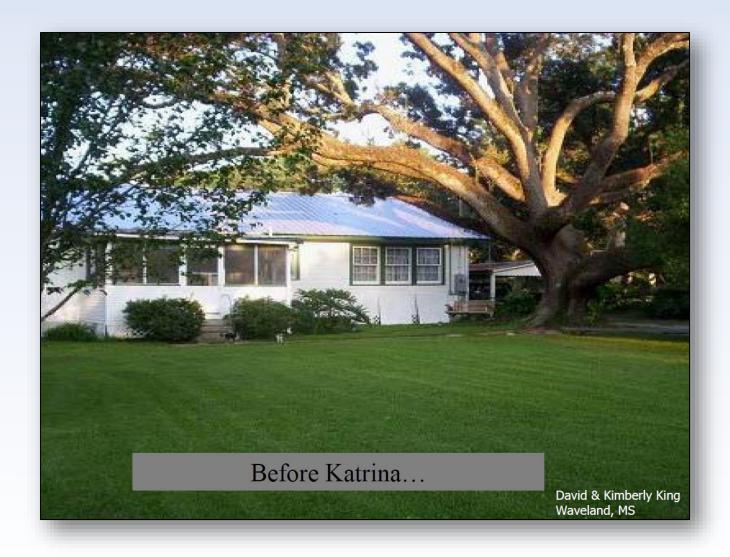


# Cedar Key Surge





## Before 2005 Hurricane Katrina





# After 2005 Hurricane Katrina's Storm Surge

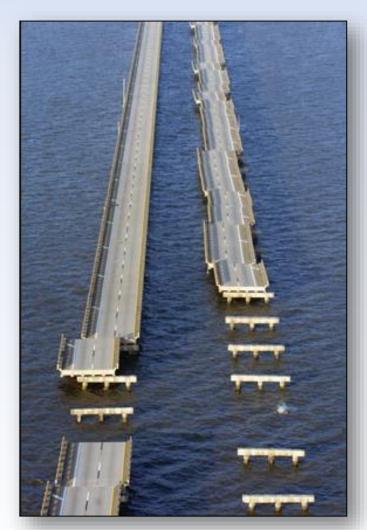




### Storm Surge can be Devastating



2008 Hurricane Ike, near Galveston, TX

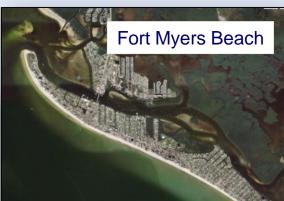


2004 Hurricane Ivan, I-10, Pensacola, FL

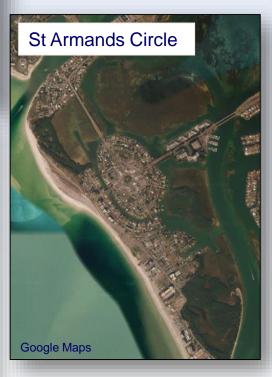


#### Our Barrier Islands Are No Different











Flooding from heavy rain is the second leading cause of fatalities in a tropical cyclone



### Flood Damage from Hurricane Matthew





Lauren Sagl @LaurenSagl



Damage to one road in #Simpson, NC, shot by a @wnct9 photojournalist. We spoke with the driver of the car, who just crashed this a.m.

10:18 AM - 9 Oct 2016



t3 11 ₩ 4



## Pinellas County in 2012 T.S. Debby

Don't Drive in Flooded Roads











### Hurricane Irma - Florida





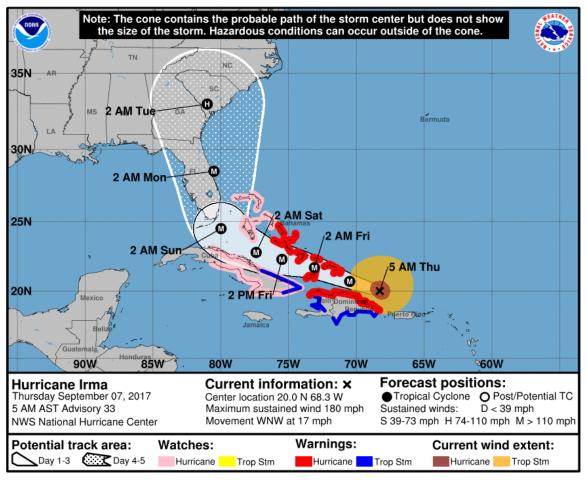
## **Lee County Storm Shelter**



#### Situation Overview

#### Hurricane Irma





- Track still shows a northerly turn Saturday Night, but forecast cone still shows a Gulf storm is possible which would be our worst case scenario
- A 3-6 hour difference in when Hurricane Irma turns north would result in major changes to local impacts
- Most people will not experience the eye wall, but some will. Prepare as if the eye wall will hit you

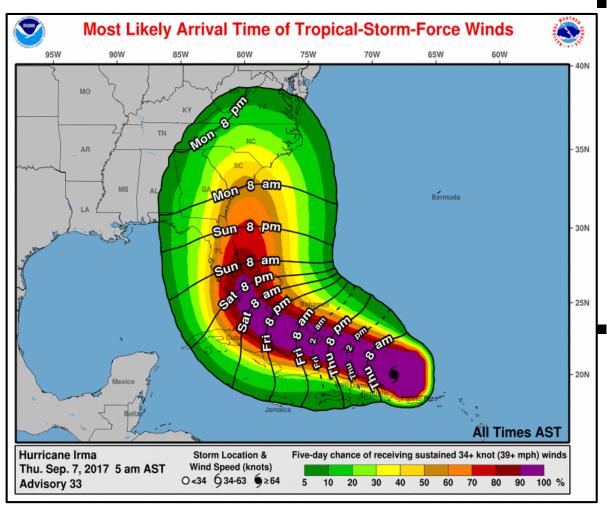




#### Most Likely Time of Arrival

Hurricane Irma





- The most likely time of arrival of Tropical Storm Force Winds:
- Fort Myers late Saturday night
- Tampa & I-4 corridor -Sunday morning
- Cedar Key Sunday afternoon.
- *However*, these areas could see Tropical Storm Force Winds arrive 12 hours earlier depending on the exact path.



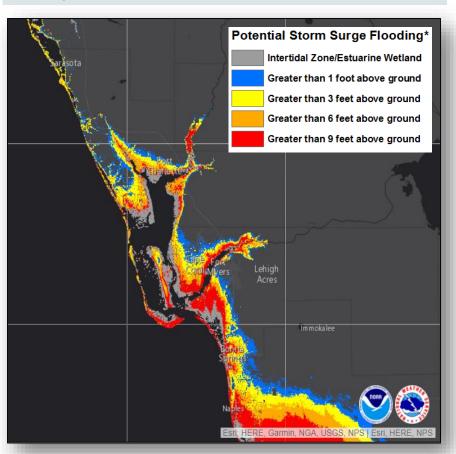


#### Potential Storm Surge Flooding



Hurricane Irma

**Note:** This graphic shows where storm surge inundation could occur in any one location. It depicts a reasonable worst case scenario.



#### Color Scale

- Red = 9-15 feet AGL
- Orange = 6-9 feet AGL
- Yellow = 4-6 feet AGL
- Timing: Storm surge inundation could begin as early as Sunday evening; greatest at Sunday night/early Monday morning high tide
- Expect a 12 hour event, longer directly at the coast







#### The Big Blowout – Tampa Bay

Hurricane Irma – 4-7 feet below normal tides









ALERT: Water surrounding Tampa Bay is very low due to the storm. It is dangerous to be walking out there.

1:51 PM - Sep 10, 2017

♀ 223 ♀ 2,004  $\bigcirc$  2.008







#### Jacksonville Storm Surge

Hurricane Irma







11/14/2017 2:41 PM



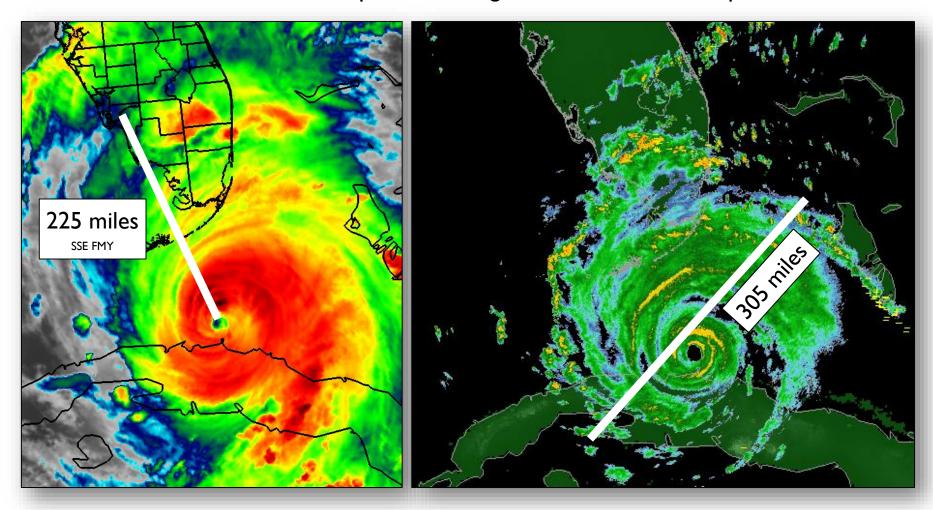


#### Satellite/Radar View

Hurricane Irma



#### Max winds 125 mph and moving west northwest at 9 mph







### NWS Ruskin Operations

Hurricane Irma







#### Hurricane Irma Marco Island

Tampa Bay Area WEATHER FORECAST OFFICE

Hurricane Irma













#### **Irma Wind Damage**









Another example of why to stay off the roads during #Irma. Minor injuries when this car flipped on Gulf-to-Bay.

7:40 PM - Sep 10, 2017

Q 13 1 195 V 143



# **Irma Wind Damage**







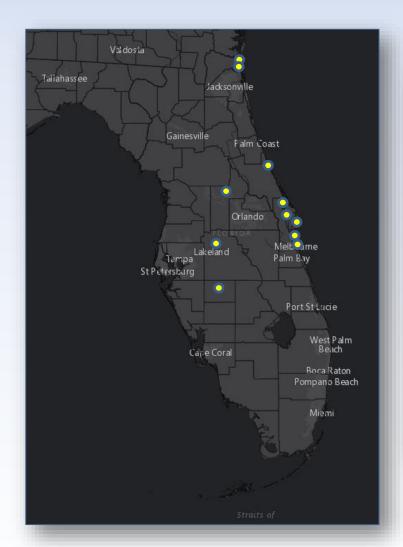
### **Power Outages**







### 2017 Hurricane Irma - Tornadoes





### **Evacuations**







### Evacuation Called for Only 2 Reasons

#### 1. For People in the Storm Surge Zone



Hurricane Charley - 2004 Motorists fleeing Pinellas County on the Howard Franklin Bridge





## Evacuation Called for Only 2 Reasons

#### 2. For People in Manufactured Homes









## Hurricane Dangers - Evacuation



Motorists trapped on I-26 as Hurricane Floyd approached Charleston, SC in 1999



Houston as Hurricane Rita approached in 2004

Evacuate 10s of miles, not 100s of miles





#### Top 5 Most Difficult Hurricane Evacuations

according to Donald Lewis, VP of ATKINS at the 2012 National Hurricane Conference

- 5. Southeast Florida
- 4. New York City / New Jersey Coast
- 3. Delmarva Peninsula (DE, MD, VA)
- 2. Tampa Bay Area, FL
- 1. Southwest Florida





# Hurricane Irma Impacted 3 of the 5 Most Difficult Places to Evacuate

#### 6.5 million Floridians evacuated









#### The NWS is Looking for Ambassadors



# Who Can Become a WRN Ambassador? http://weather.gov/tampa/wrn



The Sanctuary at Longboat Key Club Community Assoc., Inc

- ALFs and SNFs
- Housing Associations
- Churches
- Businesses large and small
- Non-profit and non-governmental organizations
- TV, Radio, and Print media
- Academia
- Any organization across all levels of government

# Example Preparedness Materials Sent to Ambassador to Share with Group

#### Simple 2-page Emergency Plan



#### Info Graphics to Share









#### A Few of our Local Ambassadors

- WFTX-TV Fox 4
- NBC 2
- U.S. Central Command at MacDill AFB
- Port Tampa Bay
- Saint Pete Astronomy Club
- University of South Florida
- Valencia Lakes Home Owners Association
- Numerous Amateur Radio Clubs





## **NWS Tampa Bay Social Media**



http://weather.gov/tampabay



@NWSTampaBay



**NWSTampaBay** 



**NWSTampa** 

http://weather.gov/tampa/wrn