# Introduction to SKYWARN® and Storm Spotting







# Today's Topics

- Overview of the NWS
- Operations & Services
- Why Do We Need Weather Spotters?
- Weather Hazards in the Mid Atlantic
- Thunderstorm Development
- How to Report Hazardous Weather
- National Capital Area SKYWARN Support
   Group Amateur Radio Users



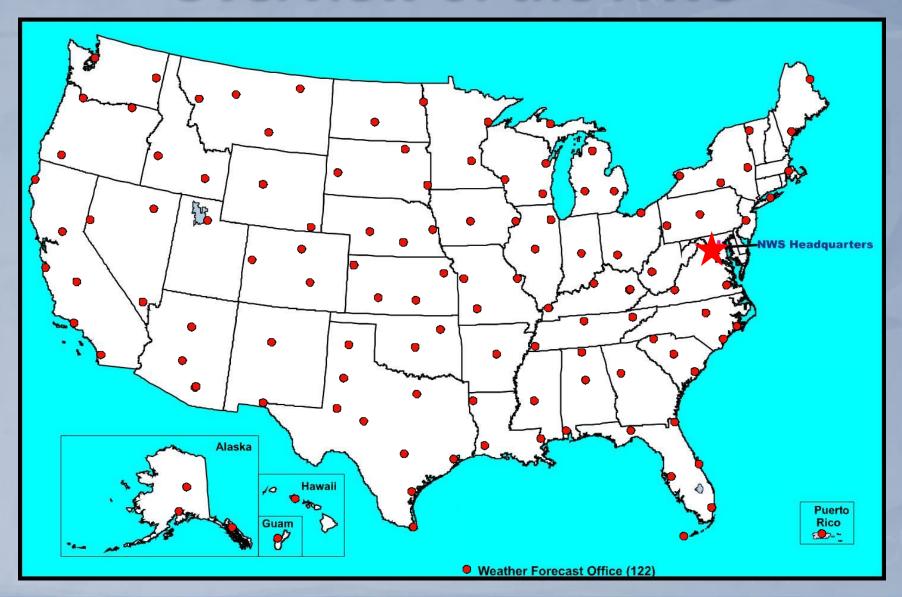
#### **About the National Weather Service**

- Provide climate, water, weather forecasts and warnings to protect life and property
- Data and products are used by other government agencies, the private sector, the public and the global community



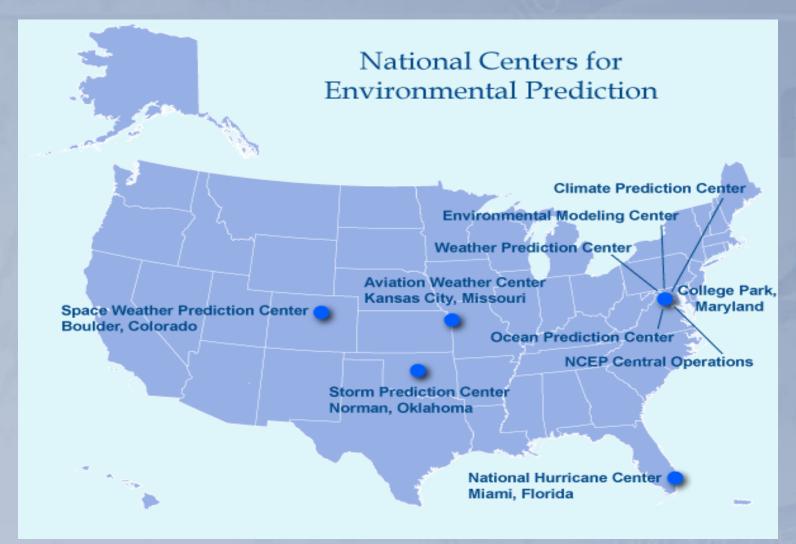
**NWS Baltimore/Washington Staff 2016** 

## Overview of the NWS





## Overview of the NWS

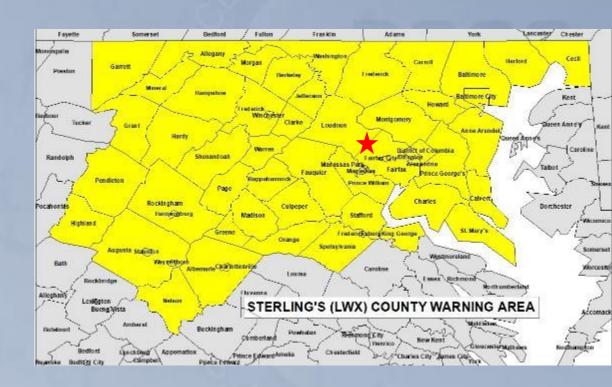


#### **National Centers for Environmental Prediction**



# **Land Area of Responsibility**

- 15 MD Counties
- 8 WV Counties
- 23 VA Counties
  - 11 Independent Cities
- District of Columbia
- The City of Baltimore



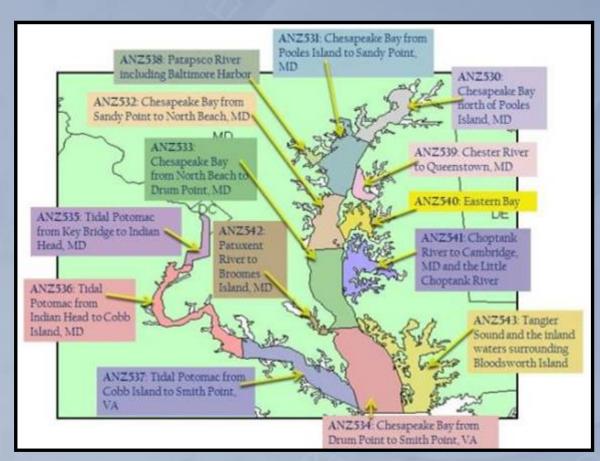
... nearly 10 million people to look out for!





# Marine Area of Responsibility

- Upper Chesapeake Bay
- Tidal Potomac
- Wind and Wave
   Forecasts & Warnings
   issued for these areas

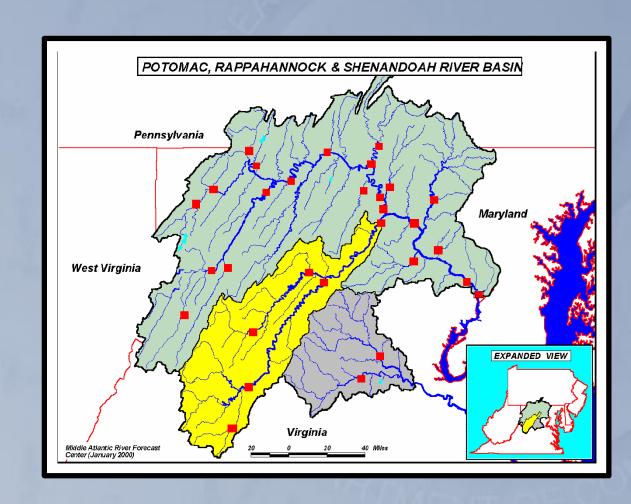




# Hydrologic Area of Responsibility

#### **River Basins**

- Potomac11,600 Square Miles22 Forecast Points
- Shenandoah3,050 Square Miles6 Forecast Points
- Rappahannock1,580 Square Miles2 Forecast Points





## **Operations & Services**

#### **Forecasts**

- Public
- Marine
- Aviation
- Fire Weather
- River
- Coastal

#### **Data Collection**

**Climate** 

**Cooperative Observers** 

#### Watch/Warnings/Advisories

- Convective
  - Tornado
  - Severe Thunderstorm
- Tropical Systems
  - Hurricanes
  - Tropical Storms
- Non-Precipitable
  - Heat
  - High Wind
  - Wind Chill/Excessive Cold
- Hydrological
  - Flash Floods
  - River Floods
  - Small Stream & Tributaries
- Winter Storms
- Coastal Flooding
- Wildfire (Red Flag)



## **Operations & Services**

#### Watch/Warnings

#### Warning

- Action needed!
- Threat is imminent or occurring in warning area.
- Advisory = low level warning

#### Watch

- "Watch the weather"
- Conditions are favorable for the hazard to occur in the near future.
- Stay tuned for updates.
- Action may be needed soon.

#### No near term threats

• Check Outlook (thru 7 days)





# Why Do We Need Spotters?

Spotters report observed weather to the NWS during potentially severe weather events.

Remember our mission? The protection of lives and property. We can't do it alone. We need you, the local experts!

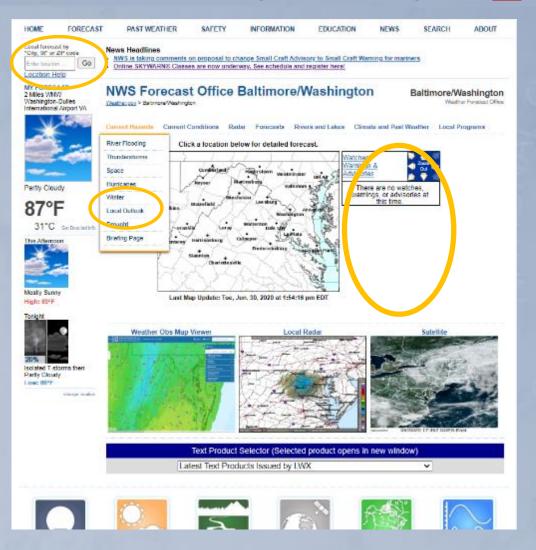


The information that you relay to us has the potential to save lives and property – helping us complete our mission.



## **NWS Web Page**

weather.gov/washington or weather.gov/baltimore



 Latest Watches, **Warnings and Advisories** 

 Local **Forecast** 

 Hazardous Weather Outlook





#### **Hazardous Weather Outlook (HWO)**

.DAY ONE...TONIGHT

A SEVERE THUNDERSTORM WATCH IS IN EFFECT UNTIL 1 AM INCLUDING WASHINGTON DC...THE I-95 CORRIDOR...AND THE ADJACENT WATERS OF THE POTOMAC RIVER.

.DAYS TWO THROUGH SEVEN...SATURDAY THROUGH THURSDAY

AN EXCESSIVE HEAT WATCH IS IN EFFECT SATURDAY FOR MUCH OF THE BALTIMORE AND WASHINGTON METRO AREAS. A HEAT ADVISORY IS LIKELY FOR HARFORD AND NORTHERN BALTIMORE COUNTIES. REFER TO THE LATEST HAZARD MESSAGE /NPWLWX/ FOR DETAILS.

HEAT INDICES MAY EXCEED 105 DEGREES ACROSS THE OUTLOOK AREA SUNDAY AND MONDAY.

A SIGNIFICANT SEVERE WEATHER EPISODE IS EXPECTED ON SATURDAY ACROSS THE OUTLOOK AREA. STORMS WILL BE CAPABLE OF PRODUCING DAMAGING WIND GUSTS AND VERY LARGE HAIL.

SCATTERED THUNDERSTORMS ARE EXPECTED TO DEVELOP SUNDAY AND MONDAY ALONG A STALLED FRONTAL BOUNDARY. SOME STORMS COULD BECOME SEVERE AND WILL BE CAPABLE OF DAMAGING WIND GUSTS AND LARGE HAIL.

.SPOTTER INFORMATION STATEMENT...

SKYWARN HAS BEEN ACTIVATED UNTIL 1 AM LATE FRIDAY NIGHT.

SPOTTER ACTIVATION IS LIKELY ON SATURDAY. LIMITED SPOTTER ACTIVATION MAY BE NEEDED TODAY AND SUNDAY THROUGH MONDAY. PLEASE RELAY ANY REPORTS OF STRONG WIND OR HAIL TO THE NATIONAL WEATHER SERVICE.

**Short Term Hazards** 

**Long Term Hazards** 

**Spotter Activation** 

weather.gov/washington or weather.gov/baltimore



# Weather Hazards in the Mid-Atlantic

**Severe Thunderstorms Tornadoes/Waterspouts** Flooding & Flash Flooding **Tidal/Coastal Flooding Hurricanes** Winter Weather **Enhanced Fire Threat Dense Fog Non Thunderstorm Winds** 



# How Do Thunderstorms Form?



### Main Ingredients for a Thunderstorm

- You can think of this like a checklist:
- 1. Heat and Moisture Determines amount of energy in atmosphere
- -Convective Available Potential Energy (CAPE) A measure of the amount of energy available in the atmosphere
- **2.** Instability Needed to break atmospheric barriers and tap into available atmospheric energy
- 3. Lift Acts as a means for air to start rising
- Wind Shear- Change of wind speed/direction with height ( Not necessary for thunderstorm development but important for strong and long lived thunderstorms



# Thunderstorm Ingredients

Heat and Moisture Source(s)





Our moisture sources come from the southern Atlantic Ocean and the Gulf of Mexico





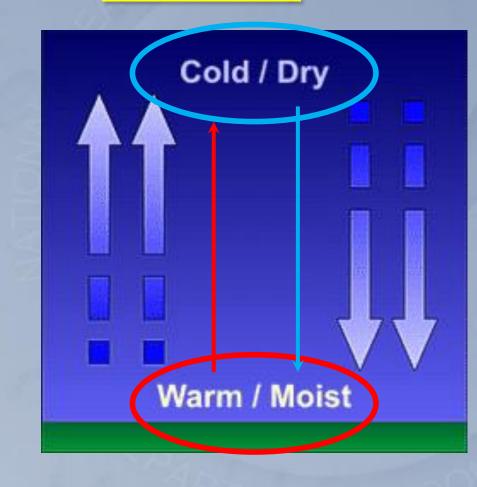
# Thunderstorm Ingredients

Hot air + Moisture = Instability

Warm & moist air is less dense than cold & dry air. The less dense air rises up while the more dense air will sink. This is called Convection

An airmass is considered unstable if a parcel of air continues to rise when given a nudge upward (like when a cold front ushers in cold & dry air).

The more warm & moist the airmass is at the surface and the colder & drier the airmass is aloft, the more unstable the atmosphere





# **Example of Convection**





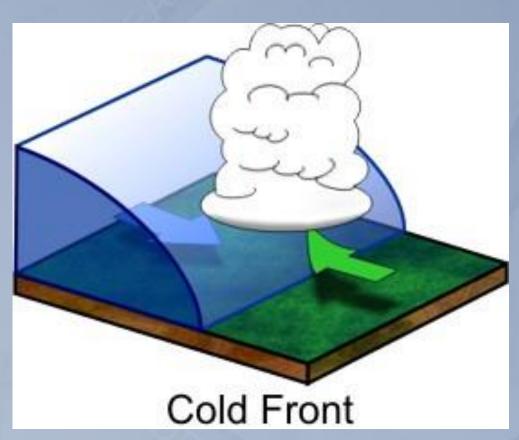


# **Thunderstorm Ingredients**

For lift, you need a mechanism or boundary for convergence. Cold fronts are a good source of lift.

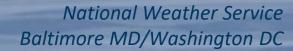
When air is forced upward along a front, it cools/condenses and precipitation forms.





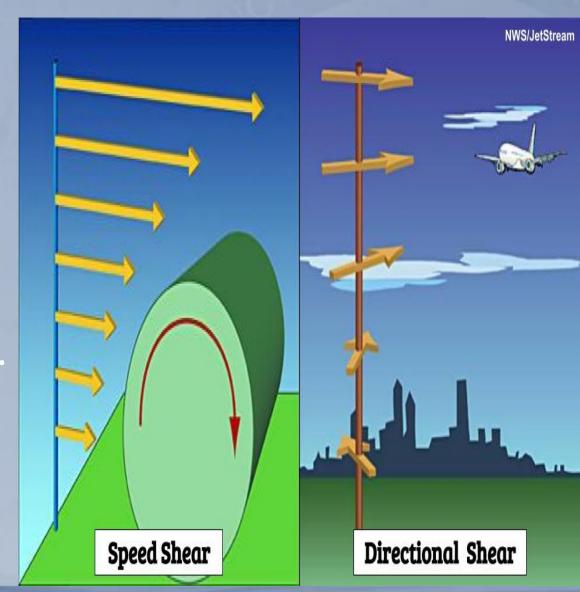
Convergence of wind along the cold front.





## Wind Shear

 Difference in wind speed and/or direction with an increase in altitude.







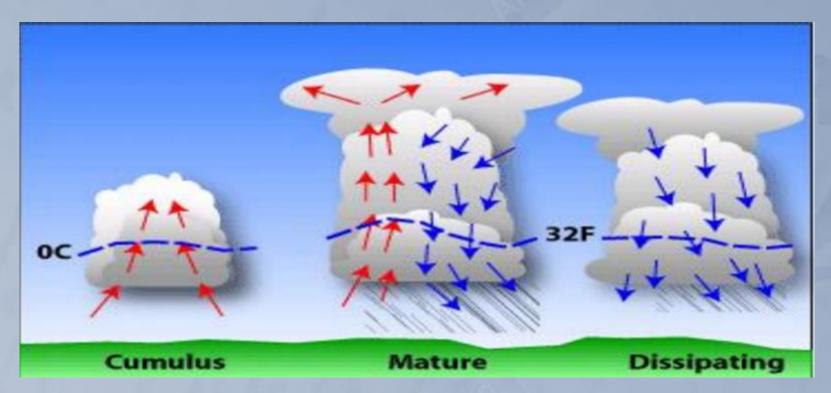
# Why is Wind Shear Important?

 Helps with the longevity of thunderstorms by keeping the updraft/downdraft more separated.





# The Thunderstorm Life Cycle



**Updraft** 

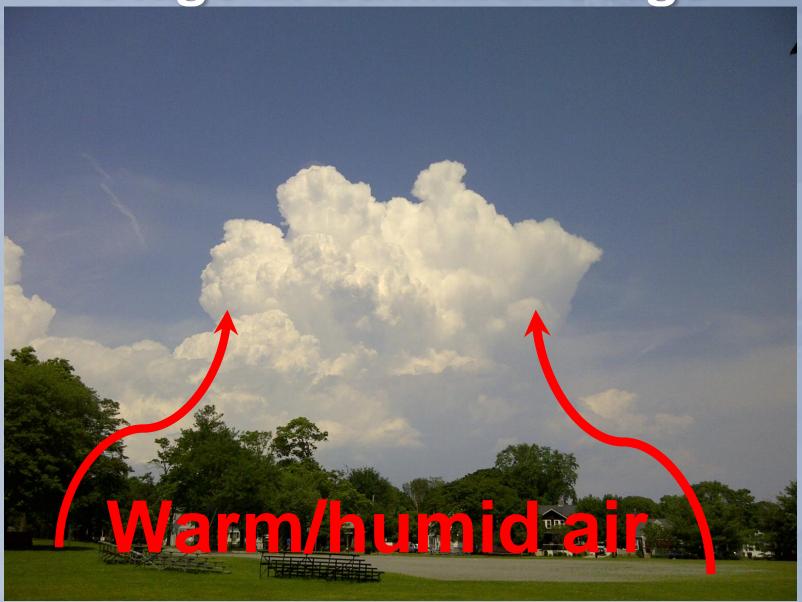
**Updraft & Downdraft** 

**Downdraft** 



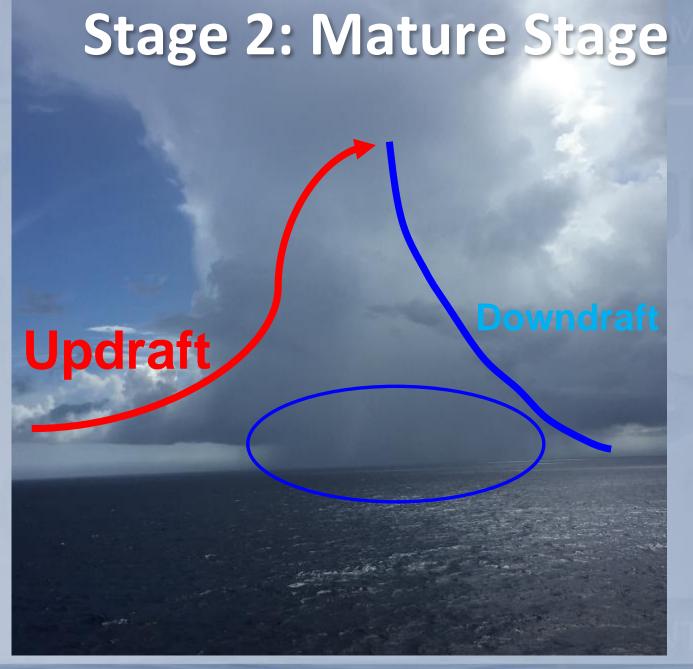


## Stage 1: Cumulus Stage





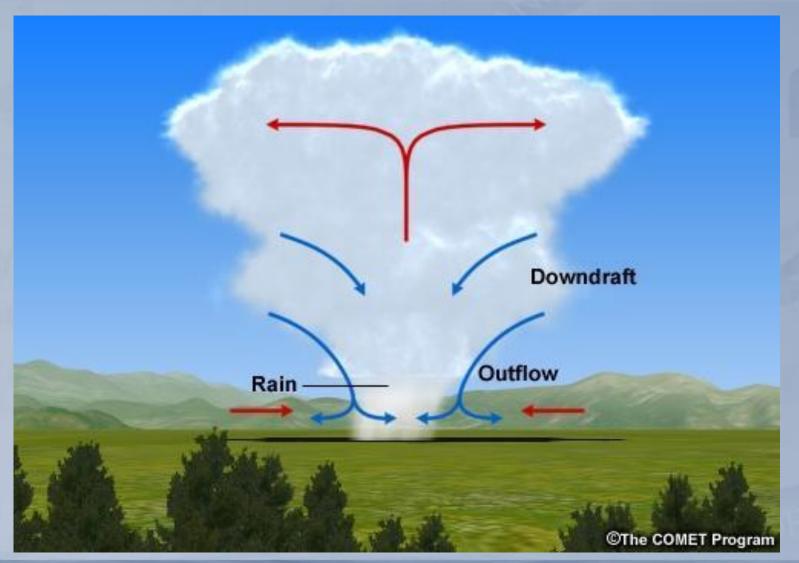








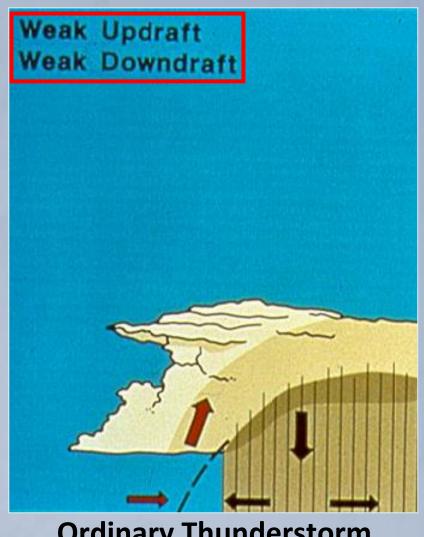
# **Stage 3: Dissipating Stage**



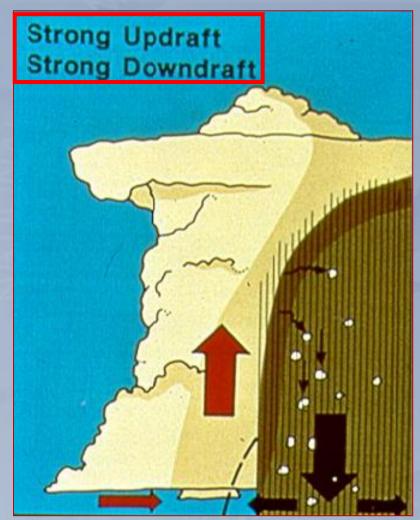




#### What is the Difference Between an Ordinary Thunderstorm and a Severe Thunderstorm?

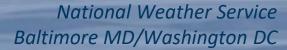


**Ordinary Thunderstorm** 



**Severe Thunderstorm** 





## **Severe Thunderstorms**

#### Warning Criteria: 1" Hail and/or 58 MPH Winds

- Damaging straight-line winds from an intense t-storm downdraft can cause extensive damage and loss of life
- Often confused with tornadoes especially at night
- Often comes with heavy rain/hail/wind
- Has the potential to spawn a tornado(s)





## How to Report Hail



Hail reports are the most difficult to gather. The hail shaft can be very narrow and short lived.

"Marble Size" hail is ambiguous. Do not report hail as marble sized.













## More on Hail

The largest hail stone on record was 8" in diameter and weighed 1lb 15oz. The hail stone fell out of a severe thunderstorm in Vivien, SD on July 23, 2010.

We can even get large hail stones in the Mid-Atlantic. Baltimore County reported a 4 inch stone in June 2015.

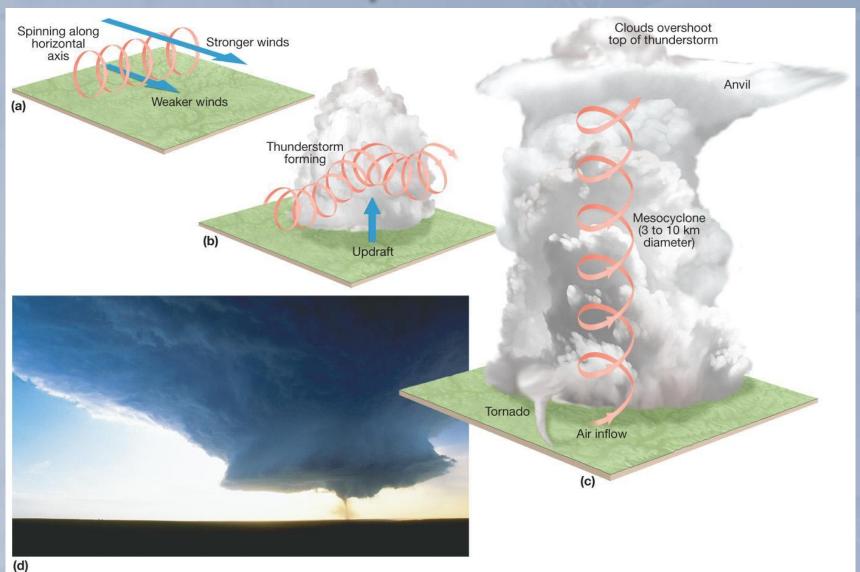








### **Formation of Supercell Thunderstorms**







## Difference between Shelf and Wall Clouds

Wall Shelf



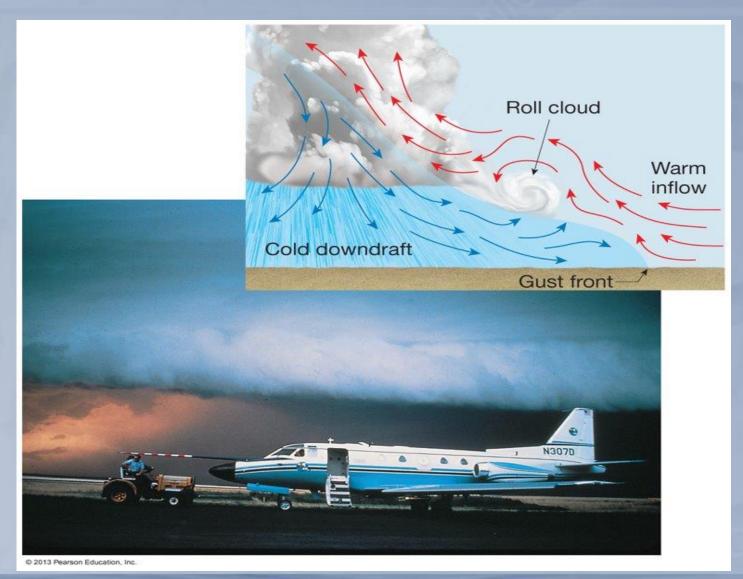


- Slopes away from precip.
- Indication of Outflow/Downdraft.
- Accompanied by horizontal turbulent motion.
- Slopes toward precip.
- Indication of inflow/updraft
- Accompanied by vertical rotation





## Formation of a Roll Cloud







#### Tornadoes, Funnel Clouds & Waterspouts

**Tornado**: A violently rotating column of air attached to a cloud base and in contact with the ground.

**Waterspout**: A tornado over the water.

Funnel Cloud: A rapidly rotating column of air NOT in contact with the ground. Some funnel clouds go on to become tornadoes, others do not.



#### Tornadoes, Funnel Clouds & Waterspouts

When reporting a tornado, funnel cloud or water spout, please get to safety and then call us. If you are then able to, take a video, not a still picture and send to us. We need to see rotation to determine whether it is a tornado or scud cloud.







## **Tornado Facts**

#### **Weak**

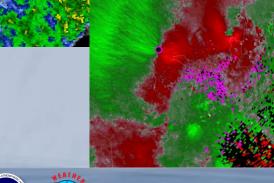
- **Torosade**quent (90%)
- Brief
- EF0/EF1 Winds < 111 MPH
- Few Fatalities
- More difficult to detect

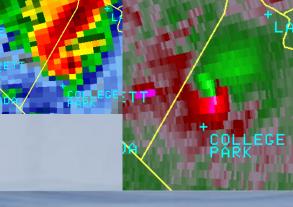
#### **Strong**

- Trace de ser frequent
- Typically lasts longer
- EF2/EF3 Winds to 165 MPH
- Some Fatalities

#### **Violent**

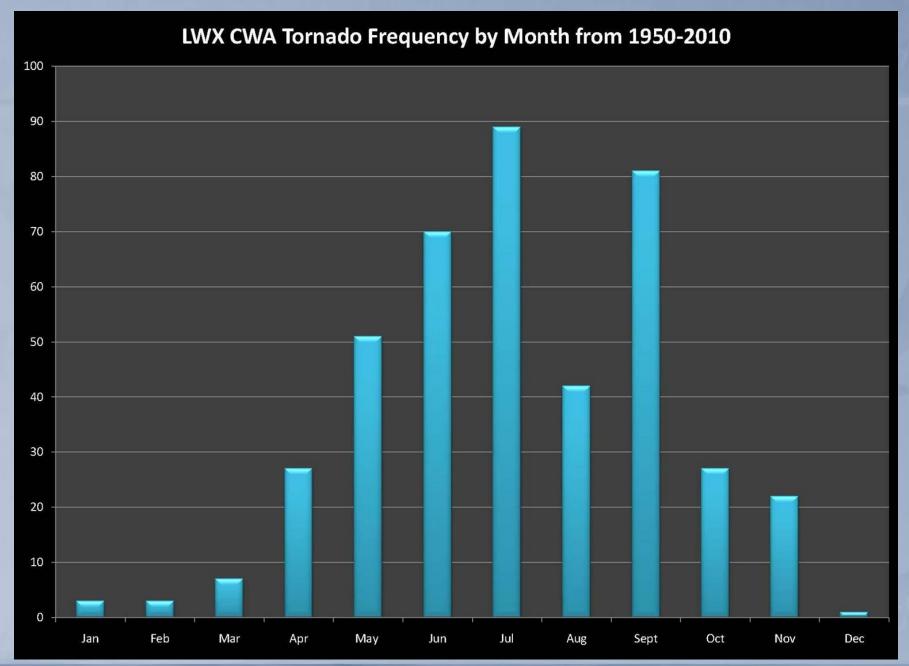
- <u>Raraado</u>
- Long lived
- EF4/EF5 Winds > 165 MPH
- Many Fatalities
- Nearly always detected





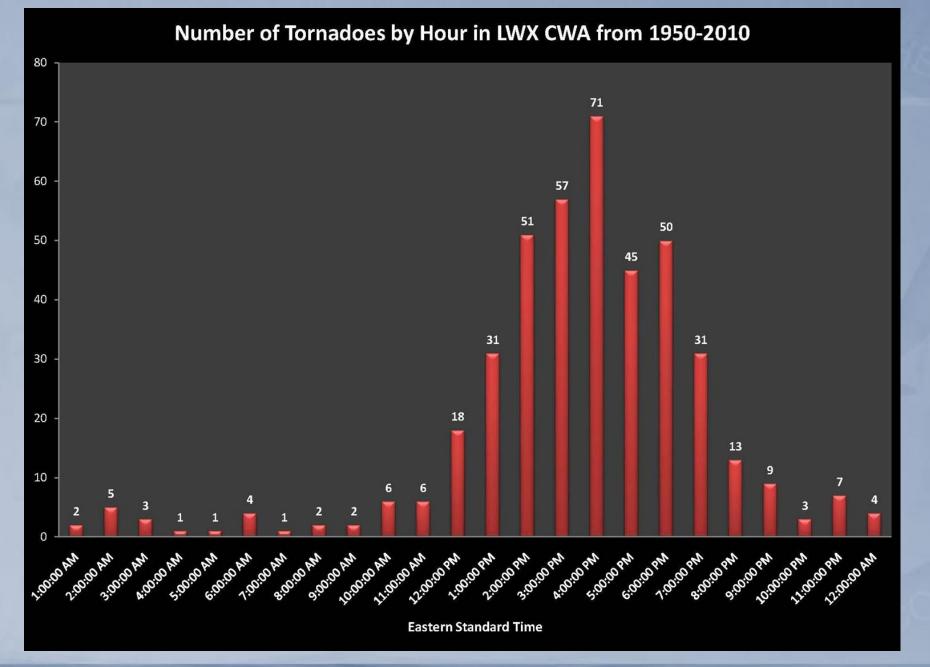




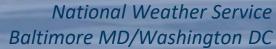


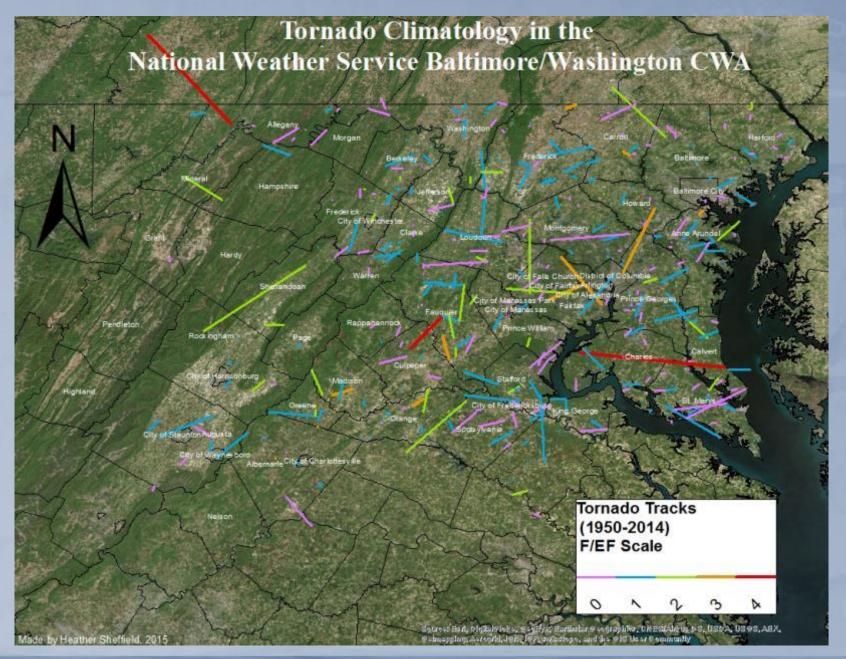
















## **Tornado Safety**

Seek sturdy shelter in an interior room if a threadight of the shelter in the standard of the shelter cover your head Mobile homes are NOT safety!!!!

Stay away from windows!!!



go to

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## **Examples of Storm Damage**

**Tropical Storm Isaias** 



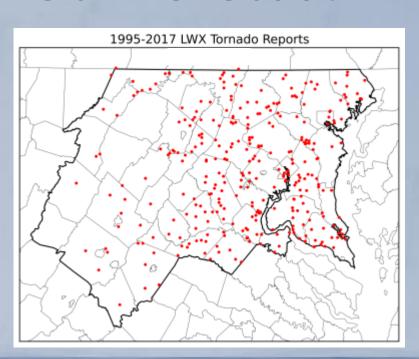


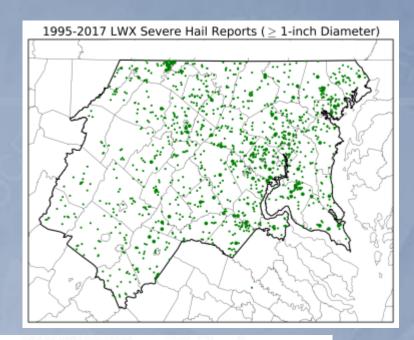


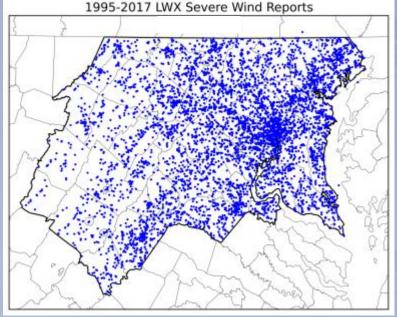




## Breakdown of Severe Weather Reports Across Our Forecast Area









## Spotter Responsibilities with Severe Weather

- Tornado/funnel cloud/waterspout
- Straight line wind damage
- Hail
- Lightning (don't call to just report it is happening. Call if there is damage as a result of a lightning strike)



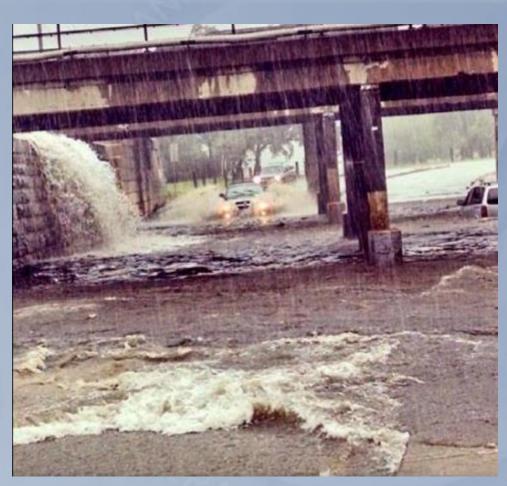
## Flooding



## Flash Flooding

Flash Flood: A flood that follows within 6 hours of a heavy or excessive rainfall, dam or levee failure, or a sudden release of water impounded by an ice jam.

Flash Floods cause more deaths than tornadoes or lightning (30) year period)!



**Baltimore, MD August 2014** 





## **Areal Flooding**



event.

Includes both river and stream flooding.



Flood: A flood that occurs

heavy or excessive rainfall

more than 6 hours after the





## **Coastal Flooding**

**Coastal Flooding: The inundation** of land areas caused by sea waters over and above the level of normal tidal action.



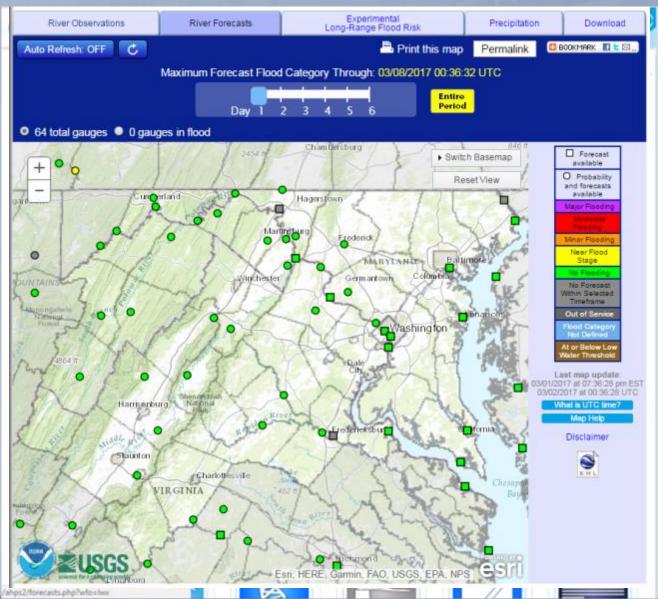
Annapolis, MD 2019

- **Prolonged onshore flow**
- Storm Surge from **Tropical Systems**
- **Spring Tides:** the highest tides in a lunar month, around new and full moon when the Earth, Moon and Sun are aligned





### **River Forecasts**





## Flooding Safety



- Never enter water over a road if it is too deep to see the pavement.
- Be very careful at night.
   Visibility is greatly reduced and flooding is harder to recognize.

- 45% of the flood fatalities in the previous couple of years were the result of people attempting to drive through flooded roadways.
- \*\*1 flood related death in MD in 2014\*\*
- If your vehicle stalls in unexpected high water, leave it at once and seek higher ground.





# Spotter Responsibilities with Flooding

- How deep is the water (if safe to measure)
- Is the water moving or still?
- Any impacts?





## Winter Weather



## Winter Weather Concerns

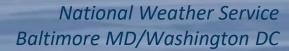
- Heavy Snow
- Blizzard

**Conditions** 

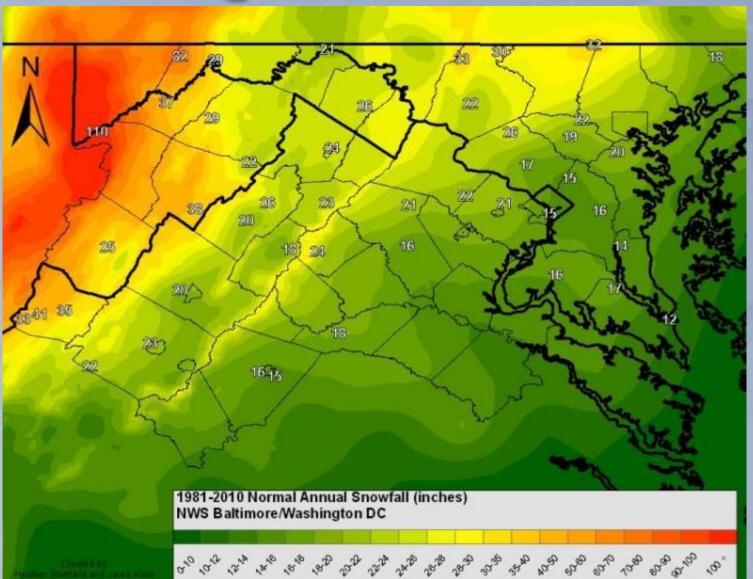
Icing

Extreme Cold





## Average Snowfall Totals





## **Setting Up for Snow Reports**





Ideally, a snowboard is the best measuring surface.

- Can be as simple as a 2 ft square piece of plywood painted white
- May want to place flags/markers near the board to help locate during snowy weather
- You can measure snow on a table if you don't have a board





## Snowfall/Ice Reporting & Measurement

- Measure with a ruler
- Ice Accumulation
  - Report Thickness
  - What kind of surface its on
- Snowfall Measurements
  - First two inches & every two inches
  - Total Snowfall
  - Is it measured or estimated?
  - If drifting becomes a problem, take several measurements and average them.





## Snowfall/Ice Reporting & Measurement

#### **Frequency of Measurements**

- Every two to three hours is adequate
- Clean off your snowboard every six hours – cleaning more often can lead to inaccurate measurements



Please report your STORM TOTAL snowfall to the nearest tenth of an inch throughout the event through:

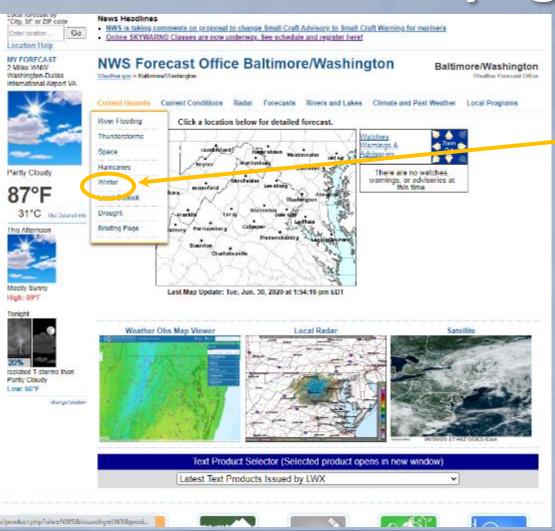
- Internet google form
- Email or Phone if you don't have easy internet access



# Preparing for Winter Weather



# Local Winter Weather Webpage

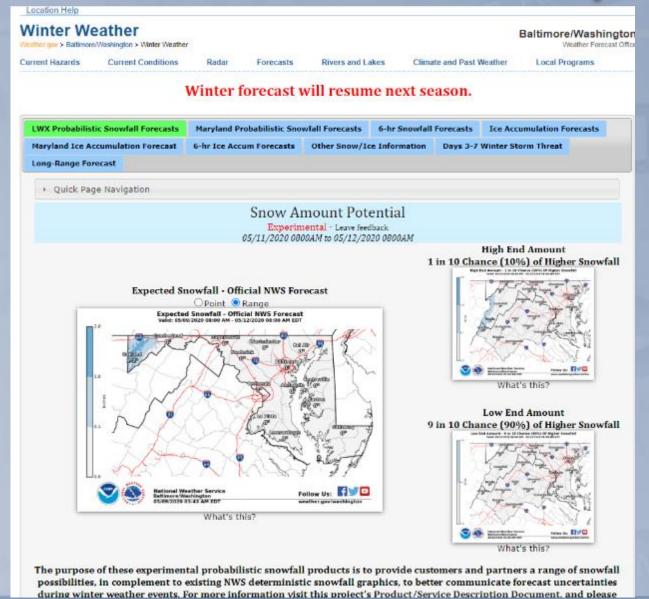


**Winter Weather Page** 





## Winter Probabilistic Graphics





# Spotter Responsibilities with Winter Weather

- Snowfall amounts
- Ice amounts







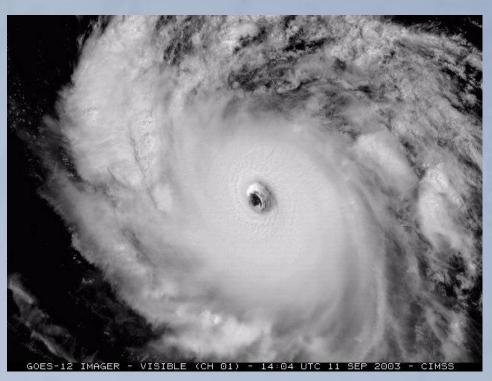


## **Tropical Weather**



## **Tropical Weather**

### Hurricane Season is from June 1 -November 30



Hurricane Isabel

### **FOUR Threats:**

- Inland Flooding (Rain)
- Storm Surge (Tidal)
- High Wind
- Tornadoes





# Spotter Responsibilities in Tropical Weather

- Flooding
  - Fresh Water or Storm Surge
- Tornadoes
- Damage from winds or flooding



## How to report to us?



## Very Important Information

If your report is severe thunderstorm hail/wind/tornado/funnel cloud or flooding related, please DO NOT send your report via email!

This type of information is time critical and needs to be relayed to forecasters *immediately*.

The best means to get information to the NWS quickly is by the telephone or Amateur Radio

PLEASE DON'T WAIT FOR US TO CALL YOU!



## **Reporting Criteria**

- Tornado or Funnel
- Hail Pea sized or larger
- Rotation within a storm
- Wind 50 MPH or greater (sustained/gust and measured/estimated)
- Damage Any weather related damage to trees or property. Give as many details as possible (t-storms or high winds).





## Reporting Criteria

- Heavy Rain Measured 1" or More
- Flooding Streams, creeks or rivers out of banks of flooding of roads from poor drainage (including coastal flooding)





- Ice Accumulation Any glaze on surfaces
- Snow Accumulation Every 2" or any accumulation not reflected in the forecast, and final total





## Reporting Criteria

- Fog Any fog resulting in hazardous driving conditions
- Tropical Flooding as a result of rain and/or storm surge, tornadoes, wind damage





Fire Weather – After calling
 911, report wildfires (especially during times of Red Flag conditions)





## Making a Storm Report

- Who is making the report?
  - Your spotter ID or Name
- What are you reporting?
- When did the event occur?
  - Time of report
- Where is the location of the report?







### Snow/Ice Reporting/Heavy Rainfall

Fill out Snow/Ice Report Form

http://ht.ly/gVpw305Nchl

Reports automatically get submitted into our

database





## What Happens to the Reports at the National Weather Service?

- 1. Received by the staff
- Integrated with other information (radar, satellite, & spotters)
- 3. Used to "calibrate" the radar
- 4. Helps in warning decision
- 5. The information you provide can be relayed in warnings, and real time storm reports!
- 6. Web, NOAA Weather Radio, and the media relay the information



It's all about getting information to the people so they can make the right decisions.



### What Happens When We Issue a Warning?





**NWS** 







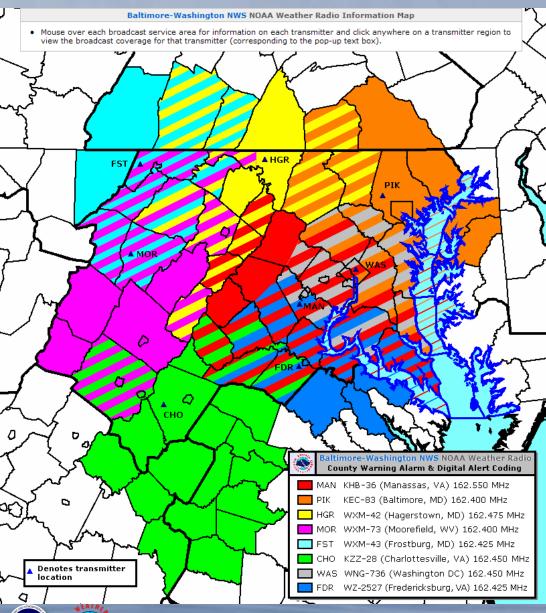








## NOAA Weather Radio (NWR)



Is the best way to receive watch and warning information!

### **Receivers**

Can be purchased in Nature and Electronic Stores and in Catalogs. They generally range in price from \$15 to \$75



# Amateur Radio and SKYWARN





## Capital Area SKYWARN ® Support Group Webpage

www.wx4lwx.or



www.wx4lwx.org

Home Leadership Frequencies Weather Awarness Net Control Station Tools Scripts Links

#### What is Skywarn?

Skywarn is a network of volunteer severe weather spotters, who act as the "eyes and ears" of National Weather Service (NWS) offices throughout the county. The spotters are trained by local NWS Forecast Offices on how to spot and report severe thunderstorms, formadoes, hall and flooding. In some areas, spotters also report snowfall and ice accumulation.

#### The National Capital Area Skywarn Support Group

NWS Battimore / Washington Forecast Office in Sterling, Virginia, has been recruiting and training scotters into its expanded network since 1990, there are currently over 5,000 volunteers who cover 44 counties, plus Battimore City and the District of Columbia.



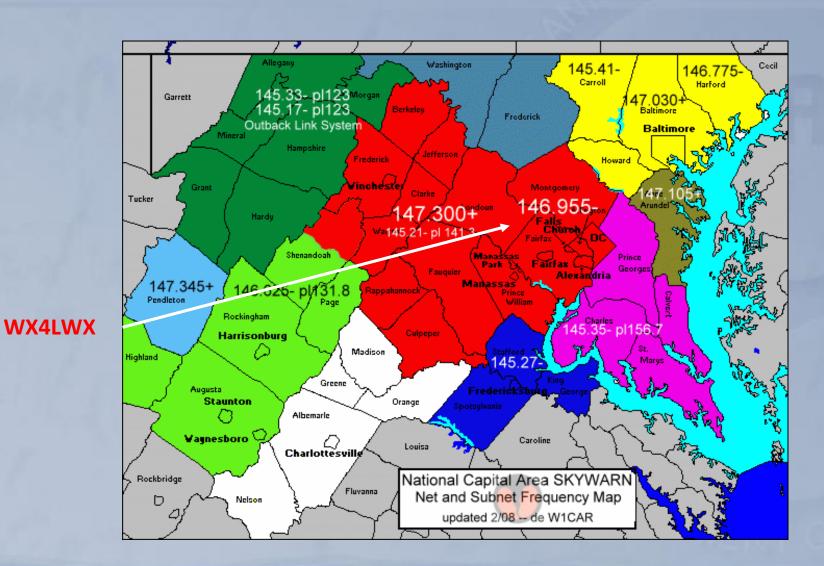
The network comprises an area from the west of the Susquehanna River and Chesapeane Bay to the Allegheny Mountains, and from the Mason-Dixon line down to St. Mary's, King George, Spotsylvania, Orange, Nelson, and Highland Counties.

#### Who Are Our Spotters?

Skywarn volunteers are a diverse group, ranging from weather enthusiasts or public-service oriented people such as amateur radio operators, REACT members, or emergency response personnel. Spotters are all ages, from 14 through retirement age, with many professions represented. Skywarn volunteers have a common interest in weather and a strong desire to help the community.



## SKYWARN Frequencies





### **Questions or Comments?**

Email main SKYWARN email address or call office <a href="https://www.report@noaa.gov">wx-report@noaa.gov</a>

1-800-253-7091

