



AWR-331

Winter Weather Hazards: Science and Preparedness

Participant Handouts

Version 1.0



FEMA

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AWR-331 Winter Weather Hazards:
Science and Preparedness

Enabling Learning Objectives

- 1-1 State the course goals
- 1-2 Describe the course content
- 1-3 Describe the course evaluation strategy

1-2

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Welcome

- Instructor introduction
- Class structure and housekeeping:
 - Breaks
 - Restrooms
 - Emergency exits
 - Cell phones
- IACET CEUs and Other Professional CECs available

1-3

Continuing Education

- International Association for Continuing Education and Training (IACET)
 - Participants who successfully complete this course will receive 0.1 CEUs for every eligible course contact hour.
- This course may also be eligible to provide the other professional continuing education credits.

1-4

Course Registration



- ✓ UPPERCASE letters
- ✓ No abbreviations

1-5

Pre-Test



- Self-evaluation tool to assess your current knowledge
- Answer to the best of your ability

1-6

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Pre-Test Answers



1-7

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Course Goal

This course will prepare participants to understand the basics of winter weather science, forecasting, warning, and preparedness.

1-8

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Learning Objectives

Upon successful completion of this course, participants will be able to:

1. describe the current state of winter weather science;
2. describe the winter weather forecast process, appreciate its complexities, and participate in a forecasting exercise;

1-9

Learning Objectives (cont.)

3. recognize the organizations involved in forecasting winter weather, associated winter weather definitions, and strategies to prepare for winter weather impacts; and
4. learn how to analyze a forecast and discuss key decision points during a winter storm scenario.

1-10

Course Agenda

Module	Title	Duration
1	Welcome, Introduction, and Administration	50 minutes
2	Science of Winter Weather	60 minutes
3	Winter Weather Forecast Process	75 minutes
4	Winter Weather Warning Process and Safety	75 minutes
5	Winter Storm Scenario	90 minutes
6	Evaluation and Conclusion	40 minutes

Note: There is a 1-hour lunch after Module 4 and three 10-minute breaks: one after Module 2, one after Module 3, and another after Module 5.

1-11

Summary

- Stated the course goals
- Described the course content
- Described course evaluation strategy

1-12

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What Drives Weather?

Near the poles, the energy strikes at an angle, spreading the energy over a larger area. This results in less energy per square mile and colder temperatures compared to the tropics.

(Source: NOAA, 2015)

Low-pressure systems exist to help the atmosphere achieve balance between warm temperatures over the tropics and cool temperatures over the poles!

2-4

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What is a “Winter Storm”?

General characteristics:

- Produces winter weather hazards **in addition to** severe weather hazards
 - Low temperatures, snow, sleet, freezing rain, wind, etc.
- Varies in size
 - Low-pressure systems
 - Average of 25-30 per season
 - Lake-effect snow squalls

(Source: NOAA, 2015)

2-5

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1 Low-Pressure System Initiation

Temperature imbalance on Earth:

- Warmer toward equator, colder toward poles
- Storm forms to create balance

(Source: NOAA, 2010)

2-6

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2 Low-Pressure System Formation

Low-pressure develops from:

- Large-scale jet stream processes
- Smaller-scale heating processes

(Source: NOAA, 2010)

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3 Low-Pressure System Maturity

Better defined structure:

- Advancing cold air at cold front; retreating cold air at warm front
- Hazards are often specific to fronts

(Source: NOAA, 2010)

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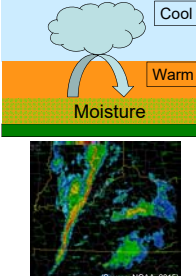
Typical Fronts and Temperatures

(Source: COMET, 2012)

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Convective Weather Hazards

- **Convection:** the upward transportation of heat and moisture
 - Convective weather hazards are:
 - Lightning storms
 - Straight line winds
 - Tornadoes
 - Hail
 - Flash flooding
- **Squall lines** are lines of strong thunderstorms often found at the leading edge of cold fronts.

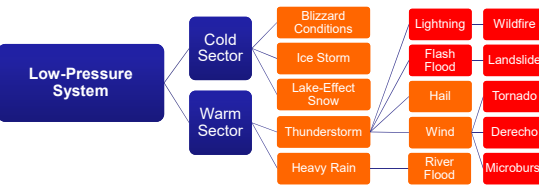


(Source: NOAA, 2016)

2-10

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Cascading Hazards



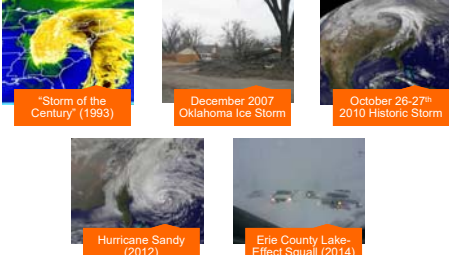
Cold Front: Advancing cold air
Cold Sector: Behind cold front and ahead of warm front

Warm Front: Advancing warm air
Warm Sector: In front of cold front and behind warm front

2-11

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Significant "Winter Storms"



"Storm of the Century" (1993)

December 2007 Oklahoma Ice Storm

October 26-27th 2010 Historic Storm

Hurricane Sandy (2012)

Erie County Lake-Effect Squall (2014)

(Source: NOAA/NWS, 2015)

2-12

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Satellite Animation of Strong Winter Storm

NOAA GOES 13 140312 1945 UTC NASA GSFC GIBS Project

(Source: NOAA, 2014)

2-13

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Cyclone Diameters

Mid-Latitude Cyclone
1,200 miles

Tropical Cyclone
300 miles

(Source: NOAA, 2014)

2-14

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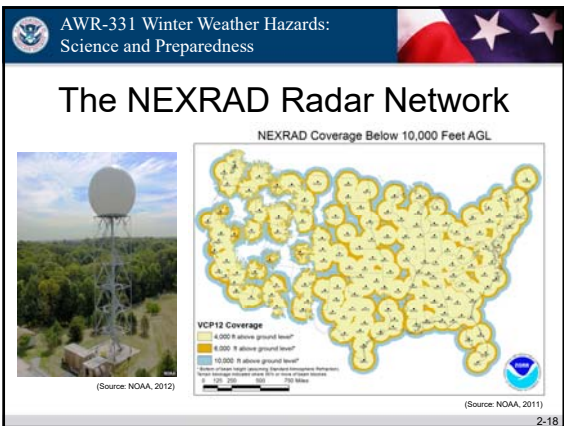
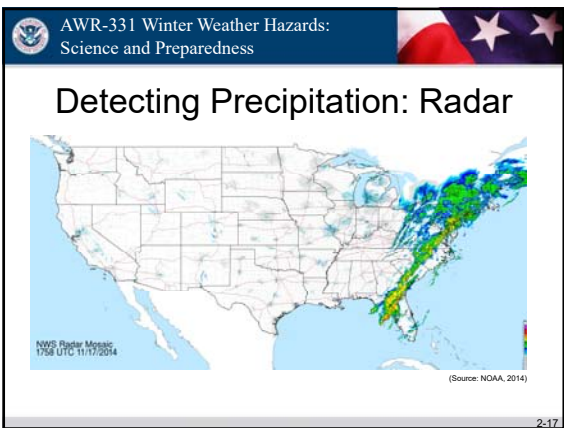
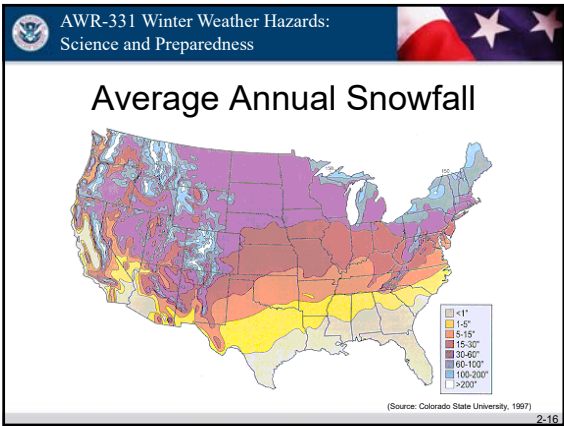
Common Storm Paths

Nor'easter

Alberta Clipper


(Source: NOAA, 2014)

2-15



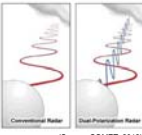
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How Radar Works



(Source: COMET, 2012)

Dual Polarization




(Source: COMET, 2012)

2-19


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Limitations of Radar

- Cannot precisely determine the type of precipitation
- Dry, powdery snowflakes are not measured as effectively as rain drops, so areas of heavy snowfall aren't accurately detected by radar
- Mountains can block the radar pulse from leeward precipitation



(Source: COMET, 2009)




(Source: COMET, 2009)

2-20


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Weather Observing Tools

- Satellites
 - Top-down view of weather systems
- Weather balloons
 - Provide upper-level atmospheric observations
- Trained individuals
 - CoCoRaHS and SKYWARN



(Source: NOAA, 2014)



(Source: NOAA, 2014)

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Forecasting Precipitation Hazards

(Source: NOAA, 2014)

2-22

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How Snow is Formed

- Snow forms when liquid water drops and water vapor turn into ice crystals.
- This complex process happens in clouds where the cloud top temperature is at least 14°F or colder.
- There are many different types of snowflakes.

(Source: NOAA, 2006)

2-23

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Sleet and Freezing Rain

Sleet/ice pellets



(Source: NOAA, 2012)

Freezing rain

(Source: NOAA, 2012)

(Source: NOAA, 2012)

2-24

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Summary

- Described the development of winter weather phenomena and hazards
- Described the technology used to track winter weather
- Listed the types of winter weather precipitation

2-25



**AWR-331 Winter Weather Hazards:
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Module 3: Winter Weather Forecast Process
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Enabling Learning Objectives

- 3-1 Describe the forecast process and cycle
- 3-2 Learn about the uncertainty associated with weather models
- 3-3 List the strengths and weaknesses of weather model forecasts of winter weather
- 3-4 Describe the basic principles of forecasting the amount and type of precipitation

3-2

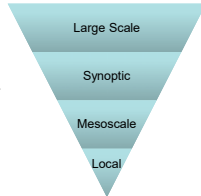
Forecast Process

1. Analyze recent history and current conditions.
 - On-the-ground reports, satellite, radar, balloons
 - The forecast process **always** begins with this step.
2. Look at data from numerical weather models.
 - Multiple models, global to local, ensemble and deterministic
3. Make adjustments based on local knowledge.
 - Integrate model solution with a knowledge of local topography and weather patterns.
4. Issue forecast and public safety products as needed.

3-3

Forecast Funnel

1. Analyze current weather conditions. **“The Forecast Funnel”**
2. Evaluate numerical model output.
3. Make decisions based on available data.
4. Issue routine products at fixed times.
5. NWS issues watches and warnings* as necessary, often under time pressure.

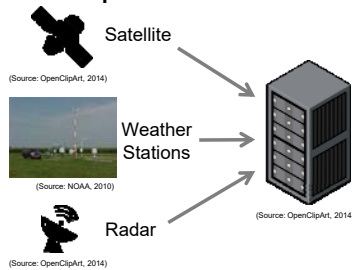


**The Storm Prediction Center (SPC) issues watches for convective/severe weather hazards and coordinates with local NWS WFOs.*

3-4

What is a Computer Model?

Complex computer program ingests data and solves atmospheric equations to determine the future state of the atmosphere



3-5

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Grid-Based Forecasting

(Source: NOAA, 2007)

(Source: Copyright © 2013, PRISM Climate Group, Oregon State University: <http://prism.oregonstate.edu/>, 2013)

3-6

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When Do the Models Update?

- Global models calculate forecasts:
 - 2-4 times per day (**00z**, **06z**, **12z**, **18z**)
 - Data usually available a few hours later
 - “Zulu” time, or UTC, is Greenwich Mean Time
- Local models might run more often
 - New “High Resolution Rapid Refresh” runs hourly
- Balance between detail in the model (resolution) and time for the model to calculate

3-7

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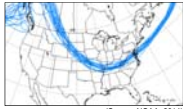
The Models are Getting Better

(Source: NOAA, 2014)

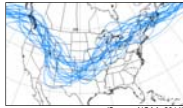
3-8

Model Uncertainty

- Small errors in short-term forecasts grow to be large errors in longer-term forecasts.
 - There are usually large changes in model solutions between runs beyond five days.
- Ensembles show range of forecasts
 - Any of the forecasts could be accurate, but the range of forecasts usually decreases closer to the start of the storm.



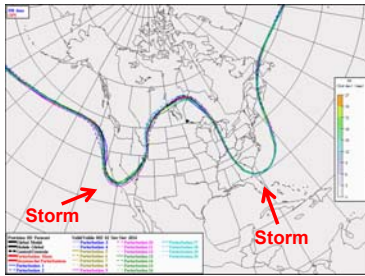
3-day forecast



7-day forecast

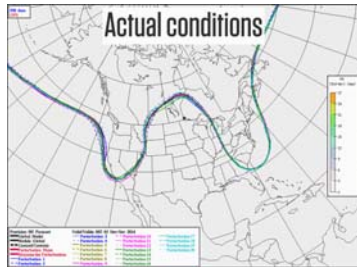
3-9

Actual Storm Positions



3-10

Reducing Uncertainty



3-11

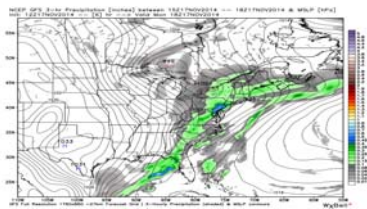
How to Think About Models

- Strengths:
 - Provide advance notice that a storm is likely
 - Show general track and potency ranges
- Weaknesses:
 - System details change with each model run
 - Miss local effects and extreme events
 - Promote a sense of certainty when there are actually a range of outcomes

3-12

Precipitation Forecasts

Models forecast amount of liquid precipitation over a given amount of time

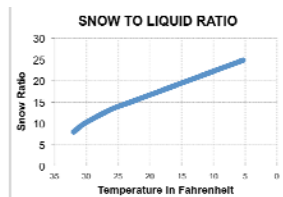


(Source: Weatherbell.com, 2014)

3-13

Forecasting Snow

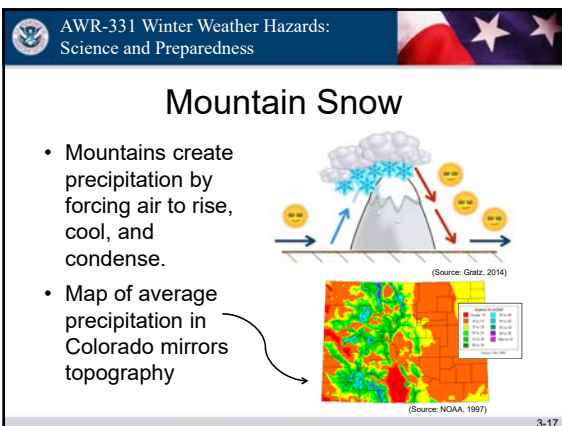
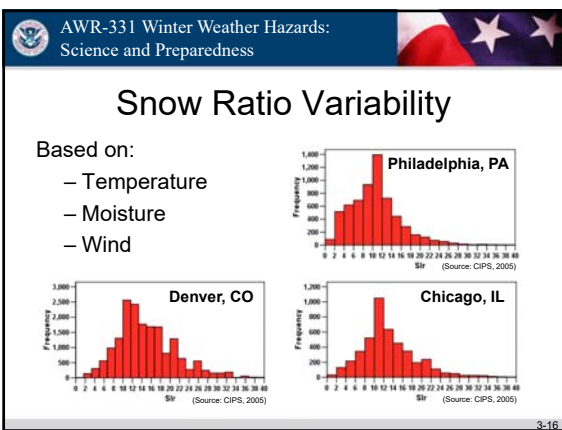
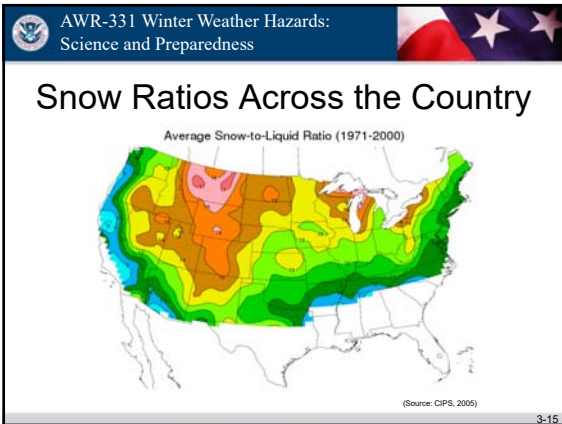
1. Forecast the total amount of liquid precipitation first
2. Multiply by snow-to-liquid ratio



(Source: Gratz, 2014)

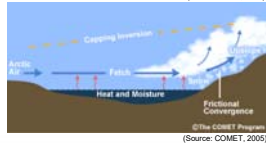
Temperature must be below 32°F from the surface to the cloud!

3-14



Lake-Effect Snow

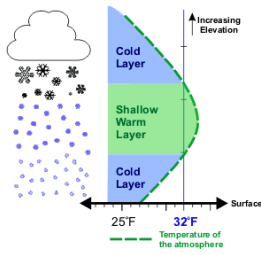
- Cold air above warm, moist air above lake (convection)
- Longer fetch means heavier snow
- Can form multiple bands or a single band
- Most intense single bands can drop 6 inches per hour



3-18

Forecasting Sleet

1. Snow falls into warmer air
2. Snow melts into rain
3. Rain falls into cooler air near the surface
4. Rain freezes into ice before hitting the ground

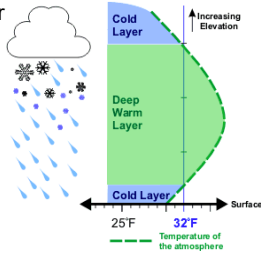


3-19

Forecasting Freezing Rain

1. Snow falls into warmer air
2. Snow melts into rain
3. Rain hits the ground and immediately freezes on surface

Freezing rain poses a threat to utility lines, critical transportation routes, and local agriculture.



3-20

Forecasting Wildcards

- Intense bands of precipitation:
 - Occur under the jet stream, along fronts, and/or are lake-effect related
 - Can double (or more!) expected precipitation
 - Models sometimes show this possibility, but usually cannot predict exact location
- Precipitation type
 - Heavy precipitation can “drag” cold air down from above yielding a better chance of snow/sleet

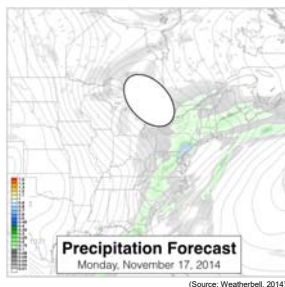
3-21

Forecasting Activity (15 minutes)

1. Break into groups
2. Analyze images in Module 3 Activity handouts
 - a. Label the pressure, fronts, and air masses.
 - b. Determine the most likely type of precipitation falling at the time of this map for each point.
 - c. Discuss how the precipitation will likely change at each point as the storm moves northeast.

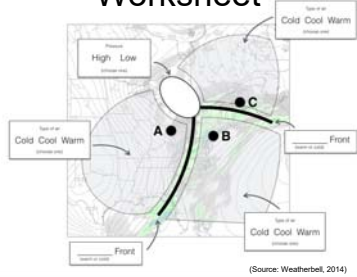
3-22

Figure #1: Precipitation Forecast



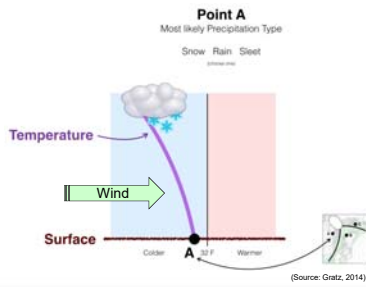
3-23

Figure #2: Participant Activity Worksheet



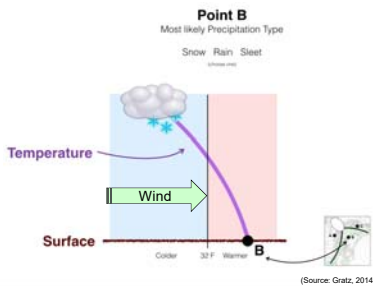
3-24

Figure #3: Point A Temperature

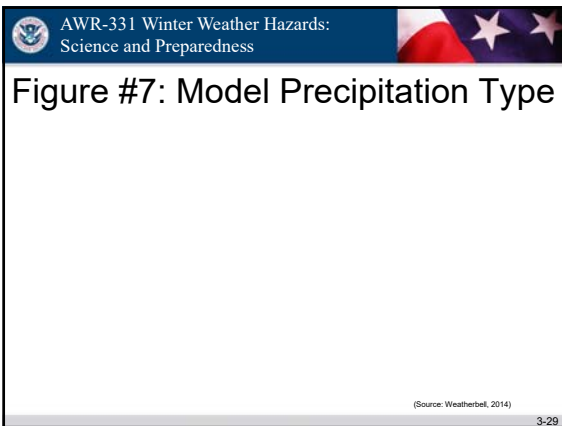
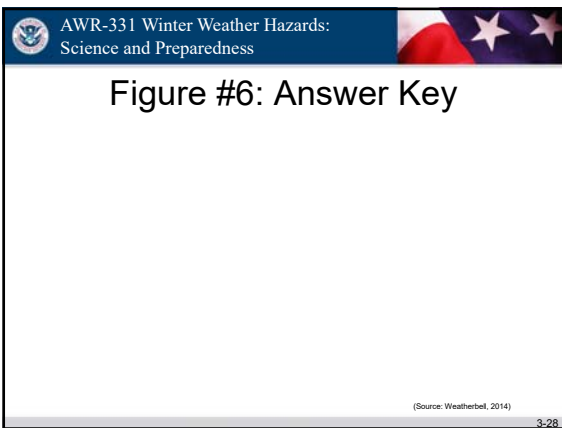
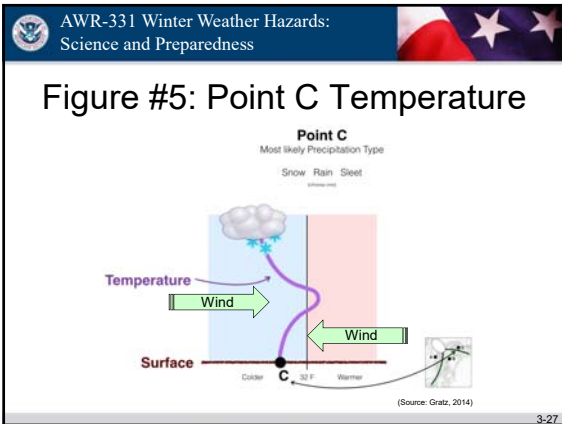




3-25

Figure #4: Point B Temperature



3-26



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Summary

- Described the forecast process and cycle
- Learned about the uncertainty associated with weather models
- Listed the strengths and weaknesses of model forecasts of winter weather
- Described the basic principles of forecasting the amount and type of precipitation

3-30



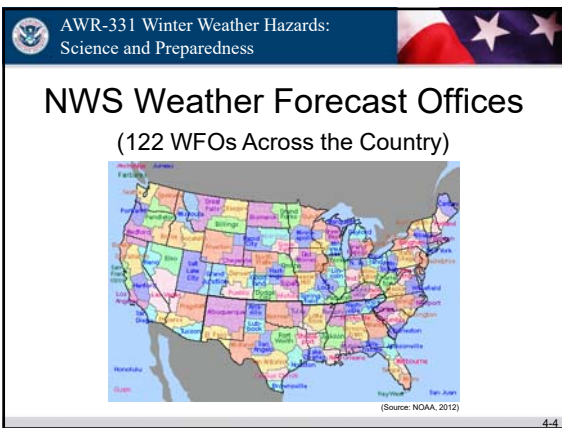
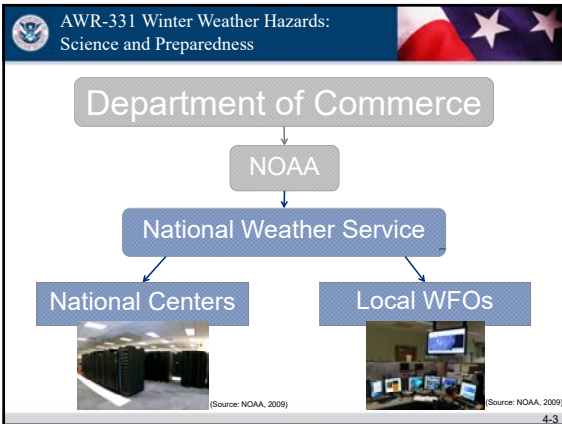
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Science and Preparedness**
Module 4: Winter Weather Warning Process and Safety
Version 1.0
 FEMA

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Enabling Learning Objectives

- 4-1 Describe the organizational structure of the National Weather Service and private sector meteorological companies
- 4-2 Define official winter weather outlooks, advisories, watches, and warnings
- 4-3 List techniques to prepare for and address the challenges and hazards created by winter weather

4-2



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Weather Forecast Office (WFO)

- Forecasting 24/7/365
- Issue watches, warnings, and advisories
- Radar and equipment maintenance
- Local education programs
- Work with local emergency management/response entities

(Source: NOAA, 2011) (Source: NOAA, 2013)

4-5

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NWS Weather Products

1	2	3
<p>OUTLOOK</p> <p>“Possible”</p> <p>Up to <u>7 days</u> before a storm.</p>	<p>WATCH</p> <p>“Likely”</p> <p>Up to <u>48 hours</u> before a storm.</p>	<p>WARNING</p> <p>“Imminent” <i>Threat to life/property</i></p> <p>and/or</p> <p style="background-color: #ffcccc; color: black;"> ADVISORY “Imminent” <i>Nuisance conditions</i> </p>

4-6

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Advisories and Warnings

*Note: An advisory or warning is **not** always issued after a watch!*

<p style="text-align: center;">3</p> <p>ADVISORY</p> <p>Nuisance conditions</p> <p><i>Could be life-threatening if proper precautions aren't taken!</i></p>	<p style="text-align: center;">3</p> <p>WARNING</p> <p>Significant threat to life & property</p> <p><i>Even with precautions!</i></p>
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4-7

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Types of NWS Products

Hazardous Weather Outlook	Issued routinely to provide information about the potential for inclement weather
Winter Storm	Definition varies by region; can include ice, sleet, snow, blowing snow, etc.
Frost/Freeze	Based on coordination with agricultural centers
Wind Chill/Extreme Cold	Definition varies by region; based on what the temperature feels like (relative)
Blizzard Conditions	Wind greater than 35 mph, visibility ¼ mile or less

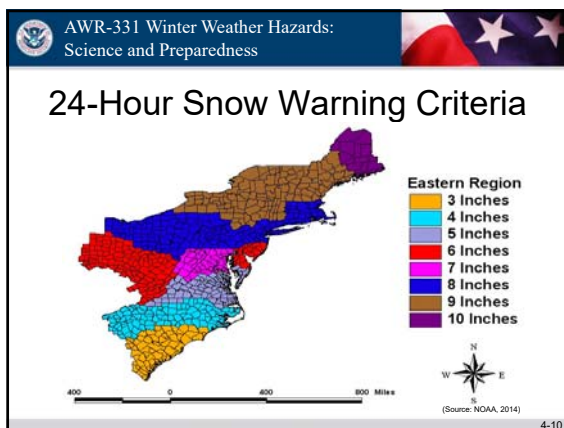
4-8

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Types of NWS Products (cont.)

- Wintry Mix** • A mixture of snow, sleet, and/or freezing rain
- Lake/Ocean – Effect Snow** • Definition varies by region; usually near bodies of water
- Avalanche** • Definitions vary; determined by likelihood, size and distribution
- Ice Storm/Freezing Rain** • Definition varies by region

4-9

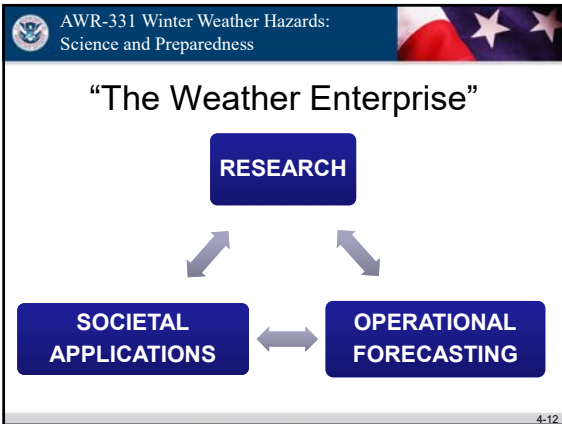


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Example for New York City

- Winter Storm Warning
 - 6" snow in 12 hours OR 8" snow in 24 hours
 - Combination of ½" of ice plus snow
 - Significant impact to mass transit or utilities
- Winter Weather Advisory
 - 3" snow in 12 hours OR trace of ice
- Wind Chill Warning: At or below -25°F
- Wind Chill Advisory: -15°F to -25°F

4-11



- AWR-331 Winter Weather Hazards: Science and Preparedness
- ## Ways to Receive Updates/Info
- From the National Weather Service:
 - NOAA All-Hazards Weather Radio
 - Weather.gov
 - iNWS / SMS (<http://inws.wrh.noaa.gov/>)
 - Cell phones are not always reliable!
 - NWSchat (<https://nwschat.weather.gov>)
 - From government and private organizations:
 - Websites, mobile apps, email, social media, TV, emergency alert systems
- 4-13

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Weather Monitoring Services: *The National Weather Service*

<p>Mission Statement:</p> <p>“The National Weather Service provides weather, hydrologic, and climate forecasts and warnings for the United States, its territories, adjacent waters and ocean areas, and the protection of life and property and the enhancement of the national economy.”</p>	<p>Duties:</p> <ul style="list-style-type: none"> • Maintaining public safety through meteorological, hydrological, and climatological monitoring and warning • Public outreach and training • On-site decision support for critical public safety operations
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4-14

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Weather Monitoring Services: Private Weather Consulting/Monitoring

- Suitable for:
 - Private organization forecast needs
 - Location and time-specific forecasts
 - Enhanced need for decision support
 - Legal risk mitigation
- Examples of products:
 - 24/7 Weather Monitoring
 - Custom Warning Services
 - Live Decision Support Services
 - GIS Integration and Displays
 - Hazardous Weather Planning



(Source: With permission, The Pennsylvania State University, 2015)

4-15

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Source of Public Safety Products


- The NWS is the only organization with the legal authority to issue official weather, water, and climate forecasts and other products for the protection of life and property.
- TV stations, private firms, websites, apps, and blogs may produce their own unofficial forecasts targeted at a particular audience, but **official public safety products originate from the NWS.**

4-16

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Naming Winter Storms

- Names may simplify communication but are not used as official reference for storm(s)
- Impacts vary depending on precipitation type and regional preparedness



(Source: The Weather Channel, 2013)

4-17



Prepare for Winter Storms

- When an outlook is issued:
 - Discuss required vs. optional commitments and begin planning elements of response
 - Highlight need for preparedness in communications
 - Remind stakeholders of important safety items and emergency kit supplies
 - Watch for updates and products from NWS
- Hazardous Weather Outlooks (HWOs) are always issued twice daily

4-18



Prepare for Winter Storms (cont.)

- When a watch is issued:
 - Review plans and procedures for EOC activation, emergency response, etc.
 - Test communications and emphasize community preparedness
 - Establish priorities and collaborate with partners to coordinate response activities, resource staging, consumable stockpiling, etc.
 - NOT an appropriate time to begin developing emergency communications plans or SOPs

4-19



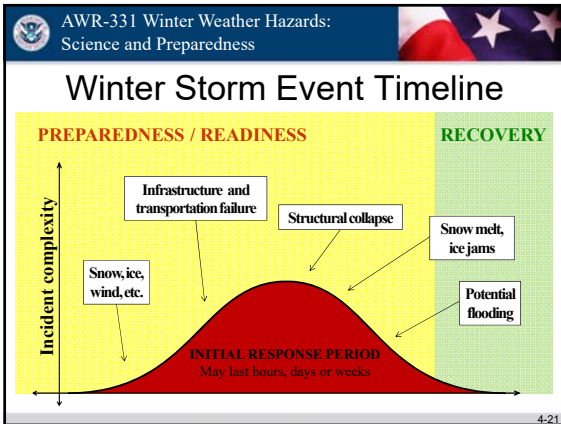
During the Storm (Response)

When a warning is issued or during a storm:

- Highlight proper safety measures to community and responders
- Monitor situation and perform response activities with safety and incident stabilization in mind
- Activate additional resources and continuity of operations procedures, when/if necessary

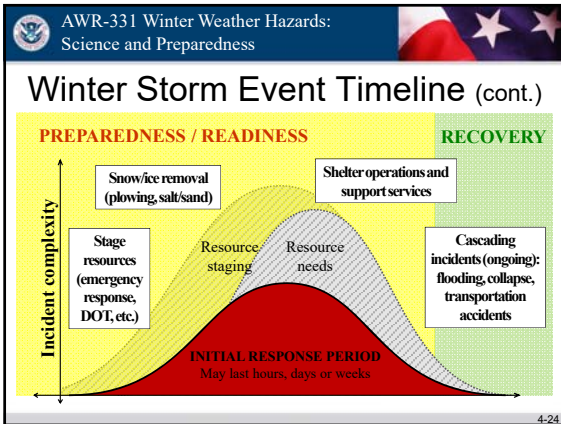
The National Weather Service will often update the forecast to account for subtle local changes in the storm that could not be perfectly forecasted ahead of time!

4-20



- AWR-331 Winter Weather Hazards: Science and Preparedness
- ## Secondary Hazards
- Power and communications loss
 - Power lines and system failure can occur with even a small amount of ice/snow
 - Icy, impassable roads
 - Snow removal resources will be taxed, especially early in storm
 - Structural collapse
 - 1 ft fresh snow = 5-21 lbs/ft² snow load
- 4-22

- AWR-331 Winter Weather Hazards: Science and Preparedness
- ## Secondary Hazards (cont.)
- Ice jams and dam failures
 - Frozen lakes/ivers subjected to sudden thaw or rising water levels can create ice chunks that become jammed at man-made or natural obstructions, causing severe flooding.
 - Ice sheets, icicles, and falling debris
 - Black ice; vehicle and pedestrian collisions
 - Downed power lines
 - Lightning and structural fires
- 4-23



AWR-331 Winter Weather Hazards: Science and Preparedness

Injuries Due to Winter Storms

- **25%** occur when people are caught out in storm, are stranded
- **70%** result from vehicle accidents
- **>75% of injuries happen to males** (Males over 40yrs sustain most injuries)

(Source: http://www.nws.noaa.gov/om/winter/resources/Winter_Storms2008.pdf)



4-25

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After the Storm (Recovery)

- Follow up on issues and misinformation
- Restock supplies
- Conduct After Action Review (AAR) as soon as possible
- Encourage stakeholders (internal and external) to prepare for next storm

4-26

 AWR-331 Winter Weather Hazards:
Science and Preparedness 



Summary

- Described the organizational structure of the National Weather Service and private sector meteorological companies
- Defined official winter weather outlooks, advisories, watches, and warnings
- Listed techniques to prepare for and address the challenges created by winter weather

4-27



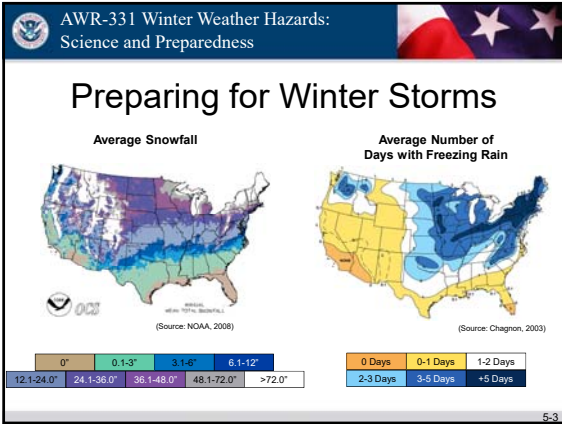
**AWR-331 Winter Weather Hazards:
Science and Preparedness**
Module 5: Winter Storm Scenario
Version 1.0
 FEMA

 AWR-331 Winter Weather Hazards:
Science and Preparedness 

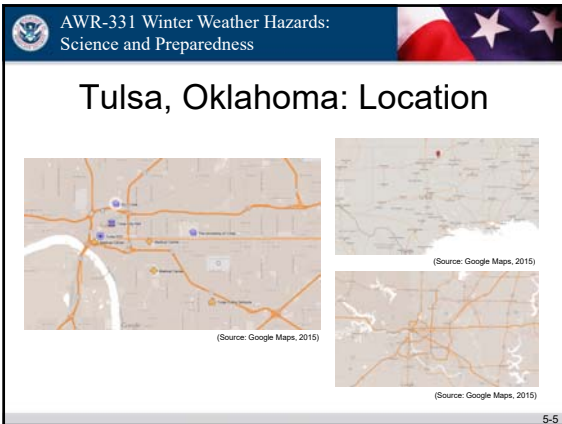
Enabling Learning Objectives

- 5-1 Participate in a guided winter storm activity
- 5-2 Identify the potential for various winter weather hazards in participants' area of responsibility
- 5-3 Understand lessons learned from a historical winter storm incident

5-2



- AWR-331 Winter Weather Hazards: Science and Preparedness
- ## Winter Storm Activity
- (60 minutes)
1. Break into five groups
 2. Utilize Module 5 Activity handouts
 3. Divide into groups of five professions
 - a. County Emergency Manager
 - b. School Administrator/Superintendent
 - c. Hospital Administrator
 - d. Department of Transportation/Public Works
 - e. First Responder (Police, Fire, HazMat, EMS)
 4. Instructor will review handouts and lead discussions
- 5-4



AWR-331 Winter Weather Hazards: Science and Preparedness

Tulsa, Oklahoma: Information

- Average December temperature: 49.3/29.6
- Average December rain: 2.49"
- Average snowfall: 2.3"
 - Record snowfall: 11.4"
- Population: 399,682
- Transportation:
 - Two airports
 - 97 buses on 19 routes; no rail
 - Large highway system

5-6

AWR-331 Winter Weather Hazards: Science and Preparedness

Activity Timeline Tuesday (Day 1)

Hazardous Weather Outlook 1 Issued

Forecasted hazardous conditions

Tuesday Wednesday Thursday Friday Saturday Sunday Monday Tuesday Wednesday

Hazardous Weather Outlook 1 (Module 5 Activity, page 9):

- ◇ There is potential for ice accumulation following freezing rain late in the coming weekend.
- ◇ Saturday: Winter weather potential
- ◇ Sunday: Cold front passage, freezing rain possible
- ◇ Monday: Freezing rain possible

5-7

AWR-331 Winter Weather Hazards: Science and Preparedness

Activity Timeline Wednesday (Day 2)

Hazardous Weather Outlook 2 Issued

Forecasted hazardous conditions

Tuesday Wednesday Thursday Friday Saturday Sunday Monday Tuesday Wednesday

Hazardous Weather Outlook 2 (Module 5 Activity, page 10):

- ◇ There is potential for ice accumulation following freezing rain late in the coming weekend **into early next week.**
- ◇ Saturday: Thunderstorm potential
- ◇ Sunday: Thunderstorms and freezing rain possible with cold front passage
- ◇ Monday: Freezing rain possible
- ◇ Tuesday: Freezing rain possible following second cold front passage

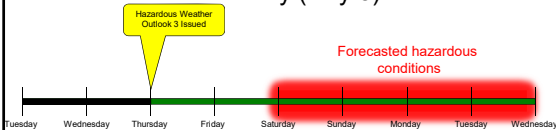
5-8

Class Discussion

- Think about the professional role you represent. What are your primary concerns if this ice storm threatens your area of responsibility?
- Generate a short email message to disseminate to staff and stakeholders pertaining to the potential for hazardous weather.

5-9

Activity Timeline Thursday (Day 3)



Hazardous Weather Outlook 3 (Module 5 Activity, page 11-13):

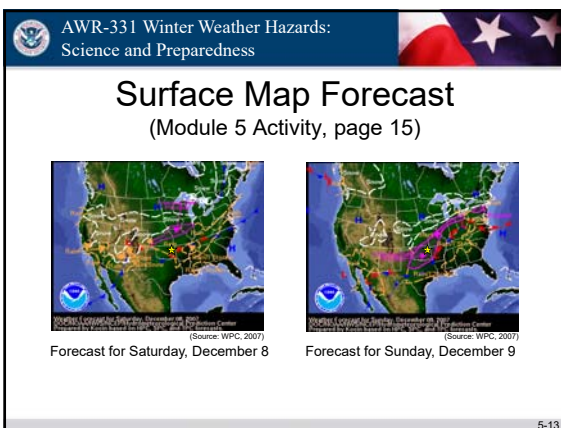
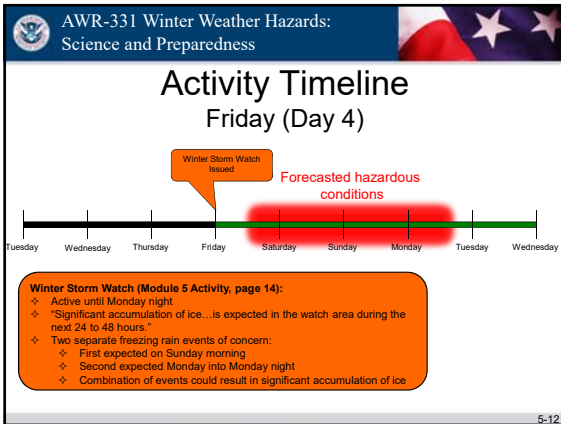
- ✦ Continued confidence of a long-term freezing rain event from the coming weekend to the middle of next week
 - ✦ Saturday: Thunderstorms possible
 - ✦ Sunday: Significant ice accumulation from freezing rain possible
 - ✦ Monday: Significant ice accumulation from freezing rain possible
 - ✦ Tuesday: Freezing rain possible
 - ✦ Wednesday: Freezing rain possible

5-10

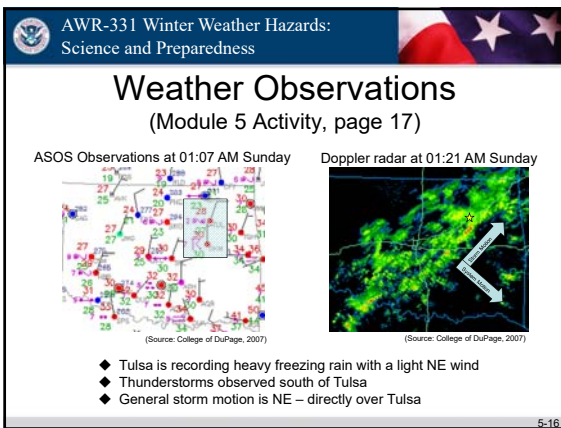
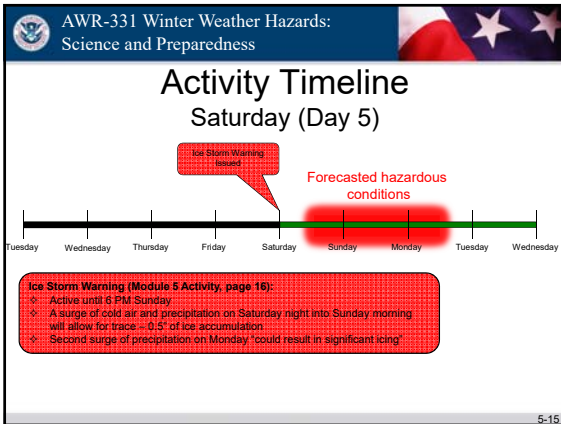
Class Discussion

- What type of preparations should be made this morning for your profession?
- The NWS WFOs are hosting telephone and internet-based emergency management briefings today/tomorrow. What questions will you ask them?
- Based on what you have learned about official NWS winter weather products, what is the next type of public safety product that you should expect if the situation escalates?

5-11



- AWR-331 Winter Weather Hazards: Science and Preparedness
- ## Class Discussion
- What challenges do you expect from two separate freezing rain events?
 - Do you expect your incident complexity to rise as the event proceeds into the workweek?
 - Generate a public statement to disseminate to local media pertaining to the potential for hazardous weather.
- 5-14

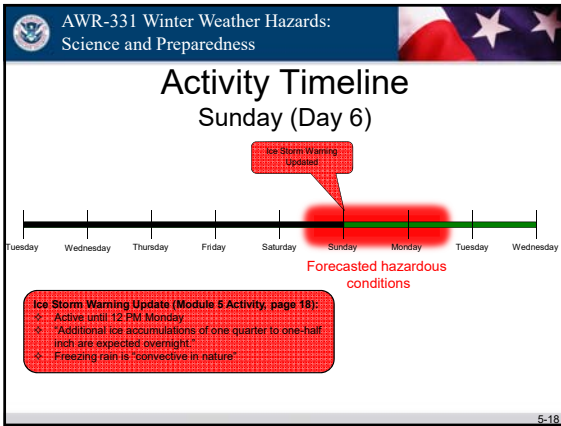


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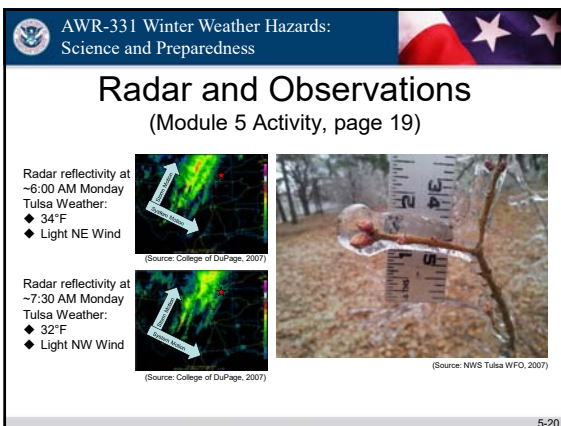
Class Discussion

- Based on knowledge of weather radar obtained from this course, are the text products you have read so far consistent with the surface maps and radar you have seen?
- Are there any final preparations you would like to make or activities you would like to coordinate with your partners?

5-17



- AWR-331 Winter Weather Hazards: Science and Preparedness
- ## Storm Situation Report
- More than 29,000 power outages at this time
 - Many motor vehicle crashes, some fatal
 - All DOT crews state-wide are out clearing roadways
 - American Red Cross has opened three warming shelters
 - Power lines observed to have 0.25"-1.5" of ice accumulation
- 5-19



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Class Discussion

Now that the second storm is beginning to hit, how do you plan to handle the following:

- Road clearances?
- Injured and/or stranded persons?
- Hospital surge?
- 9-1-1 calls for service?
- Other unforeseen incidents?

5-21

AWR-331 Winter Weather Hazards: Science and Preparedness

Activity Timeline

Monday (Day 7)

Ice Storm Warning Updated

Forecasted hazardous conditions

Ice Storm Warning Update (Module 5 Activity, page 20):

- Active until 12 PM Tuesday
- Temperatures are remaining around 32°F and expected to remain low overnight
- Widespread precipitation is expected to continue through the afternoon and evening

5-22

AWR-331 Winter Weather Hazards: Science and Preparedness

Significant Ice Accumulation

Freezing rain damage in Norman, OK

(Source: Owen Sheeh, 2007)

(Source: Owen Sheeh, 2007)

(Source: Owen Sheeh, 2007)

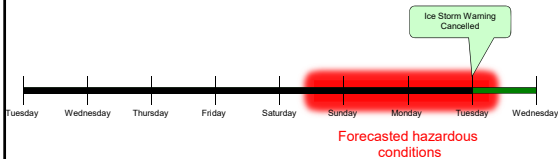
5-23

Storm Situation Report

- 634,749 power outages at this time
- State EOC remains active
- 29 shelters are now open state-wide; mass-feeding operations are taking place
- State OEM will open a call center on Thursday to assist with damage assessment and reporting needs

5-24

Activity Timeline Tuesday (Day 8)



Ice Storm Warning Cancellation:

- ◇ Temperatures are remaining above 32°F
- ◇ Icy conditions continue to be reported but no additional accumulation of ice is expected

5-25

Class Discussion


- How long do you expect to be affected by this storm? What type of short- or long-term response activities will you be focusing on?
- Based on your roles/responsibilities: what are your priorities moving forward?
- What does "recovery" look like to you in this incident?
- What is the potential economic impact on business and government?

5-26

AWR-331 Winter Weather Hazards: Science and Preparedness

Freezing Rain Event (1 of 3)

Oklahoma Freezing Rain Event Started December 9, 2007



(Source: Rob Ferguson, 2007) (Source: Rob Ferguson, 2007)

5-27

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Freezing Rain Event (2 of 3)

Freezing rain event damage in Moore, OK




(Source: Gayland Kitch, Director of Emergency Management and Communications for Moore, OK, 2007)

5-28

AWR-331 Winter Weather Hazards: Science and Preparedness

Freezing Rain Event (3 of 3)



(Source: Beverly Reese, 2007) (Source: AP/News Tribune, Julie Smith, 2007)

Tree trimming following ice storm damage in Jefferson City, MO

Freezing rain event damage in Norman, OK

5-29

Casualties from the Storm

- 29 ice storm-related fatalities:
 - 16 in motor vehicle accidents
 - 9 in house fires
 - 2 from CO poisoning
 - 2 from hypothermia
- Area 2-1-1 and 9-1-1 call centers operated 24/7 and took more than 4x normal call volume



(Source: NWS Tulsa WFO, 2007)

5-30

The Aftermath

- More than 25 counties in OK affected by storm
- More than 630,000 customers without power at one time
- 1.5"-3" of ice observed from Oklahoma City to Tulsa (many other areas received 0.25"-0.5")
- Presidential Disaster Declaration granted for public assistance (FEMA-1735-DR)

5-31

Summary

- Participated in a guided winter storm exercise
- Identified potential for winter weather hazards in local area
- Reviewed lessons learned from ice storm event and discussed how to apply understanding to other winter weather hazards

5-32



AWR-331 Winter Weather Hazards: Science and Preparedness

Enabling Learning Objectives

- 6-1 Share lessons learned gathered from the course
- 6-2 Identify additional resources and training opportunities
- 6-3 Provide feedback on a course evaluation form
- 6-4 Complete a post-test

6-2

AWR-331 Winter Weather Hazards: Science and Preparedness

Course Summary

This course prepared participants to understand the basics of winter weather science, forecasting, warning, and preparedness.

6-3

AWR-331 Winter Weather Hazards: Science and Preparedness

Additional Resources

- National Weather Service Homepage
<http://www.weather.gov/>
- National Weather Service Winter Storm Safety
<http://www.nws.noaa.gov/os/winter/>
- NDPTC Courses:
 - AWR-326 Tornado Awareness
 - AWR-332 Hazardous Weather Preparedness for Campuses
 - PER-304 Social Media for Natural Disaster Response and Recovery

6-4

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Discussion

Questions? Comments? Thoughts?

6-5

AWR-331 Winter Weather Hazards: Science and Preparedness

Course Evaluation

Student Assessment of Course and Instructors

Section 1: Student Assessment of Course		Section 2: Student Assessment of Instructors	
Item	Rating	Item	Rating
1. Course content was relevant to the program.		1. Instructor was knowledgeable about the subject.	
2. Course content was presented in an interesting manner.		2. Instructor was well organized.	
3. Course content was presented in a logical sequence.		3. Instructor was clear in presentation.	
4. Course content was presented in a clear and concise manner.		4. Instructor was easy to understand.	
5. Course content was presented in a timely manner.		5. Instructor was fair in grading.	
6. Course content was presented in a manner that was easy to understand.		6. Instructor was helpful in explaining assignments.	
7. Course content was presented in a manner that was easy to learn from.		7. Instructor was helpful in explaining assignments.	
8. Course content was presented in a manner that was easy to learn from.		8. Instructor was helpful in explaining assignments.	
9. Course content was presented in a manner that was easy to learn from.		9. Instructor was helpful in explaining assignments.	
10. Course content was presented in a manner that was easy to learn from.		10. Instructor was helpful in explaining assignments.	

6-6

AWR-331 Winter Weather Hazards: Science and Preparedness

Post-Test

The image shows a 'Test Answer Sheet' from the National Disaster Preparedness Training Center. It includes fields for 'Test Name', 'Date', and 'Test ID'. Below these are instructions for marking answers: 'Mark the correct answer by filling in the circle next to the letter of the correct answer.' A grid of 20 questions is visible, each with five options (A-E) and a bubble for marking the answer.

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National Domestic Preparedness Consortium

[instrumental music]

www.ndpc.us

Logos shown include: FEMA, NDPTC, NCBRT, and others.

AWR-331 Winter Weather Hazards: Science and Preparedness

Thank You!

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