1. Data Quality

Instructor Notes: Welcome to the AWOC Data Quality IC, Lesson #2 on data quality issues with spotter reports. This lesson should last for approximately 20 minutes.

Student Notes:


Data Quality

Advanced Warning Operations Course
IC Core 4
Lesson 2: Spotter Reports
Warning Decision Training Branch

2. Learning Objectives

Instructor Notes: There are three learning objectives for this lesson. First, we'll present the different sources of spotter reports for a forecast office during warning operations. Students should be able to identify them and know their strengths and limitations. Second, this lesson will provide several ways in which errors enter storm reports. In some cases, the observation or method of observations is erroneous. In other cases, the communication of that report creates error. Students should be able identify these common sources of error. Lastly, the lesson will also give some steps to mitigate erroneous storm reports during warning operations. These steps can be done to filter out bad reports (or at least minimize them). The goal is that these reports do not impact warning operations in a negative way. Students should know these different steps.

Student Notes:

Learning Objectives

1. Identify the various sources of storm reports along with their strengths and weaknesses
2. List the ways reports can be erroneous
3. List steps used to mitigate erroneous reports from impacting severe weather operations

3. Performance Objectives

Instructor Notes: In addition to the learning objectives, there is one performance objective for this lesson. An important note is that the performance objective will NOT be part of the examination process at the conclusion of this instructional component. The performance objective is to demonstrate the ability to mitigate erroneous spotter reports from impacting severe weather operations. It's not expected that all errors will be eliminated or corrected. However, reports with obvious errors should be recognized through simple QC procedures.

Student Notes:

Performance Objectives

1. Demonstrate the ability to mitigate erroneous spotter reports from impacting severe weather operations

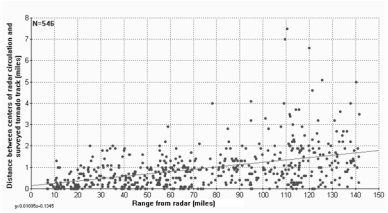
4. Importance of Spotter Reports

Instructor Notes: We're all familiar with the importance of spotters since observations of any kind are crucial during warning operations. While all observational data have value, radar data and spotter reports are usually heavily weighted during warning operations. Radar data, with all of its benefits, do have some significant limitations, especially when looking at small features at long ranges. The graphic on the right shows that the distance between a tornado track and radar circulation can increase dramatically at long ranges (Speheger and Smith, 2004). Spotters are the forecasters eyes and ears in the field. They are very much like "sensors" that provide observations to the forecast office and help overcome some of the limitations of radar data.

Student Notes:

Importance of Spotter Reports

- Radar and spotters crucial in warning ops
- Radar data have limitations
- Spotters help overcome those limitations



Speheger and Smith (2004)

5. Spotter Network Composition

Instructor Notes: Like surface observations, spotters compose their own network of sensors. Using this analogy, there are numerous types of sensors in your spotter network. The primary source of data from your spotter network comes from the locally-trained spotters. In a little bit, we'll get into why that's a good thing. In many parts of the country, the media are also active components of your spotter network. Even in areas less active, the media is an informative communicator. In an ideal environment, they can provide something that the forecaster cannot get anywhere else…real-time video! In addition to your locally trained weather spotters, you may have other "experienced" spotters in your area. Many times, these other spotters might be storm chasers, researchers, or enthusiasts who are in your area because of the severe weather potential. Many of these folks are very educated about severe weather and are very knowledgeable spotters. They clearly want to help you do your job better. However, there are always a few, let's just call them "yahoos", that are more trouble than they are worth. The difficult thing for you as a forecaster is knowing which kind of person you're observation is coming from. If you are not familiar with a particular chaser and have questions about their report, skepticism of their reports validity may be valid. Besides the previously mentioned groups, you also have the general public. This group contains the average citizen, but can also include emergency personnel or other first responders to a weather induced emergency that have no experience or training in severe weather. All of these different groups, or "sensors", compose your spotter data network.

Student Notes:

Spotter Network Composition

- NWS trained spotters
- Media
- Other "experienced" spotters
- General Public

6. NWS Trained and "Other" Spotters

Instructor Notes: We've grouped the two most experienced spotter groups together because they have many of the same strengths and limitations. These spotters provide the most accurate reports of severe weather that you are likely to get. They are generally knowledgeable about severe weather threats and how they form. They are pro-active. Many use vehicles to track storms and follow a threatening storm. This dedication, understanding, and accuracy make them the backbone of any spotter network. Probably the biggest limitation with these spotter reports is communication. Many spotters have HAM radio and communicate directly with the WFO. However, some spotters pass reports to the Emergency Manager (or even a dispatcher, who passes along to the EM or forecast office). This "chain" of communication can lead to a data quality issue. Another potential problem is your local "characters" or "yahoos". While these folks may be few and far between, there are probably a couple in everyone's CWA. Many times there may be a political or personal reason for their behavior. Knowing the cause may often help mitigate any problems that occur. Chasers, while knowledgeable about phenomena, may not have the best grasp of the local area. Errors may creep into these reports as a result. Result – Much of the early progress in warning operations were due to spotter programs. Forecasters have relied on them for up to 60 years in some areas to help detect severe weather. The vast majority of these folks are excellent, although they may make an occasional honest mistake. On average, the most error-prone point in this group is when information takes several steps to make it to the forecast office.

Student Notes:

NWS Trained and "Other" Spotters

Pros
- Most accurate
- Knowledgeable
- Pro-active

Cons
- Communication issues
- Can be "characters"
- Chaser familiarity with local landmarks?

Results
- Best quality reports come from these spotters
- Most observation errors are honest ones
- Communication issues most likely problem

7. Media

Instructor Notes: While the media's involvement varies around the country, these breakdowns are generally true across the board. The media can be very knowledgeable spotters who provide timely information. In case of TV reports, they have the potential to provide visual feedback in way of pictures or video footage. Media are also strong communicators who are efficient at getting important information out to people, including forecast office. Because of time pressures, the media can relay information that is incorrect. The media may broadcast information in a manner that ultimately results in higher ratings, not in a manner that is optimal to the forecast office. If information is received through broadcast reports, the forecasters have to take the effort to contact the media about any questions they have, which reduces timeliness of the information. The end result depends on the media market. Logic suggests that the information that is received from broadcast media will be skewed towards larger populations. If media crews are following a storm and are able to broadcast live, the resulting video is a great benefit to forecasters. A positive partnership between the media and the WFO is critical to the long-term success of both in disseminating severe weather information to the general public.

Student Notes:

Media

Pros
- Timely information
- Video…sometimes
- Good communicators

Cons
- Errors from timeliness
- Not optimal for operations
- Passive communication

Results
- Coverage slanted toward larger populations
- Video is invaluable information
- Partnership is critical to long-term success

8. General Public

Instructor Notes: The general public can help fill gaps in your spotter network that are now well covered by the media or trained spotters. In most areas, the general public will outnumber trained spotters by at least an order of magnitude. Having more people means you have a greater chance of observing an event. Even if you do not receive info in real-time, the general public can be a great help with verification. The downside to reports from the general public is that they have limited experience and/or knowledge. Since many people do not know how to relay information to the NWS, these reports are often 2nd or 3rd hand and the information may be corrupted in transmission. These reports tend to come in later and are much more serendipitous than reports from other sources. The end result is, generally, the public will only report information that has a direct impact on them. Since the reports are primarily relayed through a third party, it can be very difficult to clarify any questions that forecasters have about the report. The relaying process itself may even cause errors. Because of their lack of knowledge, their lack of familiarity with communicating reports to the forecast office, and the time lag in getting reports in, most inaccuracies in spotter reports come from this group.

Student Notes:

General Public

Pros
- Population size
- Help with verification

Cons
- Less knowledgeable
- Less timely
- Serendipitous

Results
- Reports come from direct impacts to public
- Report quality hampered by relaying
- Most inaccuracies in reports come from public

9. Error Sources

Instructor Notes: While we have hit on some of these topics while discussing the report sources, we will now discuss the more commons sources of error with spotter reports: Poor observations – Some observations are just bad, while others are just honest mistakes. Many times, though, these reports can come in from people lacking the proper knowledge about storms. “Chain” error – The more people that a report has to go through, the more likely the information will be misreported to the forecast office. Even among knowledgeable people, this process can cause error. Anyone who has played the childhood game “Operator” is familiar with this process. Location juxtaposition – This problem is a subset of the “chain” error. It’s not uncommon for someone to write a spotters location down as the location of a phenomenon. Time juxtaposition – Similar to the previous error, it occurs when the received time is written down as the report time. Both

of the juxtaposition errors may be enhanced by workload issues. Terrain/visibility issues – Sometimes a report may be bad because it's just not possible to observe the phenomenon. Remote storms, rain-wrapped, or nocturnal tornadoes are all examples. Smoke stacks, or even grain silos, can add confusion as to what an observer really sees. This list is not all-inclusive. However, this list does contain the more common ones. As a result, it should not be a surprise that there is a significant error associated with incoming spotter reports. We are providing a conservative estimate of 10%. Some research suggests that the number could be as high as 30% in some areas of the country (Witt et. al, 1998).

Student Notes:

Error Sources

- Poor observation
- "Chain" error
- Location juxtaposition
- Time juxtaposition
- Terrain/visibility issues
- >10% of reports are bad

10. Mitigating Inaccurate Reports

Instructor Notes: Now that we have discussed the sources of error, here are some simple steps to mitigate their impact: First, Maintain good Situation Awareness (SA). You probably will not be able to quality control every report as it comes in due to time and/or staff issues. But, with good SA, you should be able to spot the more obvious bad reports. Next, use radar data to help quality control incoming reports. In some offices, an AWIPS workstation is located next to the HAM radio and phone areas. It is very helpful if these folks can take the time to try and match up incoming reports with radar data for those areas. Many questionable reports can be flagged in this manner. Even if you cannot do this step during warning operations due to staff or timing issues, it is recommended that you do this step as part of any post-mortem exercise. Third, find out if the report is second- or third-hand. If you are getting the report relayed to you by a dispatcher, it's at least second hand information. During a significant event, it's possible for these folks to receive numerous phone calls from different people with different reports. It can be easy for some reports to get mixed up, times and locations to be misread, etc. Try to avoid the "chain" error. You can't prevent it, but you can minimize the impact. If you know a questionable report was passed through a third party, consider contacting a spotter in the area directly and determine if they can corroborate the questionable report. In addition to knowing if the report has been passed on, you should know the report source. Is it a NWS spotter, media person, or the general public? If the report comes from a county with a good spotter network, 80-100% of events will have at least one report from a NWS

spotter. Conversely, a poor county network may result in a percentage closer to 30% (Baumgardt, 2004). While anyone can make an inaccurate report, trained spotters are the best source of information during events. If a member of the general public has provided a report that appears questionable, getting a report from a trained spotter in that same area may help clarify the issue. You probably won't catch every bad report using these steps, but you may be surprised by how many you do. These simple steps could reduce your inaccurate reports by half, maybe more.

Student Notes:

Mitigating Inaccurate Reports

- Maintain good SA
- Match reports to radar
- Try to avoid "chain"
- Know the report's origin
- Can reduce errors by half

11. Other Questions to Ask?

Instructor Notes: Here are some other questions to ask yourself (or better yet, the spotter)… Are they seeing it, or are they experiencing it? Does the person see a tornado, or has the tornado just ripped off their roof? The farther removed from something we are, the more likely we are to make a mistake in observing it. A common example is the apparent change in the size of the moon between moonrise and its peak in the sky. It looks so much bigger at moonrise because we have objects next to it to give it a frame of reference. Our eyes can be deceived much easier than more material evidence such as damage. Is there only one report? Let's face it, there will always be times when only one report is received for a particular storm. During the May 3rd tornado outbreak in OK and KS, 17% of the tornadoes were reported by only one source (Speheger et al., 2001). Since most storms will not garner that much interest from knowledgeable spotters, the percentage for most severe weather events will be higher than that. It's always nice if you can get multiple spotter reports of an event, but many times it just will not be possible. Are there any non-meteorological factors at play? Using the picture on the right as an example, how many reports do you expect to get from a forest vs. a large subdivision? What time do you have? You may think a report sounds inaccurate, but the reason may be the observer's watch is off. A variation of +/- 5 minutes is probably a reasonable variance to assume with all incoming reports. That's +/- a volume scan. It's possible for reports from fast moving storms, or even storms far from the radar, to appear bad because the observer just kept incorrect time.

Student Notes:

Other Questions to Ask?

- Seeing or experiencing?
- One or many reports?
- Non-meteorological factors at play?
- What time do you have?

12. Conclusions

Instructor Notes: A key point to this lesson is that the quality of information we receive from spotters depends on the source of that information. While any individual report may be good or bad regardless of its source, the general trends discussed in this lesson will average out over the long haul. That's why it's important to know the source of the information because it can give you a hint as to the quality of the information. Besides knowing the source of the information, you need to know how a report can go bad. While bad data is a single destination, there are many ways to get there. Being familiar with the more common sources of error will help you identify a bad report when it comes in. Identifying a bad report allows you to mitigate the impact that report has on your operations. Several ways to help do that were presented here, but you may have some of your own. In fact, your office may have some local policies that may help address some of the error situations presented. Now is as good time as any to review your local policies to make sure you understand them.

Student Notes:

Conclusions

- Data quality varies depending on source
- Important to know who's making reports
- Need to know how reports can go bad
- Taking basic QC steps can help mitigate the problem
- No better time than the present to review local office policy!

13. Questions???

Instructor Notes: If, after going through this lesson you have any questions, first ask your SOO. Your SOO is your local facilitator and should be able to help answer many questions. If you need additional info from what your SOO provided, send an e-mail to the address on the slide. This address sends the message to all the instructors involved with this IC. Our answer will be CC'd to your SOO so that they can answer any similar questions that come up in the future. We may also consider the question and answer for our FAQ page. Thanks for your time and good luck on the exam!

Student Notes:

Questions???

If you have any questions about this lesson:

1. First ask your SOO (or local facilitator)
2. If you need additional help, send an e-mail to iccore4@wdtb.noaa.gov (Instructors group – answers will be CC'd to the SOO and considered for the FAQ page)

Take test as soon as possible after Lesson 4