1. Using RWIS Data from MADIS in AWIPS

Instructor Notes: This module is the second part of a lesson discussing Tools for Monitoring Road Weather. This presentation discusses how RWIS data, via MADIS, are viewed in AWIPS, including all of the QC information that MADIS generates. This presentation should take approximately 15 minutes.

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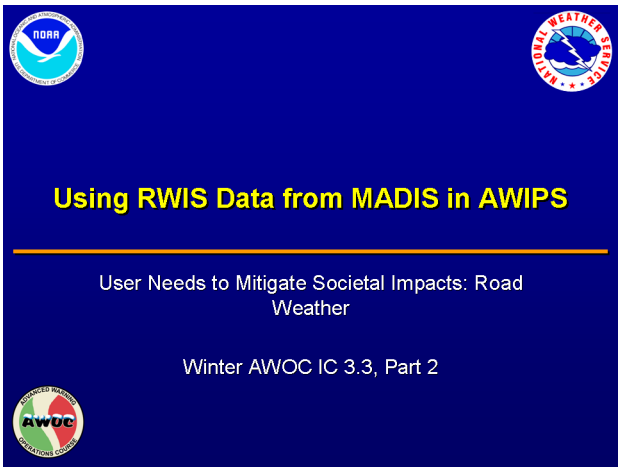

2. Learning Objective

Instructor Notes: There is one learning objective for this lesson: 1. Describe the most common issues NWS forecasters may encounter with using RWIS data (and other surface mesonetwork data from MADIS) operationally.

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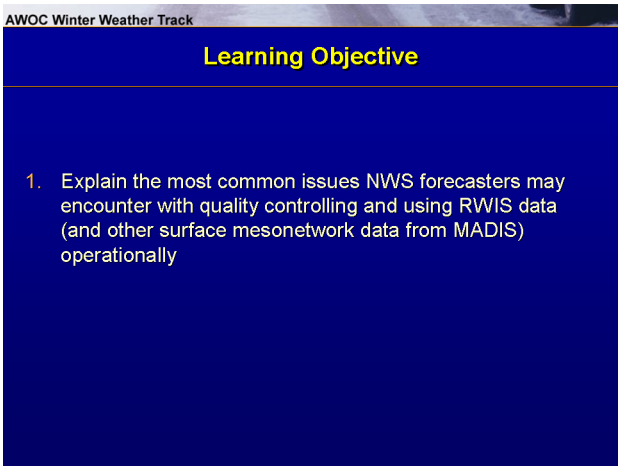

3. Availability of QC Data Important

Instructor Notes: Almost all forecast offices in the NWS are currently ingesting surface observations from local mesonets via MADIS. They may be using these data in local

mesoscale modeling efforts, to better monitor surface conditions, or possibly for some other reason. [CLICK] The MADIS data feed includes data from approximately 25-30 local and state DOTs around the U.S., as well as data from other surface mesonets. For all of these data, quality control (QC) is a primary concern. [CLICK] The level of data quality controls (QC) performed by each data provider is not easily known. Fortunately, MADIS performs a series of QC tests on all of the data they provide to their users. [CLICK] These QC data are displayable in AWIPS along with the observations. Since their data feed contains more than just RWIS data, the discussions in this module are also applicable to other mesonets in the MADIS feed. Before discussing how to use these QC data, we will first explain what QC data are available and what they mean.

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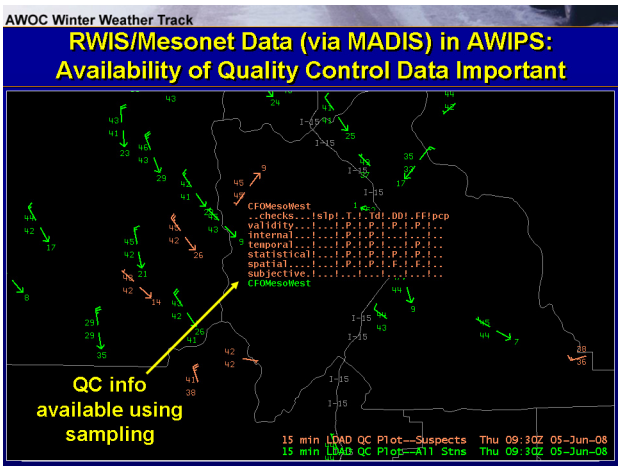

4. MADIS Automated QC Procedures

Instructor Notes: Because RWIS and other surface data available via MADIS have no standardized QC process, MADIS performs QC tests on all the data they provide to their users. There are a total of 6 quality control test results that MADIS provides its users and can be displayed in D-2D (MADIS, 2008). These QC tests include: [CLICK] A level 1 validity check to ensure observations fall within a range of tolerance limits; [CLICK] A level 2 internal consistency check for determining if certain reasonable meteorological relationships are maintained among observations at a specific site; [CLICK] A level 2 temporal consistency check for determining if the temporal rate of change of a specific observation falls with a range of tolerance limits; [CLICK] A level 2 statistical consistency check tests if a specific parameter has failed any QC test 75% of the time or greater during the last 7 days; [CLICK] A level 3 spatial consistency check is performed to see if an observation deviates significantly from neighboring, or “buddy”, sites; and [CLICK] A subjective test that allows MADIS and the local WFO to subjectively override the results of automated QC checks using a “reject” or “accept” list. For each of the tests, the “P” indicates the observation passed and the “F” indicates the observation failed.

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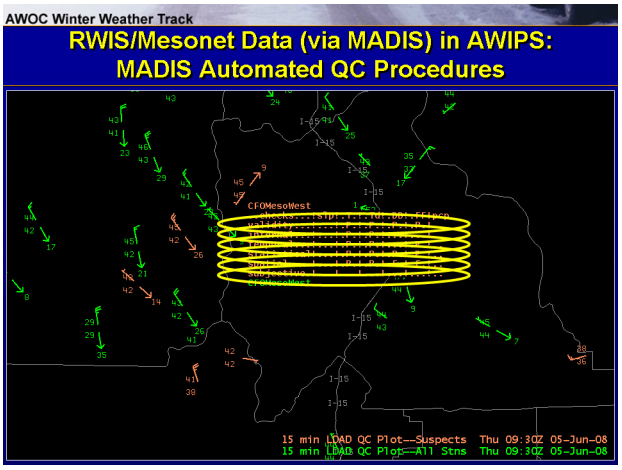

5. Displaying & Interpreting the QC Products

Instructor Notes: So let's take a moment and pull up one of the QC products and walk through what we see in AWIPS. Just to be complete, I'll show all the steps for loading the product. [CLICK] We start off by selecting the Obs menu [CLICK] and selecting Other Local Plots. You can visualize the QC plots for either the 30 min or 15 min products by selecting the item with "stn plot + QC" in the title. [CLICK] I selected the 15 min product for this example. [CLICK] Now we just need to sample each observation to pull up the QC test information. The green observations in the image have passed all of the QC tests while the salmon colored observations have failed at least one test for that particular observation. I'll pull up three different obs that failed different tests so you can get a better idea of interpreting the QC info. The first observation we'll look at is out here in the four corners region. Looking at the cursor readout, you can see that the observation failed the temporal test for temperature. In other words, there was too large of a change in temperature between observation times. In fact, just prior to this time the sensor experienced some form of malfunction and was reporting a temperature of -20 F. [CLICK] Moving on to the next ob, we'll look at this RWIS site in NW Nebraska. According the QC fields, this site failed a spatial, "or buddy", check for dew point temperature. At this particular time, this site had a dew point temperature 10-15 degrees F colder than surrounding sites. [CLICK] One last example I want to show you is in northern Kansas. In this example, this weather bug site with calm winds failed both the wind speed and direction spatial test as most surrounding sites observed winds of 10-15 kts out of the south.

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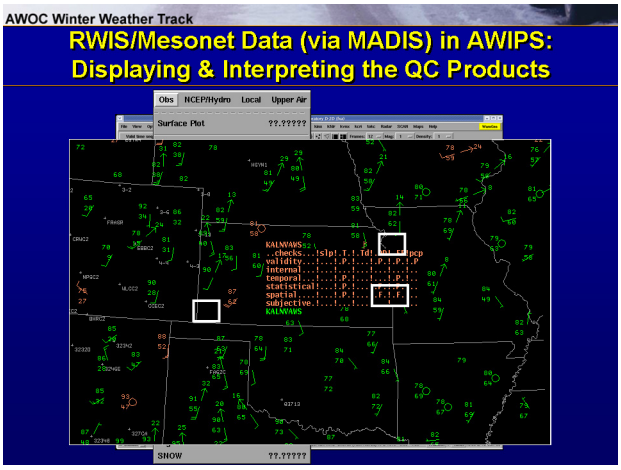

6. Spotting Calibration & Maintenance Issues

Instructor Notes: Instrument calibration and site maintenance are significant issues for any mesonet site, but possibly more so for RWIS. RWIS sites are either maintained by a private contractor (likely the original equipment vendor) or by the transportation operator's in-house staff. In either case, regular calibration and maintenance may not occur at the intervals that most meteorologists desire. [CLICK] Problems with calibration or maintenance could cause any of the MADIS QC test to fail consistently. [CLICK] Once the errors occur regularly (>75%) for at least a week, the statistical QC test should provide an indication that the sensor is failing (MADIS, 2008). This QC flag will continue to indicate the sensor is failing until the failure rate falls below 25% for a week's time. If a sensor at a given site, or all of the data for a single site, remain suspect for a lengthy period of time, they will be put on the "reject" list by MADIS and a 'F' will appear in the subjective line for that's sites parameters. The subjective "reject" list is updated on weekly basis by MADIS, so it's worthwhile to download that information regularly.

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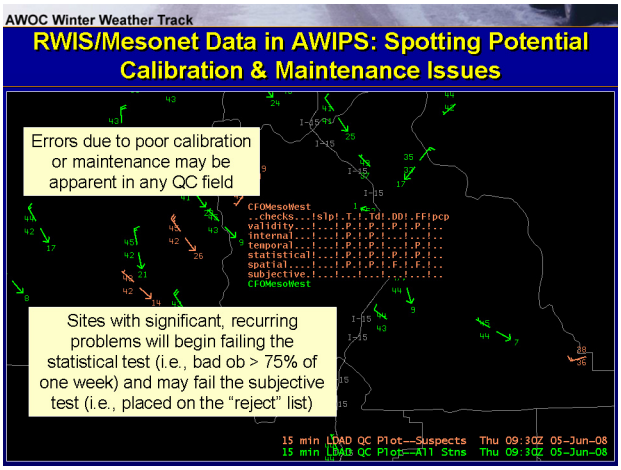

7. When Good Data May Fail a QC Test

Instructor Notes: It's important to remember that just because an observation fails one of the QC tests, it doesn't mean the observation is actually poor. [CLICK] For instance, quality observations may regularly fail "buddy" tests in mountainous terrain during certain conditions. The example shown here is from south of Salt Lake City (you can see I-15 running through the middle of the image). From the QC test fields, you can see that this particular observation failed the spatial test for wind speed and direction. It's pretty obvious why when you compare the observation to all the surrounding data. But is the observation incorrect? [CLICK] Here are the same observations with a surface terrain map overlay. In this second image, the observations that failed the QC are black while the other obs are grey. All of the QC failures in this image were due to the wind speed and/or direction spatial test. With the terrain overlaid on the observations, you get a better picture of what's going on in this example. [CLICK] The mountain to the north and west of the observation is blocking the northerly flow at the surface. [CLICK] So, as the winds near the surface flows down the valley south of Tooele, they turn southwesterly and slow down as they flow around the mountain barrier. This kind of observation isn't unexpected when you compare the data to the topography, but spatial QC tests don't pick up on these meso-to-microscale details.

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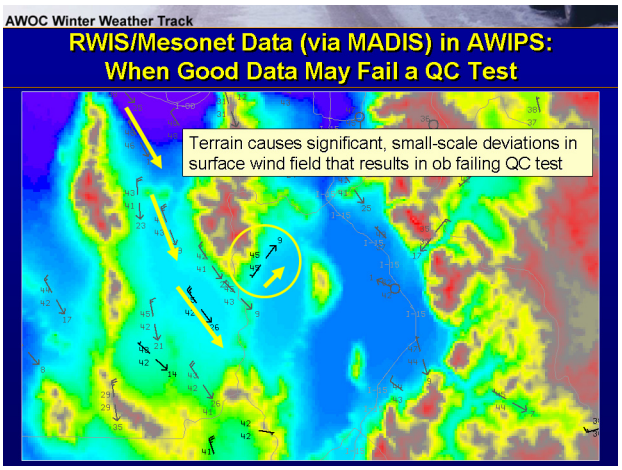

8. Identifying Network Owners & Metadata

Instructor Notes: There's just one last point I want to make on the quality control issue. [CLICK] As I said earlier, there are numerous surface observing networks included in the MADIS data feed. The vast number of observations available can be a little daunting. [CLICK] To see what I mean, just set the Density in your D-2D window to max and load the observations. [CLICK] There are so many observations in the larger urban areas that the data are almost unreadable even when you zoom in to the maximum extent. [CLICK] If you're using the MADIS data to monitor surface conditions, then you'll want to know the mesonet that site belongs to. Fortunately, if your office is using the mesonet super sampling configuration supplied by MADIS, then you can determine the station owner

easily enough. [CLICK] Just remember that some of the networks, like MesoWest, are actually composed of other, smaller networks. For these sub-networks, you can usually determine the owner by looking at the end of the “Location” field. In the example shown, the station is a SNOTEL site. The sampling feature in D-2D allows users to access what metadata is available for each site via MADIS. Some networks have more extensive metadata available on-line. [CLICK] For instance, the Clarus Initiative has already started posting metadata for some RWIS networks on their website (Clarus, 2008). You may be able to find similar metadata sites on-line for other surface networks. For the RWIS observations, metadata can help determine if a site is regionally or locally representative as well as other important details.

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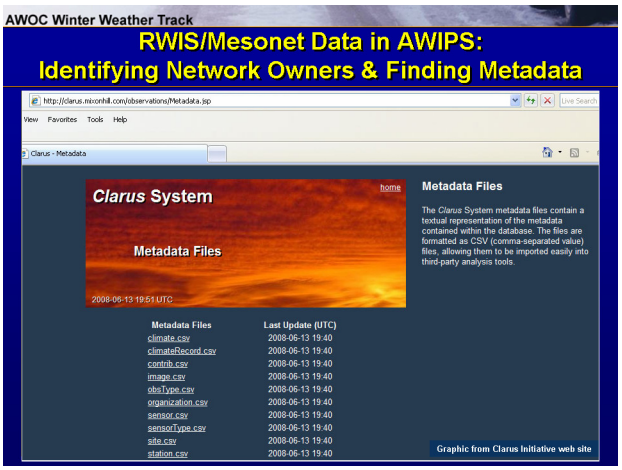

9. Interactive Question

Instructor Notes: Please take a few moments to read the question on the slide. Use your mouse to position the cursor over your answer and push the left-mouse button to proceed to the feedback slide.

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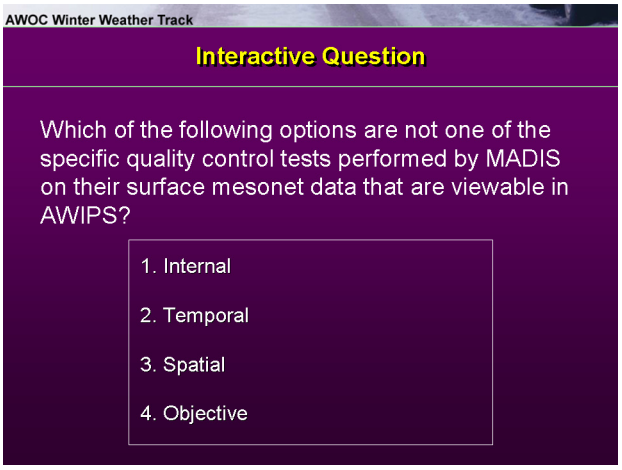

10. I'm Sorry, That's Incorrect

Instructor Notes:

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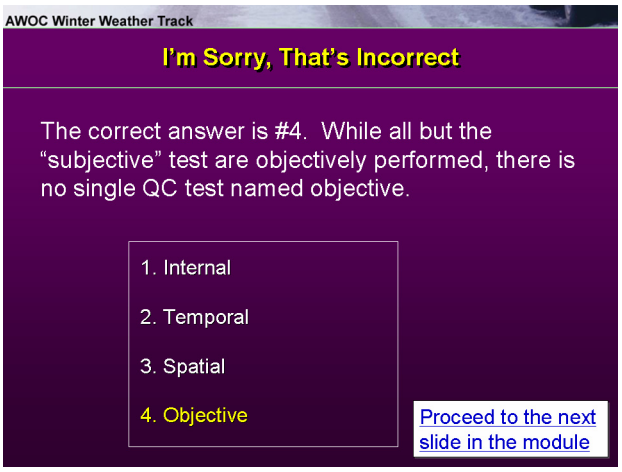

11. That's Correct!

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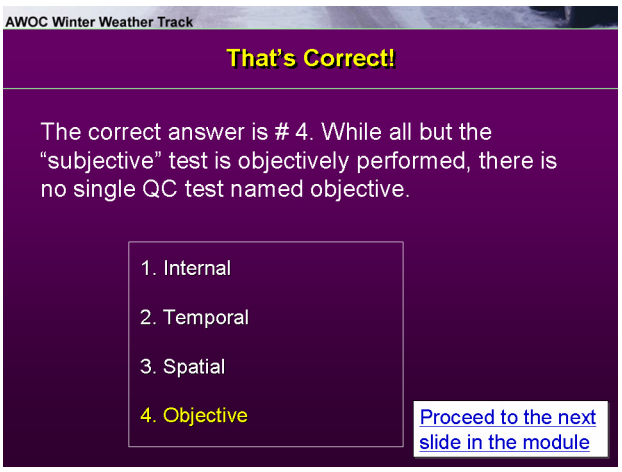

12. More Data Available Than May Be Visible

Instructor Notes: For those offices who are ingesting surface data from multiple networks (i.e., most WFOs), you are probably using the "mesonet super sampling" readout in your localization. This customization is great at decoding data from a variety of different networks simultaneously. [CLICK] This readout is easier to interpret than the raw sampling information that you see on the right. There's even some information in the customized readout, such as the Mesonet and Location IDs, that do not appear in the raw sampling information. There's just one catch, though. [CLICK] Sometimes, there is

information in the netCDF file that does not get displayed in the super sampling readout, but does appear in the raw sampling display. The raw sampling display lists all of the information from that network's .desc file. [CLICK] Here is an example of what that file looks like. As you look down the list of data in the file, you can see that the last four variables fit into this category. Depending on how you are using the surface observations, there may be data in the netCDF file that you want to access. [CLICK] In the example shown, the Oklahoma Mesonet data includes 4 cm soil temperature. Many of the RWIS networks include pavement temperature in their data. As discussed in previous modules, RST data can be very useful to NWS forecasters during winter weather and fog forecasting.

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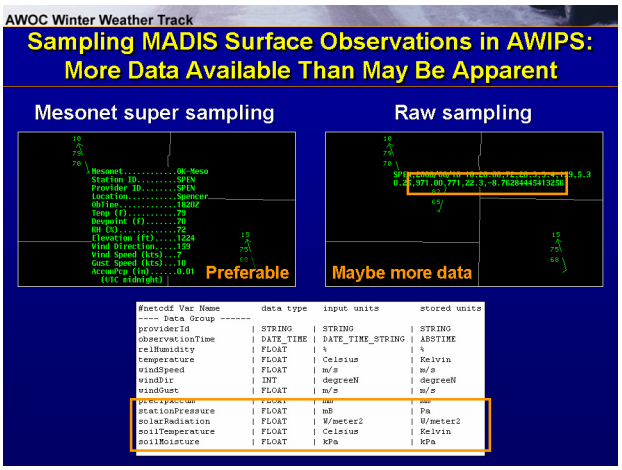

13. Local Customizations & On-Line Access

Instructor Notes: If there are data visibile in the raw sampling that you wish to access operationally, there are a couple of things you can do. [CLICK] First, you can customize your local AWIPS workstation displays to add the sensor data to the sampling readout. If you decided to go down this road, I strongly suggest you talk with the folks from MADIS on how to proceed. In addition to making the data visible, you may wish to create map overlays for the various surface data networks in your CWA. These overlays can be beneficial for forecasters to help them remember which networks provide what data parameters. [CLICK] Another option is to access these observations on-line. You can use the MADIS Text/XML surface data viewer page to access the data in standard text, XML, or Comma-delimitted formats (MADIS, 2008). [CLICK] You could also try accessing the data from the network owner's web site, if they make that data available on-line in real-time. Many DOTs have web sites where they post RWIS data as well as other useful road and weather condition information. If there is only one or two RWIS networks in your CWA with these sorts of web sites, you might want to consider adding these pages to your office SA displays or have someone regularly monitor the information. Some of these sites may include observations from plow drivers and public safety personnel during inclement weather that are not available anywhere else.

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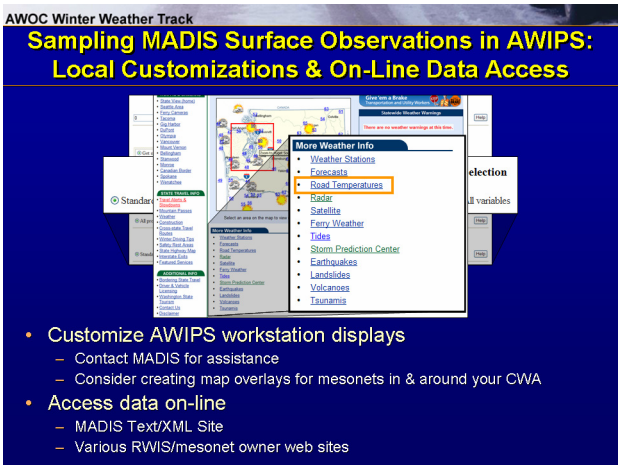

14. Significant Data Lags Are Possible

Instructor Notes: There's two last points to remember when viewing surface mesonet data from MADIS in AWIPS. [CLICK] Occasionally, there's a signficant time lag between when the observation was taken and when it's available for viewing. [CLICK] This time lag can be anywhere from a few minutes to over half an hour. Additionally, depending on which menu item you use to display the data in D-2D, you may notice observations appearing, disappearing, and then reappearing. [CLICK] This behavior is due to the data time matching the frames in the display loop. For instance, if you load 15 minute observations and a local mesonet only updates its data every 30 or 60 minutes, those observations may not be visible for the in between time frames. For this time matching issue, remember that you have to ability to load the local data at 30, 15, 5, and 1 minute intervals. If you are overlaying these observations with other data, try to match the mesonet intervals with the intervals of the other products you are displaying. That should insure the best time matching. And, even if an observation is late, the data should show up eventually.

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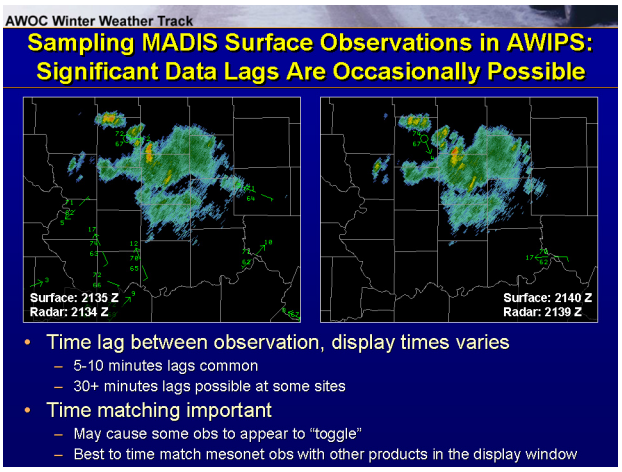
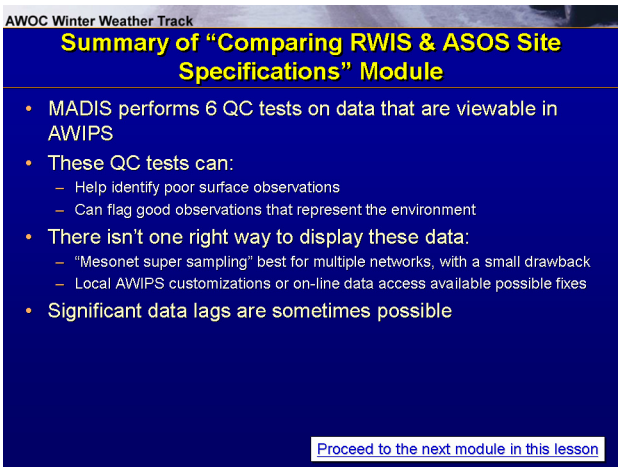


15. Summary

Instructor Notes: In summary, this module discussed some of the primary issues when viewing MADIS surface observations in AWIPS. Much of that discussion was focused on quality control issues. [CLICK] MADIS provides the results of 6 QC tests to data users that can be displayed in AWIPS. [CLICK] These QC tests results are beneficial to NWS forecasters because they can help them identify poor surface observations in the data feed. However, it's important to remember that not all flagged data are necessarily poor. Sometimes, observations that are environmentally representative of that location are flagged such as in areas of significant terrain. [CLICK] When viewing these data, it's important to remember that you have some options (i.e., there is not a single correct way). For offices that ingest data from numerous surface networks, the "mesonet super sampling" format provides users with an easy to read and flexible cursor readout. The only downside is that some data may not be displayable. If that data may be of use to your office, you can customize your localization or view the data on-line. [CLICK] When viewing mesonet data in AWIPS, some data may lag in the display panel when compared to other observations. Usually, these lags are not significant, but they can occasionally be 30 minutes or more. Also, remember to properly time match mesonet data with other data you choose to display in the same window. [CLICK] To proceed to the next section of this lesson, click on the link at the bottom of the slide or use the navigation in the NWS Learning Center.

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