Talking points for MCS

1. Title slide
2. Learning objective
3. This is the GOES-16 IR band at 10.3 microns during an event in June 2018. In this loop we observe various clusters of thunderstorms grow upscale into various MCSs with the primary MCS being in Nebraska and Kansas by the end of the loop. MCSs tend to develop during the overnight hours, making the IR channel at 10.3 micron ideal for monitoring MCS activity. Individual updrafts can be observed via cloud top cooling, along with the expansion of anvil cirrus. Gravity waves can be seen on top of the convective updrafts associated with the MCS as ripples or lines that emanate away from the source (which in this case is the convective updraft).
4. This is a 4 panel display over the same time period, except now we add the 3 water vapor bands from GOES-16 in addition to the IR band at 10.3 microns. Details of the overshooting tops aren't quite as clear in the water vapor bands compared to the IR band, however gravity waves show up quite well. Gravity waves are important for monitoring the potential for turbulence and may initiate new convection. Short waves may also be monitored in the water vapor bands and may initiate new convection. Next, we'll focus in on the low-level water vapor band at 7.3 microns since this is the water vapor band with the lowest in altitude in weighting function profiles of the 3 water vapor bands.
5. This is the 1-minute imagery from GOES-16 7.3 micron band. Gravity waves are readily observed as lines emanating away from convective updrafts. You will see more gravity waves when looking at 1-minute imagery compared to looking at 5-minute imagery. Consider how you might make best use of this imagery when monitoring for turbulence.
6. We switch to a different time period, earlier than we were just looking at. Note the different sizes of the MCSs we observe during this time period, the obvious one is the large MCS across the Dakotas that moves into Minnesota. On the northwest flank of this MCS note the transverse bands along the edge of the anvil cirrus. There are other MCSs across the scene further to the southwest in Nebraska, along with a relatively small MCS in northwest Kansas. The improved spatial and temporal resolution of the GOES-R series will really help in identifying these smaller MCSs that may have been much more subtle in the pre-GOES-R series. Two key aspects of monitoring MCS activity include identifying the decay of an MCS (typically during morning hours) and also the potential for convective redevelopment along outflow boundaries produced by the MCS. MCS decay can be assessed by the decreased rate of expansion of the convective cloud shield followed by a warming trend in the coldest cloud tops as well as the convective cloud shield. For potential convective redevelopment along outflow boundaries produced by the MCS, we'll make use of the visible imagery with its higher spatial resolution.
7. We move on to the visible imagery as daylight is now available. Remember that MCS activity primarily occurs at night, so that the IR band at 10.3 microns will usually be your top priority in monitoring MCSs. During the daylight hours, you can utilize the higher resolution visible band at 0.5 km resolution to monitor MCS decay and outflow boundaries. These outflow boundaries can lead to convective initiation with daytime heating. Pay particular attention to MCS outflow boundaries that interact with other boundaries such as fronts, drylines, sea and lake-breeze

boundaries and so forth. Note that the MCS that moved from Minnesota into Wisconsin leaves behind a mesoscale convective vortex (or MCV) that can provide a source of convergence and vorticity for later thunderstorm development. There is another MCV left behind by the smaller MCS in northwest Kansas. Go back to the IR loop on the previous slide to see if you would've observed either of these MCV's in the IR imagery alone.

8. We move on to a different case to look more closely at another MCV. This IR loop shows a decaying MCS over the Dallas region, which leaves behind a MCV that can be seen by the end of the loop. Further west, we see a region of low clouds with no convection, but seems to have circulation associated with it. Is this a MCV? We'll use the visible imagery with its higher resolution to help answer that question.
9. This is the associated visible band at 0.64 microns during daylight hours. The higher spatial resolution of the visible band allows you to observe details of the MCV, including how convectively active it is and where convection may have a tendency to develop. Note that the smaller MCV to the west without any convection is much more clearly identified. The key to monitoring MCV detection is sufficiently long IR loops during the overnight hours that have continuity into the daytime hours where the higher resolution visible band can be used to watch for MCS decay that leaves behind a MCV.
10. Time for an interactive exercise. Consider a comparison between pre-GOES-R series imagery with GOES-R series imagery in this GOES-15 versus GOES-16 loop of a MCS. The GOES-15 loop is bit rough since it is being time matched to the GOES-16 loop, and the same color table is applied to each loop. The question I ask is, how does the improved spatial resolution of the GOES-R series aid in your identification and tracking of MCSs? I'll give you some time to think about this.
11. With so much more detail available in GOES-16 versus GOES-15, it may be possible to identify MCS development and decay earlier than you would've with the more coarse GOES-15 imagery. Much greater detail is observed at cloud top with the overshooting tops. How about aviation forecasting, how will this benefit from being able to see so much more detail with gravity waves (and potential regions of turbulence). How about MCV identification left in the wake of decaying MCSs? This should be an enormous help for MCVs that can be subtle for a variety of reasons. These are some ideas for having an open mind on ways to analyze higher resolution data to improve skill in monitoring hazards associated with MCSs.
12. Summary