Talking points for MCS

1. Title slide
2. Learning objective
3. As proxy data for GOES-R, we'll be making use of imagery from the Himawari satellite. This is the IR band at 10.4 microns. In this loop we observe various clusters of thunderstorms grow upscale into a MCS. Hopefully the thing that strikes you the most is how many more details we see in this imagery at 2 km resolution compared to current GOES IR band at 4 km resolution. The details include individual cloud tops, their evolution and how readily gravity waves appear. The 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 the Himawari 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, this band would be the most useful in analyzing gravity waves. Gravity waves are these lines emanating away from convective updrafts. You will see more gravity waves in GOES-R compared to current GOES due to increased resolution and the additional bands, remember they are important potential regions of turbulence and may initiate new convection. Late in the loop we also see gravity waves here resulting from convection off the screen moving towards the southwest. Note the details in the cloud tops aren't quite as clear as that from the IR 10.4 micron band.
5. 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.
6. 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 10.4 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 as we see in this loop where an outflow boundary on the southern flank leads to additional convection. Pay particular attention to MCS outflow boundaries that interact with other boundaries such as fronts, drylines, sea and lake-breeze boundaries and so forth.
7. We move on to a different case to look more closely at another aspect of MCS monitoring and that is an MCS that leaves behind a mesoscale convective vortex (or MCV) that can provide a source of convergence and vorticity for later thunderstorm development. In this example, we see a line of thunderstorm grow upscale into an MCS. The MCS later decays but leaves behind a conspicuous circulation which is the MCV. The MCV should be monitored for later convective development not only as seen here in the IR band, but also the visible band.

8. 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 the stable air mass left in the wake of the MCV with obvious outflow from the east.
9. In this 4 panel plot, we place emphasis on particular channels to monitor MCS activity. The IR band at 10.4 microns should be the top priority, not just because MCSs tend to develop at night, but you can also observe continuity into the daytime hours. Watch cloud top temperature trends not only during development stages, but also the decay phase and circulations that may appear thereafter associated with a MCV. The visible channel will typically catch MCS activity during the decaying stages during the morning hours, and it plays a key role in monitoring for potential later convective development along MCS outflow boundaries or MCV. On the bottom panels I show 2 of the 3 water vapor bands (omitting the upper level water vapor band). You can monitor the potential for shortwaves that may interact with a MCS, get an idea of the 3-dimensional flow looking at clouds at different levels between channels and you should find great detail in gravity waves spawned by MCSs in the 7.3 micron band.
10. Time for an interactive exercise. Consider what you have now for tracking MCSs with current GOES at 4 km and compare with GOES-R at 2 km which is what we've been showing with our Himawari examples. In this example I show an MCS west of Hawaii with current GOES, then a time matched view from Himawari with the same band and color table for comparison. Keep in mind this is on the limb for Himawari, which degrades the spatial resolution to some extent. This is not a time resolution comparison, but the idea to convey here is improved spatial resolution of GOES-R. The question I ask is …. I'll give you some time to think about this.
11. With so much more detail available in GOES-R versus current GOES, it may be possible to identify MCS development and decay earlier than you would've with the more blocky current GOES imagery. With the greater detail at cloud top, will this have useful information operationally? Perhaps, as experience grows and potentially research is done. 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). We did not show a temporal resolution comparison here, but you will also need to consider how will 1-minute imagery be optimally utilized to detect trends in MCSs? These are ideas for having an open mind on ways to analyze higher resolution data to improve skill in monitoring hazards associated with MCSs.
12. Summary