

MCV 2022 Lesson Script

1. This is the VISIT lesson on Mesoscale Convective Vortices. There are convectively-generated features that can persist and influence subsequent development of weather.
2. This lesson will show you some examples of MCVs, help you remember the environment in which the systems form and persist, and show examples of how MCVs can affect local weather.
3. If you're old-school now, you might remember when these were called 'Neddies', or 'Neddy Eddies', as Edward "Ned" Johnston was one of the first researchers to discuss them. For a while they were also referred to as Mesoscale Vorticity Centers – MVCs. They typically emerge from underneath the cirrus canopy of a decaying MCC/MCS as the sun rises.
4. Think of MCVs as a potentially underforecast (or unforecast in the worst case) source of vorticity that might be moving towards an unstable airmass. The circulation around an MCV can shift the distribution of thermal and moisture fields. Numerical models can struggle with the accurate evolution of MCVs, either in their formation, or in their persistence, in part due to their convective nature. The formation of an MCV might therefore mean a forecast revision is necessary!
5. This is an example from 2016 -- note how the tornadoes on this day are clustered from Indiana into NW Ohio (and actually up into SW Ontario!) But that's far from the SLGT RSK issued at 1200 UTC on this day. What happened?
6. This slide shows the evolution of the SLGT RSK fields from 1200 to 1300 (not much change) to 1630 and 2000 (significant elongation to the east!) Note in the 1630 discussion that the presence of an MCV is noted. At 1200/1300 UTC, it had not yet emerged from the decaying system over the upper Midwest!
7. Mid-day MCD talks about the MCV as well, and how it might be aiding convection.
8. Hourly imagery from GOES-13 visible -- note the circulation moving eastward just to the south of the Great Lakes. The circulation is changing the shear profile in the environment in which thunderstorms are forming. Additionally, the circulation will move warmer/moist air northward, perhaps strengthening a warm front (shown in Figure 7)
9. What are some MCV characteristics? The circulation is cyclonic, and warm-core. It forms in the region of stratiform precipitation that develops within a nocturnal Mesoscale Convective System (MCS). The latent heat release in the stratiform precipitation is a diabatic heating process that causes convergence, and the convergence spins up vorticity. MCVs are mid-tropospheric phenomena, and can be present before the cirrus canopy erodes (allowing their spin to be viewed) if you look in radar imagery.
10. What helps MCVs initiate: Ample moisture, not much mid-level wind shear, slow evolution in atmosphere. What helps MCVs persist: Moisture! Instability! Generate new convection so there's another source of latent heating. Small wind shear. It's

relatively rare, though, for an MCV to persist for more than a day – usually because it moves into a harsher environment, that is an environment that causes an MCV to dissipate: an environment with strong stability/low moisture (so convection cannot develop) or high shear (so latent heat release is displaced from the MCV center). Kill off a MCV with more shear, or less stability/moisture

11. Will this MCV persist? It's moving towards low stability -- look at the contours of CAPE in the image. In addition, model winds (400- and 700-mb winds are plotted) show little change with height.
12. The MCV persists with time. And it spawns new convection. That's what you have to be alert for when an MCV is approaching: that it will spawn convection. Is it in the forecast?
13. Here's a MCD from SPC; the MCV location is indicated, and it's moving into a region of more instability. Consider also how the low-level circulation might change the low-level shear.
14. And what happened? Convection formed in the center of the MCV and also in regions to the east as it moved over them. I also really like -- in this visible animation -- the obvious gravity waves perturbing the surface cumulus field as the move out away from the MCV towards the Mississippi River. If an MCV is moving towards you -- say you're in the boot heel of Missouri on this data -- pay especial attention to any cumulus lines that might initiate into convection, because the forcing from the approaching vortex might give an extra boost to the development.
15. From the archives! An example from 2007. An MCV diving southward through Minnesota. As you view this animation, ask yourself: What kind of shear profiles should I expect over Minnesota? What kind of moisture is likely present?
16. The MCV is moving through a corridor of low shear, as depicted on the right by plots of 700-400 mb speed shear. And there is plenty of low-level moisture: look at the surface dewpoints. I would not expect this MCV necessarily to persist as it moved into Iowa, where shear increased markedly.
17. If you start the (pre-sunrise!) day with an MCS upstream of you, and you're wondering if an MCV will emerge and move over your CWA and affect you. Look at the shear. Is it strong? Look at the moisture. Is it abundant? These two things tip the scale towards an MCV affecting you. But does the MCV exist now? Maybe look at the precipitation under the MCS via radar. Has it already acquired spin? Pay close attention as the cirrus canopy erodes from the MCS after sunrise.
18. The environment that supports an MCV (low shear, abundant moisture) is similar to an environment that supports tropical cyclogenesis.
19. Relative Vorticity over 10 days tracks the MCV on its circuitous path to the Gulf of Mexico. The system starts in Kansas and at the end you'll see a Tropical Depression and then Storm. These are 700-mb vorticity fields from the SSEC/CIMSS Tropical Weather website. I put white Xs on the map to show the track of the impulse.

20. NHC was also interested. Why? Because the MCV is in an environment of small vertical shear and abundant moisture. And it's a source of vorticity for a nascent storm. So if it moves over the warm Gulf of Mexico...cyclogenesis might occur. Note that probabilities are increasing for that cyclogenesis as the system gets closer and closer to the Gulf.
21. Here's a long animation. Look at it until you can view the impulse moving through all the other weather occurring. It starts in Kansas, moves to Missouri, then southeastward through Tennessee and Alabama and then into Georgia before dropping south into the Gulf of Mexico.
22. Here's another example, from 2011, late May/early June (not mid-May). An MCS forms over the Midwest, then moves eastward, off the Atlantic Coast before moving southward along the east coast, backing into the Florida Peninsula and into the Gulf of Mexico, crossing all the way to the Texas Gulf Coast! A long path around the perimeter of a strong anticyclone. This one did not develop into a tropical system -- likely too much shear over the Gulf.
23. Summary slide. If the system is not forecast in the model, and it appears despite this forecast, you may need to reassess things in your forecast area.
24. Other Training sources are available at the links in this PowerPoint.