We're going to take a short tour of a supercell thunderstorm, starting with the basic pieces you learned about previously. This is idealized radar reflectivity of a classic supercell moving toward the northeast. Air flows into the storm and rises in the updraft region, which coincides with the rotating mesocyclone. Because of vertical wind shear, the precipitation doesn't fall into the updraft, and the storm ends up with separate downdraft regions. Some precipitation wraps around the mesocyclone, forming the hook echo, and if the storm spawns a tornado, it usually forms near the hook echo, near the "T" on this graphic.

Now, let's add some more pieces to our model of a supercell. This idealized image shows radar reflectivity and the cloud outline associated with a classic supercell moving toward the northeast. You can see the storm's inflow traced by these arrows racing in and then ultimately rising in the rotating updraft, but most of the storm's precipitation actually falls on the forward, or leading, flank of the storm. This precipitation forms the forward-flank downdraft, which spreads out at the ground, forming a gust front along its leading edge.

There's another distinct region of precipitation in the storm that forms the rear-flank downdraft, which spreads out along the ground, forming its own gust front. Some of the precipitation in the rear-flank downdraft wraps around the mesocyclone to form the hook echo.

But, not all supercells are this classic. Depending on the upper-level winds, sometimes supercells don't display a hook echo at all. Sometimes, supercells take on more of a pendant shape, where you can see all of the precipitation falling in the forward-flank downdraft, but the rear-flank downdraft isn't very prominent, and contains little or no precipitation. These supercells can still produce a tornado, which would occur near the "T" in the mesocyclone, even though they don't display a hook echo on radar.

On the other hand, if the upper-level winds are just right, sometimes the rear-flank downdraft is really prominent, and contains lots of precipitation. In such cases, there's not an obvious hook echo, and the supercell's radar reflectivity ends up looking more like a kidney bean. Despite the lack of a hook echo, these supercells can still produce a tornado, which would occur again near the "T", although from the ground these tornadoes can be hard to see because they're often masked by precipitation wrapping around them.

So, not all supercells are created equal, which sometimes makes them hard to spot with radar reflectivity. Fortunately, today, meteorologists have Doppler radar with dual polarization capabilities to help them better identify supercells that may be spawning tornadoes.