Talking points for low-level jet features

1. Title
2. Our learning objective is to introduce GOES-R capabilities for identification of various types of low-level jets, we'll spend most of this session discussing the sting jet. Recall the sting jet develops during frontal seclusion phase as the bent back warm front begins to encircle the surface low. The region labeled as SJ is the sting jet and is important since very strong winds would be associated with this feature. Note the sting jet does not last long as the cold conveyor belt catches up with the sting jet, strong winds may still occur but the highest wind speeds associated with the sting jet are over.
3. Our sting jet case study is from an intense extra-tropical cyclone off the eastern seaboard on 3 to 4 January 2018. This loop of the 7.34 micron imagery captures the evolution of the sting jet. Later loops will look at 1-minute imagery during shorter time periods.
4. Now we zoom in to the region of interest which is the center of the cyclone where we can view the evolution of the sting jet. This is a 4-pnael of the 3 GOES water vapor bands along with the 10.3 micron band. Our first signs of sting jet development occurs in the region of the cusp that begins to swing around towards the northeast. A sting jet refers to the fast moving descending air from the tip of the cloud head into the dry slot ahead of it. It usually doesn't last for more than a few hours. Note in this region we see multiple cloud bands evolve into the cloud head associated with the sting jet.
5. This is the 7.3 micron low level water vapor channel, since the weighting function peaks lower than the other 2 water vapor bands, this band will be quite useful in analyzing the sting jet. The yellow arrows depict multiple cloud bands in the location where the sting jet develops. Browning referred to these as the banded cloud head. Compare the conceptual diagram with the banded cloud head highlighted in the blue box with what we observe in the water vapor imagery in the yellow arrows.
6. The clouds we observe in the imagery develop just below the sting jet in a way depicted in this conceptual diagram on the left from Clark and others. Note that the strongest winds are ahead of the banded cloud head, within the sting jet which descends from mid-levels. The diagram on the right illustrates the banded cloud head produced by slantwise motions consisting of alternating ascending and descending branches. Evaporative cooling from precipitation enhances descent.
7. Soon after we observe those features in the imagery, the sting jet moves cyclonically around the surface low. In this case, towards the east and then northeast. Monitor the position of the sting jet signature seen on satellite since it indicates particularly strong and likely damaging winds.
8. Later on, as the sting jet wraps cyclonically around the surface low we observe clouds denoted in the yellow oval on the IR image that form along the convergence line at the leading edge of the sting jet. The strongest wind gust exists just behind the convergence line where enhanced evaporative cooling associated with precipitation in the banded cloud head.

9. Now we'll look at a few other low level jet features with a focus on higher temporal resolution imagery available with GOES-16 and 17. In this 1-minute visible loop of a developing cyclone off the east coast, note all the details we can see in the clouds at low-levels, indicative of a low-level jet. The 1-minute imagery allows you to see fast moving clouds more readily than other scan modes. This is particularly helpful for brief looks over multi-layered cloud decks, for example this region north of the warm front.
10. Remember to use the GOES Derived Motion Winds baseline product. This product allows you to choose winds at appropriate pressure levels to identify low-level jets. This example shows a low-level jet in the Southern Plains.
11. In summary, the GOES-R series introduces new capabilities that will improve low-level jet identification with respect to new bands, in particular the 3 water vapor channels used in tandem to provide a 3-dimensional perspective. Also, the greater spatial and temporal resolution will aid in identification of low-level jets. The Derived Motion Winds baseline product also has utility.