

- annual variability of these phenomenon
- component analysis of the imagery
- structures of the cold lows in this record

- mid-oceanic troughs/TUTT (Frank 1970)
- maintenance (Frank 1970)
- and once formed may be self reinforcing (Knaff 1997)
- PV (Liu and Barnes, 2018, and references therein)
- highs (Ricks, 1959)
- (Zhang and Wang 2017; Blake 2014)



A 10-year GOES-East-based Climatology of Cold Lows John A. Knaff, NOAA Center for Satellite Applications and Research, Fort Collins, Colorado

Storm direction relative principle component analyses







RH and T Across the Track



The kinematic structure of the cold lows that were tracked show central warm anomalies of 5° C vs environment (at 900 km radius) at the 150 hPa level and cold anomalies of -2° C at 400 hPa. In the innermost core of the cold low relative humidity is slightly enhanced and slopes toward the left quadrant. The highest RH is in the edges of the upper level cyclone. Very dry mid-levels are evident in all quadrants but the left. The largest height anomalies (-60m) are near the core at 250 hPa, and the radial gradiant of height anomalies is greater front-to-back. This warming maximum is above 250 hPa –the local tropopause. It is interesting that the warm anomalies extend to the 250 hPa in the mean and RH values near 45% allow for cooling to space - maintenance mechanism (Frank 1970). There is clear signs that cold lows are to some degree baroclinic with sloping features (RH, Vt) with higher features on the left. Radial flow seems a oposite of motion with large convergence in the stratosphere. Comparing the mean cold low to the Dunion (2011) tropical Atlantic sounding is another way to show these anomalies.



an we use simple hurricane models to learn more about cold low evolution and structure? Can we make use of current satellite imagery to better interpret cold low strength and depth or make forecasts of changes in those qualities?

Should an effort be made to create annual tracks of cold lows to improve our understanding and provide another metric for NWP?



Combined EOF analysis based on cold low analysis

The combined EOF analysis suggests that there is variability in the background, strength and depth of the cold lows that were tracked. Future work will be conducted to determine if these three factors can be interpreted directly from the water vapor imagery.

- Thus far it appears that:
- . The warmer the overall WV temperatures (in the whole scene) associated with the deeper the circulation, and
- Stronger cold lows often have an accumulation of moisture nearer the center and cooler temperatures near the center