

Research Objectives

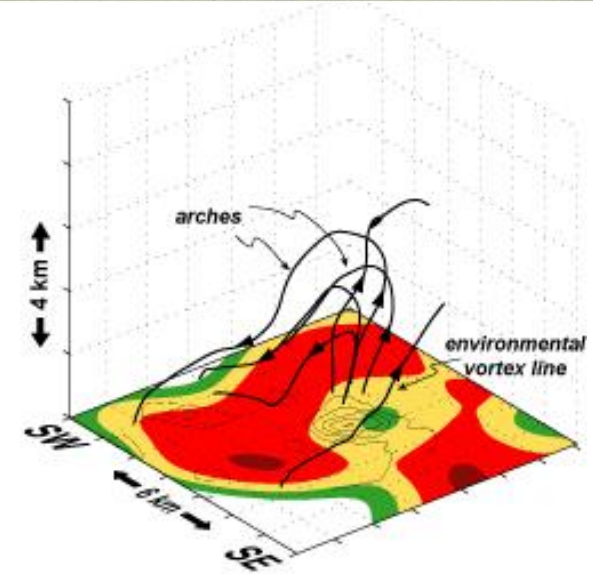
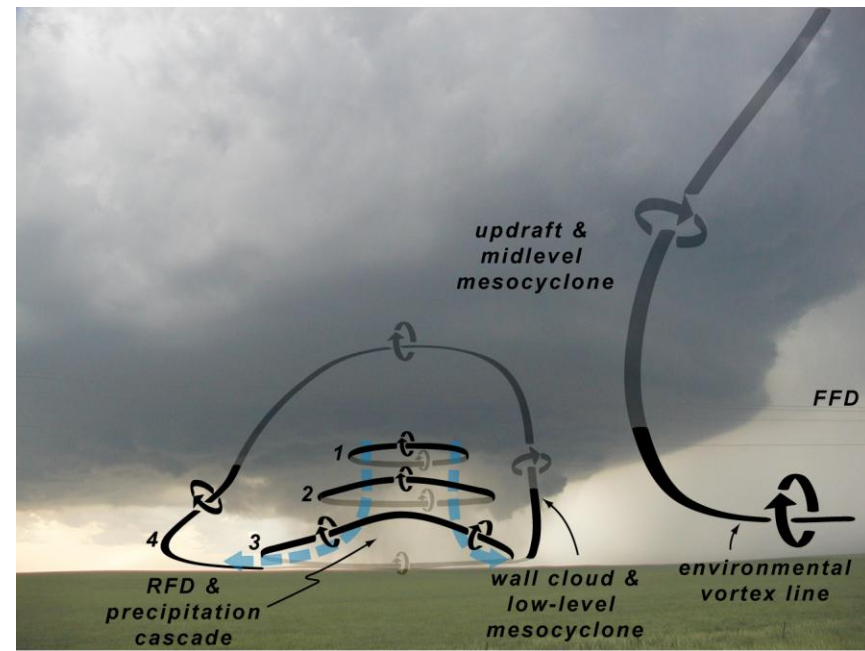
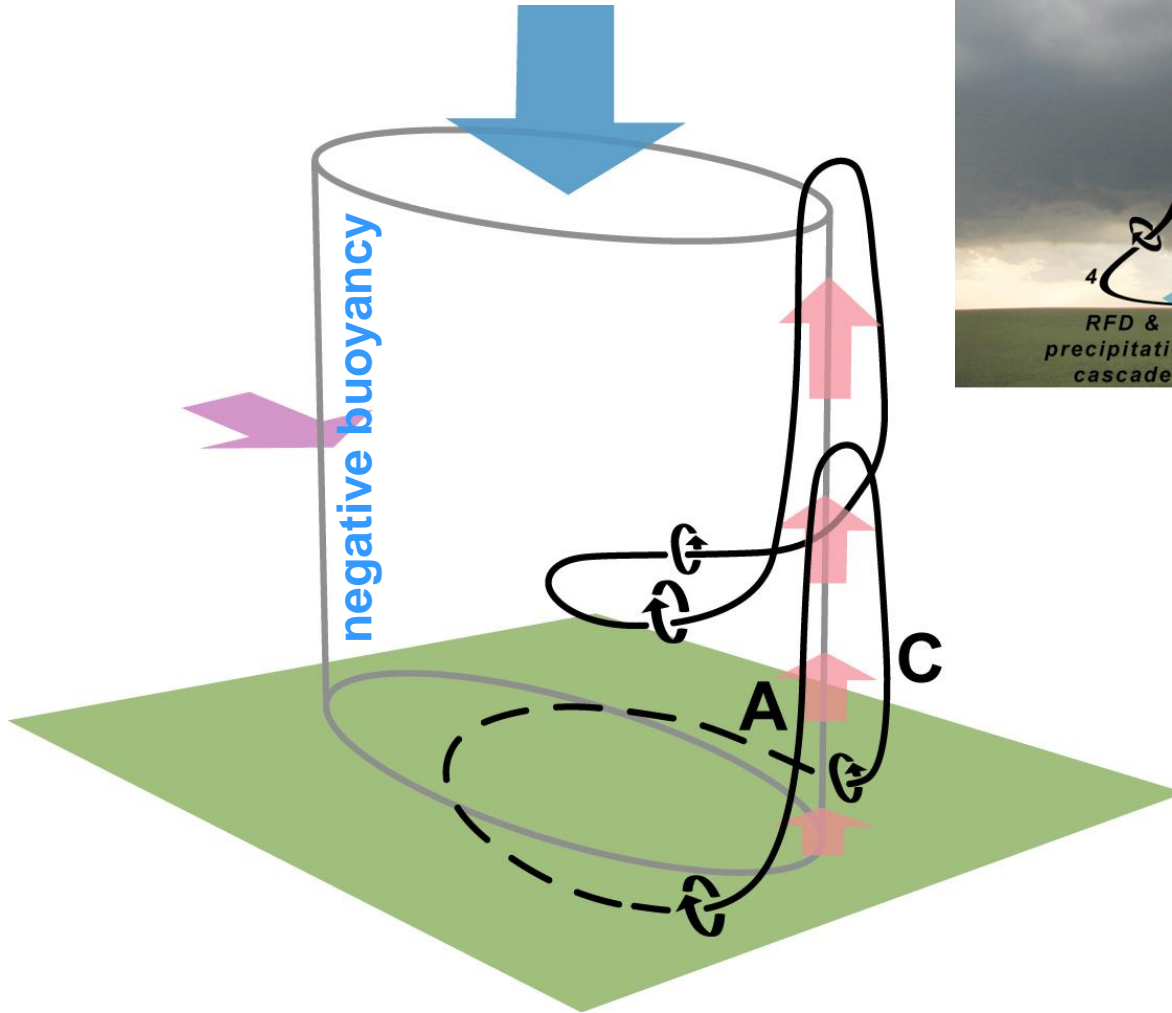
Richardson/Markowski Grant

Students: Ryan Hastings and Tim Hatlee

Post-Doc: James Marquis

Tornadogenesis

purely baroclinic process



observed case: vortex lines passing through low-level vorticity maximum form arches

SIGNIFICANTLY TORNADIC

25 May 1994 (Northfield, TX)



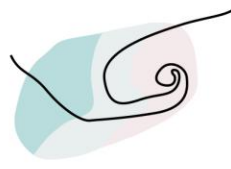
2 June 1995 (Frona, TX)



2 June 1995 (Dimmitt, TX)



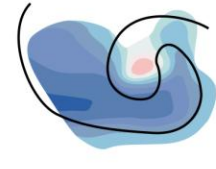
16 May 1995 (Burdett, KS)



8 June 1995 (Wheeler, TX)



8 June 1995 (Allison, TX)



25 May 1997 (South Haven, KS)



3 May 1999 (Apache, OK)



3 May 1999 (Minco, OK)



31 May 1999 (Sitka, KS)



WEAKLY TORNADIC

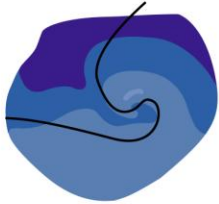
1 June 1999 (Coleman, OK)



2 June 1999 (Nazareth, TX)



6 May 1994 (Kaw Lake, OK)



17 April 1995 (Temple, OK)



16 May 1995 (Kalvesta, KS)



7 June 1998 (Farwell, TX)



20 May 1999 (Jericho, TX)



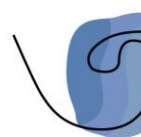
29 May 1994 (Loving, TX)



29 April 1995 (Sherman, TX)



12 May 1995 (Haskell, OK)



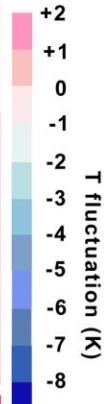
19 May 1998 (Sidney, NE)



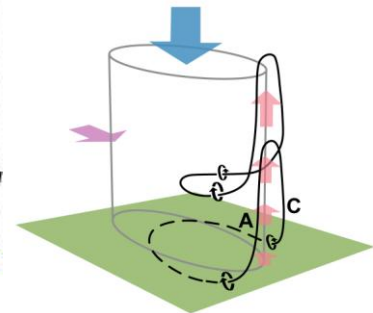
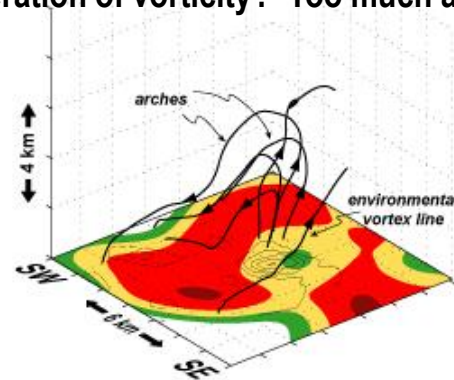
24 May 1998 (Medicine Lodge, KS)



8 June 1998 (Okla City, OK)

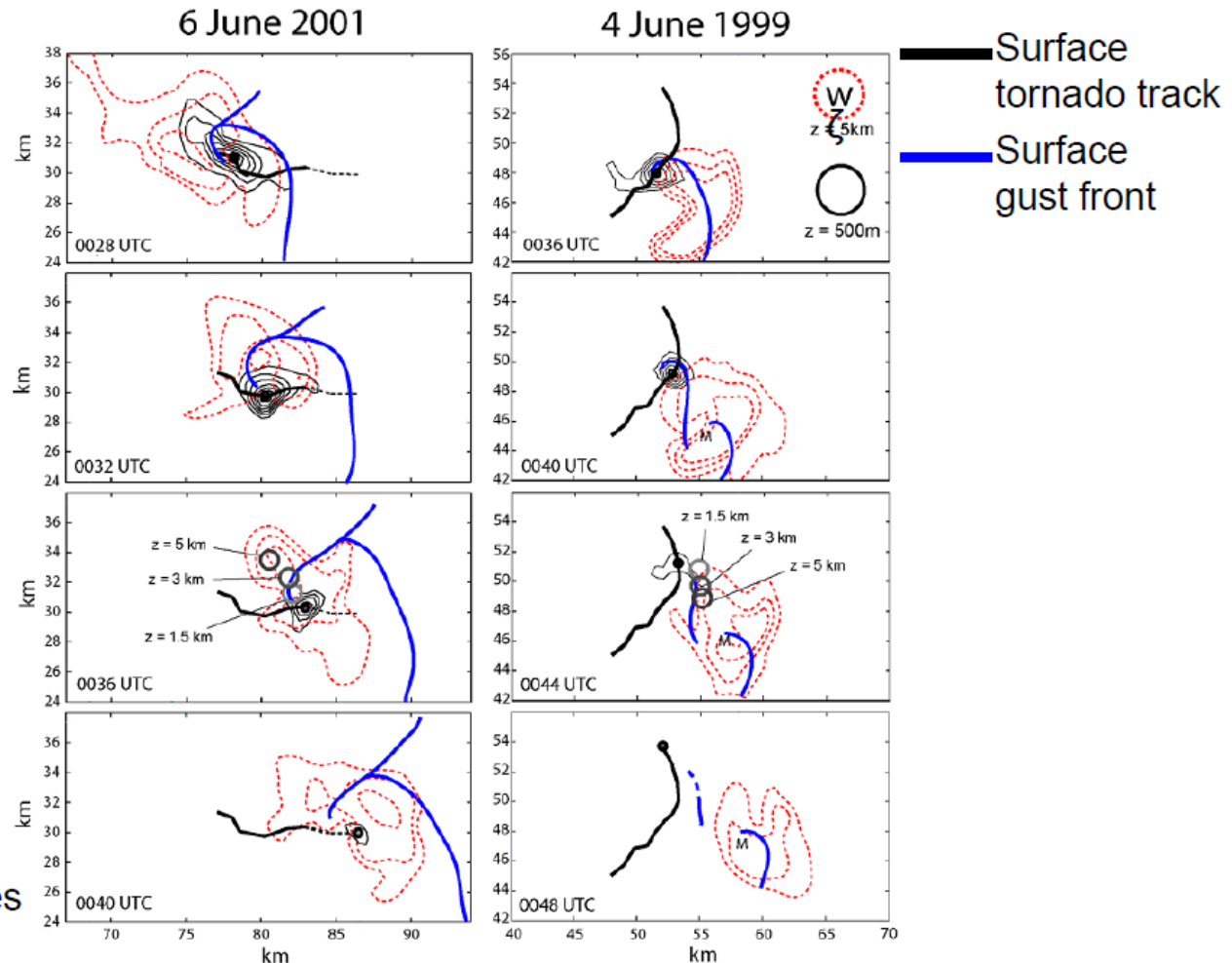


A problem of perfect balance? We need just the right amount of baroclinity? Too little and we have insufficient baroclinic generation of vorticity? Too much and we cannot contract the cold air?



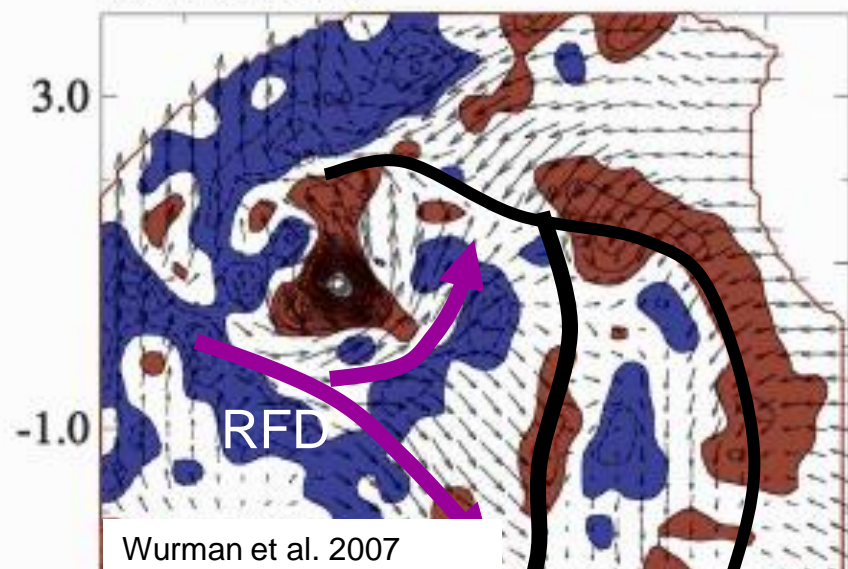
Tornado maintenance: updraft relative position

(EnKF)

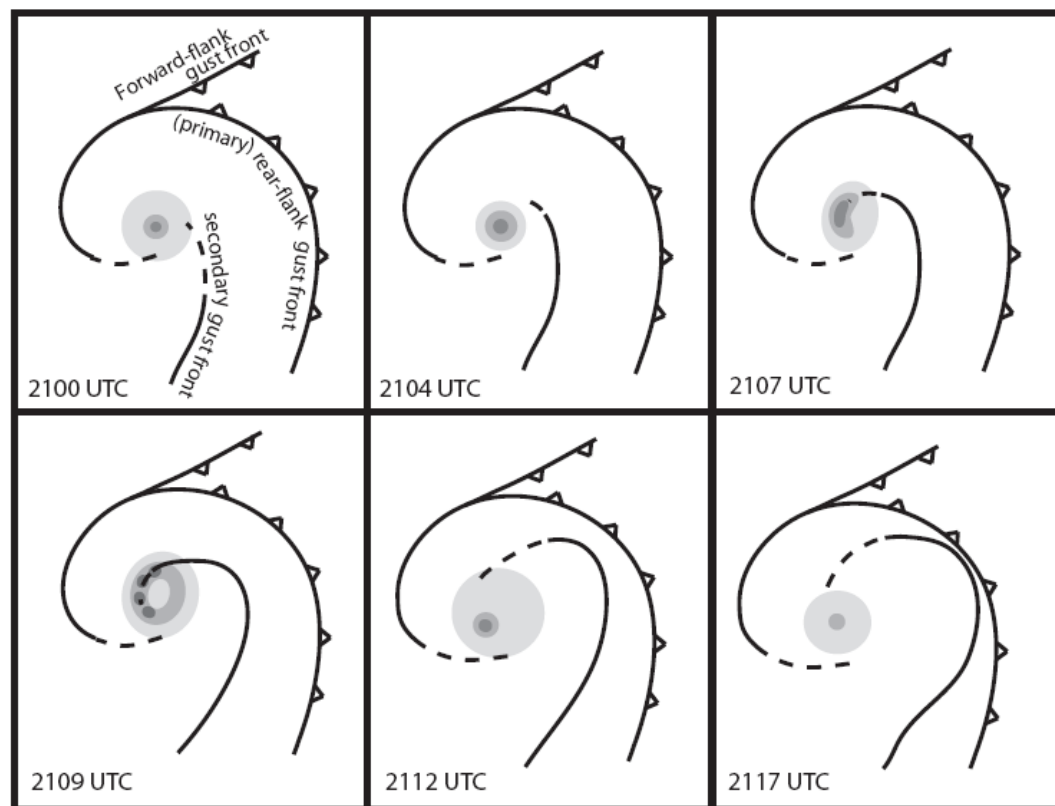
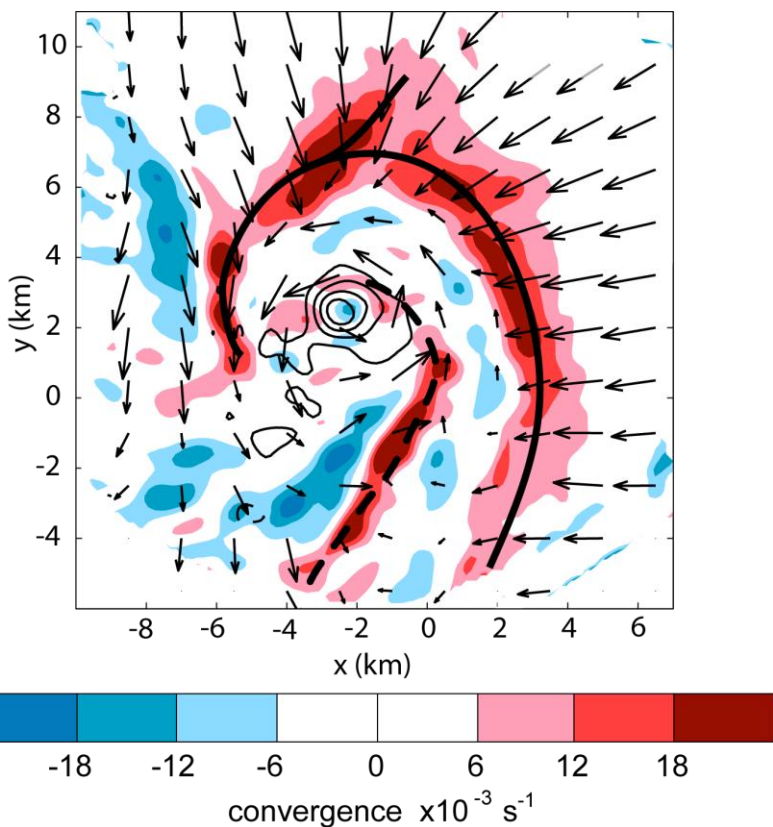


Courtesy James
Marquis

What role, if any, do secondary gust fronts play in tornado genesis and/or maintenance? What are the thermodynamic fields around them?

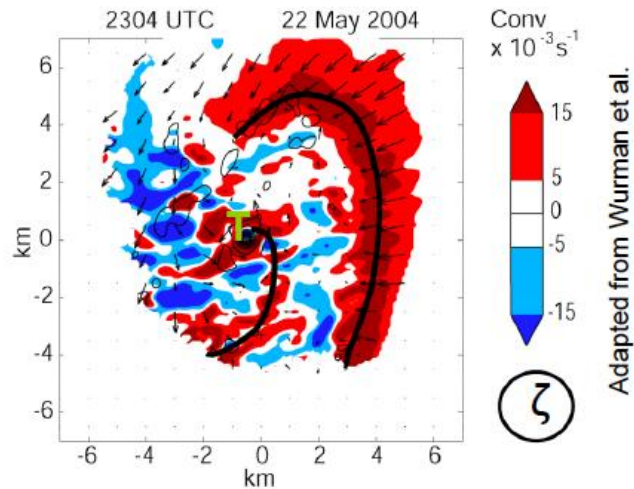
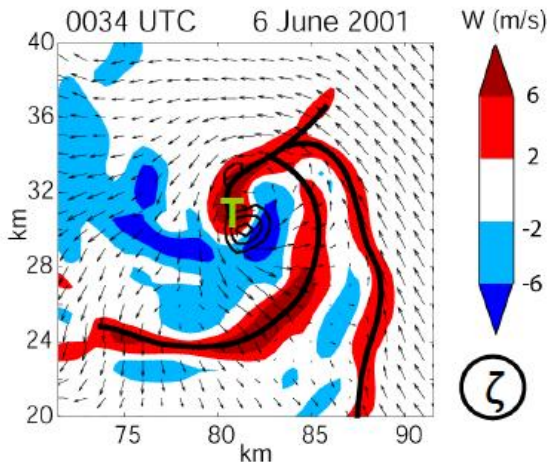
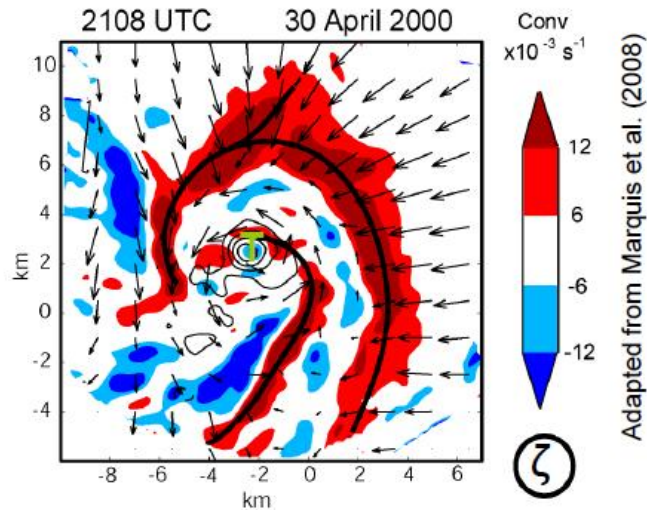
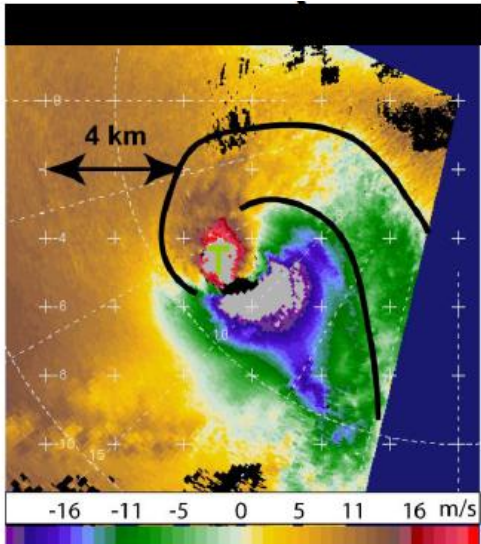


2107:35 UTC 30 April 2000



Marquis et al. 2008

Gust front surges (or secondary convergence lines)



Measurements Needed

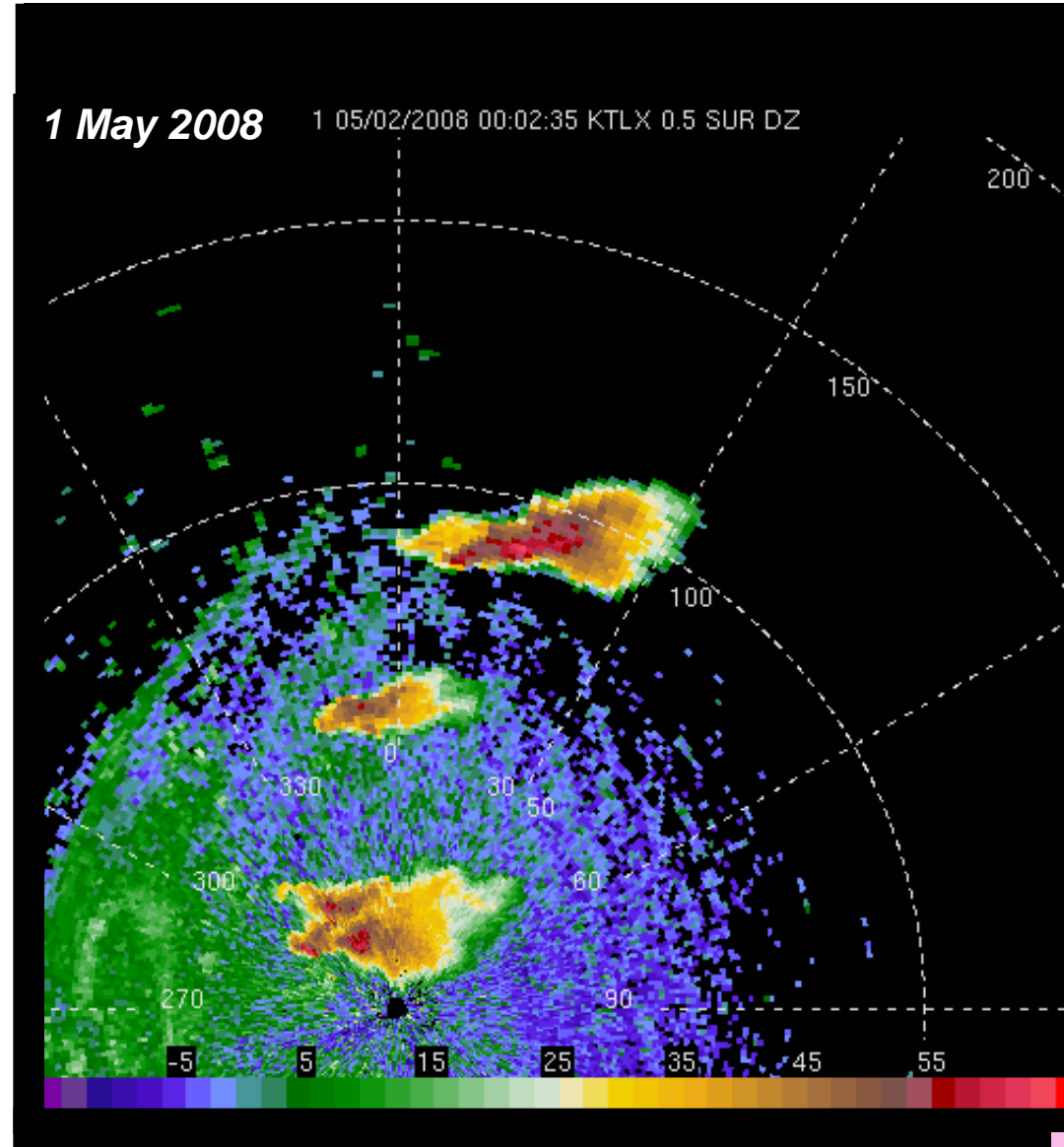
- Wind and thermodynamic data covering storm to tornado scale
- Traditional analyses as well as data assimilation is being used to combine fields
- Expect to assess RFD trajectories and forcings as a function of time and space and compare with nontornadic storms

storm-storm interactions

What controls the final outcome when storms merge?

Requires:

Wind and thermodynamic data before and after merger; ideally this would be available for both storms prior to merger



Data assimilation using radar and mesonet data to evaluate modeled cold pools

- Use mesonet data to evaluate cold pools produced by different microphysics schemes
- Assess the impact of the data assimilation of mesonet observations within the cold pool

Cases of most interest

- 5 June 2009 tornadic case
- 11 June and 19 May 2010 (merger cases), also 11 June 2009 to a lesser extent
- 13 June 2010 (cyclic tornadic, but is there dual-Doppler?)
- 5/12/10 tornadic supercell near Clinton
- 5/18/10 marginally tornadic supercell from west of Dumas, TX to Stinnett, TX
- 5/25/10 cyclic, weak tornado-producing supercell near Tribune, KS
- 6/10/10 cyclic tornadic supercell near Last Chance, CO
- 6/7/10 weakly tornadic supercell near Scottsbluff, NE
- 5/26/10 nontornadic storm near DIA
- 6/7/09 Missouri nontornadic (or very weakly tornadic?) case