

Research Objectives

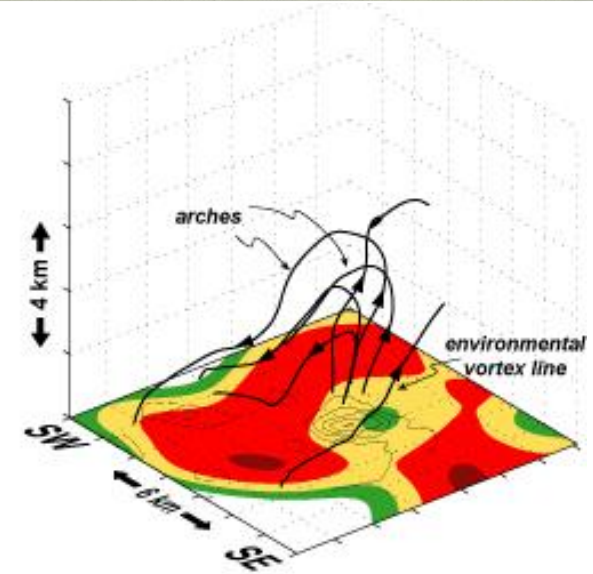
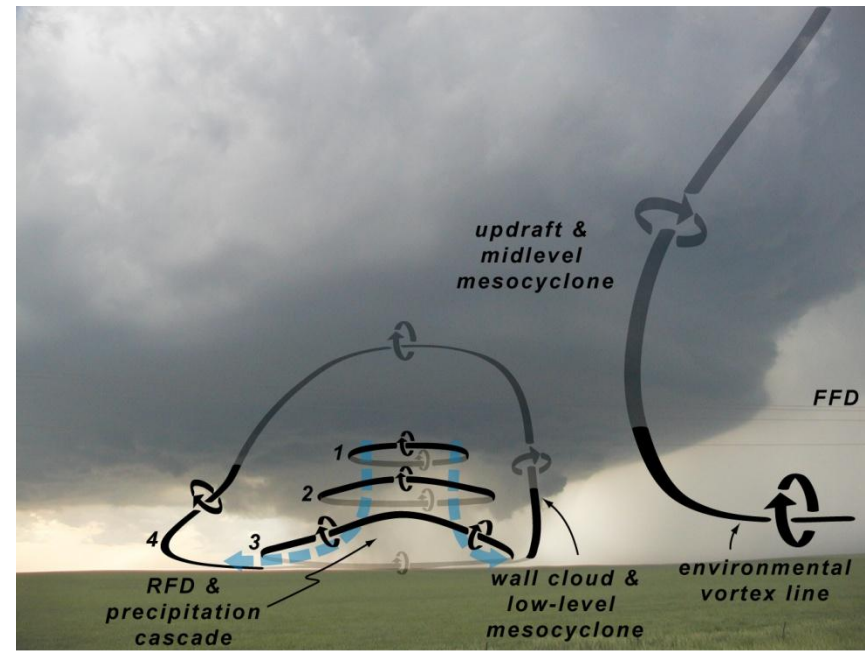
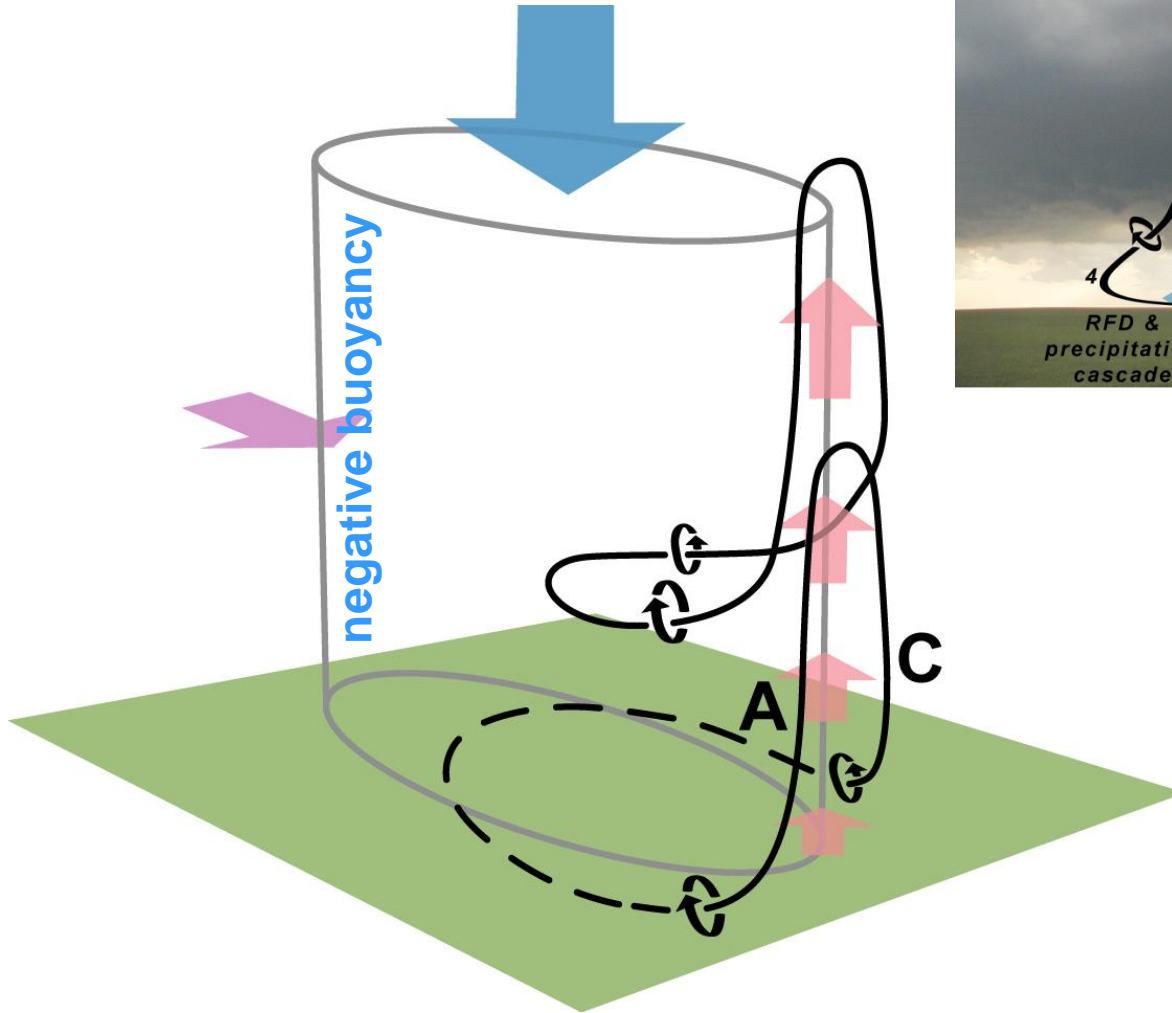
Richardson/Markowski Grant

Student: Ryan Hastings

Post-Doc: James Marquis

Tornadogenesis

purely baroclinic process



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

SIGNIFICANTLY TORNADIC

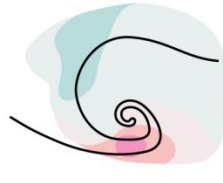
25 May 1994 (Northfield, TX)



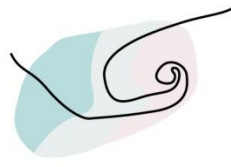
2 June 1995 (Frona, TX)



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

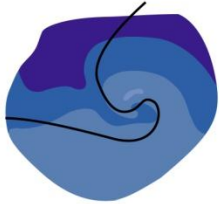
1 June 1999 (Coleman, OK)



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)



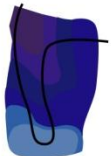
29 April 1995 (Sherman, TX)



12 May 1995 (Haskell, OK)



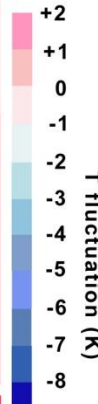
19 May 1998 (Sidney, NE)



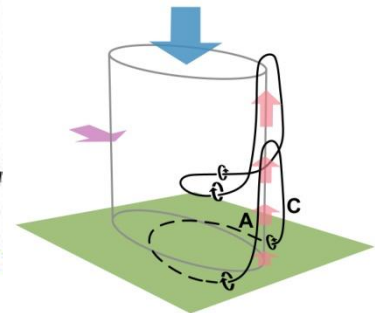
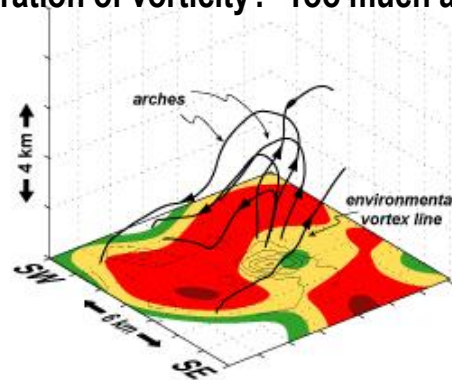
24 May 1998 (Medicine Lodge, KS)



8 June 1998 (Okla...)

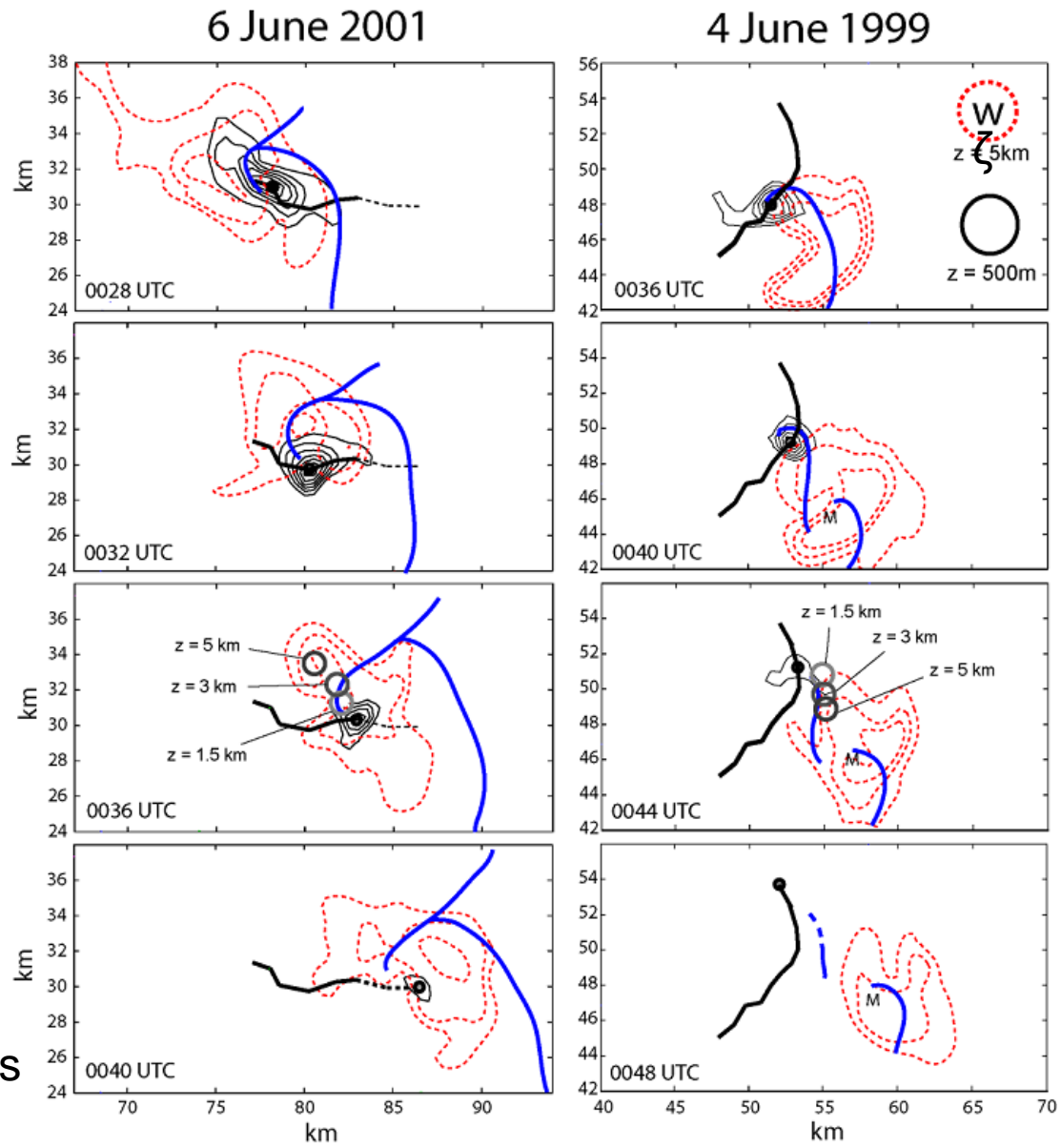


A problem of perfect balance? We need just the right amount of baroclinity? Too little and we have insufficient baroclinic generation of vorticity? Too much and we cannot contract the cold air?



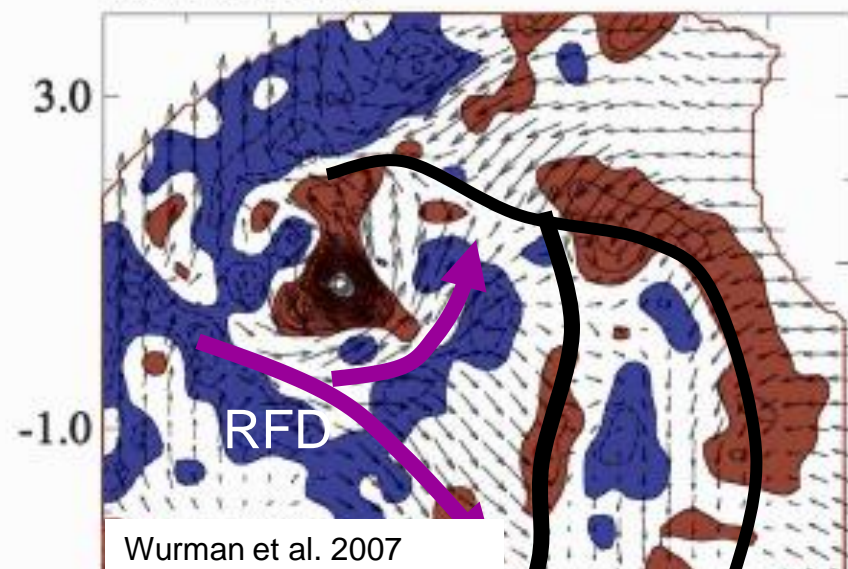
Tornado maintenance: updraft relative position

(EnKF)

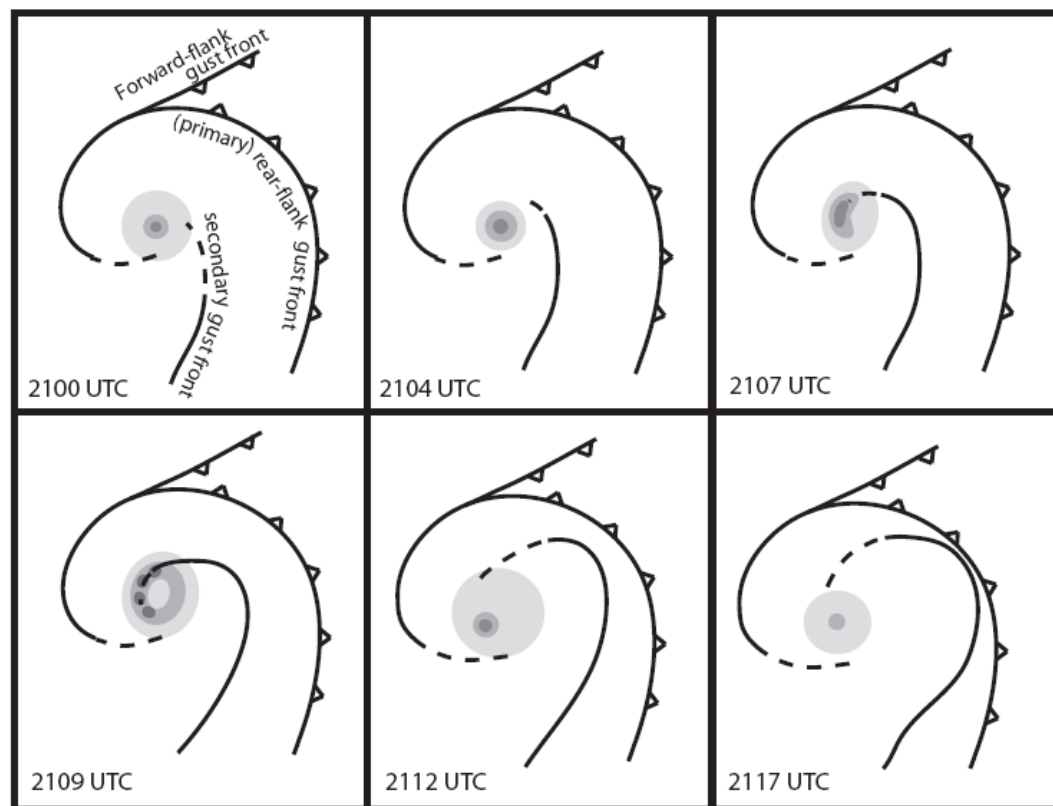
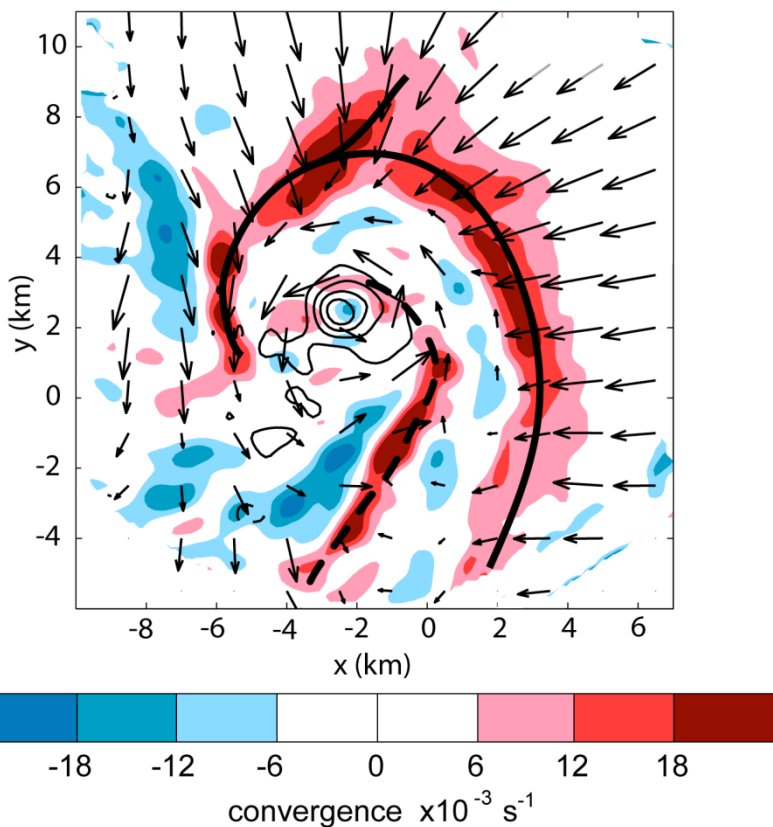


Courtesy James
Marquis

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

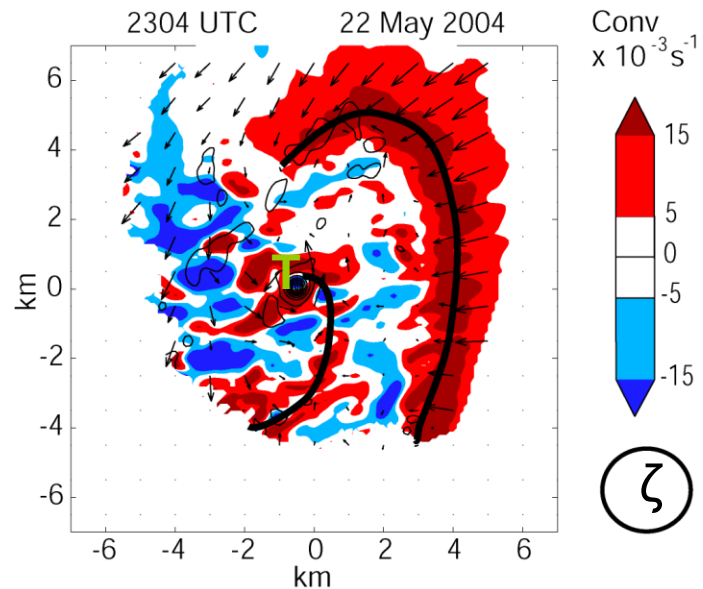
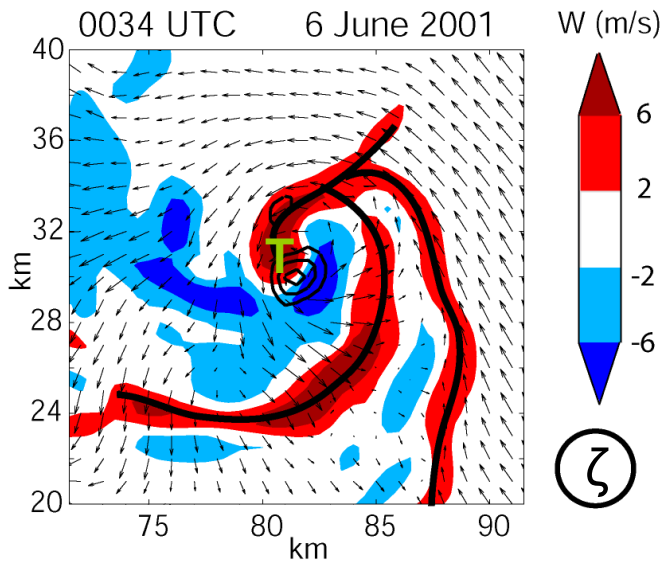
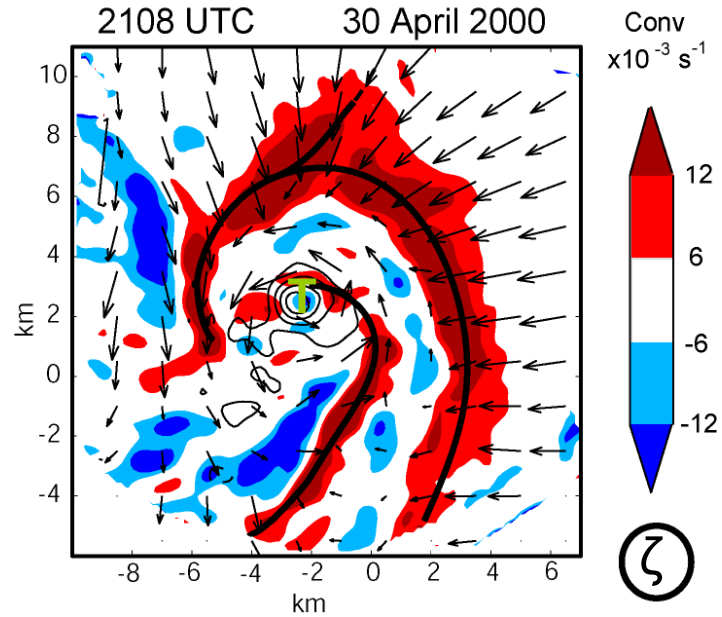
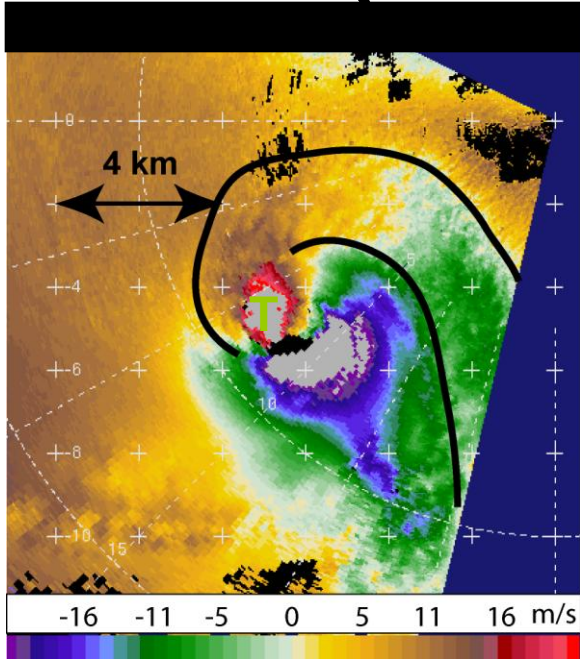


2107:35 UTC 30 April 2000



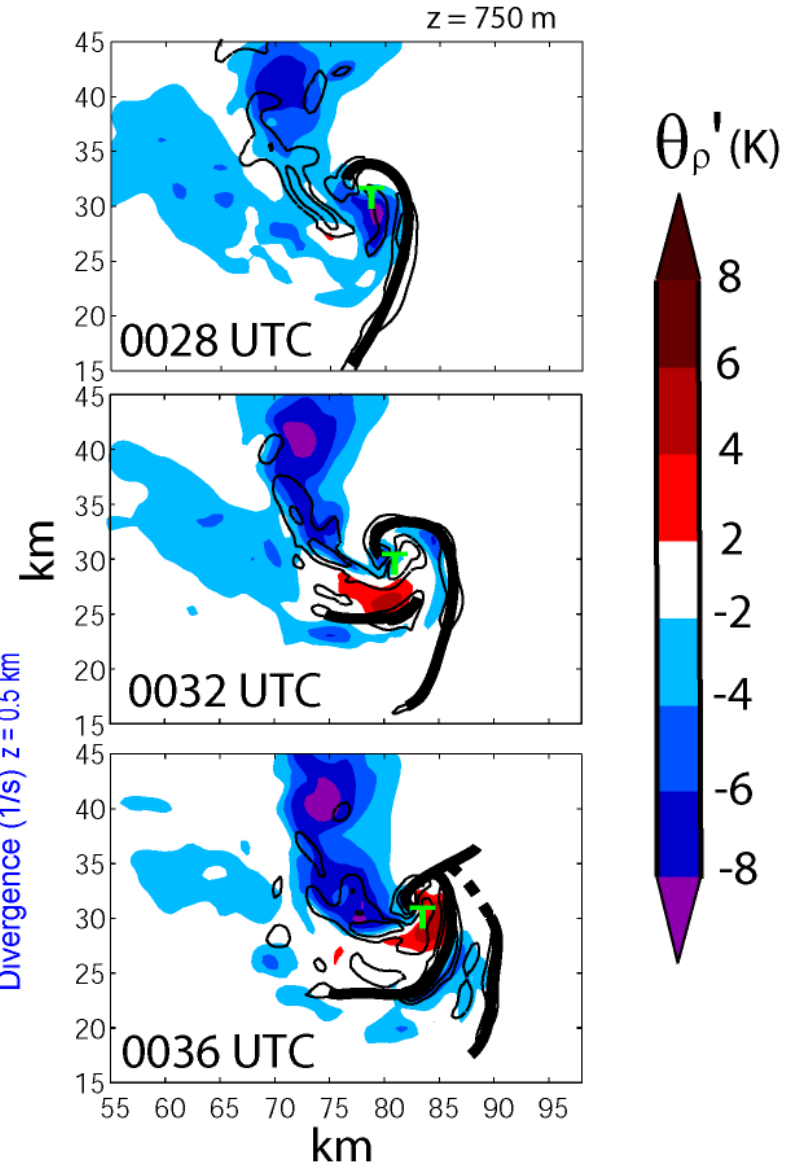
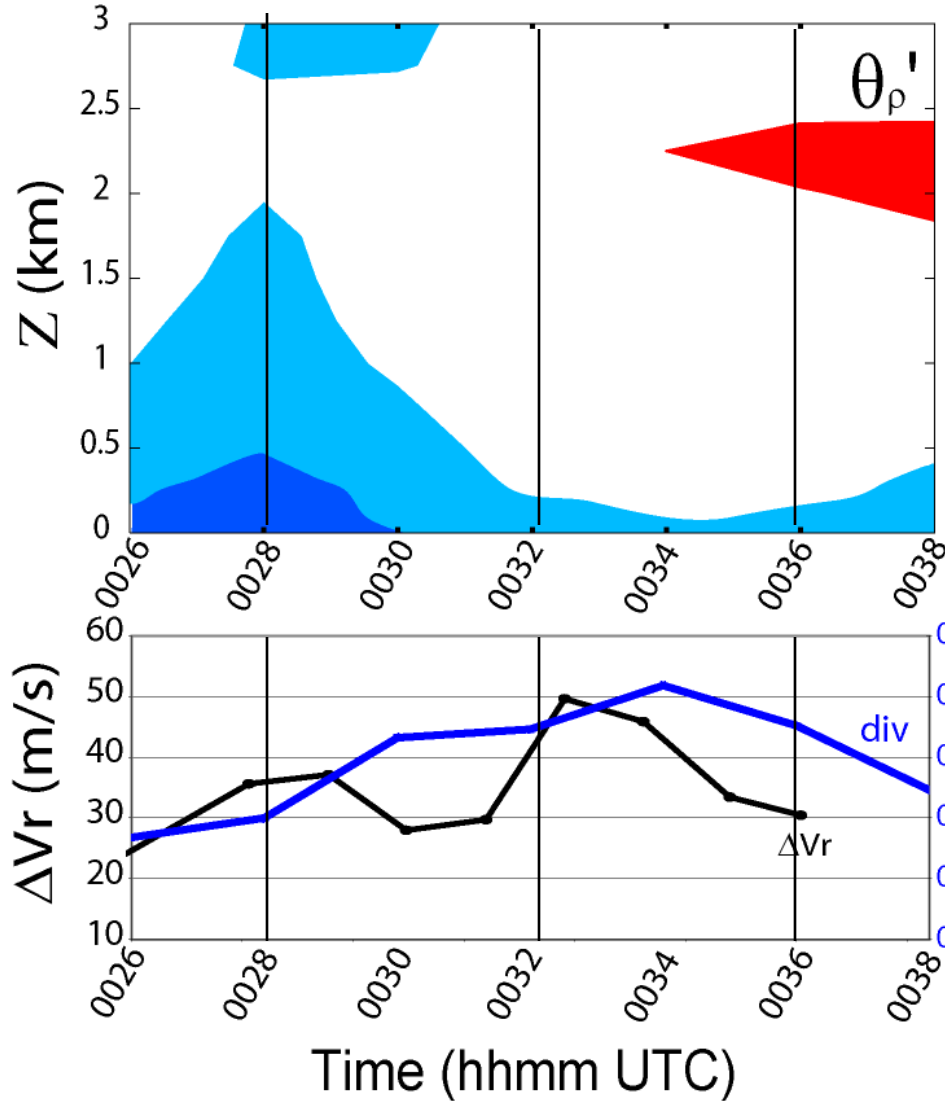
Marquis et al. 2008

(secondary) Gust fronts



3) Results: EnKF temperatures

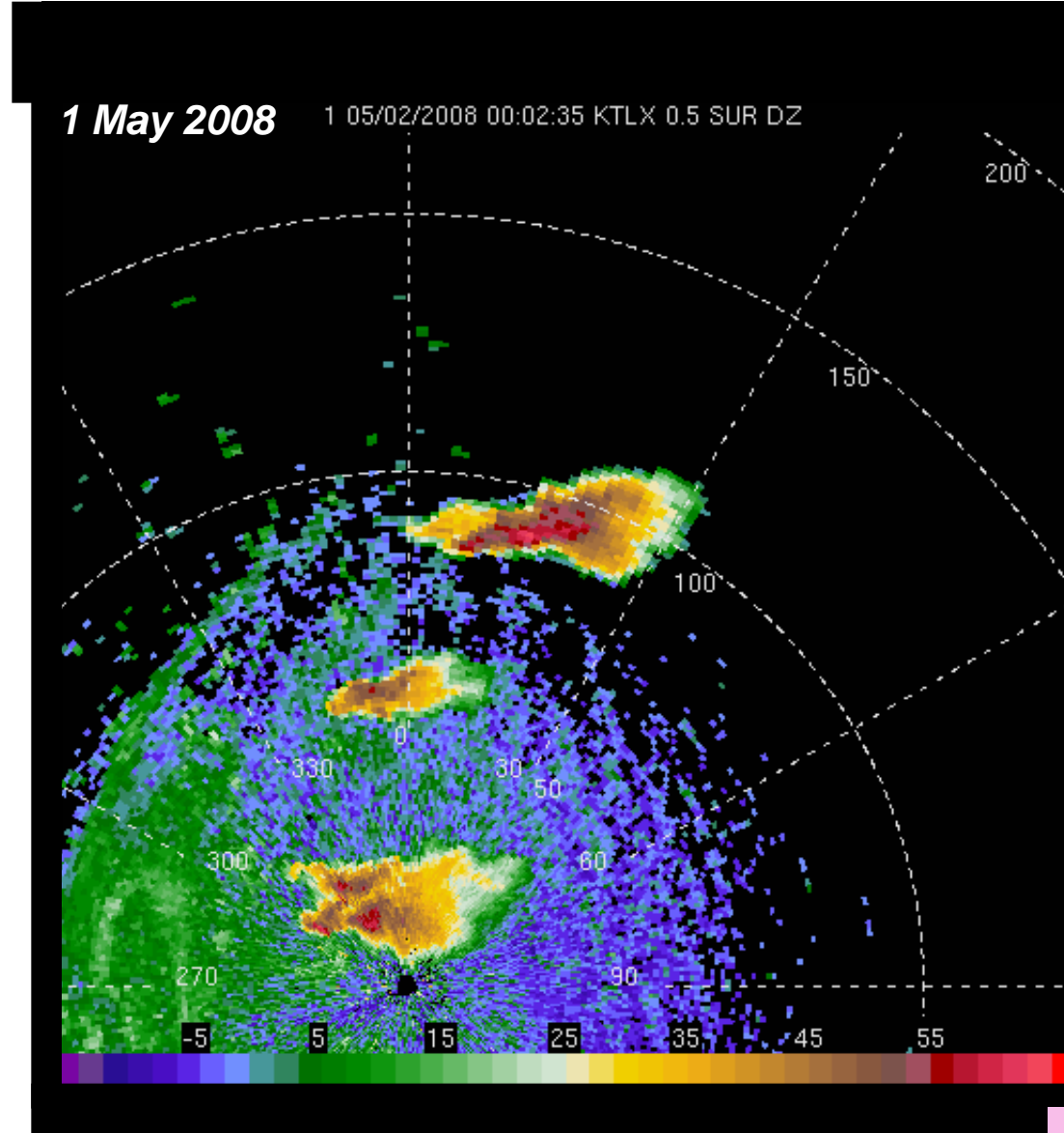
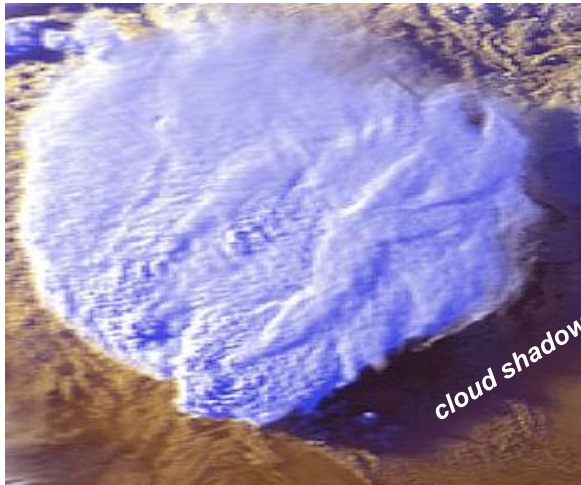
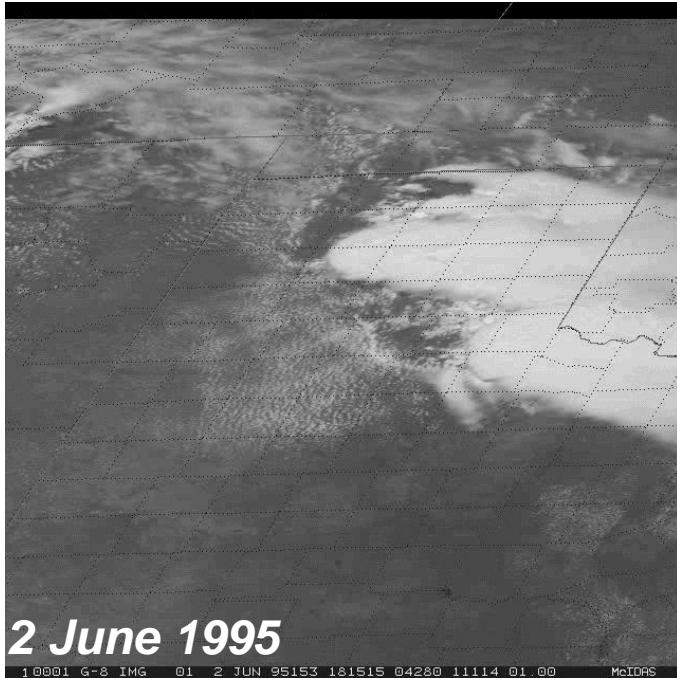
6 June 2001



Measurements Needed

- Wind and thermodynamic data covering storm to tornado scale
- Traditional analyses as well as data assimilation will likely be used to combine fields
- Expect to assess RFD trajectories and forcings as a function of time and space and compare with nontornadic storms
- Only tornadic case so far is 5 June 2009
- Good nontornadic cases for comparison include 7 June and 9 June 2009

Storm-environment and storm-storm interactions



storm-storm interactions

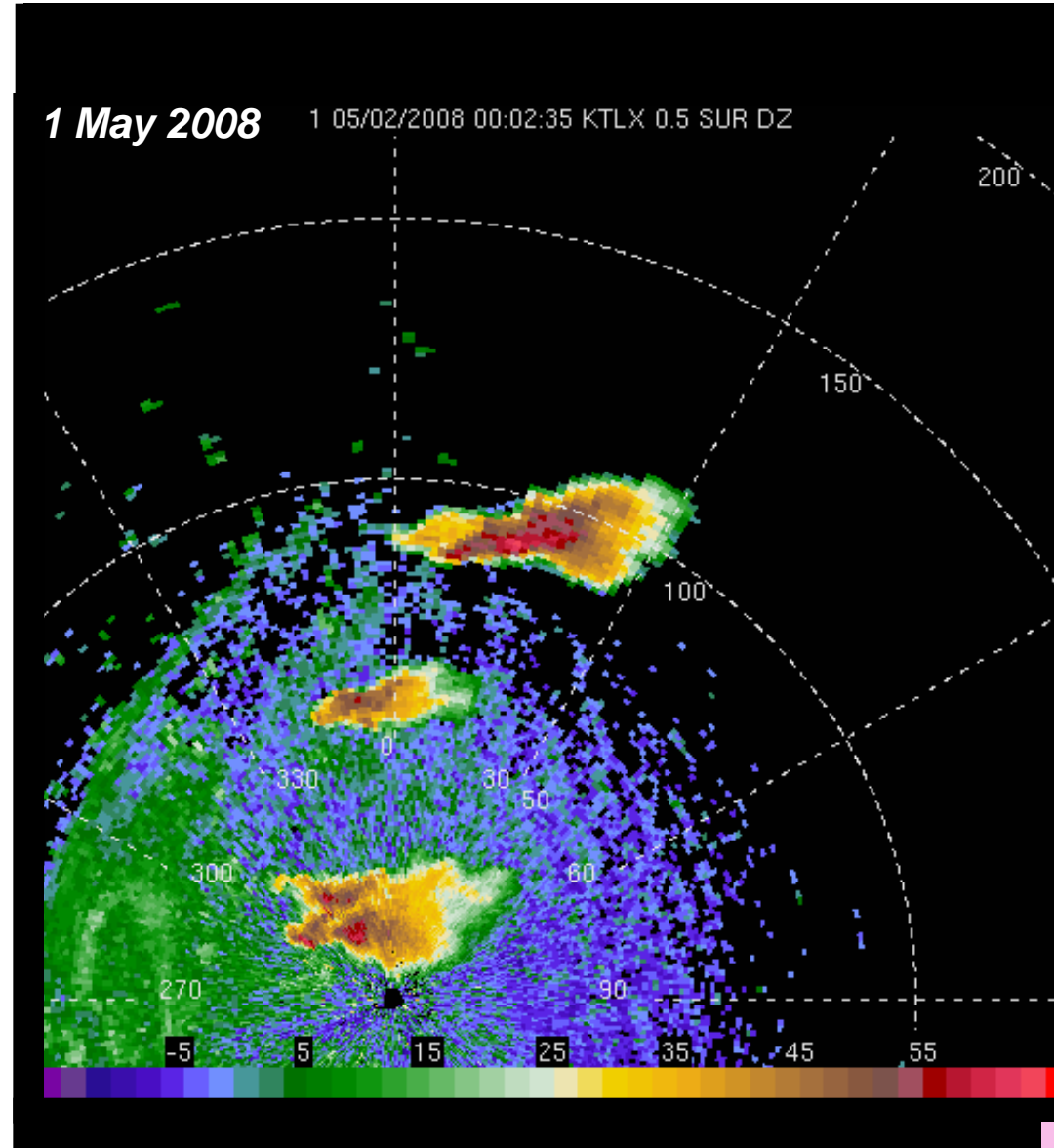
What controls the final outcome when storms merge?

Requires:

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

Possible Case:

11 and 13 June 2009



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
- Could be done using almost any of the cases