P32

Analyzing the role of low-level forcing in significant severe weather outbreaks in the eastern U.S.

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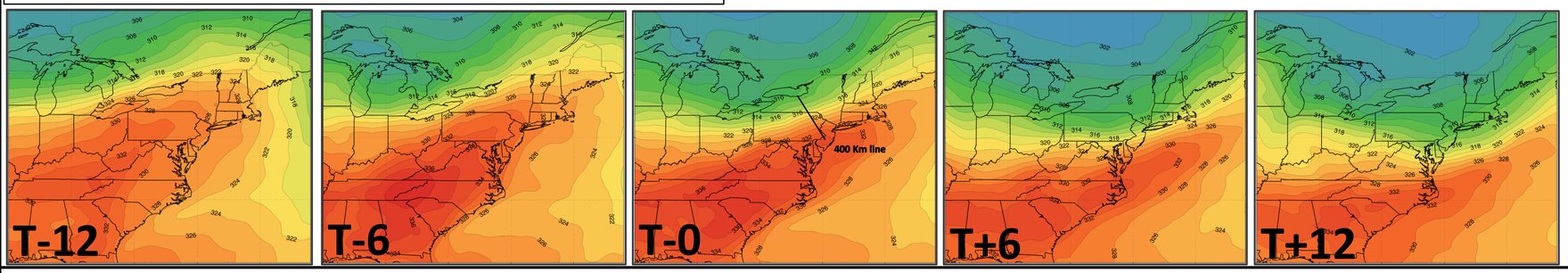
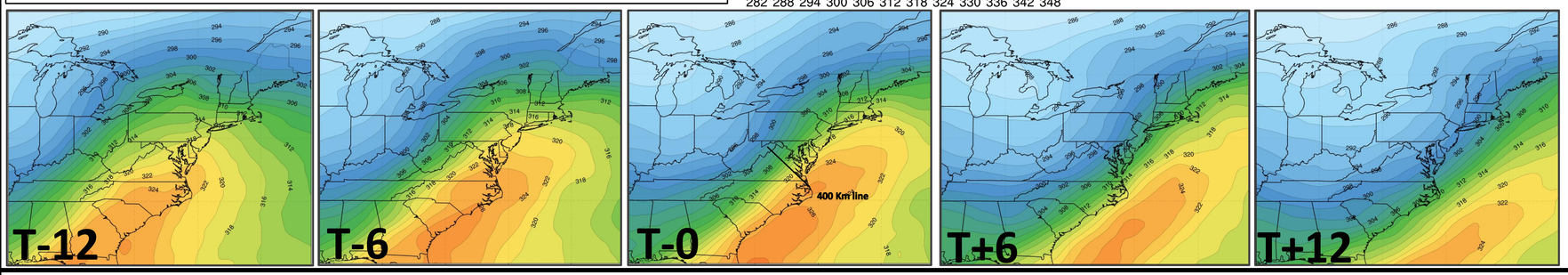
Northeast 850-hPa Theta E (K) Composites (N=9)

282 288 294 300 306 312 318 324 330 336 342 348



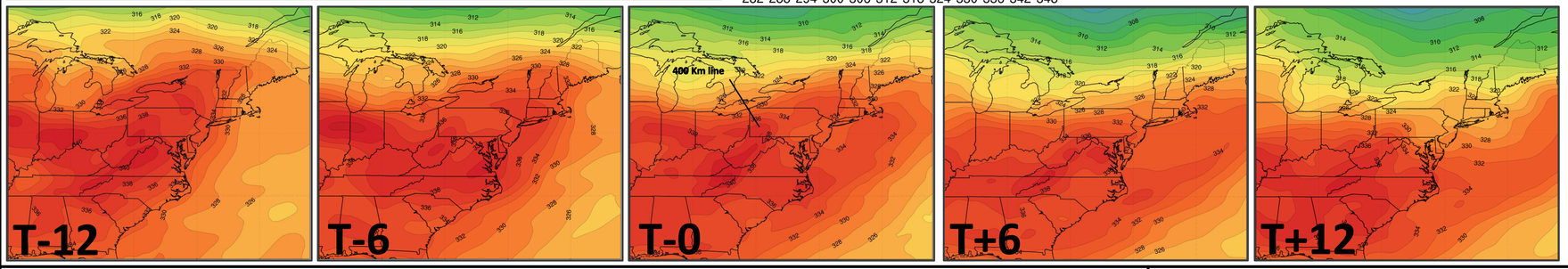
Mid-Atlantic 850-hPa Theta E (K) Composites (N=13)

282 288 294 300 306 312 318 324 330 336 342 348

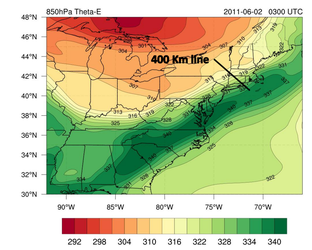


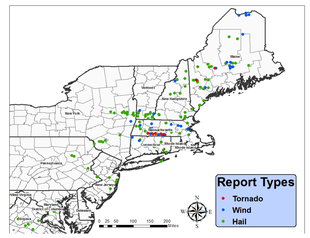
Derecho 850-hPa Theta E (K) Composites (N=6)

282 288 294 300 306 312 318 324 330 336 342 348

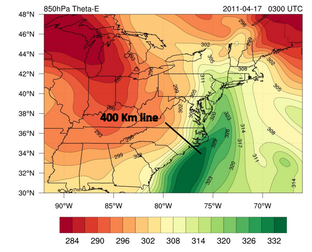


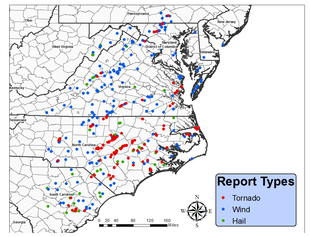
Northeastern U.S. sample case – 1 June 2011



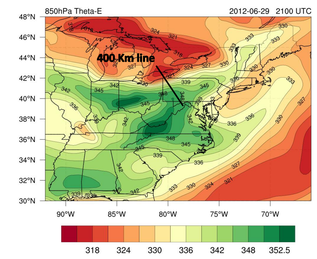


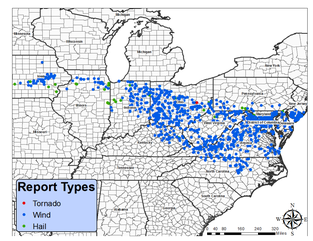
Mid-Atlantic U.S. sample case – 16 April 2011





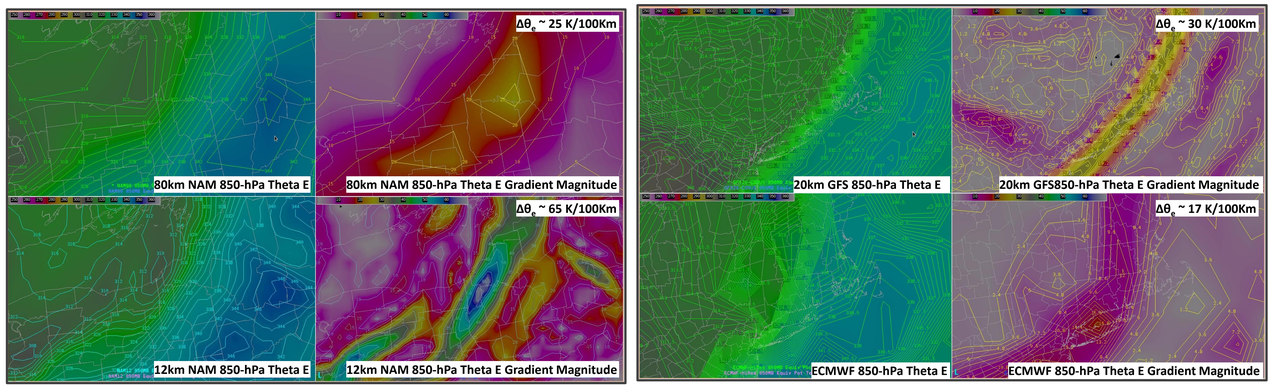
Derecho sample case – 29 June 2012





θ_e gradient Vs. $\Delta\theta_e$

Note the differences in magnitudes of gradients based on the resolution



Gradient magnitude is $\Delta\theta_e$ in units of K/100Km, therefore small scale tight gradients exhibit inflated values

Need to display the $\Delta\theta_e$ in units of K/400Km to resolve the synoptic scale density discontinuity

Previous Work and Summary

- ✓ Previous research identified several factors supporting significant severe weather outbreaks
  - ✓ Elevated mixed layer with surface-based Lifted Indices exceeding -2
  - ✓ Wind core at 850-hPa ≥ 35 Kt
  - ✓ Gradient of θ_e ≥ 25K at 850-hPa
- ✓ Composites for northeast, mid-Atlantic U.S. and progressive derechos were produced
  - ✓ Composites show $\Delta\theta_e$ ≥ 20K/400 Km
  - ✓ Individual cases showed $\Delta\theta_e$ ≥ 25K/400 Km with localized θ_e gradients ≥ 25K/100 Km
  - ✓ $\Delta\theta_e$ in units of K/400 Km is more representative of the synoptic scale density discontinuity than localized θ_e gradients in units of K/100 Km
  - ✓ Low magnitude $\Delta\theta_e$ depicted in the derecho composites due to the varying spatial positions of the θ_e gradients for each case
- ✓ Future Work
  - ✓ Display magnitudes of $\Delta\theta_e$ and θ_e gradients in units of K/400Km for research and operational applications