VORTEX-SE:
Characterization of environmental influences on downdraft processes occurring in potentially tornadic storms in the Southeast United States
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Research Objectives:

1) Explore refinement and development new methods of dual- and multiple-Doppler wind synthesis techniques specific to areas of complex terrain and varied land use

2) Examine in situ and remotely-sensed downdraft characteristics, such as hydrometeor properties and rapid intensification, and relate them to rapid changes in the near storm environment

3) Identify how specialized and/or targeted observations can improve detection or forecast of tornado occurrence can help guide future observing networks, modeling systems, and further field research in the southeastern U.S.
Objective (1)
Part 1: dual-Doppler technique development with pre-VSE (Flatland) Data
Incorporating surface obs network into dual-Doppler synthesis

Dual-DOW + mesosnet and sticknet obs from VORTEX2 cases

Difference between dual-Doppler horizontal (vectors) and vertical (shaded) velocity retrievals when solutions include/exclude objectively analyzed surface wind obs
Inclusion of Terrain

- Assessing near-surface up/downslope of horizontal wind imposed upon terrain upon iterative dual-Doppler solution

- May be significant effect in some VSE deployments
Objective (2)
Downdraft characteristics in VSE cases
Data Selection: VSE 2017

Needs:

• “Interesting” weather in domain

• Synced dual-Doppler with [mostly] un-blocked low-level radar scans

• Good coverage of surface instrumentation and sonde/profilers
27 March 2017: IOP 1b - QLCS with bowing segments, areas of weak low-level rotation, and leading isolated cells

5 April 2017: IOP 3B - Elongated cells leading a parallel-stratiform QLCS over Sand Mt.

30 April 2017: IOP 4C - Weakening QLCS with small/weak bowing segments over Sand Mt.

Most optimistic dual-Doppler coverage, with: < 25km, 25-40km, > 40km baselines
Mapping realistic dual-Doppler coverage/quality
Initial dual-Doppler syntheses

27 March 2017: IOP 1b
SMART-R & ARMOR

2104 UTC

Z = 800m

X distance from SMART-R

Y distance from SMART-R

\( \zeta \geq 0.005 \)  \( \zeta \leq 0.005 \)  Refl = 37 dBZ

0 10 20 30 40 50 60

-10 0 10 20 30 40 50 60

0 4 8

W

10 m/s

Reference Vector

SMART-R

ARMOR

Purdue Xpol

NOXP

KHTX

SMART-R

ARMOR
Integrating dual-Doppler and surface obs (stesonet): To evaluate thermodynamics across gust front and downdraft

27 March 2017: IOP 1b, 2104 UTC

291 K

Winds in m/s
Potential Temp in K
Working toward VSE wind retrievals with surface data
Sticknet at 30 km spacing

**STICKNET OBAN:**

very little smoothing

more smoothing

+ terrain

= better 2D/3D winds (vectors) over a large area?

**ARMOR radial velocity**

**VSE radars:** e.g., ARMOR

STICKNET winds converted to radial velocity from ARMOR's POV
Evolution and distribution from predominantly graupel and hail to predominantly rain near/at the surface.
Ongoing and Future Work

• Continued integrated dual-Doppler, dual-pol, in situ analysis of *IOP1b* downdrafts & environments, 5 April 2017: IOP 3B, 30 April 2017: IOP 4C

• Continued dual-Doppler technique development (*lower boundary condition with terrain and sfc obs*),

• Website to disseminate results
Want to learn more?
Send us a hedgehog dressed as old west sheriff

(A real one, not a picture. No return postage necessary)

OR...visit our website (under development)