VORTEX-SE:

Characterization of environmental influences on downdraft processes occurring in potentially tornadic storms in the Southeast United States

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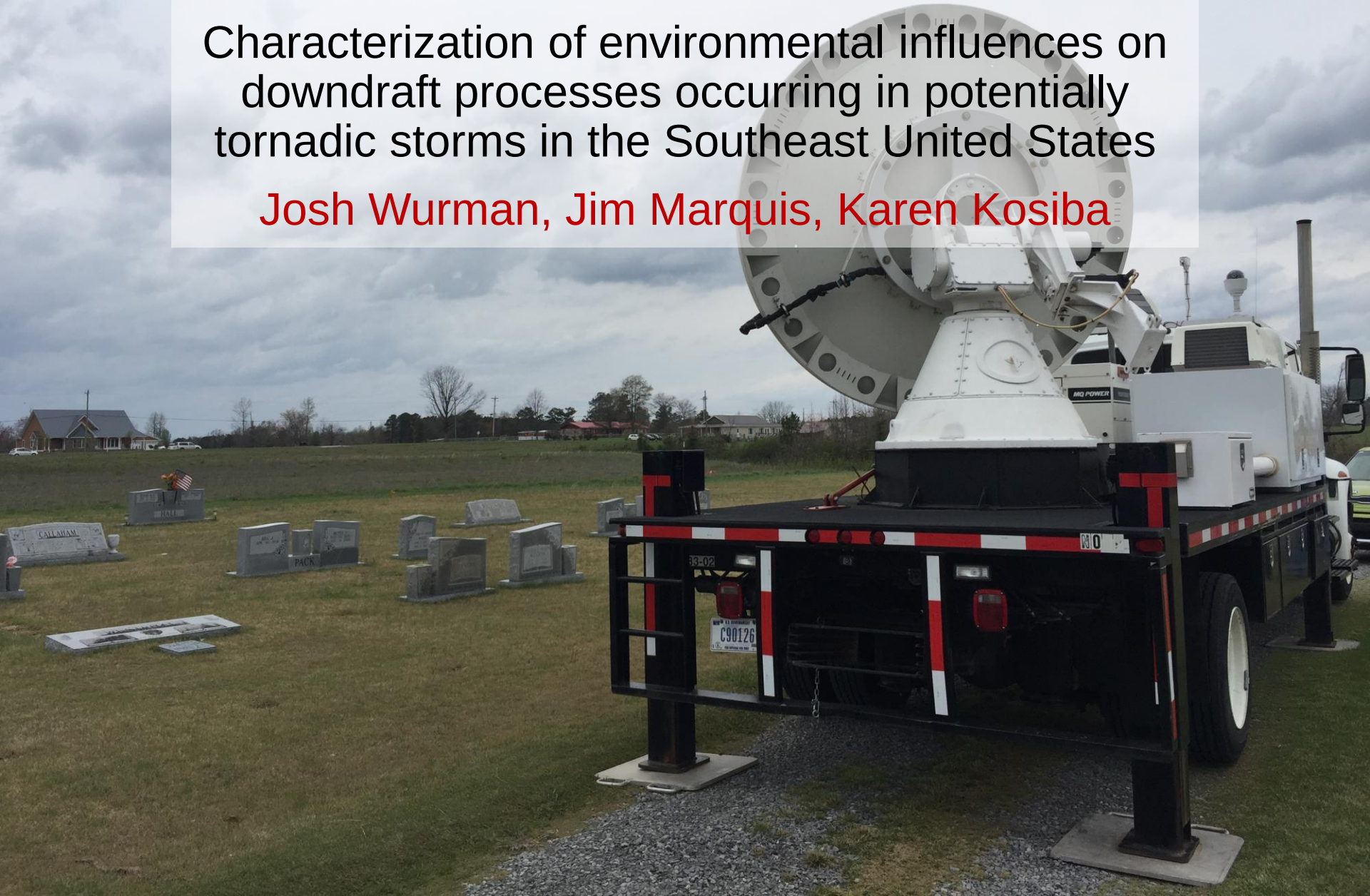


Research Objectives:

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

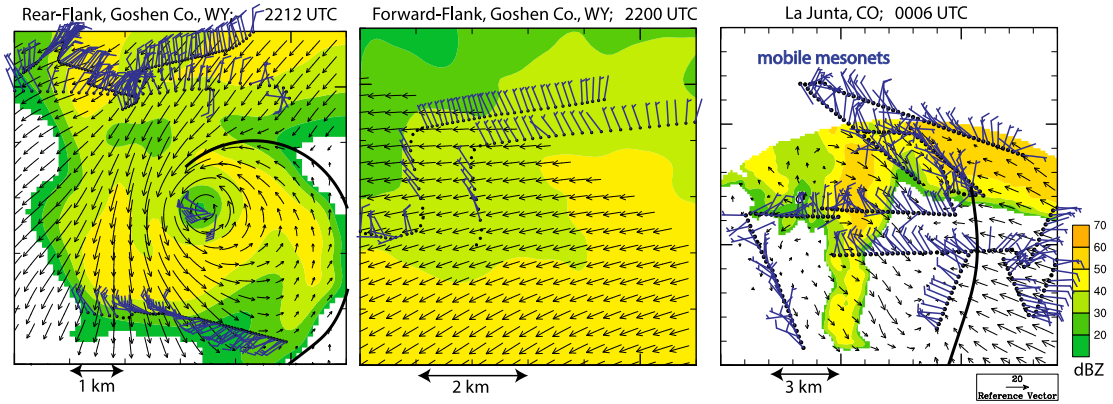
3) Identify how specialized and/or targeted observations can improve detection or forecast of tornado occurrence can help guide future observing networks, modeling systems, and further field research in the southeastern U.S.

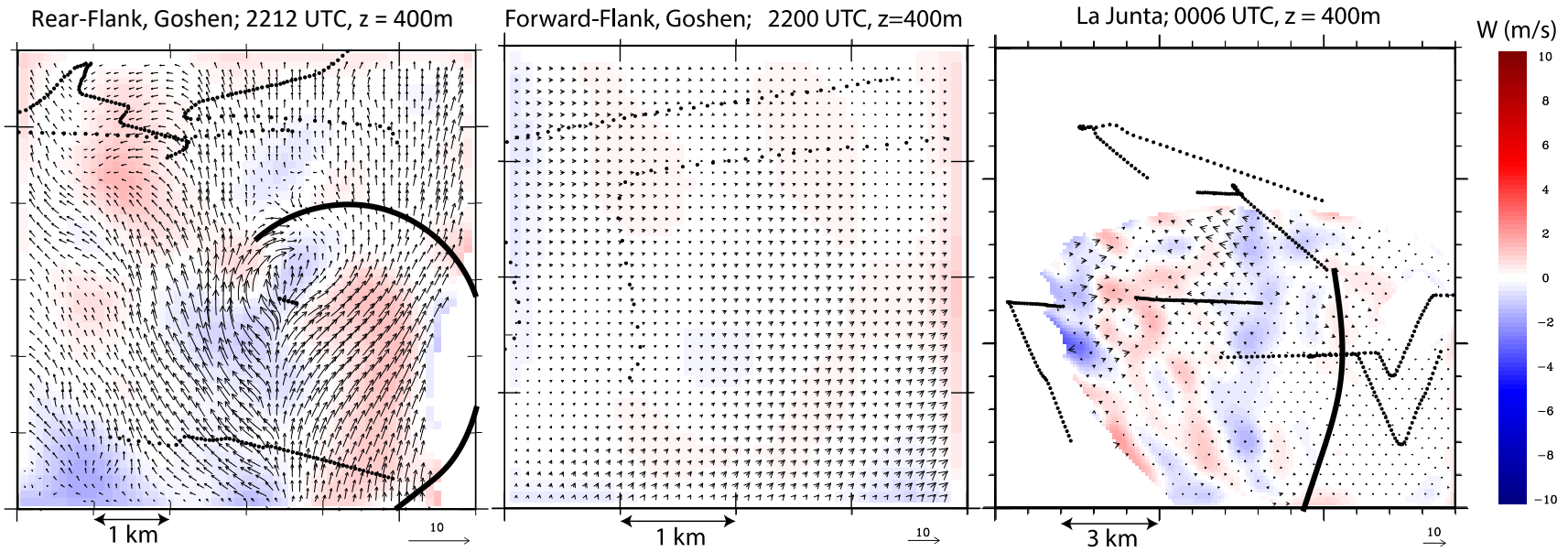
Objective (1)

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

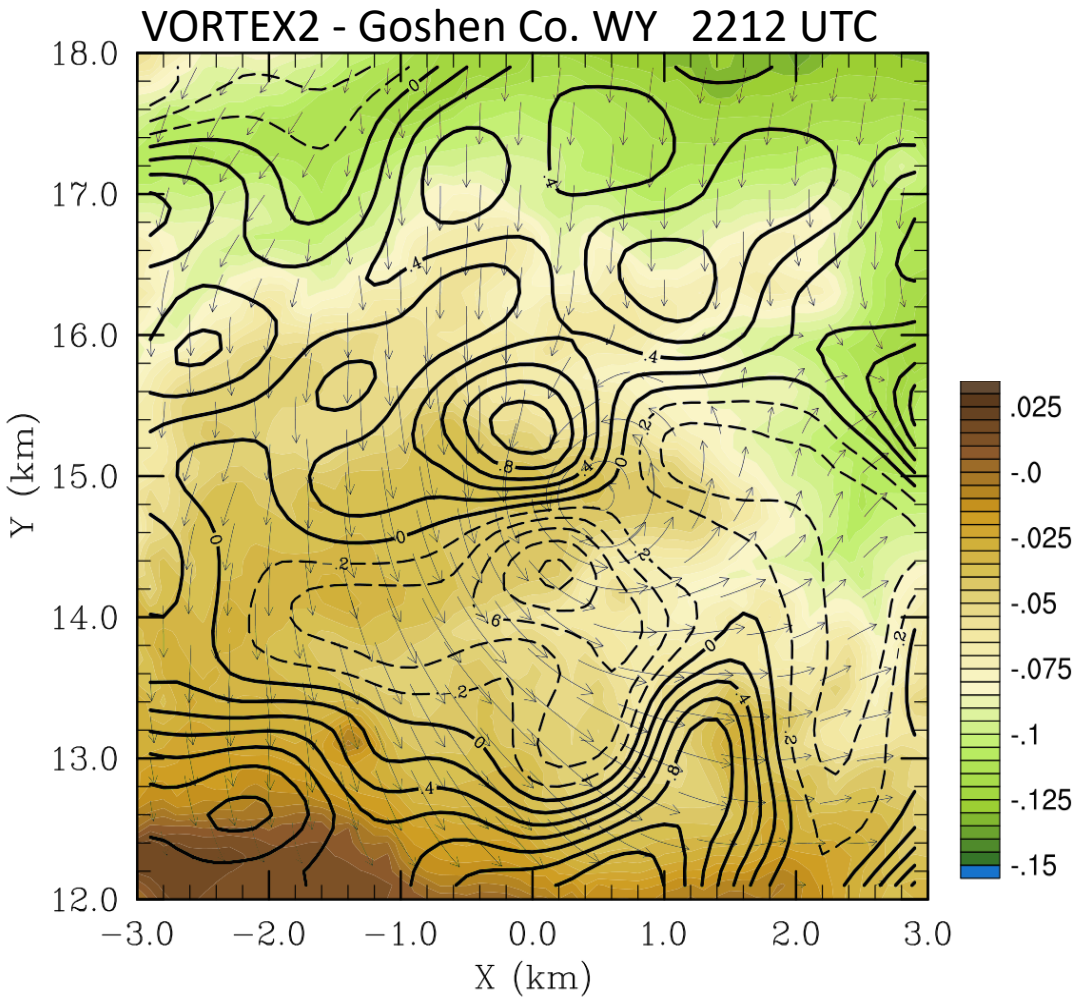




Difference between dual-Doppler horizontal (vectors) and vertical (shaded) velocity retrievals when solutions include/exclude objectively analyzed surface wind obs

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



Terrain height in km relative to the altitude of the lowest radar (shaded); horizontal dual-Doppler wind (vectors); terrain-induced upward (solid) and downward (dashed) wind (W) contours.

Objective (2)

Downdraft characteristics in VSE cases

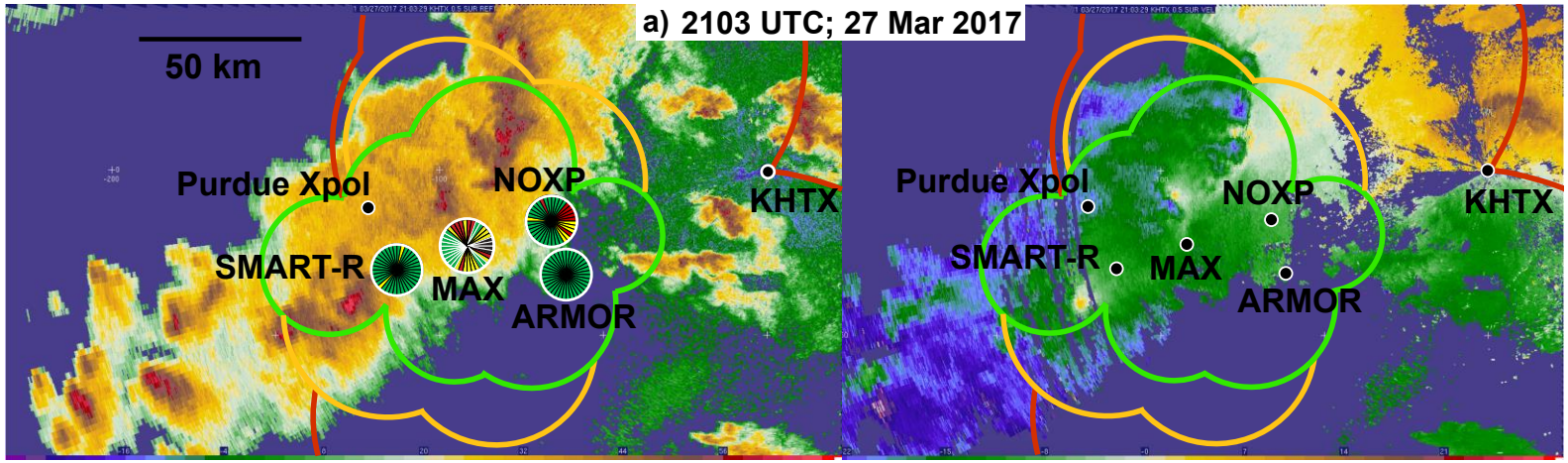
Data Selection: VSE 2017

Needs:

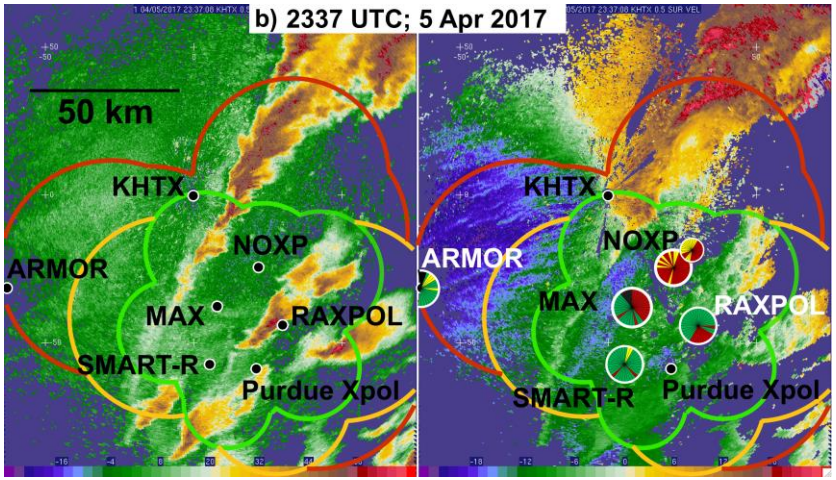
- "Interesting" weather in domain
- Synced dual-Doppler with [mostly] un-blocked low-level radar scans
- Good coverage of surface instrumentation and sonde/profilers

Center for Severe Weather Research

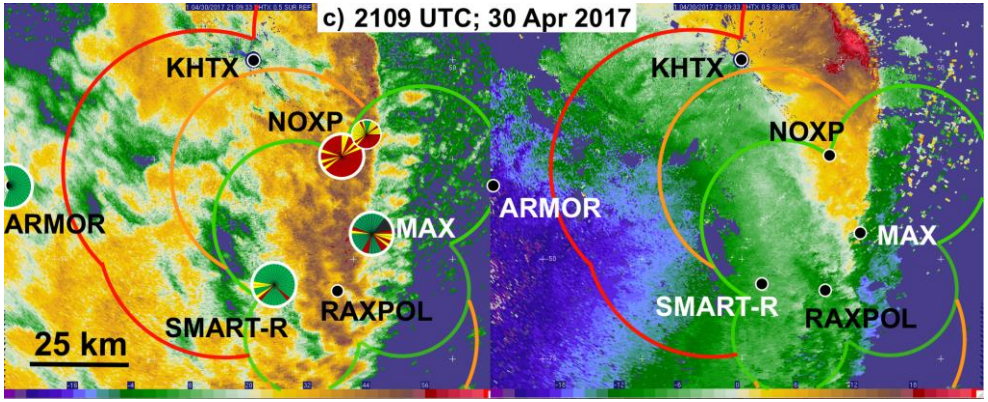
27 March 2017: IOP 1b - QLCS with bowing segments, areas of weak low-level rotation, and leading isolated cells



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

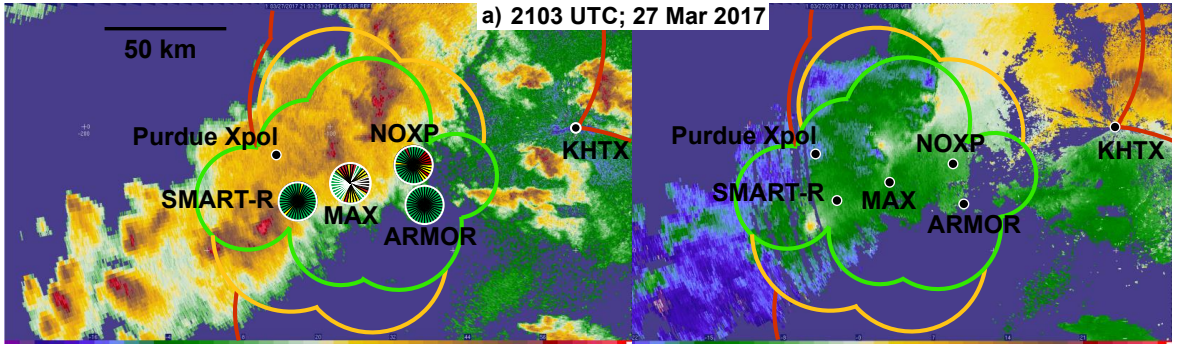


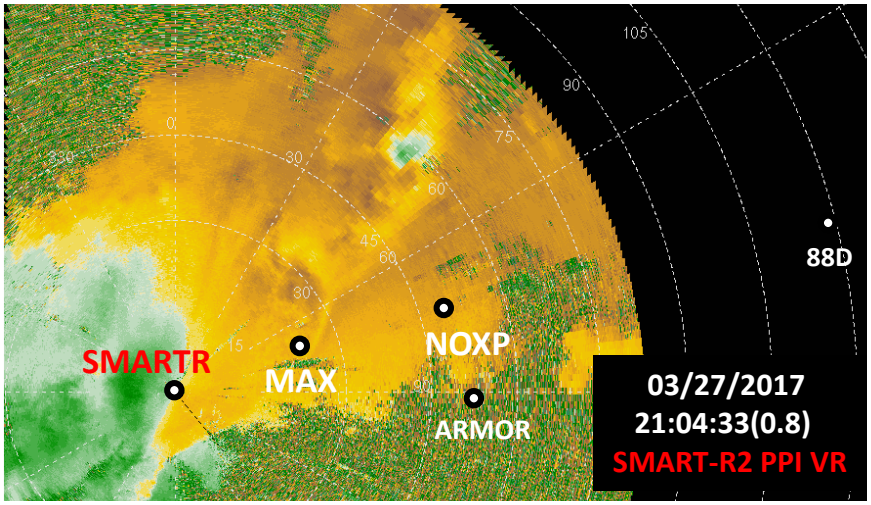
30 April 2017: IOP 4C - Weakening QLCS with small/weak bowing segments over Sand Mt.

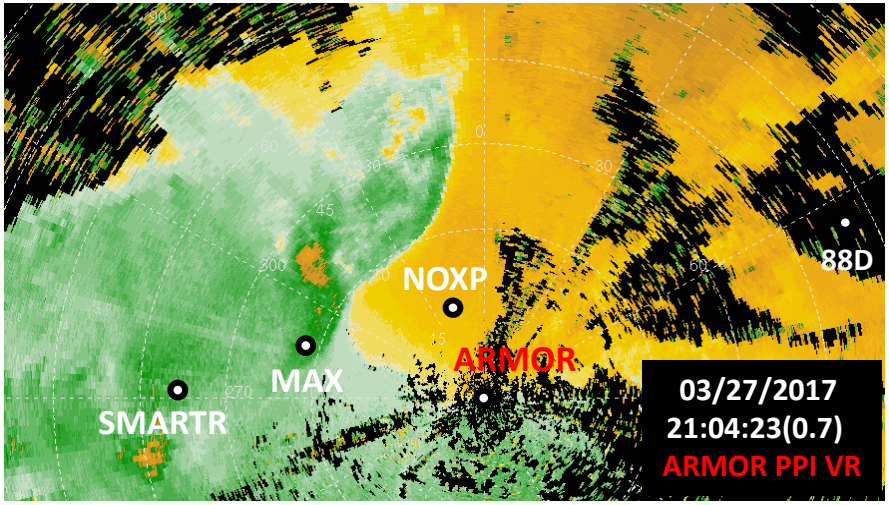


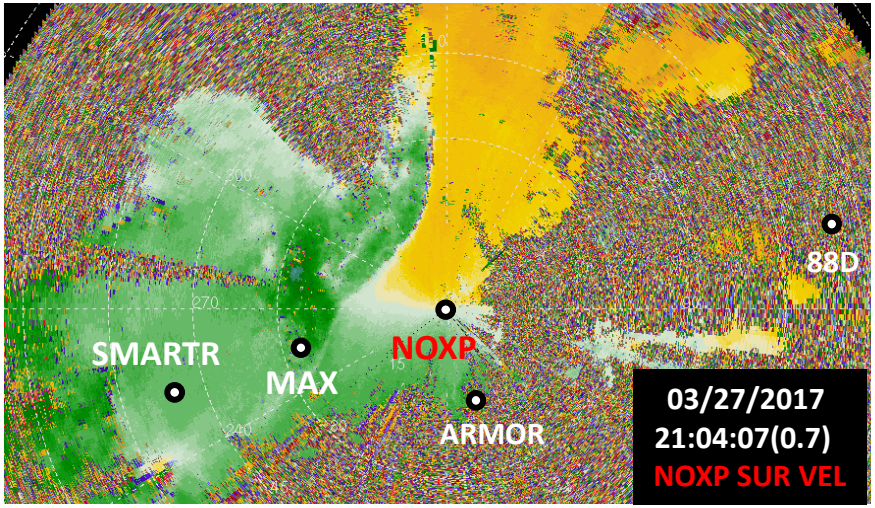
***Most optimistic* dual-Doppler coverage**, with: **< 25km**, **25-40km**, **> 40km** baselines

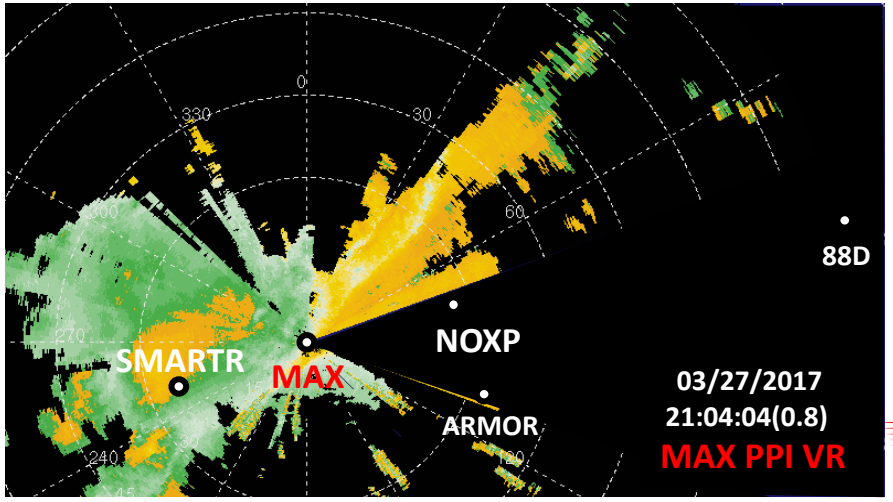
Mapping realistic dual-Doppler coverage/quality



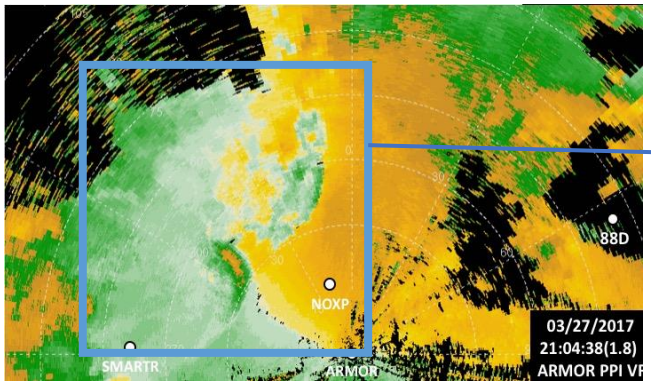


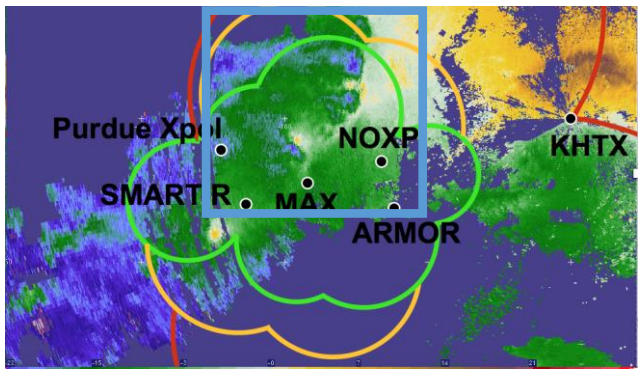


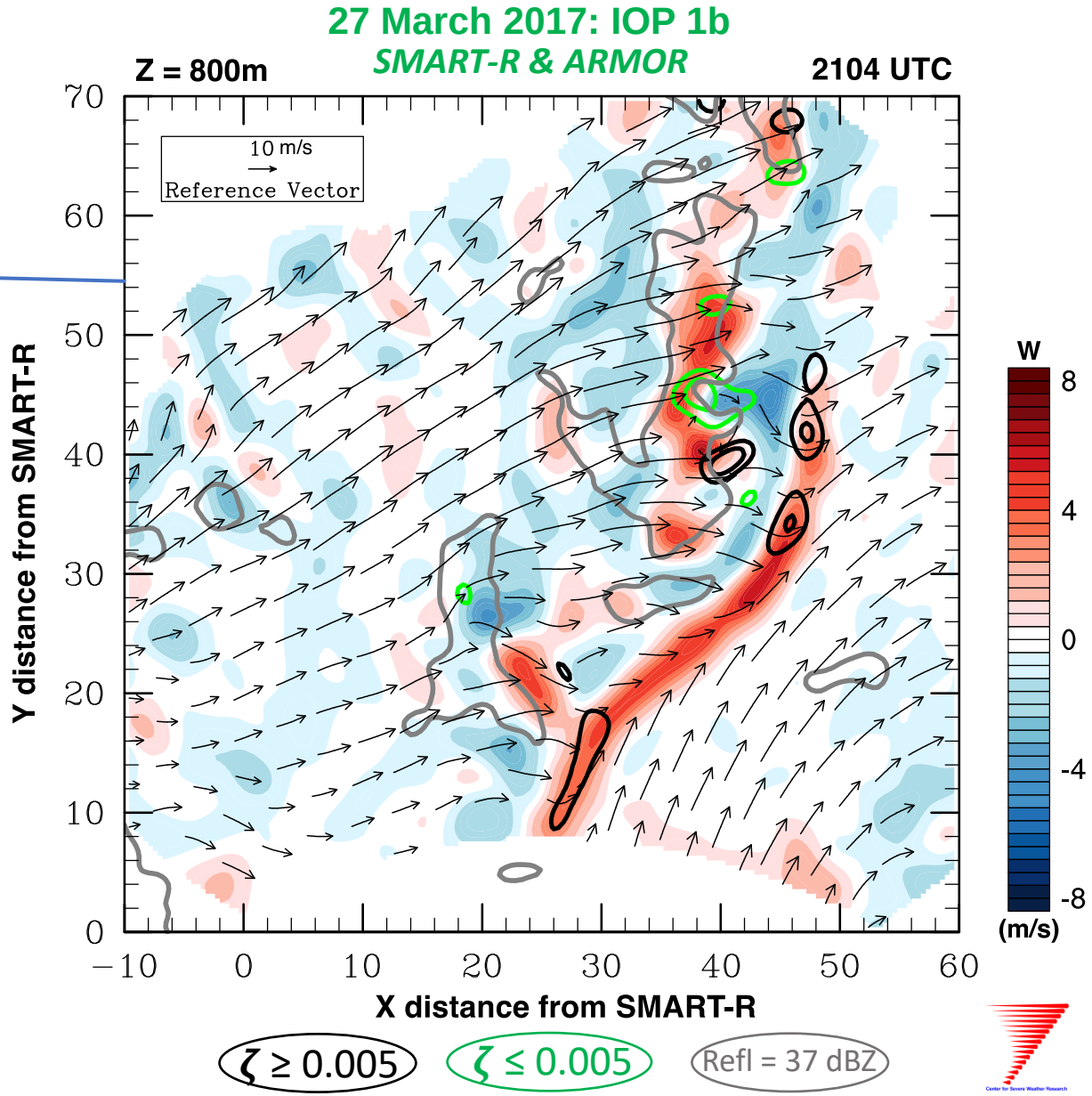




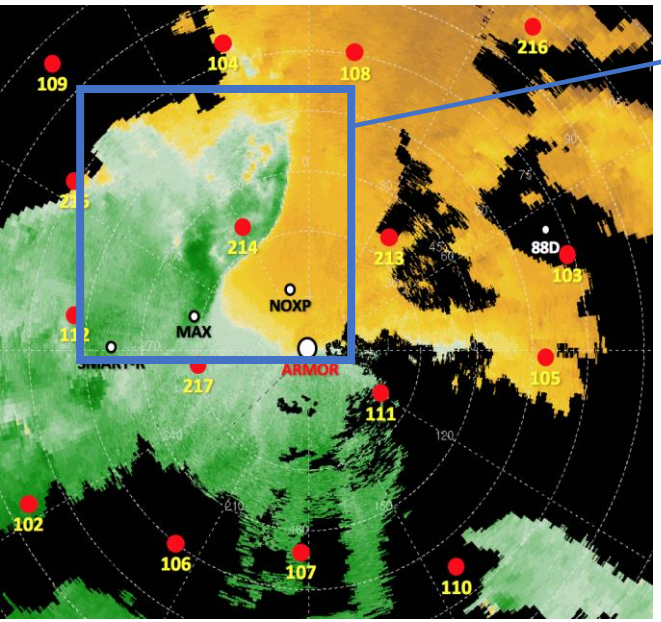
Initial dual-Doppler syntheses



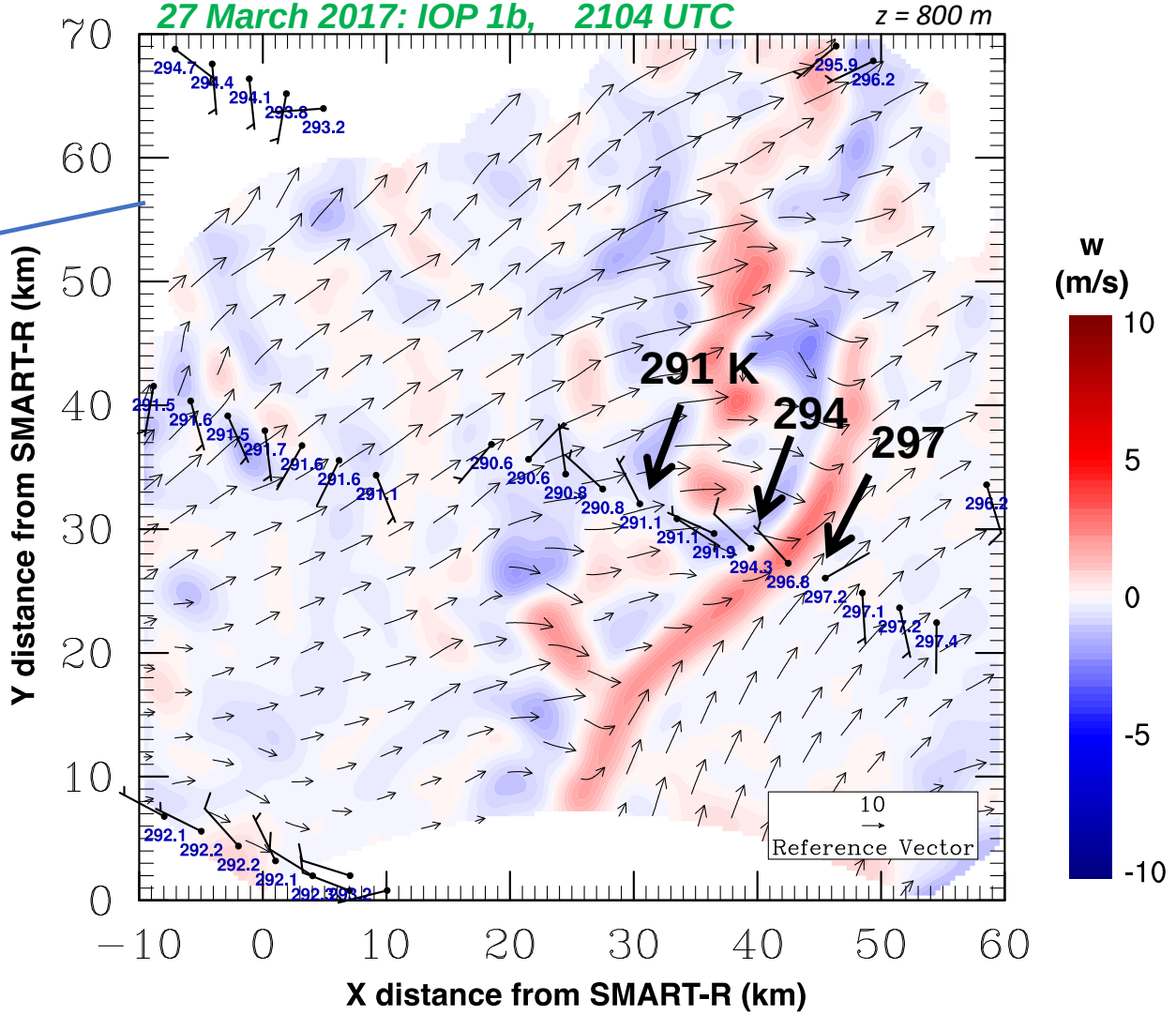




Integrating dual-Doppler and surface obs (stesonet): To evaluate thermodynamics across gust front and downdraft



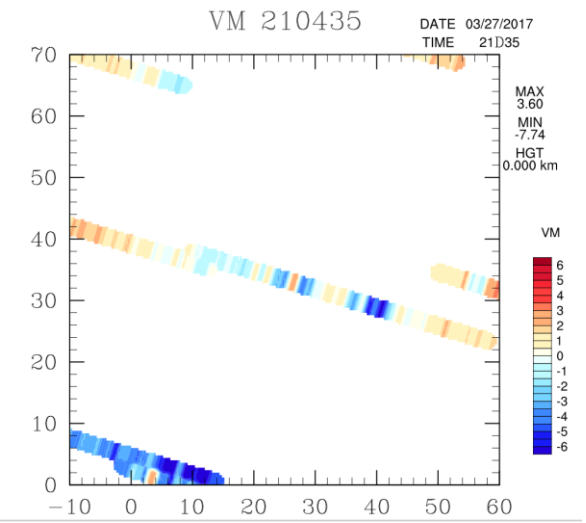
Time-Space Conv. (5-min window)
Winds in m/s
Potential Temp in K



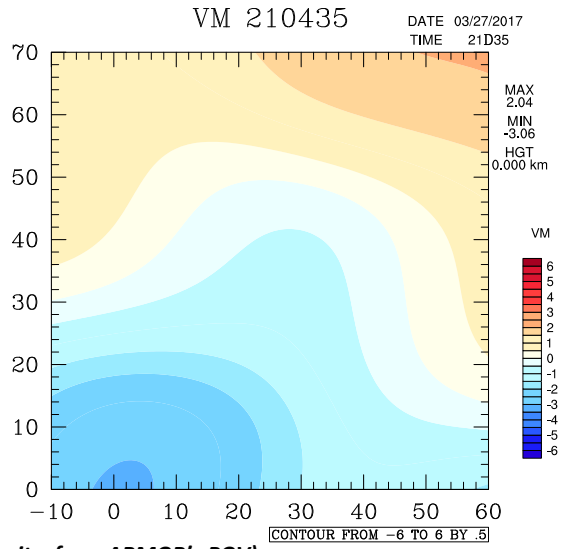
Working toward VSE wind retrievals with surface data
Sticknet at 30 km spacing

STICKNET OBAN:

very little smoothing



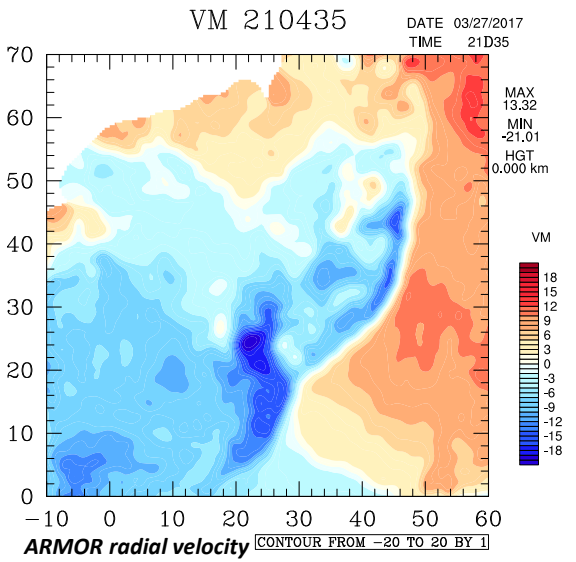
more smoothing



(STICKNET winds converted to radial velocity from ARMOR's POV)

+

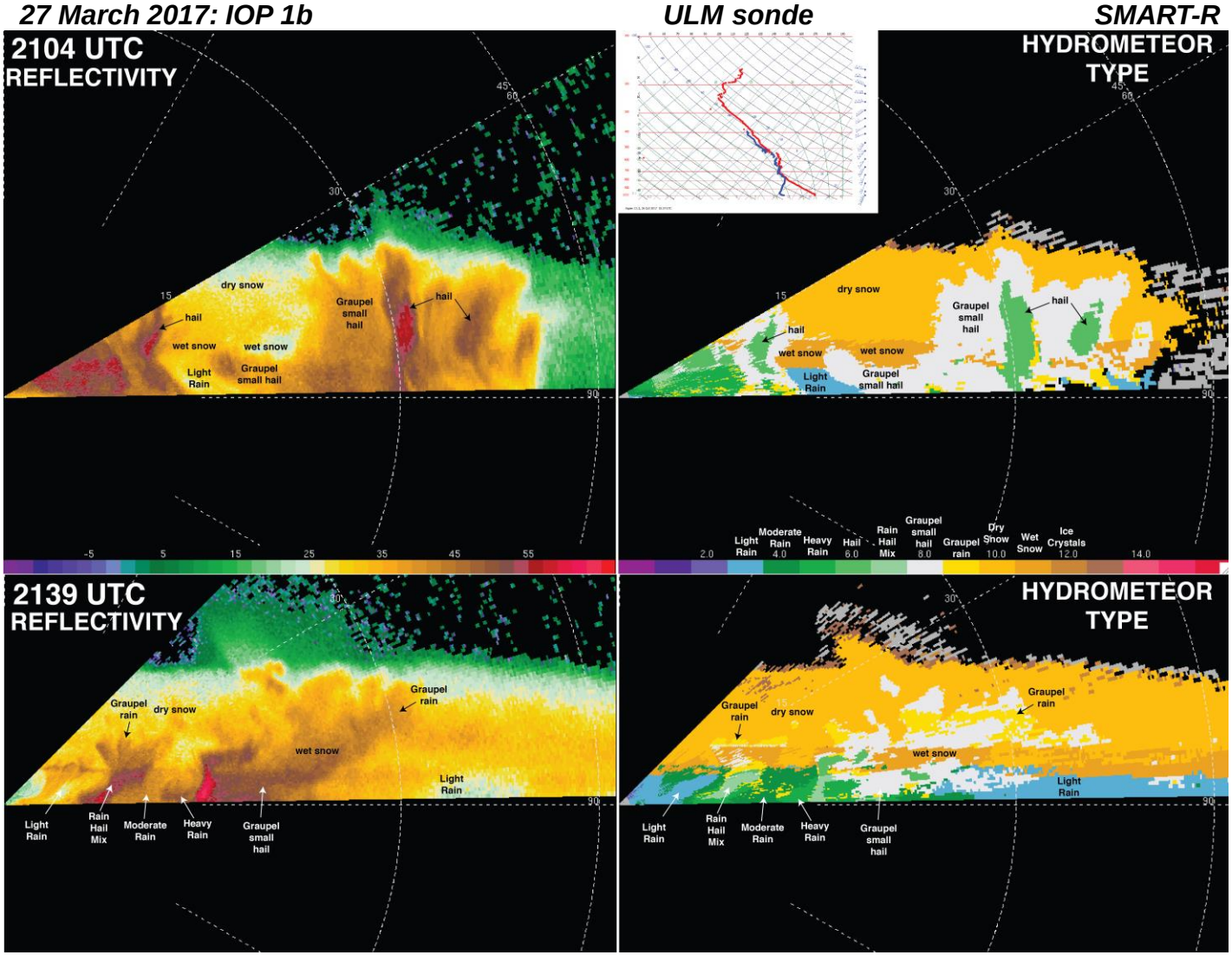
VSE radars:
e.g., ARMOR



+ terrain

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

Microphysics of downdrafts: Hydrometeor type retrievals from dual-pol obs



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

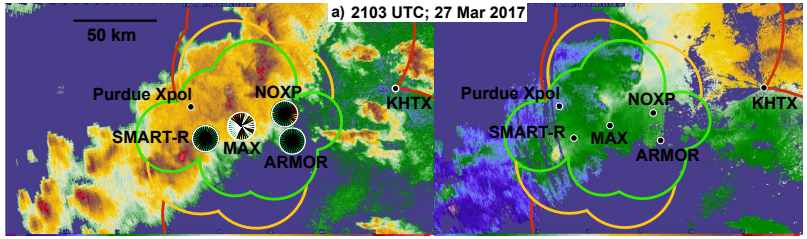
- Continued dual-Doppler technique development (*lower boundary condition with terrain and sfc obs*),

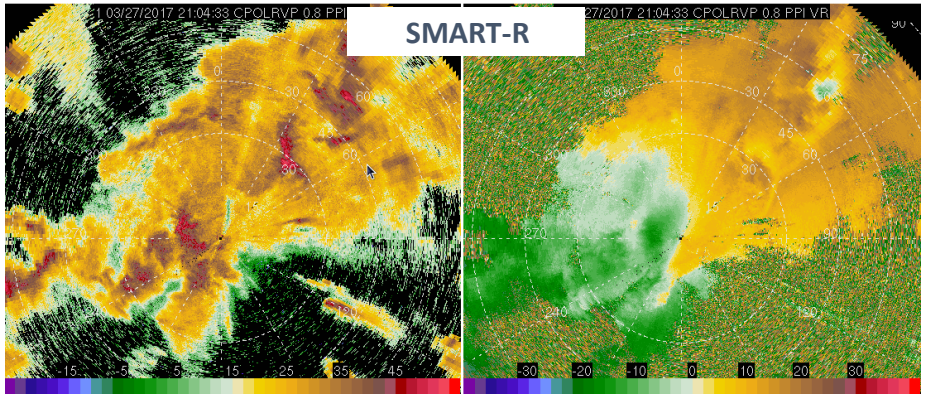
- Website to disseminate results

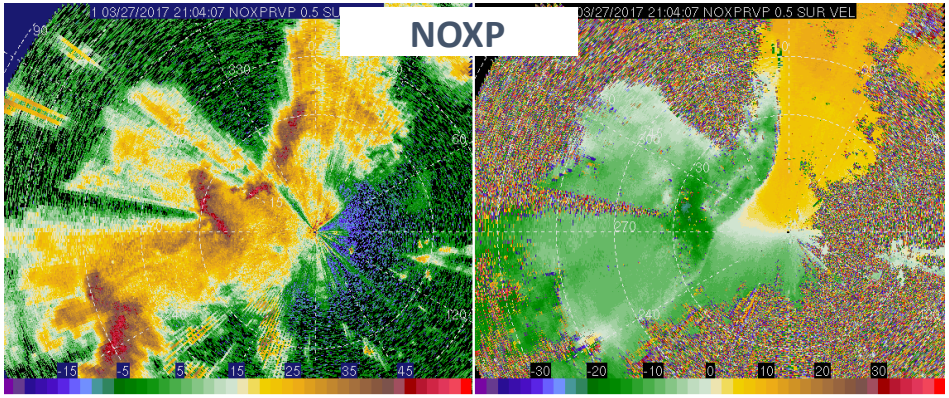
Want to learn more?
Send us a hedgehog dressed as old west sheriff

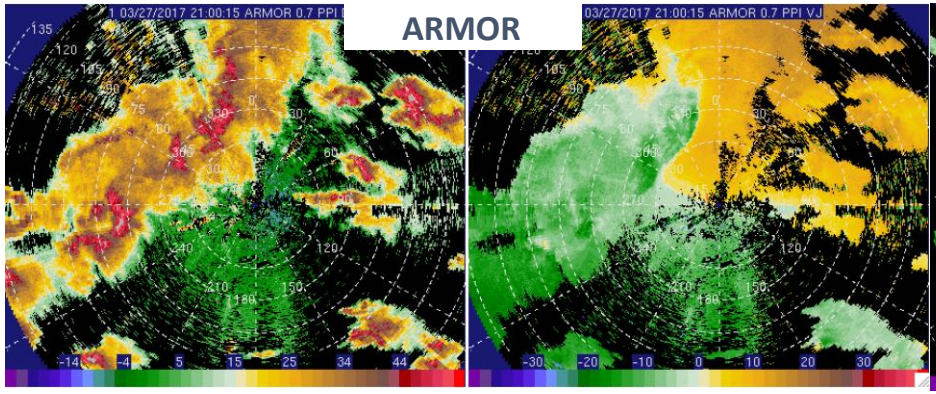
(*A real one, not a picture. No return postage necessary*)

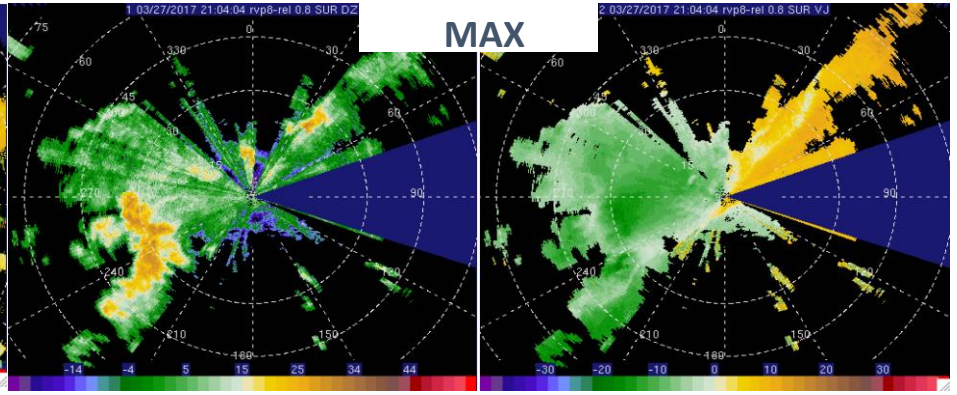
OR…visit our website (under development)


a) 2103 UTC; 27 Mar 2017
50 km
Purdue Xpol
NOXP
KHTX
SMART-R
MAX
ARMOR
Purdue Xpol
NOXP
KHTX
SMART-R
MAX
ARMOR


SMART-R


NOXP


ARMOR


MAX