VORTEX-SE

Environmental influences on downdraft processes in potentially tornadic storms in the Southeast United States

Center for Severe Weather Research

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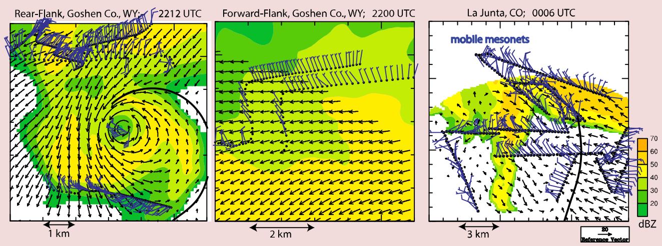
GOALS:

…USING DATA COLLECTED PRIMARILY FROM 2017 VSE FIELD PHASE:

1. Refine dual-/multi-Doppler analysis techniques, with emphasis on the lower boundary condition, as applicable to areas of complex terrain and land use similar to the southeastern U.S.
2. Dual-Doppler, in situ, and environmental analysis of downdrafts associated with potentially tornadic storms using instruments fielded during VORTEX-SE

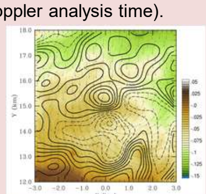
1) Low-level multi-Doppler technique development:

Algorithm development prior to VSE 2017 field phase using dual-Doppler data collected with DOW radars and dense network of in situ surface instruments during VORTEX2, including terrain at the lower BC.

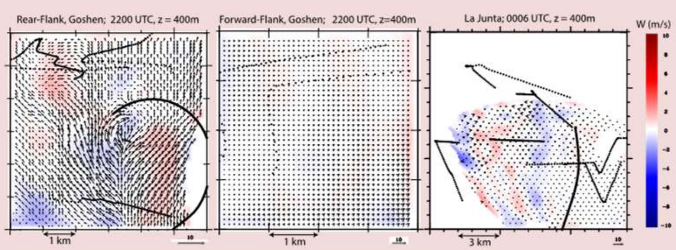


ABOVE. Illustration of the dual-Doppler radar and in situ data used for the initial modification of wind retrieval software. Near-surface dual-Doppler-retrieved horizontal winds (vectors) and radar reflectivity (shaded) for three analyses of two supercells observed with DOW radars during VORTEX2; **left:** rear flank of the Goshen CO., WY, storm, **middle:** portion of the Goshen storm's forward flank, and, **right:** the La Junta, CO, storm. Locations of near-surface gust fronts are traced (black lines) and positions of near-surface in situ wind observations are shown in blue (time-space converted, valid within 3 min of the dual-Doppler analysis time).

BELOW. Difference between dual-Doppler horizontal (vectors) and vertical (shaded) velocity retrievals from above when solutions include and exclude objectively analyzed surface wind observations. For reference, thick black lines indicate positions of near-surface gust fronts and black dots indicate positions of raw surface observations used in each retrieval.



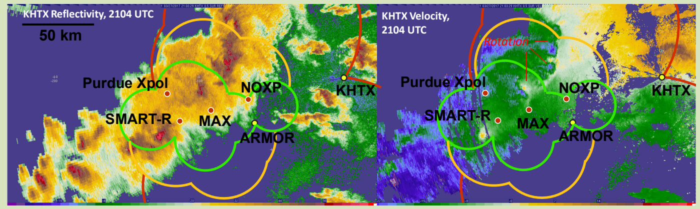
ABOVE. Vertical velocity at Z = 0 m with the inclusion of terrain in the dual-Doppler retrievals in the Goshen Co., WY, case. Color contours indicate terrain height in km relative to the altitude of the lowest radar; solid (dashed) lines are upward (downward) vertical velocities in m/s; vectors depict the horizontal winds.



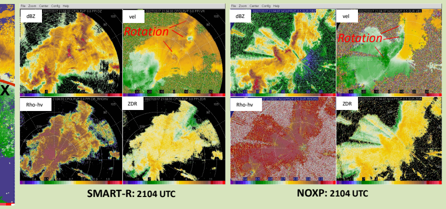
2) Preliminary RADAR data evaluation from 2017 field phase:

Evaluation in progress of dual-Doppler suitability of available radar data collected in the western and eastern VSE domains from three cases that will be focus of downdraft studies. *Mobile Radars with available data: NOAA NOXP (X-band), OU SMART-R (C-band), OU RaXPol (X-band), Purdue X-Pol (X-band) ; MAX (X-band) (data may be available in the future)* *Stationary Radars: ARMOR (C-band), KTHX 88D (S-band).*

IOP 1B, 27 MARCH 2017: QLCS with bowing segments, areas of weak low-level rotation, and leading cells.



Best theoretical dual-Doppler lobes between VSE radars (not accounting for blockage, attenuation, etc.), with baselines: < 25 km (green), 25-40km (yellow), and +40km (red).

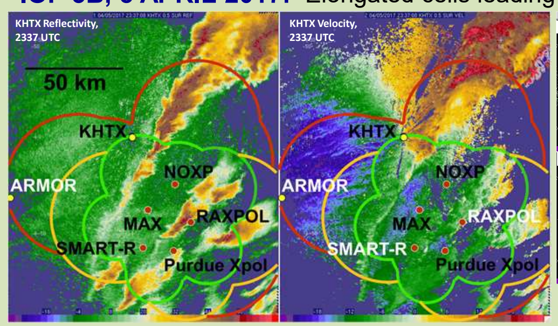


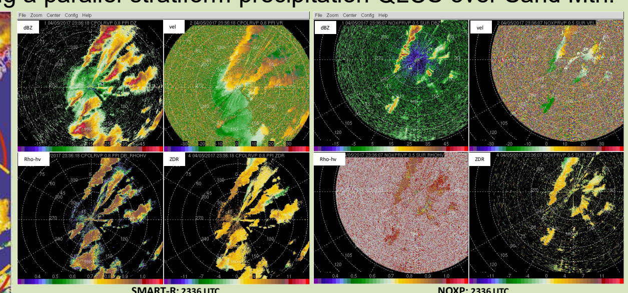
SMART-R: 2104 UTC

NOXP: 2104 UTC

Mobile radars with available data from the same time as the KHTX image to the left. (0.8 or 0.5-degree elevation angle).

IOP 3B, 5 APRIL 2017: Elongated cells leading a parallel-stratiform precipitation QLCS over Sand Mtn.





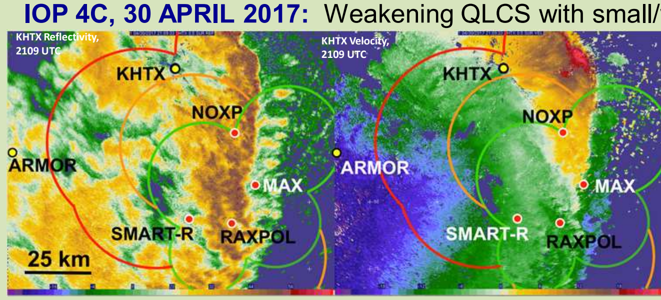
SMART-R: 2336 UTC

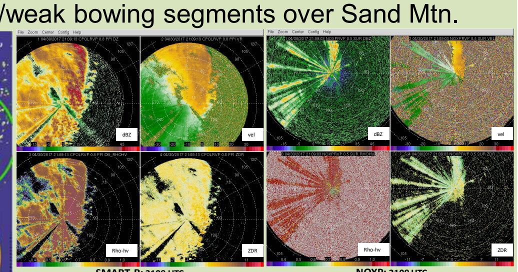
Generally good radar coverage of this event with SMART-R, limited beam blockage in some sectors.

NOXP: 2336 UTC

Beam blockage below 1.5-degrees limits dual-Doppler coverage near this site.

IOP 4C, 30 APRIL 2017: Weakening QLCS with small/weak bowing segments over Sand Mtn.





SMART-R: 2109 UTC

Generally good coverage with SMART-R. Limited beam blockage and few attenuation issues.

NOXP: 2109 UTC

Beam blockage below 1.5-degrees and attenuation limits dual-Doppler coverage near this site.