NOAA, X-BAND, DUAL POLARIZATION (NOXP): A MOBILE RADAR FOR MULTIPLE USES

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1. Introduction

- **NOXP** was built by NSSL engineers and technicians in 2008 for in-the-field radar data collection programs where high-resolution and lower-height-above-the ground information were needed
- The radar was initially called the **X**-band **E**xperimental **R**adar for the **E**xamination of **S**torms (**XERES**), but the name was changed to **NOXP** in 2009.
- NOXP has been used as a part of a wide variety of field programs since 2008:
  - Supercells/Tornadoes
    - VORTEX2 (2009-2010)
    - NSSL/OU/CSWR Joint Program (2011)
  - Thunderstorm Electrification
    - DC3 (OK, TX, CO, 2012)
  - Hydrologic Cycle
    - HyMeX (France, 2012)
  - Winter Storms
    - SNOW-V10 (Vancouver Winter Olympics, 2010)
  - Desert Thunderstorms/Haboobs
    - SRP (AZ, 2010-2012)
  - Bat Migrations
    - TX, NM (2011)
  - Hurricanes
    - OU/NSSL (Ike, 2008)
  - Boundary Layer Studies (proposed)
    - dry line, partially elevated convection, others

2. Technical Specifications and Data Collection Details

- NOXP and KTLX have parabolic dishes, while PAR has a flat-plate antenna
- NOXP is mobile and PAR and KTLX are fixed base.
- Radar comparison information below

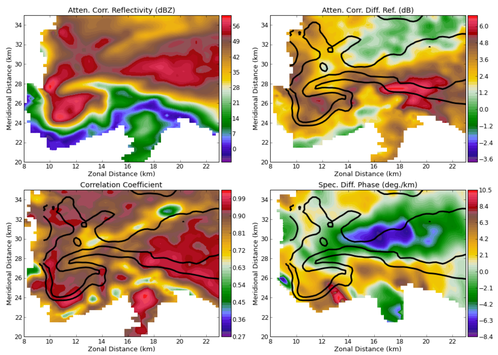
Radar Name	PAR	KTLX	NOXP
Wavelength	S-band (λ=10-cm)	S-band (λ=10-cm)	X-band (λ=3.2 cm)
Frequency	~2700 - ~3000 MHz	~2700 - ~2900 MHz	9410 MHz
3-dB Beamwidth	1.5° boresight/ 2° at edges of sector	0.93° (at 2850 MHz, Measured Average)	0.9°
Az. Sampling	~0.8° boresight / ~1° at edges of sector	0.5° (super-res.) / 1° (legacy res.)	0.5°
Nyquist Co-Interval	28.15 m/s Variable	26.12 m/s Variable	19.9 m/s Variable
Gate Length	0.24 km	0.25 km (super-res.) / 1 km (Ref. Factor - legacy res.) 0.25 km (Rad. Vel. – legacy res.)	0.075 km
Max Unambiguous Range	420.4 km	460 km (Ref. Factor) 300 km (Rad. Vel. – super res.) / 230 km (Rad. Vel. – legacy res.)	59 km
Peak Power	750 kW	750 kW	250 kW
Beam Steering	Mechanically Rotating Pedestal w/ Electronic Beam Steering	Mechanically Rotating Pedestal w/ Elevation Drive	Mechanically Rotating Pedestal w/ Elevation Drive
Sectors Collected	90°	360°	360°
Volume Scan Time	~1 min	~4.5 min	2 min (meso) 3 min (dual-pol)

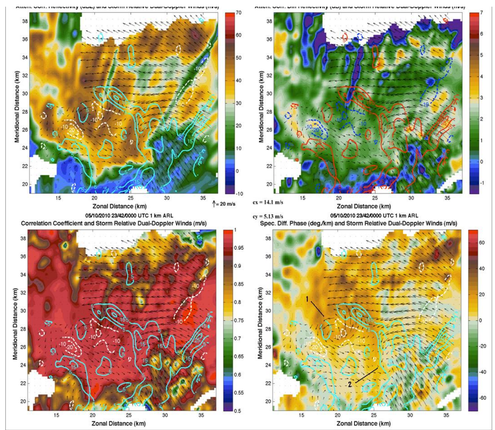
Table 1 – The technical specifications, scanning strategies, and corresponding beam height information (km Above Radar Level (ARL)) for the PAR, KTLX, and the NOXP mobile radar during the 2010 data collection season.

Questions? Email: Donald.Burgess@noaa.gov

3. Data Collection Examples

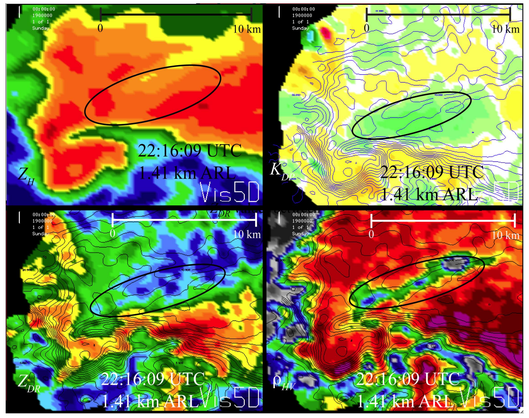
Supercells

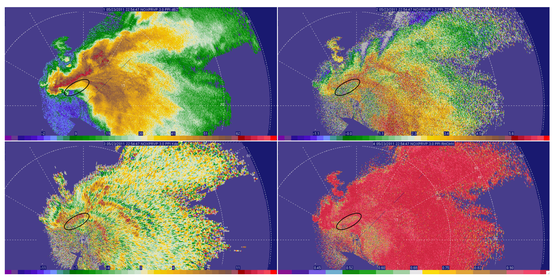


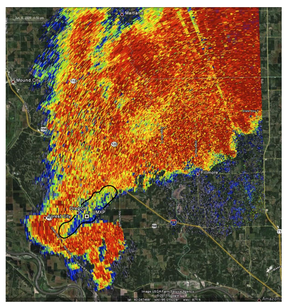


Supercells – (Top) NOXP deployment near Greensburg, KS on 9 June 2009 as part of VORTEX2; (Middle) 4-Panel of attenuation-corrected Zh (upper left), Attenuation-corrected Zdr (upper left), Rhv (lower left), Kdp (lower right) for 5 June 2009 in Goshen, County, Wyoming (VORTEX2); (Bottom) 4-panel as in middle except for 10 May 2010 near Wewoka, OK. Horizontal wind vectors and vertical velocity contours (upward-solid, downward – dashed) overlaid. For this cyclic supercell, both dissipating mesocyclone (1) and developing mesocyclone are marked (lower right panel; VORTEX2 case).

Giant Hail

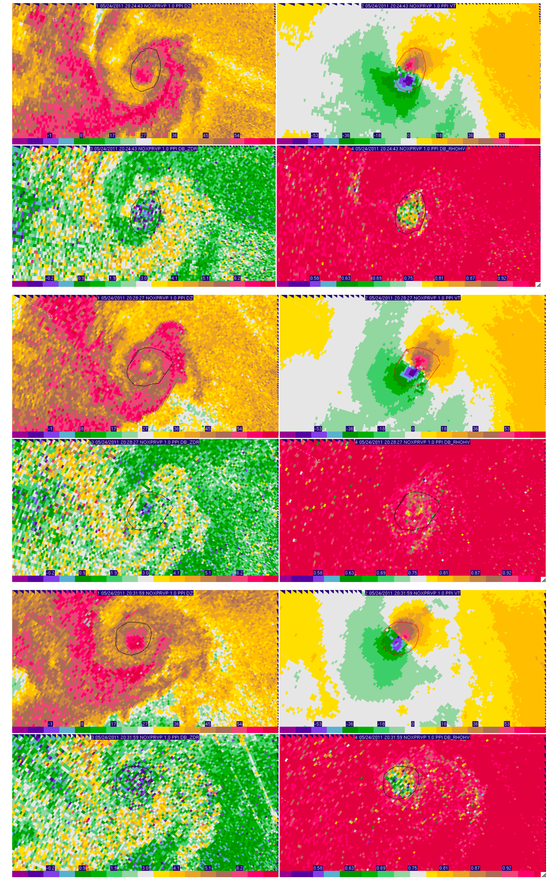






Giant Hail – (Top) 4-panel of attenuation-corrected Zh (upper left), Kdp (upper right), attenuation-corrected Zdr (lower left), Rhv (lower right) for 5 June 2009 in Goshen, County, Wyoming (VORTEX2). Large hail region (>5 cm) marked with ellipse. (Middle) 4-panel of Zh (upper left), Zdr (upper right), Kdp (lower left), Rhv (lower right) for 23 May 2011 in Kiowa County, OK, near time of 15 cm diameter hail (Oklahoma State Record; large hail region marked with ellipse), (Bottom) Rhv for 7 June 2009 near Savannah, MO (VORTEX2). Ellipse marks large hail area; UMXP marks location 10 cm diameter hail fall.

Tornadoes



Tornadoes – 4-panels (Zh (upper left), Vr (upper right), Zdr (lower left), Rhv (lower right) at three different times (top to bottom: 2024Z, 2028Z, 2031Z) during the Canton Lake, OK tornado 24 May 2011. Circled area is tornado debris signature. Note changes in debris signature as tornado passes from land (top), to water (middle), and back to land (bottom).

4. Summary

- NOXP collects data (Z, Vr, and dual-polarization) useful for many research purposes
- Mobile deployments are fast and easy to perform (set-up time of <5 minutes)
- Questions about use of NOXP should be directed to Mike Jain, NSSL Radar R & D Division Chief, and Allen Zahrai, NOXP Chief Engineer