The response of birds to abrupt natural hazards as observed using weather radar

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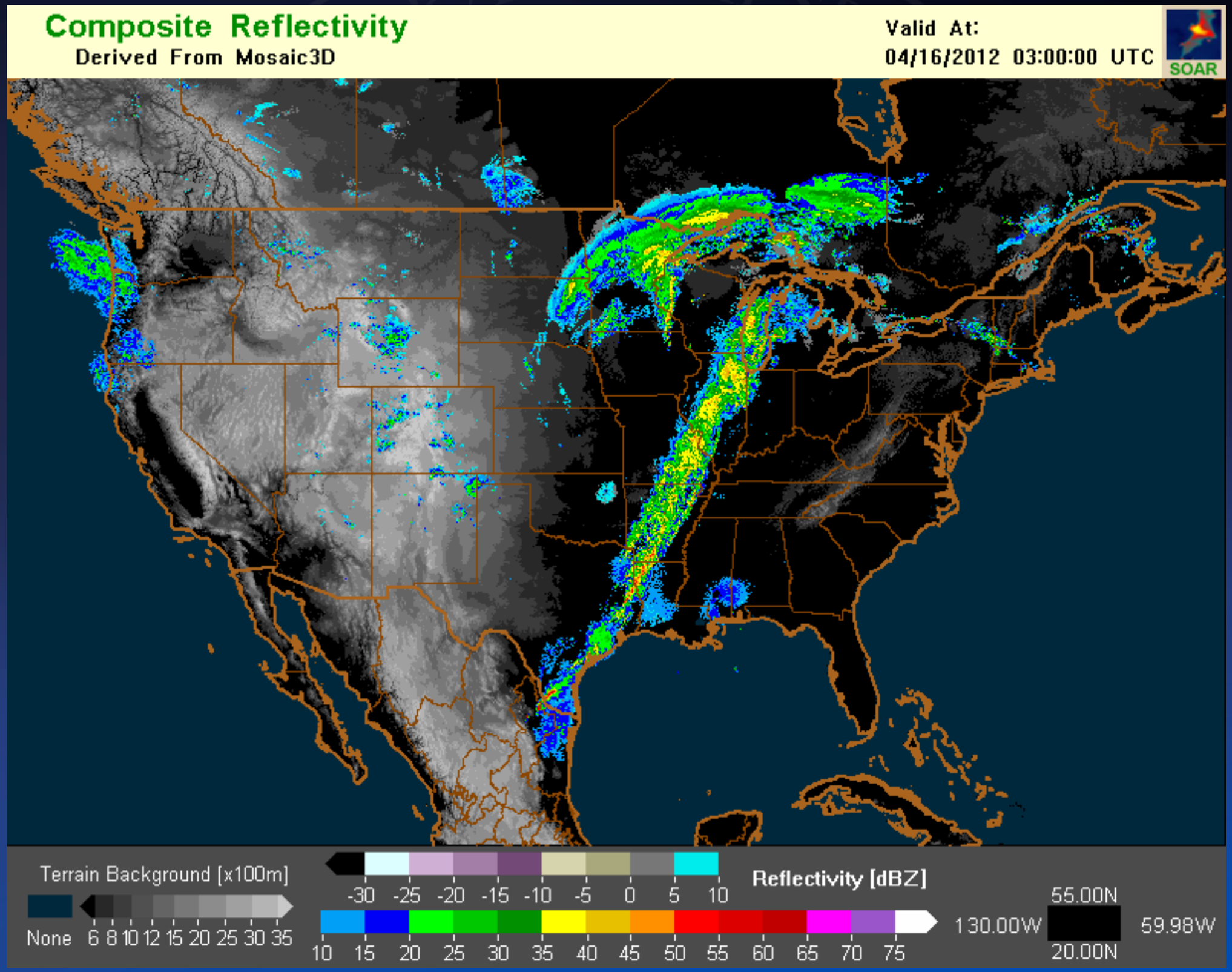
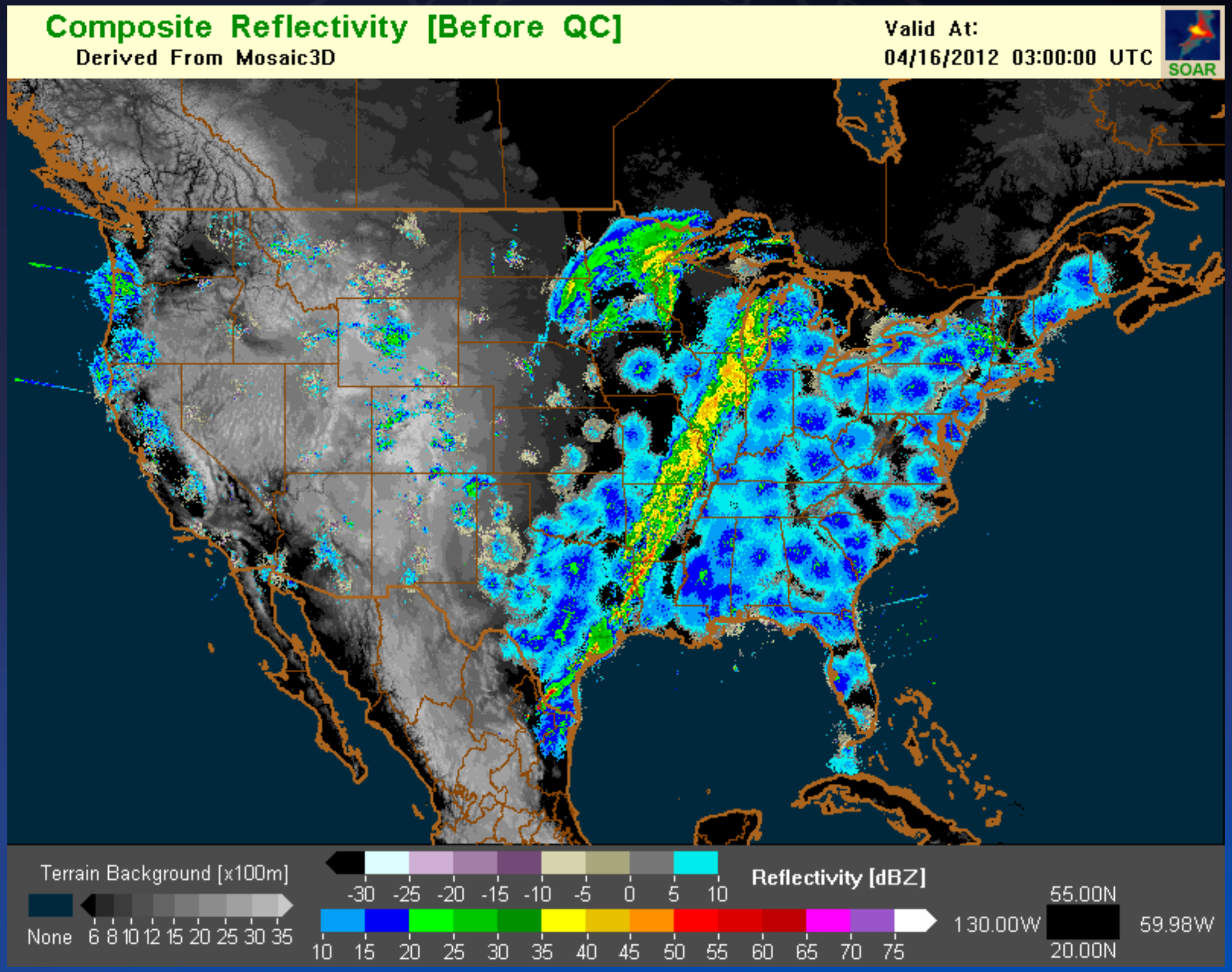
Background

There is a lack of information regarding how airborne animals respond to abrupt natural hazards: earthquakes, severe weather, flash floods, tidal waves and so forth.

Radar to Observe Birds, Bats, and Insets

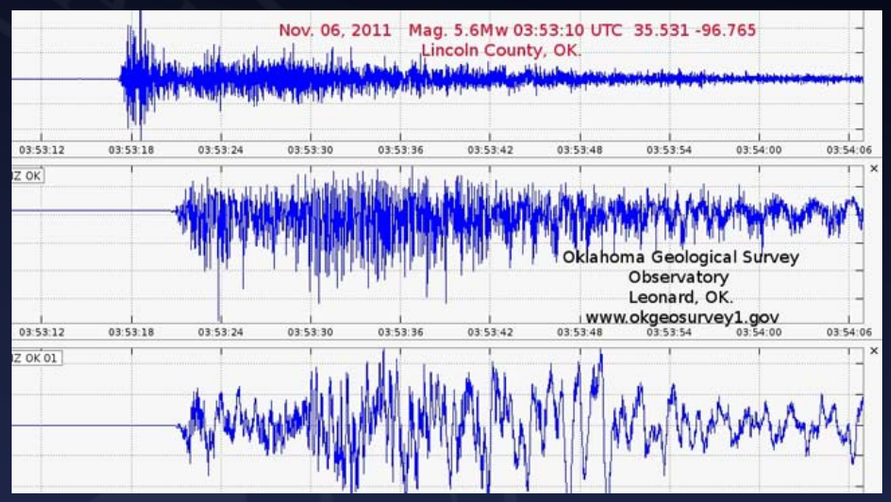


Radar to Observe Birds, Bats, and Insets



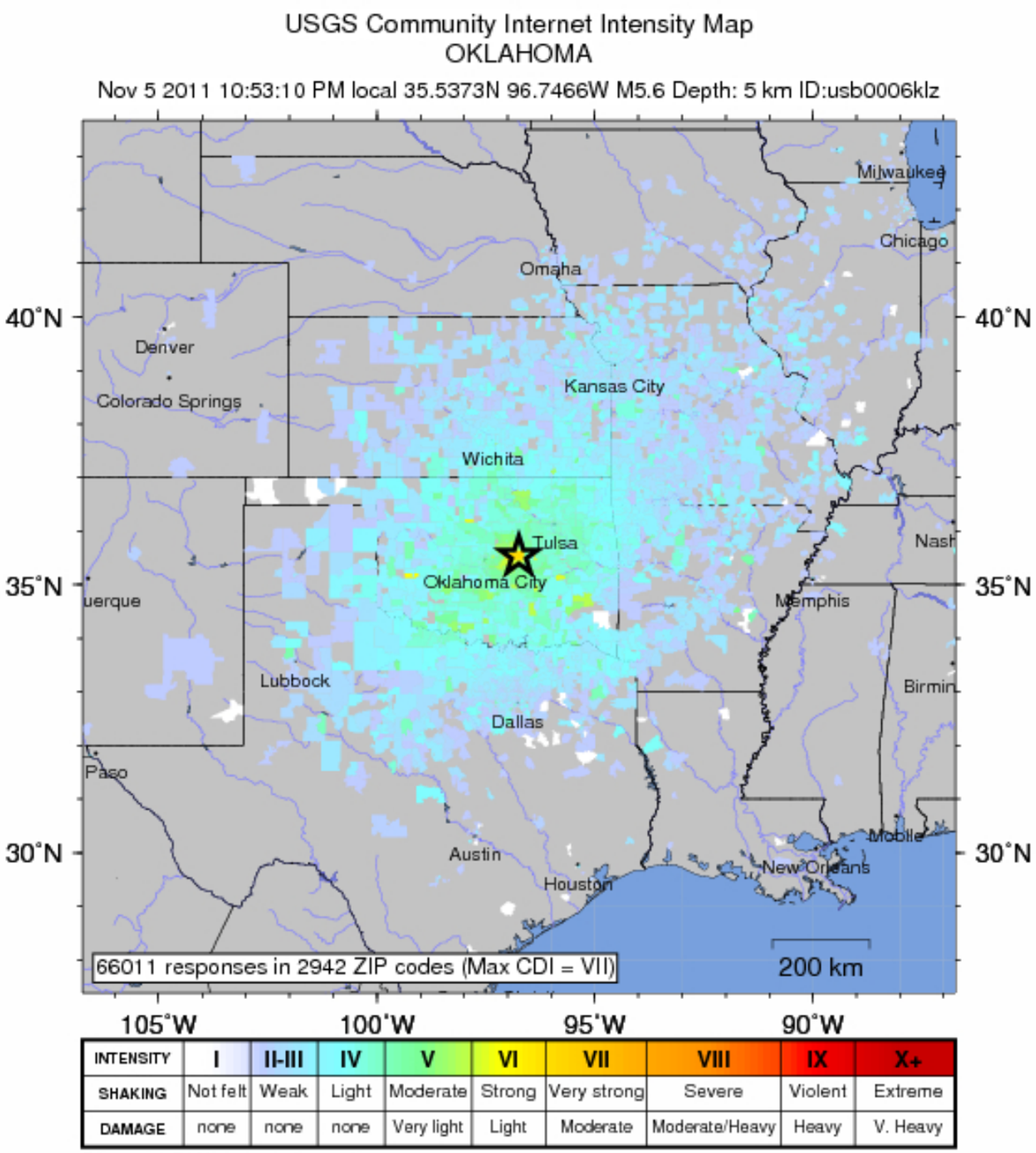
Cases Considered

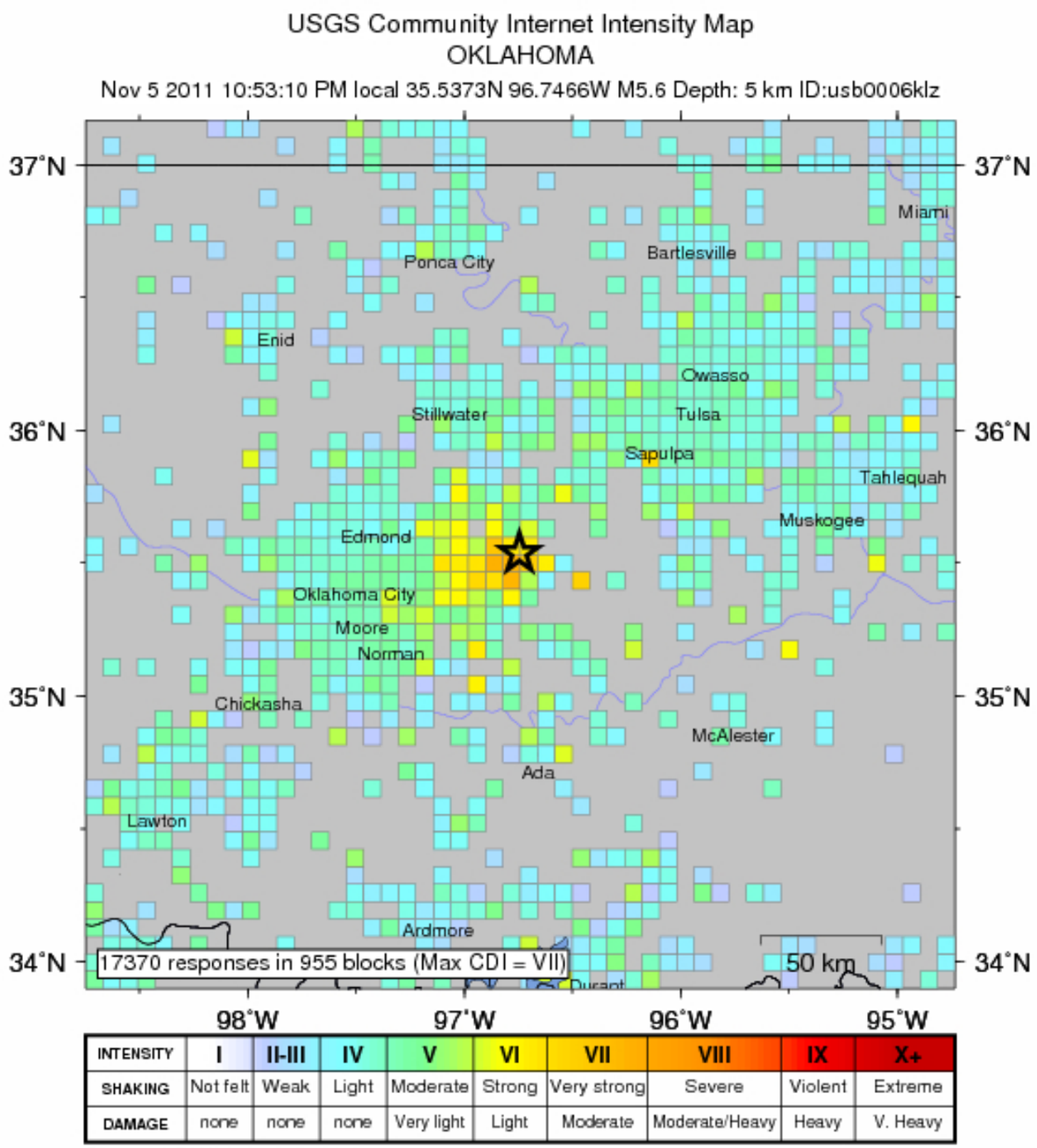
Earthquake:
Central Oklahoma
Magnitude 5.6 (largest on record in Oklahoma)
November 6th 2011
0353 UTC (22:53 local time)



Tornadic Storms:
Southwest Oklahoma
Generated several tornadoes including one EF-4 (strongest November tornado in Oklahoma records)
November 7th – 8th 2011

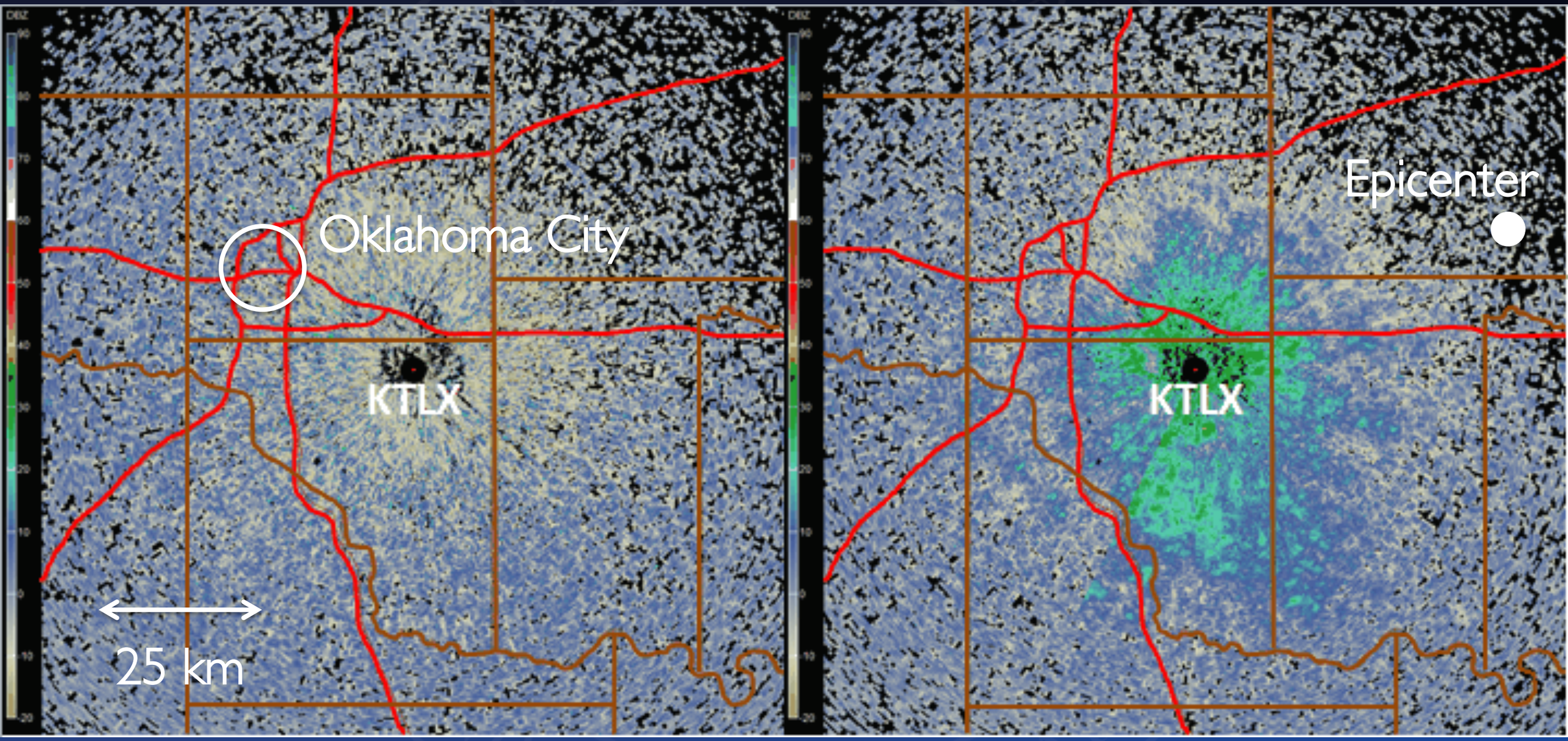
Earthquake Near Oklahoma City





http://earthquake.usgs.gov/earthquakes/eqinthenews/2011/usb0006klz

Earthquake Near Oklahoma City



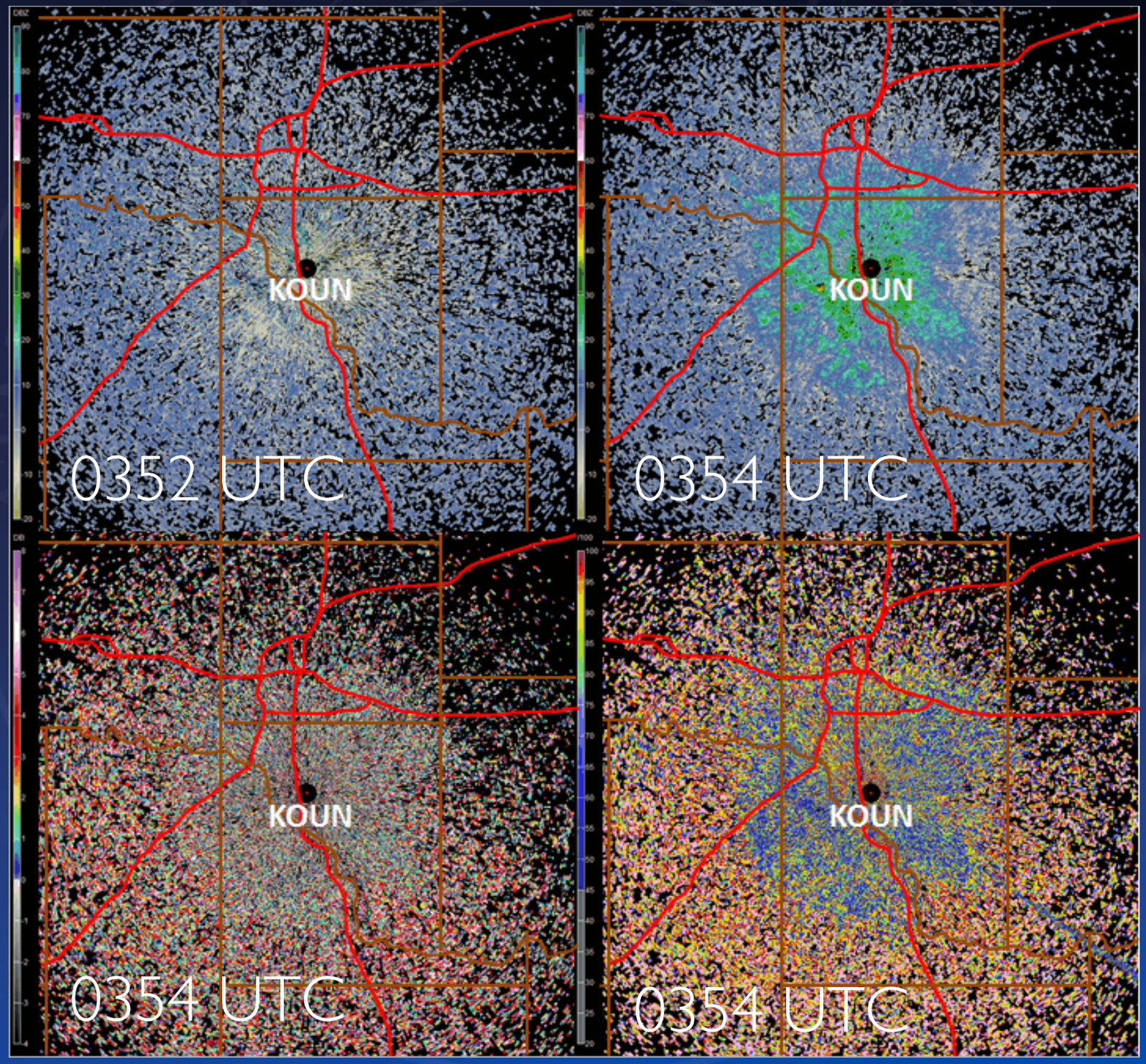
0350 UTC

0353 UTC

Z Observed with KTLX

Earthquake Near Oklahoma City

Z



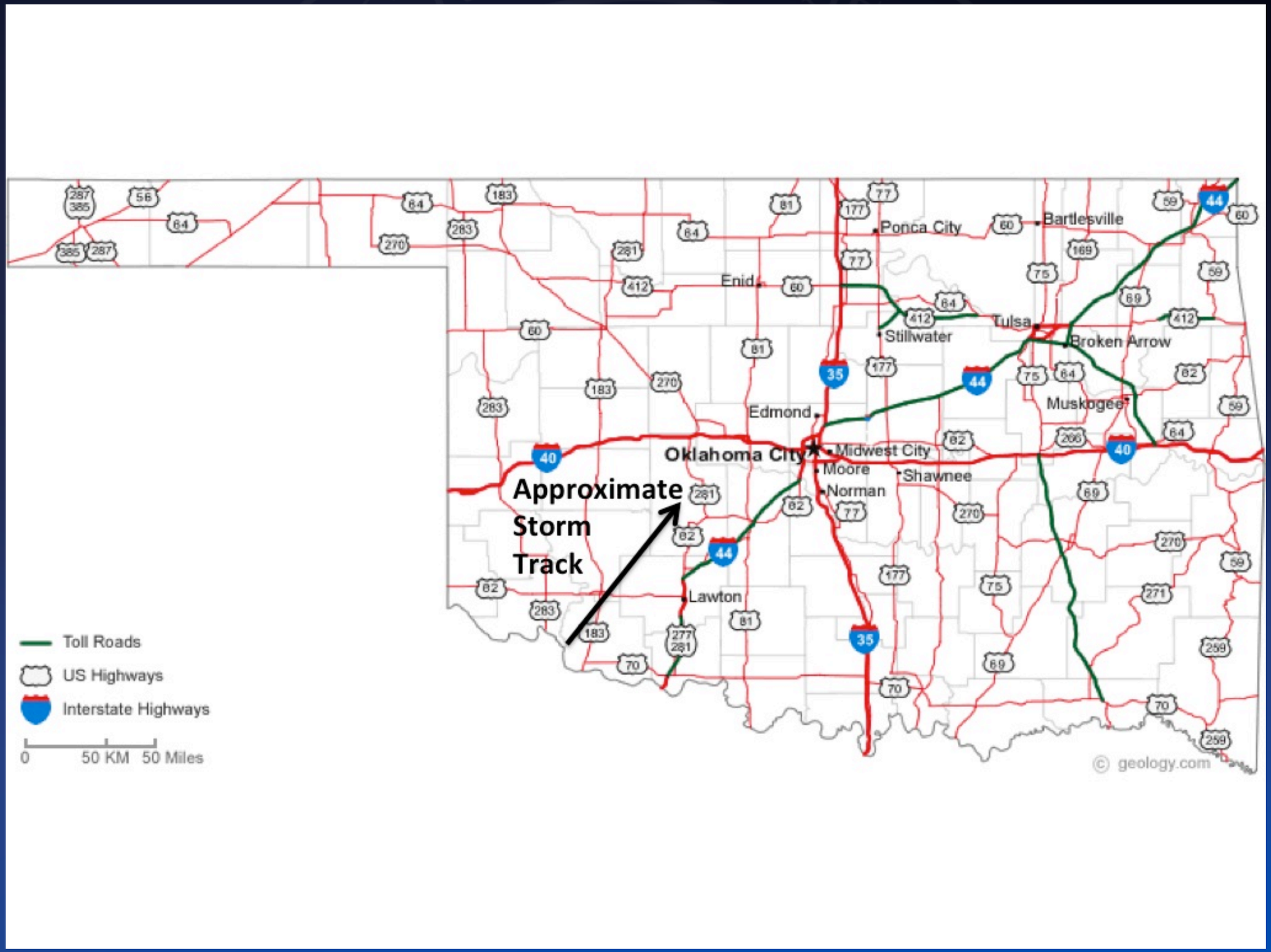
Z

ZDR

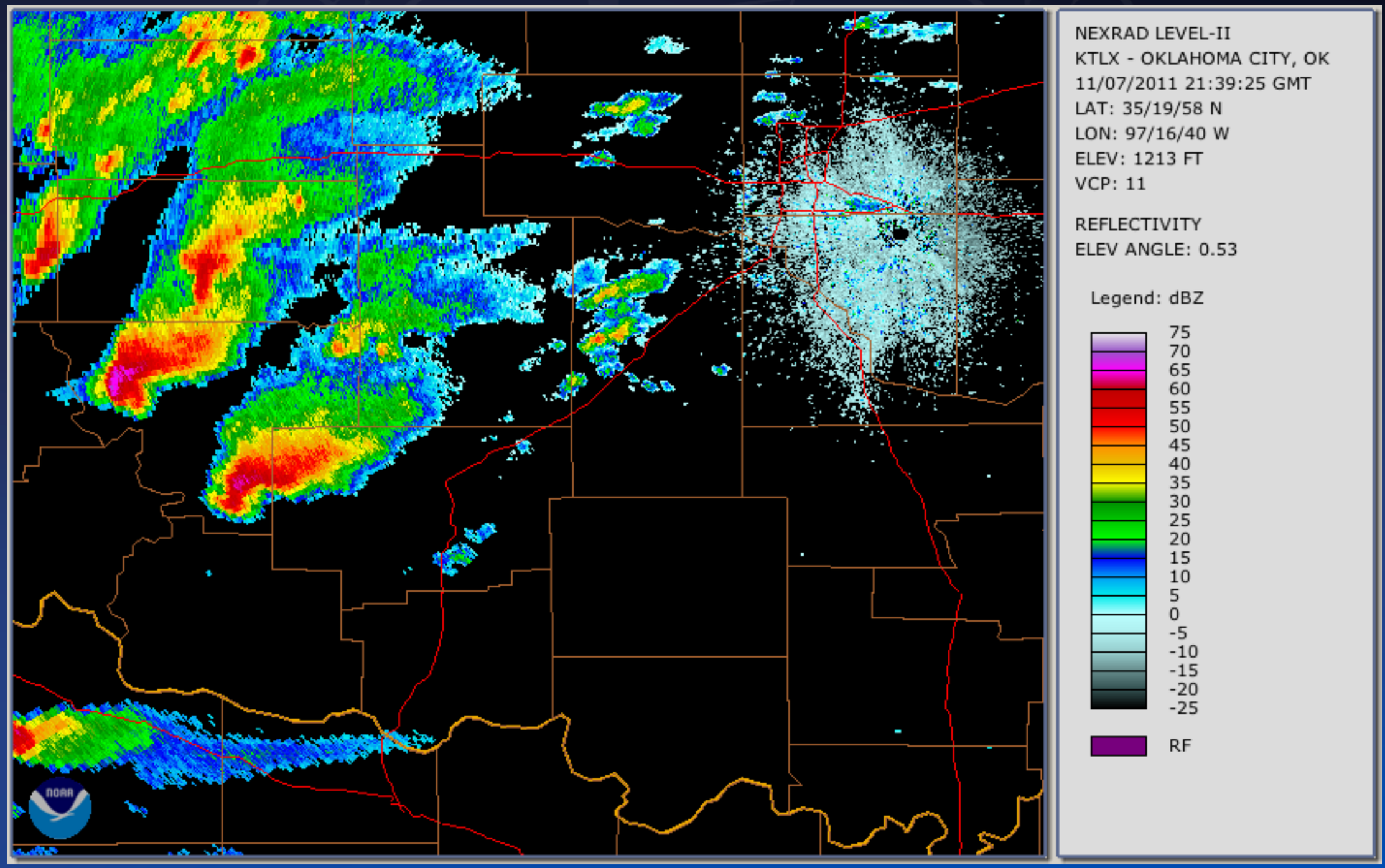
ρ_{hv}

Observed with KOUN (S-band polarimetric WSR-88D)

Tornadic Storms



Just another severe weather image coming from Oklahoma?



The Radar Operations Center Noted an "odd" signature in the polarimetic radar data corresponding to this event

After closer examination it became clear that these spatial regions correspond to the following features:

- Low values of ρ_{hv}
- Structure in the values of Φ_{DP}
- Structure in the values of Z_{DR}

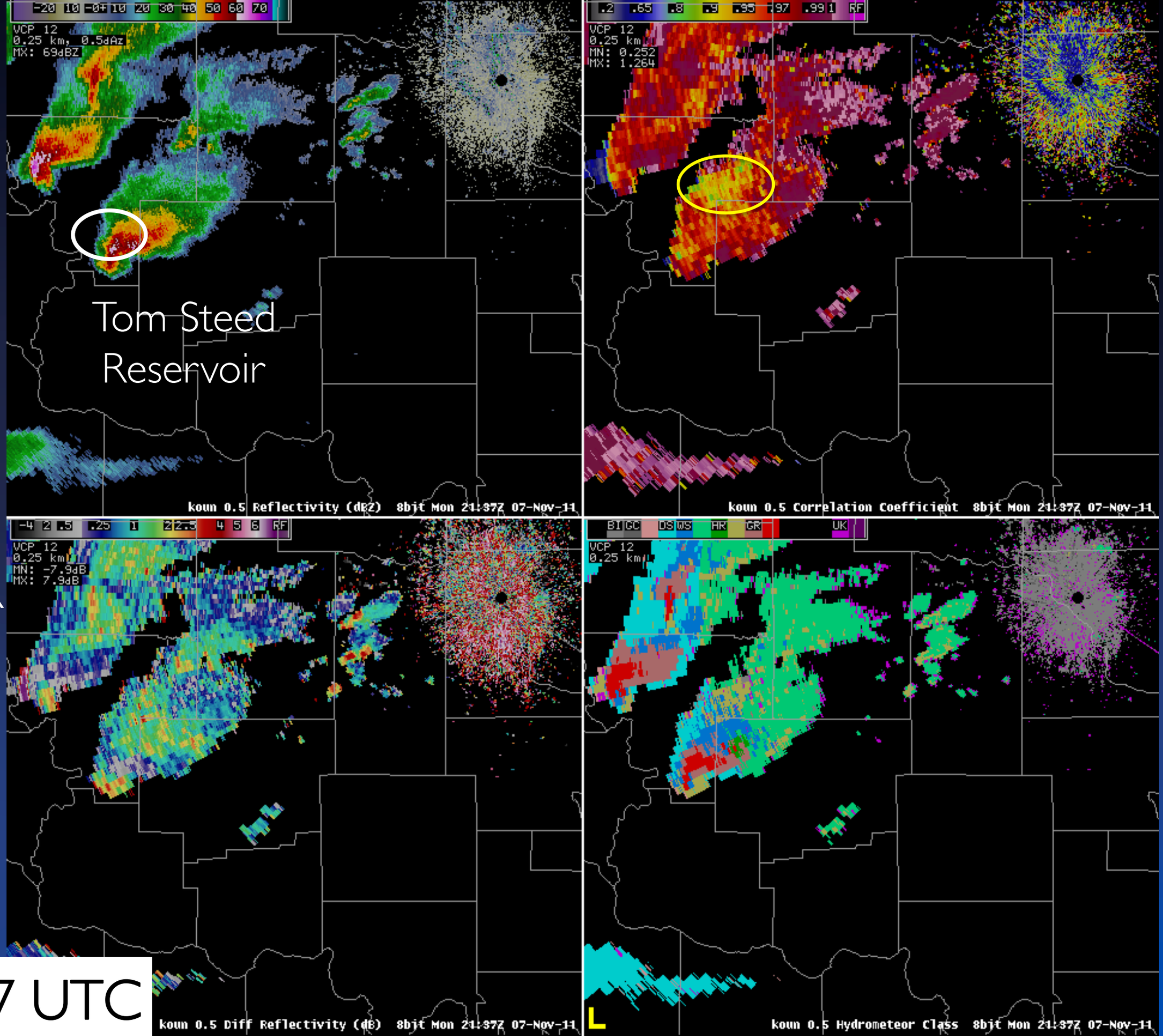
Following radar images are from KOUN: S-band polarimetric WSR-88D

Z

ρ_{hv}

ZDR

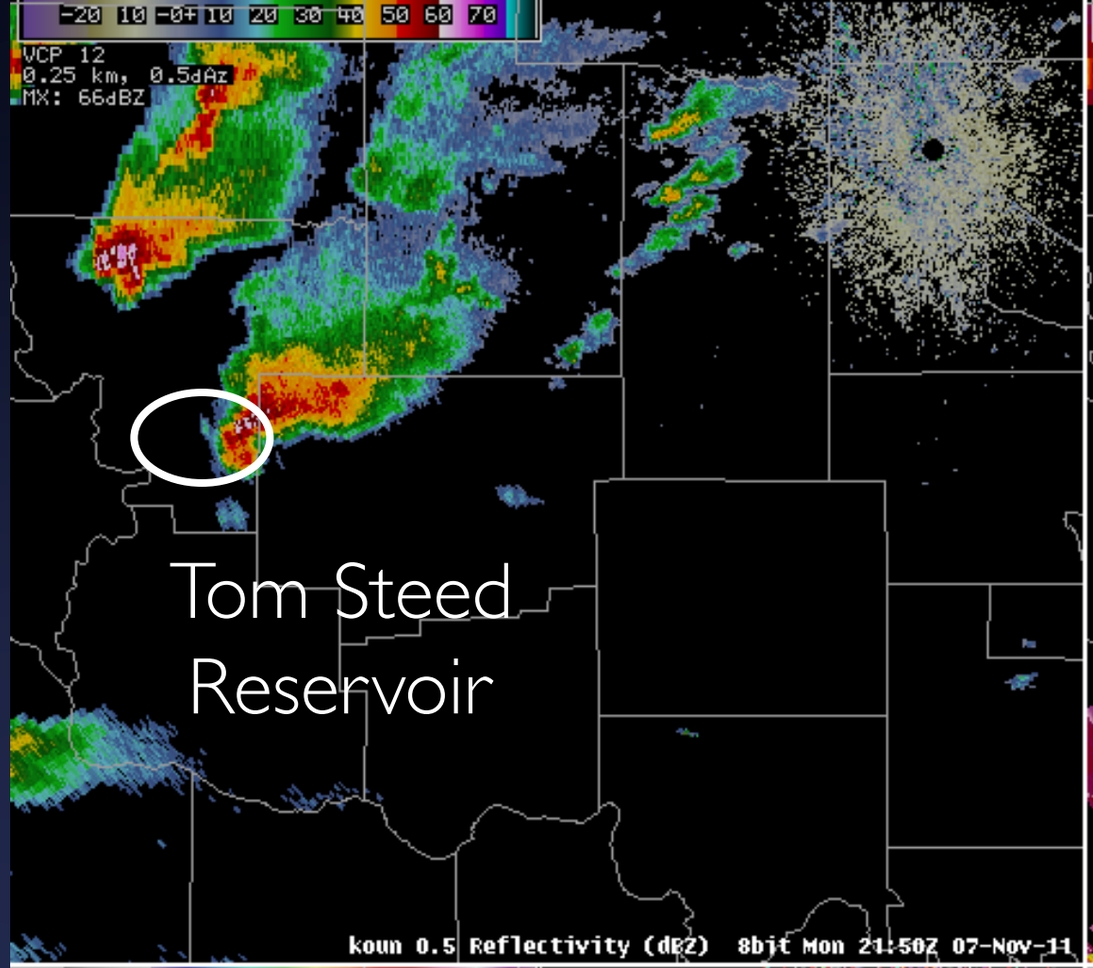
HCA



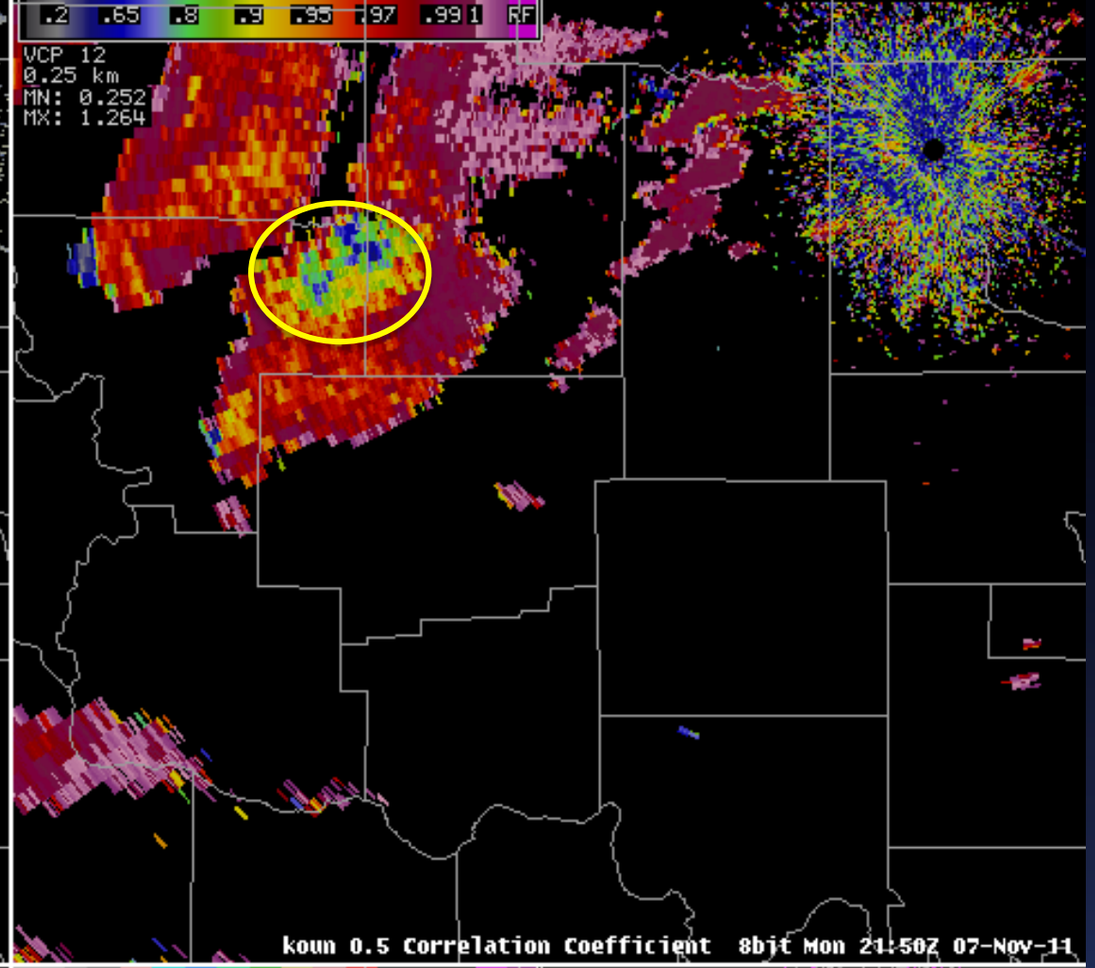
2137 UTC

Z

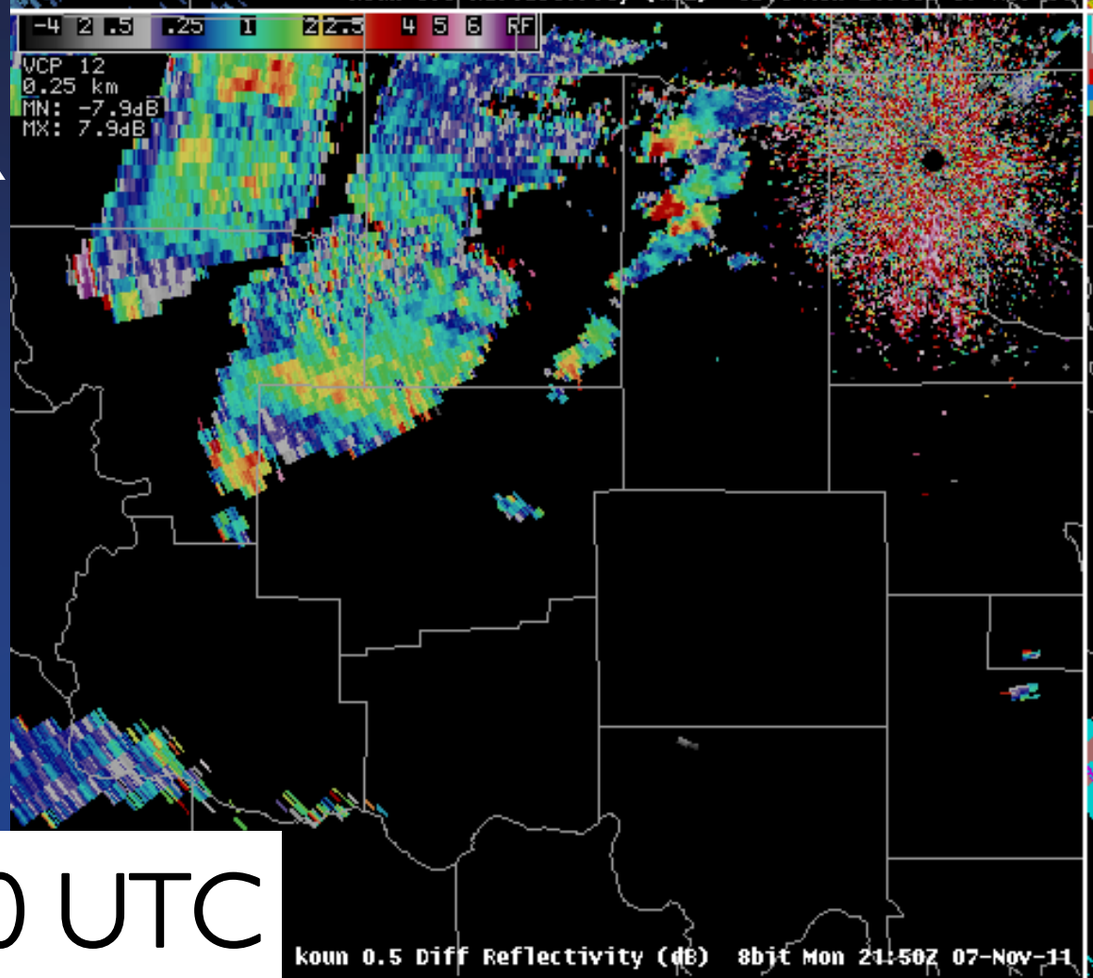
ρ_{hv}



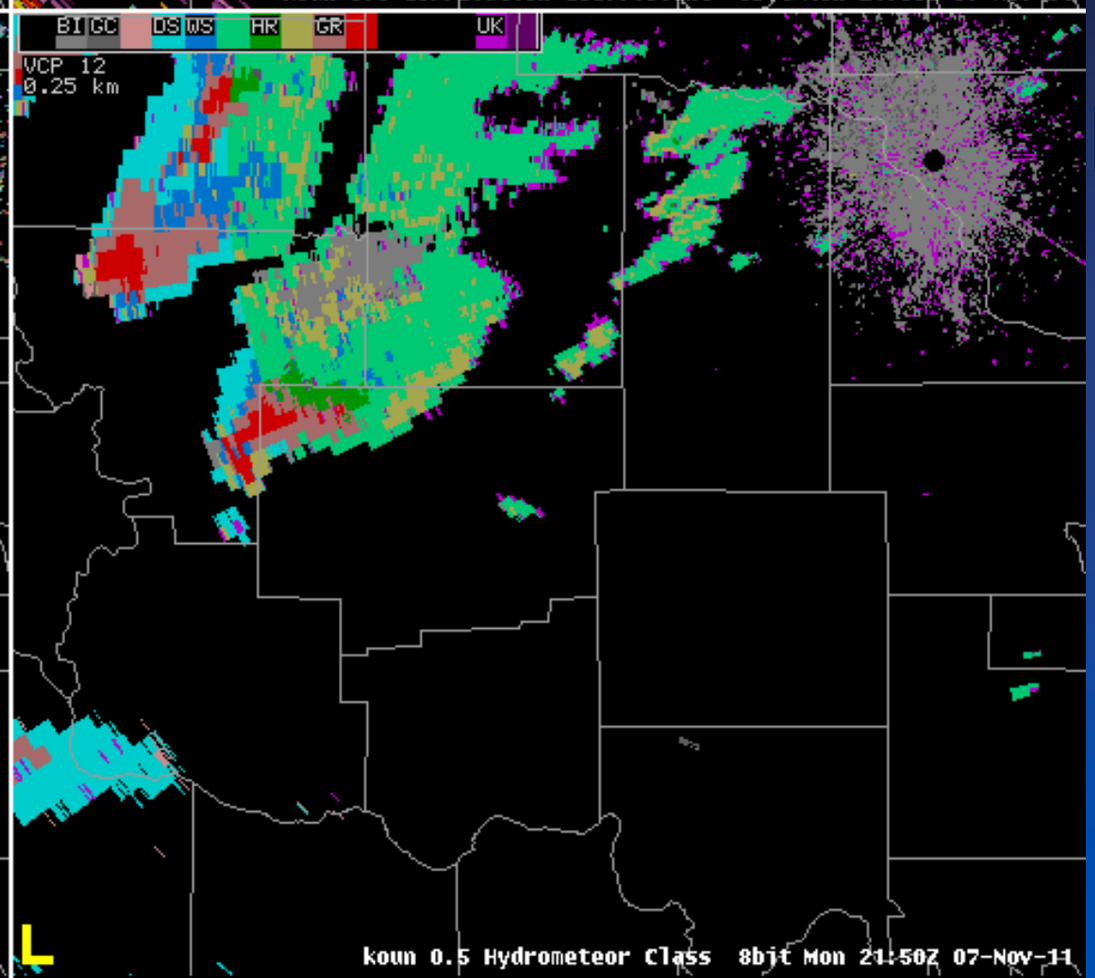
Tom Steed Reservoir



ZDR



HCA



2150 UTC

Z

ρ_{hv}

Tom Steed Reservoir

ZDR

HCA

2203 UTC

More data from later in the storm

Z

ρ_{hv}

Fort Cobb Reservoir

ZDR

HCA

2243 UTC

Z

ρ_{hv}

Fort Cobb Reservoir

ZDR

HCA

2256 UTC

Z

ρ_{hv}

Fort Cobb Reservoir

ZDR

HCA

2309 UTC

Suspects

Canada Geese
(Branta canadensis)

Snow Geese
(*Chen caerulescens*)

Mallards
(*Anas platyrhynchos*)

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- We have demonstrated how polarimetric weather radar can be used to observe the response of birds to abrupt natural hazards.
- More analysis is needed to fully grasp the significance of these data, but for now …

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We should consider advice given to Spiderman:

"With great power comes great responsibility"