

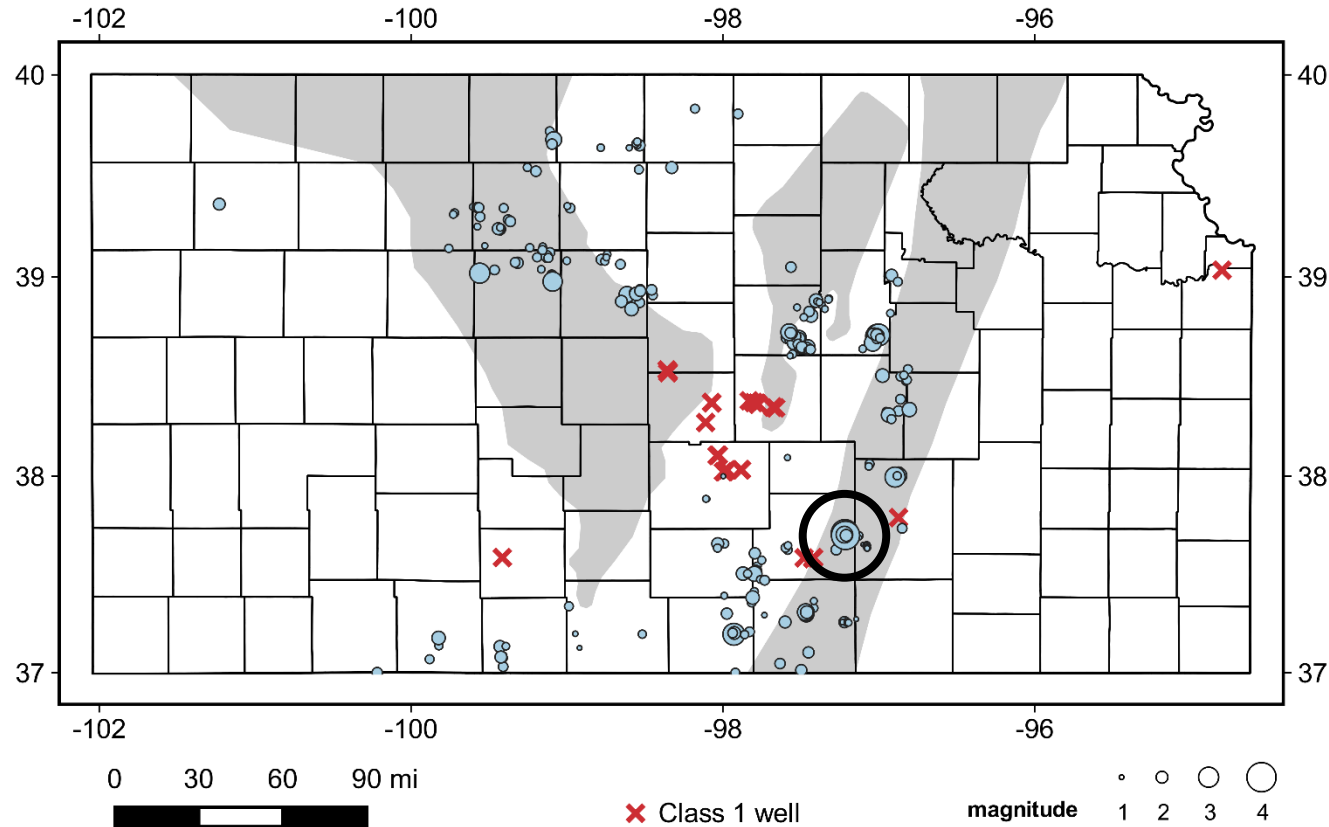
Consortium to Study Trends in Seismicity

Quarterly Report October 1 to December 31, 2020

Rex Buchanan, Shelby Peterie, Rick Miller, *Kansas Geological Survey*



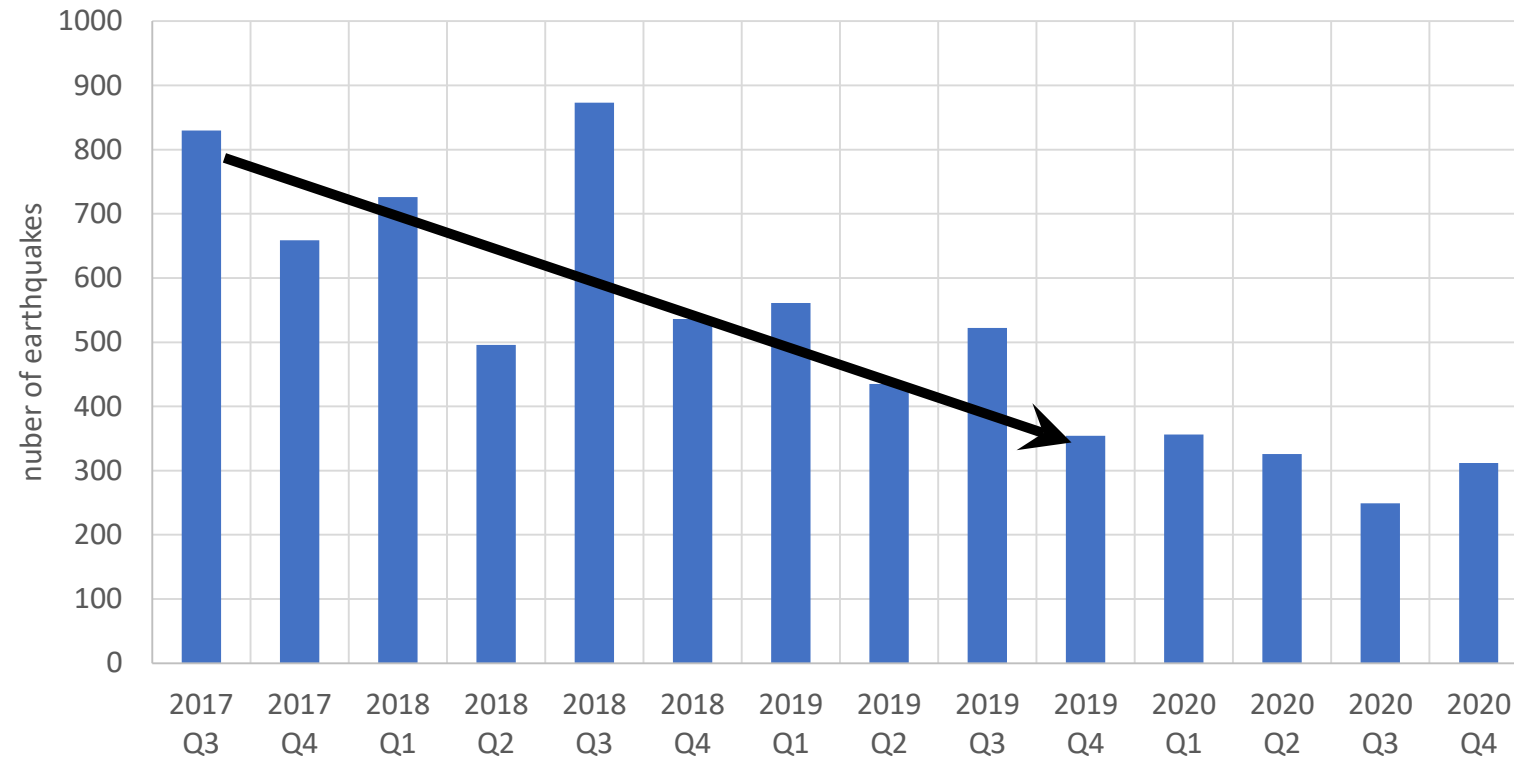
Statewide Earthquakes



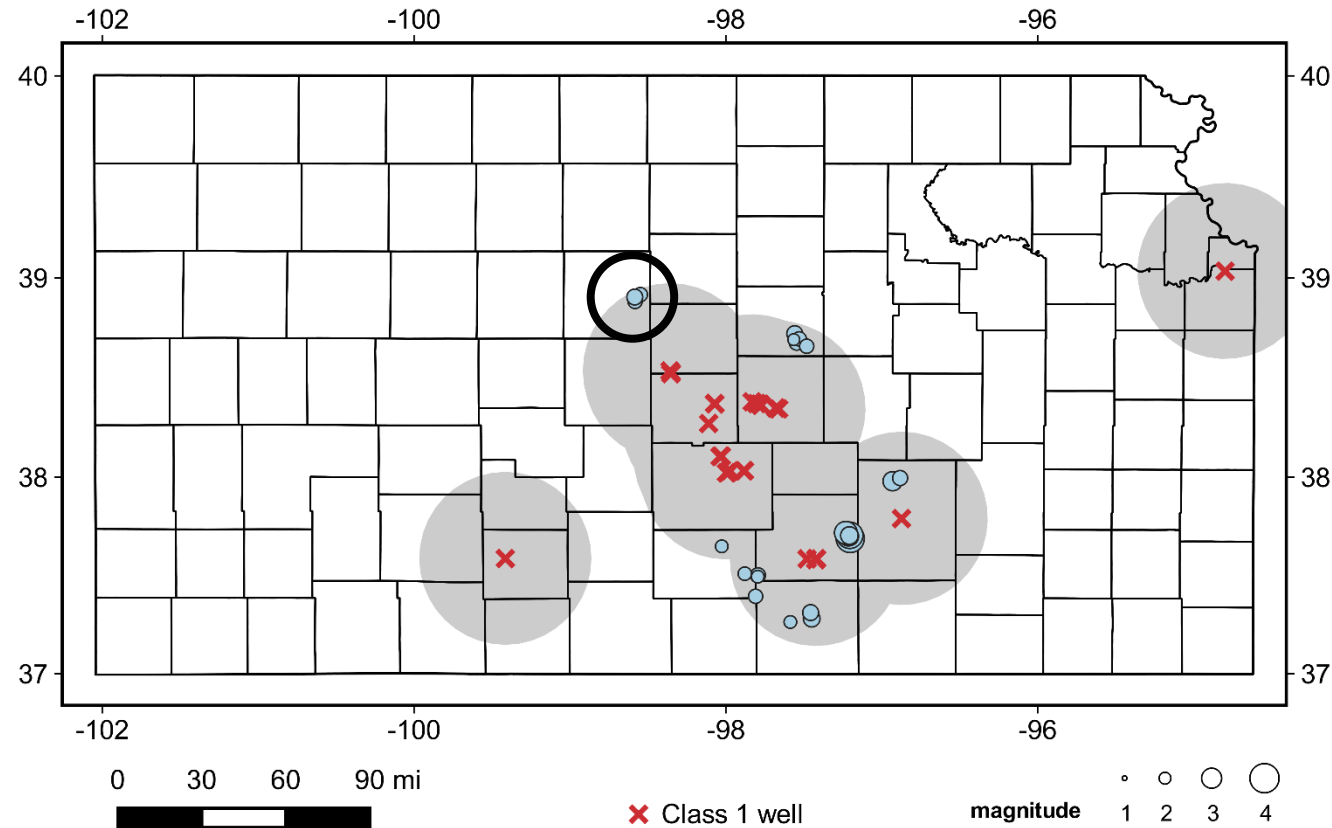
307 earthquakes

largest = M 3.9
near Wichita

Quarterly Number of Earthquakes Statewide



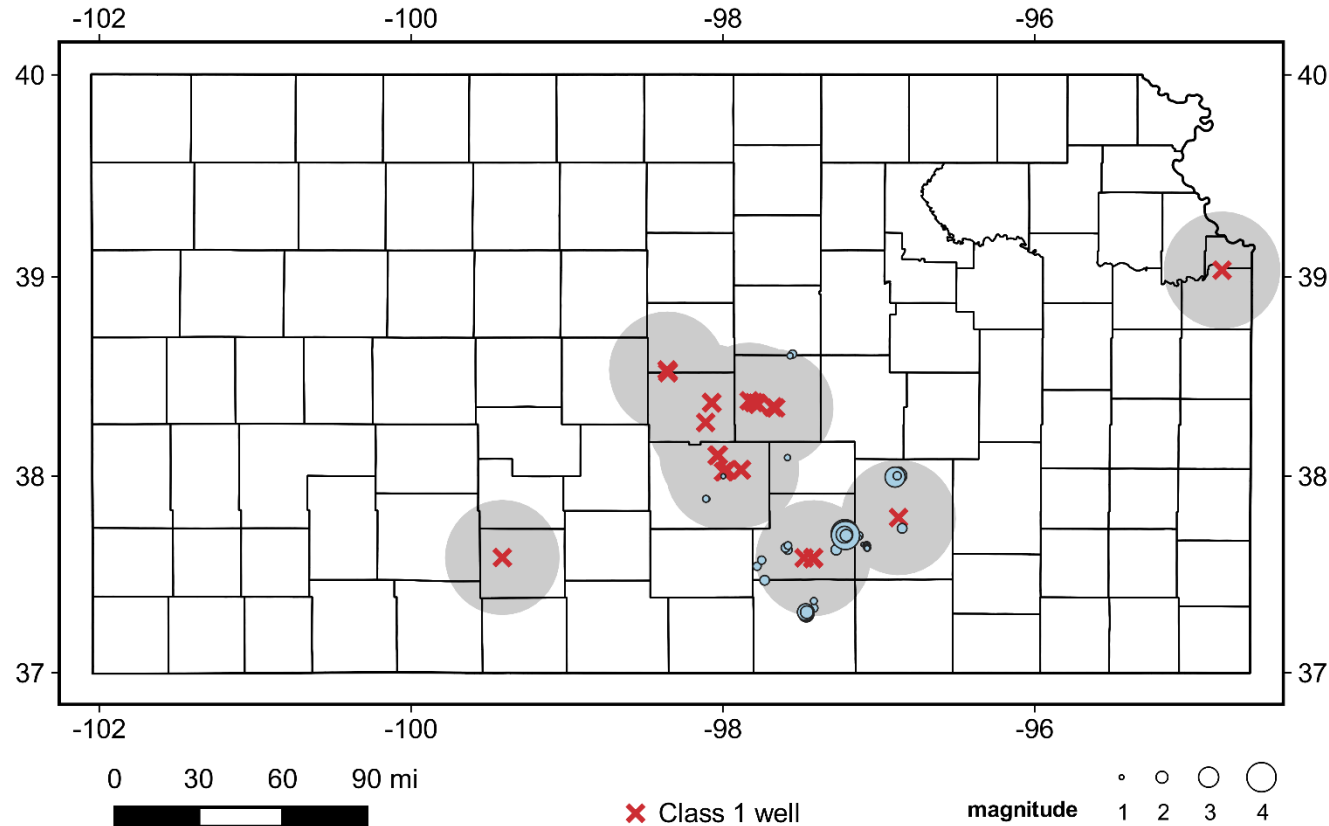
CSTS Alerts



$M \geq 2$
within 30 miles

Total: 40

Earthquakes Within 20 miles

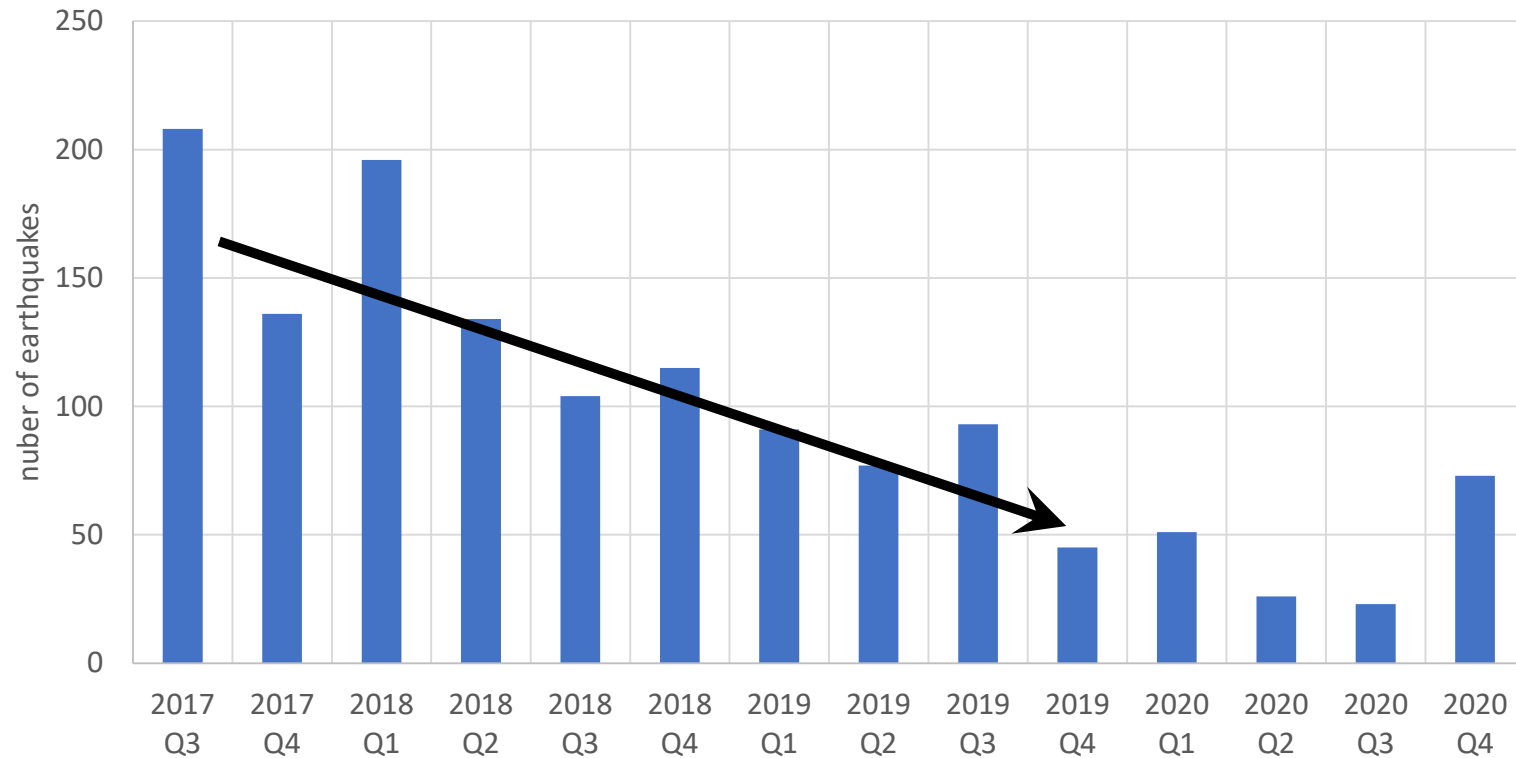


Total: 78

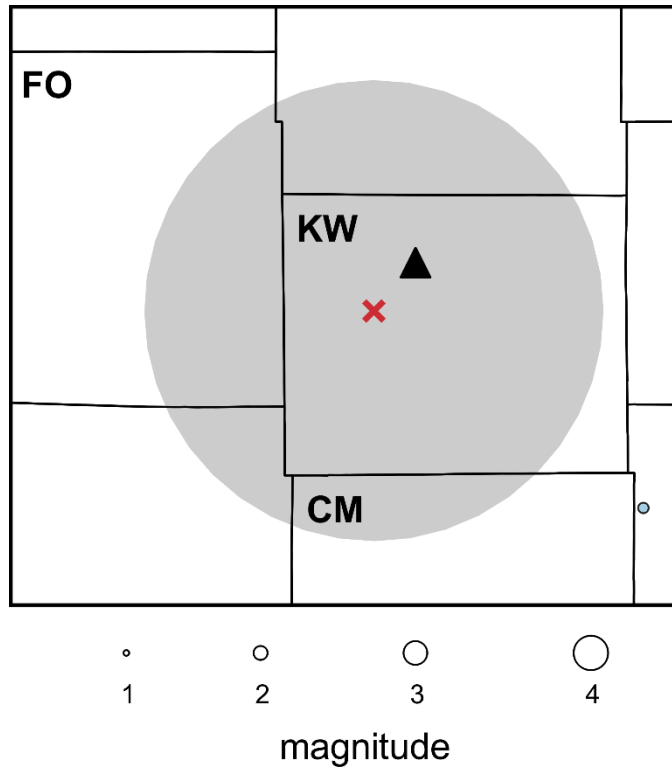
*22 in the
previous quarter*

*more than double
due to Wichita area events*

Quarterly Number of Earthquakes w/in 20 mi

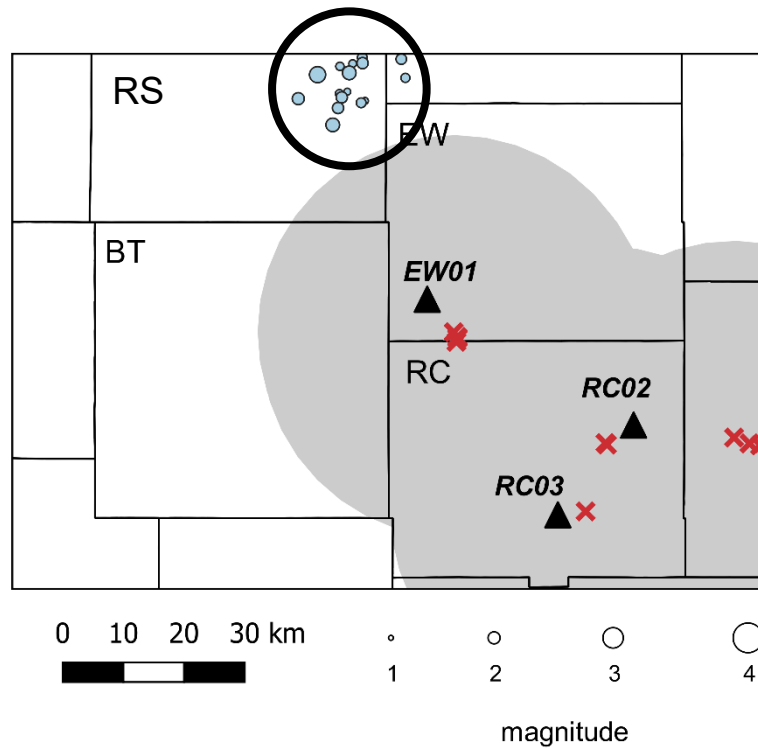


Kiowa County



- Located earthquakes
 - none
- Subnetwork events
 - none
- Consistent with past observations

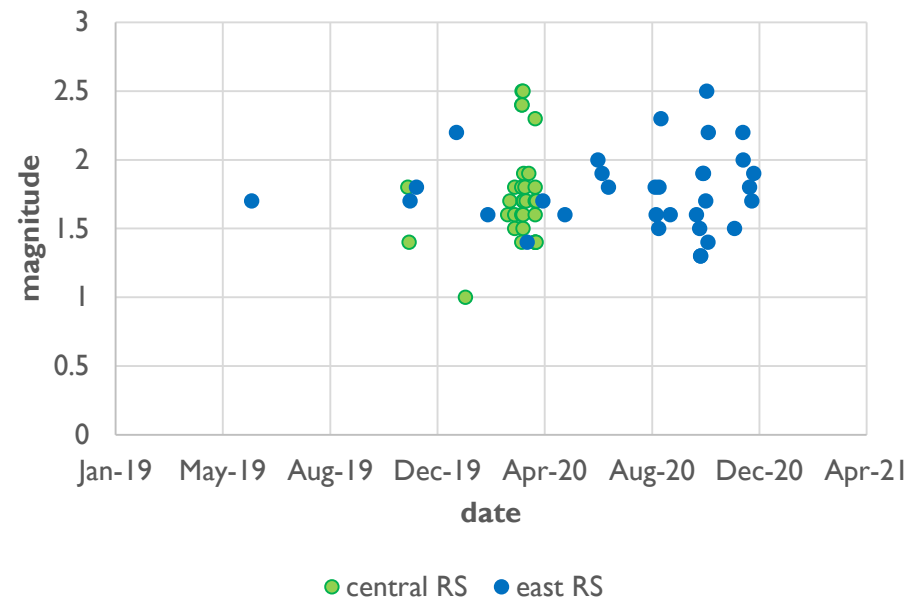
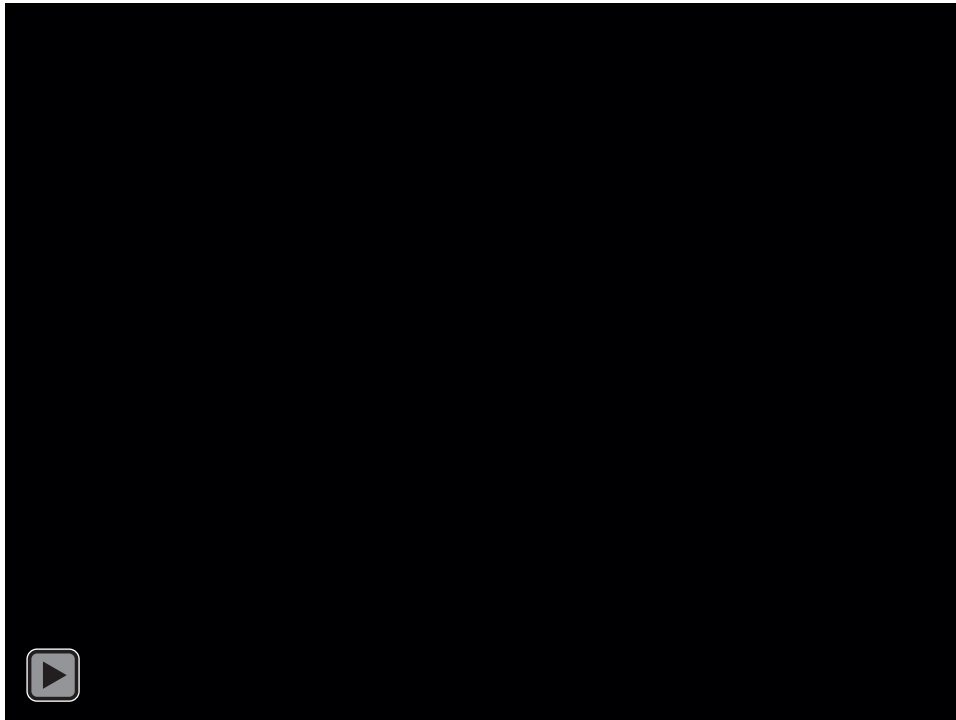
Rice and Ellsworth Counties



- Located earthquakes
 - none w/in 20 mi
- Subnetwork events
 - EW01: 2, largest M 0.2
 - RC02: 7, largest M 0.4
 - RC03: 151 (blasts)
- Consistent with past observations
- Earthquakes in new area
 - Russell County
 - 7 earthquakes $M \geq 2$
 - largest M 2.5
 - none reported by USGS

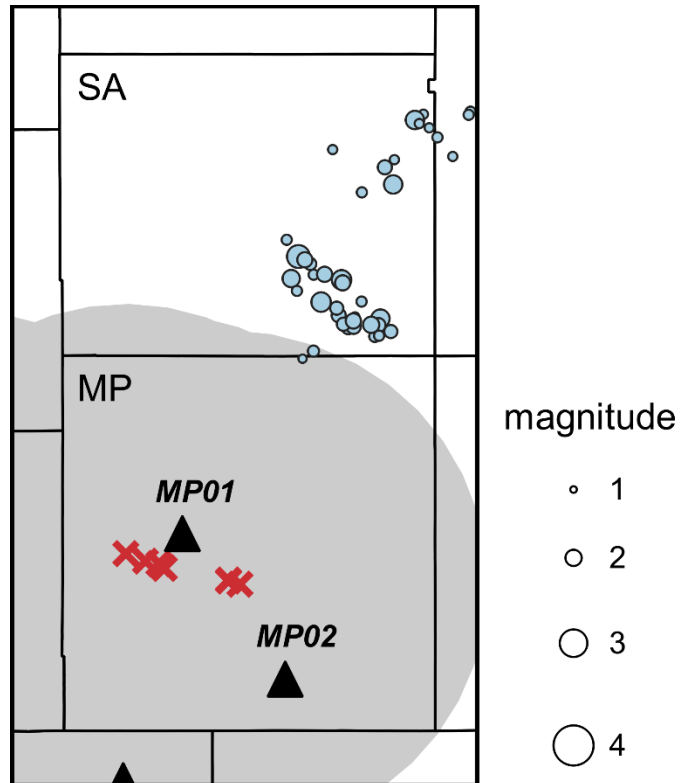
Progression of Earthquakes into Russell County

cumulative seismicity 2015-2020



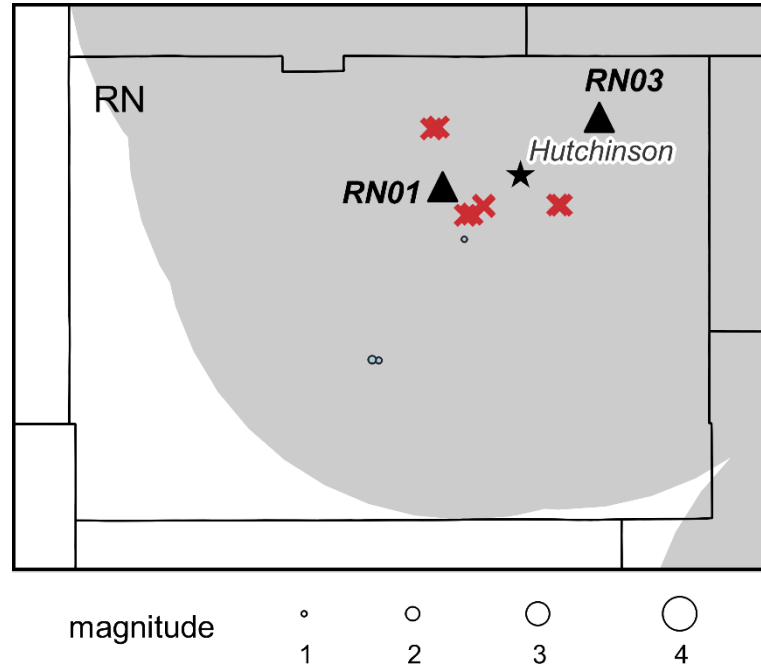
occurred along the margin of the Central Kansas Uplift
pronounced eastward progression from Ellis/Rooks counties

McPherson County



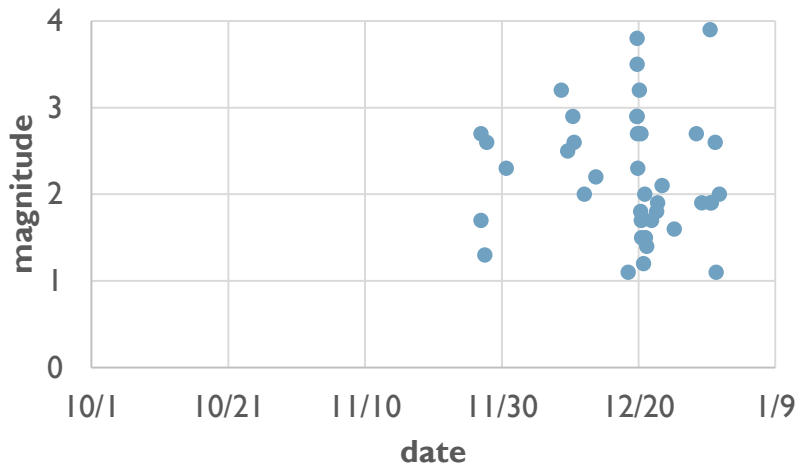
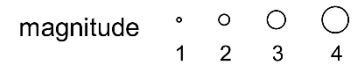
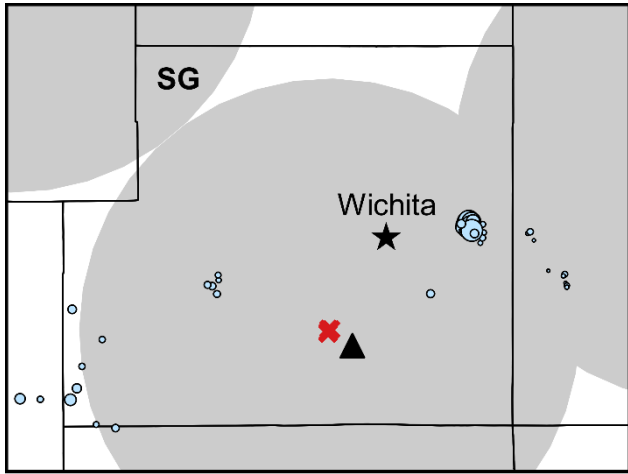
- Located earthquakes
 - 2 (M 1.5 and 1.2)
 - >15 miles from wells
 - consistent with MGA
- Subnetwork events
 - MP01: 7
 - MP02: 5
 - largest = M 0.1
- Consistent with past observations

Reno County



- Notable decrease in activity
- Located earthquakes
 - 3 earthquakes
 - largest = M 1.3
 - (5 last quarter)
- Subnetwork events
 - RN01: 31
 - consistent with the Hutchinson cluster
 - decrease from 58 previous quarter
 - RN03: none

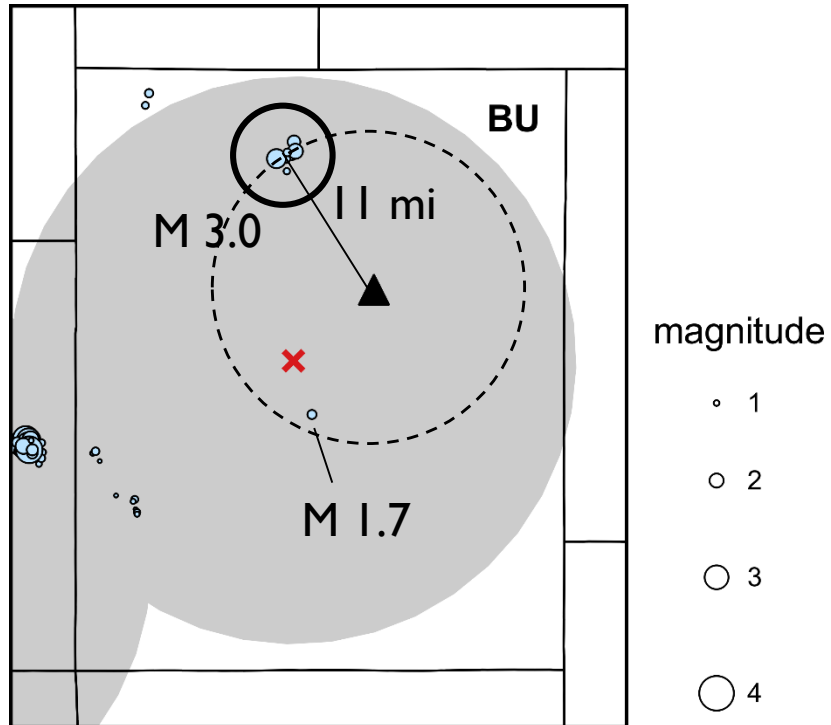
Sedgwick County



- Located earthquakes
 - 65 events late Nov to Dec
 - M 1.9 to M 3.9
 - Two dozen M2+
 - M 3.9 occurred Dec. 30
- Subnetwork events
 - SG02: 6
 - $M \leq 0$
 - timing and distance consistent with Wichita cluster

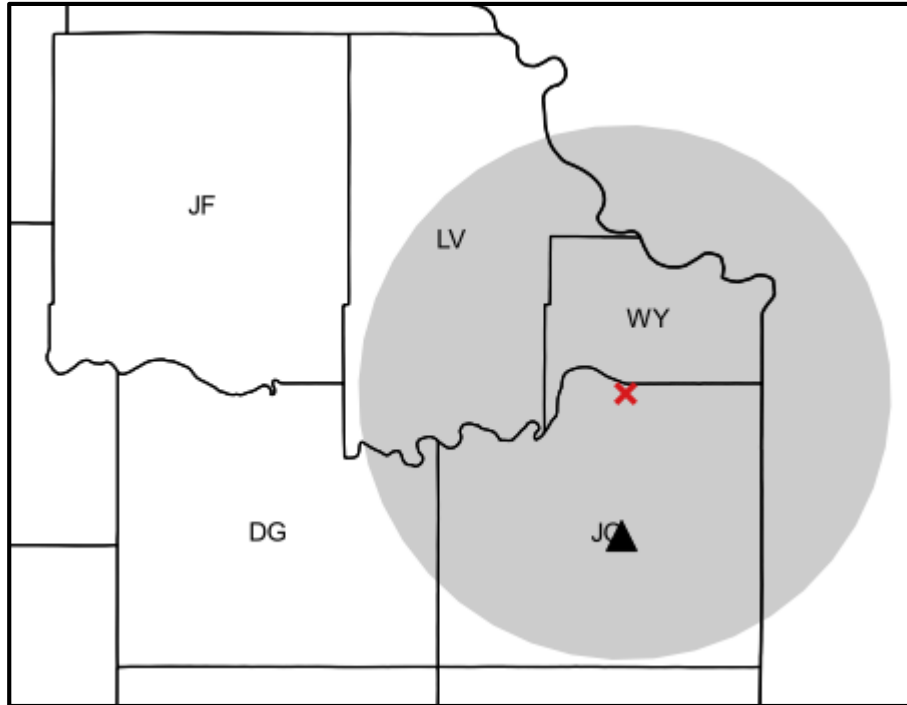
timing of
located
events

Butler County



- Located earthquakes
 - 17 events near De Graff
 - previous seismicity
 - 2016-2017
 - M 3.0 on Oct. 27
 - M 1.7
 - 4 mi from facility
 - consistent with low-energy seismicity observed here in the past
- Subnetwork events
 - BU02: 8
 - 11 mi
 - timing and distance consistent with the De Graff cluster

Johnson County

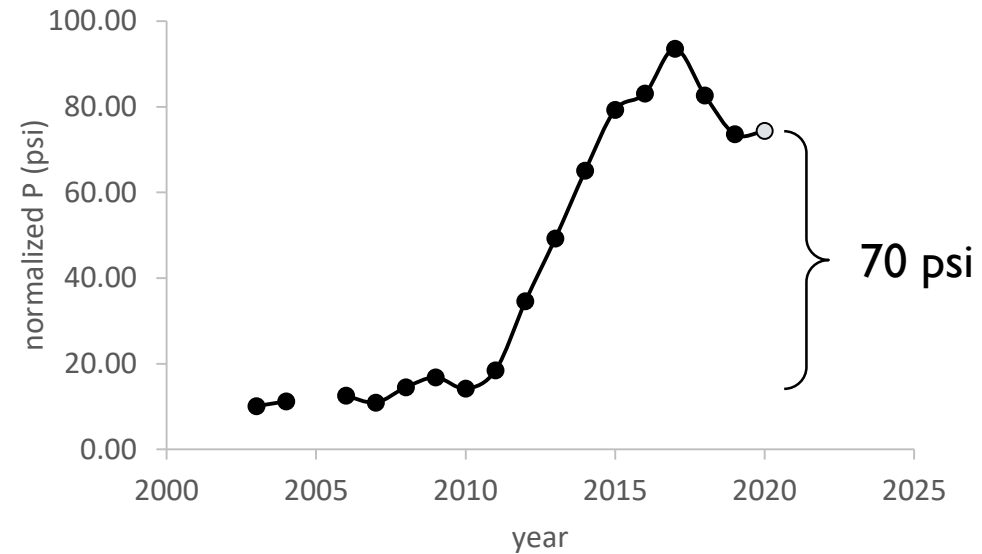
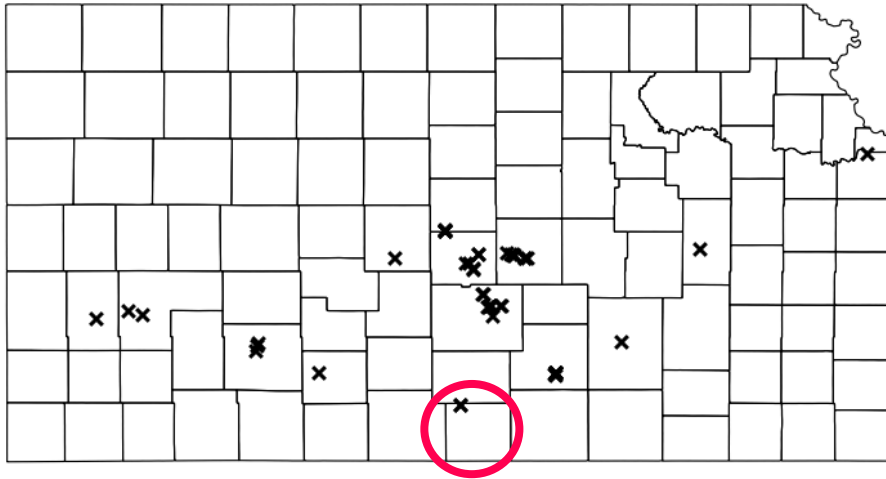


- Located earthquakes
 - none
- Subnetwork events
 - none

2020 Formation Pressures

Arbuckle Formation Pressure

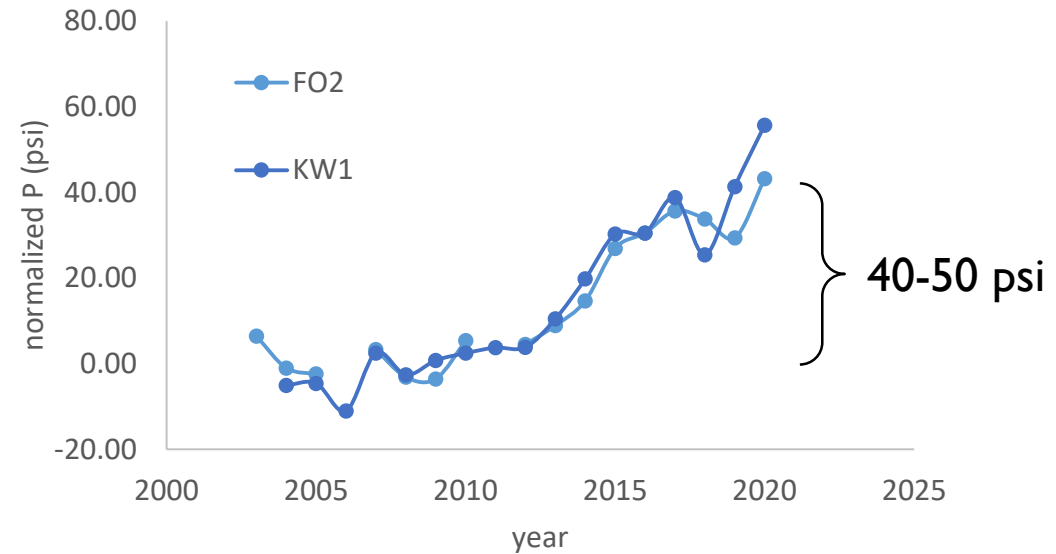
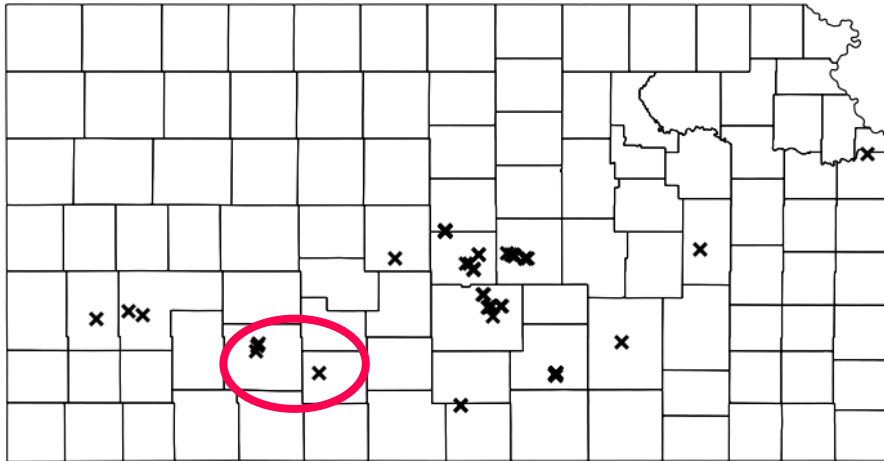
Harper County



2020 pressure consistent with 2019, ~70 psi above historic

Arbuckle Formation Pressure

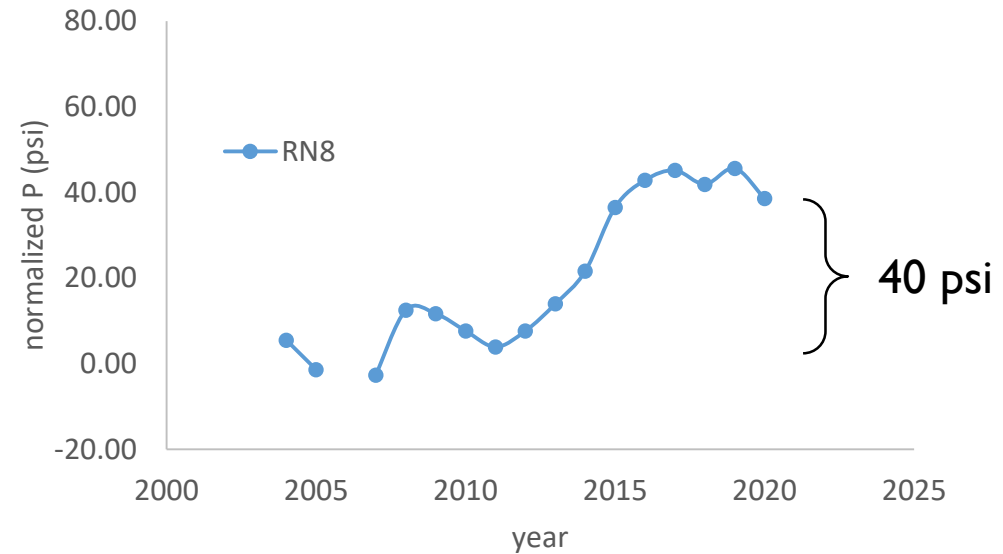
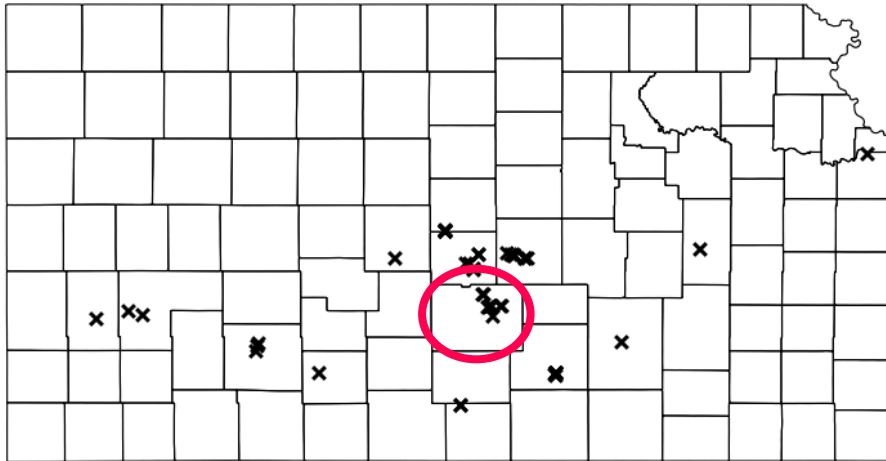
Kiowa and Ford counties



pressures increased about 10 psi and are 40-50 psi above historic levels

Arbuckle Formation Pressure

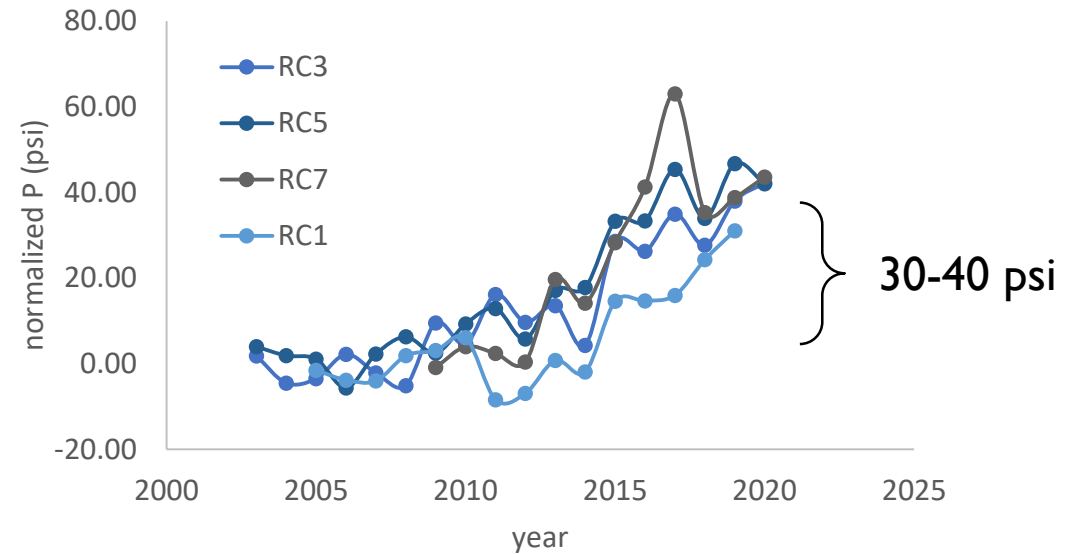
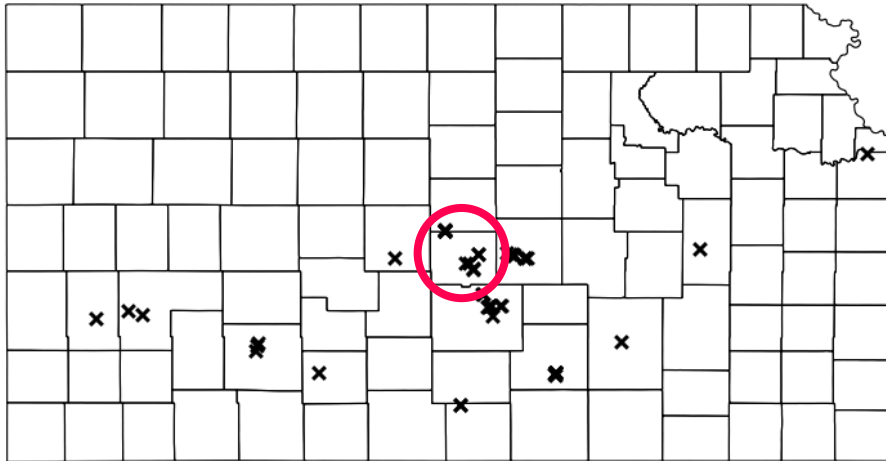
Reno County



pressures either steady or slightly decreasing, but remain
about 40 psi above historic levels

Arbuckle Formation Pressure

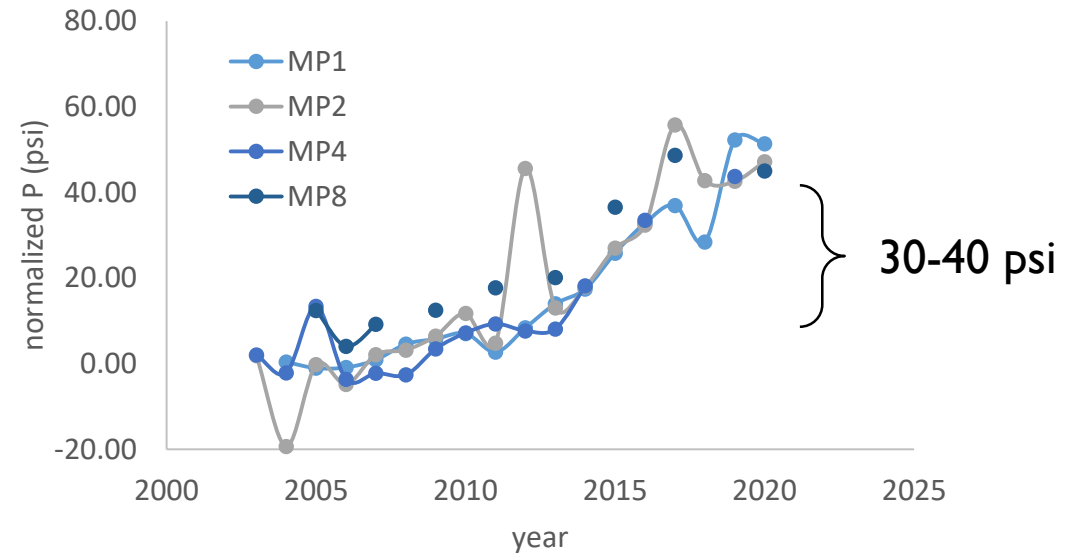
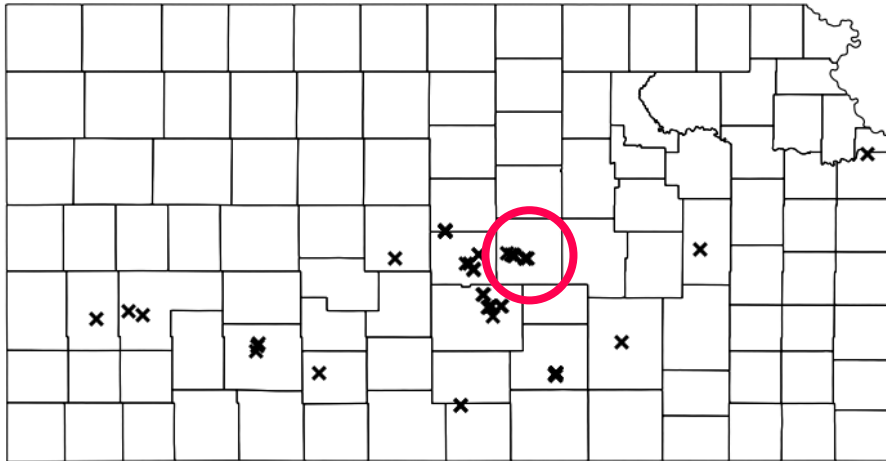
Rice County



pressures increased slightly in 2020 and are 30-40 psi above historic levels

Arbuckle Formation Pressure

McPherson County



consistent with 2019 pressures, 30-40 psi above historic levels

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