Constructing a 3-D radially anisotropic seismic model to investigate induced seismicity in Oklahoma

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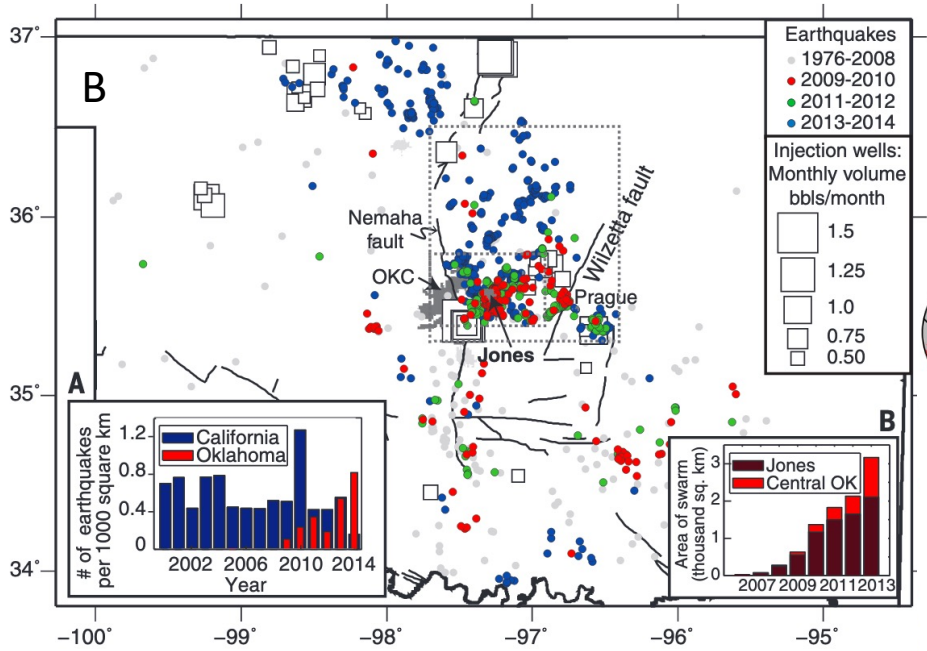
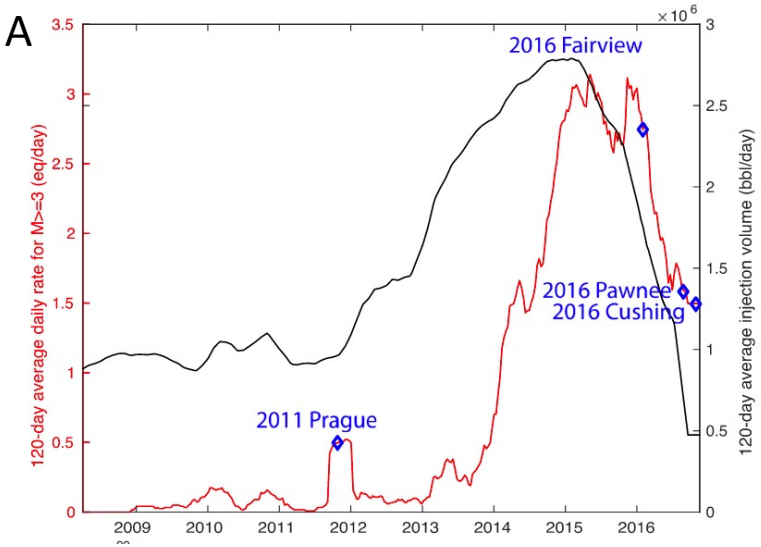
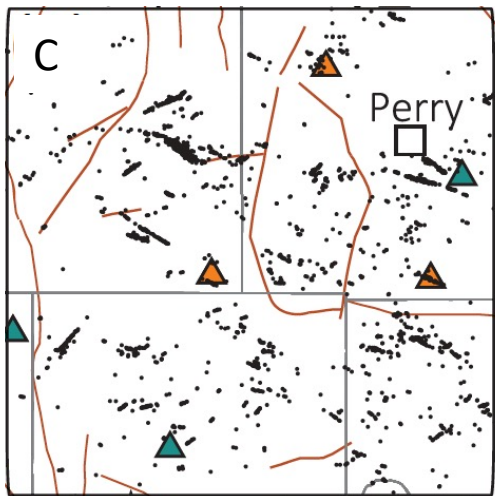
- Seismicity rate significantly increased in Oklahoma from 2009 to 2016, and then dropped after 2016.
- Most of these events, during that time, are occurred around the fault zones
- Current earthquake catalog does not show a strong correlation with the fault traces



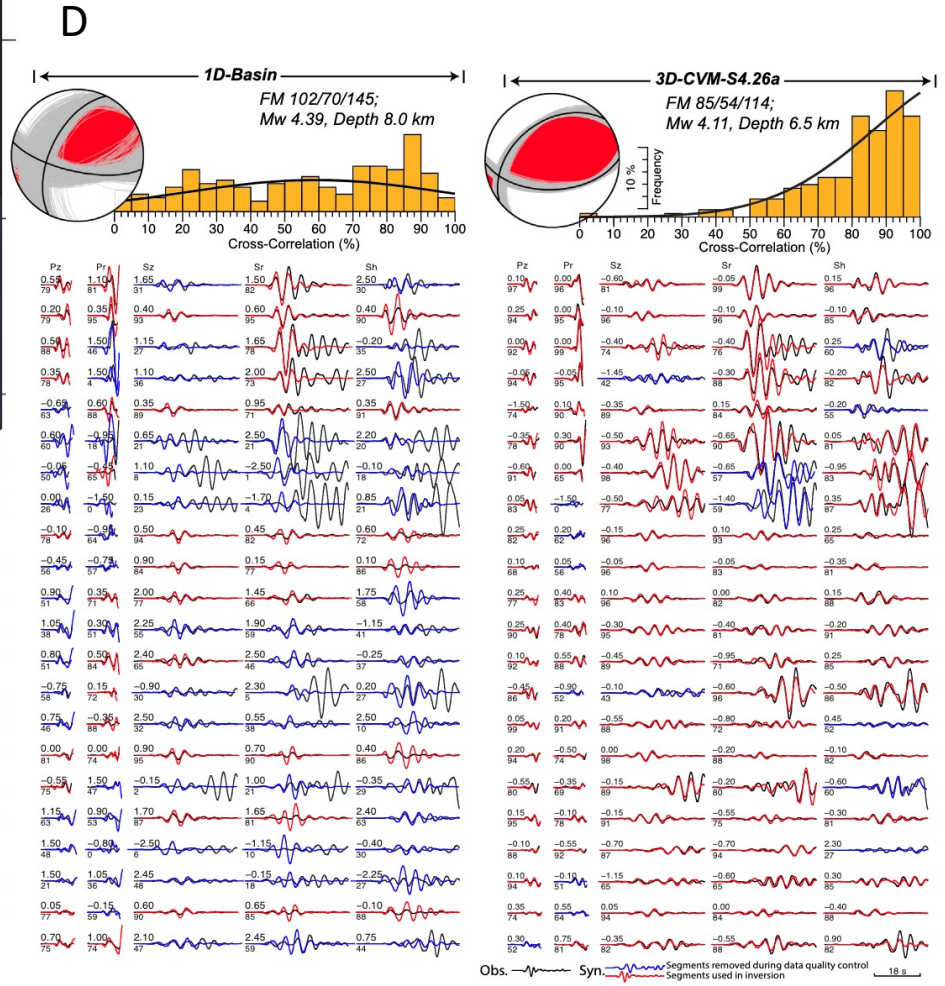
Keranen et al, *Science*, 2014



Chen et al, *Science Report*, 2017



Schoenball & William, *SRL*, 2017



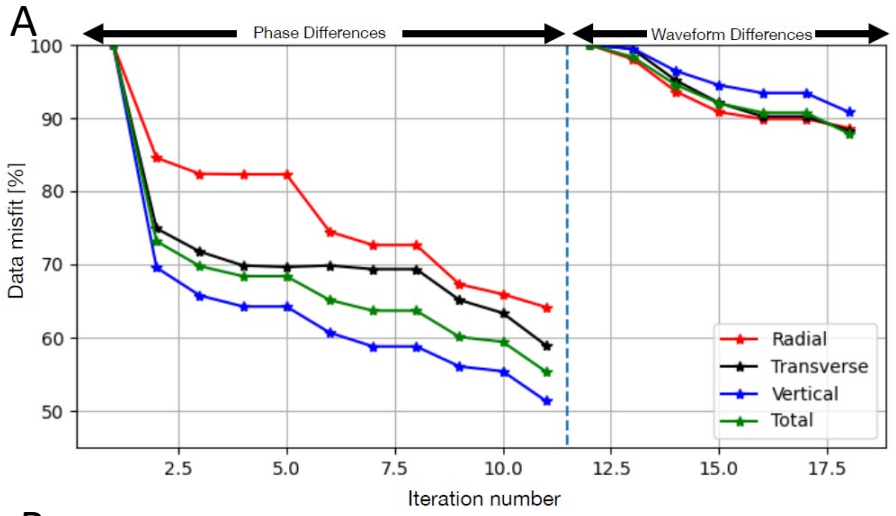
Wang & Zhan, *GJI*, 2019

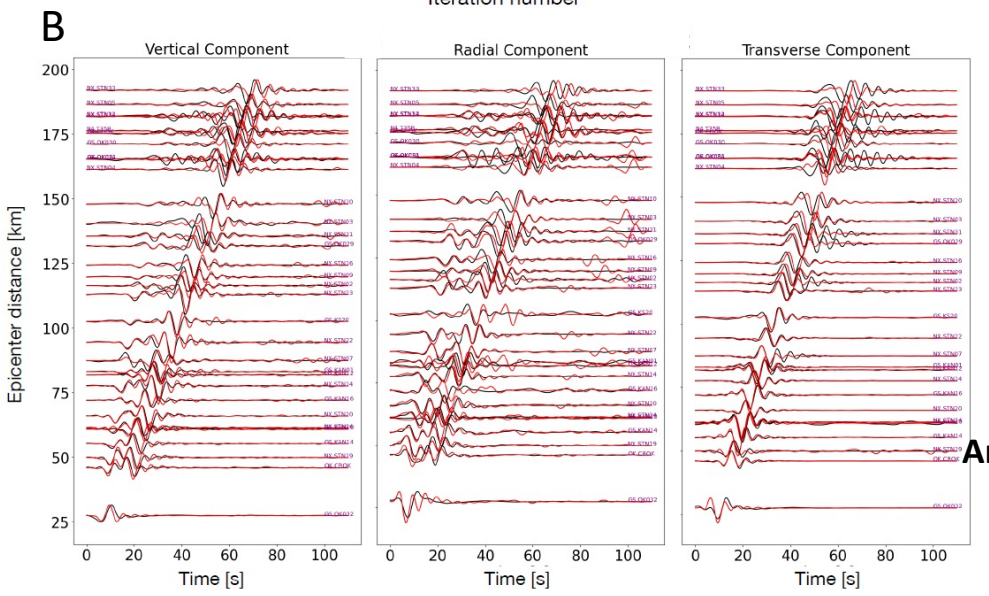
- Estimating the 3-D anisotropic velocity model by using FWI algorithm

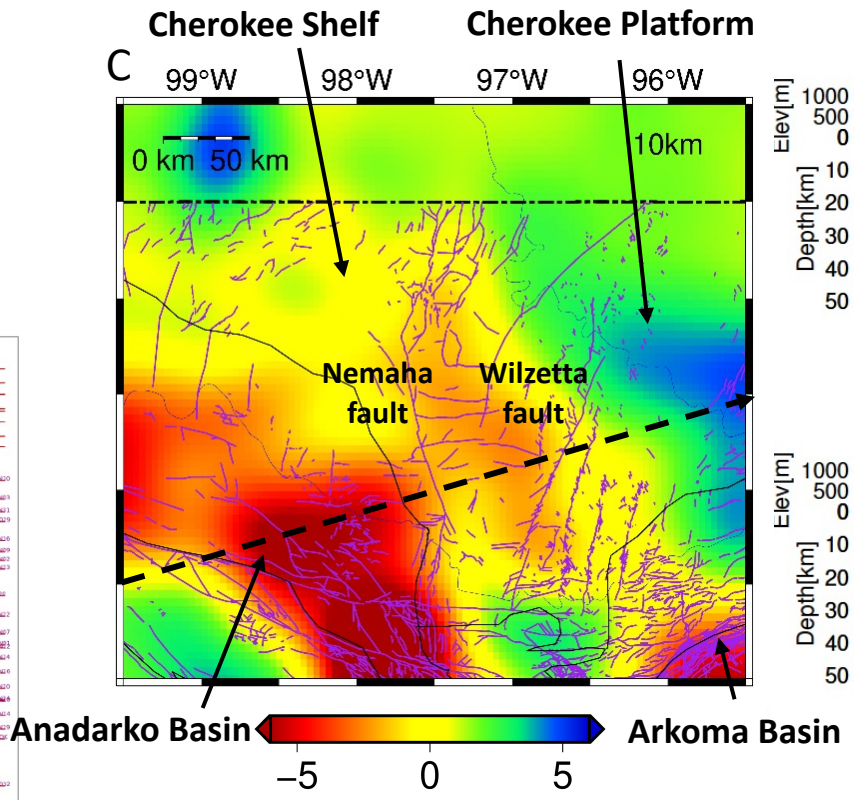
Earthquake	226
Seismometer	182
Measurement	23,072

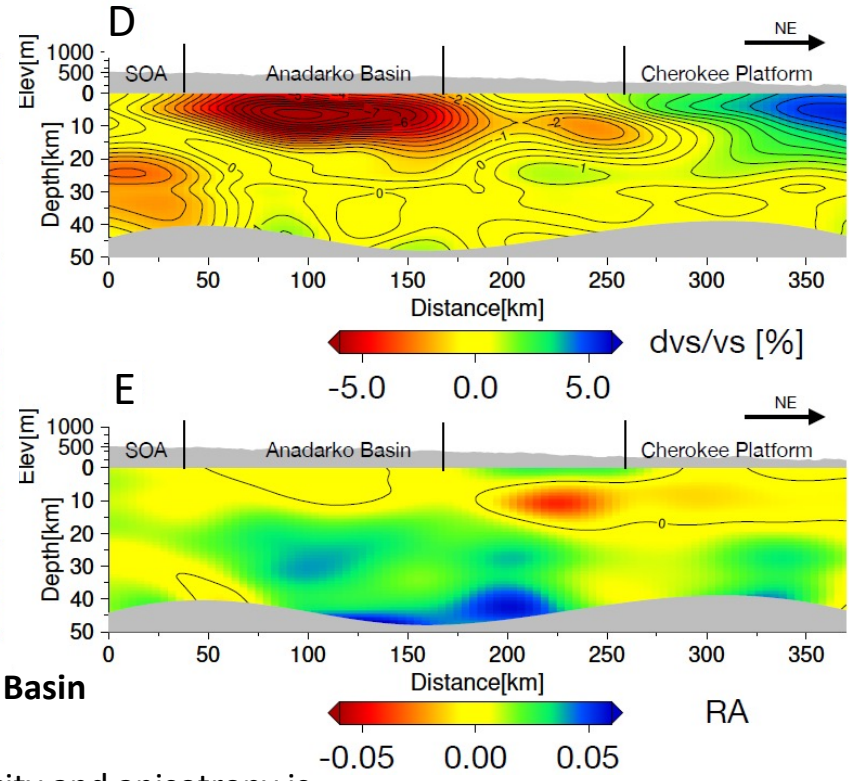
- Using a multi-taper technique to measure frequency-dependent phase difference

$$\chi = \frac{1}{2}\sum_{s}\sum_{r}\sum_{m}\omega_m \int \left[\frac{\Delta\tau_m(\omega)}{\sigma_m(\omega)}\right]^2 d\omega$$





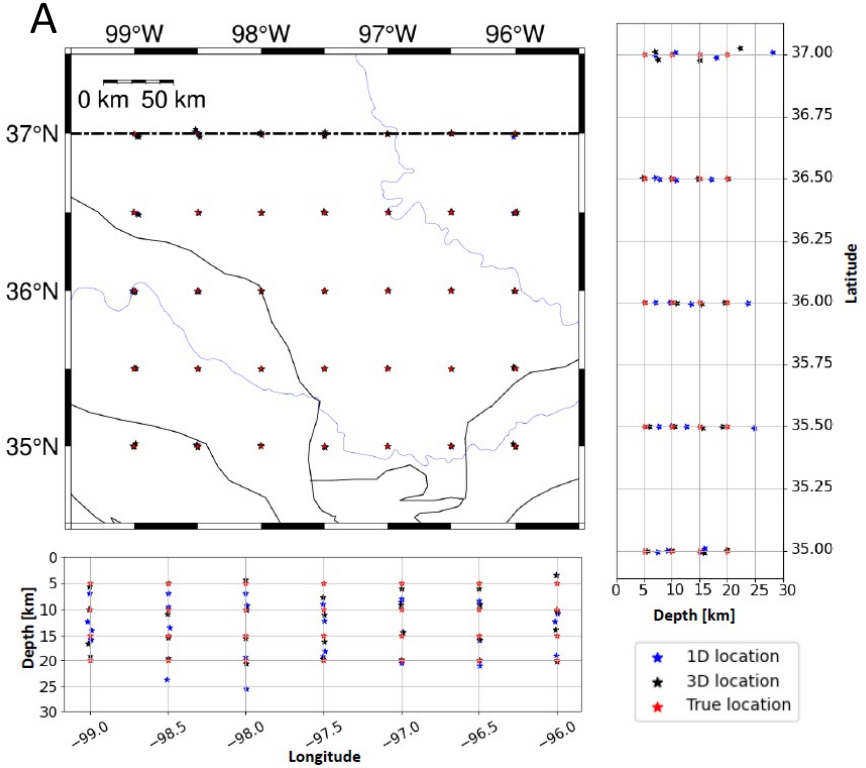




- The anomalies in velocity and anisotropy is corresponding to the geological features in Oklahoma

2016 Mw5.1 Fairview earthquake

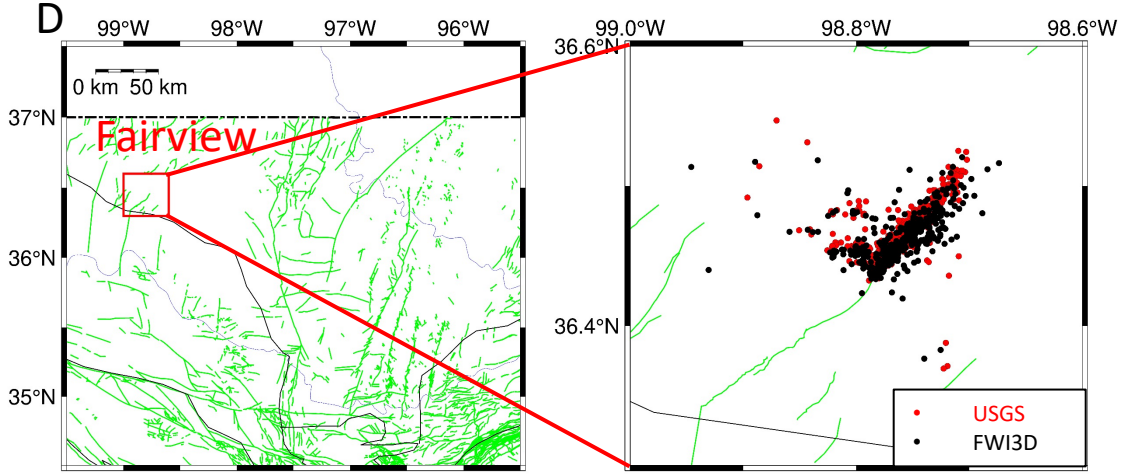
A



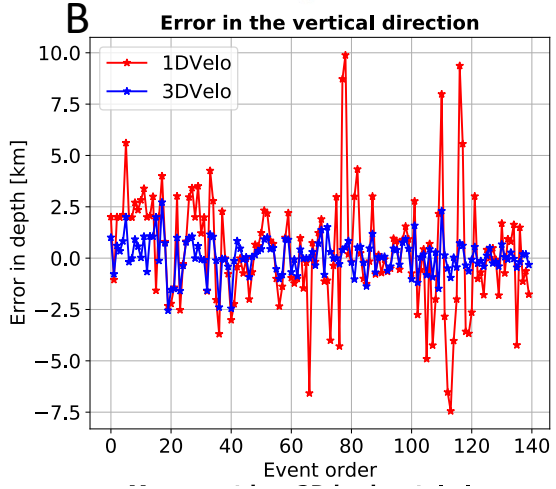
- Locate 140 synthetic earthquakes in the study area based on the 1-D and 3-D velocity model.
- 3-D velocity model enable us to improve the accuracy of the earthquake location, especial in vertical direction.

- Applying the 3-D velocity model to relocate the real earthquake sequence – 2016 Mw5.1 Fairview earthquake
- An improved earthquake catalog enable us to better delineate the geometry of the fault plane.

D



B



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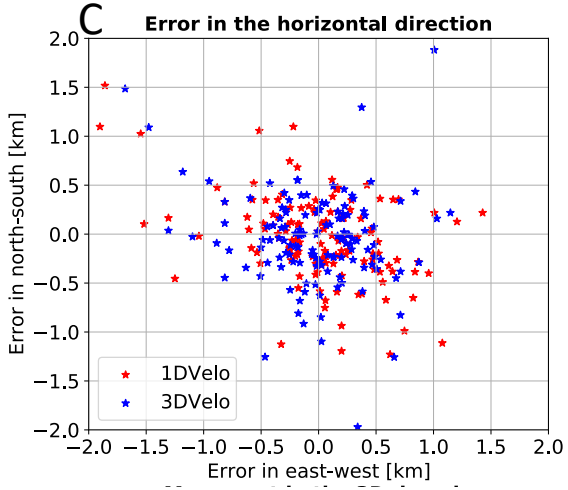
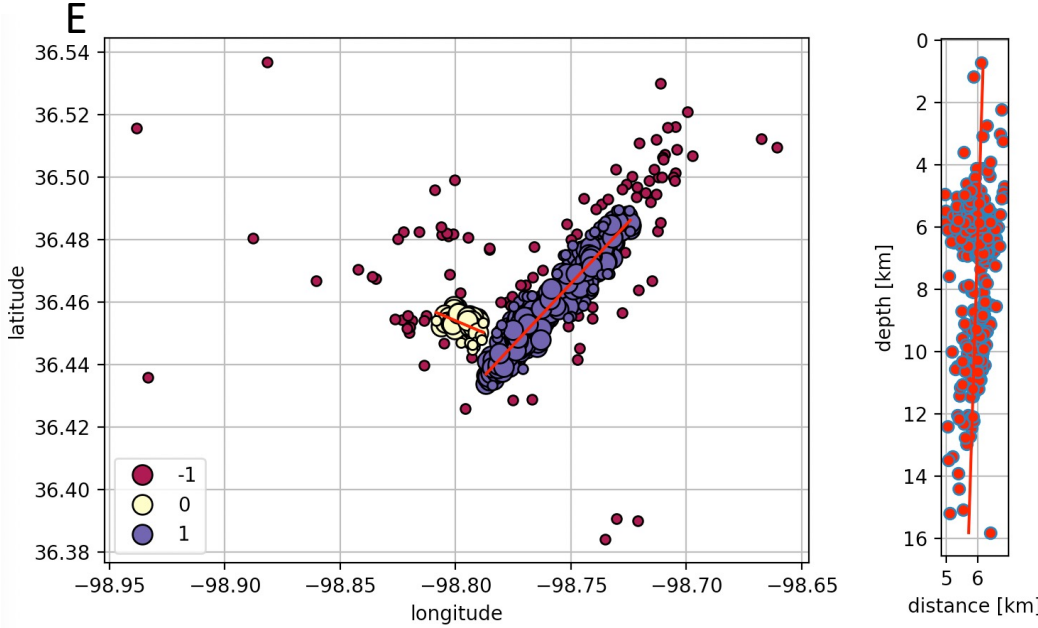


E



Thanks for your attention!

If you are interested in my topic, feel free to contact with me

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