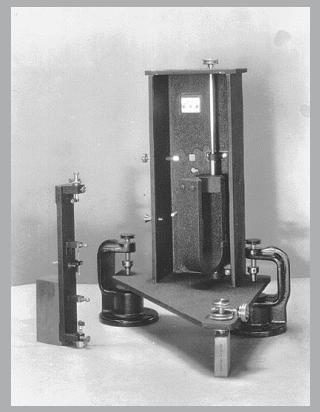
RICHTER PREDICTOR

Exploring recorded earthquakes in the US

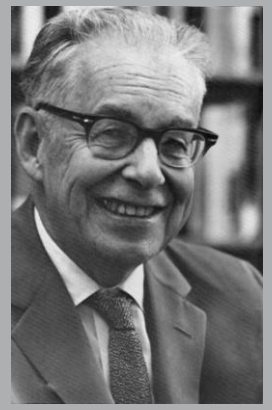
Kendall Phillip Choi Chris Ljungkull Max Oneill Finn Wurtz

BACKGROUND

1880:
John Milne credited with first modern seismometer



Entering 1900s: seismology expands worldwide as the seismometer evolves

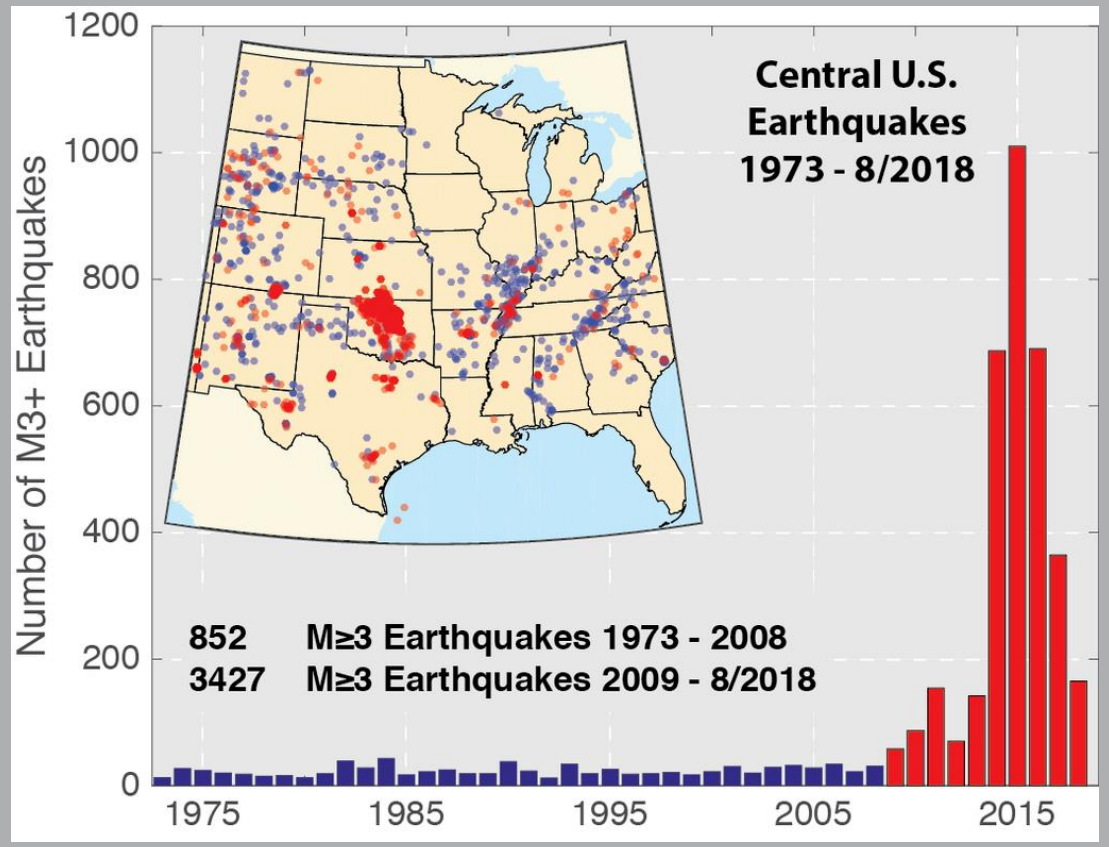


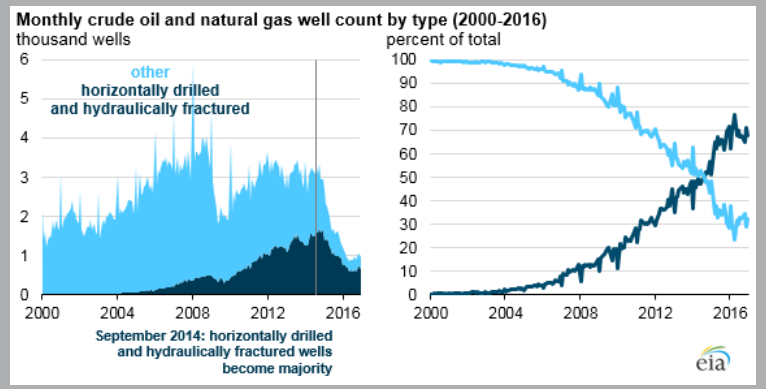
1935:
Charles Richter introduces magnitude scale system

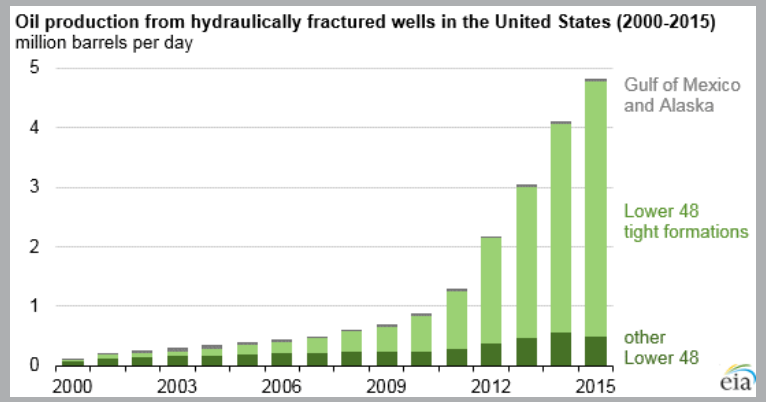
Mid-1900s:
Precise measurement and recordkeeping with improved computing

Today:
Earthquakes measured real-time, but no closer to predicting

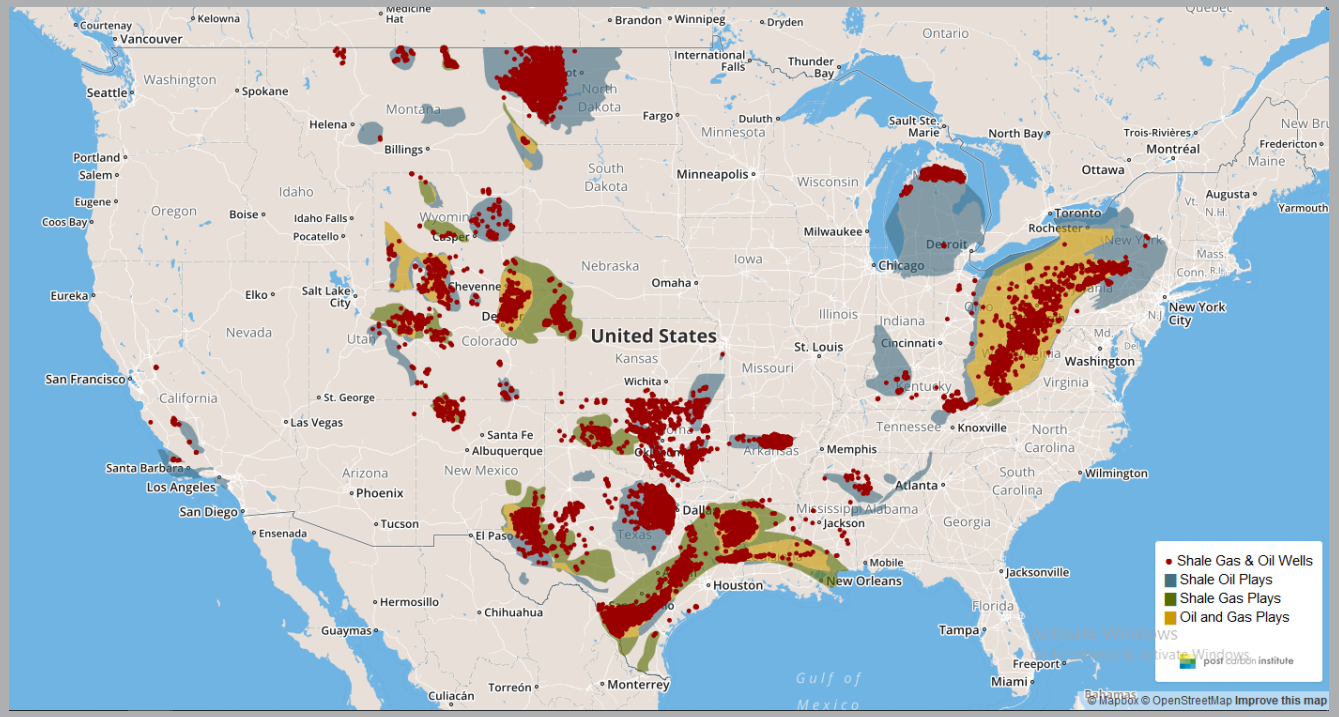
BACKGROUND


Central U.S.
Earthquakes
1973 - 8/2018
Number of M3+ Earthquakes
1200
1000
800
600
400
200
0
1975
1985
1995
2005
2015
852 M≥3 Earthquakes 1973 - 2008
3427 M≥3 Earthquakes 2009 - 8/2018

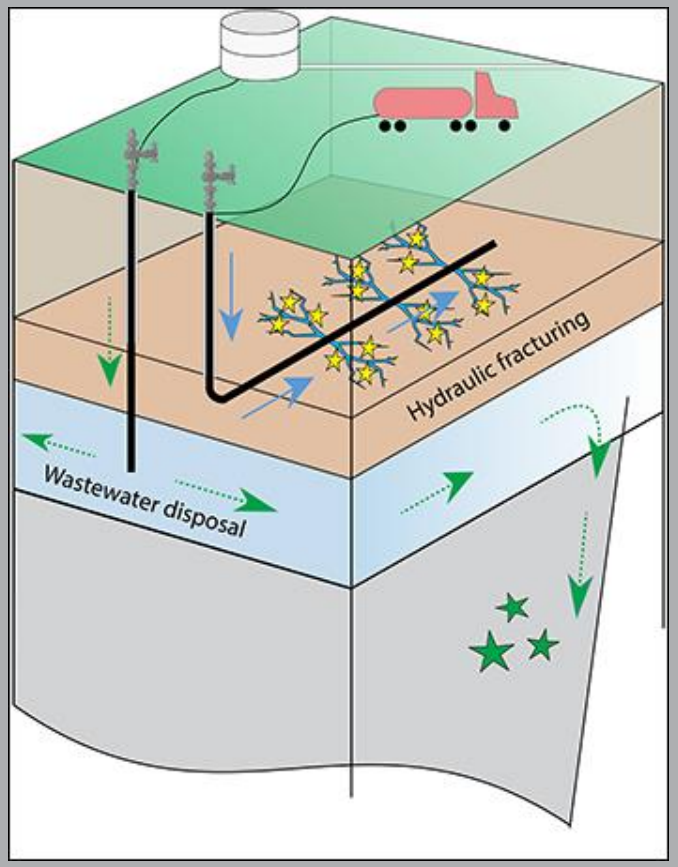

Monthly crude oil and natural gas well count by type (2000-2016)
thousand wells
percent of total
other
horizontally drilled
and hydraulically fractured
September 2014: horizontally drilled
and hydraulically fractured wells
become majority
eia


Oil production from hydraulically fractured wells in the United States (2000-2015)
million barrels per day
Gulf of Mexico
and Alaska
Lower 48
tight formations
other
Lower 48
eia

BACKGROUND



https://shalebubble.org/dbd-map/



PROJECT SCOPE

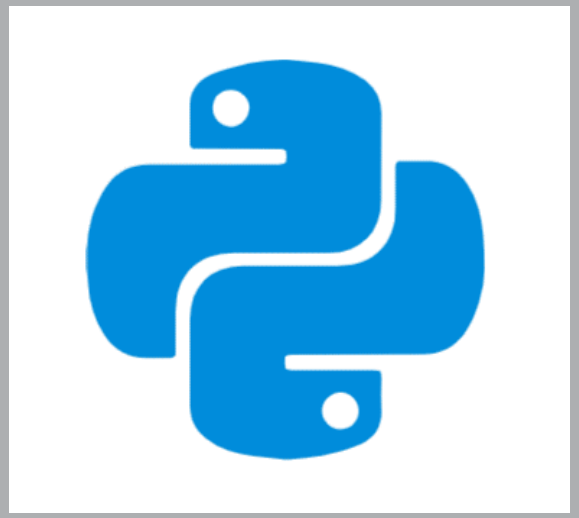
- Geocoordinates and timeline of earthquakes in US > 3.5 M
- Geocoordinates of Oklahoma fracking wells
- Dataset limited to active wells in 2011-2015

DATA COLLECTION

	A	B	C	D	E	F
1	time	mag	year	id	latitude	longitude
2	4/25/2010 2:10	3.9	2010	usp000hbvf	27.708	-97.845
3	3/24/1997 22:31	3.8	1997	usp0007zcf	27.717	-98.054
4	4/3/2005 14:39	3.5	2005	usp000dm3z	28.393	-100.305
5	4/9/1993 12:29	4.1	1993	usp0005qx9	28.811	-98.124
6	1/6/2018 15:37	3.6	2018	us1000c1fk	28.8497	-98.119
7	3/3/1984 1:03	3.9	1984	usp00022dp	28.852	-98.461
8	10/20/2011 12:24	4.8	2011	usp000j9kx	28.865	-98.079
9	11/12/2011 10:34	3.5	2011	usp000jar2	28.869	-98.21
10	7/20/1991 23:38	3.6	1991	usp0004ue9	28.908	-98.042

	A	D	F	G	
1	Type	year	latitude	longitude	wellname
11295	Fracking	2008	33.830435	-97.131074	N THACKERVILLE UNIT
11296	Fracking	2008	33.832933	-97.113915	HDSU-BANKS
11297	Fracking	2008	33.833131	-97.13759	N THACKERVILLE UNIT
11298	Fracking	2008	33.833152	-97.145152	N THACKERVILLE UNIT
11299	Fracking	2008	33.83316	-97.128901	N THACKERVILLE UNIT
11300	Fracking	2008	33.834067	-97.128901	N THACKERVILLE UNIT
11301	Fracking	2008	33.835841	-97.139765	N THACKERVILLE UNIT

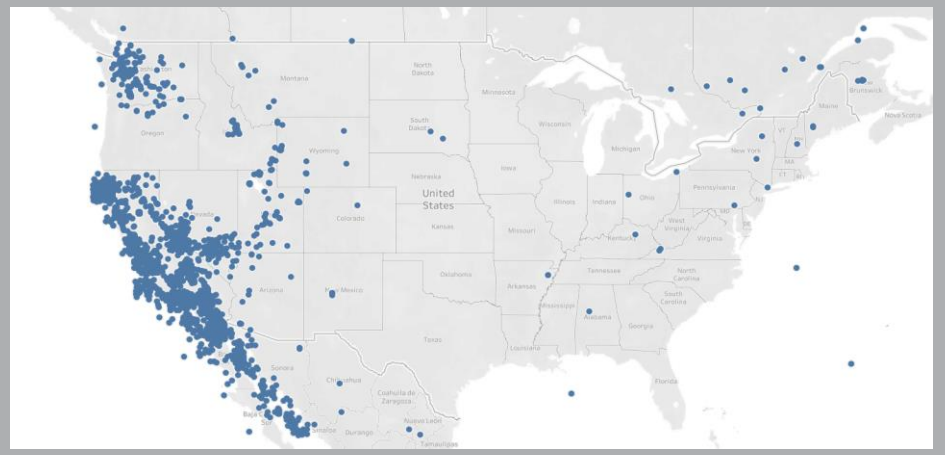
METHODOLOGY



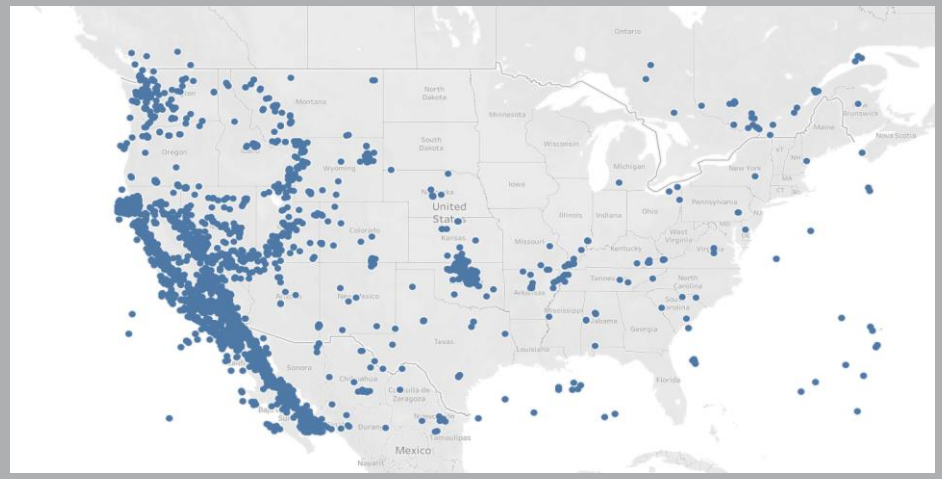
RESULTS

Comparing Earthquake Activity

Prefracking
1964-1991

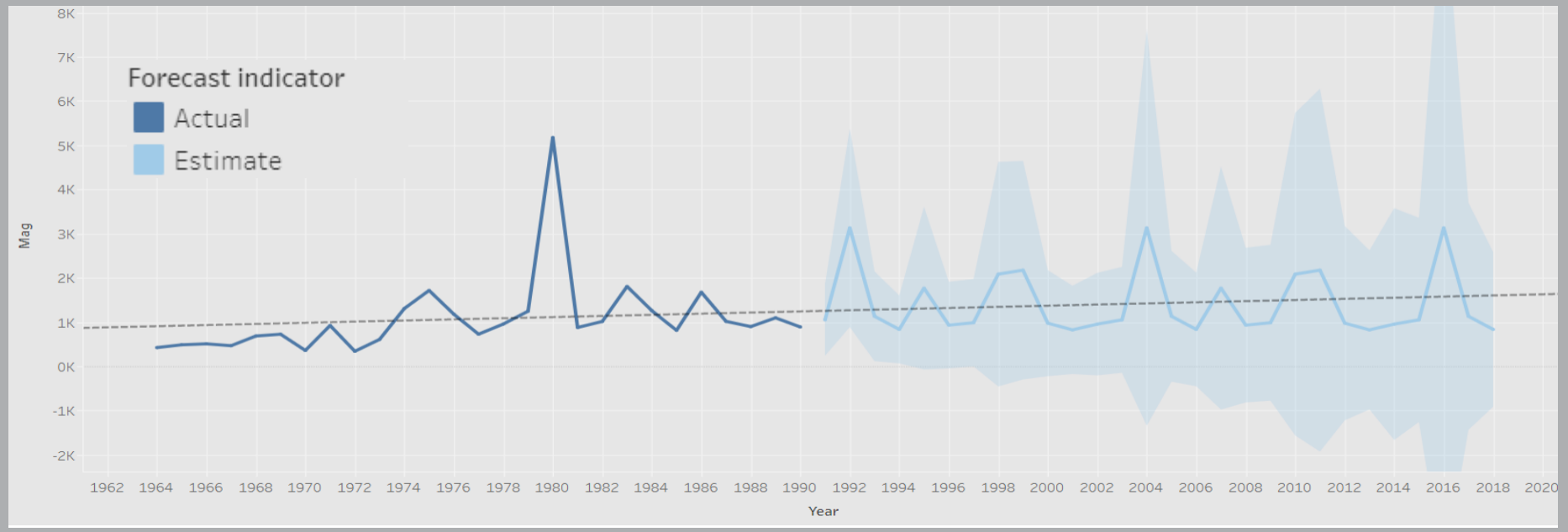


Postfracking
1991-Present



RESULTS

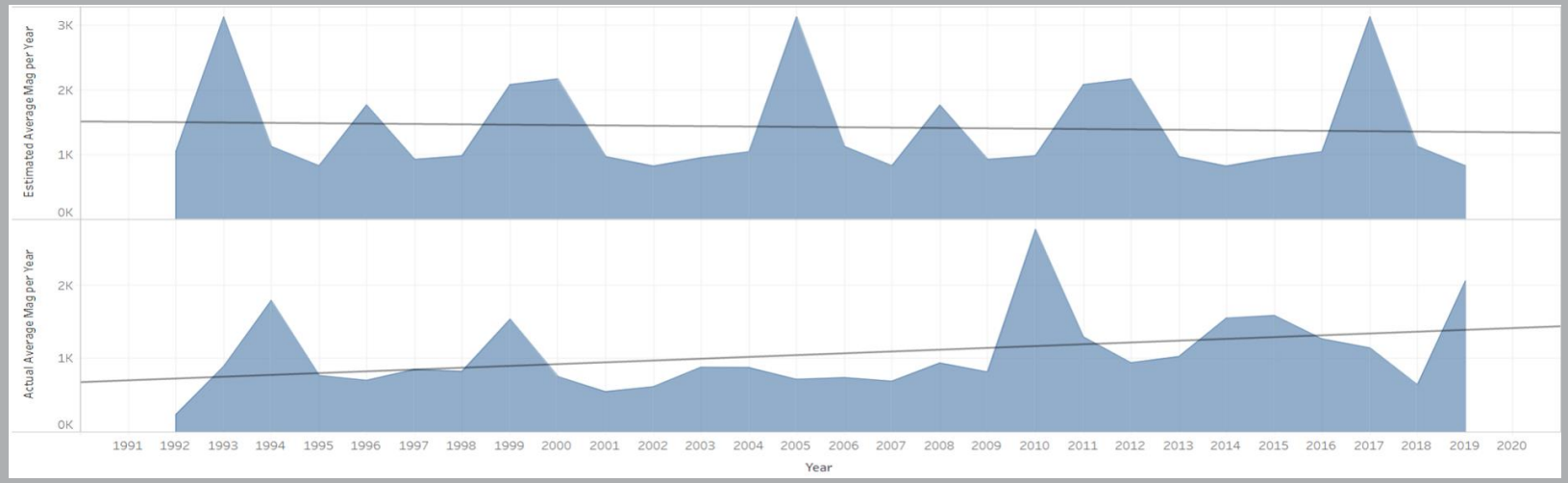
- Actual average earthquakes from 1964-1991
- Forecasting Algorithm for 1992-2019
- MASE of 0.45



RESULTS

Estimate vs Actual 1991-2019

- Estimated slope is **-5.6**
- Actual slope **24.48**



[Tableau publication link]