

Are Point-in-Time Observations of Methane in Domestic Well Water Representative of Year-Round Conditions?

Results of Year-Long Monthly Water Quality Sampling in the Marcellus Play

Amanda E. Campbell, Laura K. Lautz, Gregory D. Hoke



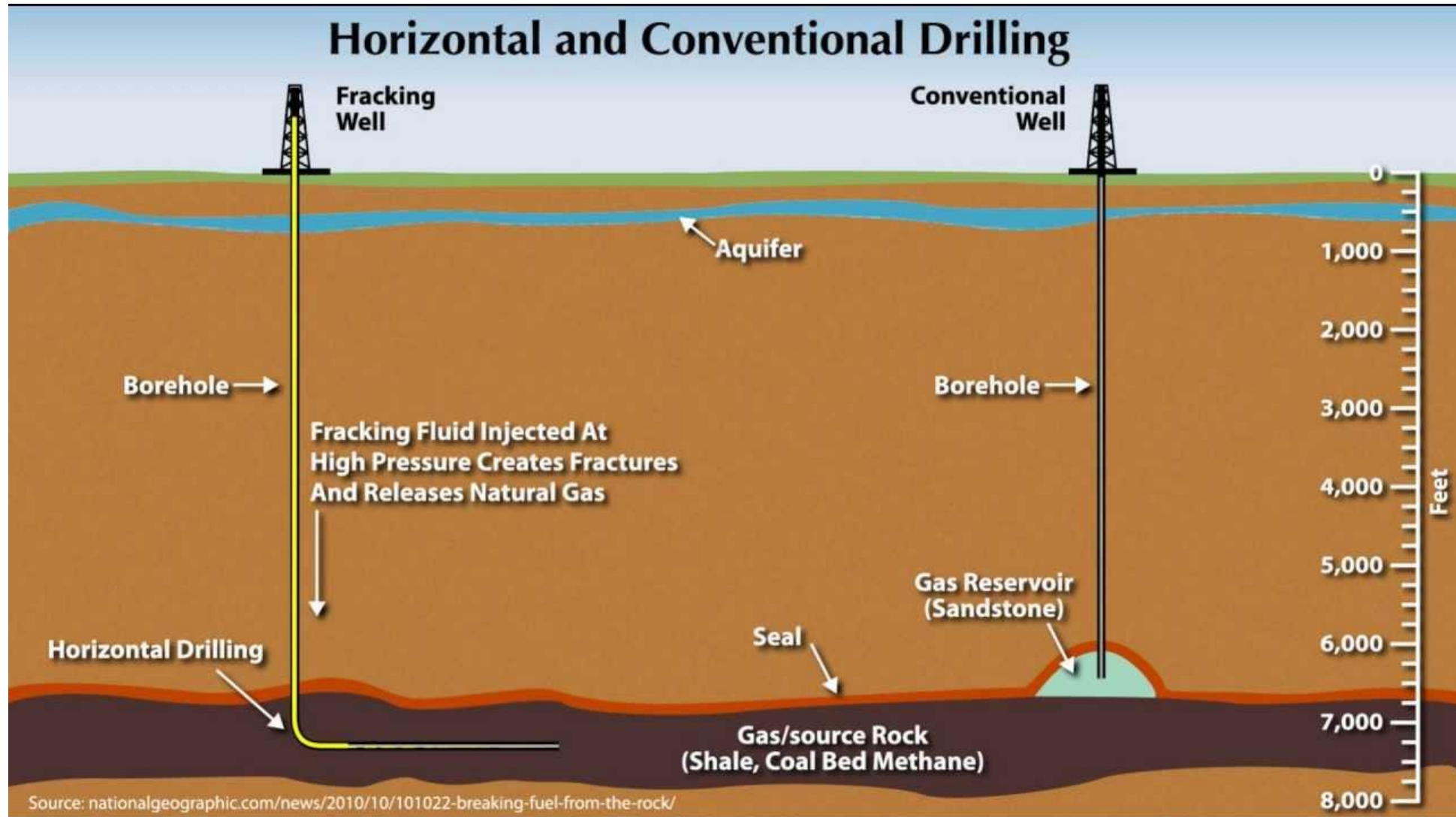
THANK YOU!

Field & Lab Assistance:

- Emily Baker
- Nathan Chien
- Chris Russoniello
- Brian Campbell



High Volume Hydraulic Fracturing

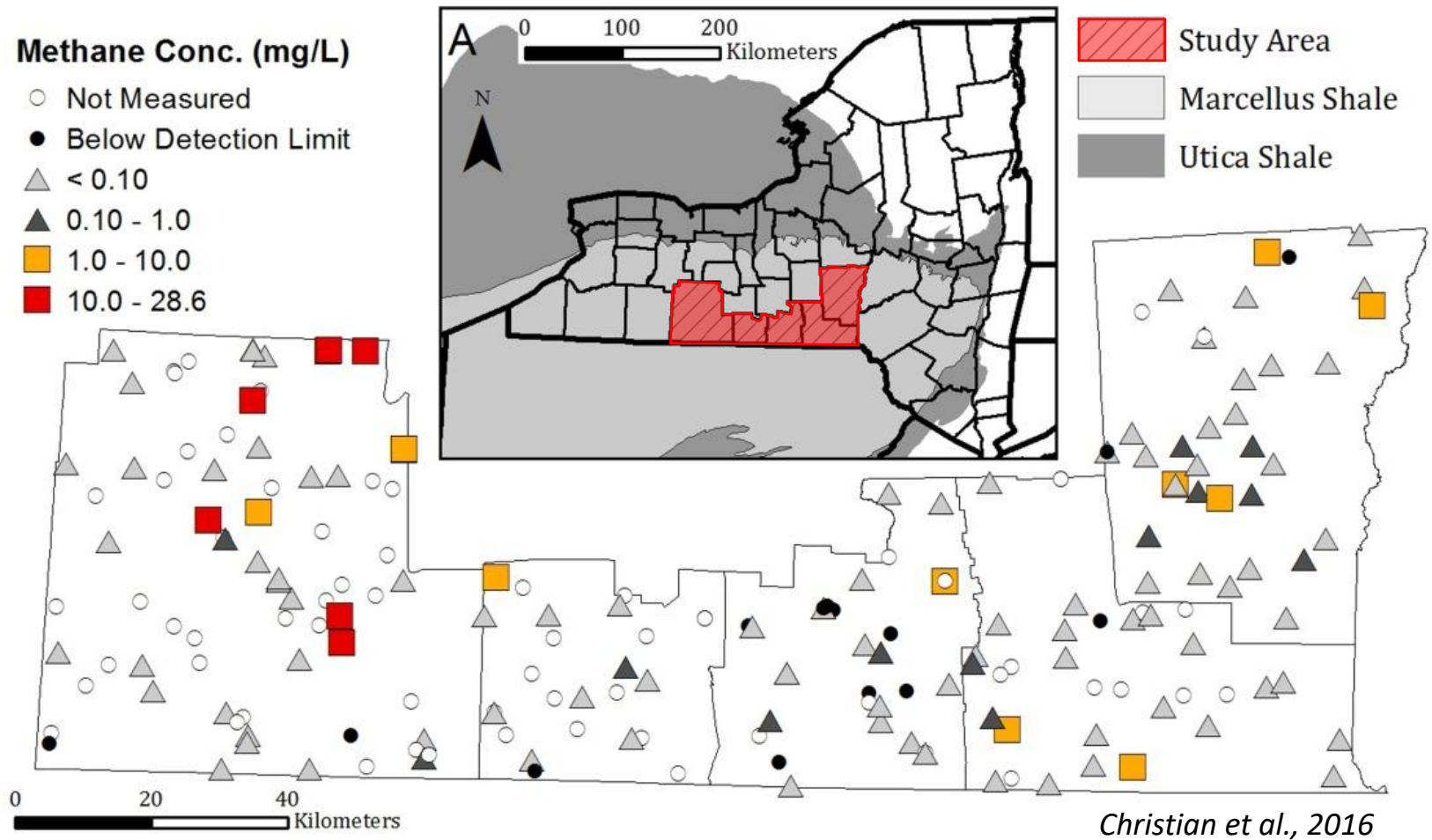


Other gas producing layers

Stratigraphic Column of New York; Oil and Gas Producing Horizons
(from D.G. Hill, T.E. Lombardi and J. P. Martin, 2002)

PERIOD		GROUP	UNIT	LITHOLOGY	THICKNESS (feet)	PRODUCTION	
PENNSYLVANIAN		Pottsville	Olean	Ss, cgl	75 - 100		
MISSISSIPPIAN		Pocono	Knapp	Ss, cgl	5 - 100		
DEVONIAN	UPPER	Conewango	Riceville	Sh, ss, cgl	70		
		Conneuat	Chadakoin	Sh, ss	700		
		Canadaway	Undiff	Sh, Ss	1,100 - 1,400	Oil, Gas	
			Perrysburg-Dunkirk	Sh, ss		Oil, Gas	
				Sh, ss			
			Java	Sh, ss	365 - 125		
		West Falls	Nunda	Sh, ss		Oil, Gas	
			Rhinestreet	Sh			
			Sonyea	Middlesex	Sh	0 - 400	Gas
			Genesee	Geneseo	Sh	0 - 450	Gas
	?		Tully	Ls	0 - 50	Gas	
	MIDDLE	Hamilton	Moscow	Sh	200 - 600		
			Ludlowville	Sh			
			Skaneateles	Sh			
			Marcellus	Sh		Gas	
			Onondaga	Ls	30 - 235	Gas, Oil	

Project SWIFT 2012 – 2016

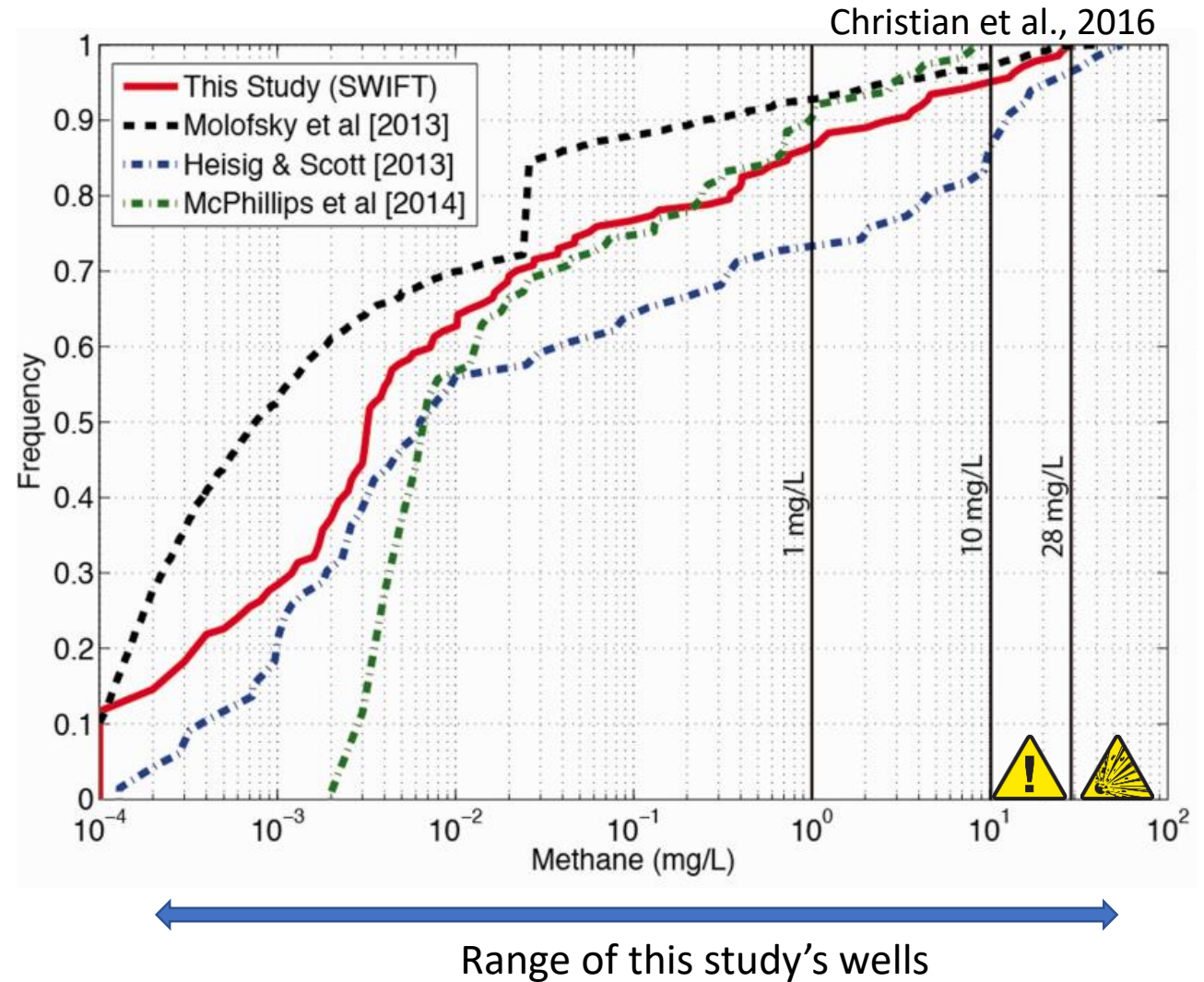


Questions

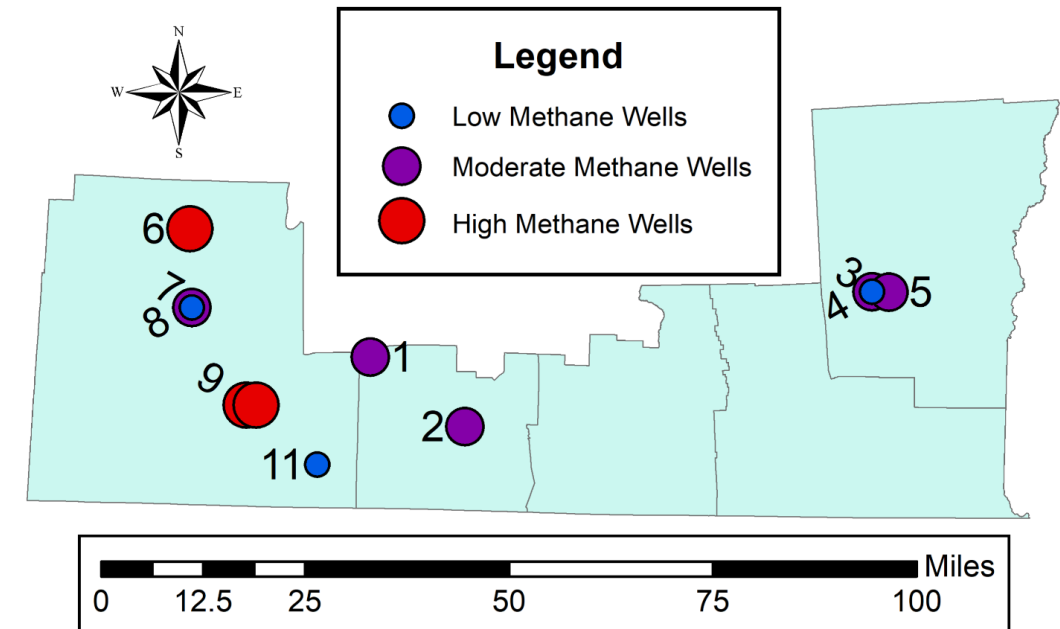
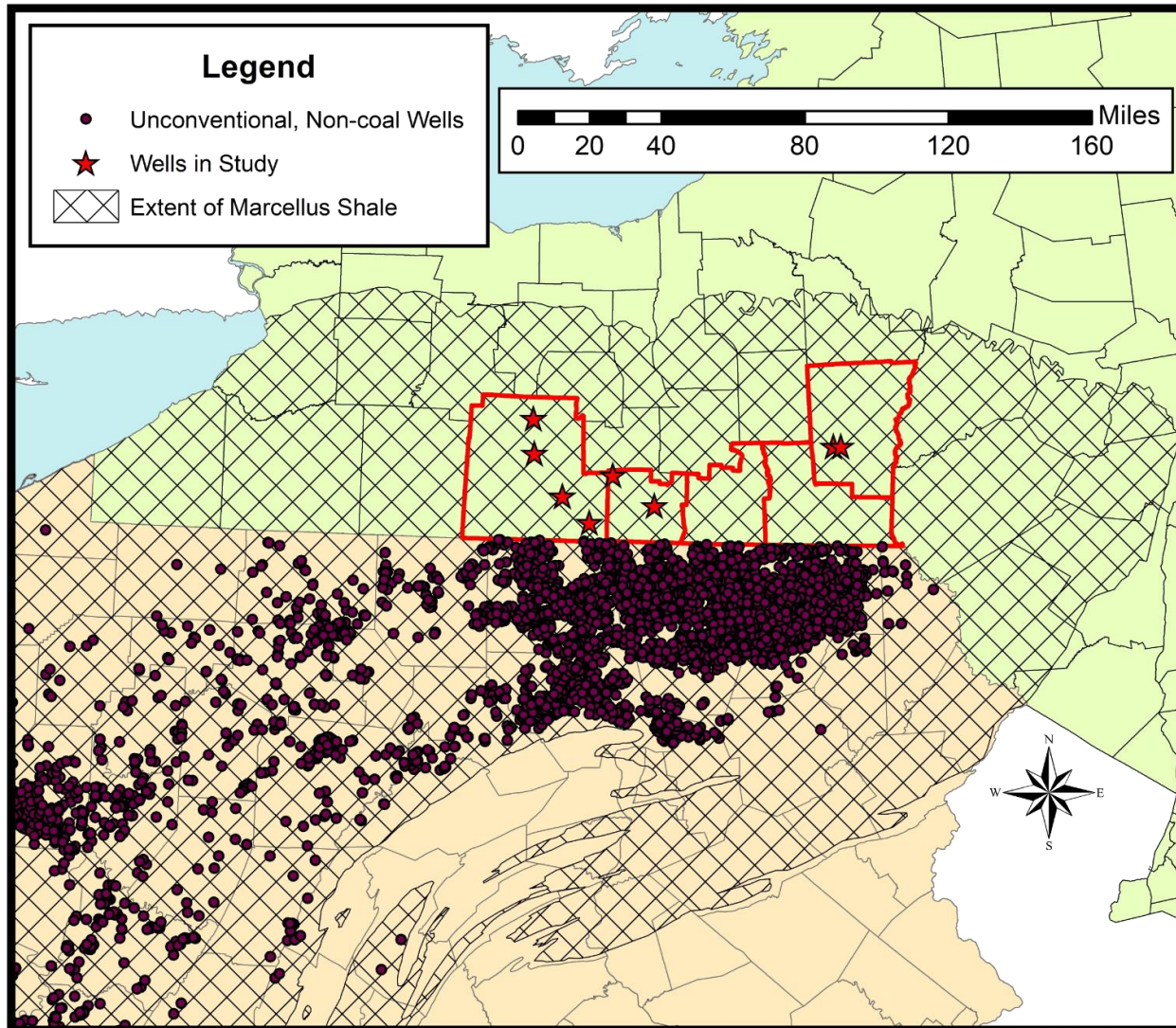
1. Are point-in-time measurements representative of long-term conditions?
2. What can explain the natural variability of methane?

Selection Criteria

- Enthusiastic homeowner
- Physically capable homeowner
- Year-round accessibility of tap
- Overall range of methane concentrations
- Multiple wells on site
- Geographic distribution

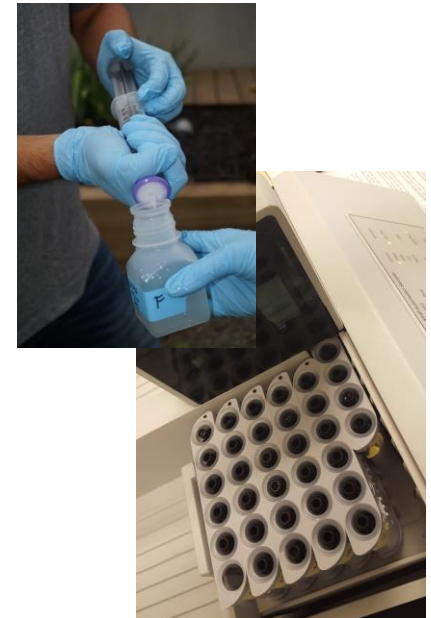
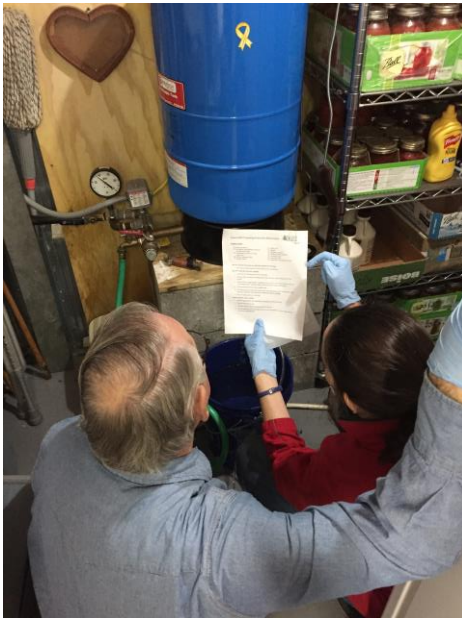


My Study Sites

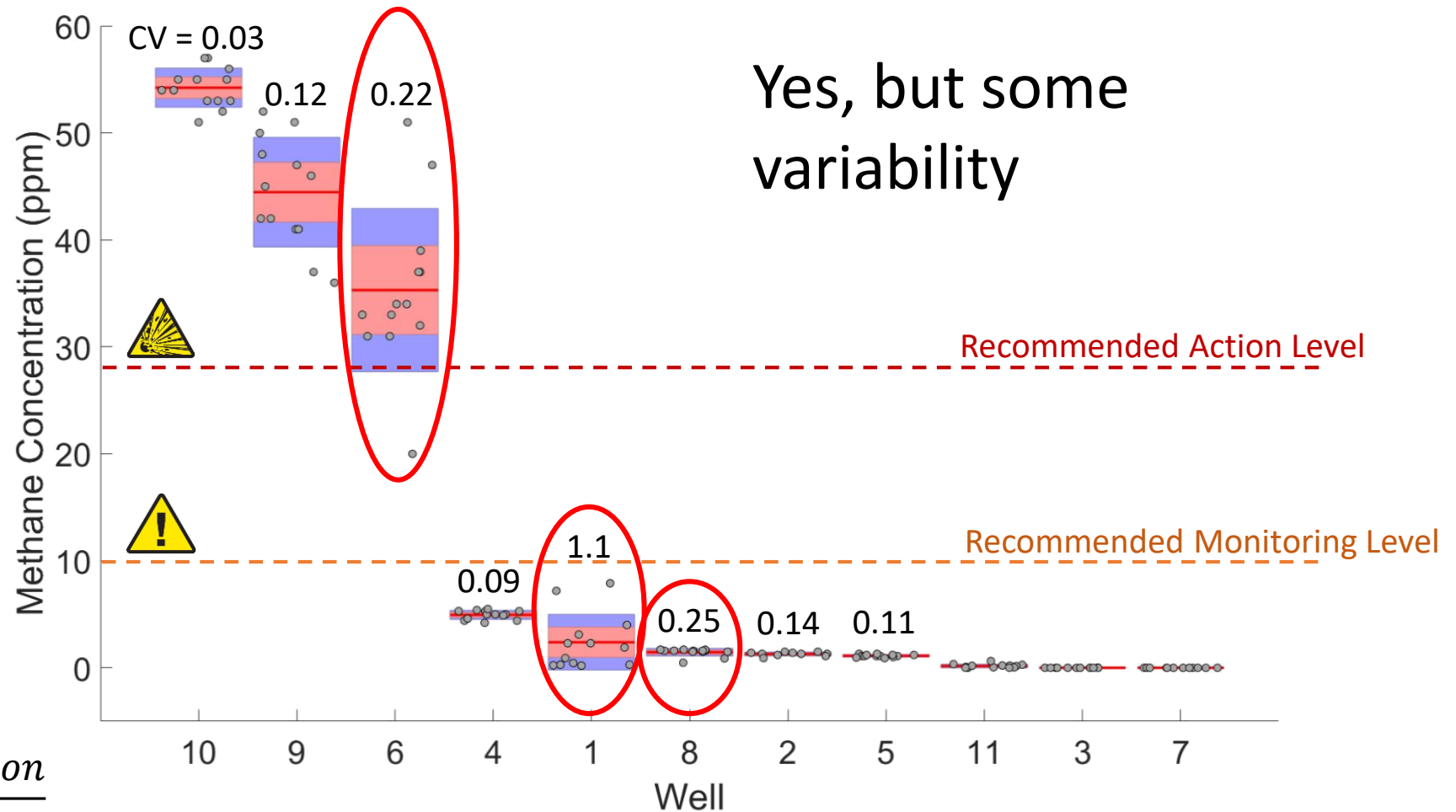


Methodology

- Sampled 11 wells for 13 months
- Dec 2016 – Dec 2017
- Monthly sampling
- Methane, ethane, propane concentrations
- Methane and water isotopes
 - $\delta^{13}\text{C}$, $\delta^{18}\text{O}$, $\delta^2\text{H}$
 - June & Dec 2017
- Major Ions: Na^+ , K^+ , NH_4^+ , Ca^{2+} , Mg^{2+} ; Cl^- , F^- , Br^- , NO_3^- , SO_4^{2-}

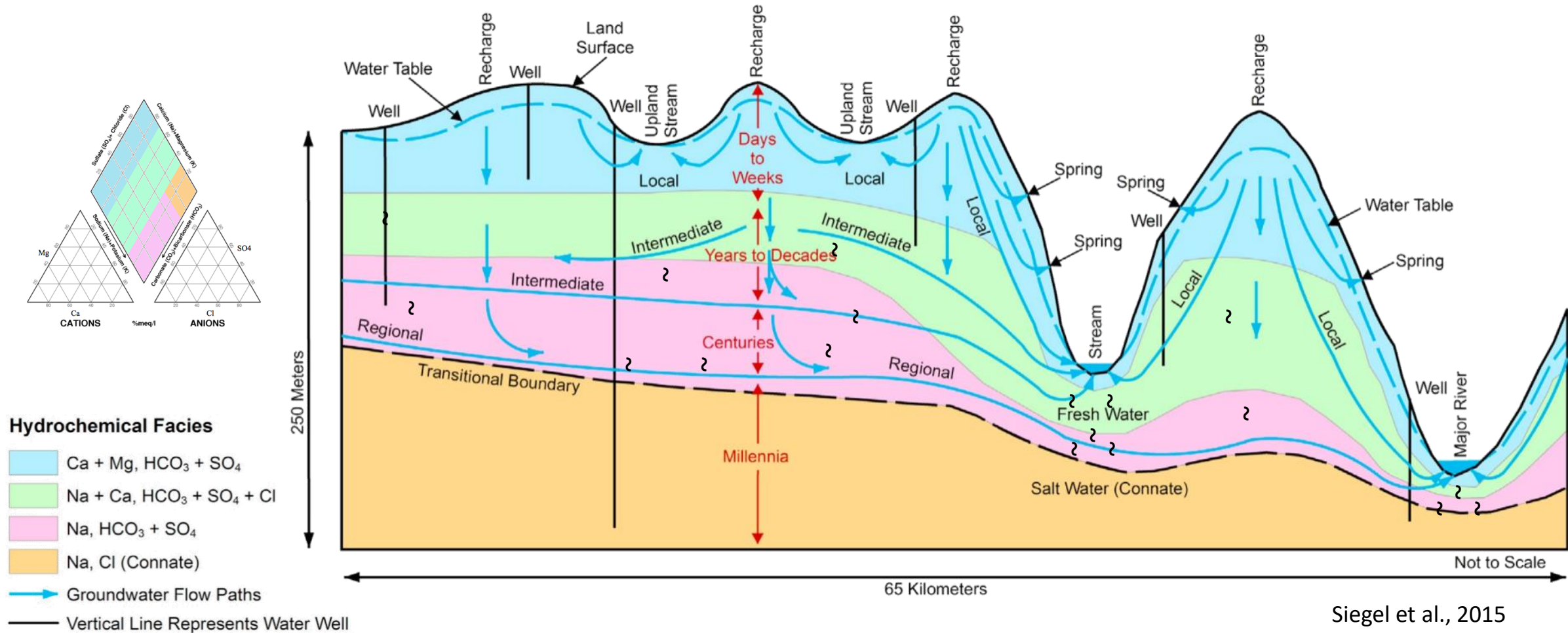


Q1: Are point-in-time measurements representative of long-term conditions?



$$CV = \frac{\text{standard deviation}}{\text{mean}}$$

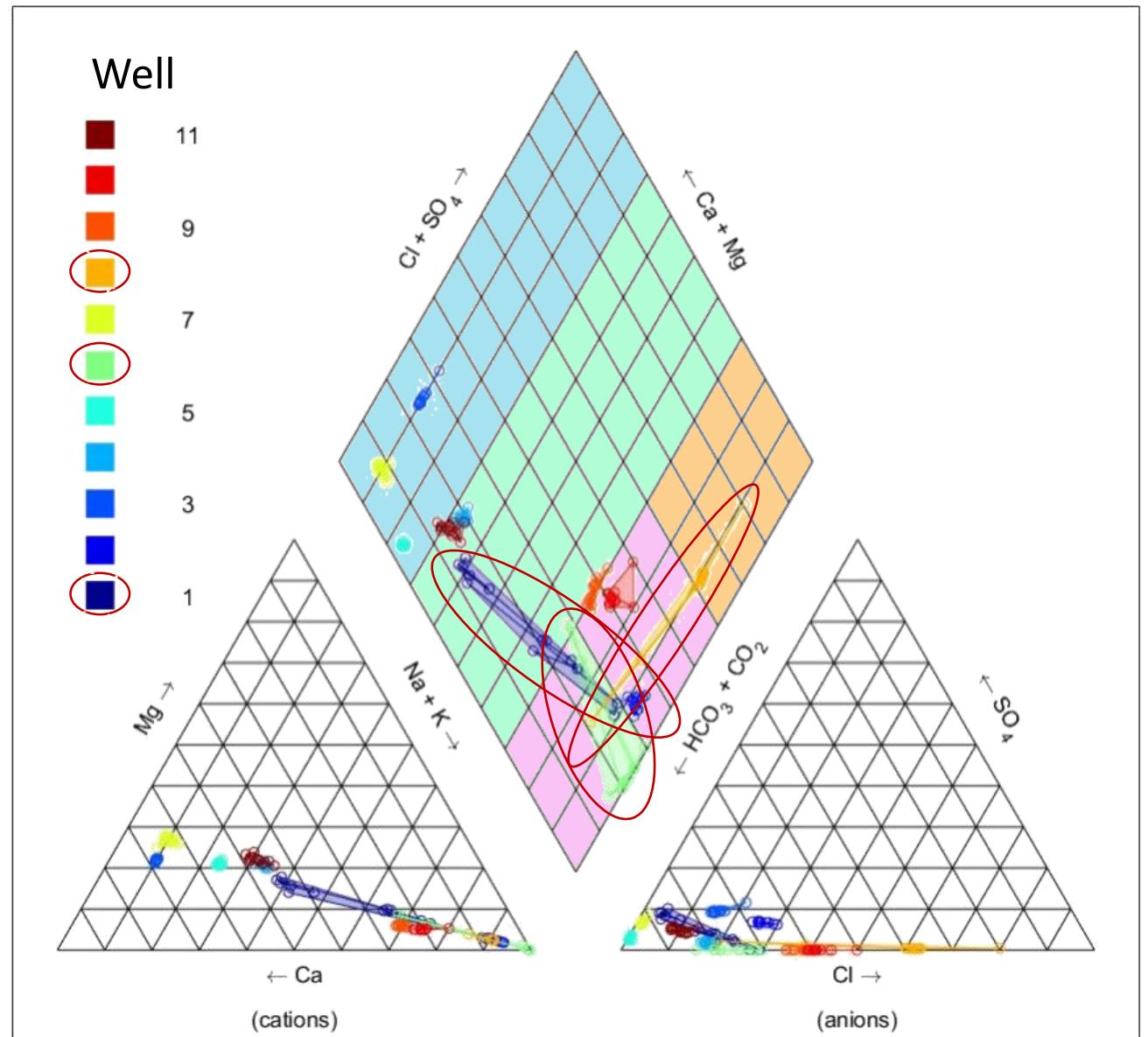
Q2: What can explain the natural variability of methane?



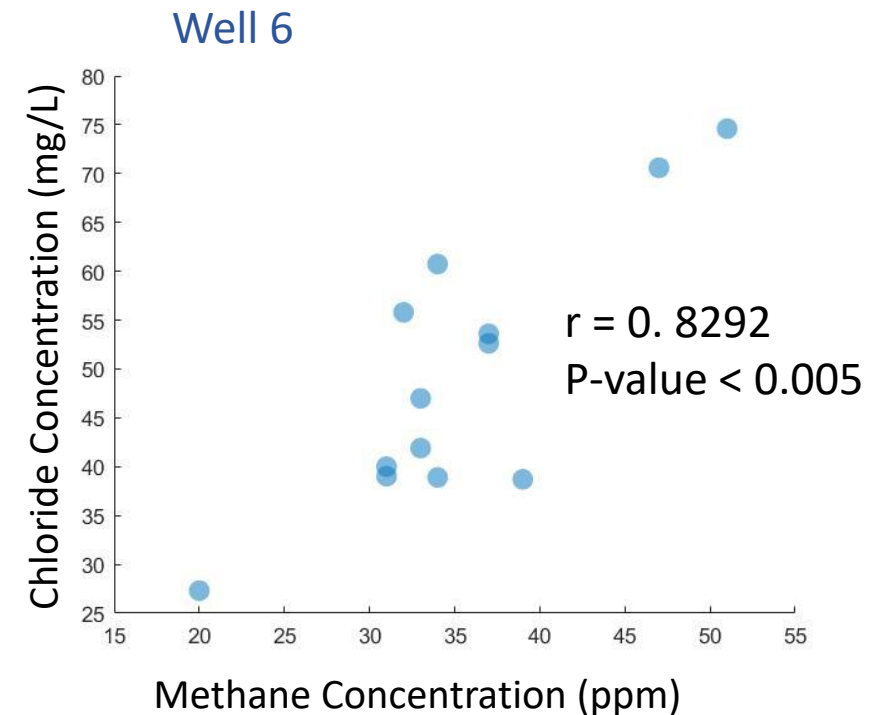
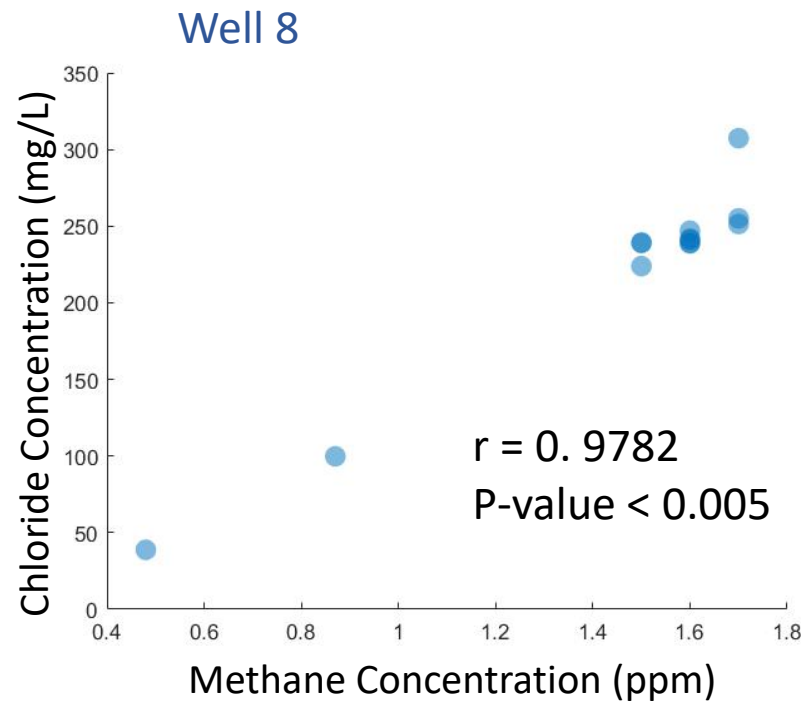
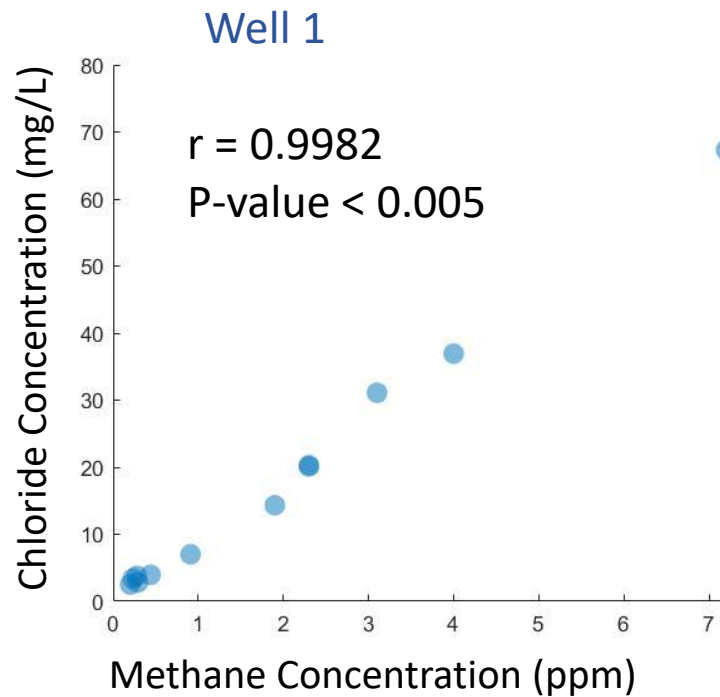
Water Chemistry

Hydrochemical Facies

Ca + Mg, HCO ₃ + SO ₄
Na + Ca, HCO ₃ + SO ₄ + Cl
Na, HCO ₃ + SO ₄
Na, Cl (Connate)



Methane Correlates with Chloride



Conclusions

- Most wells don't vary much through time
 - Point-in-time sampling is representative of overall conditions
- High methane variation (wells >1 ppm) is correlated with chloride concentration
 - Baseline samples with water chemistry are crucial
- If there is a decoupling between methane and Cl sourced from formation water, look for an unnatural source of methane

Questions?