UNDERSTANDING BEDROCK MEANDERING

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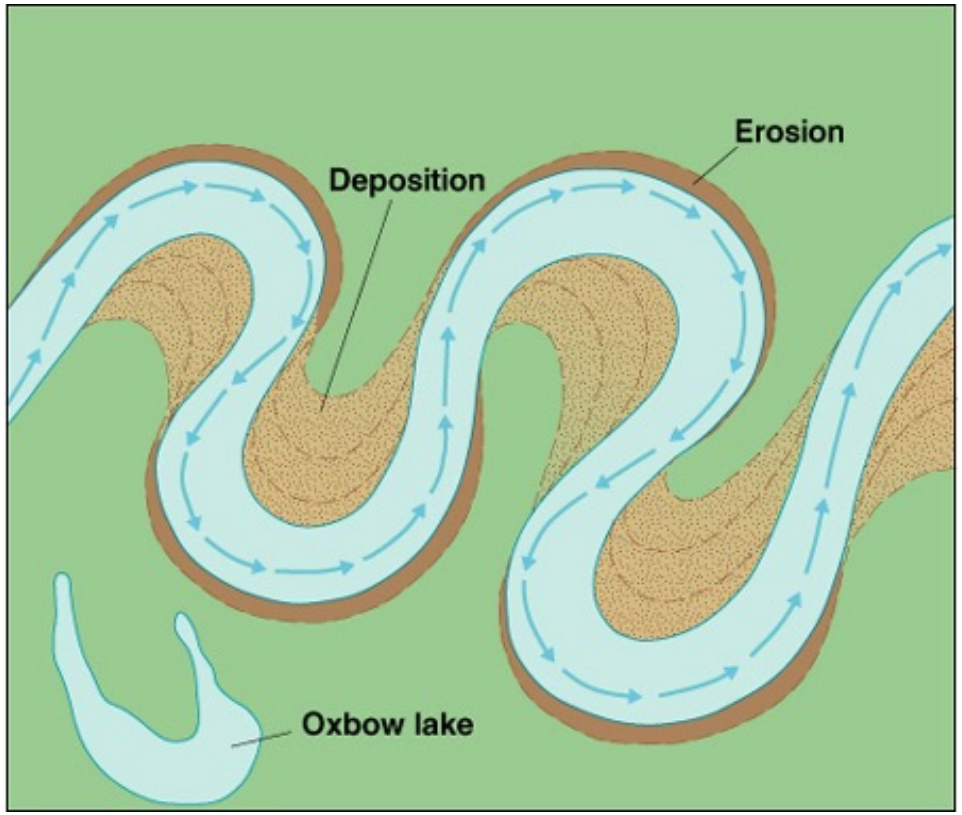
WHAT IS THE CAUSE FOR MEANDERS IN RESISTANT BEDROCK CHANNELS?

BACKGROUND

Alluvial – whose beds and banks are made of alluvium and are eroding and depositing with ease

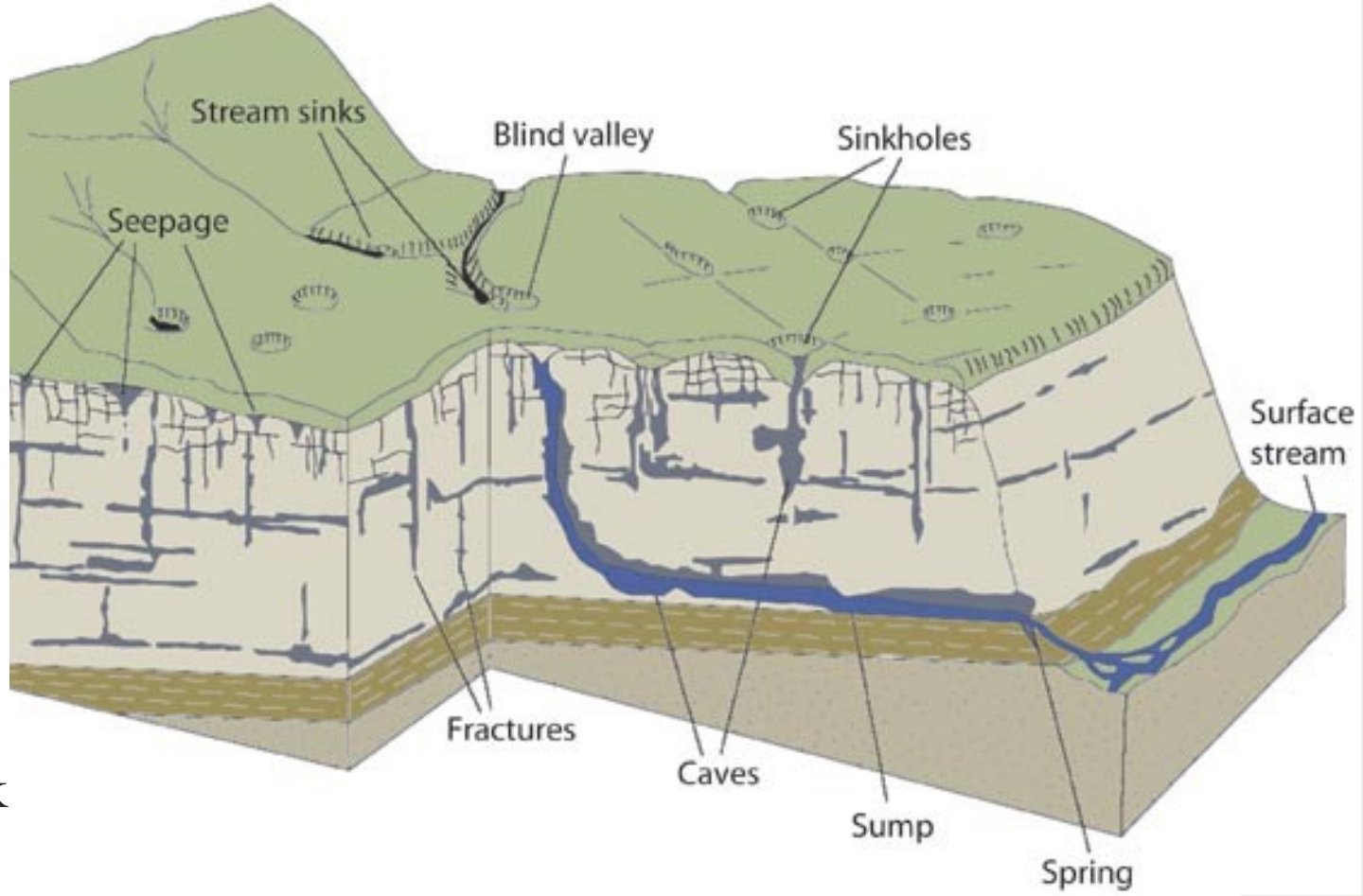
Bedrock – whose beds and banks are made of solid rock; more resistant to meandering



BACKGROUND

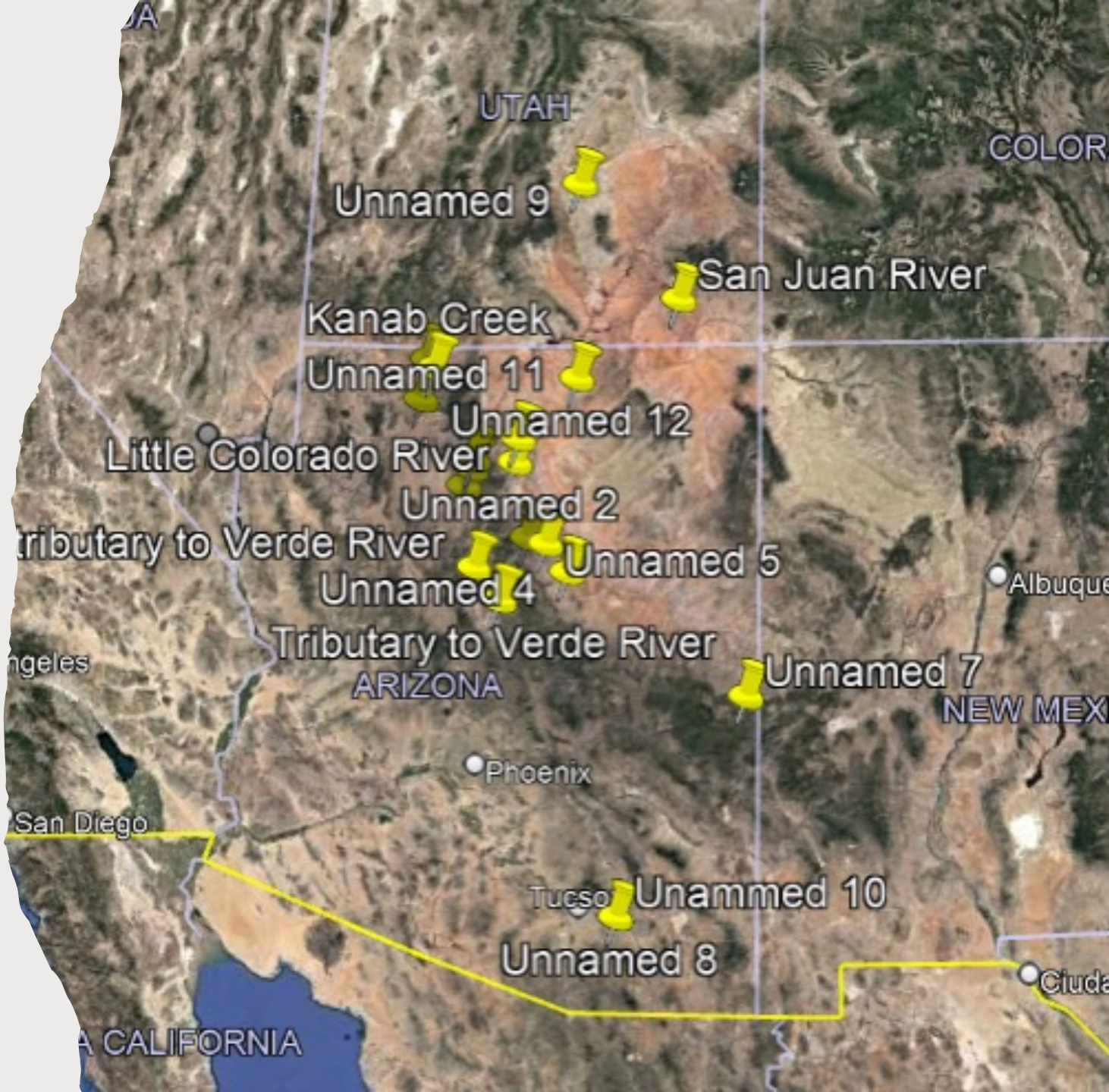
- Seepage
- Springs
- Aquifer Layers

- ***Hypothesis***: Bedrock channel meanders develop via self-enhancing feedback loop
  - Active Bedrock Meandering



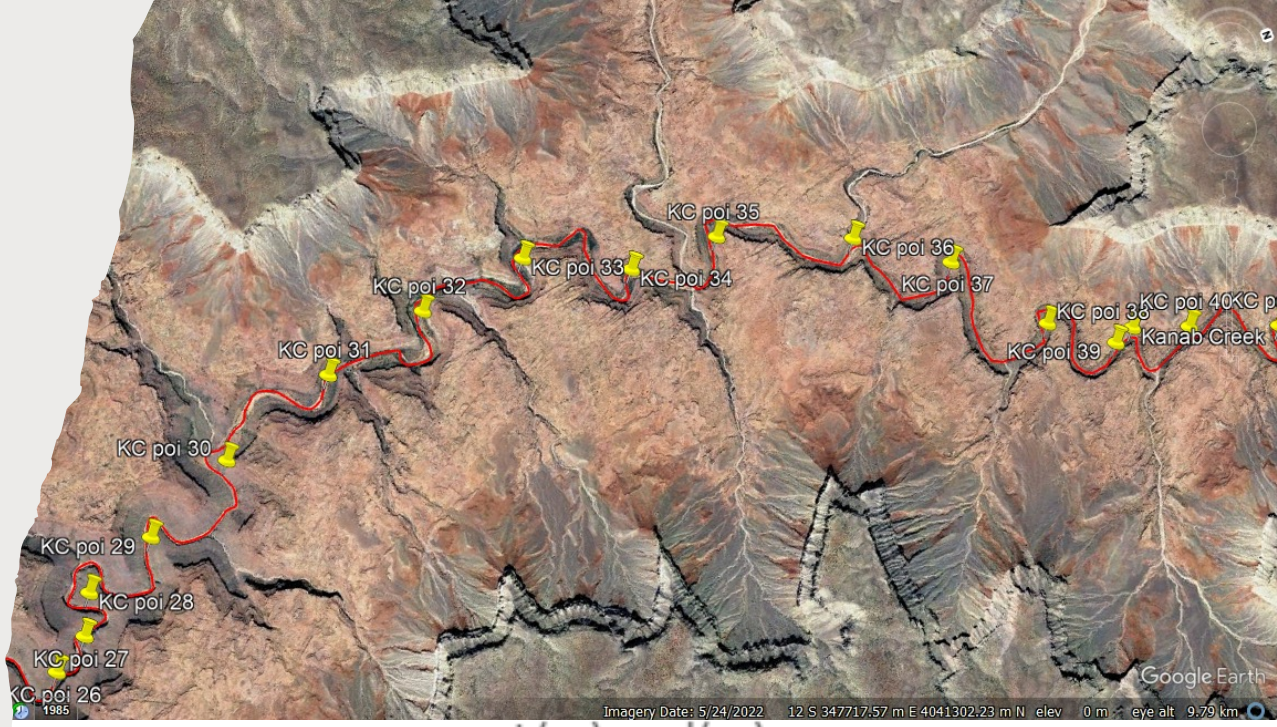
METHODS

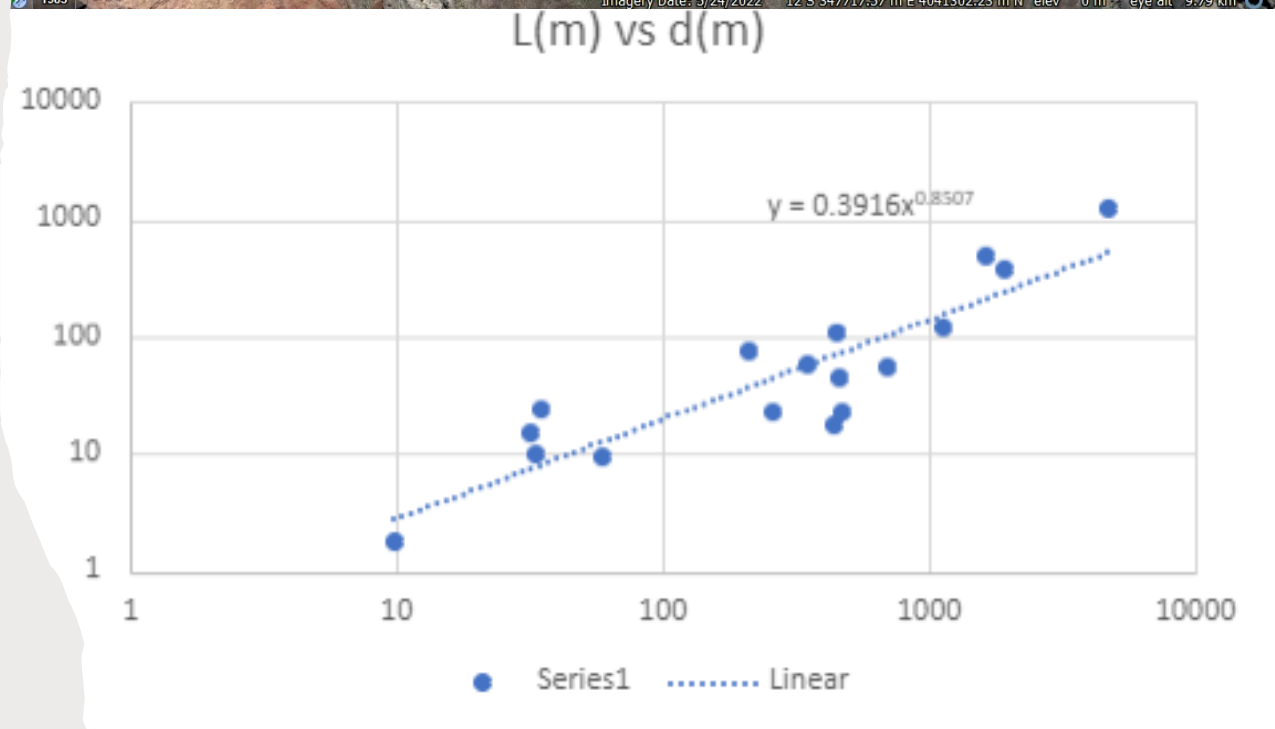
- Supplemental Reading
- Meander Data Set
- Data Analysis
- Linear Regression
- Model Comparison
- Springs Data
- Conclusion



MEANDER DATA

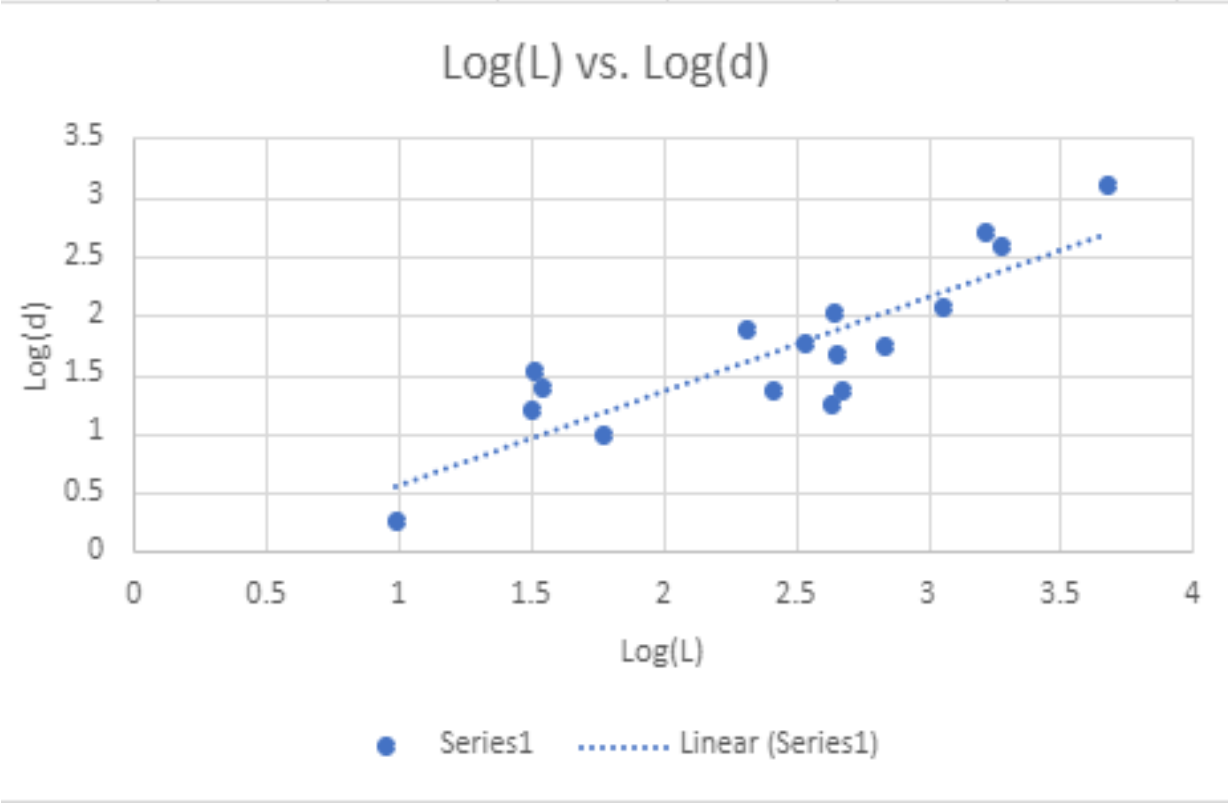
- Focused on Colorado Plateau
  - 20 streams of focus
- Wide range of Data
  - Increases validity
- Length of Amplitude – L(m)
- Depth of Incision – D(m)
- High Correlation of ***0.98***





LINEAR REGRESSION

- shows the relationship between the independent variables (Length) and the dependent variable (Depth)
- $L=7.76 \cdot d^{0.928}$
- ***Big Idea: Depth of Incision and Amplitude are correlated***



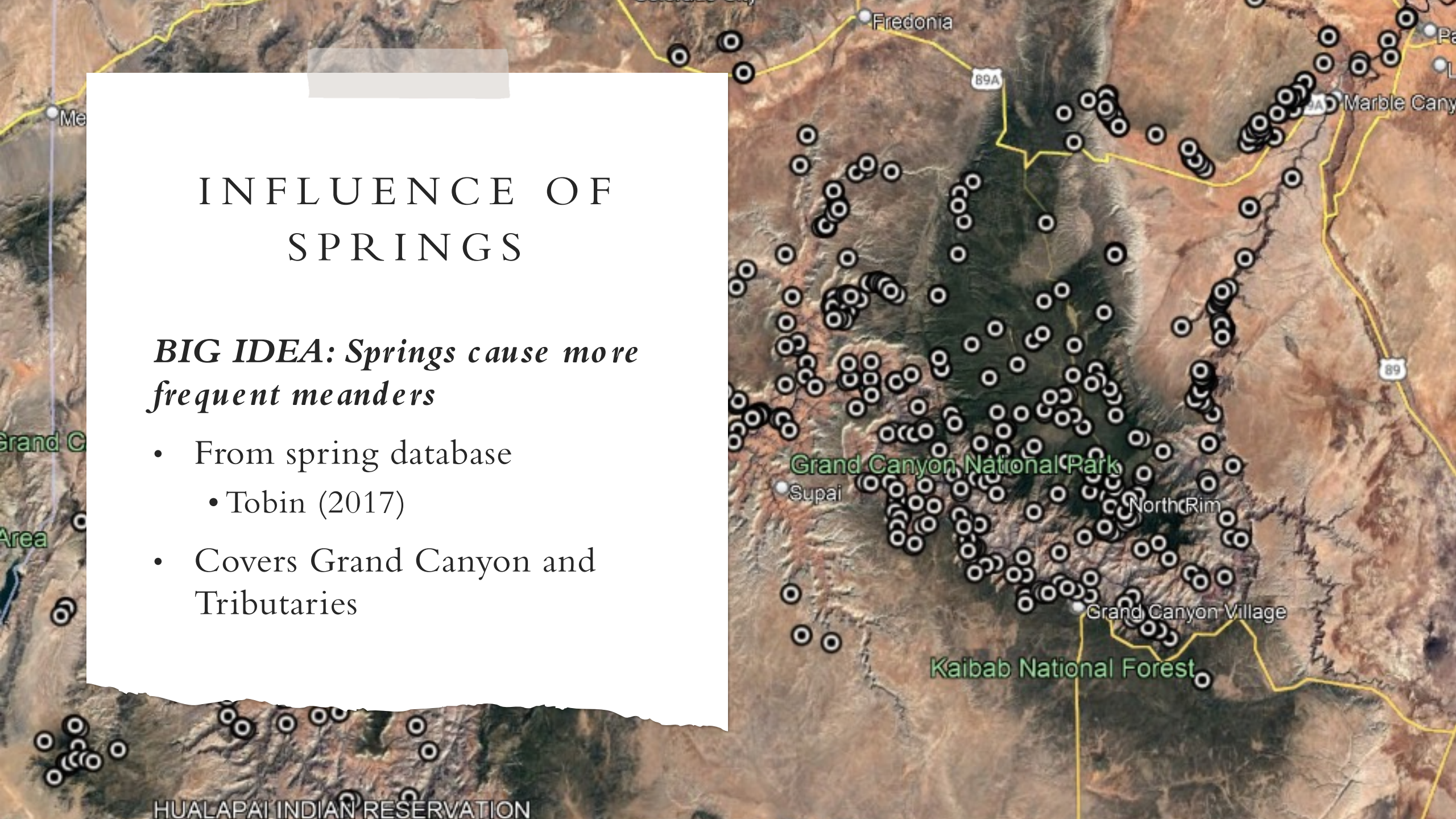
MODEL RESULTS

- Random variations
- Wavelength proportional to the depth of incision
- Data and model confirm
- Smaller channels tend to see more frequent meanders
- Larger channels more dramatic and deep meanders

INFLUENCE OF SPRINGS

BIG IDEA: Springs cause more frequent meanders

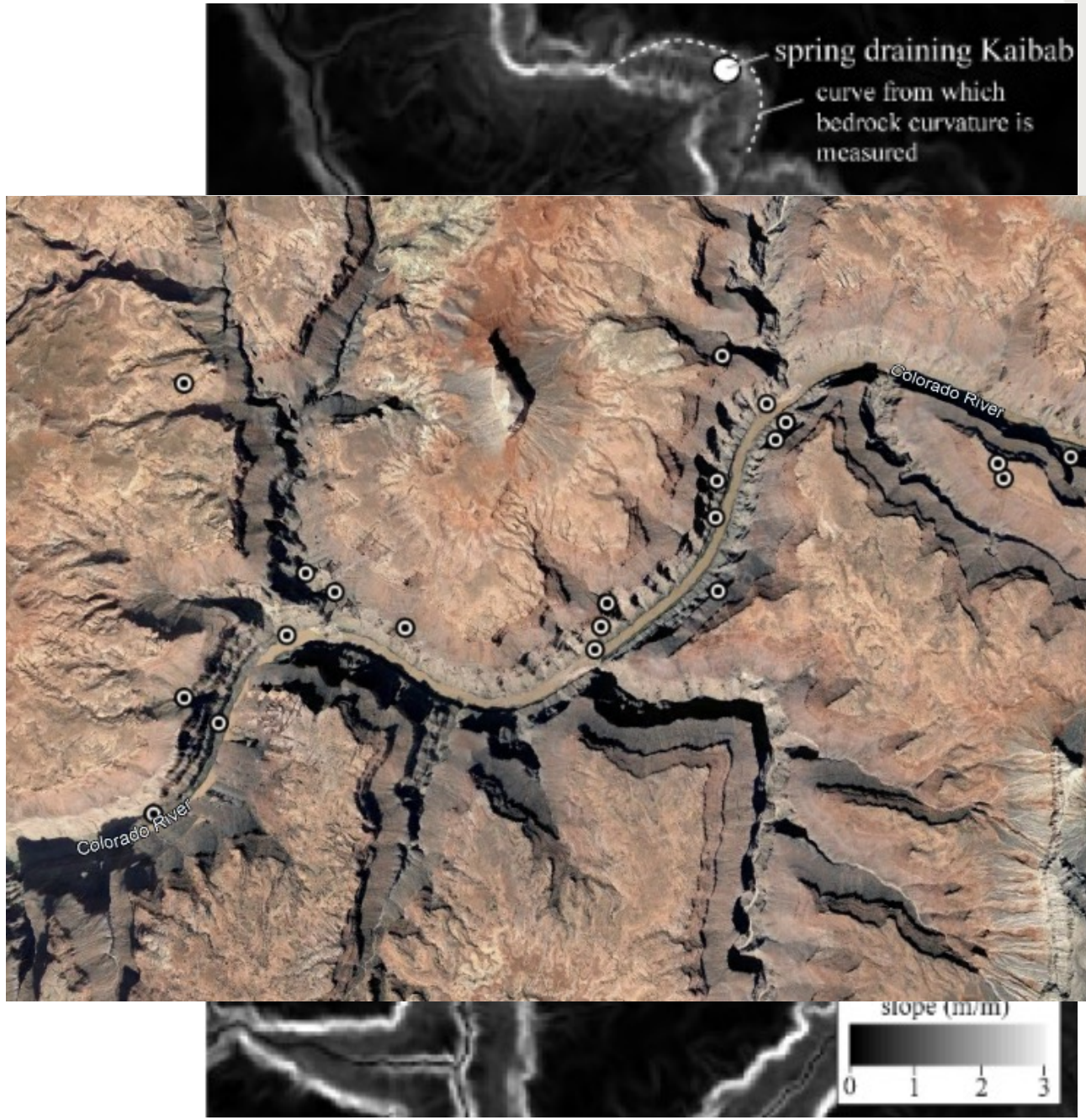
- From spring database
  - Tobin (2017)
- Covers Grand Canyon and Tributaries



SPRING SET DATA RESULTS

Curvature (units of 1/m) of the bedrock walls adjacent to springs

- Positive curvature = canyon walls bend towards spring,
- Negative curvature = bends away from spring
- The presence of springs tends to be associated with high positive curvature values.



SYNTHESIS

BIG IDEAS

- ***Depth of Incision and Amplitude are proportional***
- ***Springs cause more influence (dramatic) meanders***
- ***Active Bedrock Meandering***

FUTURE PROGRESS

- Influence of tributaries and fault lines
- Reproducing a model to produce one to one results matching linear regression
- Combat bedrock inheritance from counter arguments

CONCLUSION

How are meanders in bedrock channels influenced by external forces?

- The relationship between the meander wavelength and depth of incision determine frequency and 'intensity' of meanders
- Meanders will continue to grow incised
- Springs cause meanders to 'reach' for them
- Active Bedrock Meandering