Using mobile robotic platforms to improve decision-making in geoscience field research

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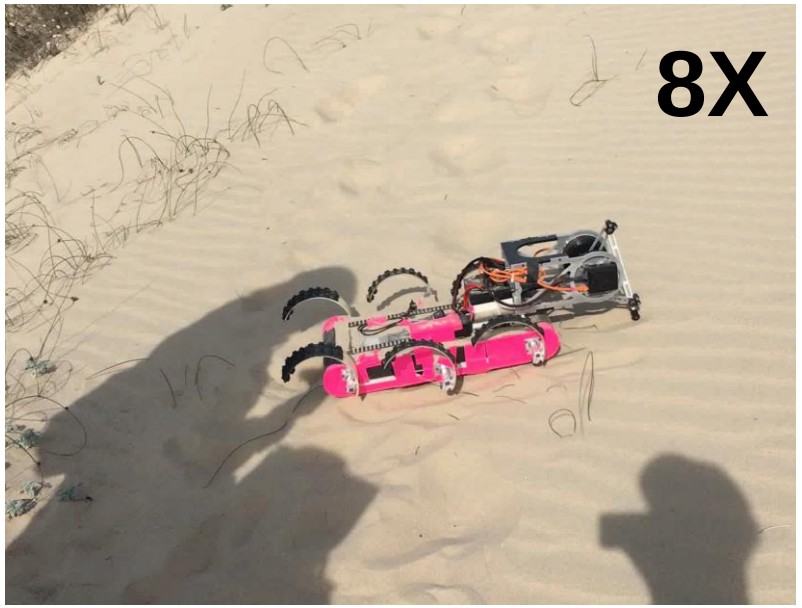
Temple University

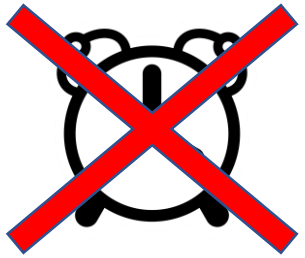
GSA Annual Meeting
September 2019

Interdisciplinary Collaboration:
Geology, Robotics, & Cognitive Psychology



Qian et al. (2017) *Aeolian Processes*

Wednesday
Hall AB, North
No. 148



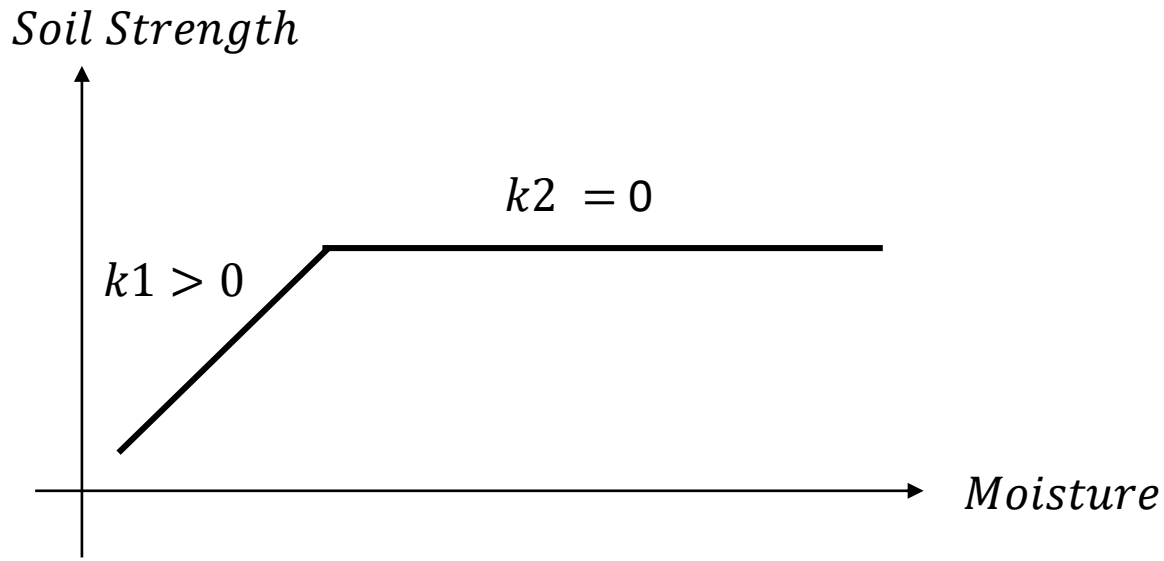
STRABOSPOT

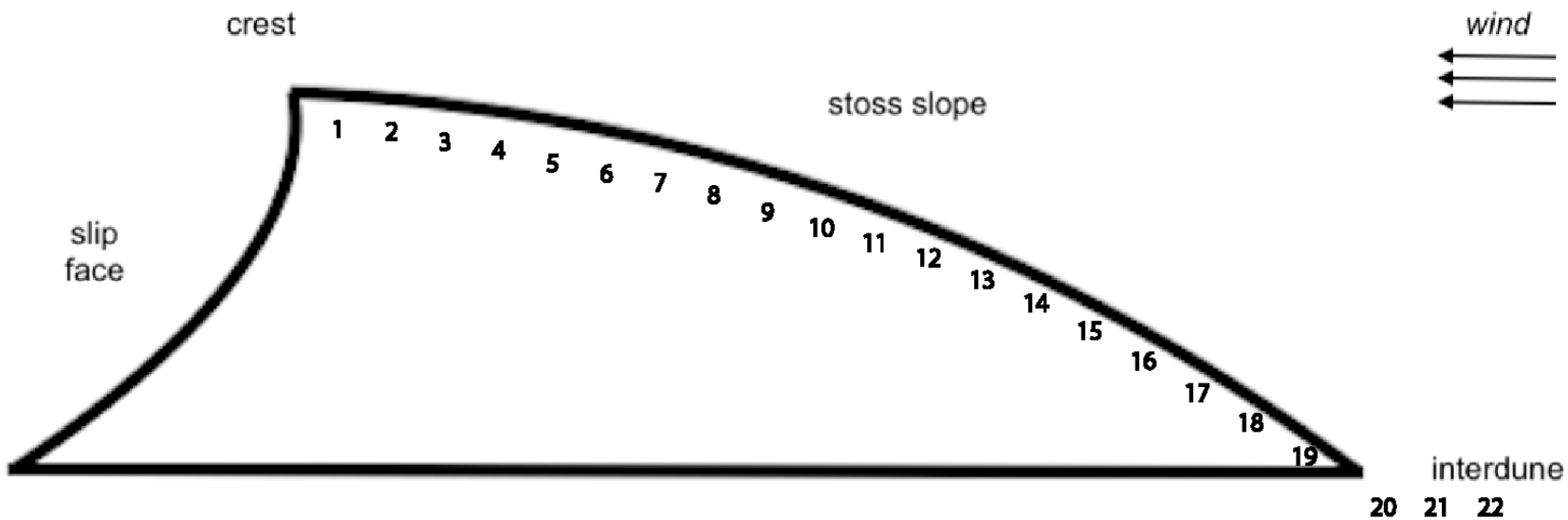
How is geologic decision making influenced by the availability of real-time, in-situ measurement data?

Simulated Geologic Decision-Making Scenario

Participants, *N* = 41

- Geoscientists
- Recruited at AGU & through research team contacts
- 73% male, *n* = 30
- Roughly equal numbers of graduate students, postdocs, & professors


Soil Strength
$k2 = 0$
$k1 > 0$
Moisture

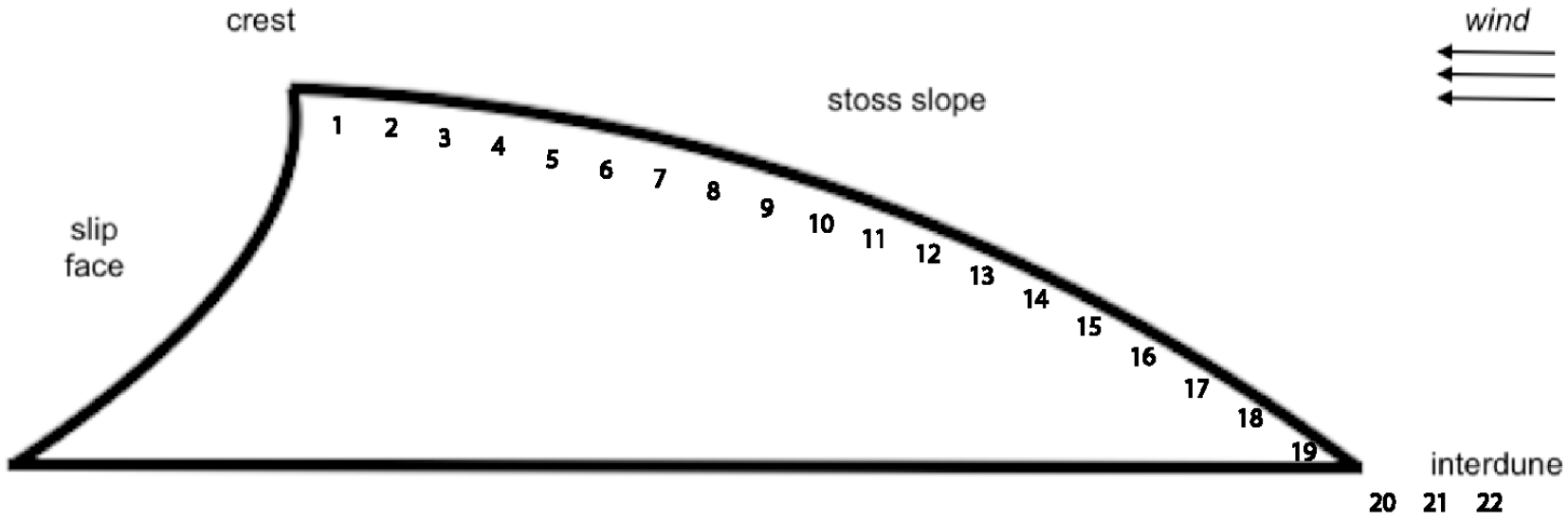

crest
wind
stoss slope
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
slip
face
interdune
20
21
22

Step 1. Select an Initial Sampling Strategy

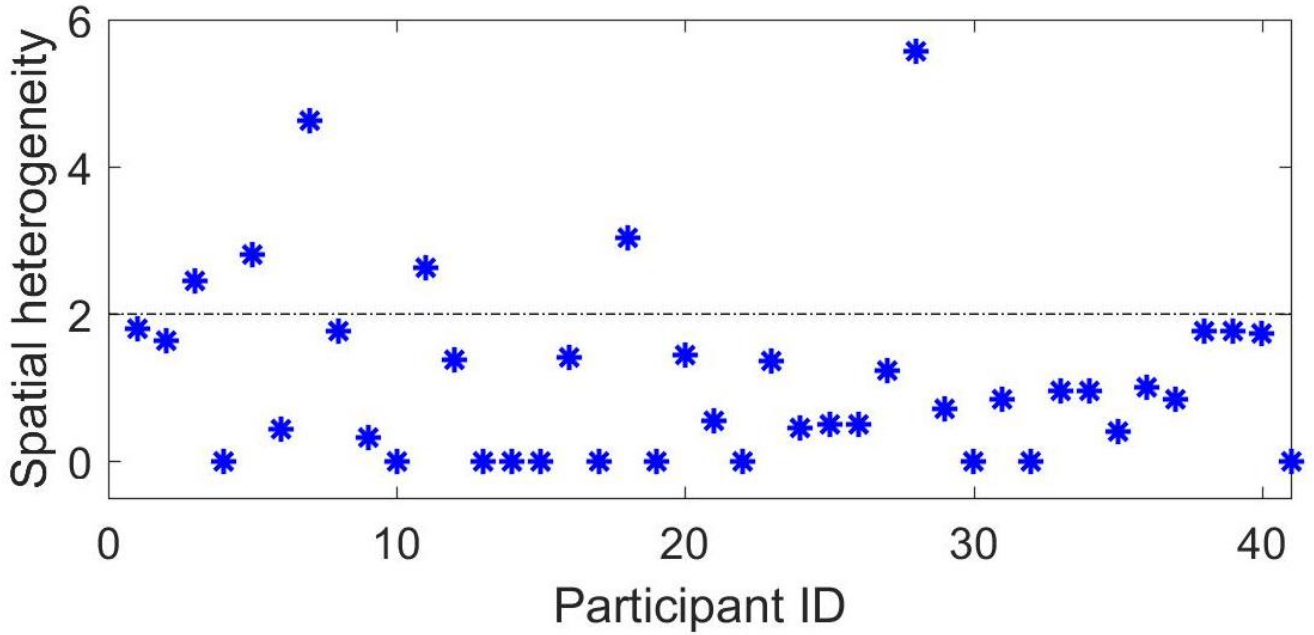
Total Number of Locations [*up to 22*]

Order to Visit Locations [*no restrictions*]

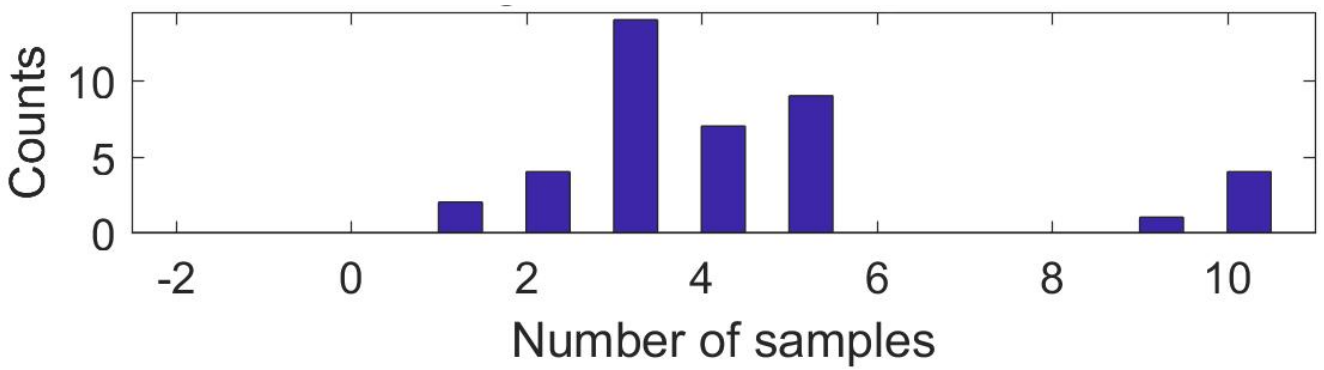
Number of Samples at Each Location [*up to 10*]



Step 1. Select an Initial Sampling Strategy

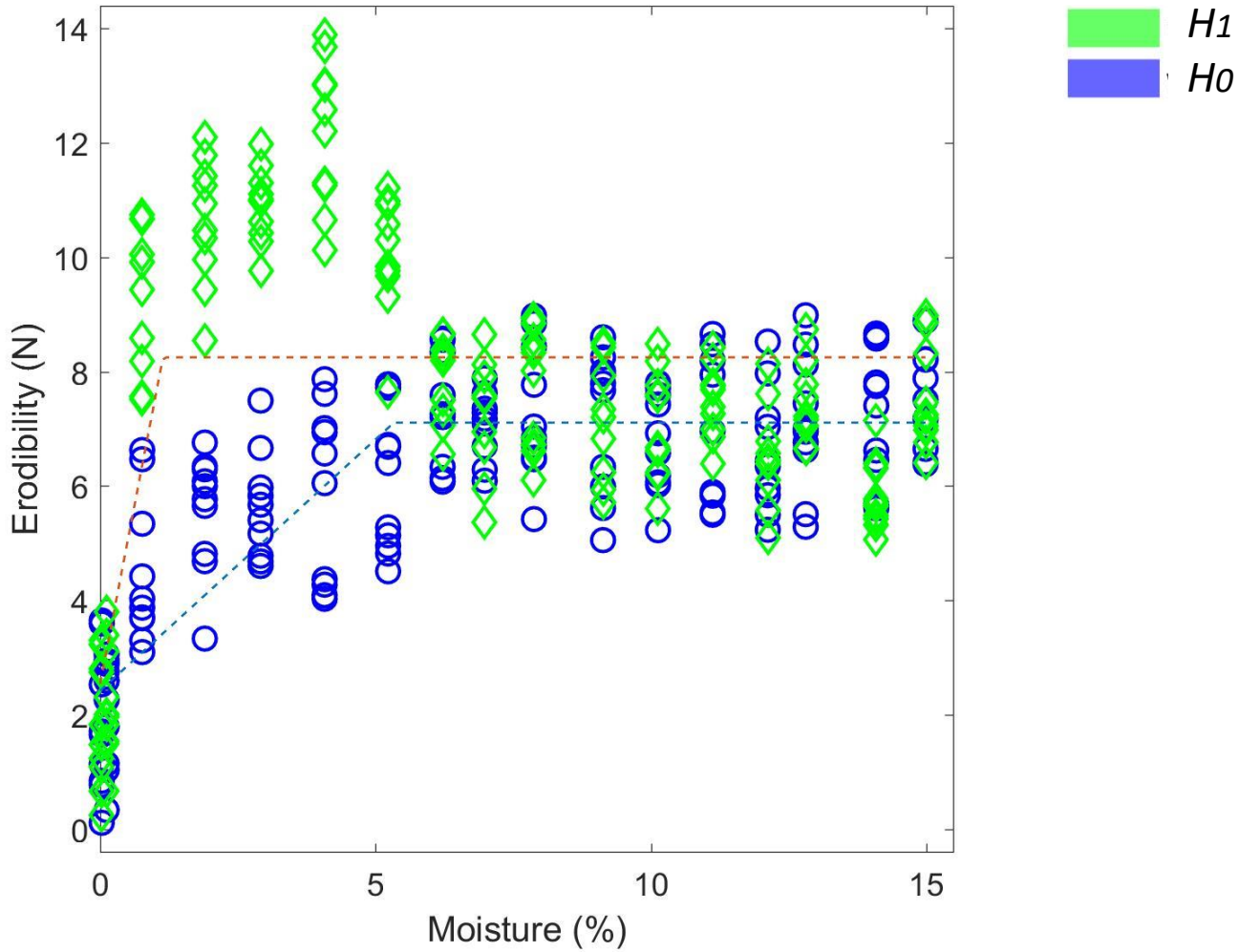


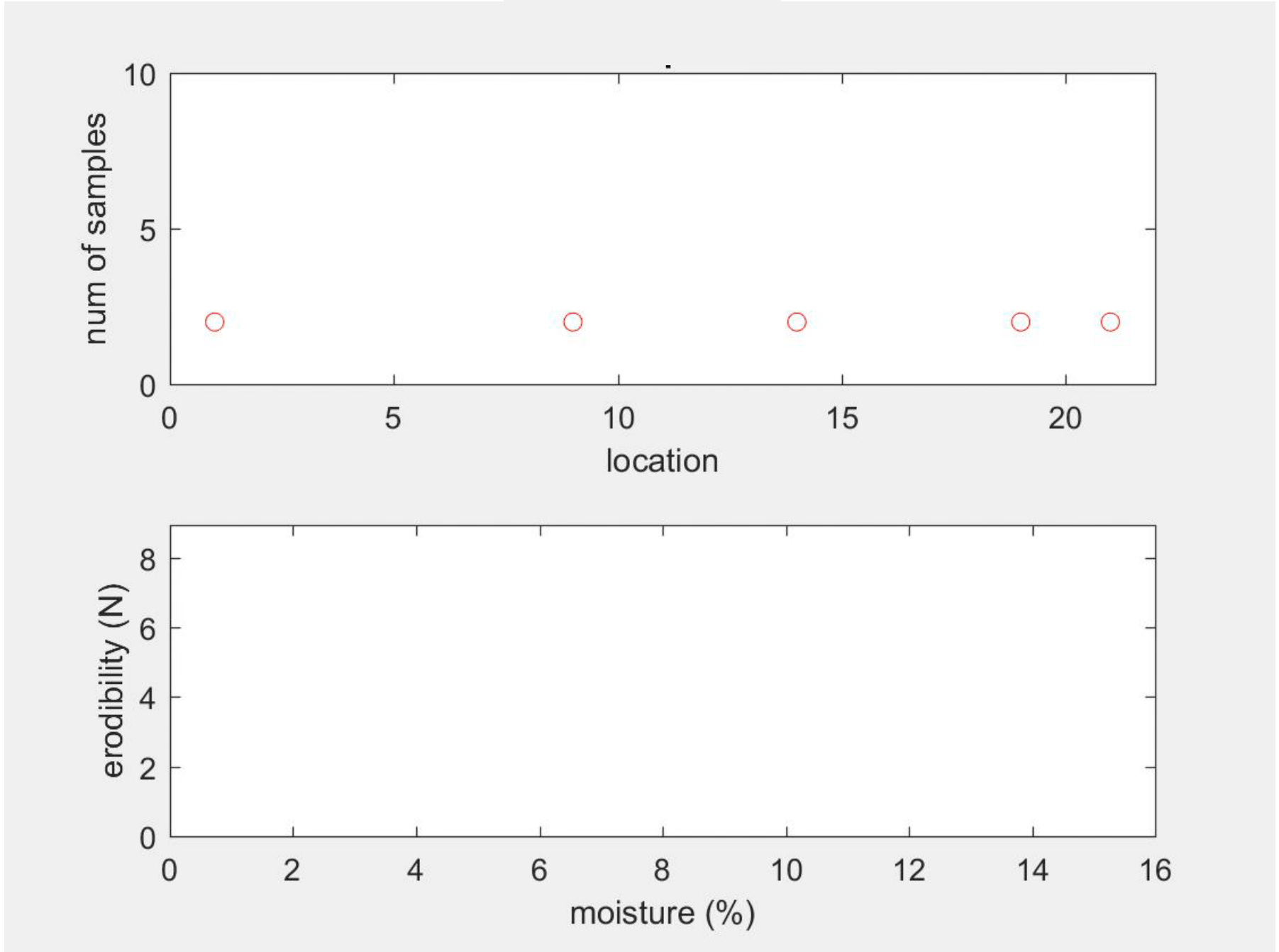
85% of participants chose locations at roughly homogenous intervals



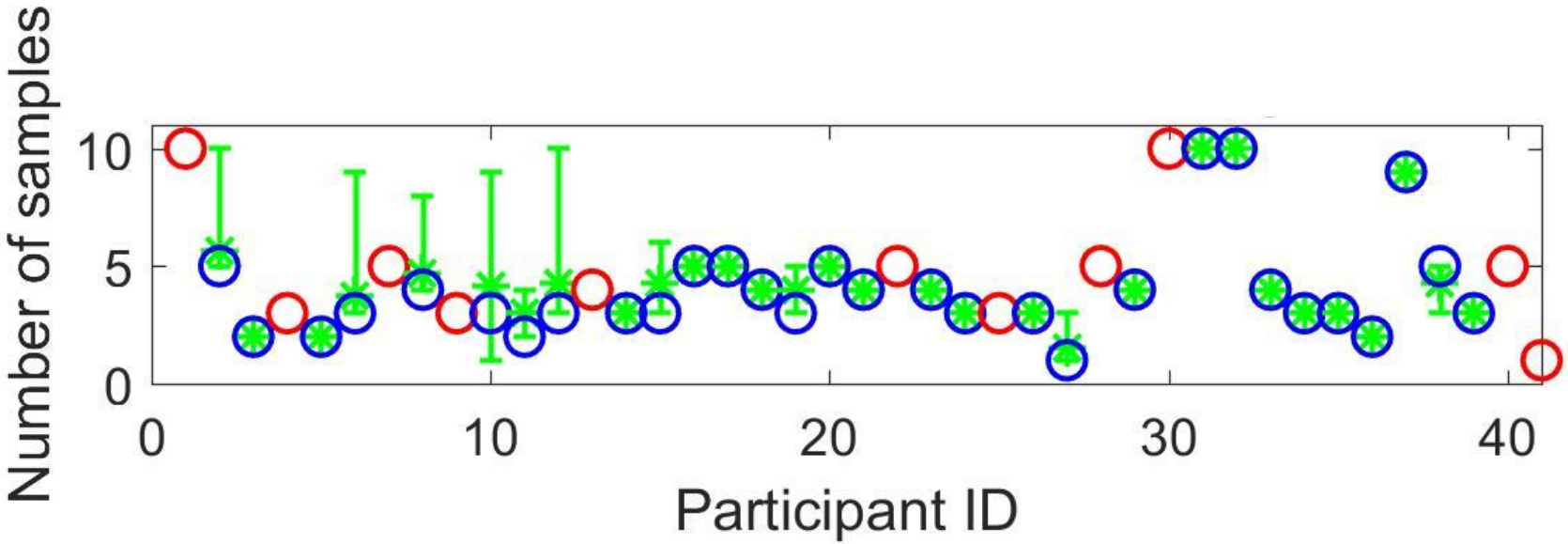
ALL participants took a consistent number of samples at each location, *i.e., the MAGIC number*

Step 2. Sampling Strategy is Executed and Data is Provided in Real-Time




num of samples
10
5
0
0
5
10
15
20
location
erodibility (N)
8
6
4
2
0
0
2
4
6
8
10
12
14
16
moisture (%)

Step 3. Changes in Sampling Strategy in Response to Incoming Data



No change [27%]

Change, same number [49%]

Change, different number [24%]

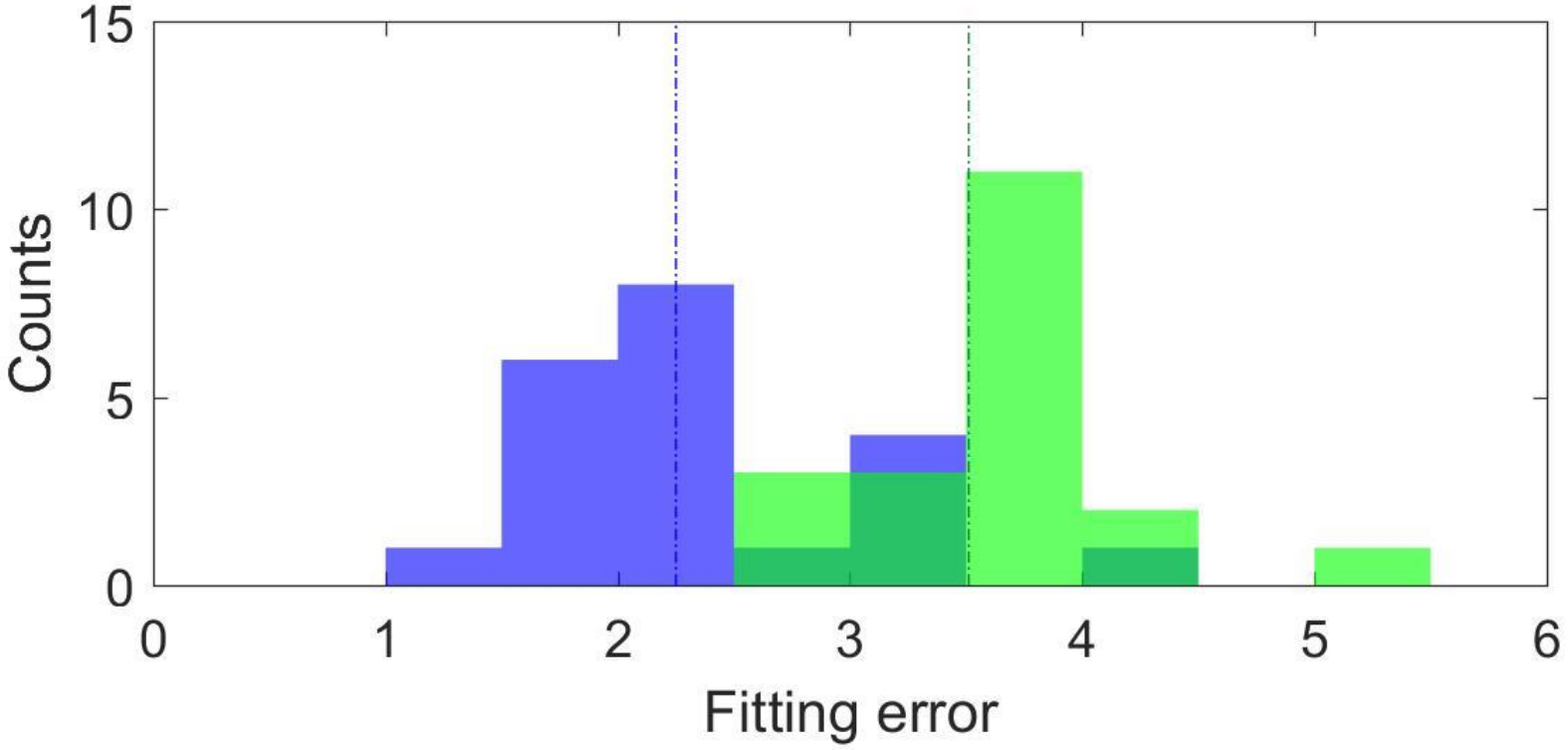
Conclusions

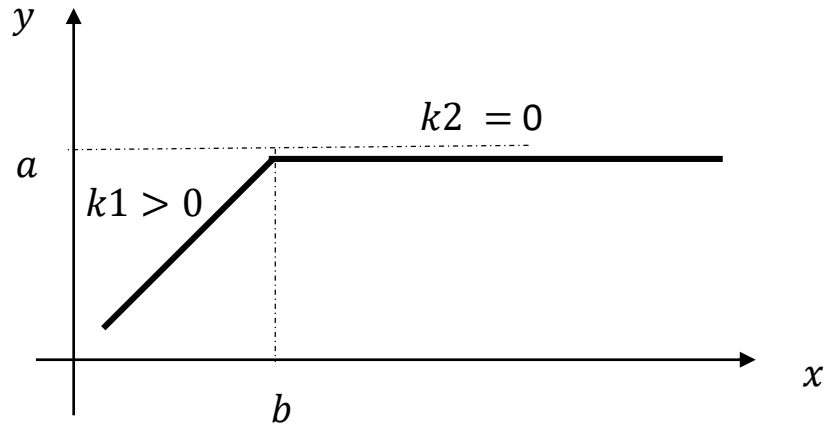
The Bad

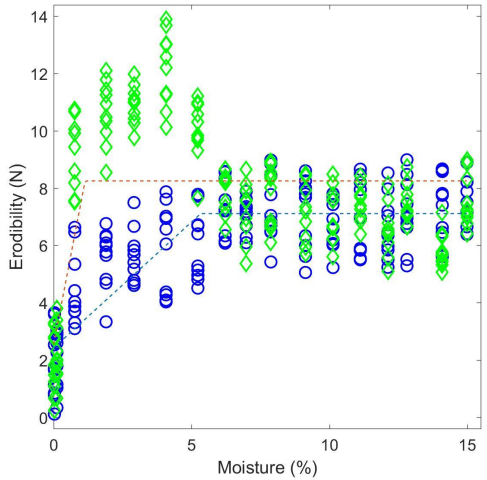
Anchoring bias

Initial sampling strategy
Magic number

Step 4. Make a Conclusion







Conclusions

The Bad

Anchoring bias

Initial sampling strategy
Magic number

The Good

Intuitive understanding of statistical fit

Simple step function

Thank You

Collaborators:
- Feifei Qian
- Thomas Shipley
- Doug Jerolmack
- Dan Koditschek
- Sonia Roberts

Penn SeD:
- Rob Fetell
- Nakul Deshpande
- Kieran Dunne

RISC lab:
- Rebekah Banerjee
- Jon Ham

Kod lab:*
- Anmol Kathail
- Weiyi Tang
- Shivangi Misra
- Chun Chang
- Divya Ramesh
- Julia Messick
- Abriana Stewart-Height
- Shricharana Puthige
- Dan Guralnik
- Diedra Krieger

NSF

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University of Pennsylvania GEOLOGY SOCIETY