Scott Valley Airborne Electromagnetic Data Interpretation and Assimilation into a Groundwater-Surface Water Model

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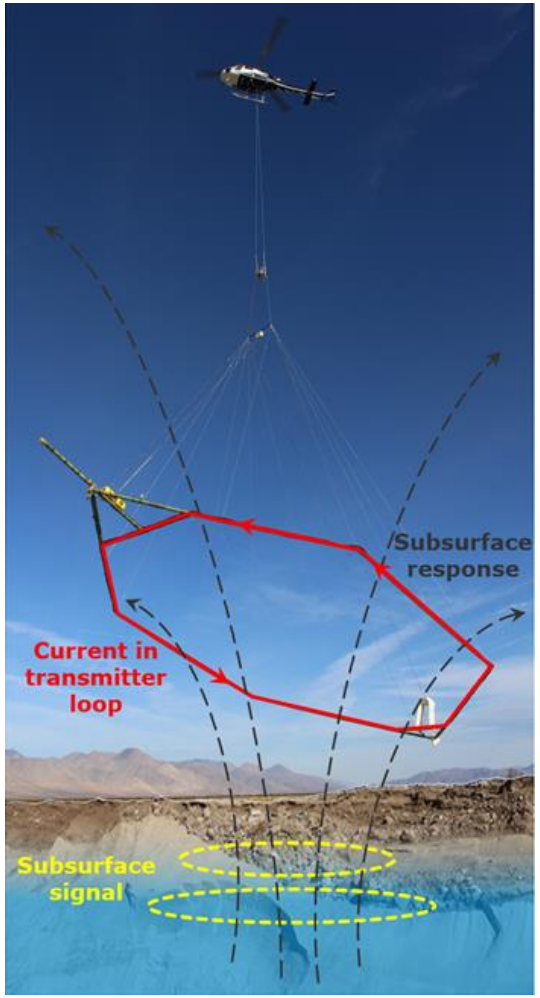
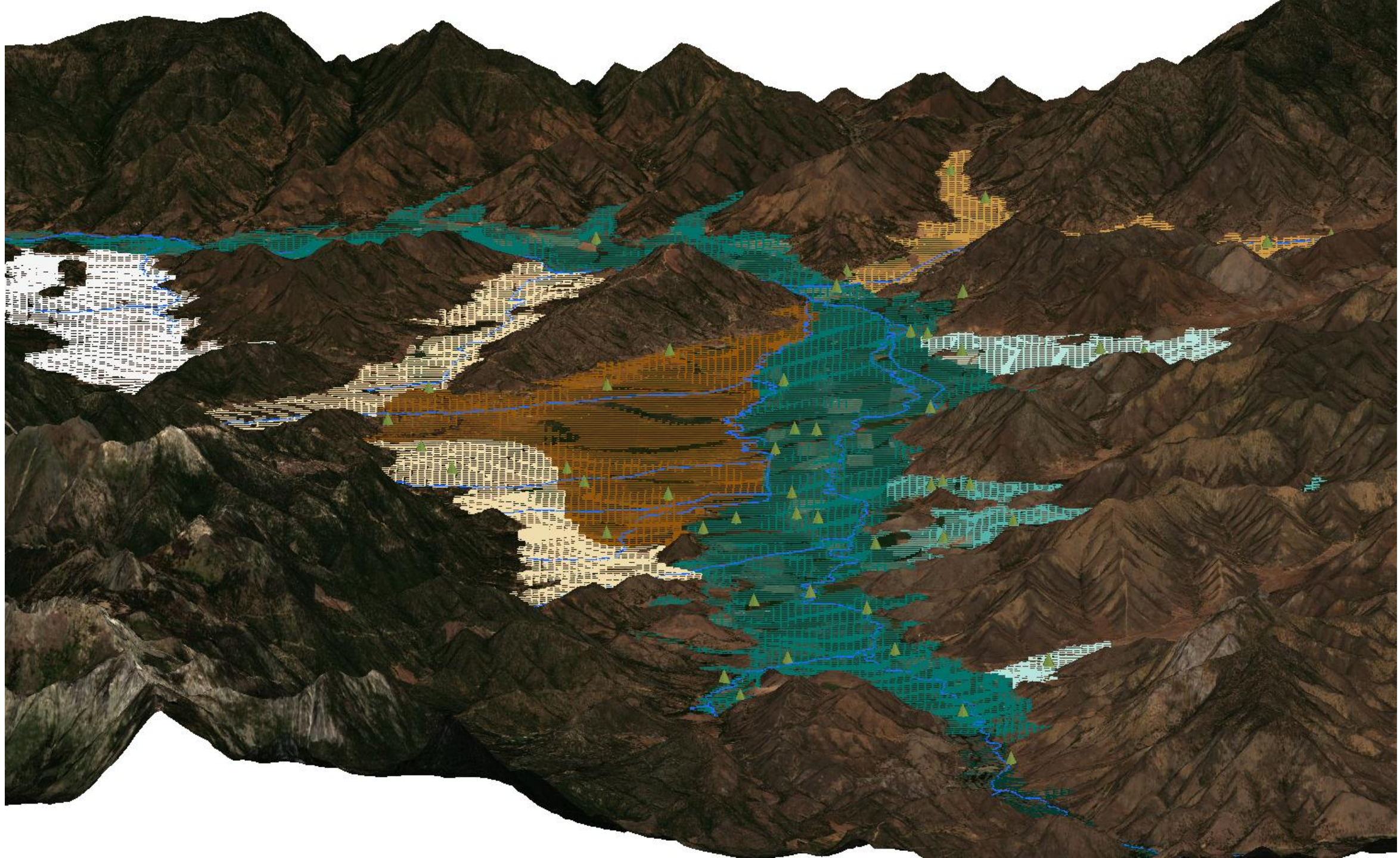
Airborne Electromagnetic (AEM) Intro

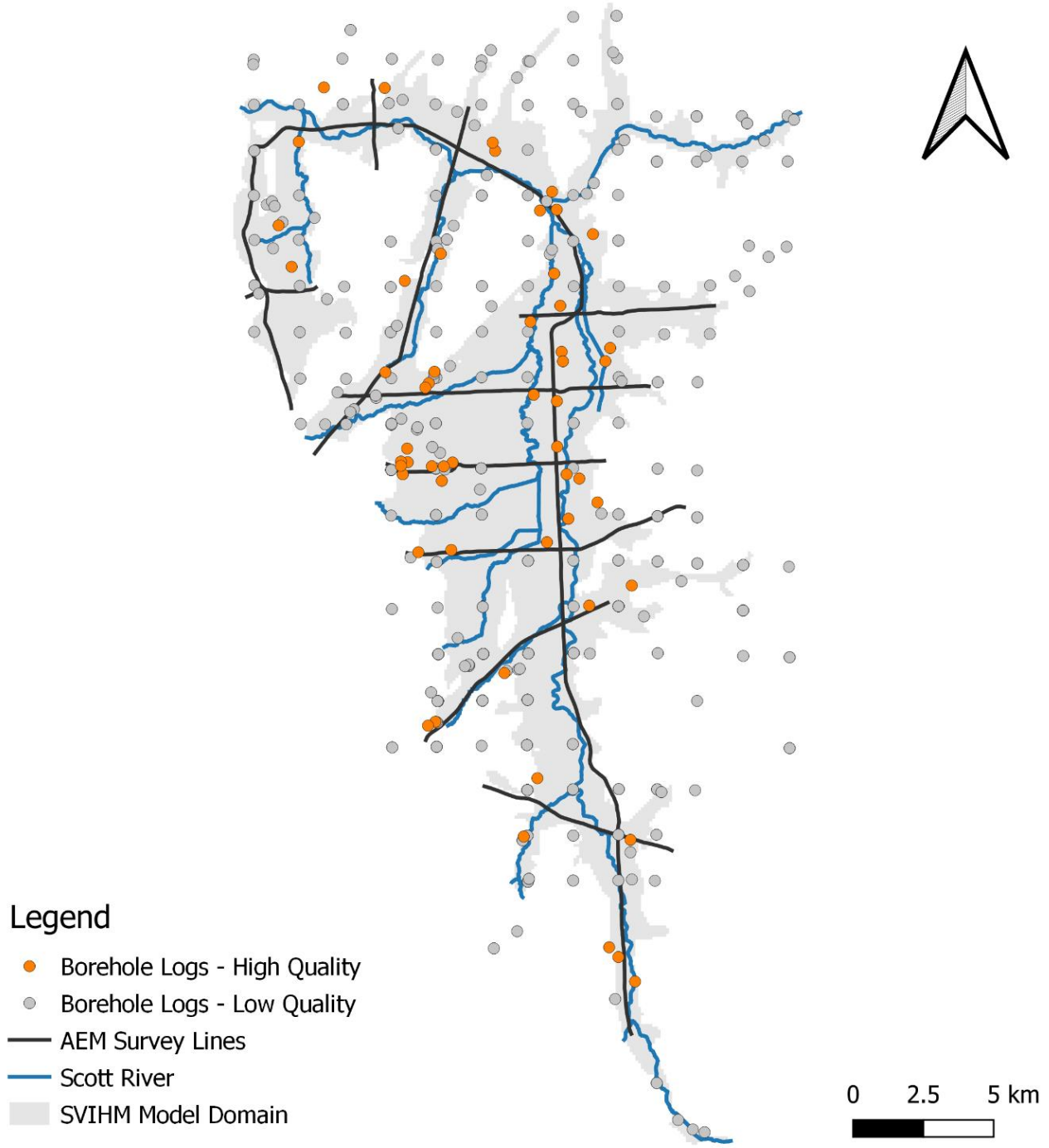
- Geophysical method measuring electromagnetic response of the subsurface
- Response is related to subsurface materials, but also…
  - Water content
  - Salinity/Water quality
- After cleaning, data can be inverted to obtain models of resistivity
  - Up to 300 m (1000 ft) deep





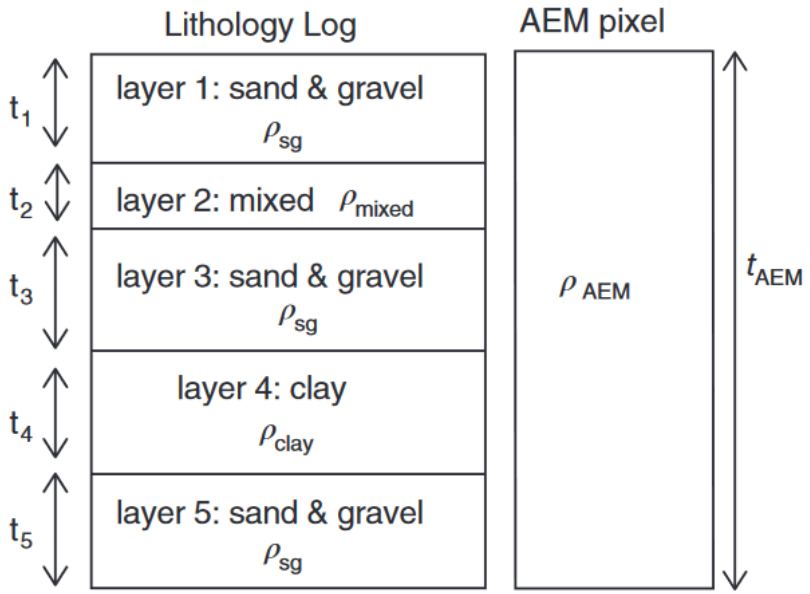
AEM in Scott Valley

- California DWR has been collecting surveys of medium and high-priority groundwater basins
- Also provide digitized lithology logs

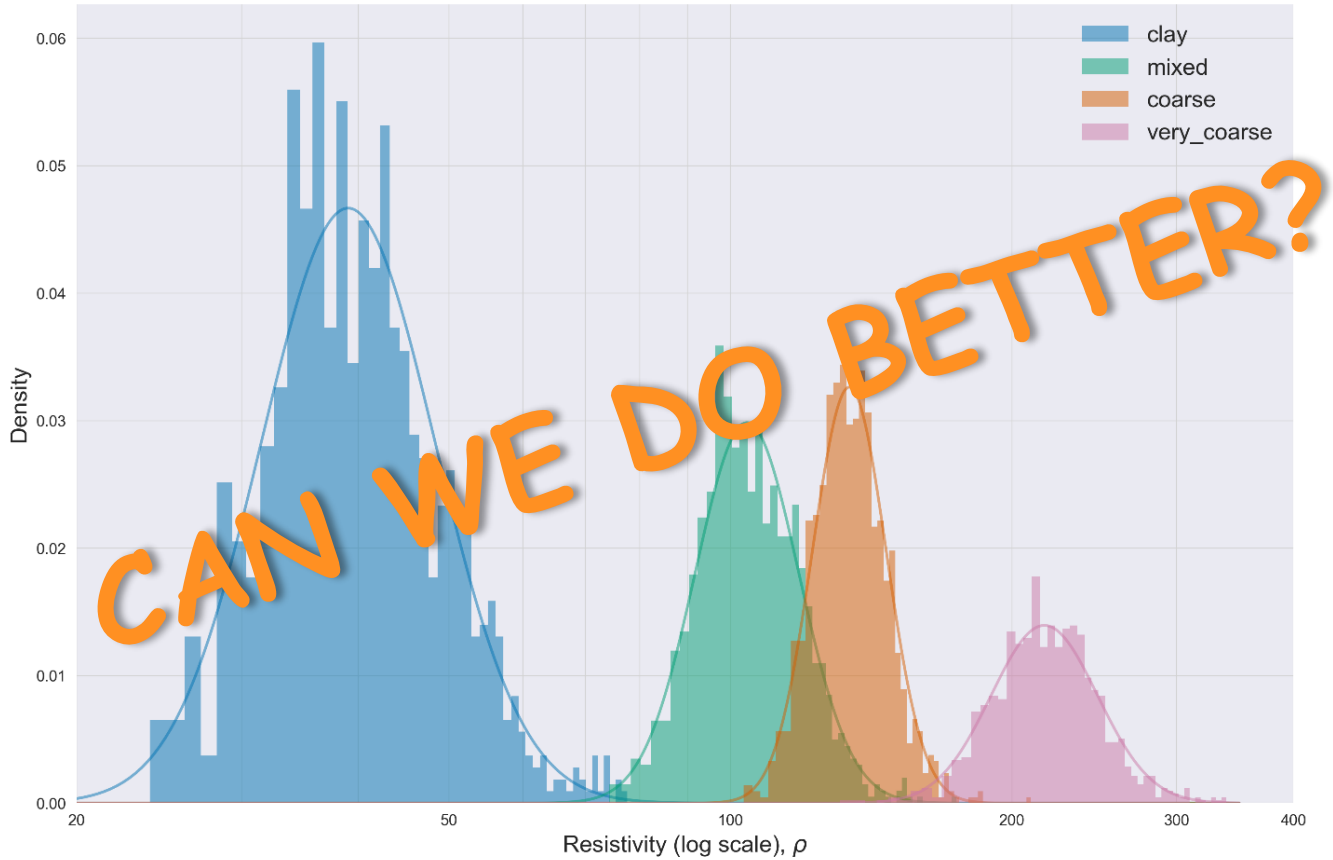


Resistivity → Texture Transform

Knight et al. (2018) Method

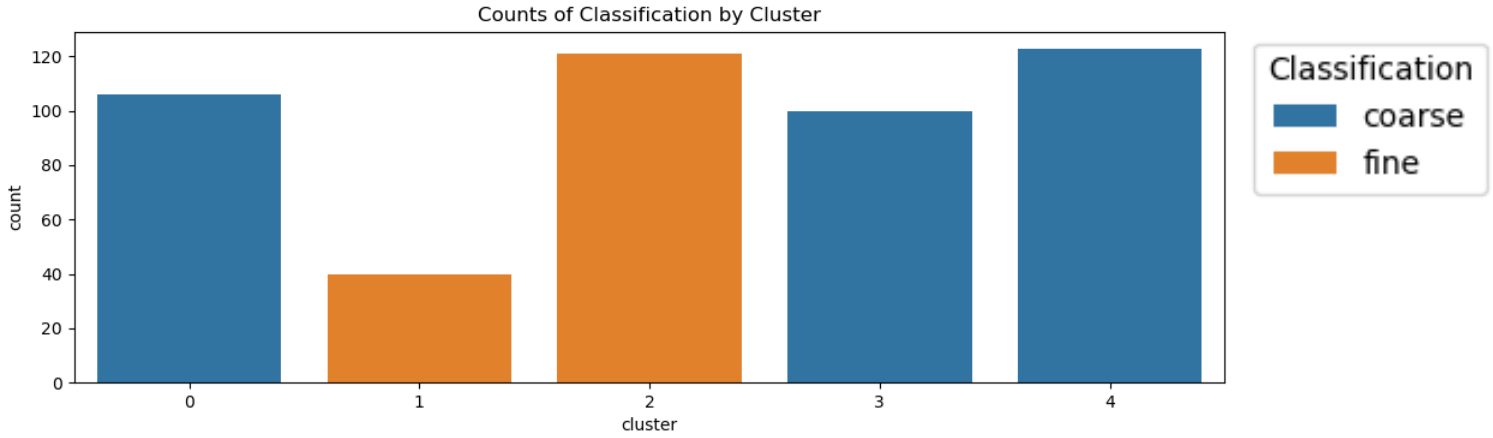


~250 equations, 4 unknowns

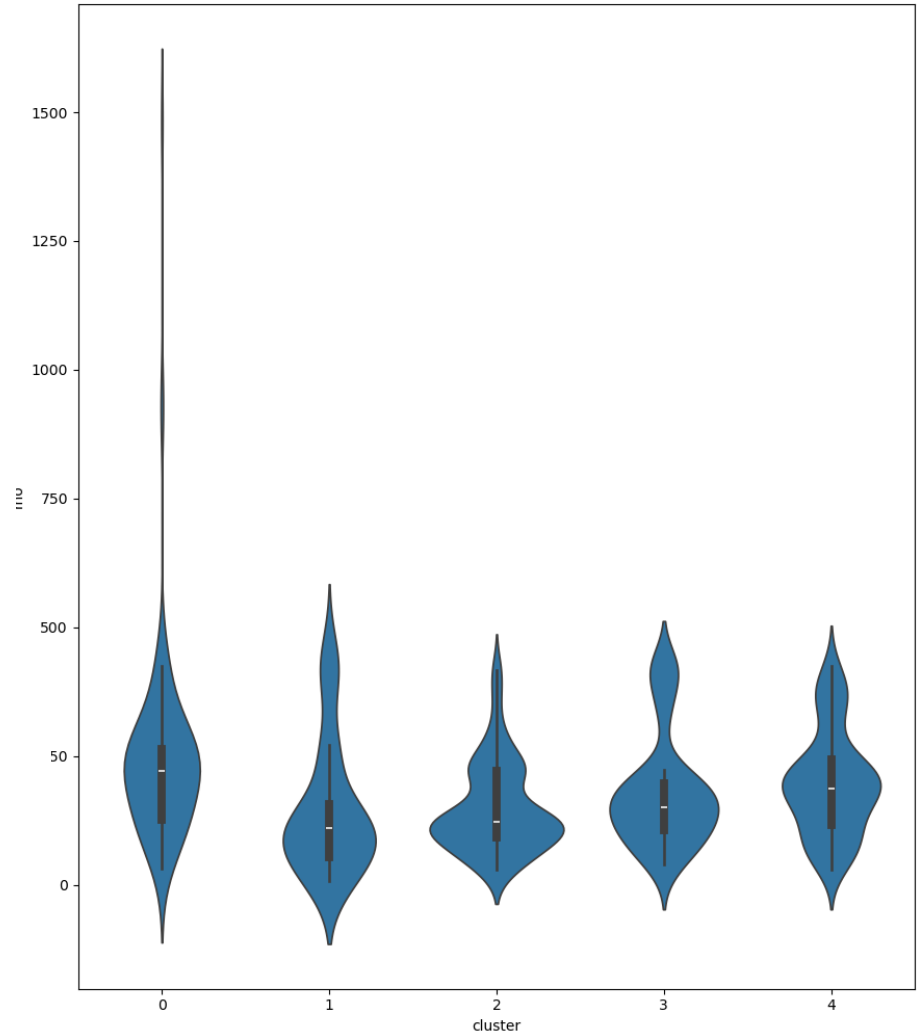


Clustering of Lithology Data

- Lithology Features include:
  - Classification (Coarse/Fine)
  - Texture (clay, sand, gravel, rock, shale, etc.)
  - Primary Texture Modifier (clayey, rocky, sandy, etc.)
  - Secondary Texture Modifier (clayey, rocky, sandy, etc.)
- AEM Resistivity Inversion
- **Uncertain Stuff to Uncertain Stuff, at a distance**

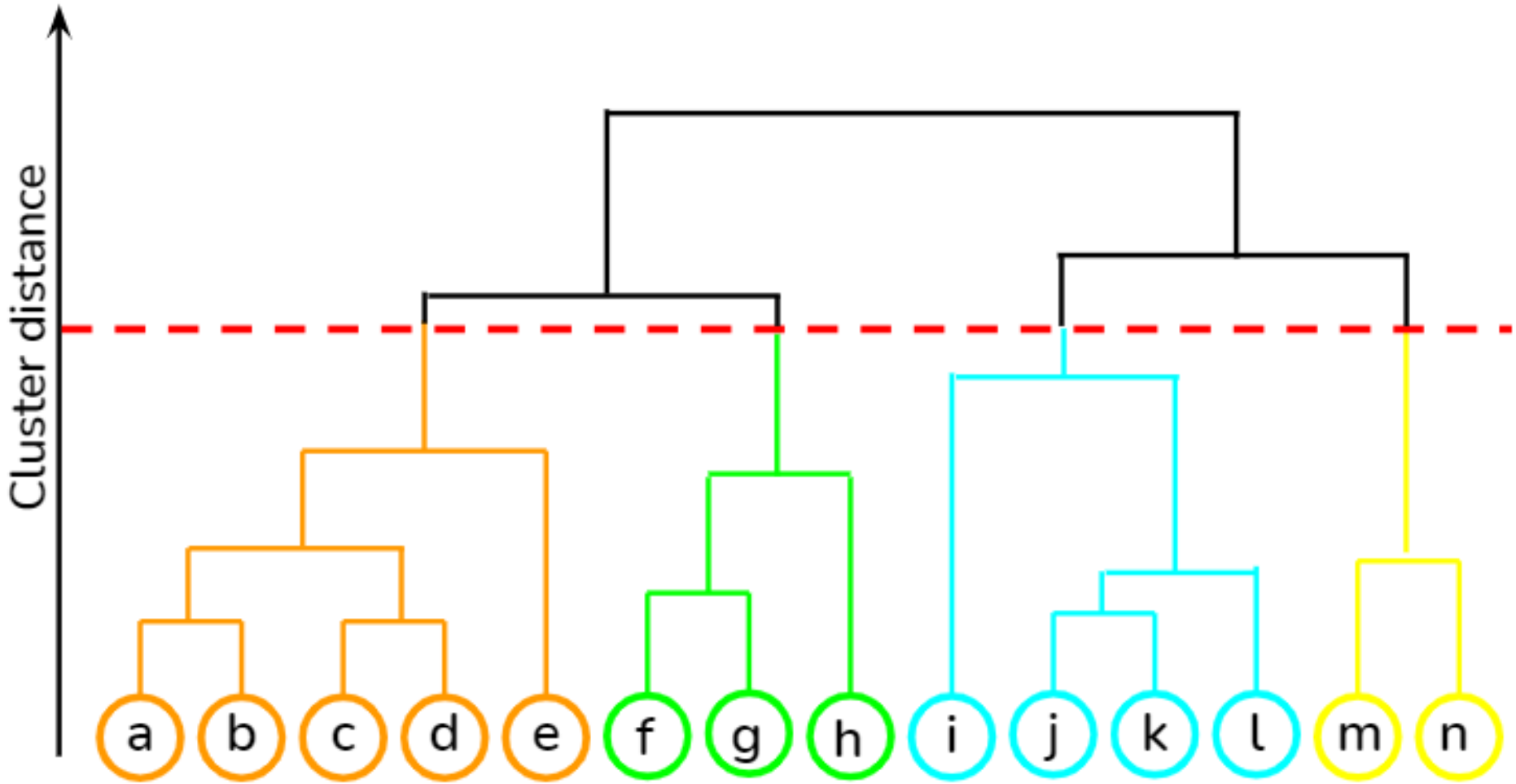


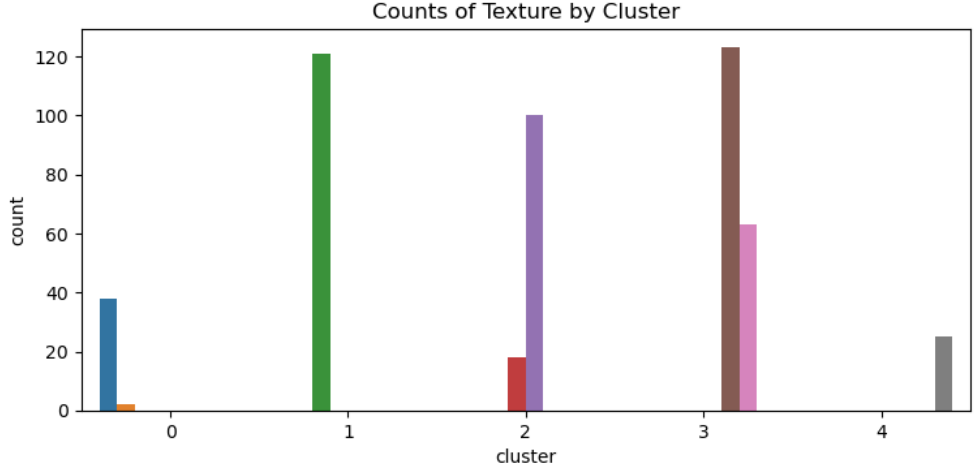
Resistivity By Cluster

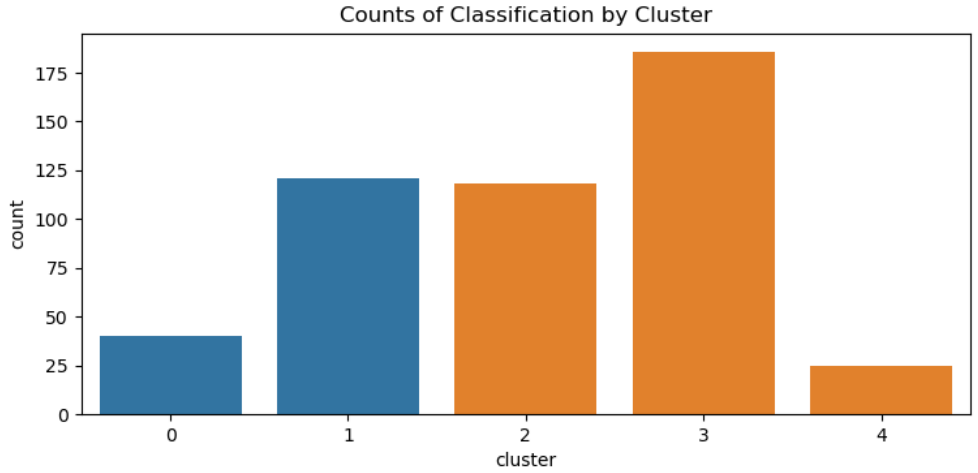


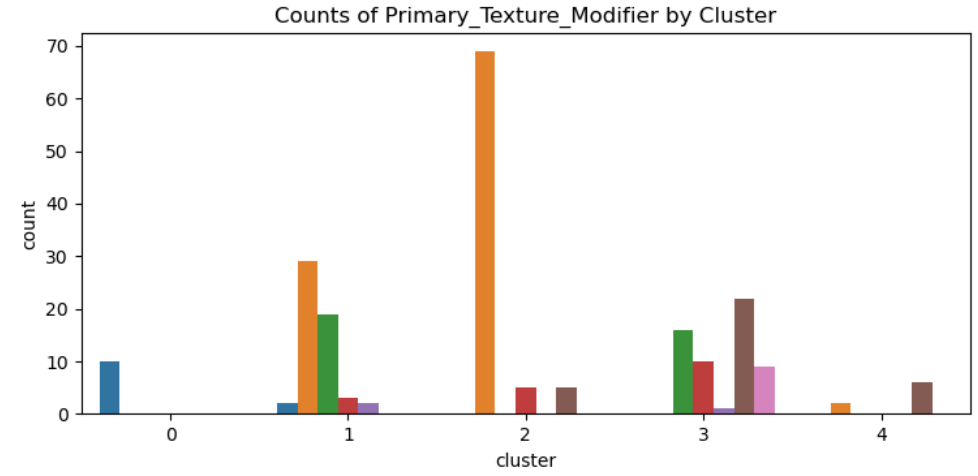
Ensemble/Consensus Clustering

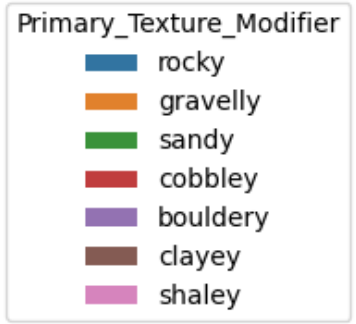
-
-
-



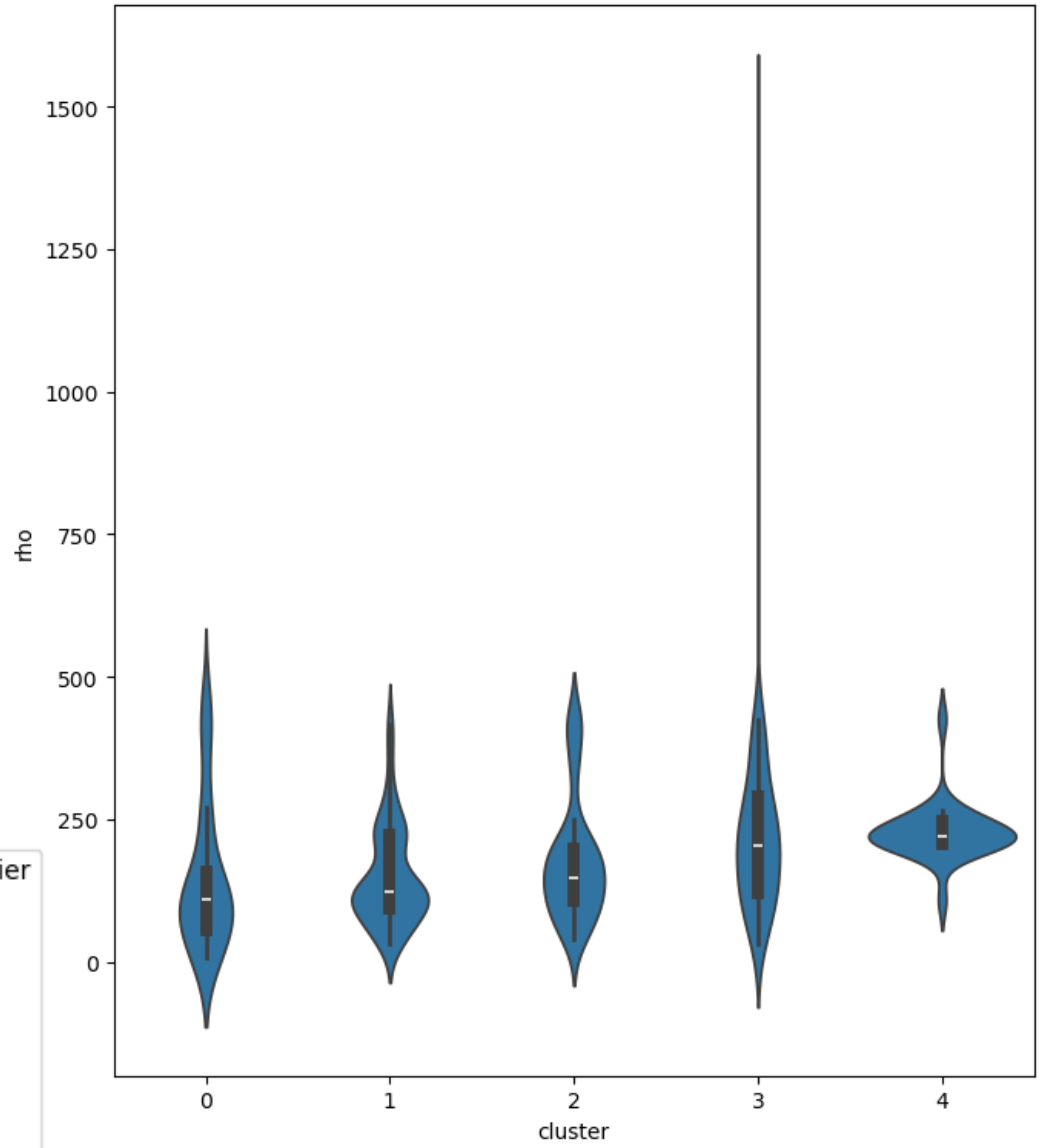


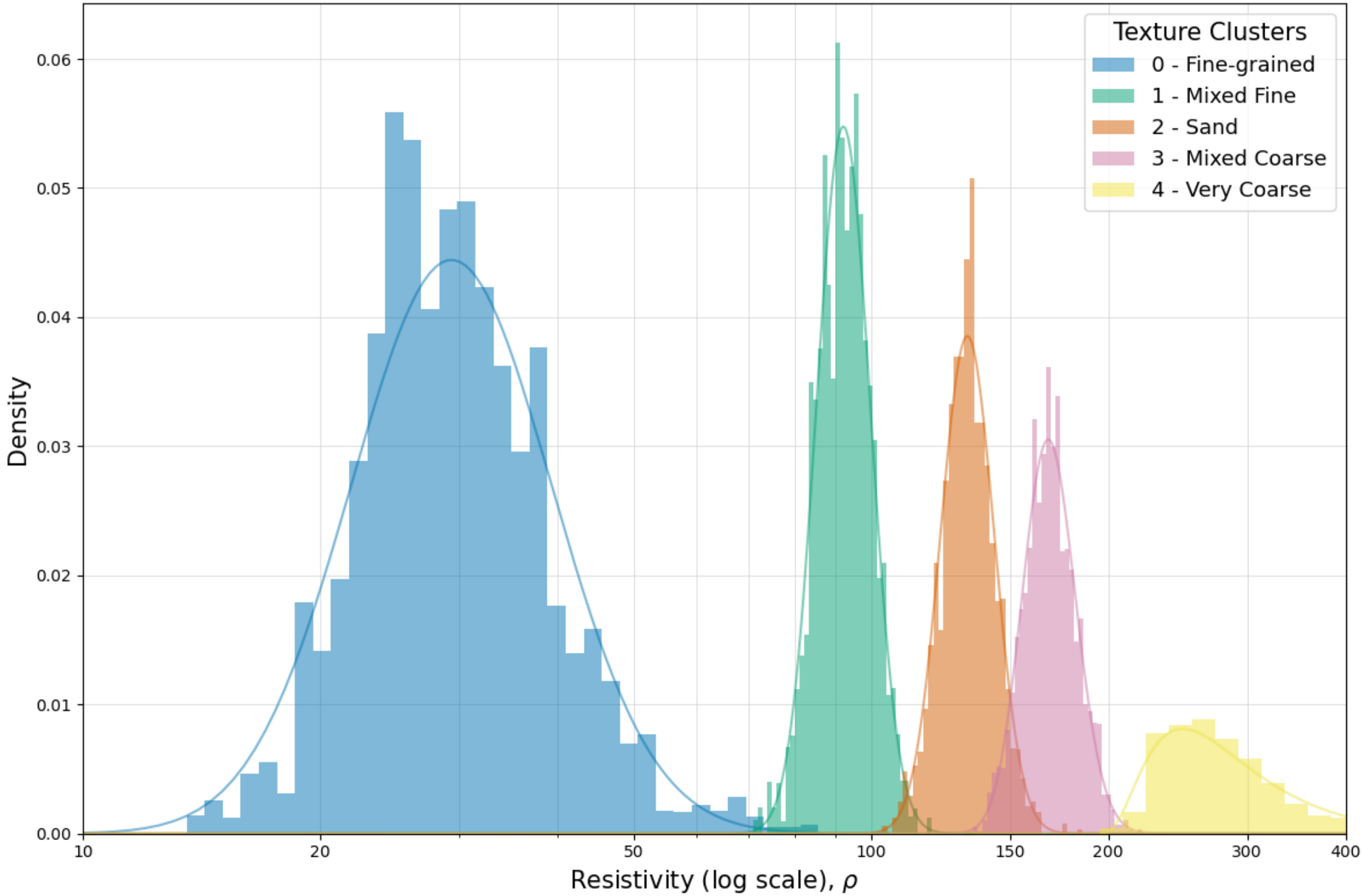


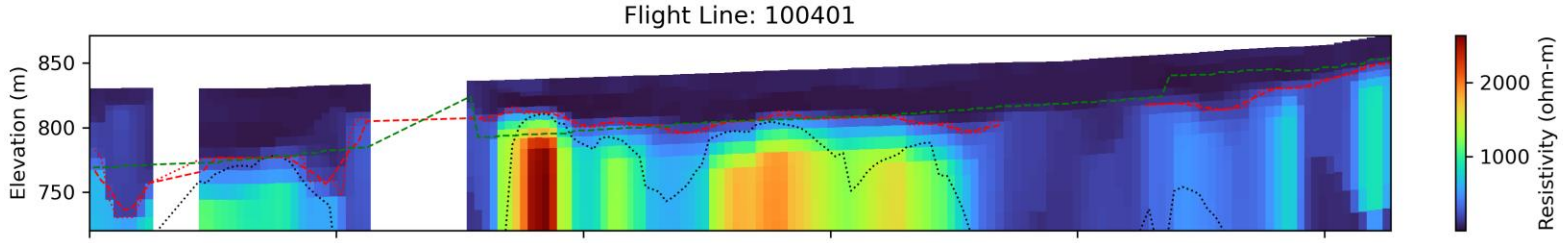


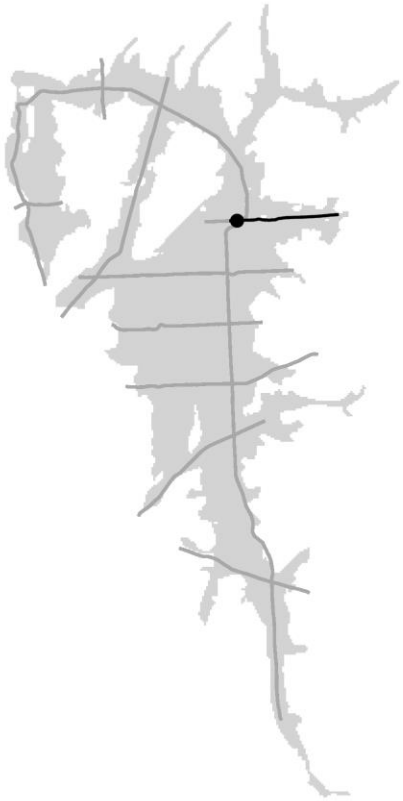


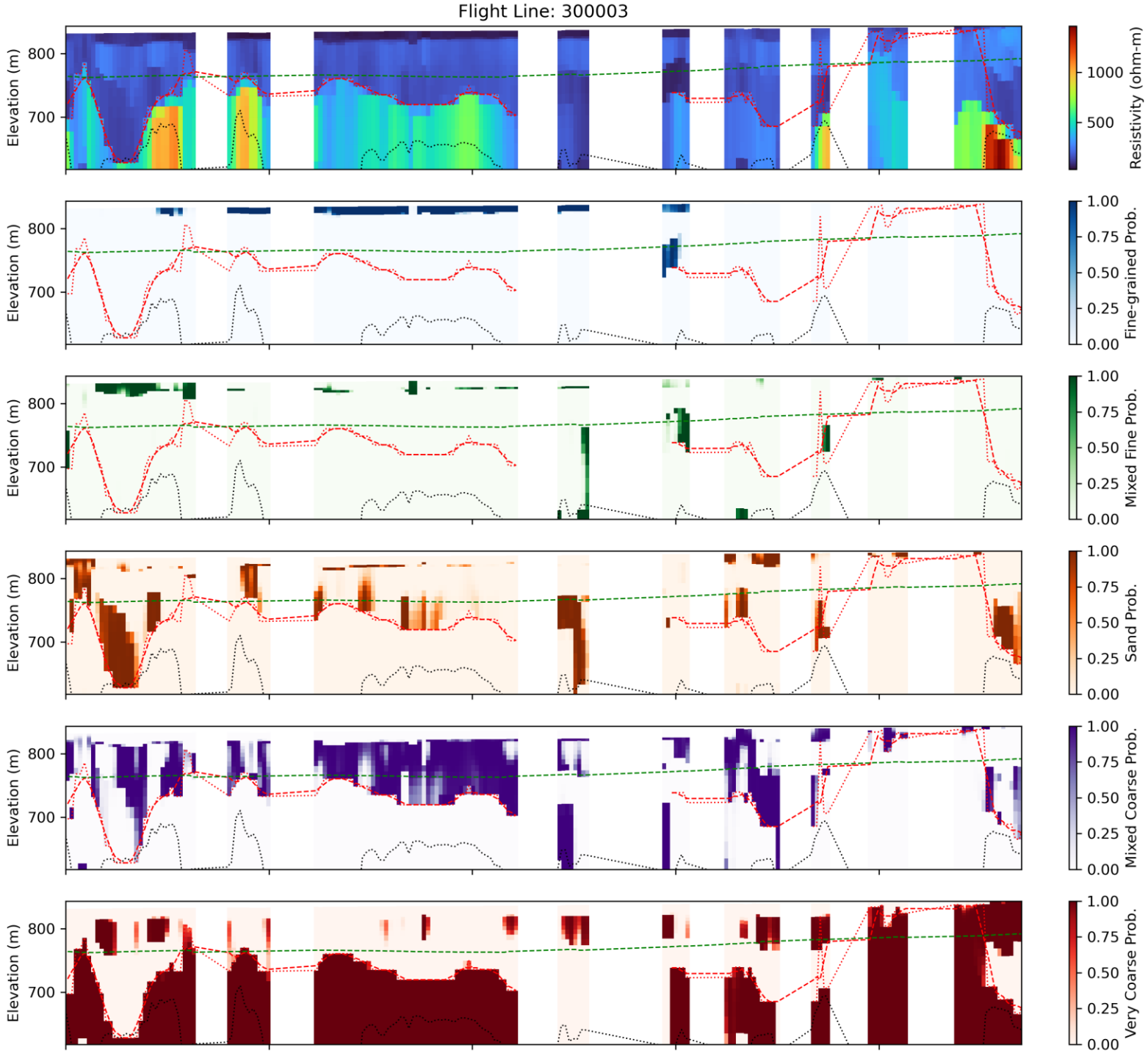
Resistivity By Cluster

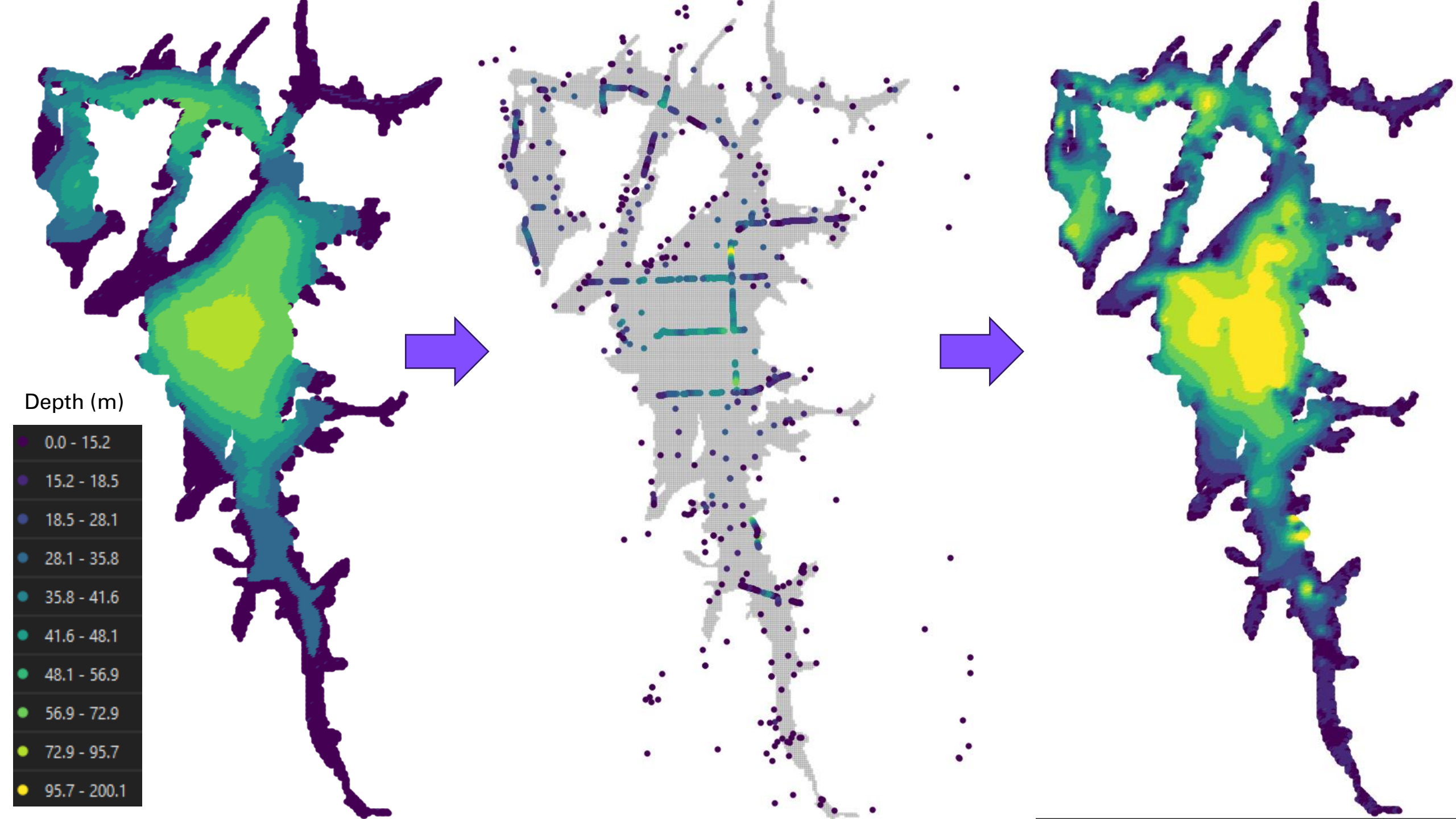



Texture Clusters
0 - Fine-grained
1 - Mixed Fine
2 - Sand
3 - Mixed Coarse
4 - Very Coarse
Density
0.00
0.01
0.02
0.03
0.04
0.05
0.06
10
20
50
100
150
200
300
400
Resistivity (log scale), ρ

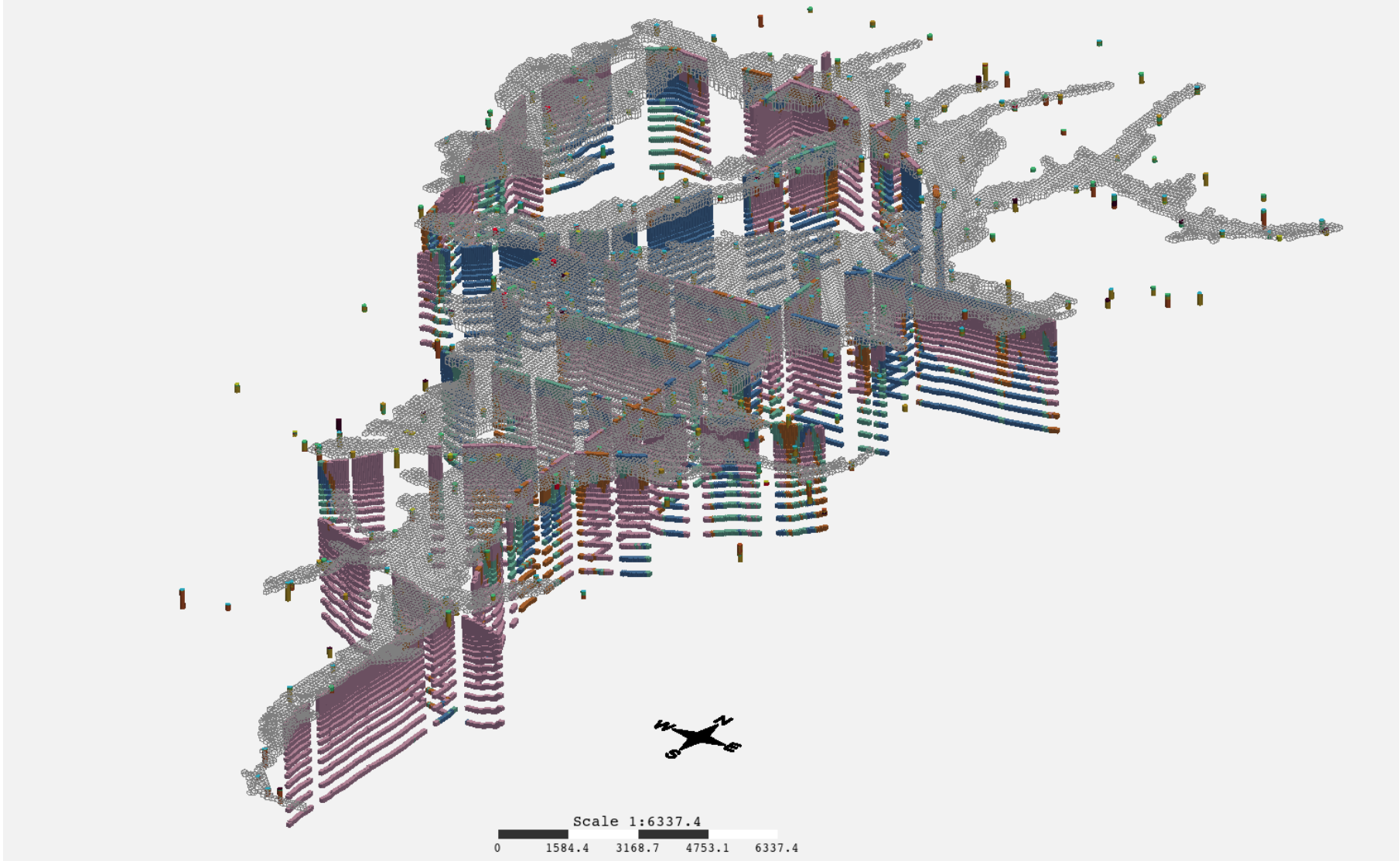

Flight Line: 100401
Elevation (m)
850
800
750
2000
1000
Resistivity (ohm-m)



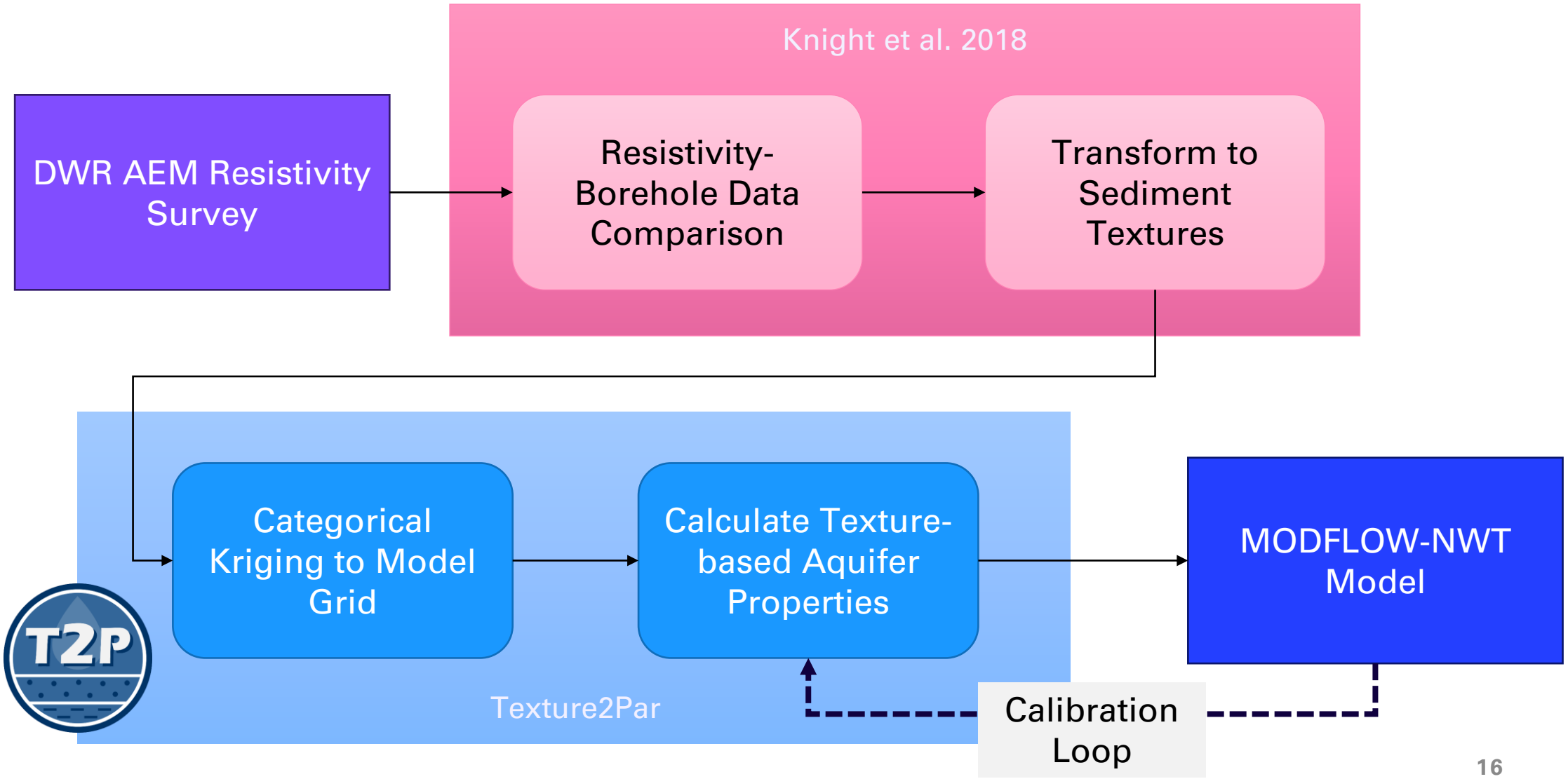

Flight Line: 300003
Elevation (m)
800
700
1000
500
Resistivity (ohm-m)
1.00
0.75
0.50
0.25
0.00
Fine-grained Prob.
Mixed Fine Prob.
Sand Prob.
Mixed Coarse Prob.
Very Coarse Prob.


Depth (m)
0.0 - 15.2
15.2 - 18.5
18.5 - 28.1
28.1 - 35.8
35.8 - 41.6
41.6 - 48.1
48.1 - 56.9
56.9 - 72.9
72.9 - 95.7
95.7 - 200.1

Towards a Texture Model of Scott Valley



Towards Aquifer Properties…



THANK YOU

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