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Extraction and Visual Analysis of Seismic Horizon Ensembles

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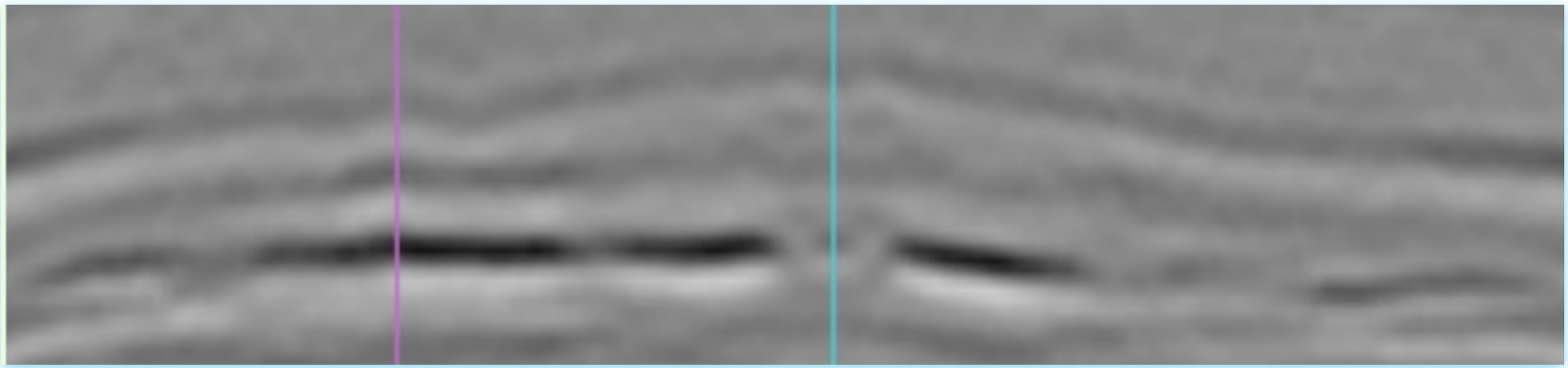
♦ University of Houston

♠ SCI Institute and School of Computing, University of Utah

Seismic Horizon Extraction



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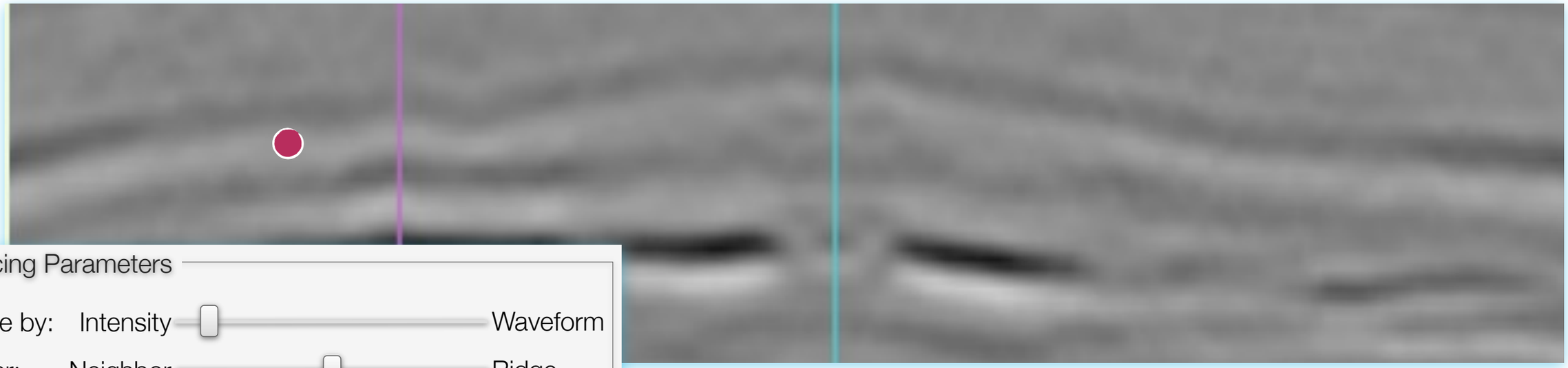

Tracing Parameters

Ridge by:	Intensity		Waveform
Prefer:	Neighbor		Ridge
Flexibility	Flexible		Stiff

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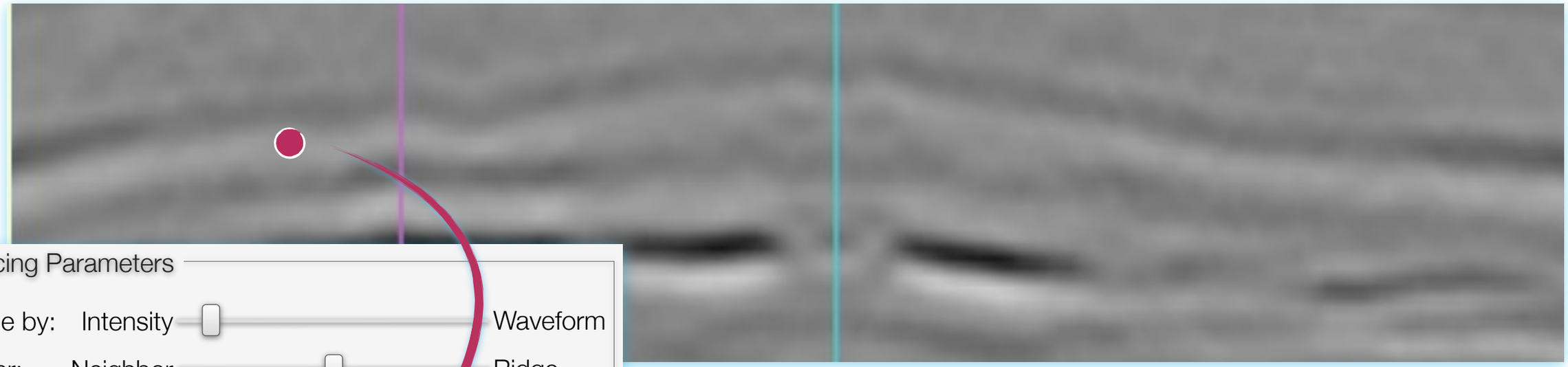
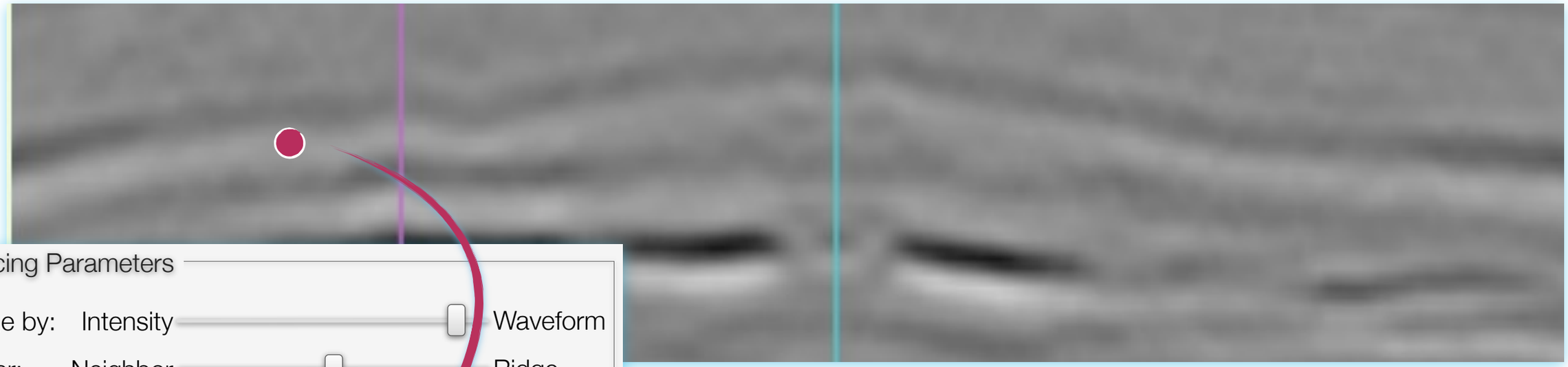
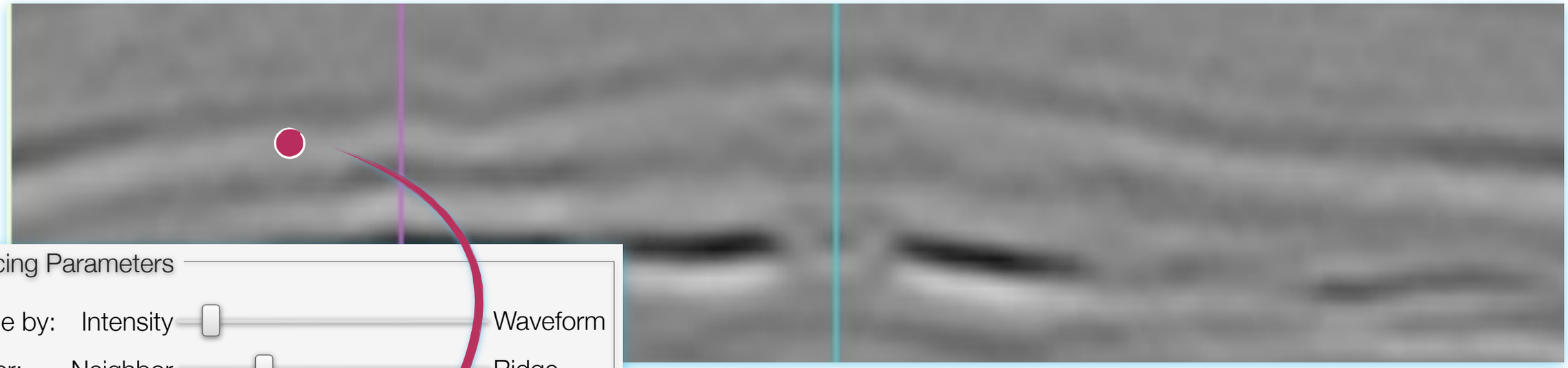


Seismic Horizon Extraction



Seismic Horizon Extraction



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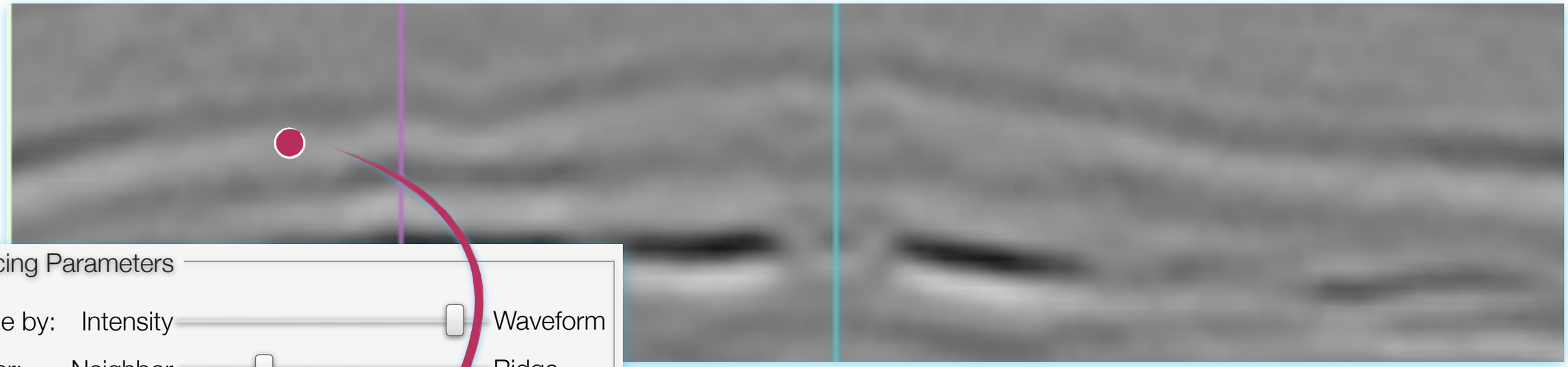
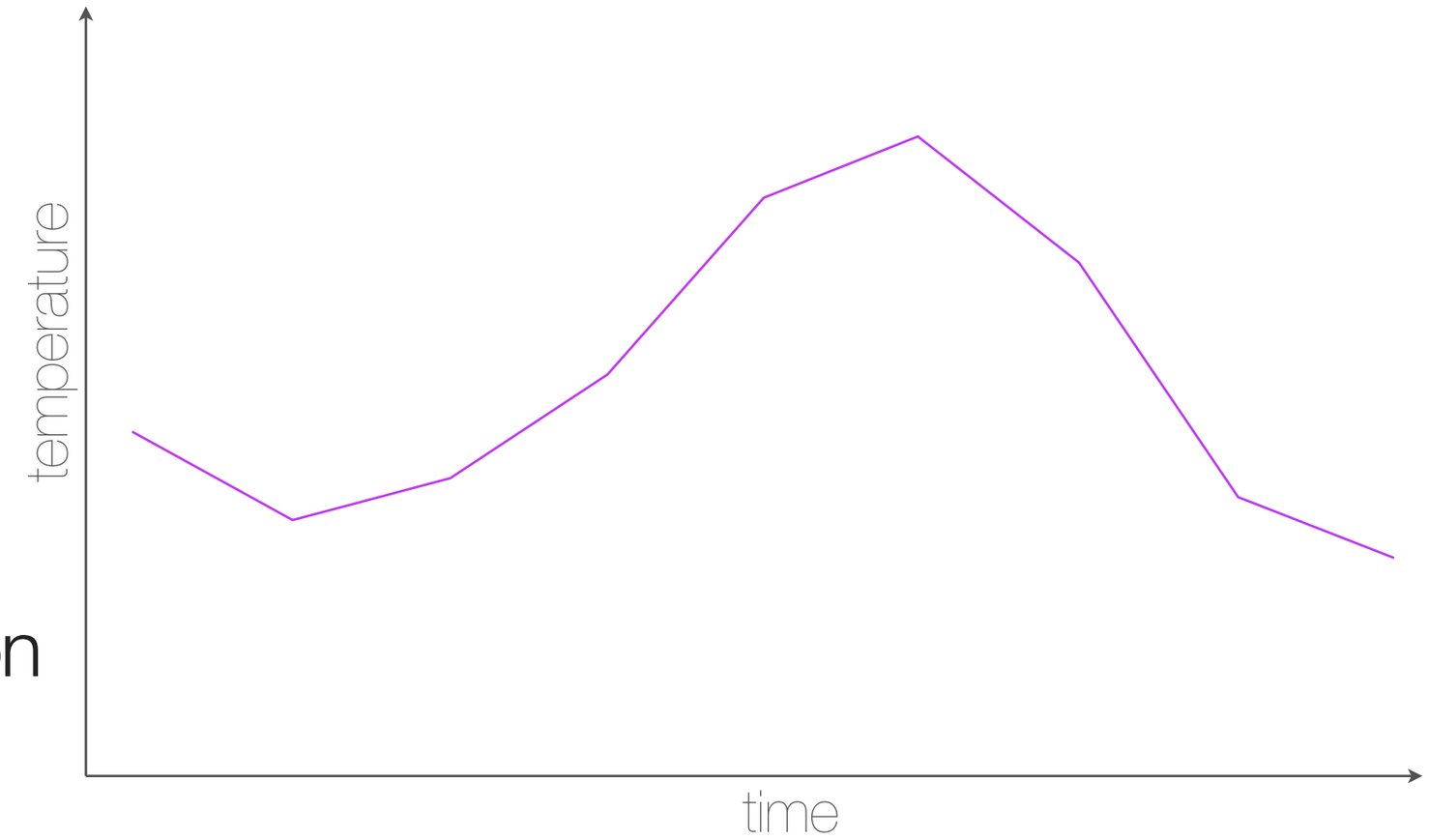


Ensemble Data

- Idea: compute multiple solutions for a single simulation/feature/event
- An ensemble usually is
  - multivalued
  - multivariate
  - multidimensional
- Often Gaussian distribution



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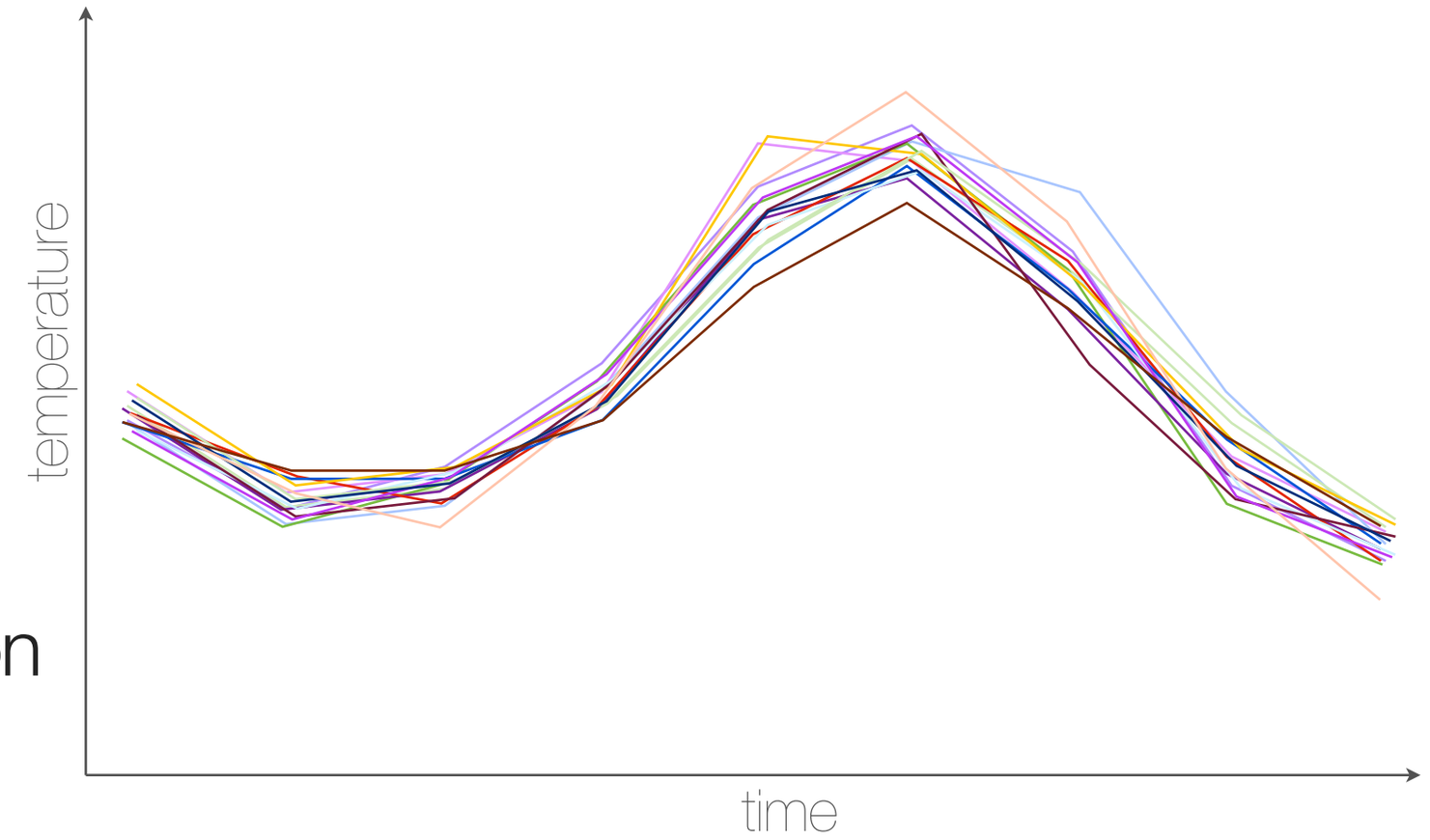

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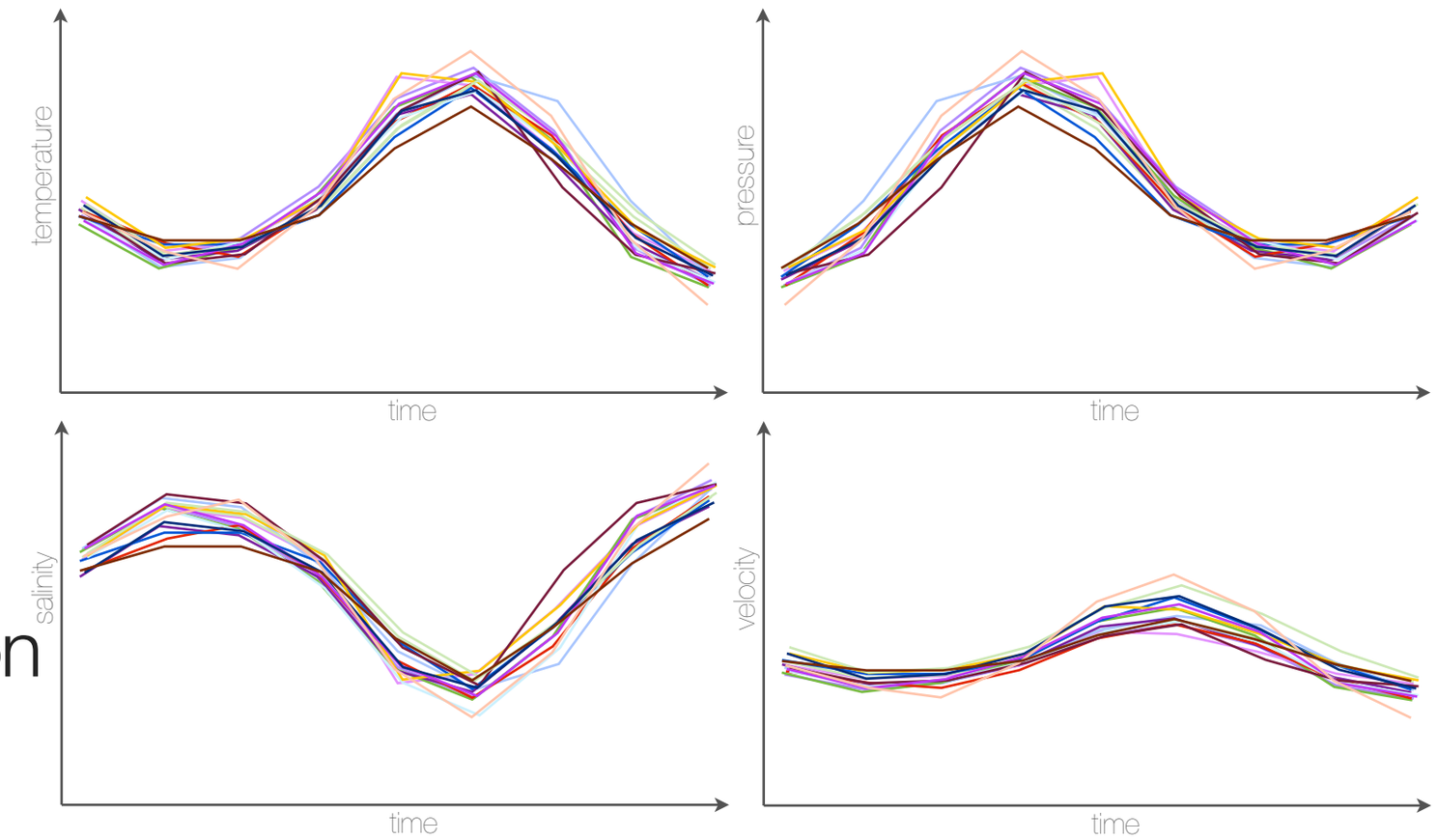
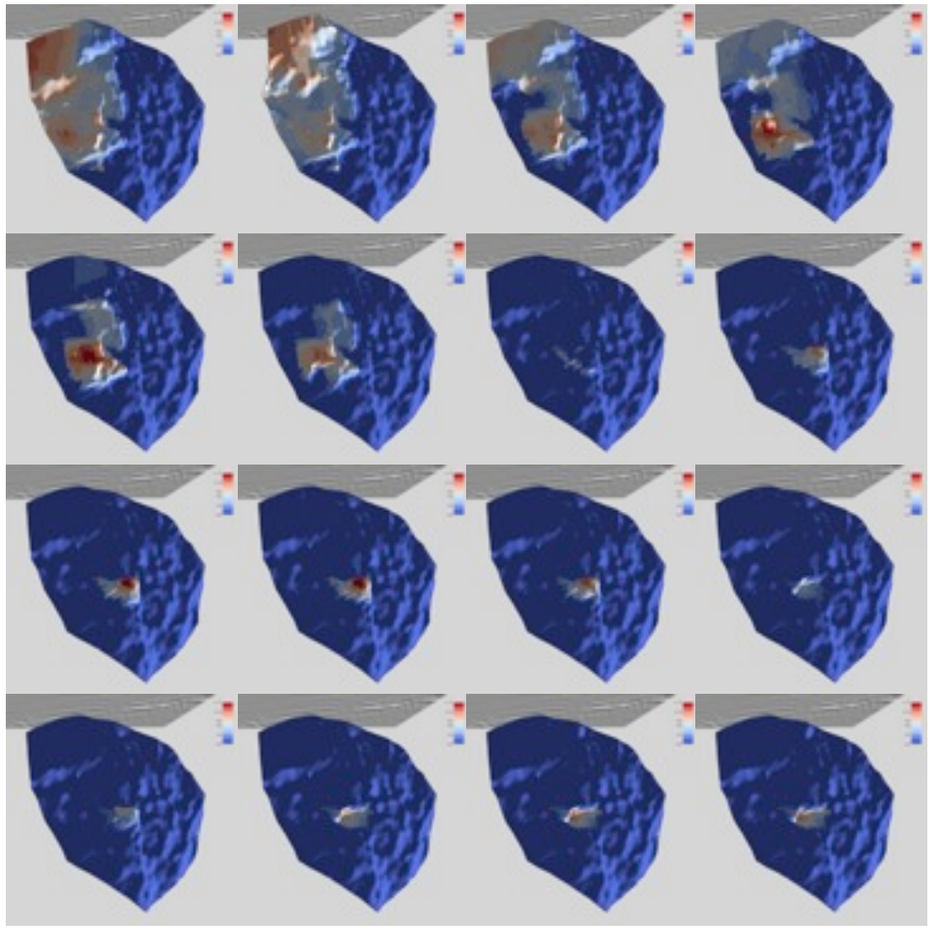
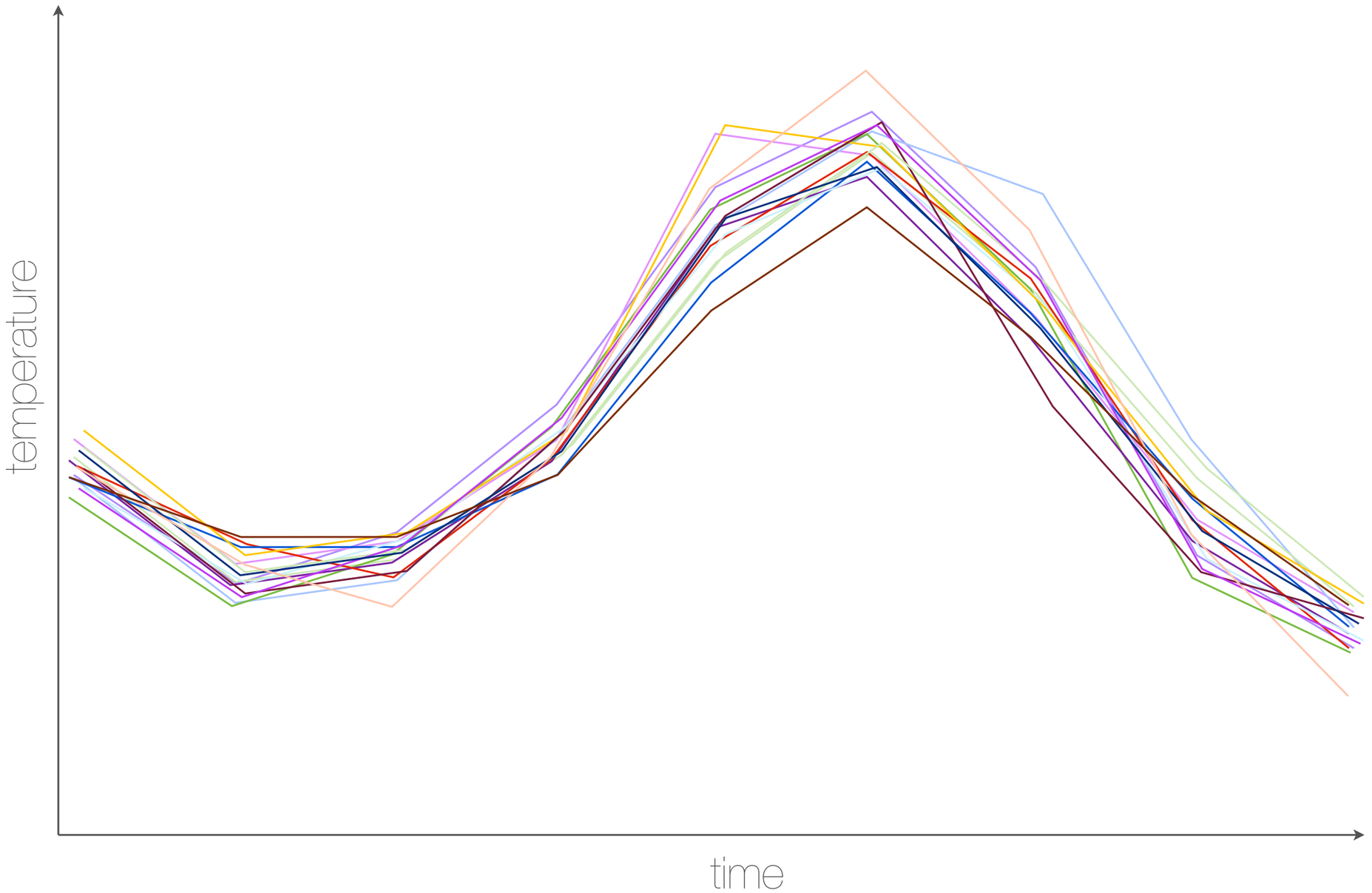


Ensemble Extraction

- We have a global optimization surface extraction technique with a parameterized cost function
  - sample parameter space
  - extract surface for each sample without interaction
  - results in a set of possible surfaces for each horizon
  - strong clustering



MultiValue Visualization



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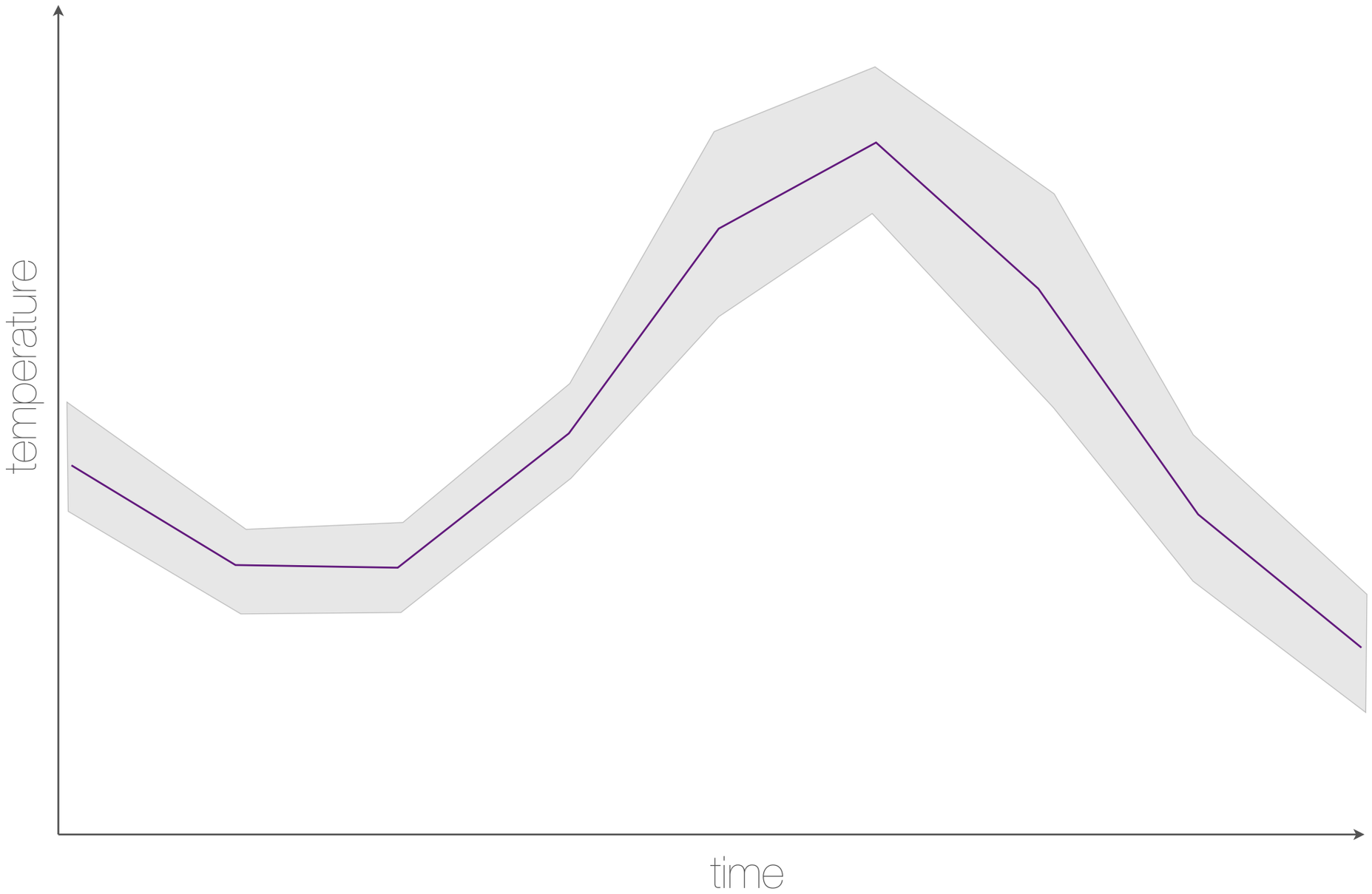
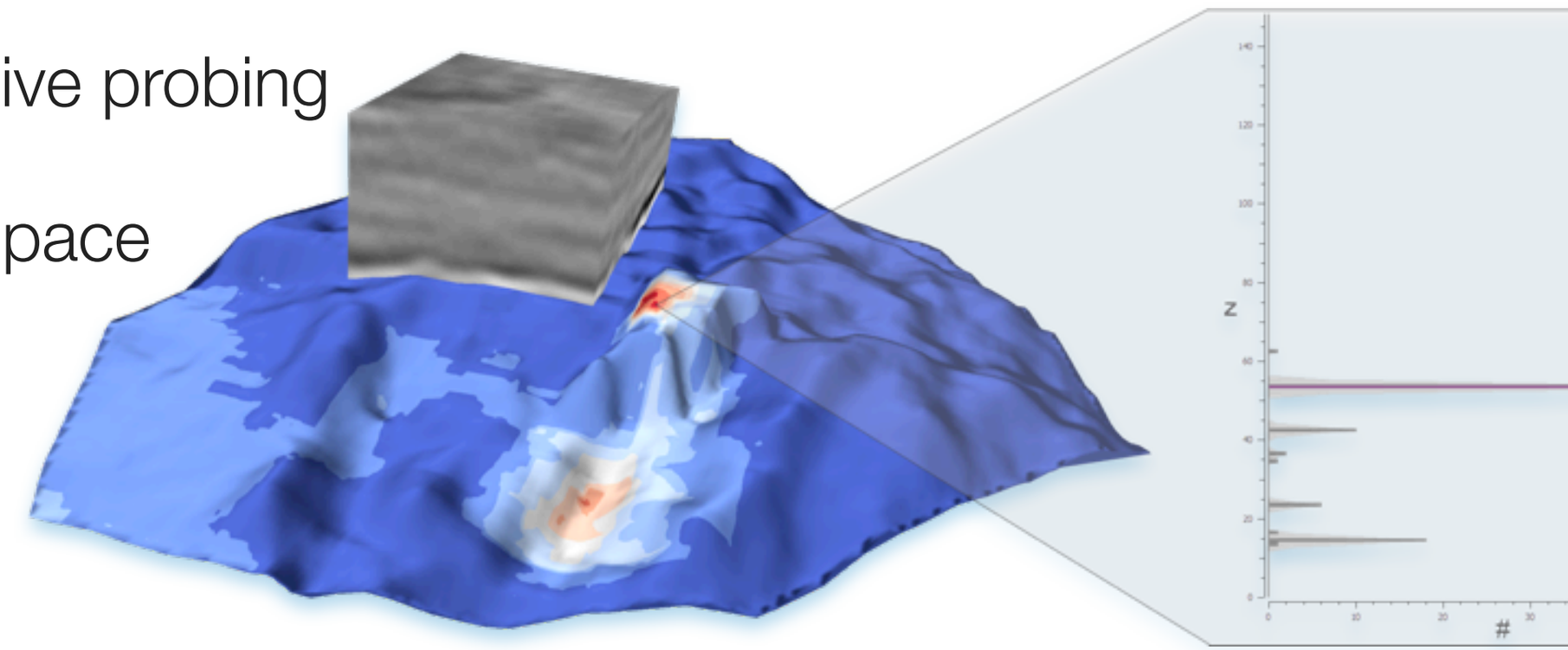


MultiValue Visualization II

- Statistical analysis
- Overview visualization by combination of representative surface + statistics
- Detail by interactive probing
- Live parameter-space exploration

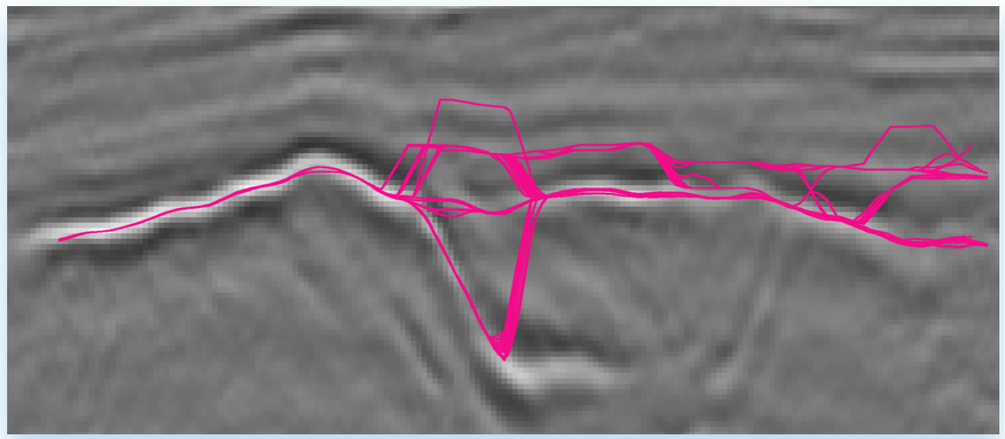


Representative Surface

- Surface extraction leads to clustering
- mean surface is not a good fit

⇨ use a ‘maximum likelihood’ surface instead

  - compute a probability for each surface patch
  - sum up probabilities for all patches
  - use surface with the highest sum



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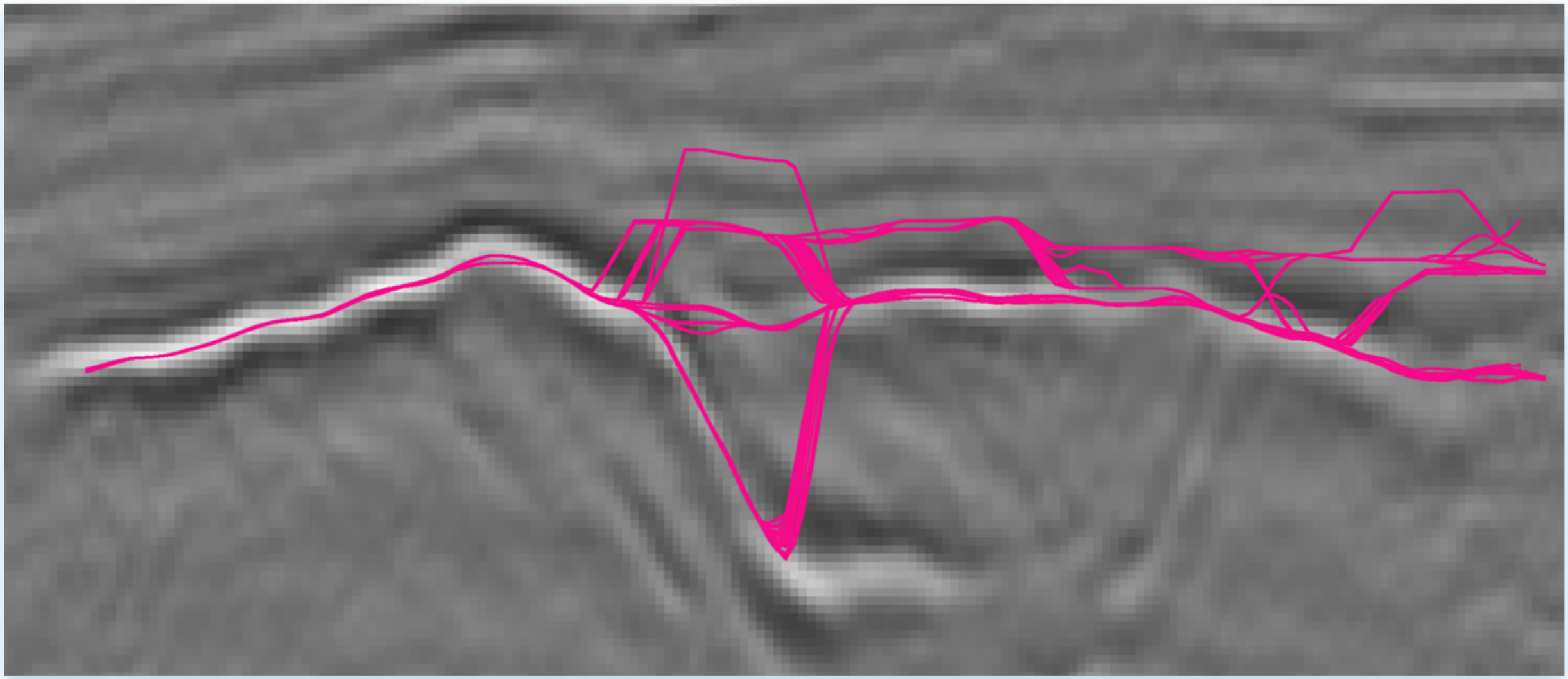

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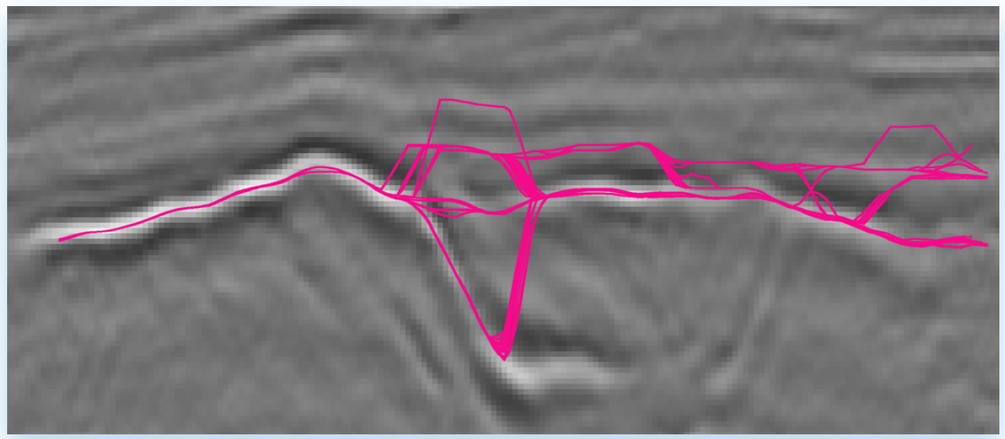
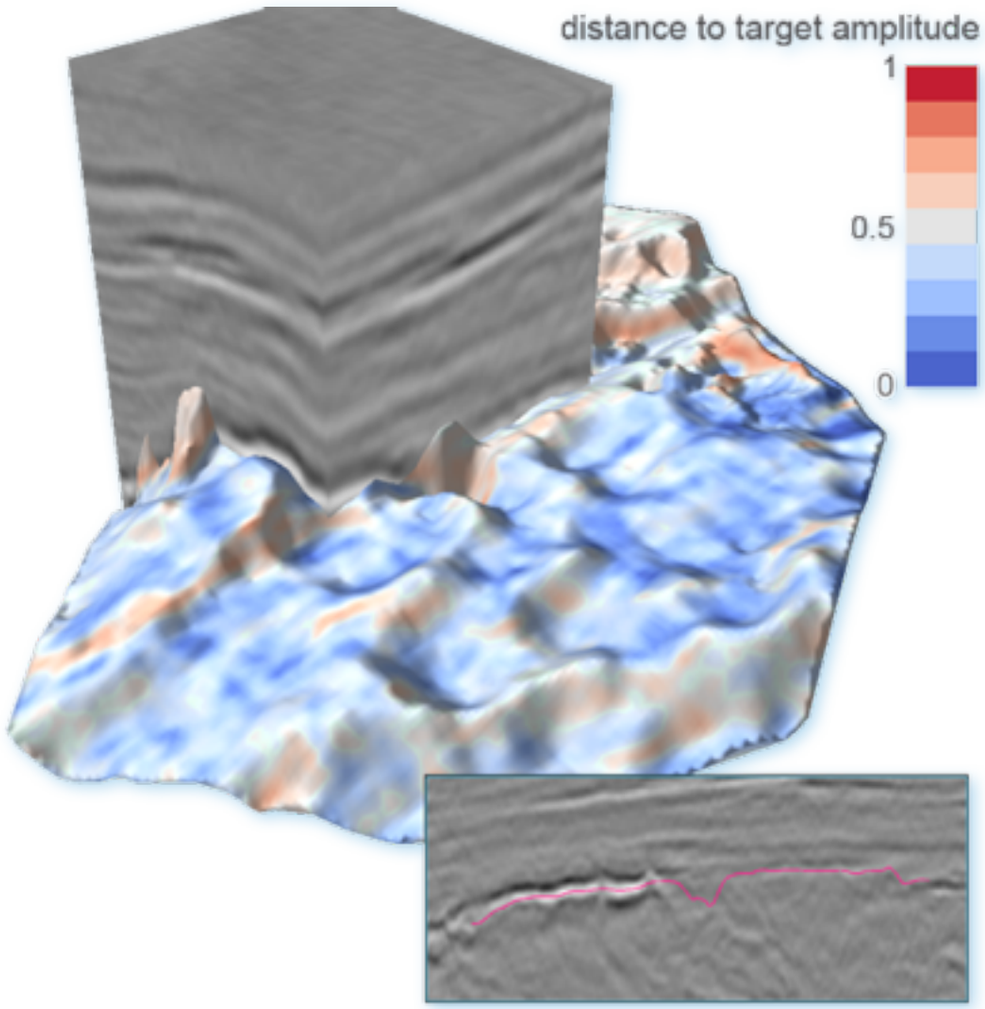
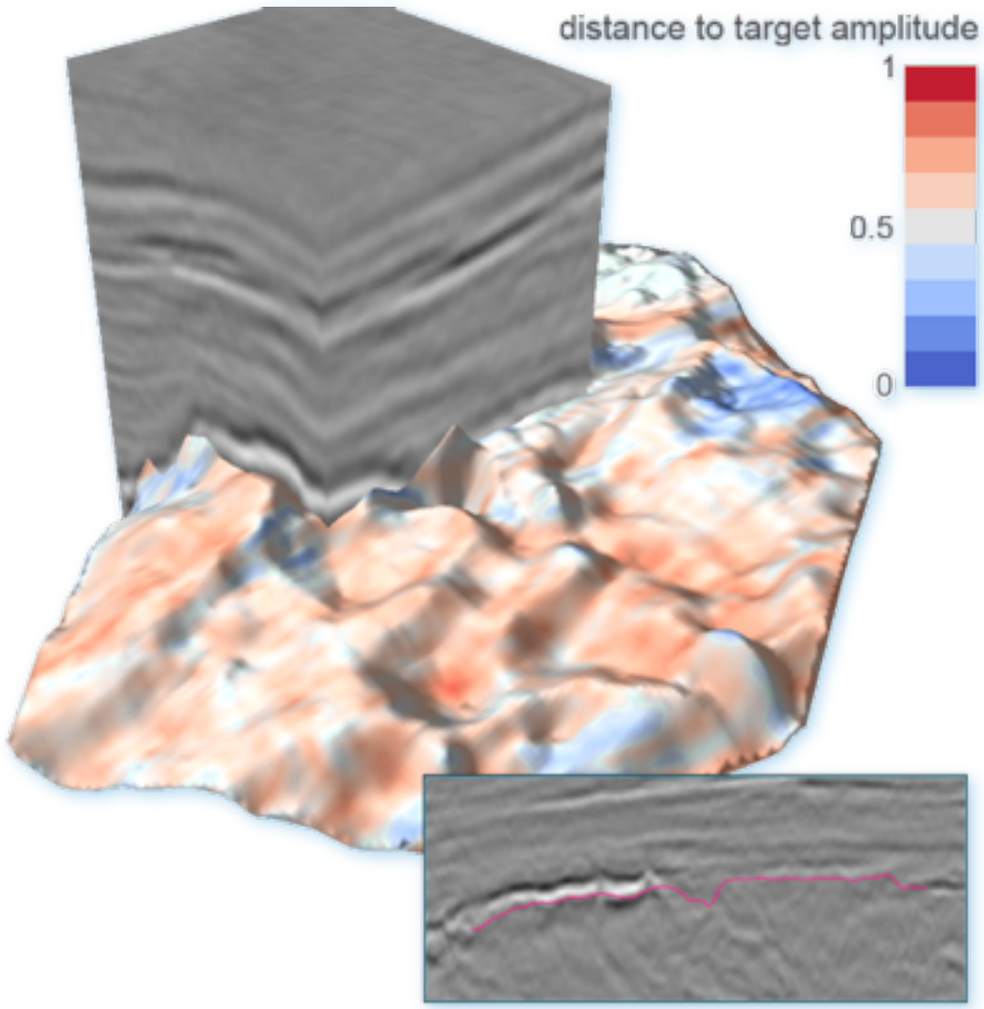


Maximum Likelihood Surface

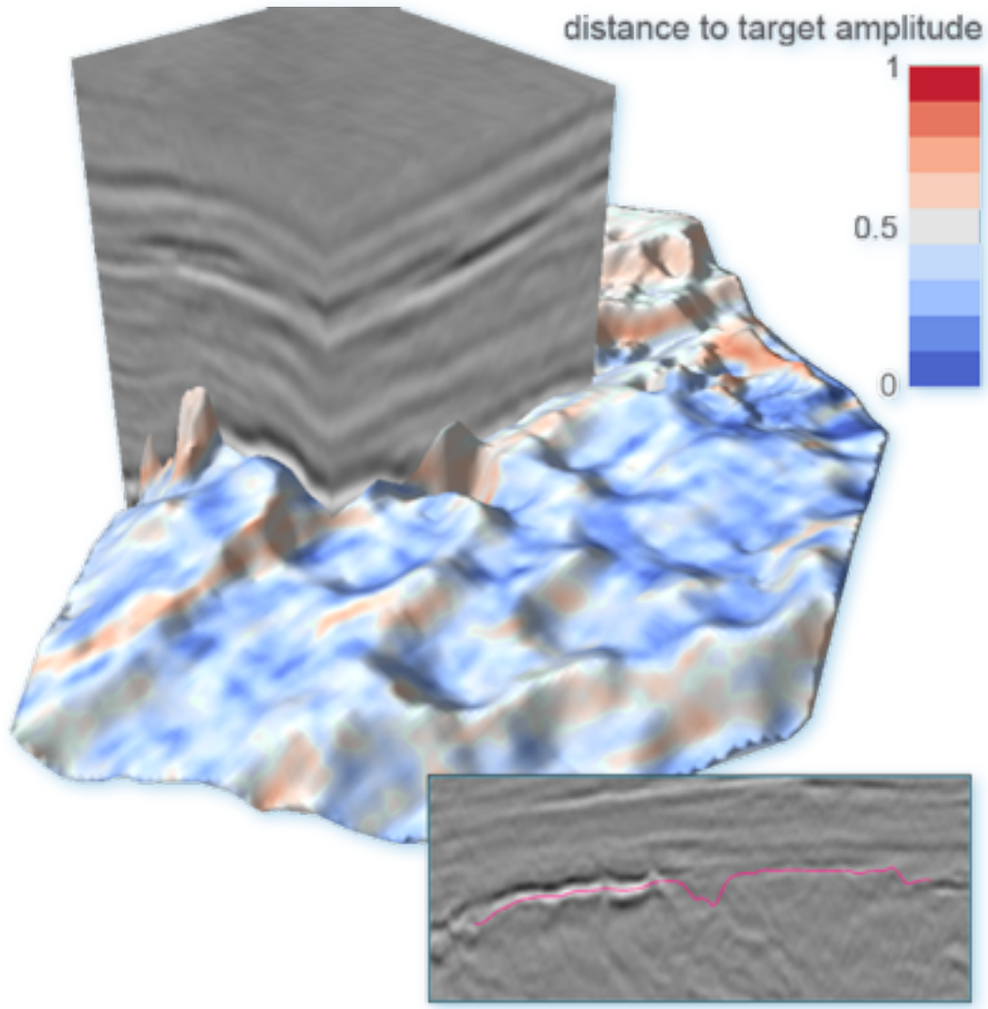


maximum likelihood



mean

Maximum Likelihood Surface



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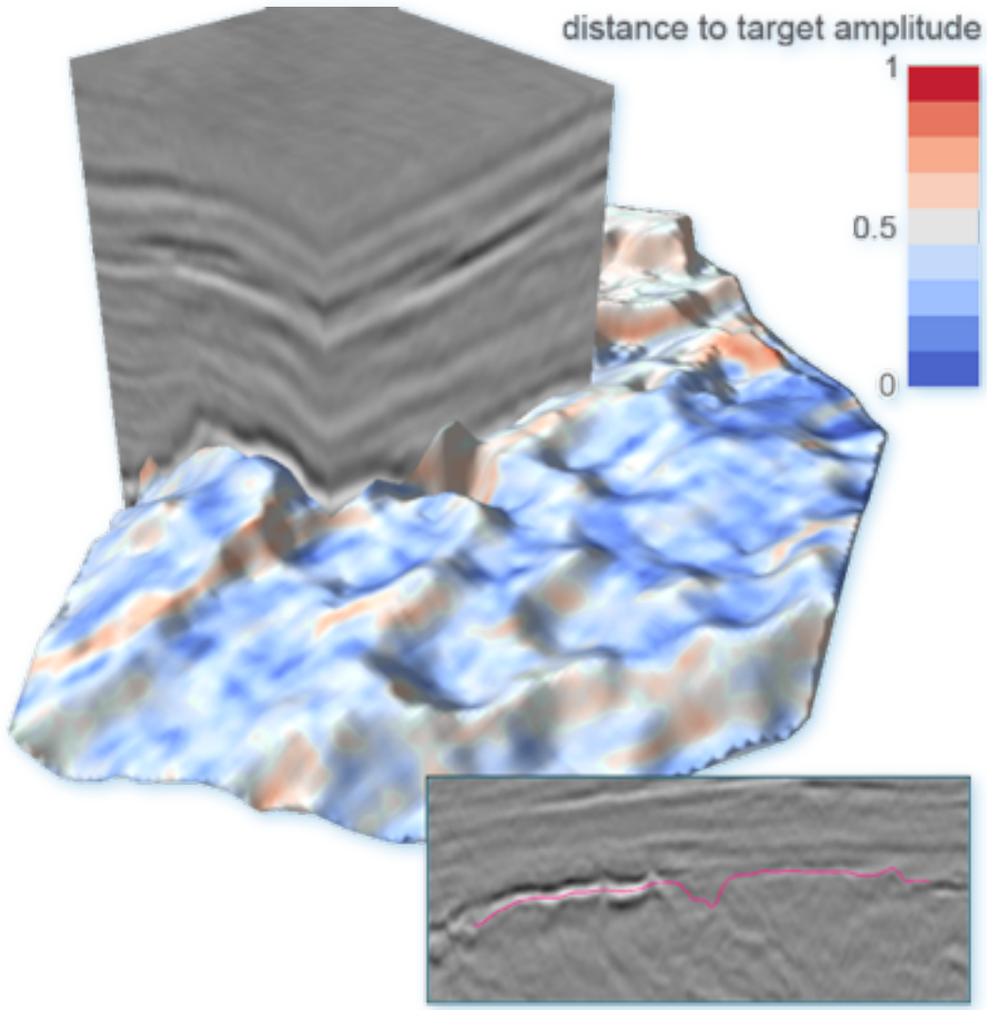
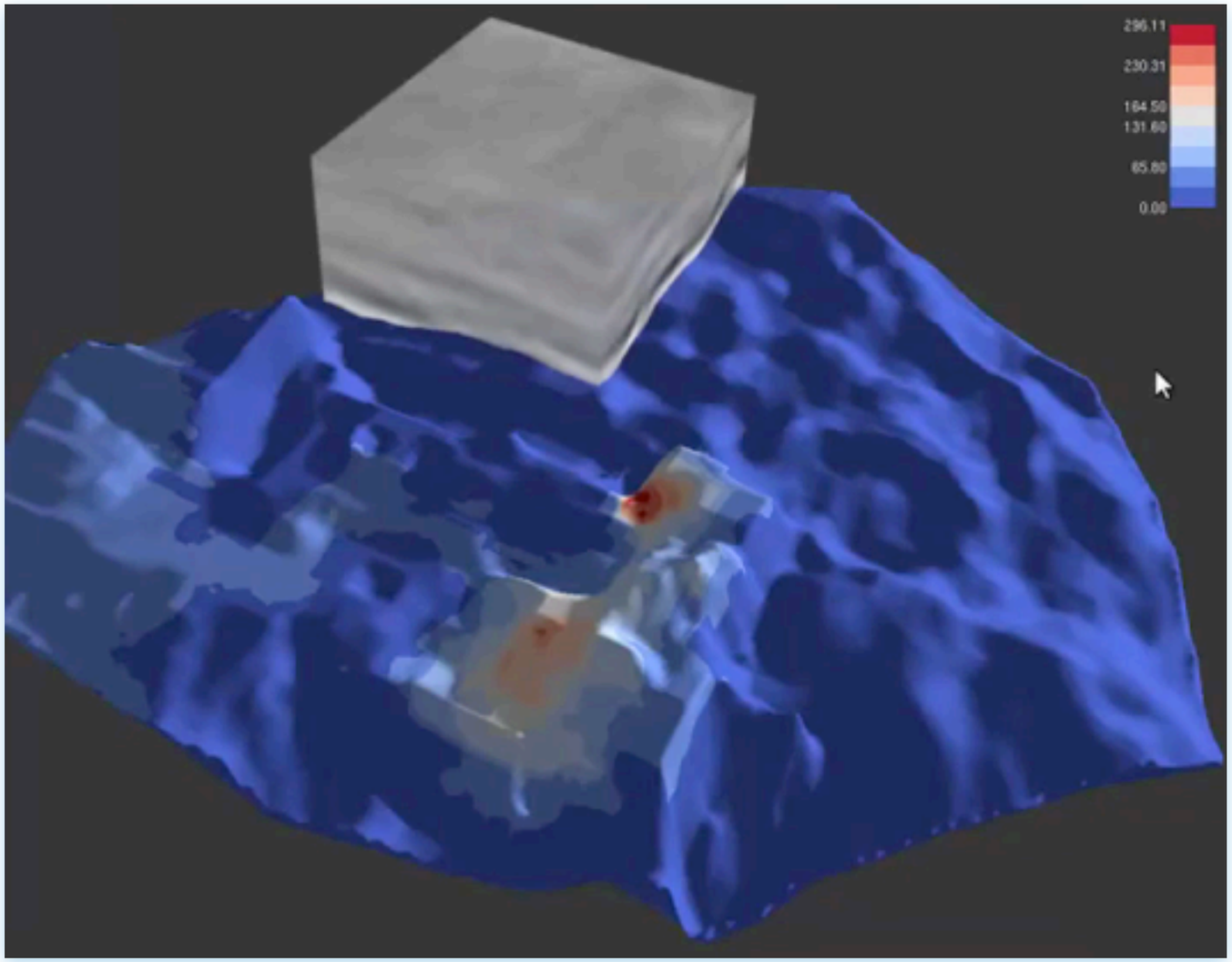
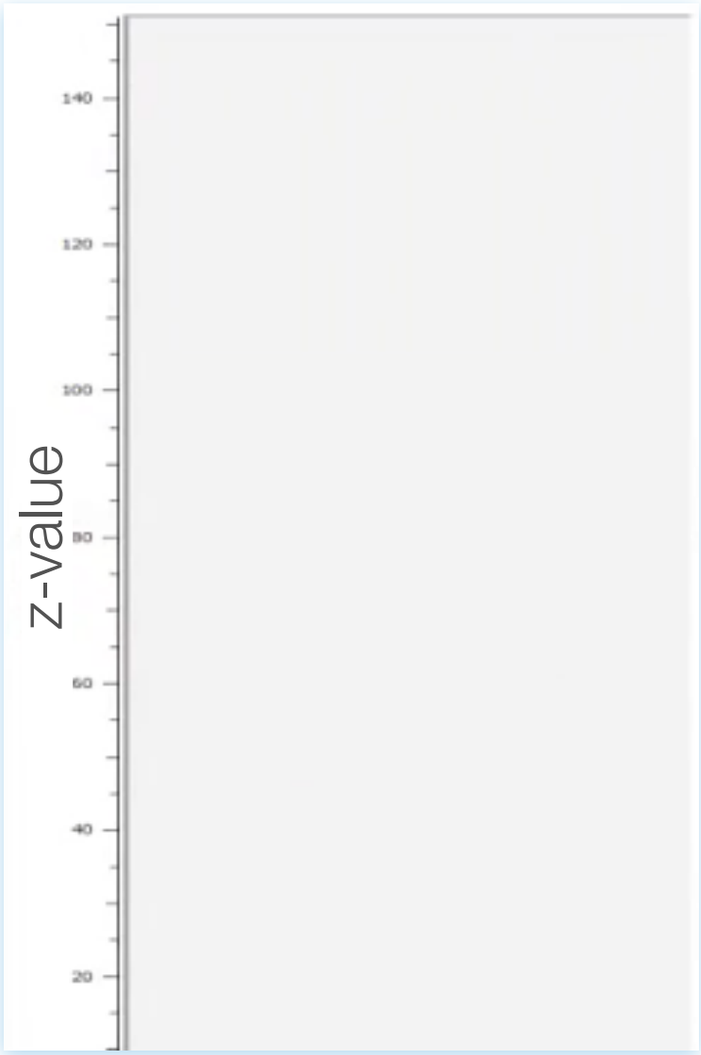


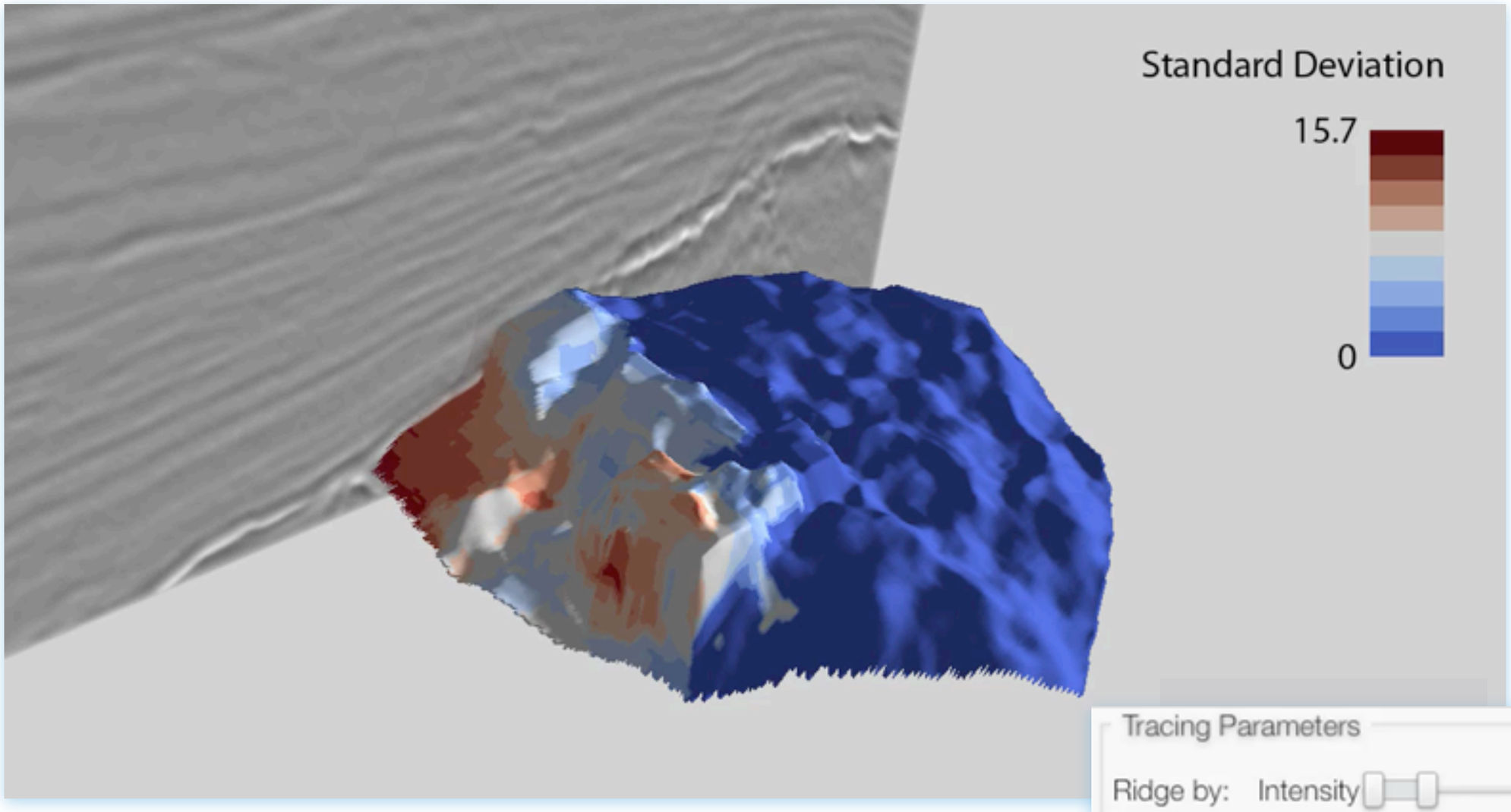
median

Interactive Probing





Parameter Space Exploration



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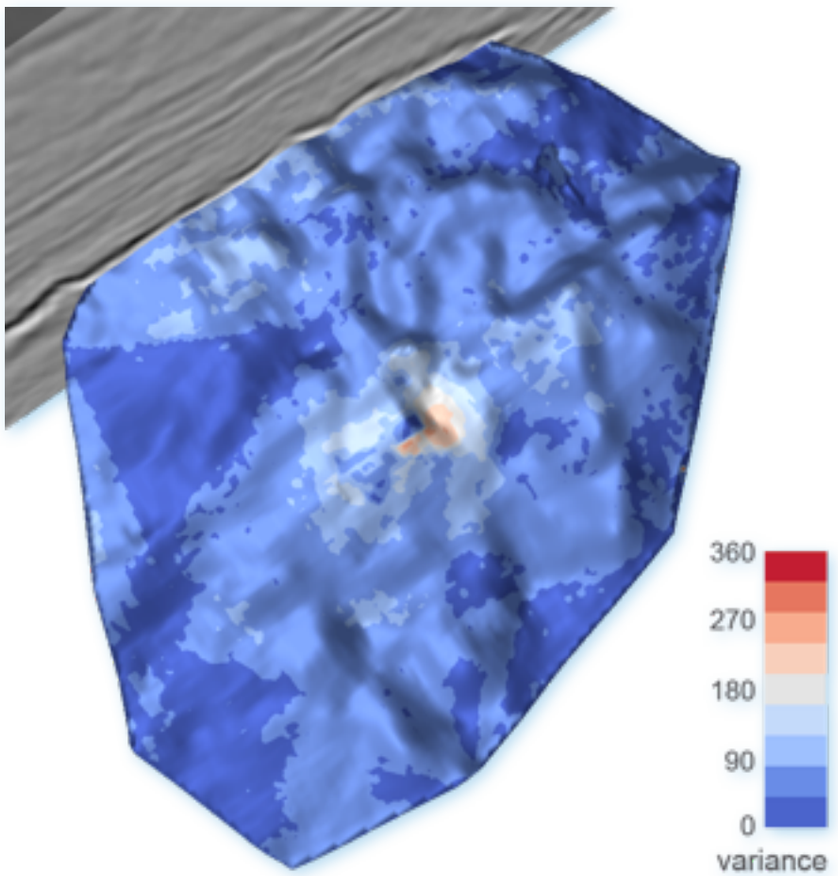
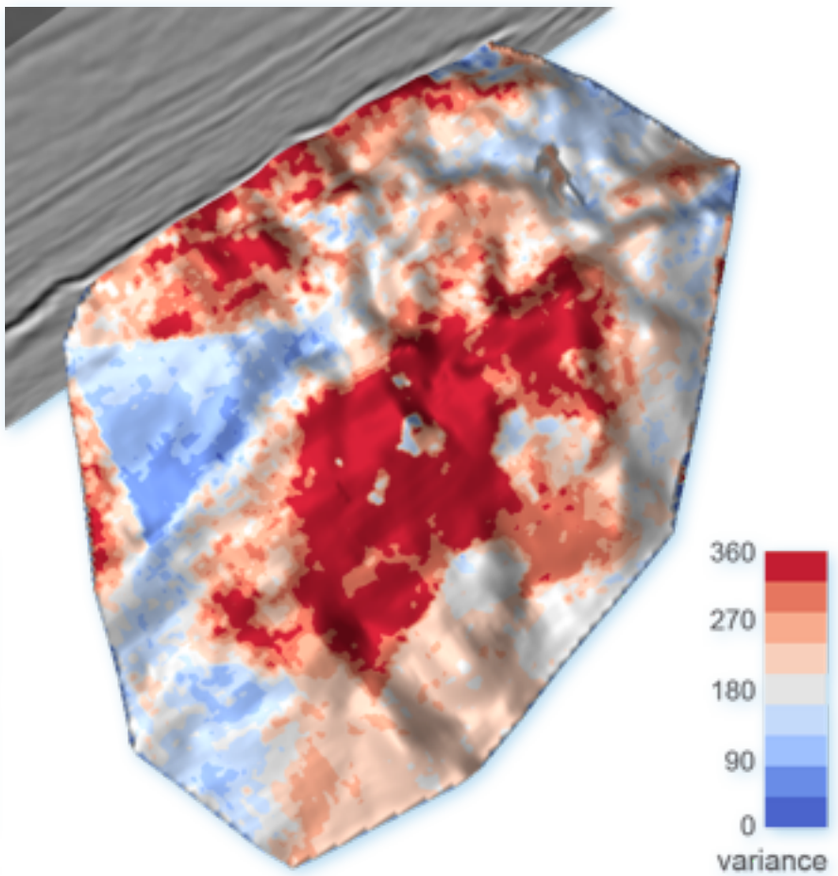


Neighbor Ridge

$p = [0..1]$



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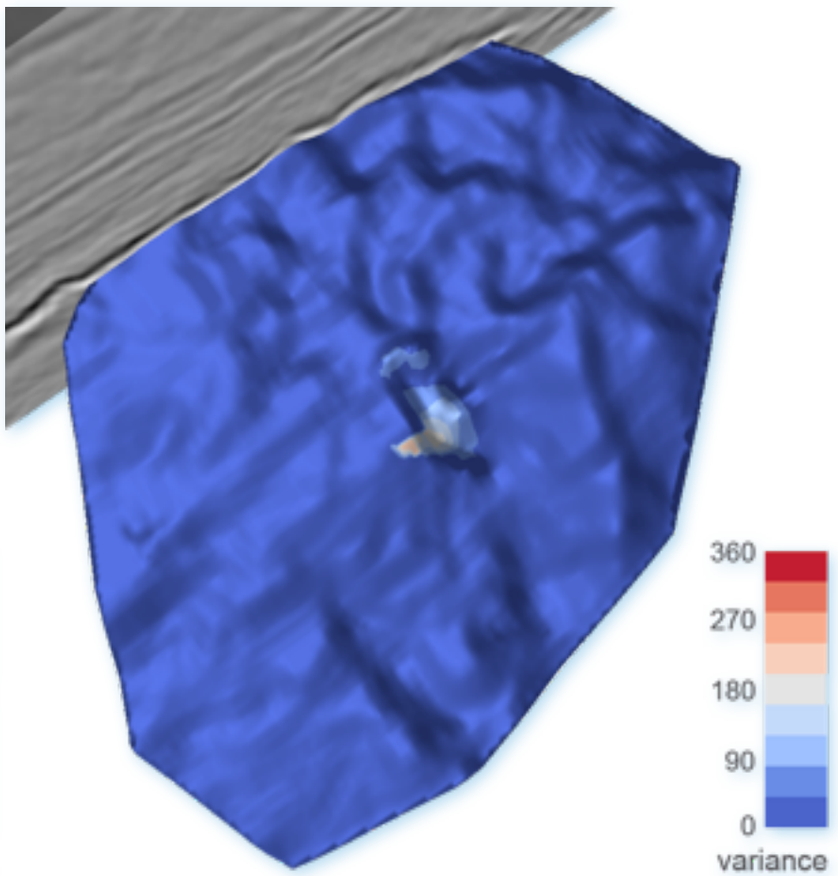

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