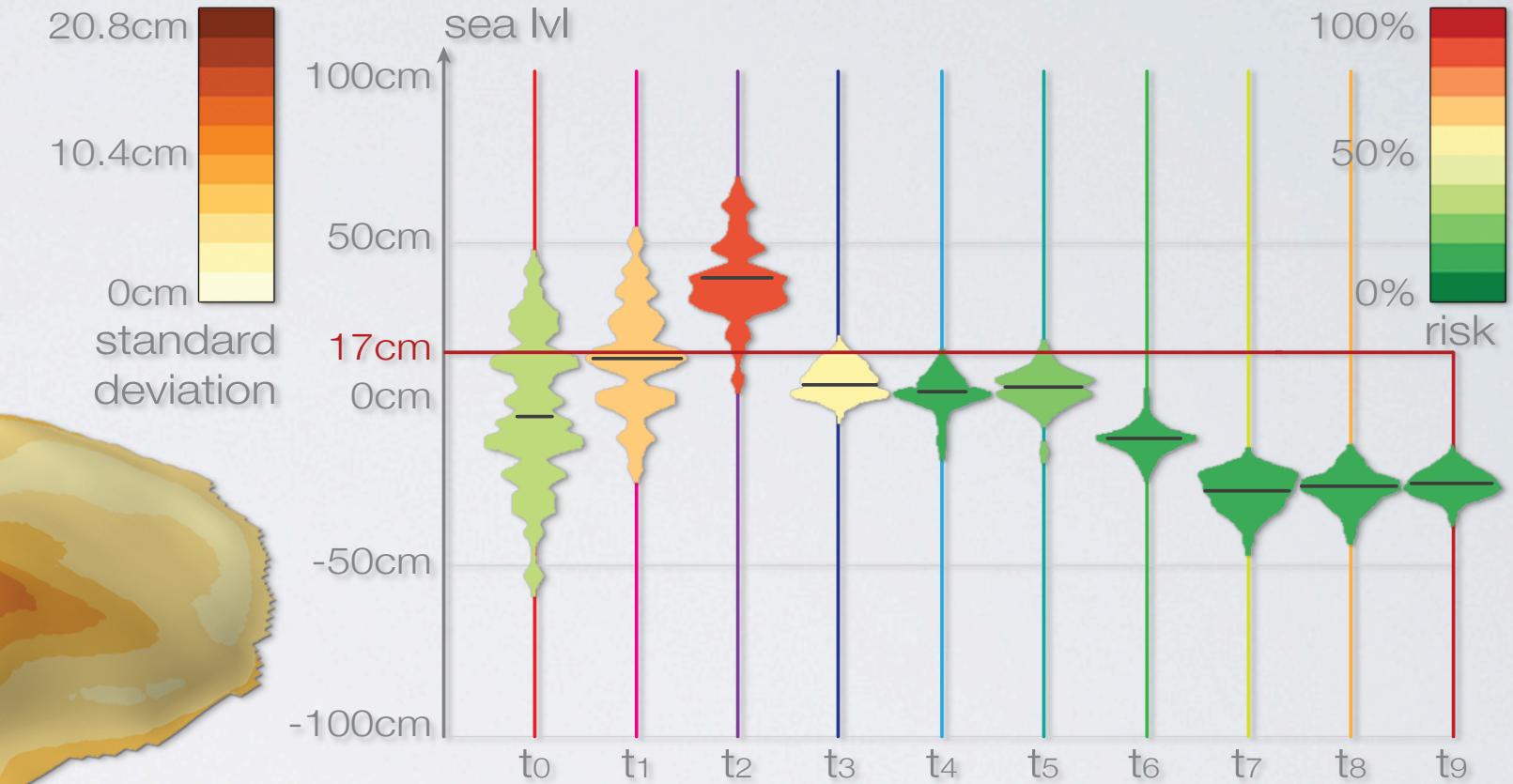
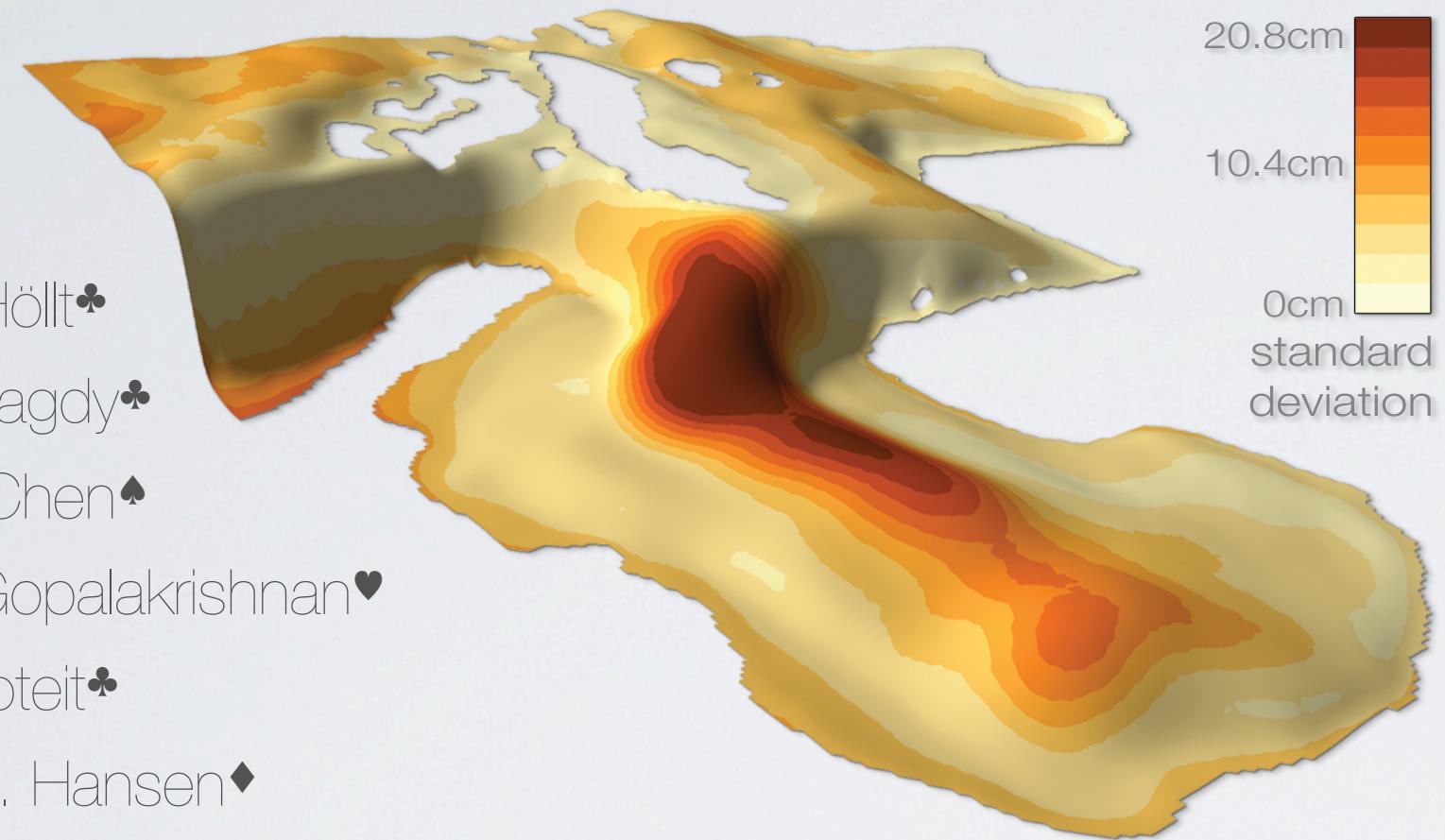


Thomas Höllt♣  
Ahmed Magdy♣  
Guoning Chen♠  
Ganesh Gopalakrishnan♥  
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Charles D. Hansen♦  
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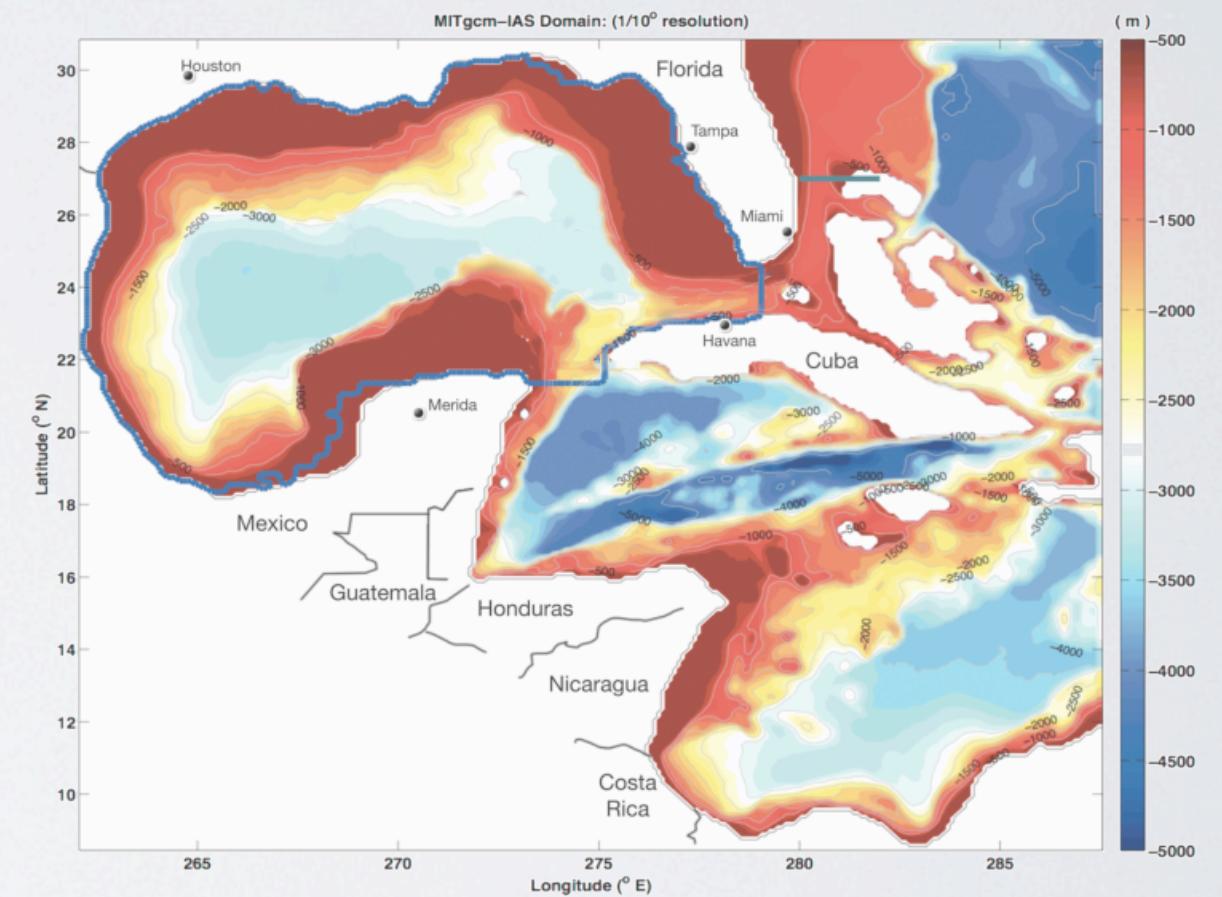


# Visual Analysis of Uncertainties in Ocean Forecasts for Planning and Operation of Off-Shore Structures



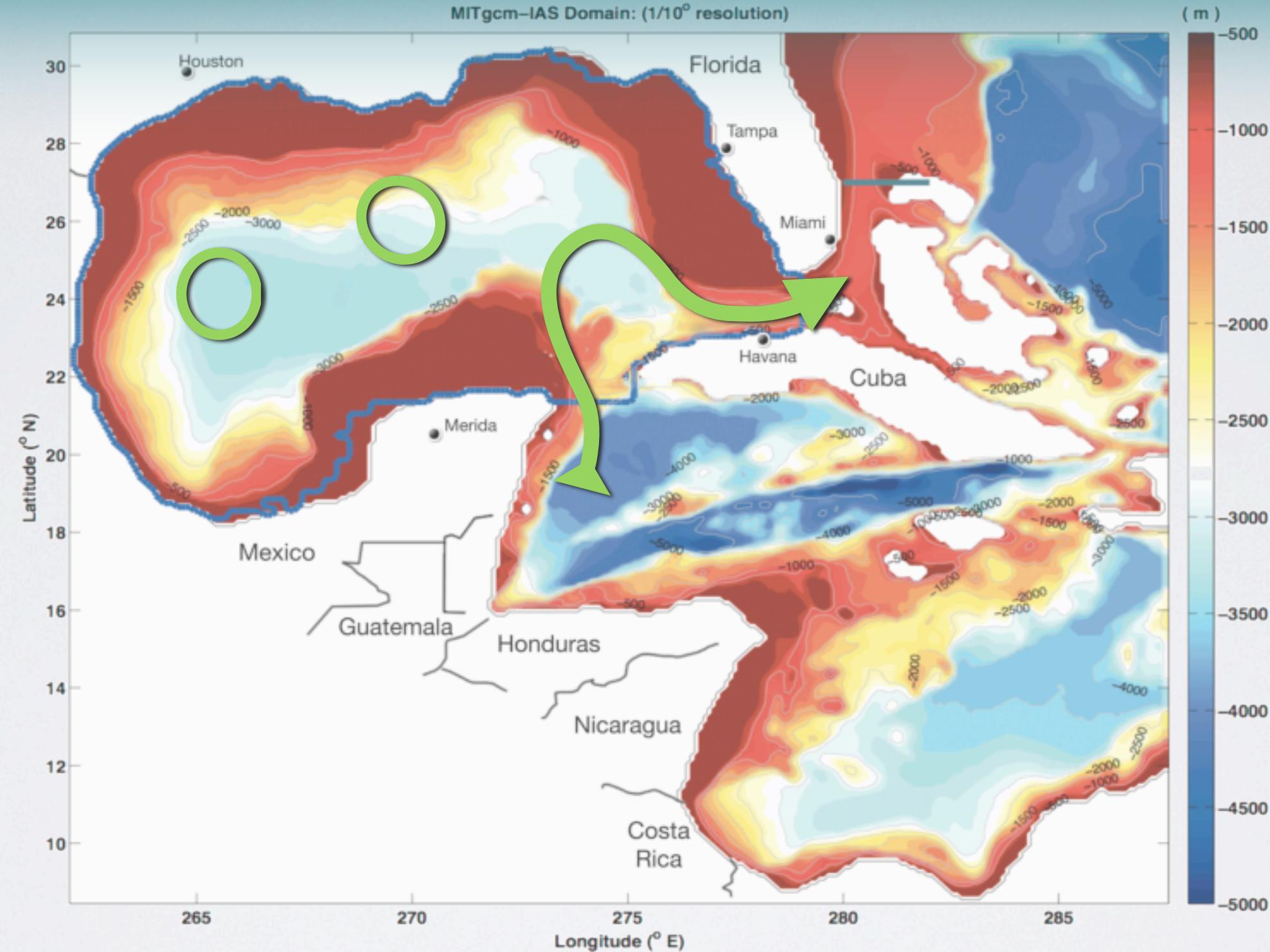
# Motivation

- Planning off-shore rig operation
  - off-shore oil exploration vulnerable to hazards





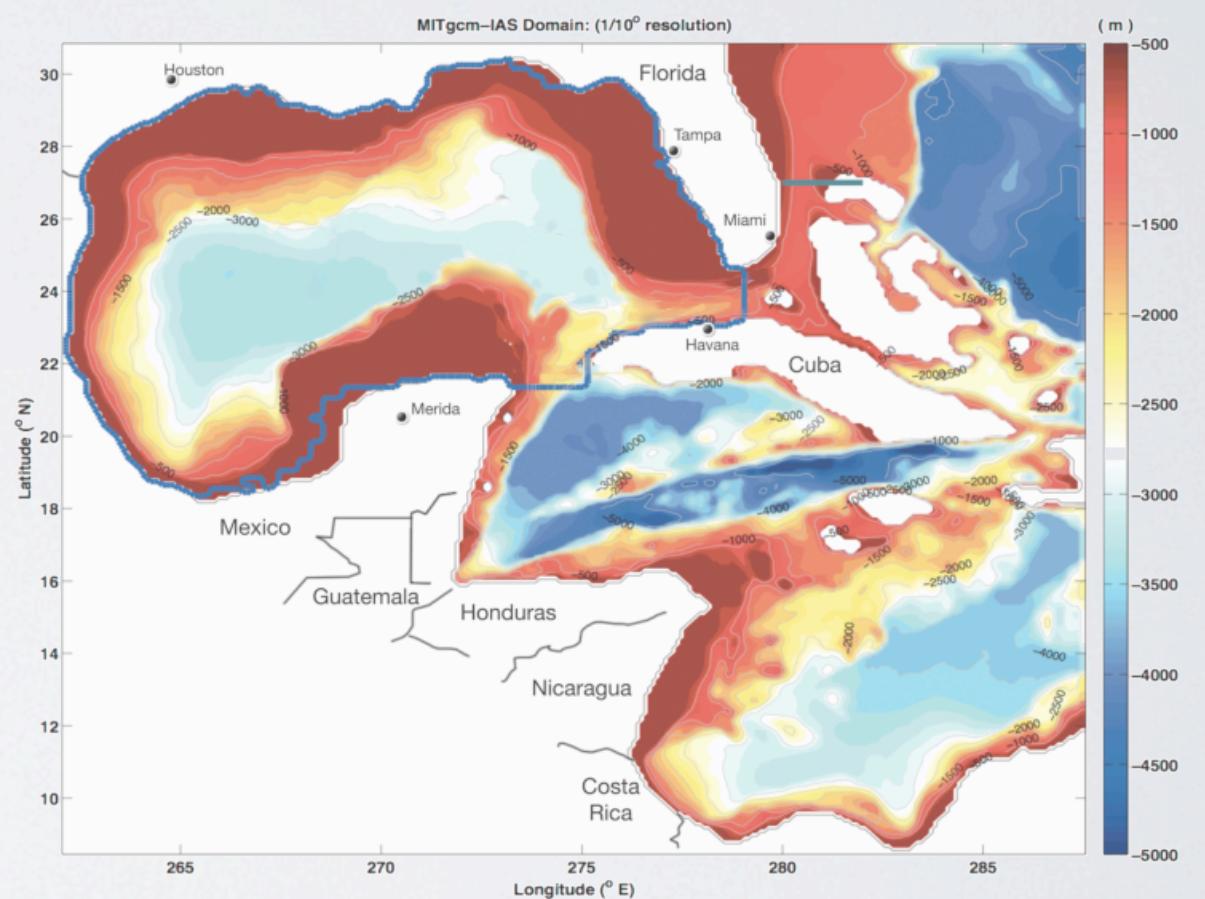
# Motivation // GoM Eddy Sheding





# Motivation

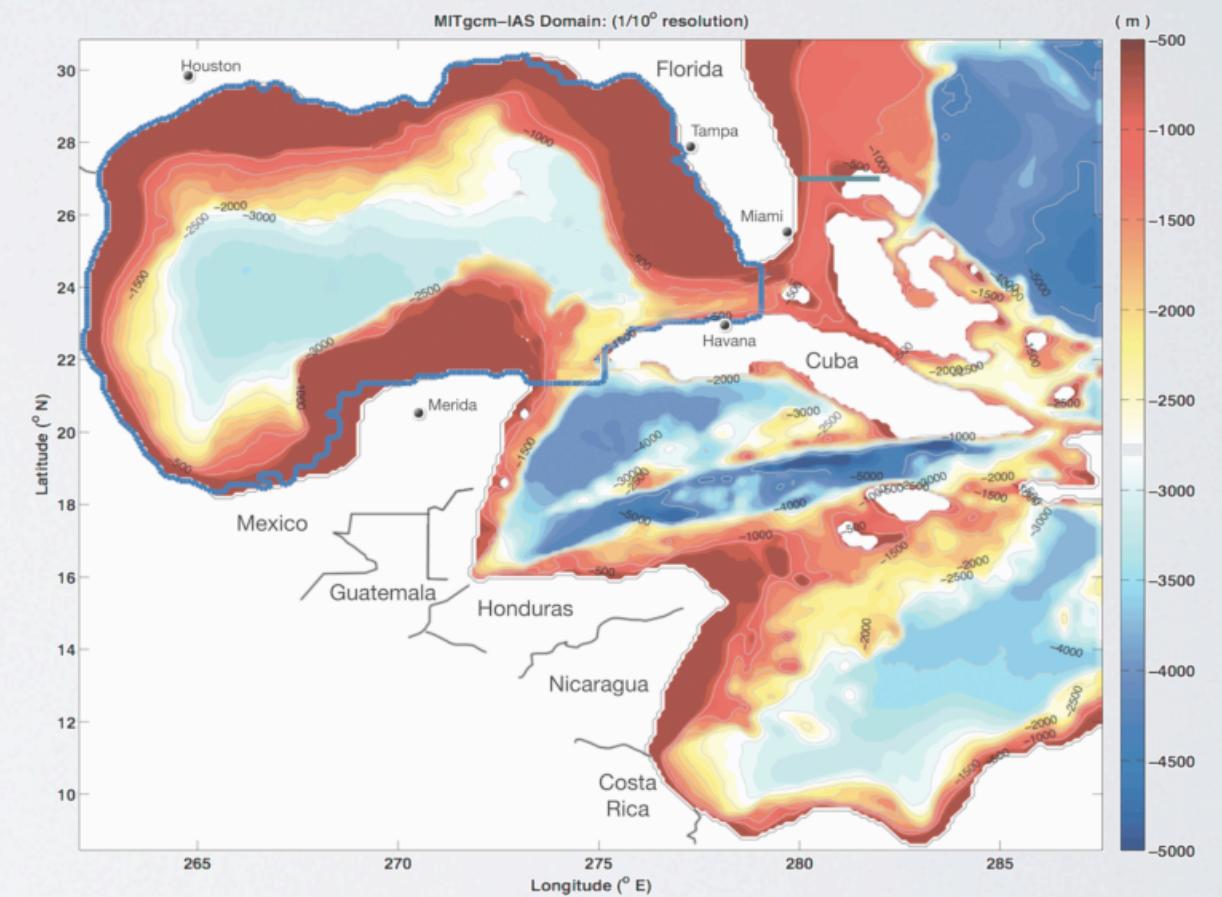
- Planning off-shore rig operation
  - off-shore oil exploration vulnerable to hazards
- ocean forecasts allow planning operation
- forecasts based on ensemble simulation





# Input Data

- Sea surface simulation of the GoM
  - height fields
  - $1/10^\circ$  grid of the GoM  $\Leftrightarrow 275 \times 325$  samples
  - 10 time steps
  - 100 simulation runs each





# Visualization

- Statistical analysis
- Overview first
  - representative surface + statistics
- Details on demand
  - interactive probing
  - live parameter-space exploration





# On the Fly Analysis

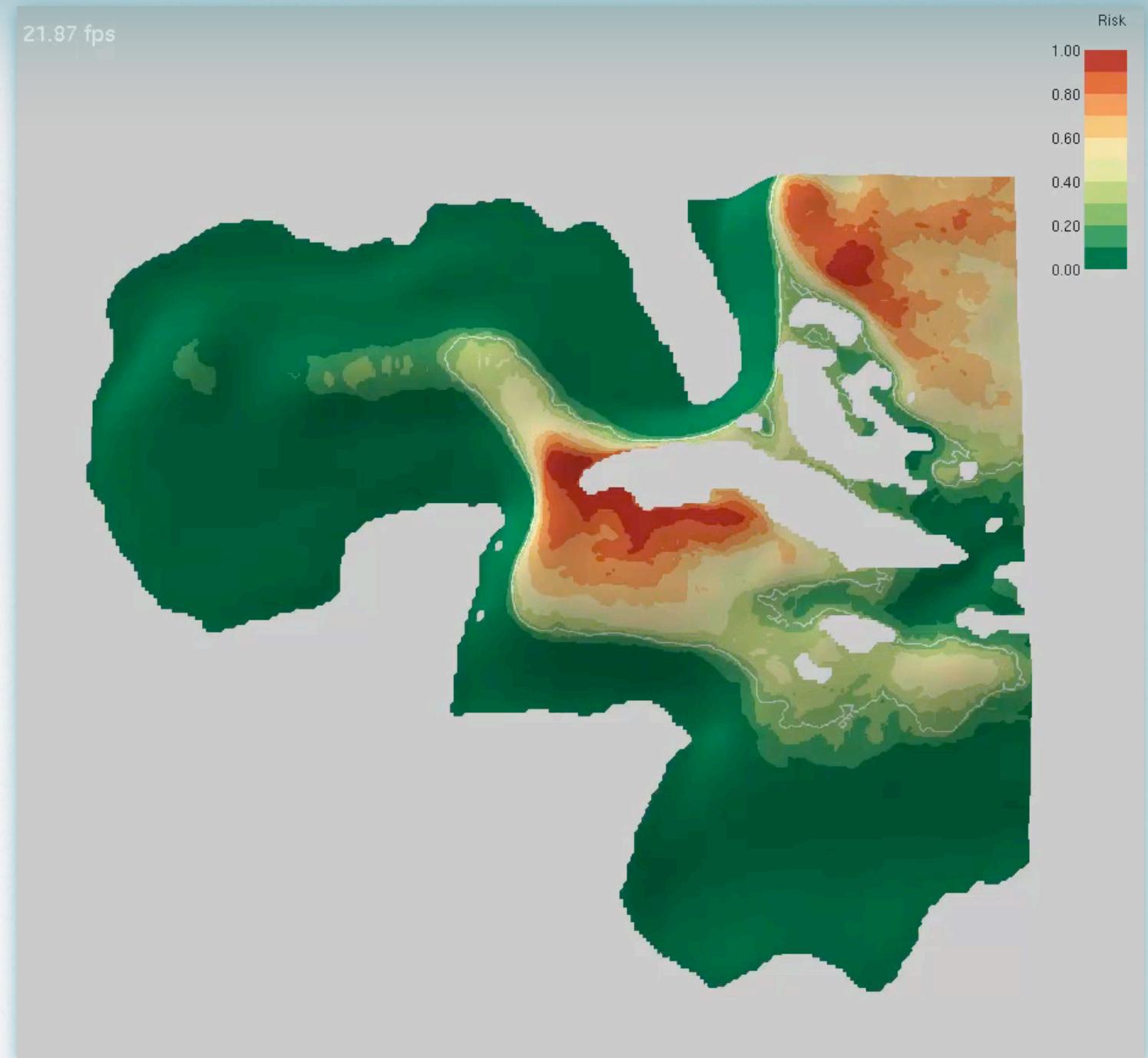
- Interactive parameter space exploration
  - statistics based on user defined ensemble subset
  - GPU-based computation
- Statistical analysis
  - histogram, pdf
  - mean, median, maximum mode ↛ surfaces
  - variance, kurtosis, risk estimate ... ↛ textures
- iso contouring





# Statistical Analysis // Risk

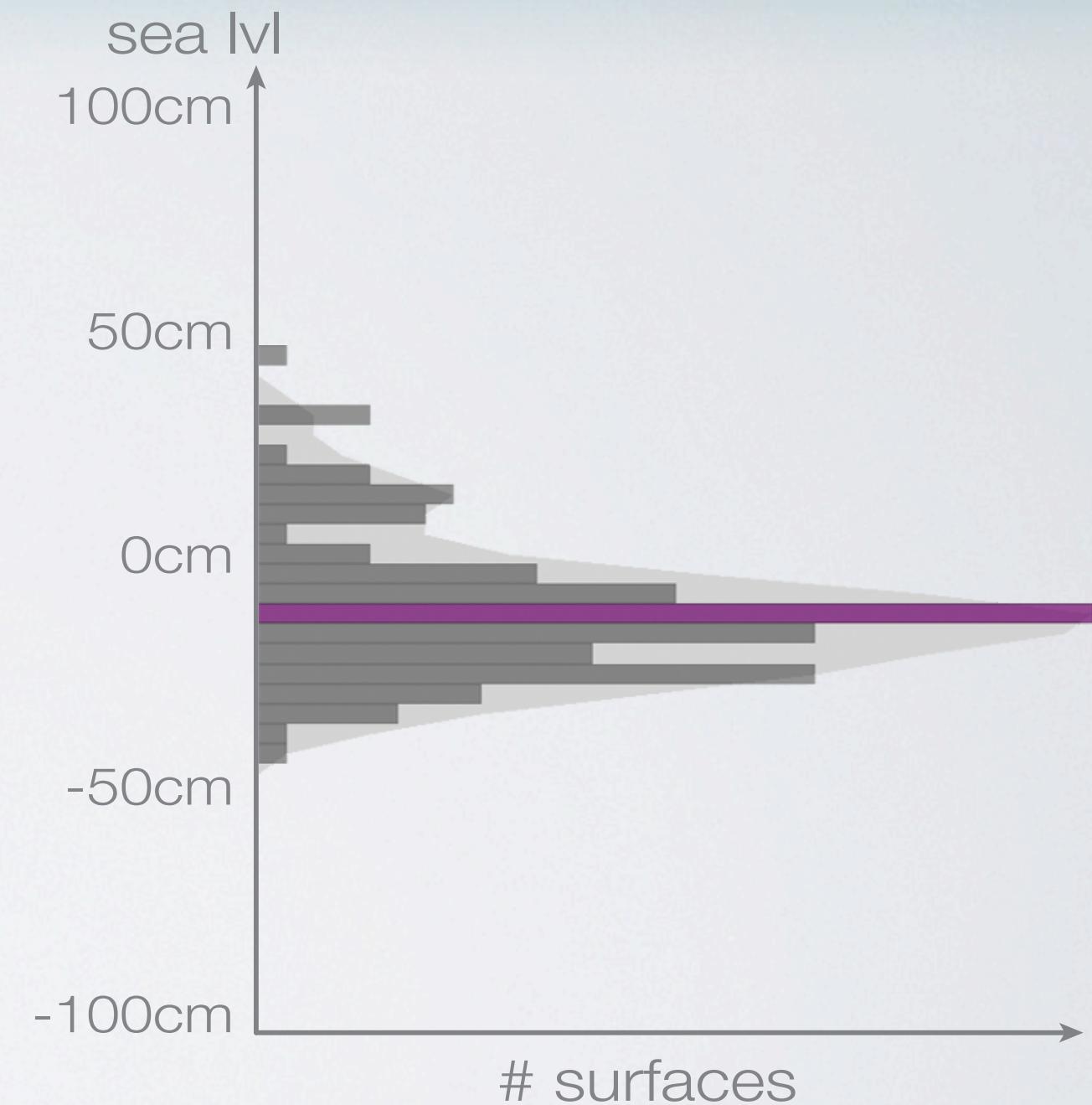
- Based on user defined critical sea-level
  - portion of surfaces above critical value
- On the fly adjustment of sea-level
- Live parameter space exploration
- Iso contouring for precise area definition





# Statistical Analysis // 3D Histogram

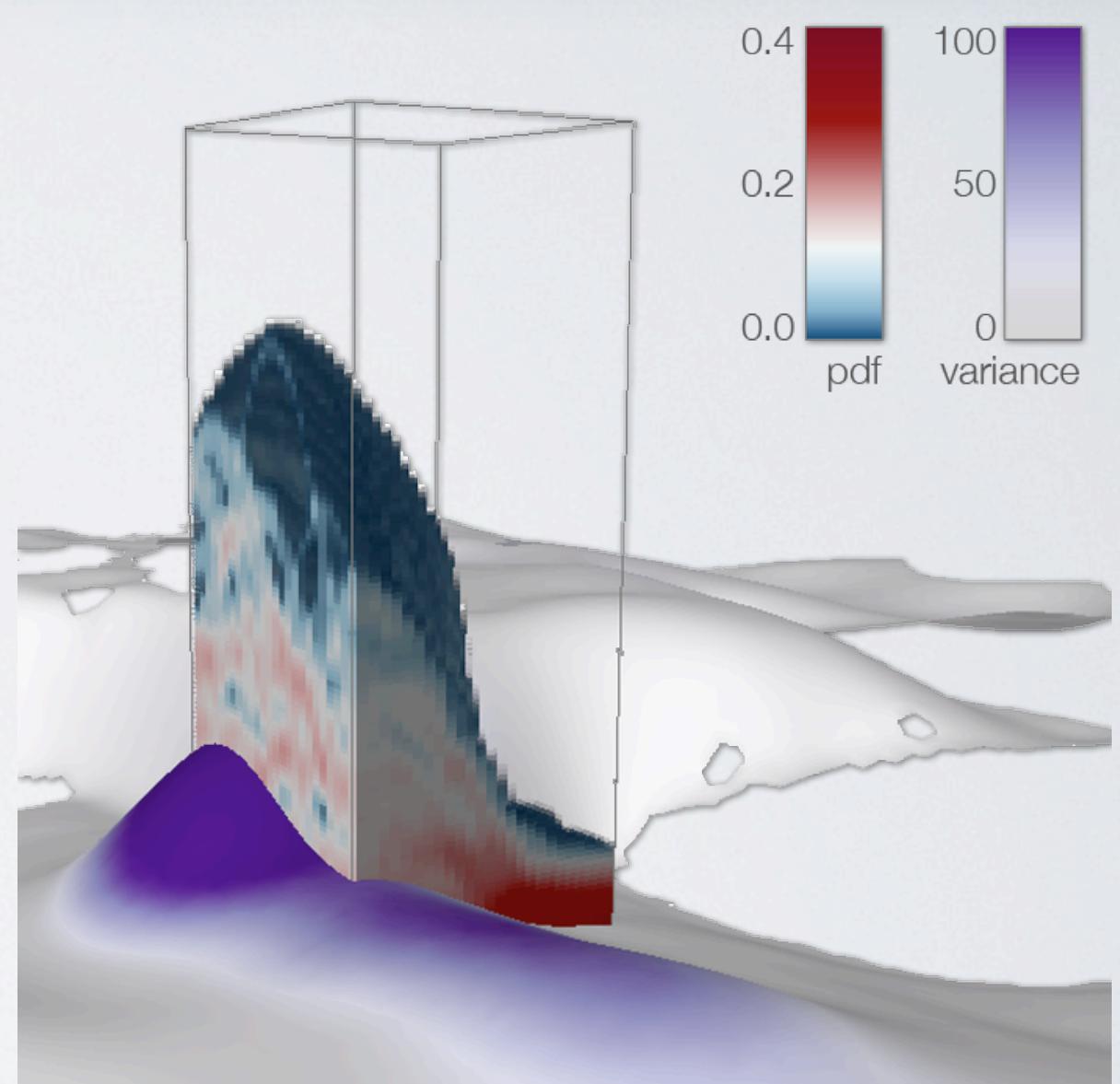
- Complete distribution for each x,y position
  - histogram + pdf
- 3D volumetric cursor
  - user adjustable size
  - avoids clutter of rendering complete volume





# Statistical Analysis // 3D Histogram

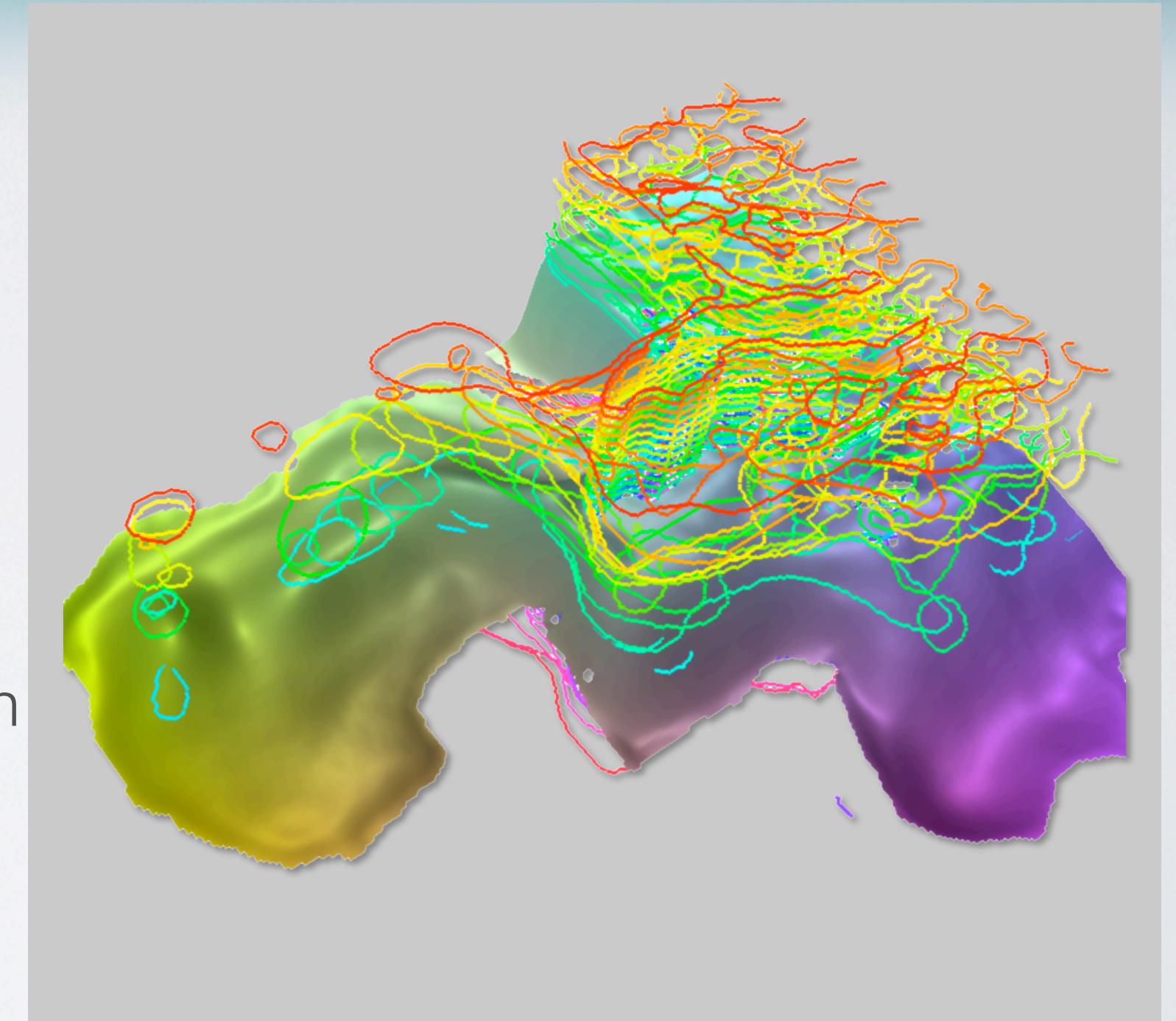
- Complete distribution for each x,y position
  - histogram + pdf
- 3D volumetric cursor
  - user adjustable size
  - avoids clutter of rendering complete volume





# Iso Contouring

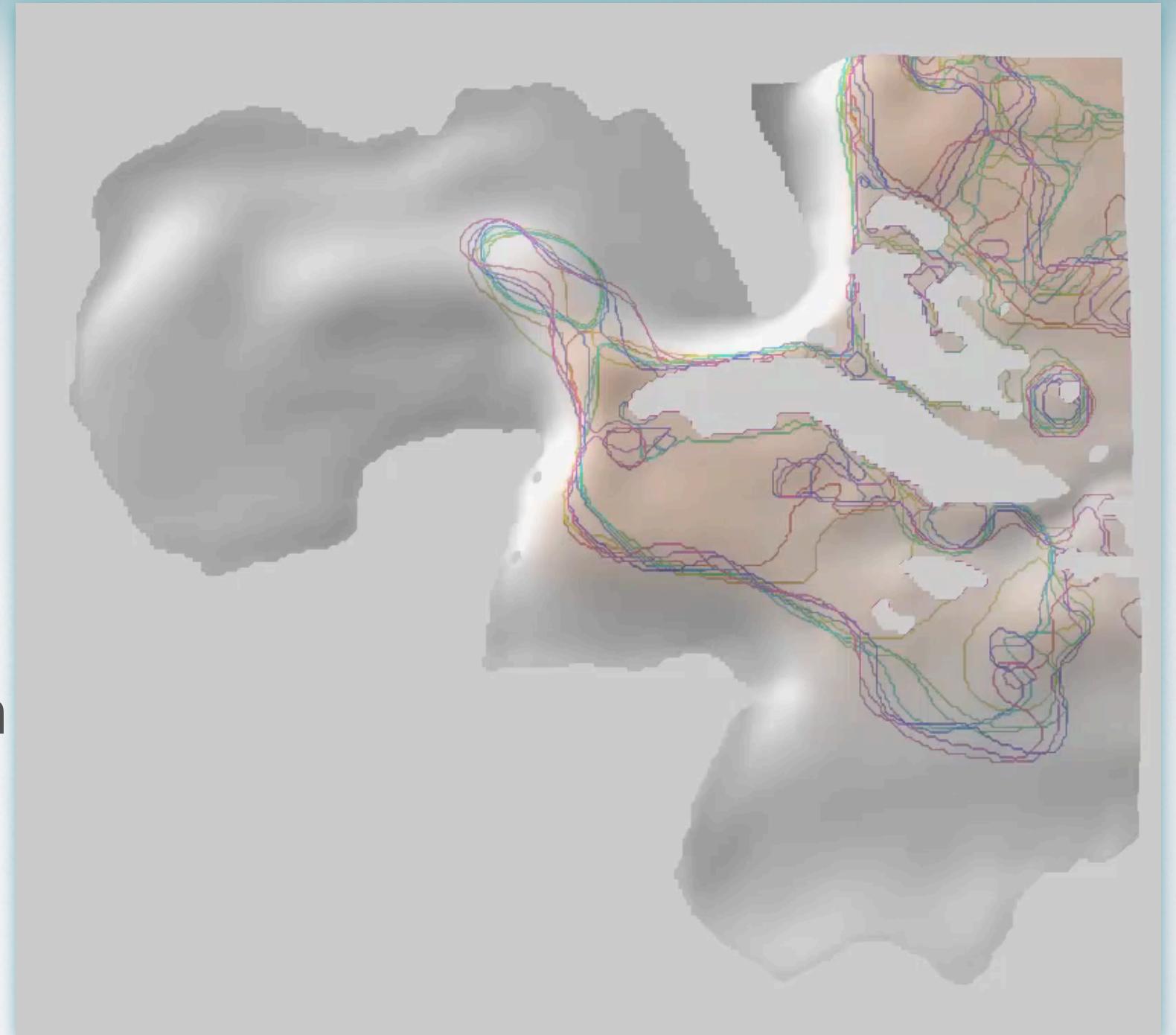
- From any surface or scalar field
- As geometry, or for texturing
- Live parameter space exploration
- Area of interest definition
- Standard marching squares implementation





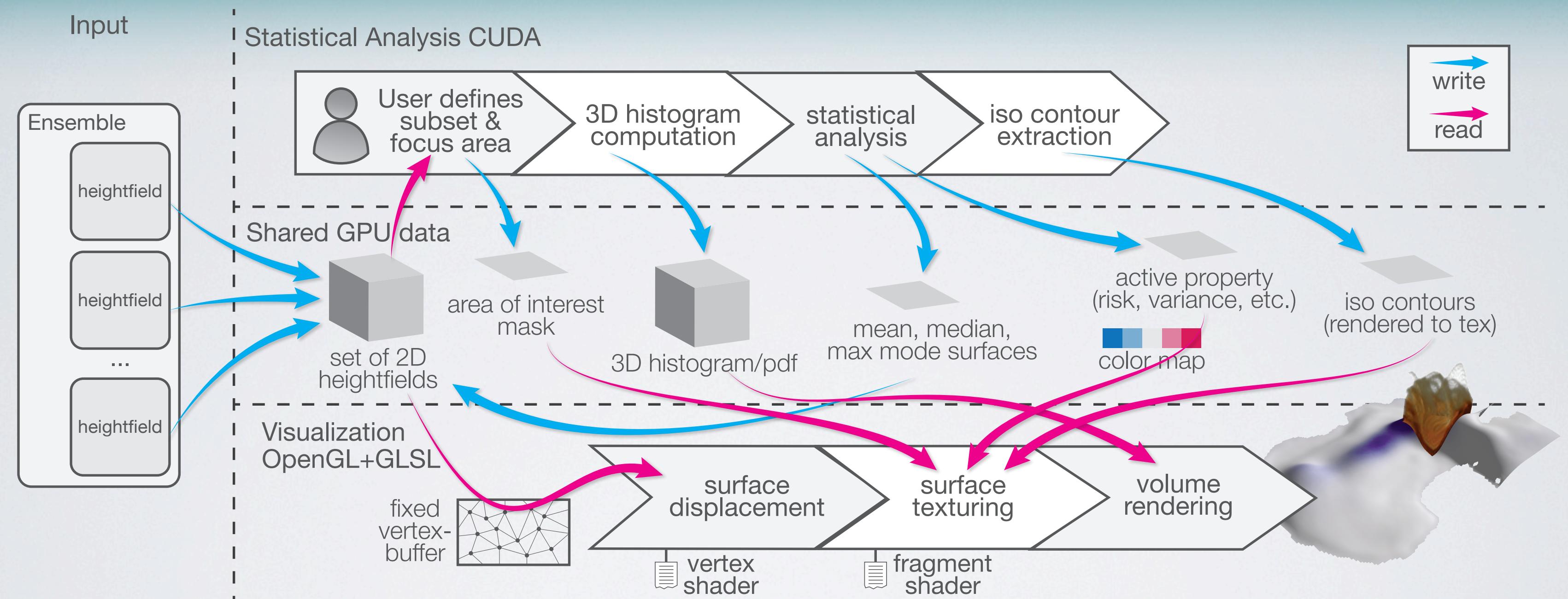
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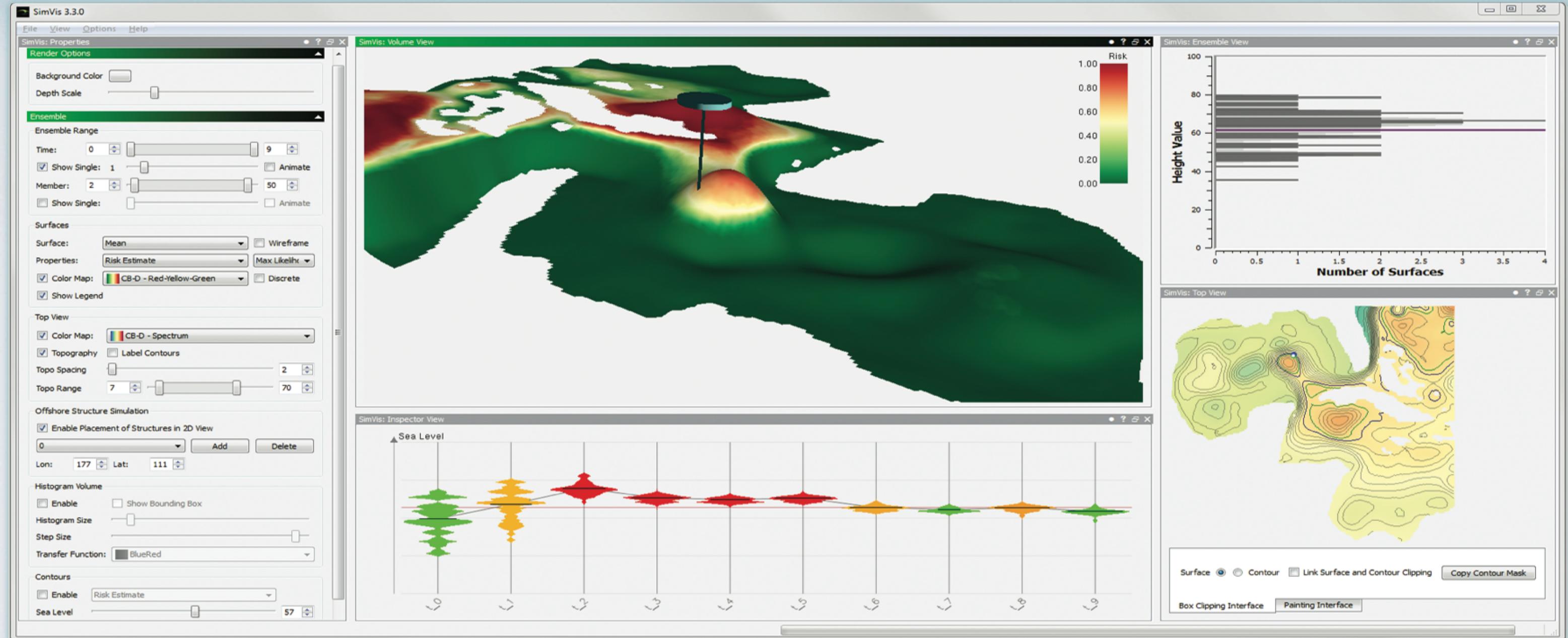


# Analysis & Visualization Pipeline

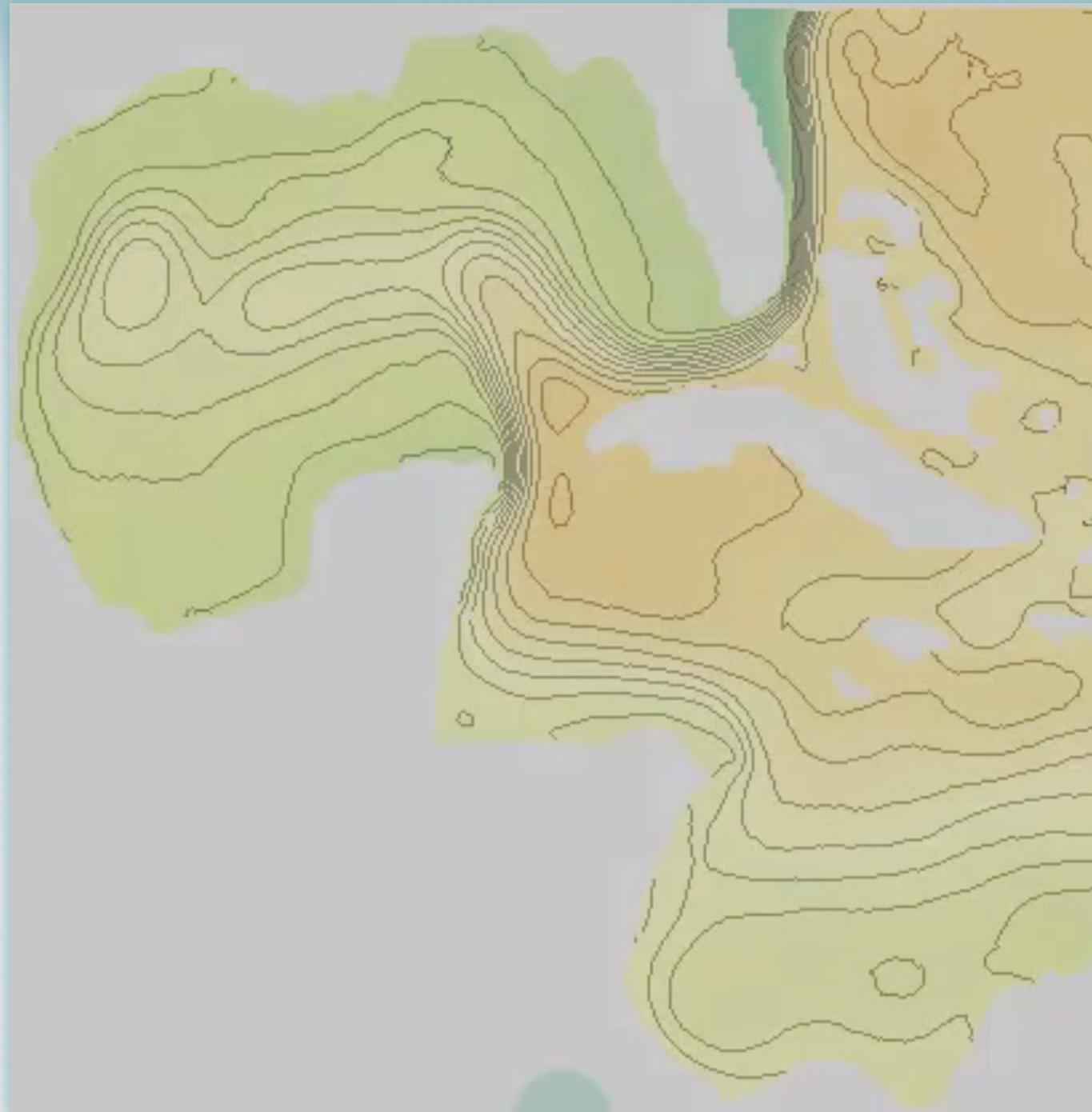




# System

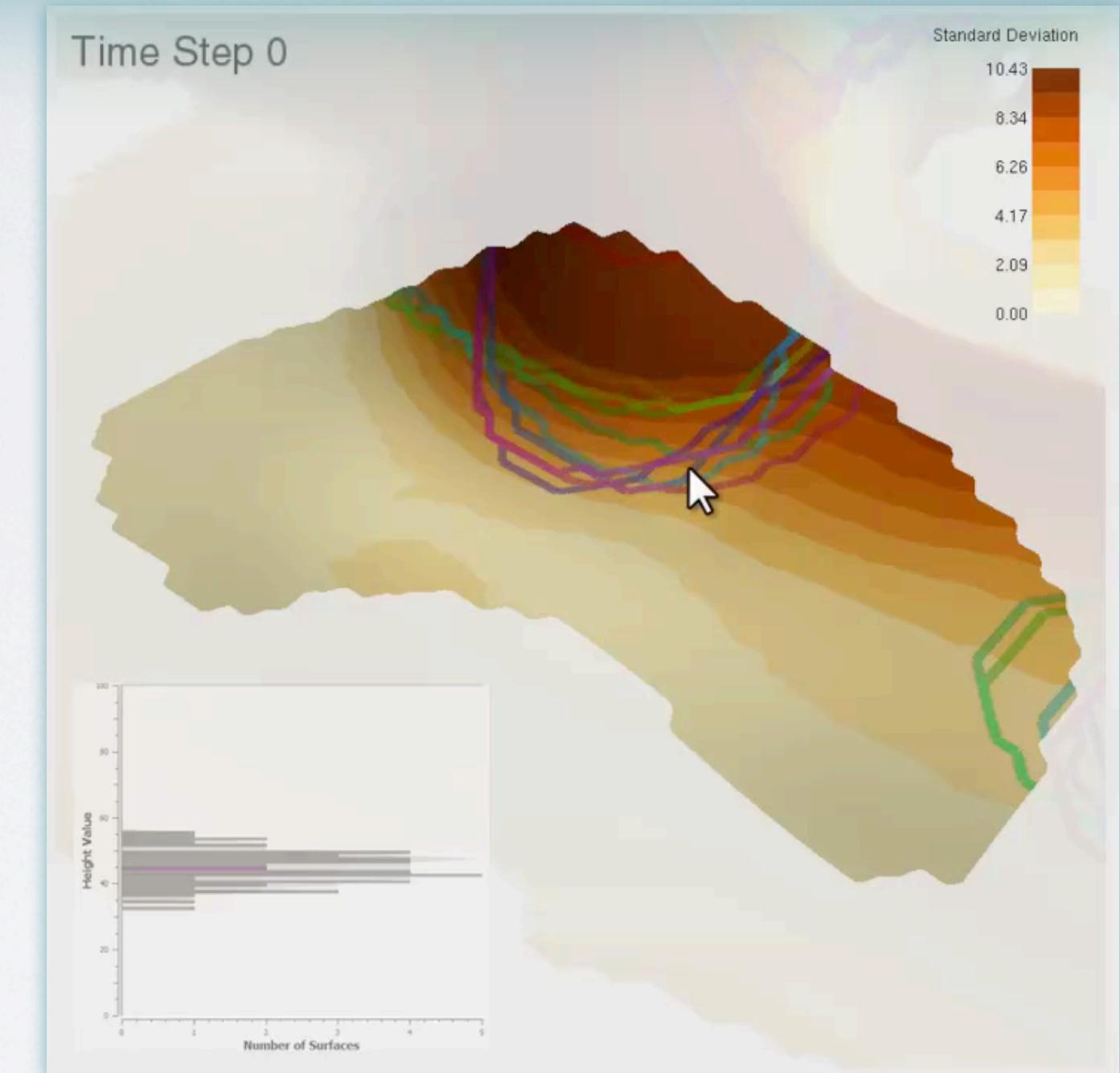
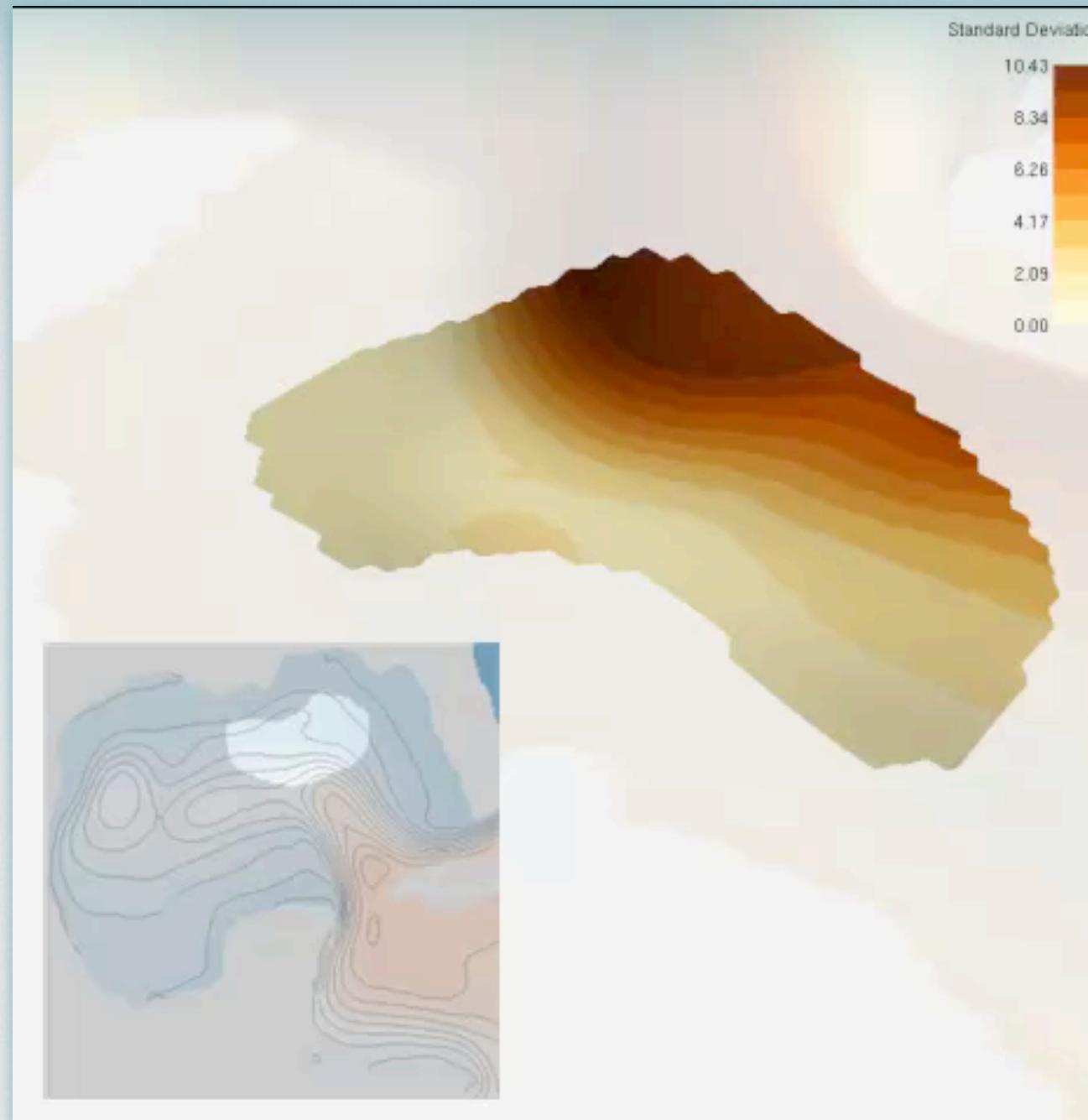


# Results // Placement Planning



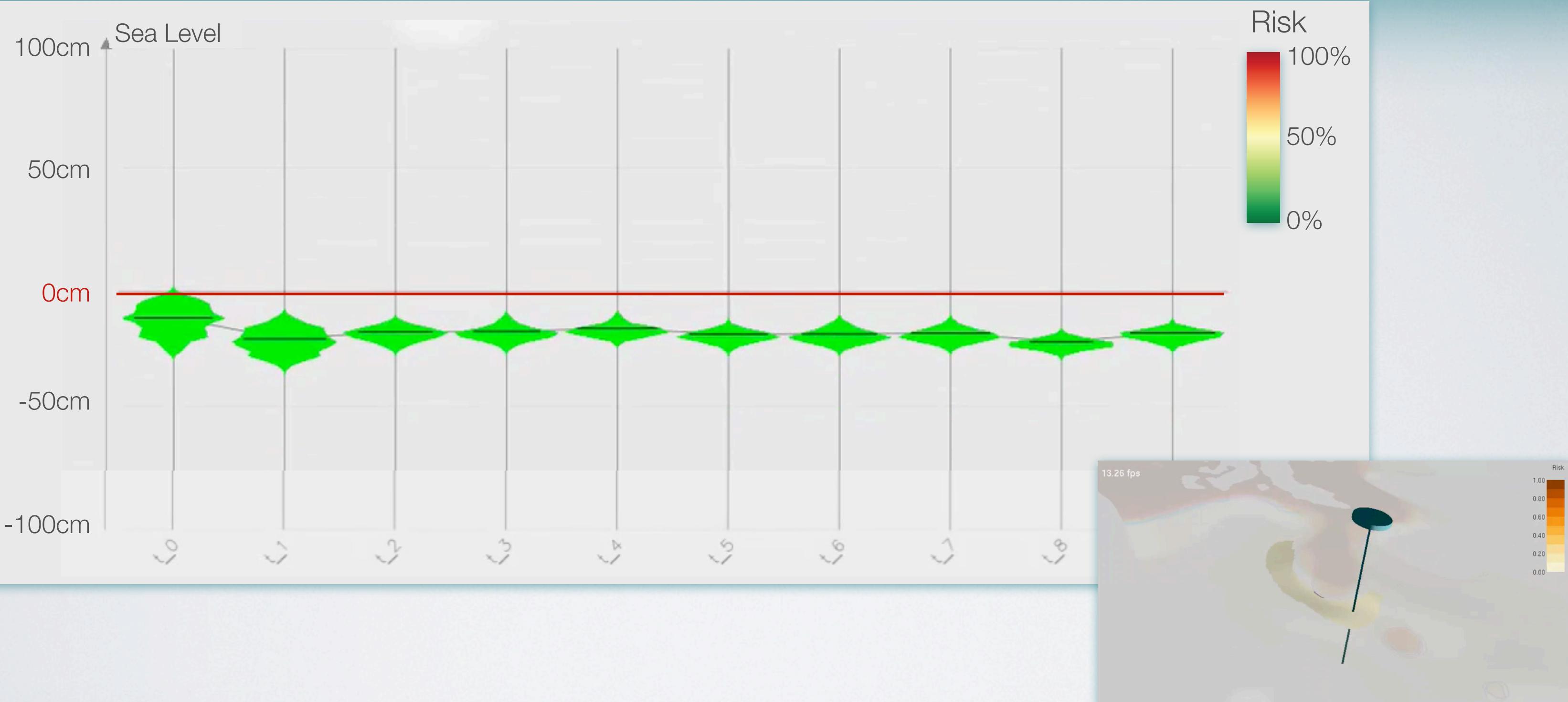


# Results // Placement Planning





# Results // Operation





# Summary

- Framework for visual exploration of uncertain ocean forecasts
  - allows efficient planning of operations and placement of off-shore rigs
  - developed in close collaboration with domain experts

Thomas Höllt♣

Ahmed Magdy♣

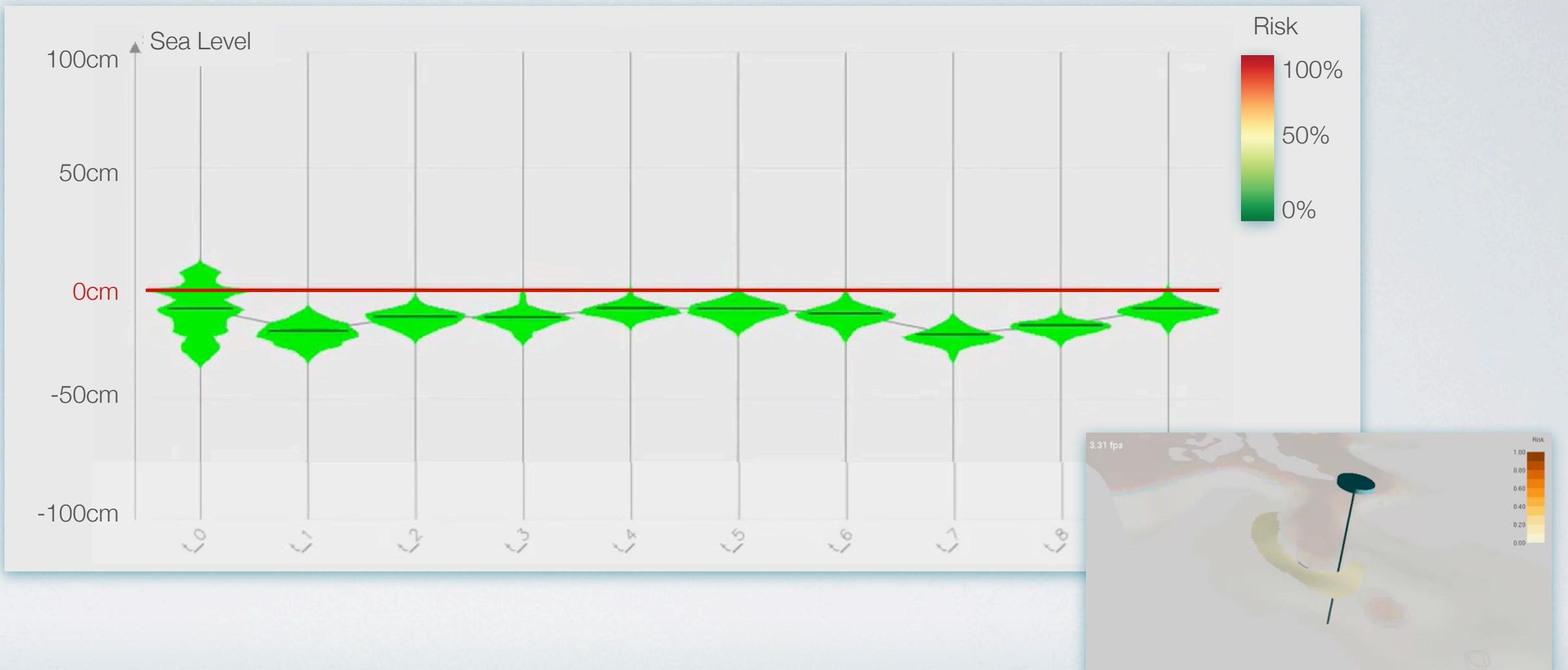
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# Questions?