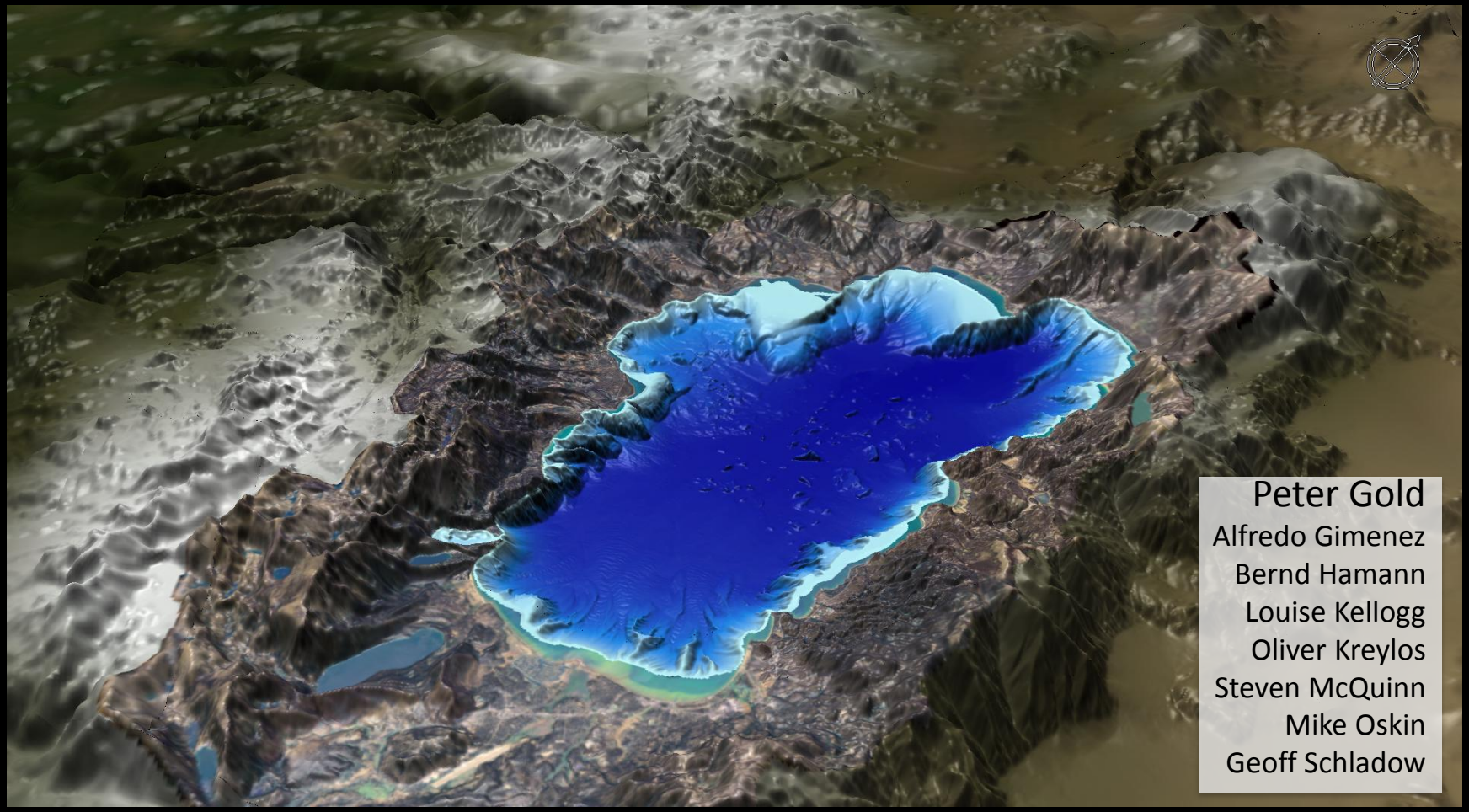
Interactive 3D Visualization and Virtual Exploration of the Lake Tahoe Basin



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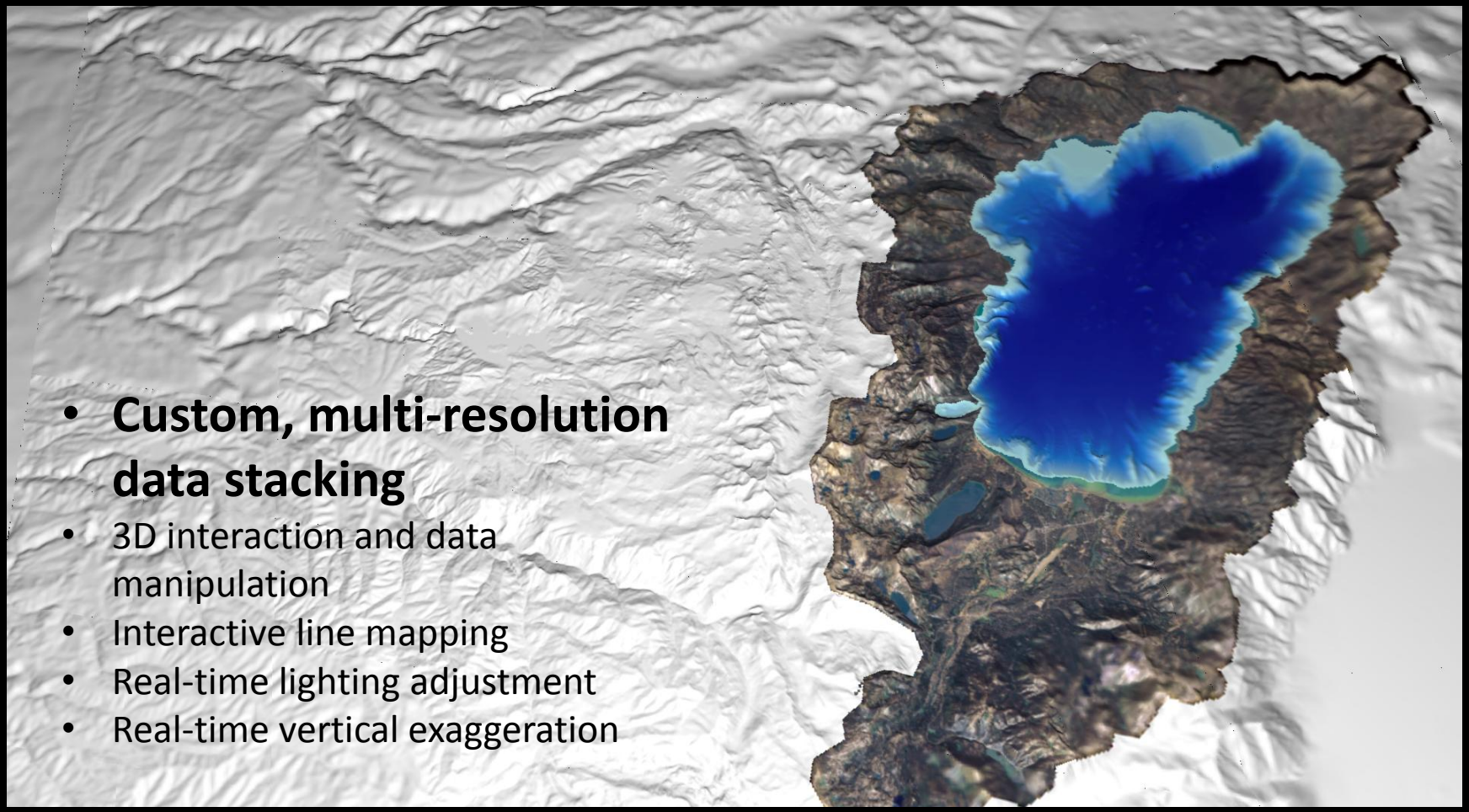
- Purpose
  - Present open source software tools for visualizing large geospatial and volumetric datasets
    - UC Davis Keck Center for Active Visualization in the Earth Sciences (keckcaves.org)
- Context
  - Lake visualization and informal science education
- Project goal
  - Develop the next generation of tools that enhance teaching and learning through 3D visualizations and interactions with the digital landscape

Outline

- Visualization tools
  1. ***Crusta:*** virtual globe
  2. ***LidarViewer:*** Point-cloud visualizer
  3. ***3D Visualizer:*** Volume renderer, data + model vis
  4. ***Augmented Reality:*** Enhancing physical space

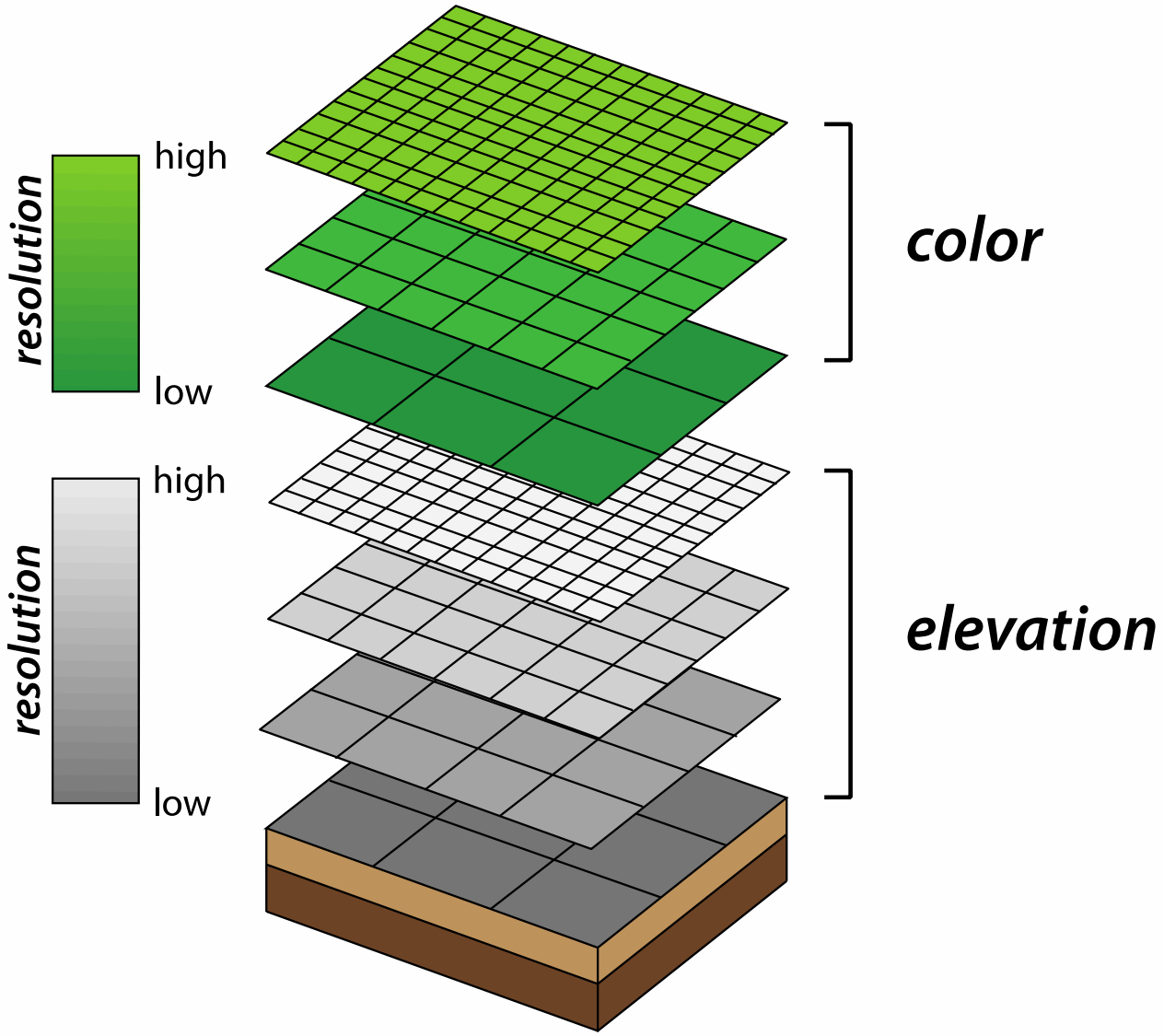
- What to take away
  - Real-time interaction
  - Data management
  - Research and educational applications
  - Free open source

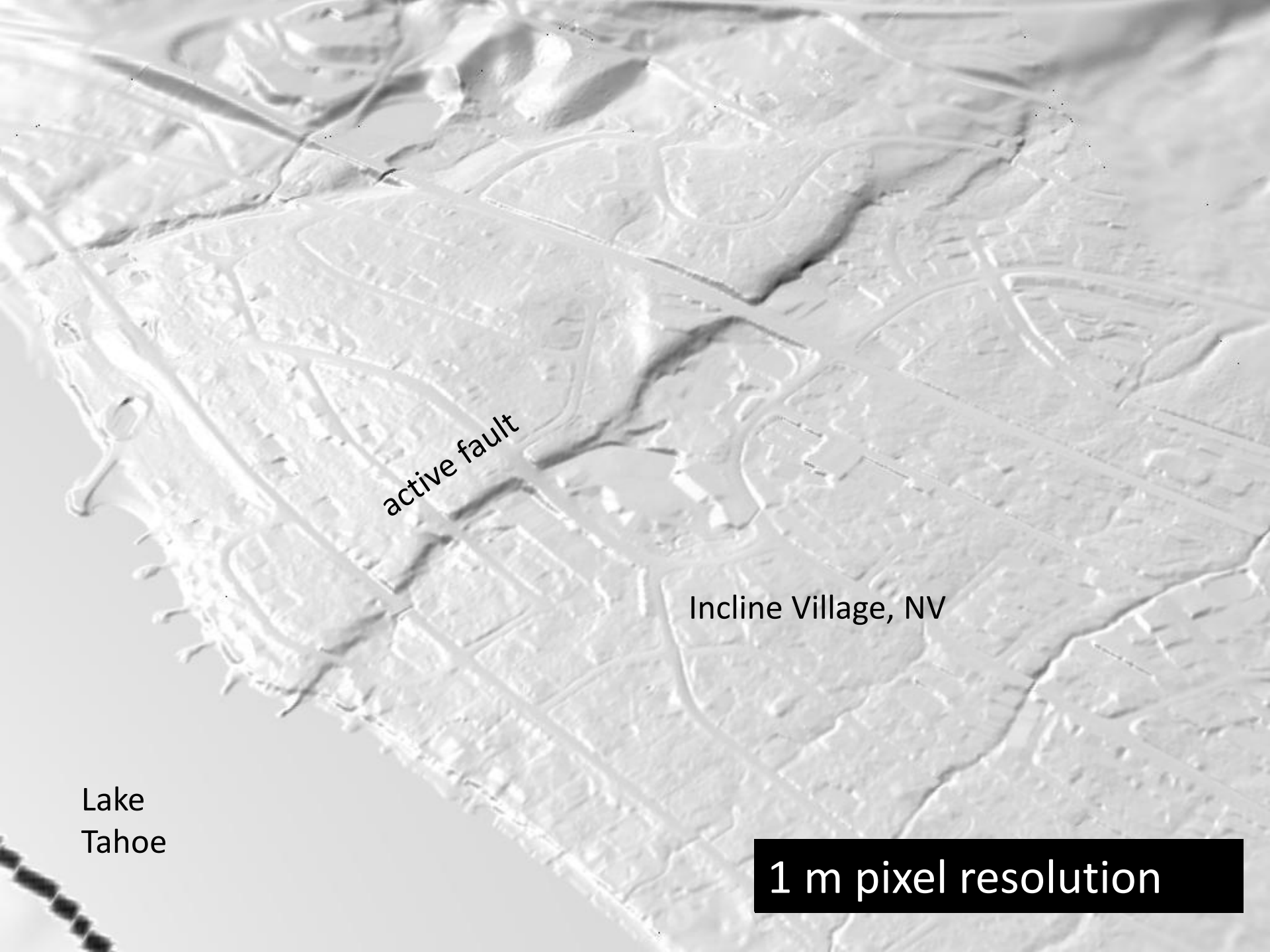
Crusta virtual globe



- **Custom, multi-resolution data stacking**
- 3D interaction and data manipulation
- Interactive line mapping
- Real-time lighting adjustment
- Real-time vertical exaggeration

Multi-resolution data layering



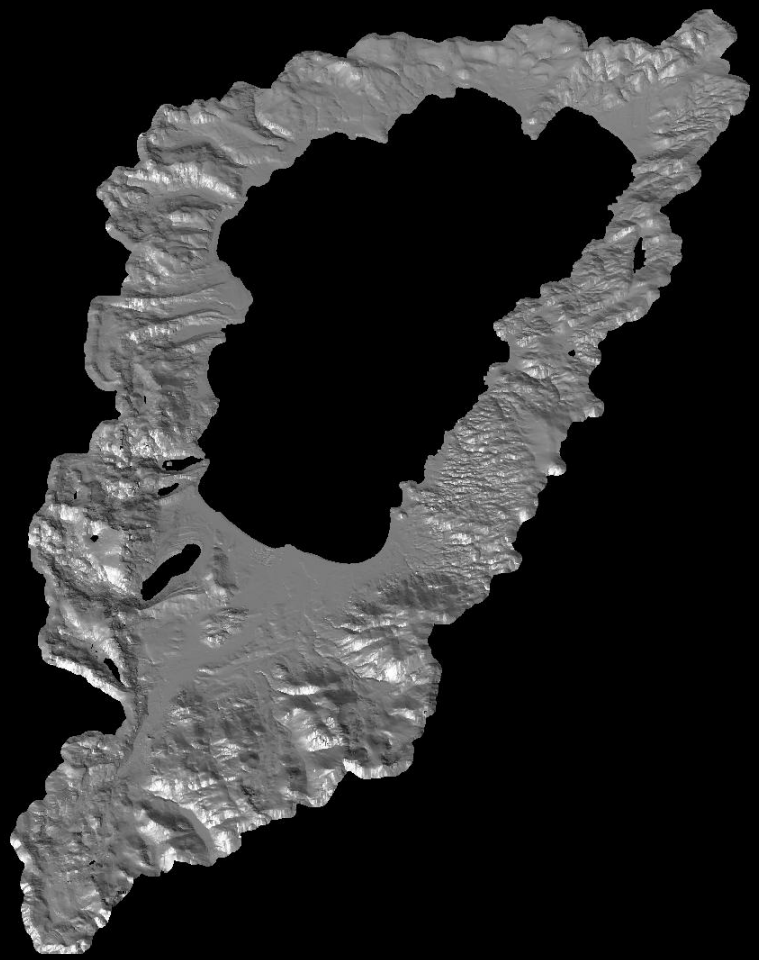

active fault
Incline Village, NV
Lake
Tahoe
1 m pixel resolution


250 m pixel resolution

Crusta

LiDARViewer

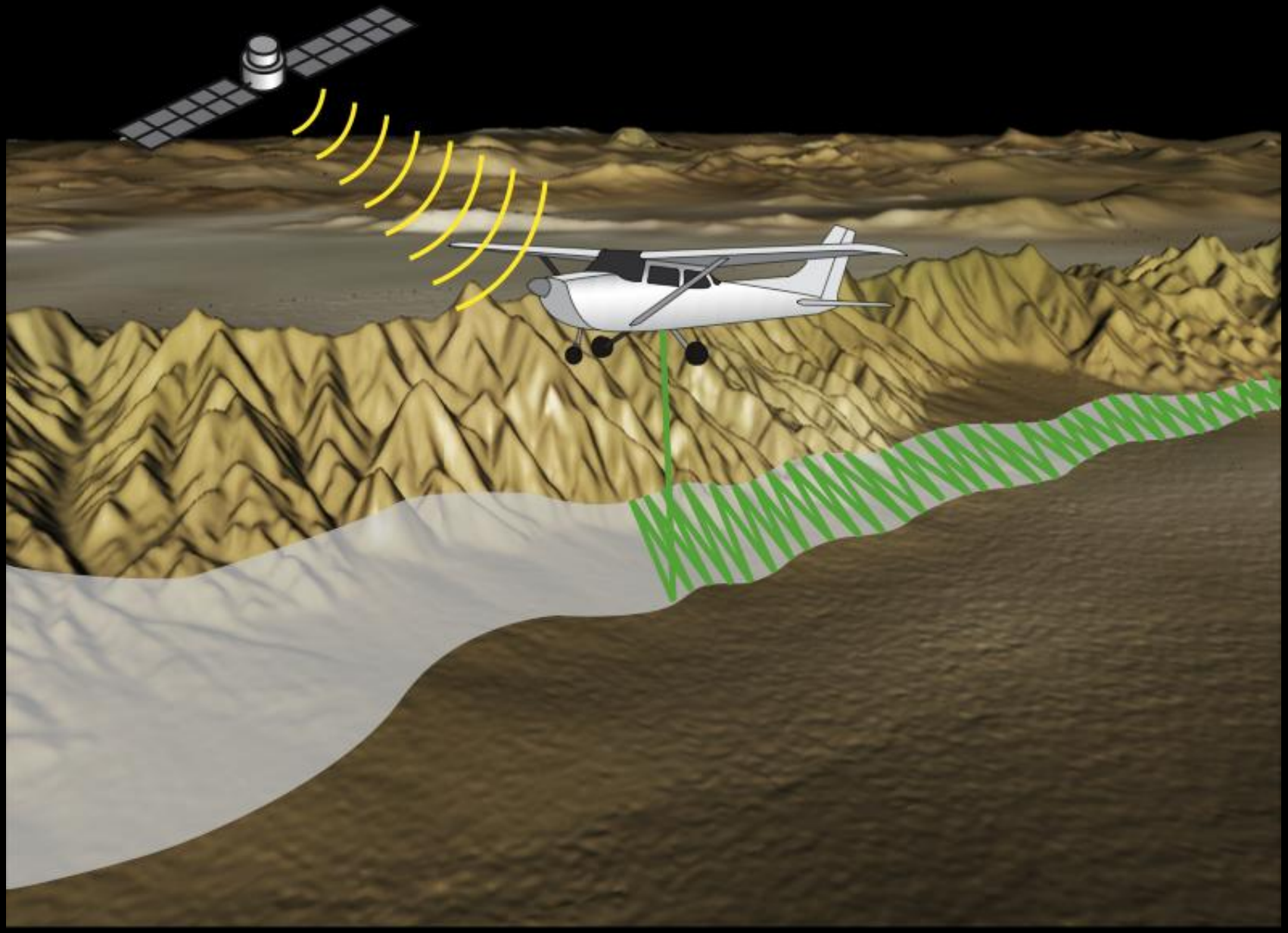
- Point-based interaction
- Interactive lighting and point-cloud manipulation
- Dynamic hillshade visualization
- Real-time lighting adjustment
- Interactive measurement and point selection



Points vs Surfaces

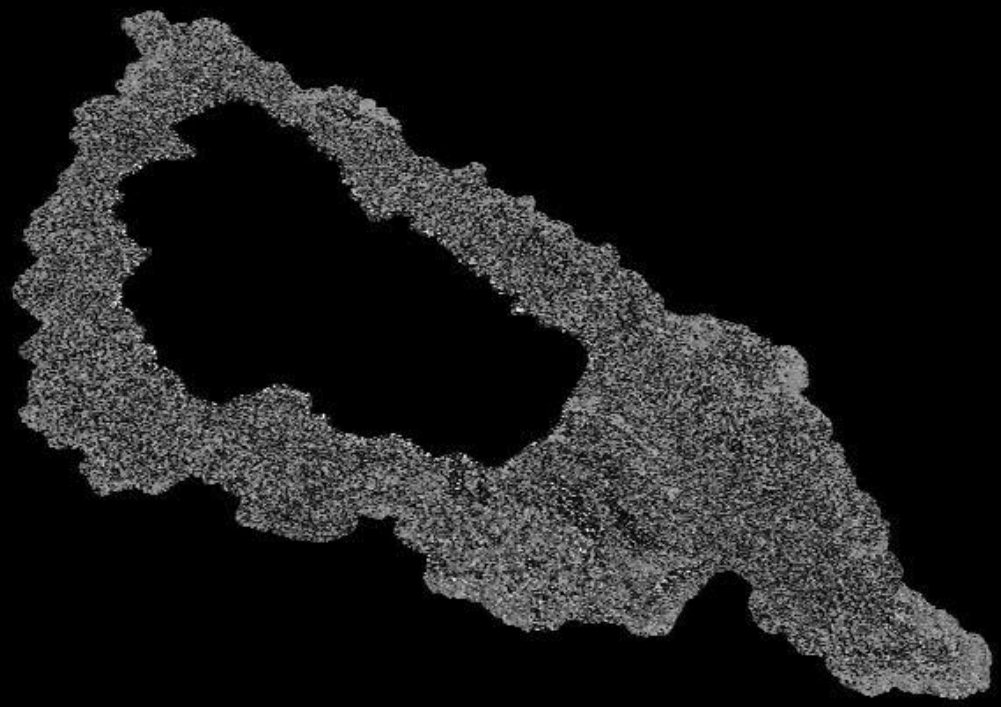
- Surfaces (e.g., DEMs) = continuous gridded surface model, no holes
- Points = x,y,z coordinates in space, have no area, point datasets have holes

Airborne LiDAR collection



Terrestrial or tripod LiDAR

LidarViewer



Data sources

Elevation Layers

5. Lake Tahoe Bathymetry (USGS)
4. Airborne LiDAR DEM (opentopography.org)
3. National Elevation Dataset-NED (USGS)
2. Shuttle Radar Topography Mission-SRTM (cgair.org, NASA)
1. Blue Marble (NASA)

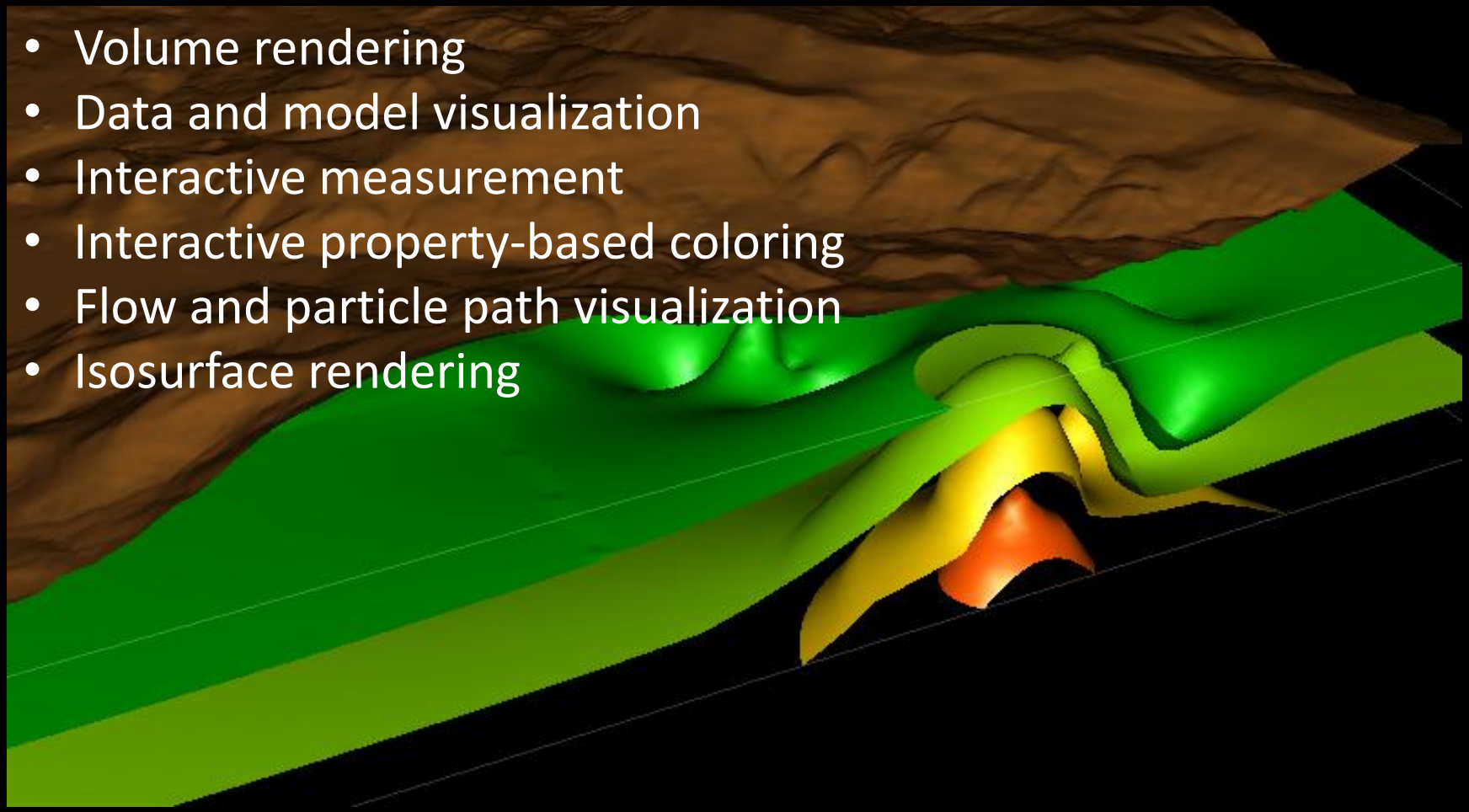
Color Layers

3. World View 2 (proprietary); NAIP (USGS)
2. Landsat/Global Land Survey (USGS)
1. Blue Marble (NASA)

Other data layers (rasters and polylines)

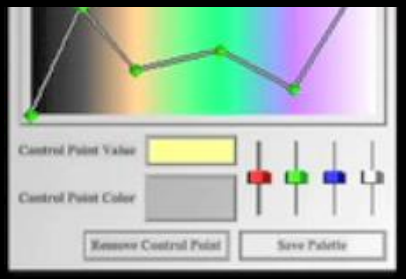
-Watershed boundaries
-Streams
-Fault lines
-Georeferenced maps
-Climate (e.g., rainfall, temperature)

3D Visualizer



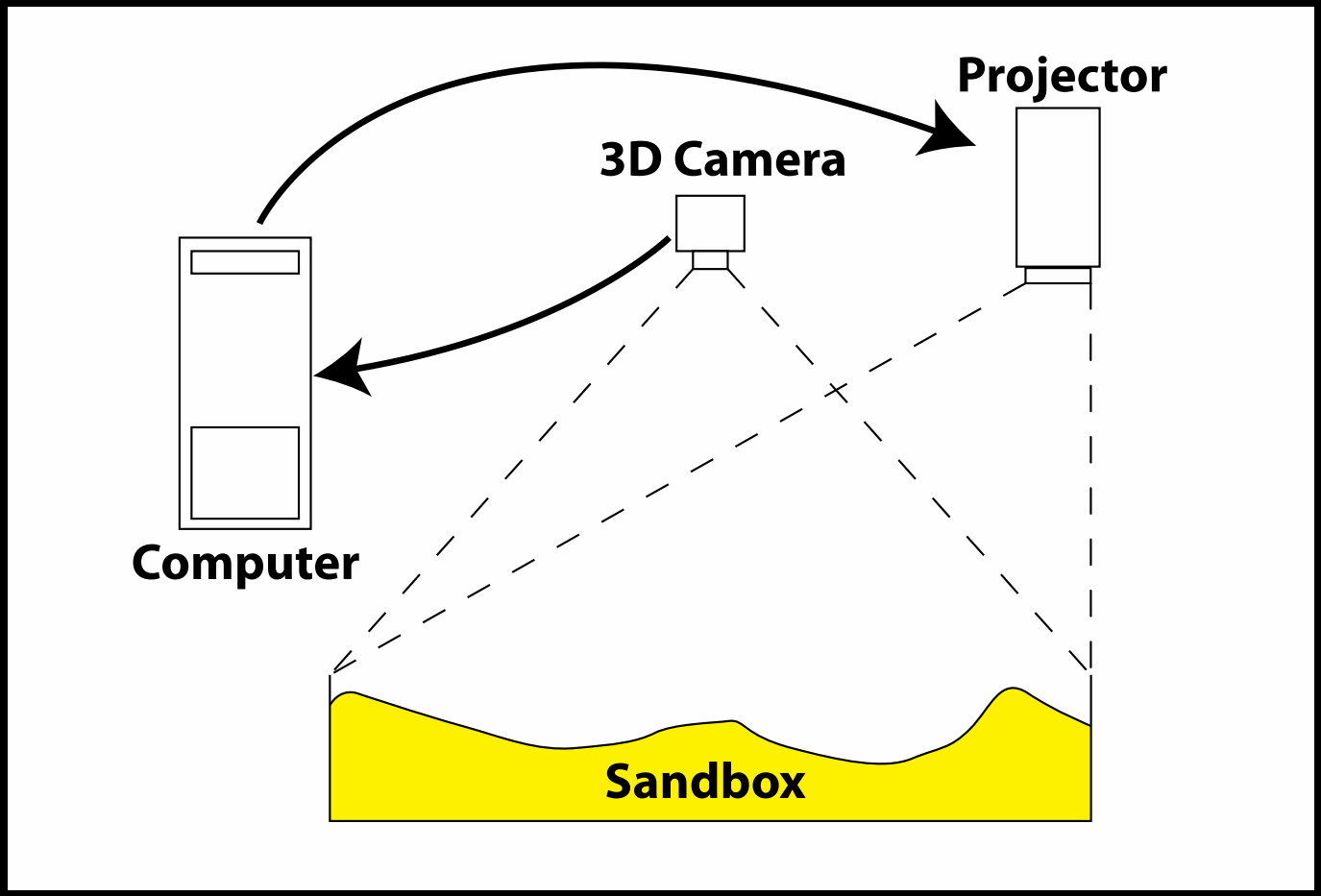
- Volume rendering
- Data and model visualization
- Interactive measurement
- Interactive property-based coloring
- Flow and particle path visualization
- Isosurface rendering

3D Visualizer



Augmented Reality

- Using technology to enhance interaction with physical environments



Augmented Reality

Thanks!

Software info and downloads at keckcaves.org