

# **LiDAR Applications for Range Management**

**Integration of Geo-spatial and Range Sciences  
Conference**

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# What is **LiDAR**?

- **L**ight **D**etection **A**nd **R**anging
- Scanning instrument mounted on airplane or satellite
- GPS used to determine instrument position and orientation



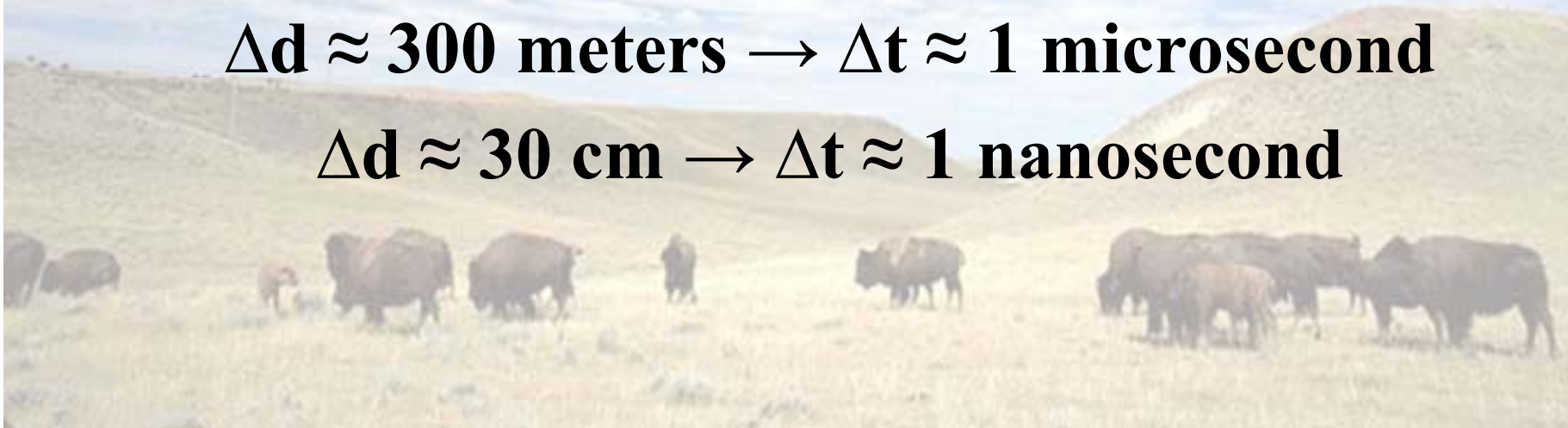
# How Does LiDAR Work?

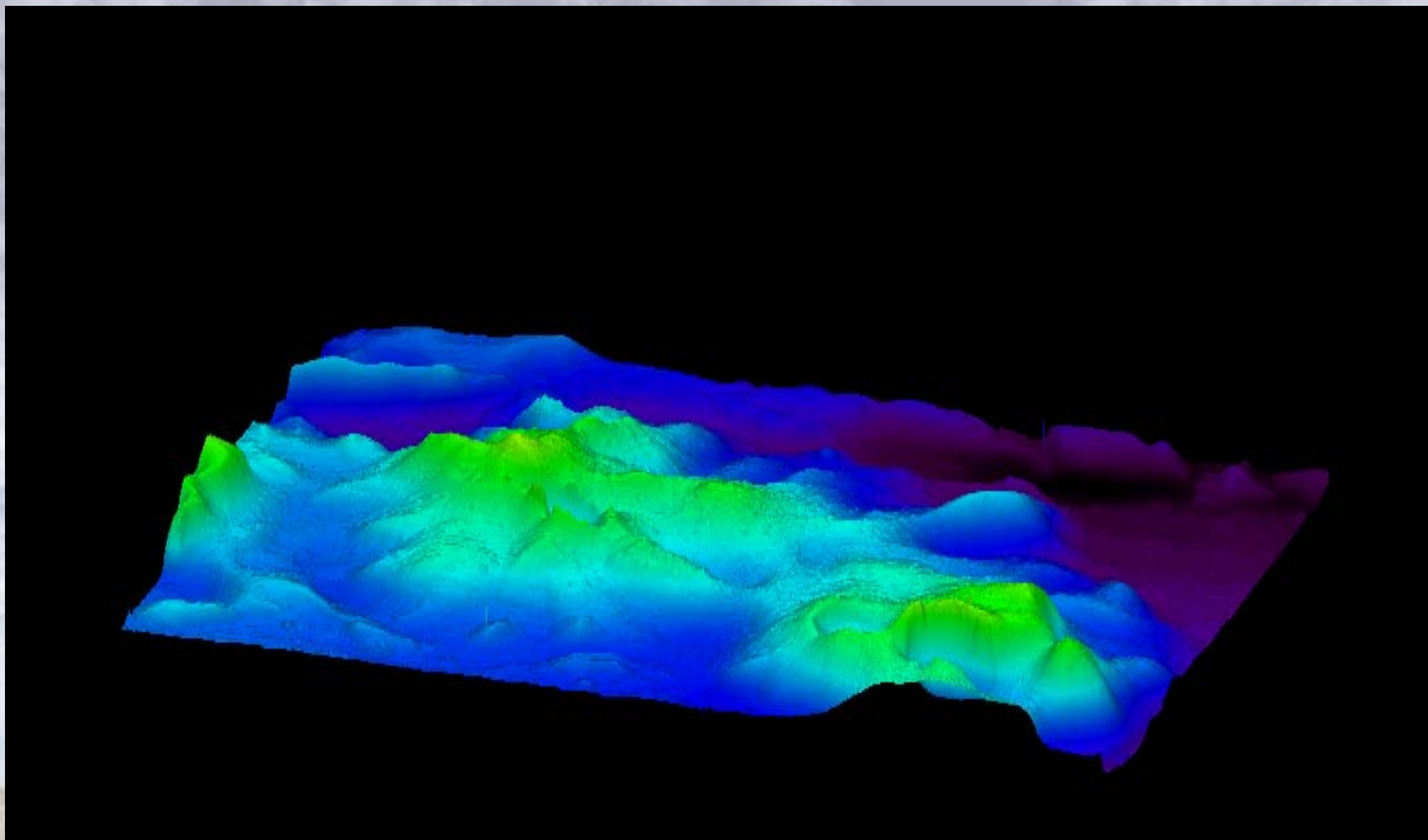
**Determines distance using a pulse of (laser) light**

**distance = speed of light  $\times$  time**

**$\Delta d \approx 300$  meters  $\rightarrow \Delta t \approx 1$  microsecond**

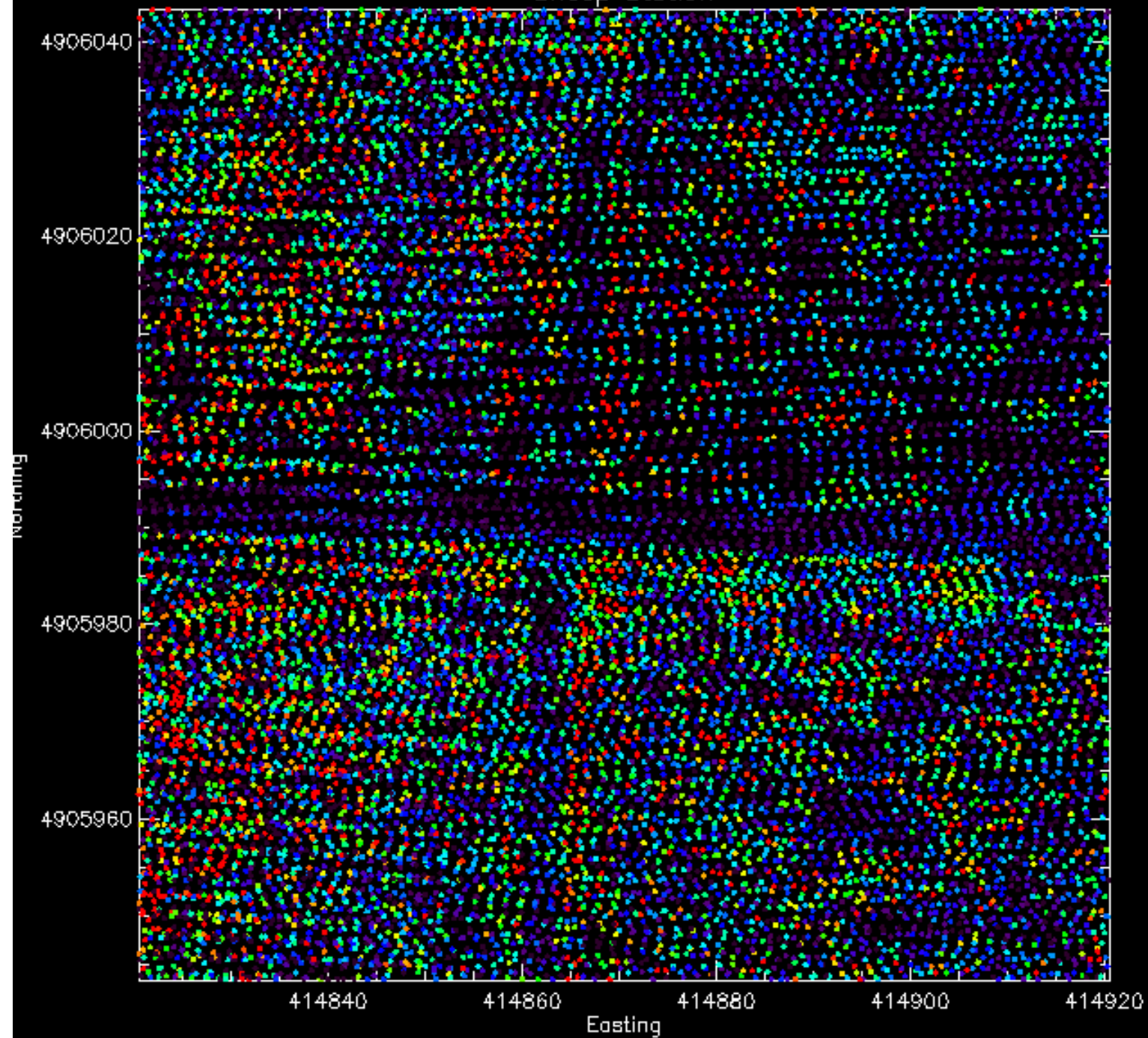
**$\Delta d \approx 30$  cm  $\rightarrow \Delta t \approx 1$  nanosecond**





**AKA Airborne Laser Swath Mapping (ALSM)**  
**AKA Airborne Laser Altimetry**

Sheep Station



# Advantages of LiDAR

- **High data density**
- **Easily cover large areas**
- **Can map remote and inaccessible areas**
- **Ground survey teams needed only for validation**
- **May be cheaper than ground surveys**

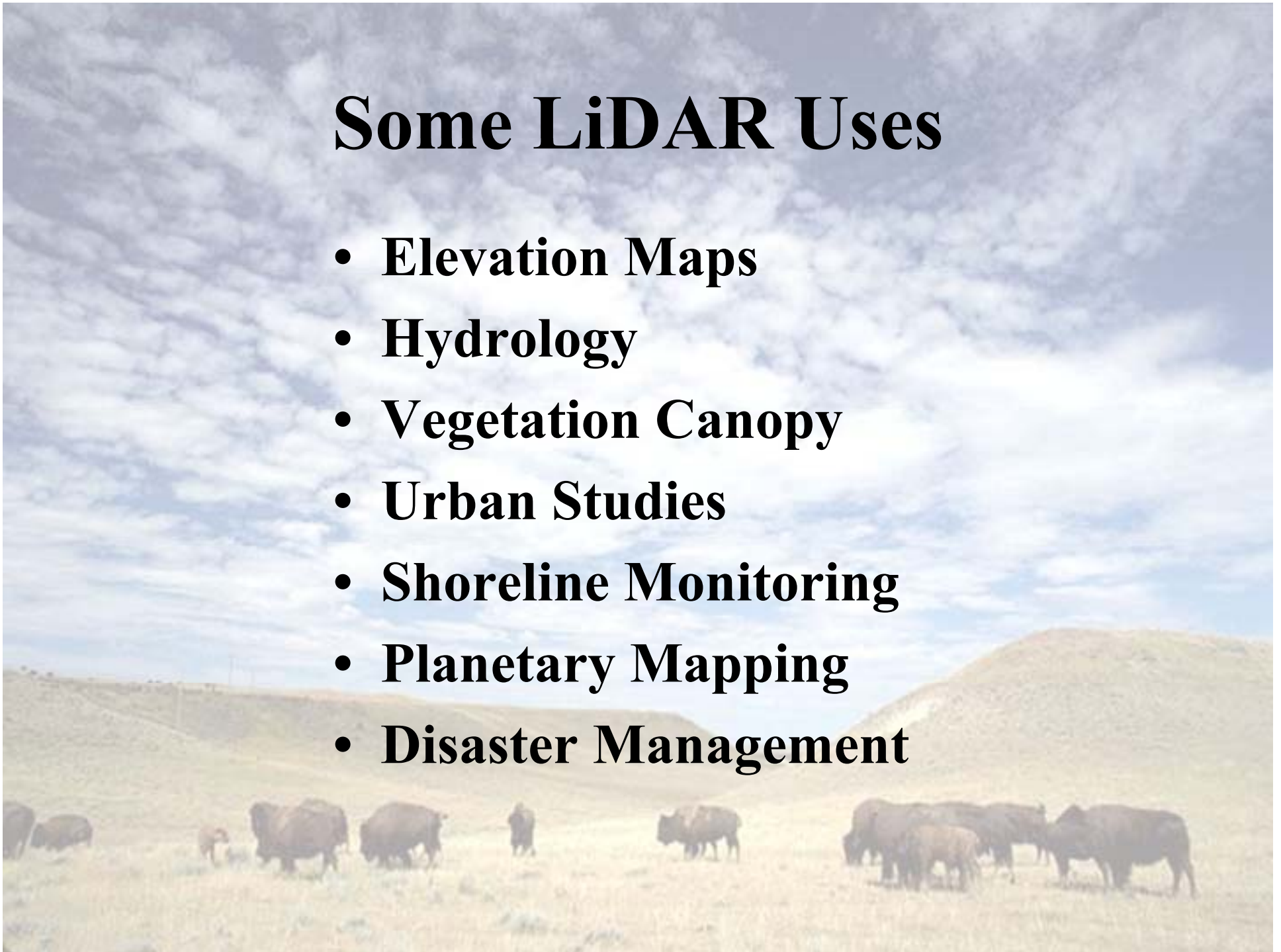


# **Disadvantages of LiDAR**

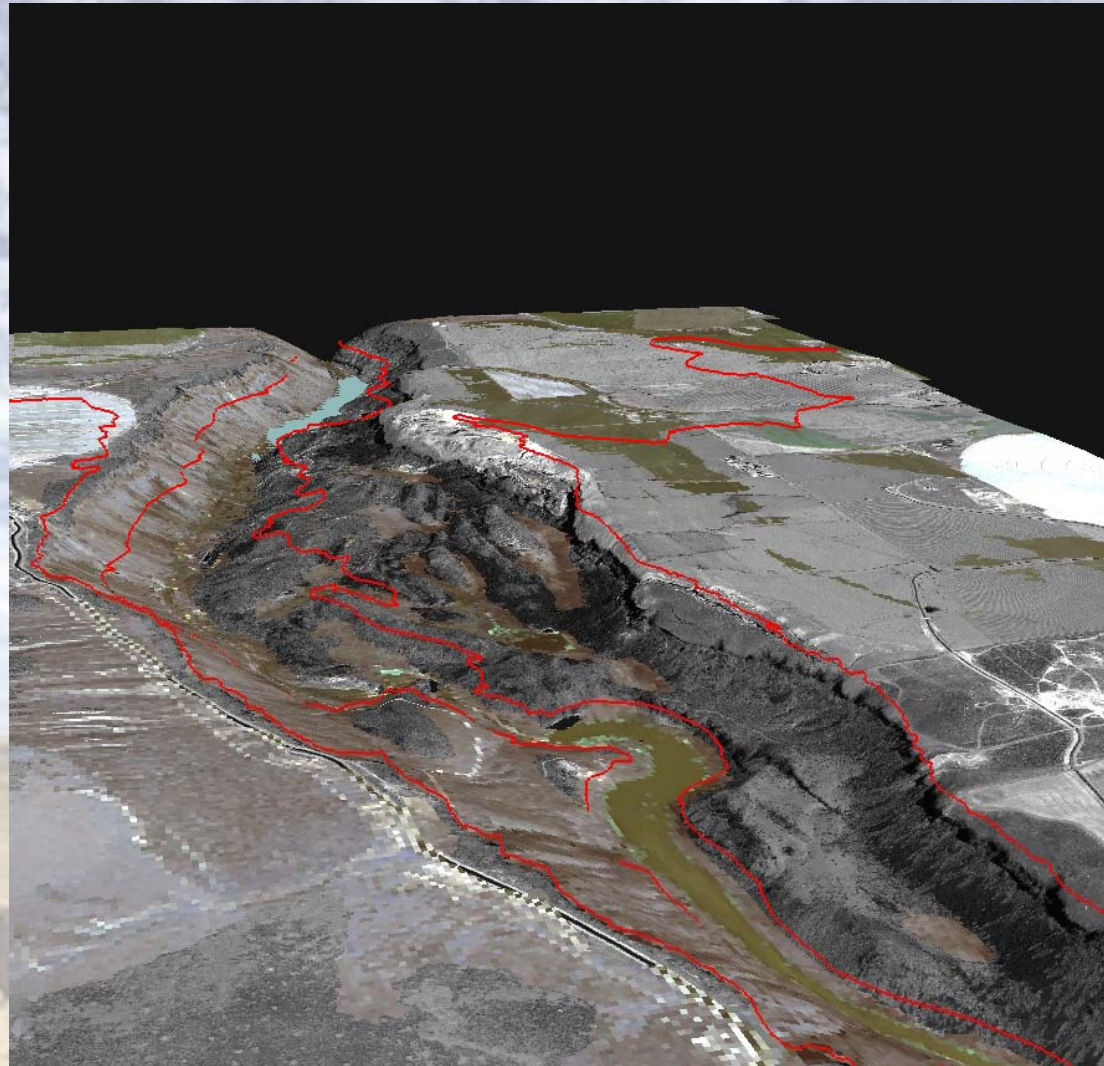
- **Need good weather to fly**
- **Scheduling**
- **New technology means possible issues with quality**
- **Large datasets (millions of data points)**
- **Computationally intensive**
- **Terrain may be obscured by vegetation**
- **May be costlier than ground surveys**

# Some LiDAR Uses

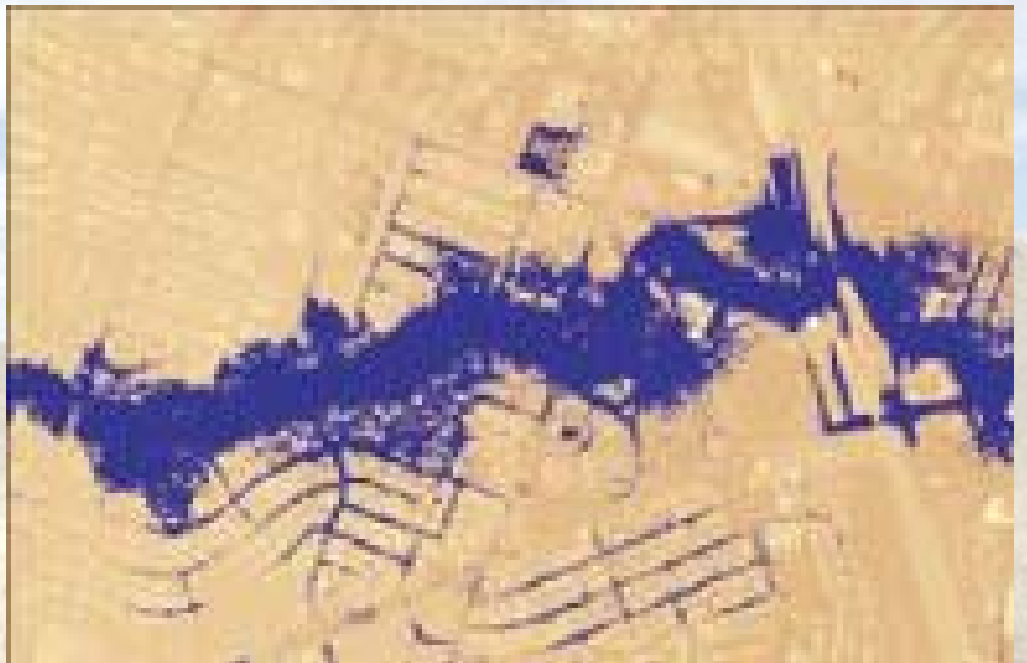
- **Elevation Maps**
- **Hydrology**
- **Vegetation Canopy**
- **Urban Studies**
- **Shoreline Monitoring**
- **Planetary Mapping**
- **Disaster Management**



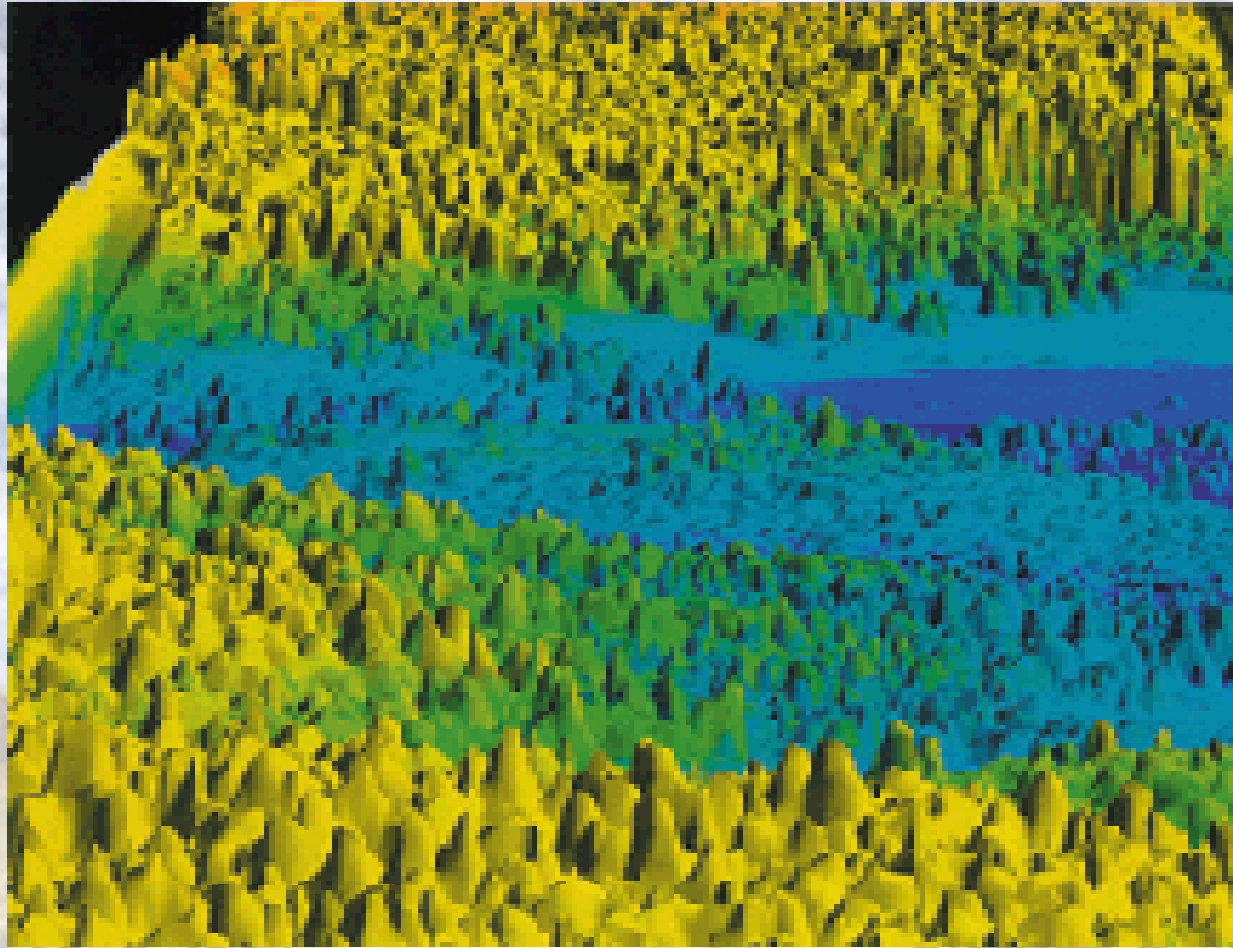
# Elevation



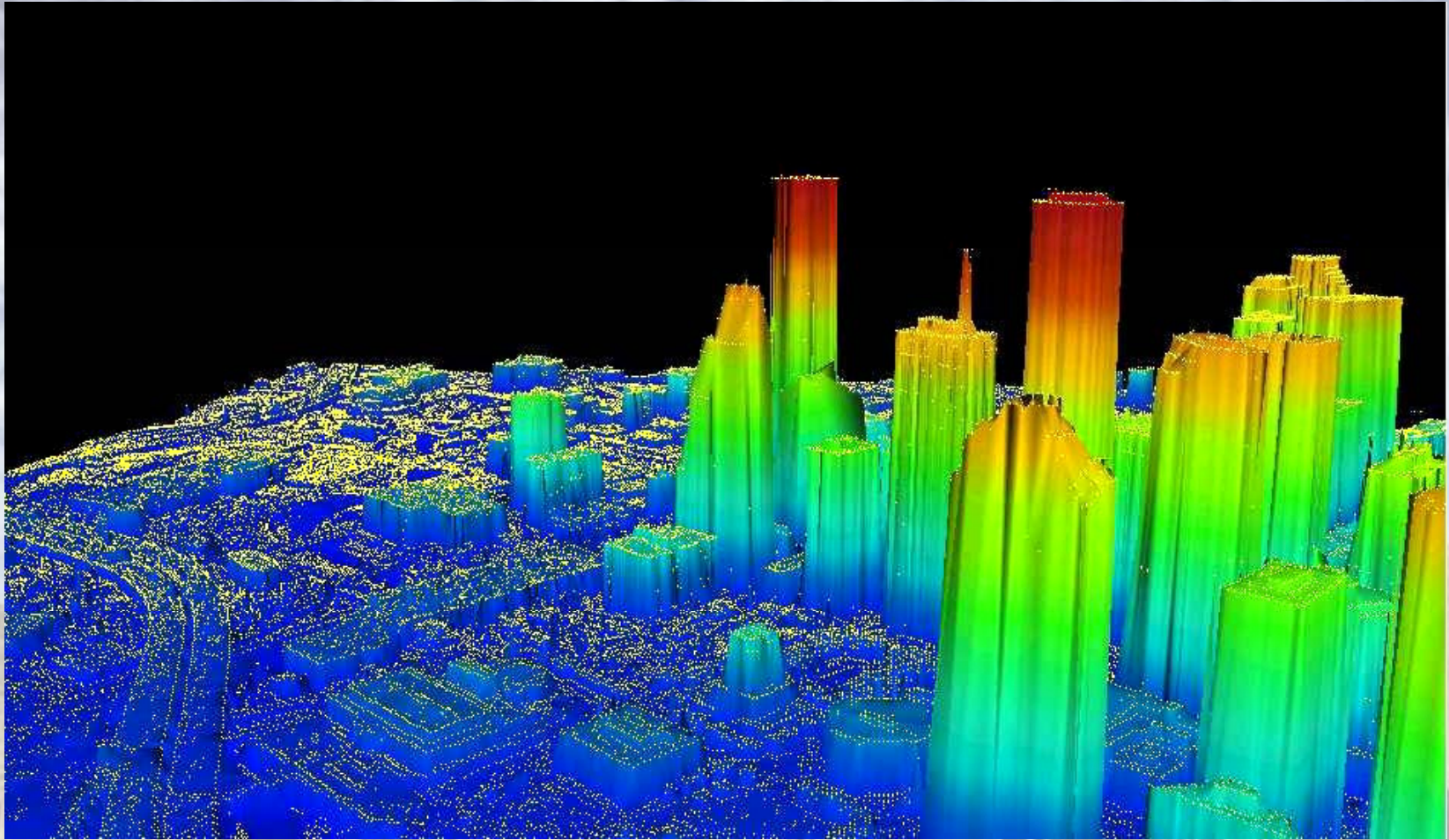
# Hydrology



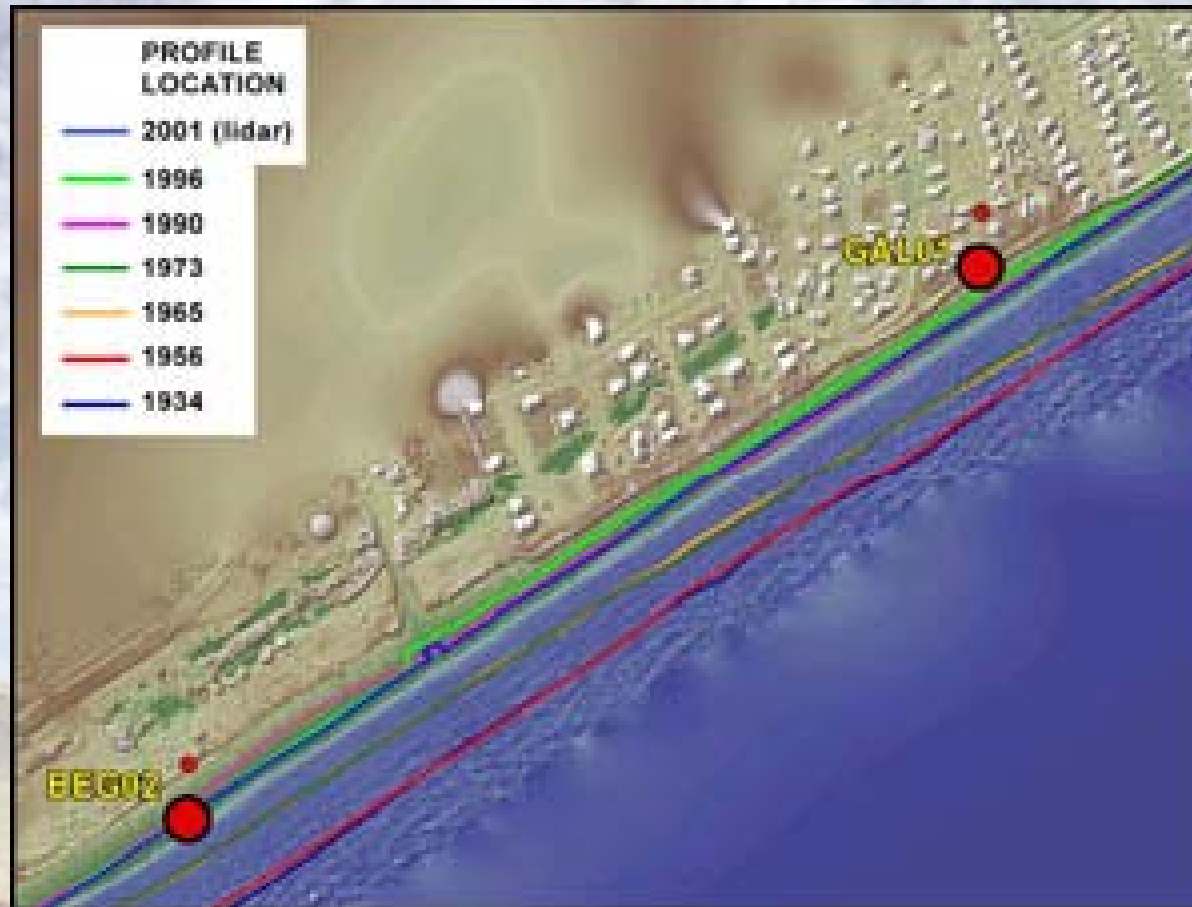
# Vegetation Canopy



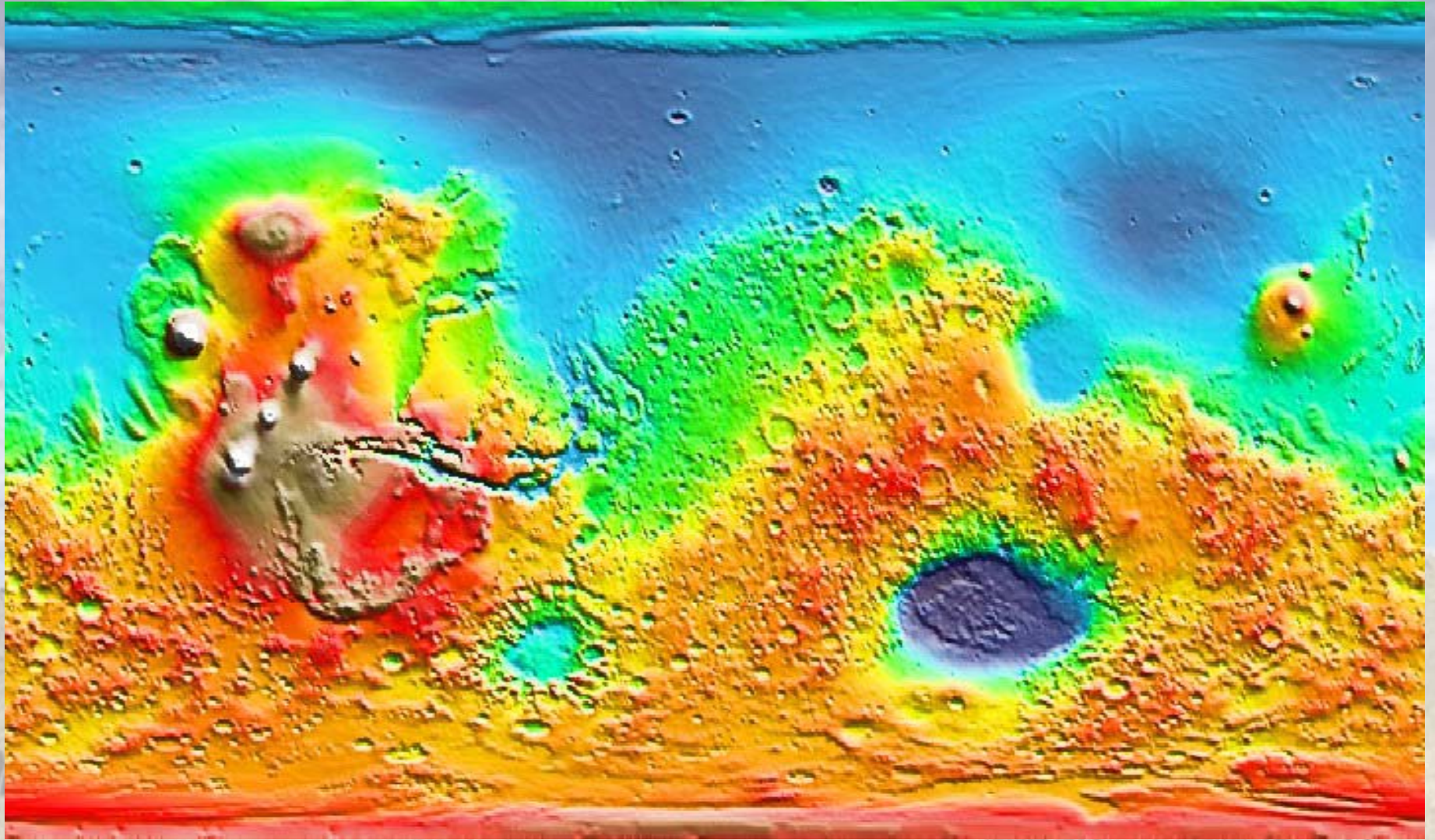
# Urban Studies



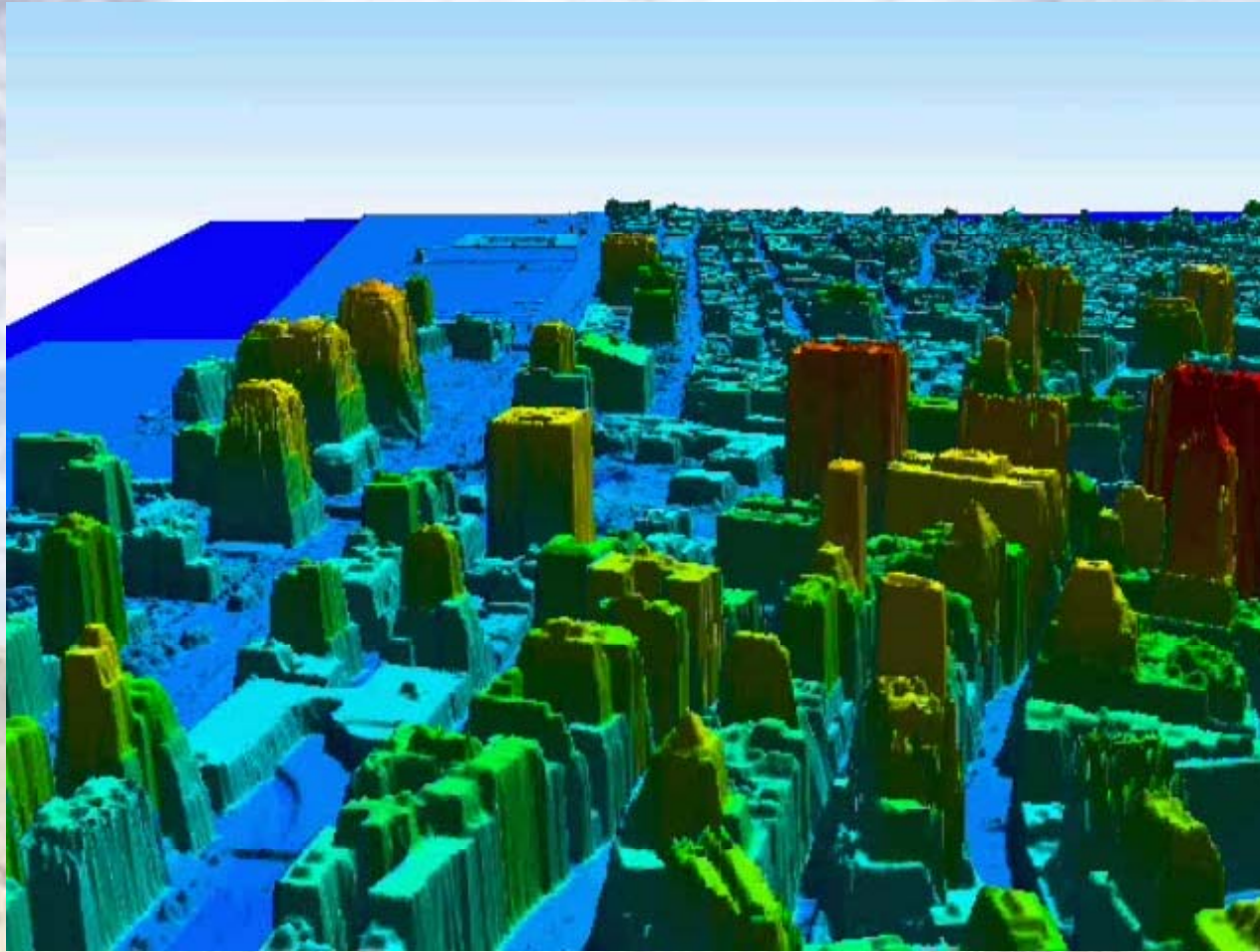
# Shoreline Monitoring



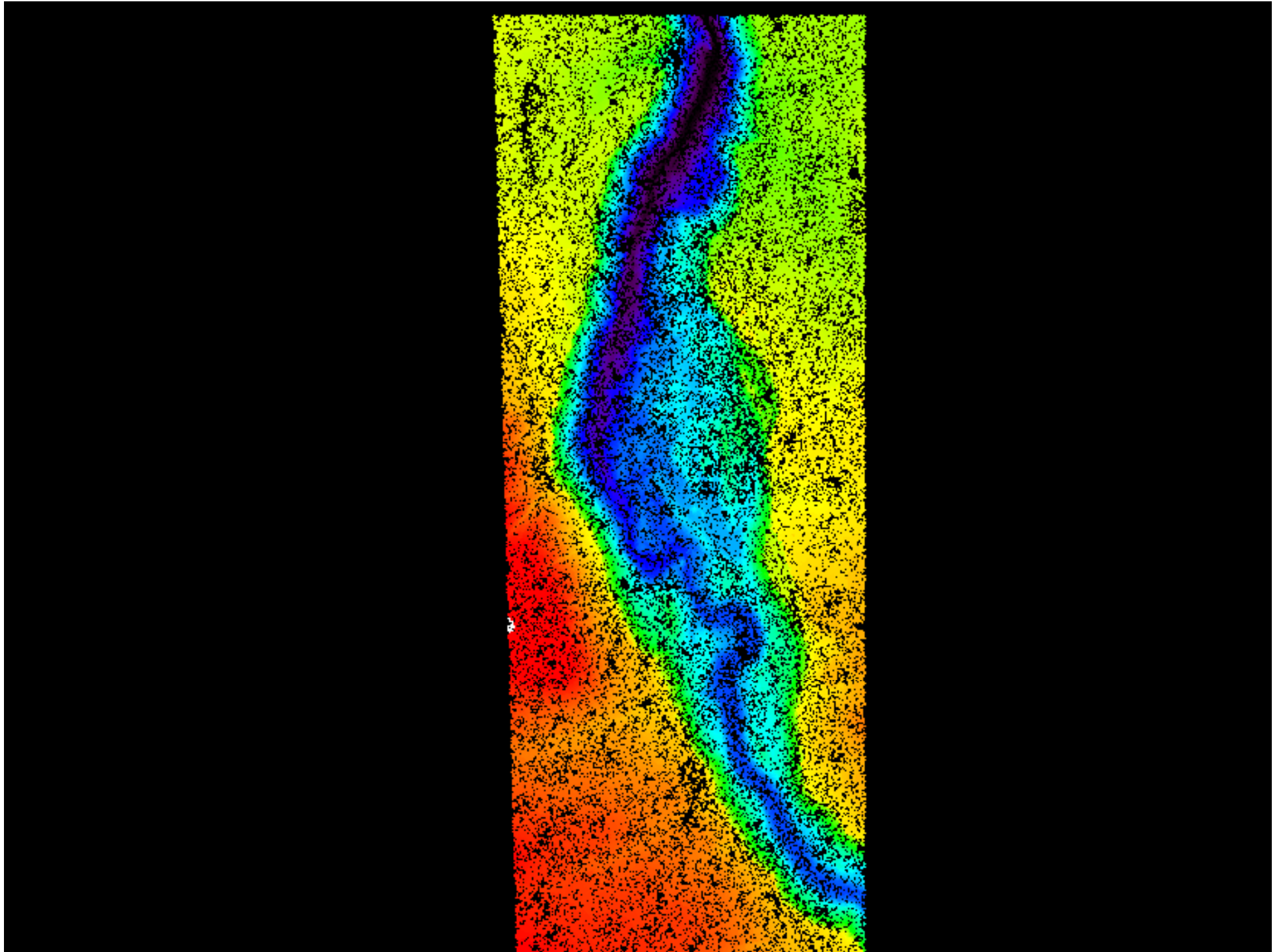
# Planetary Mapping

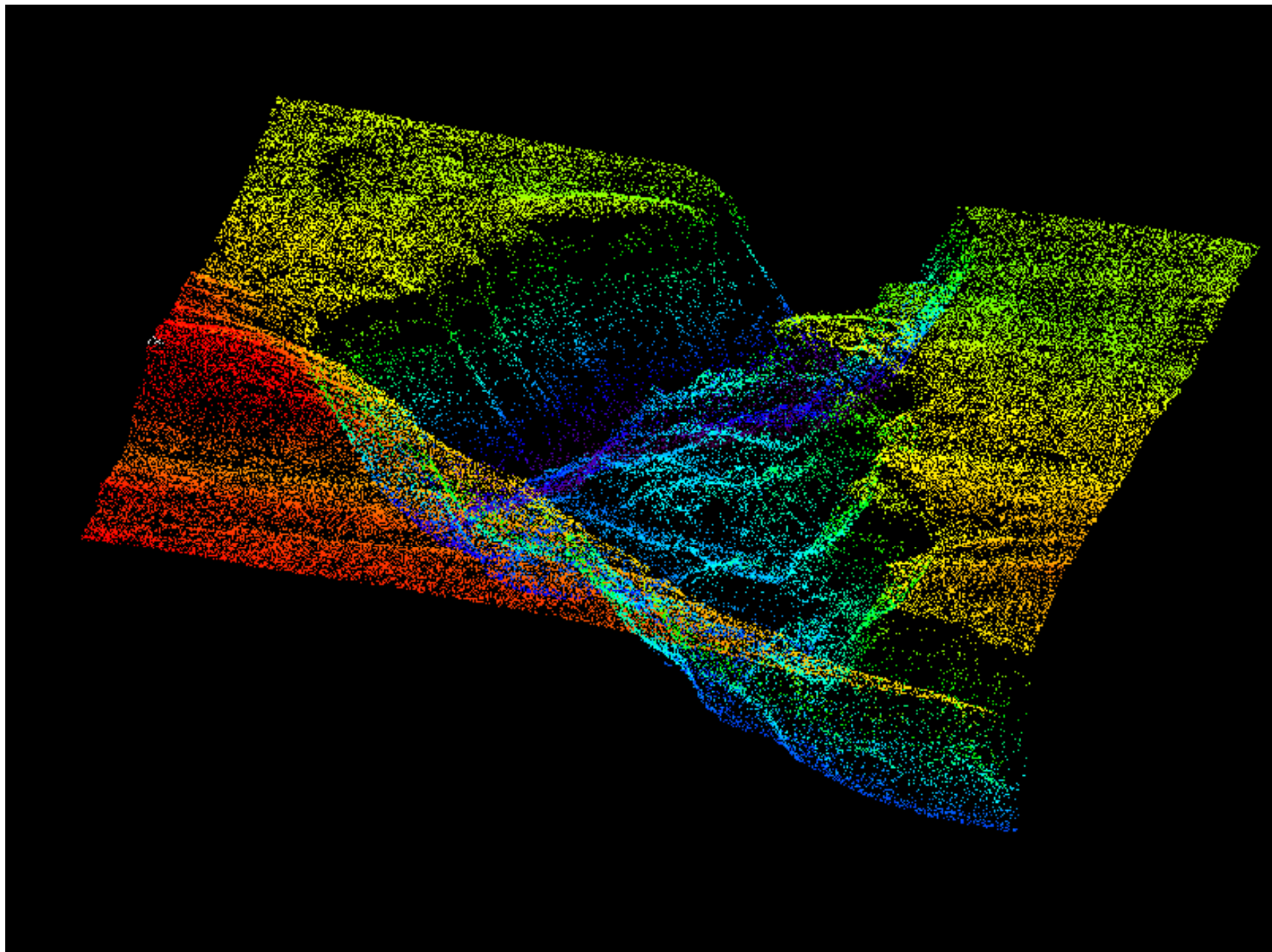


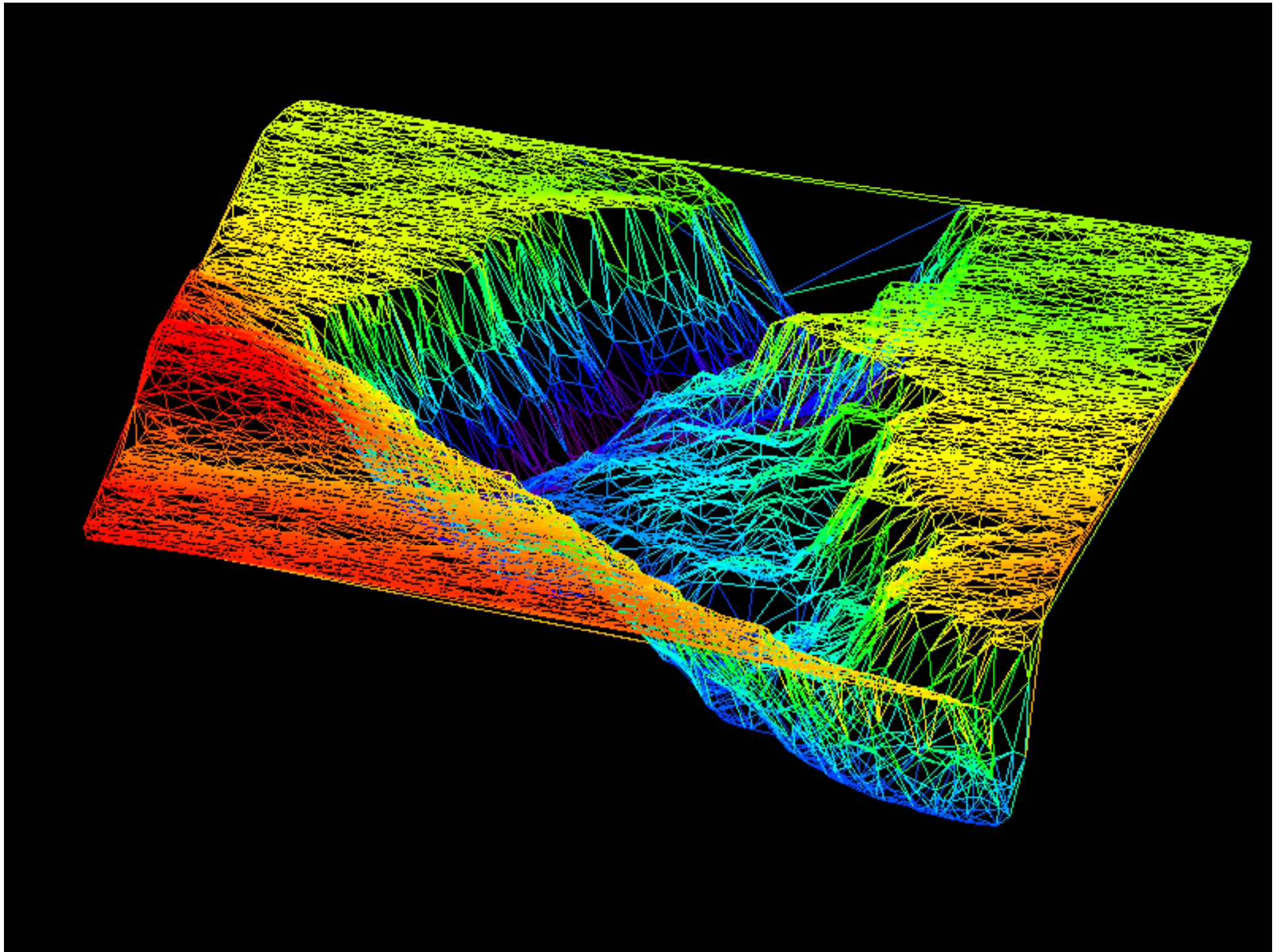
# Disasters - WTC Attack

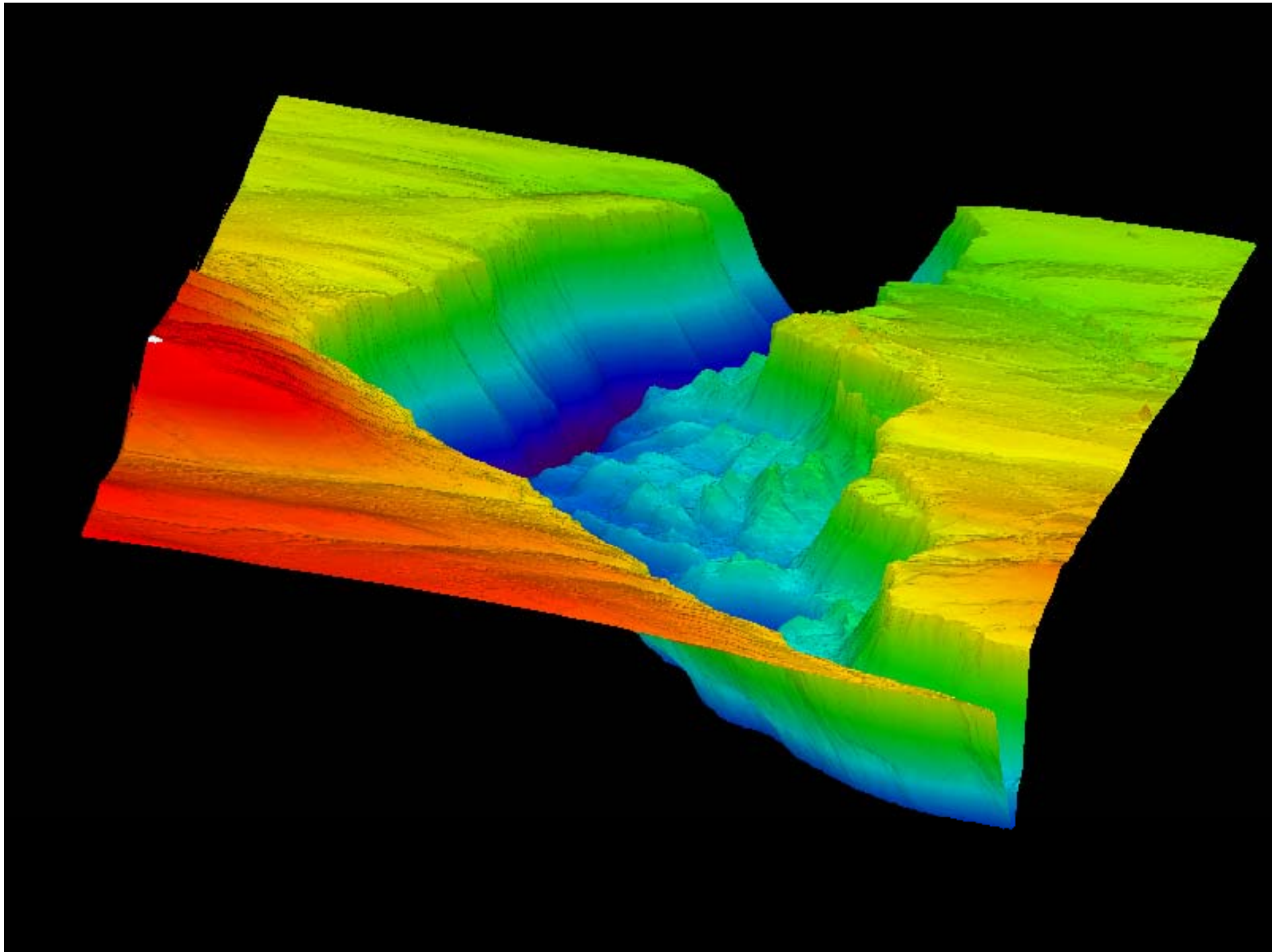


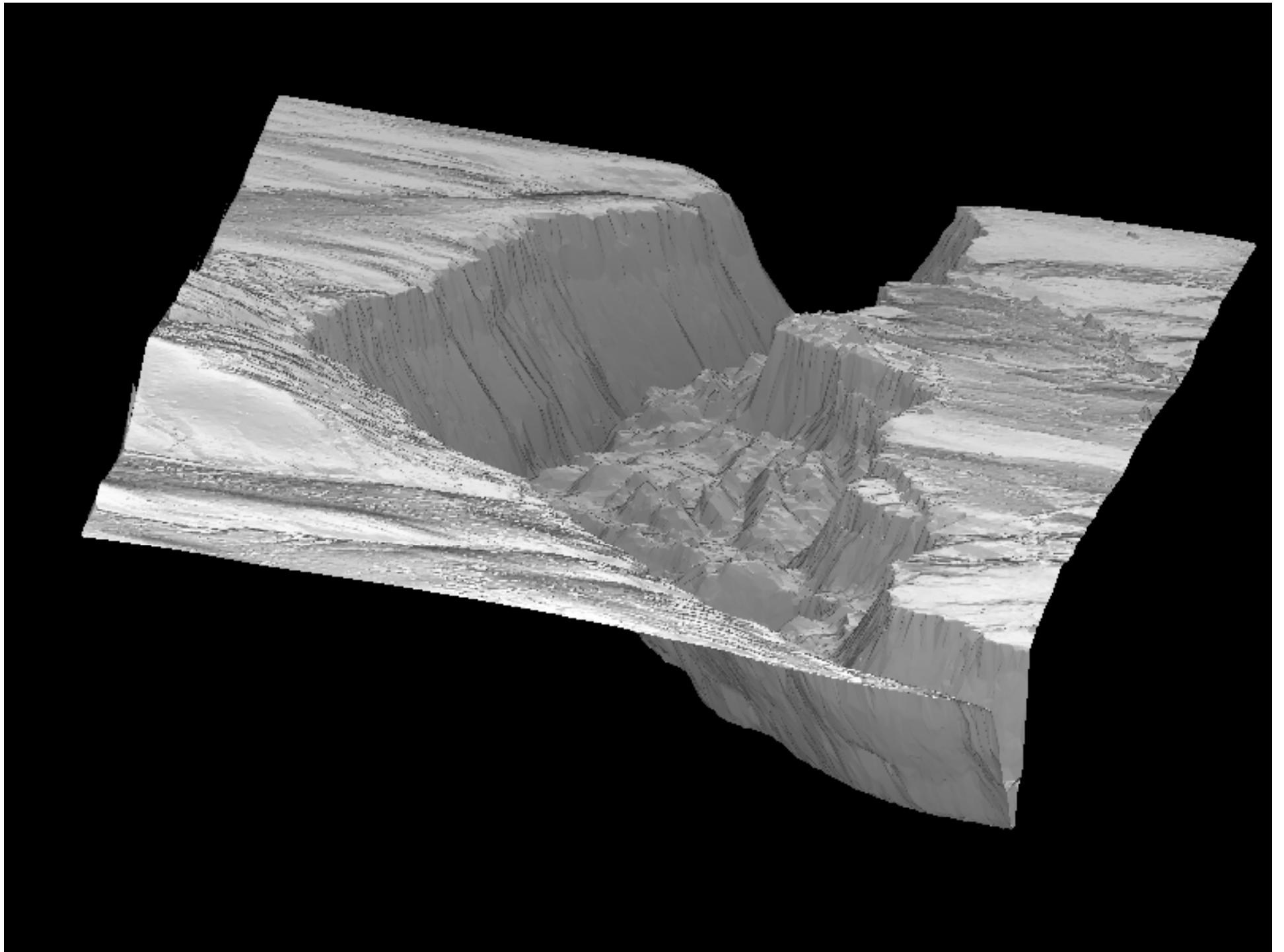


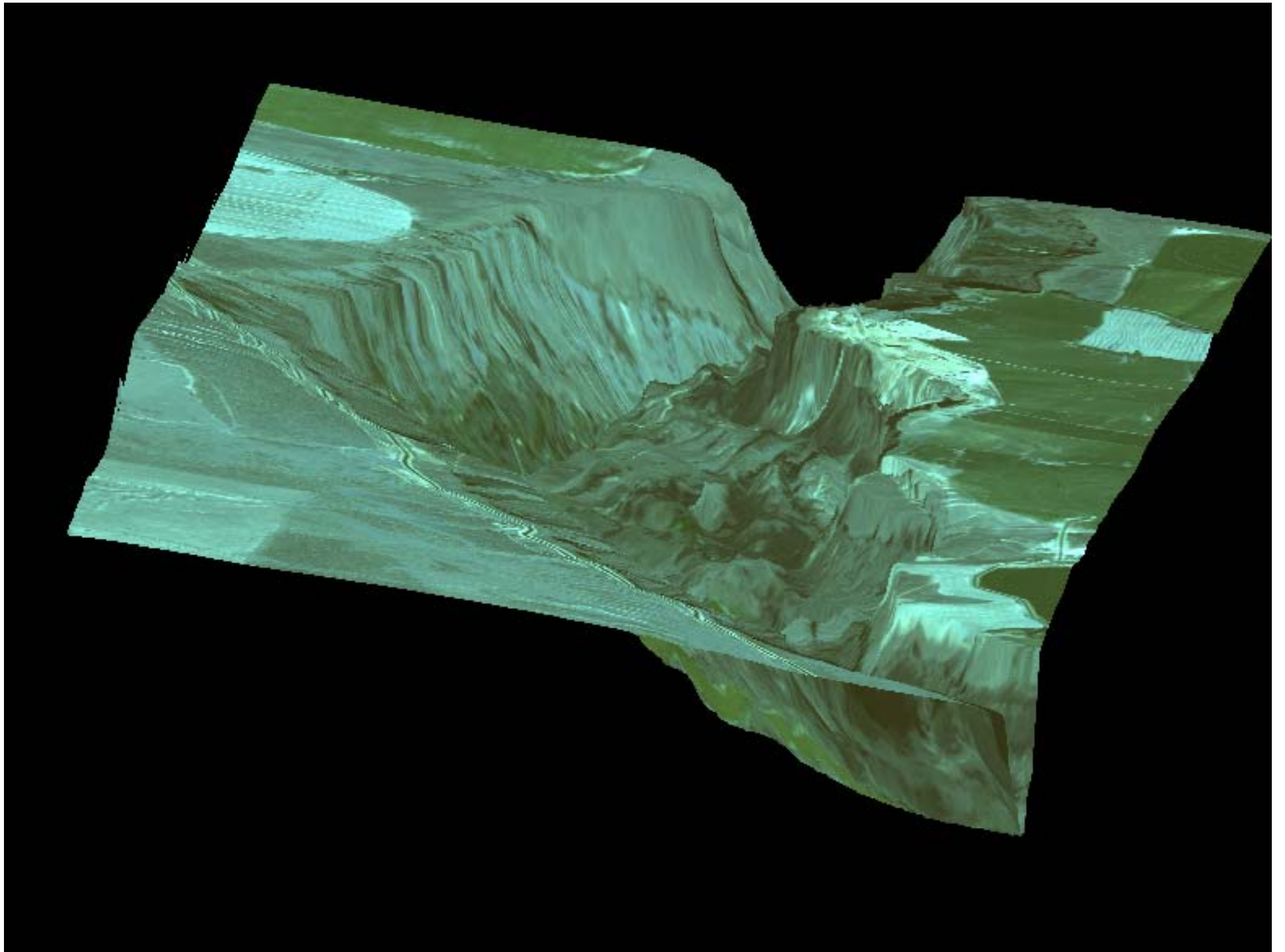






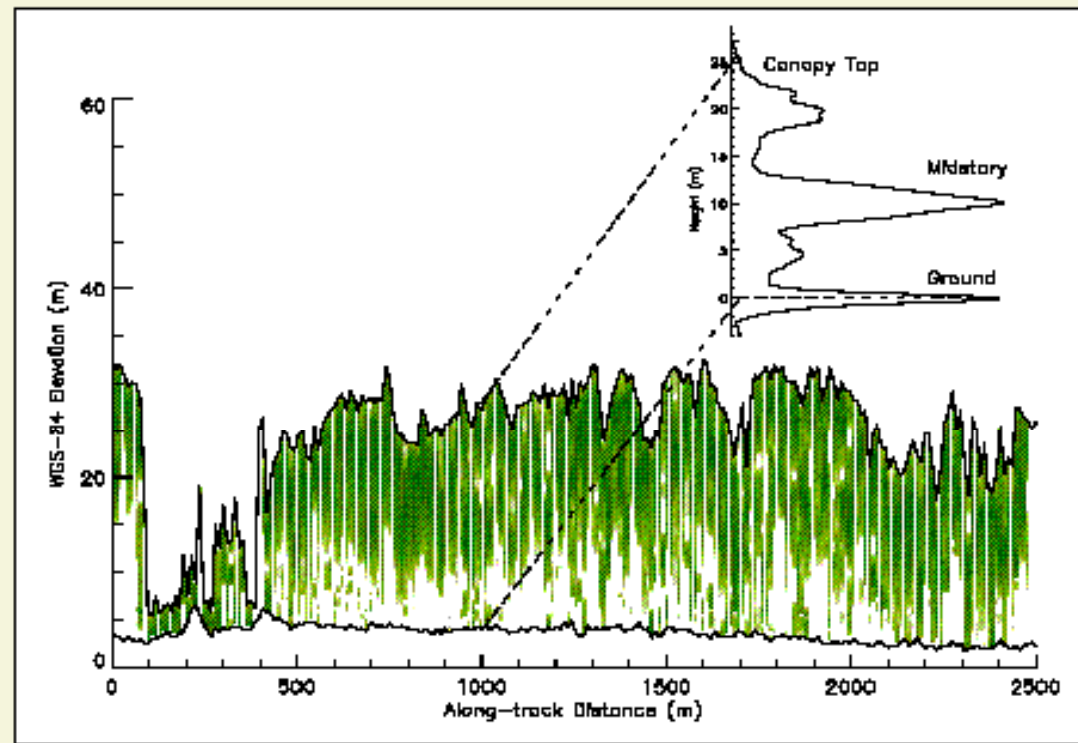
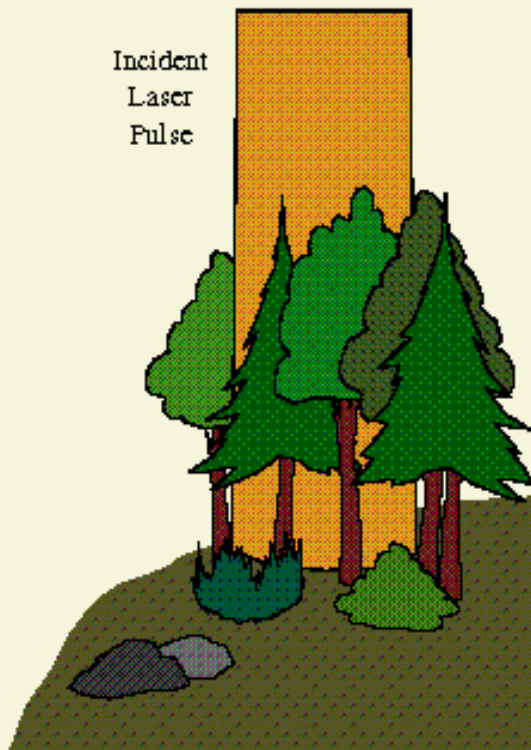


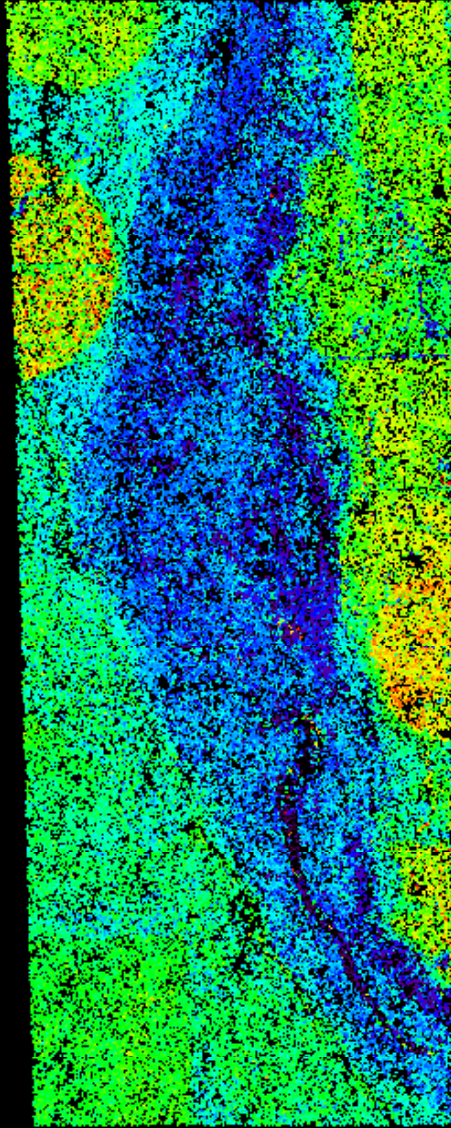
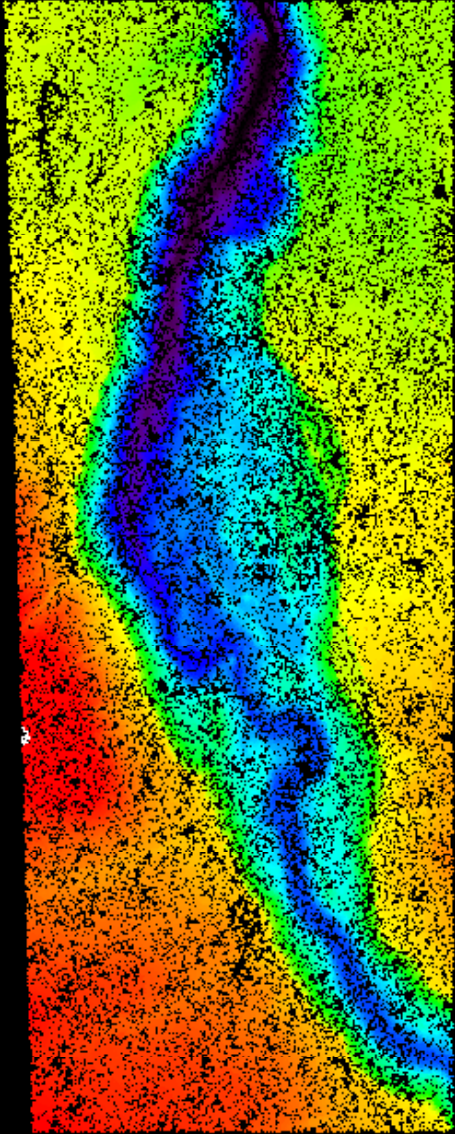




# Data Characteristics

- Intensity
- Multiple pulses





# Providers and Cost

**Airborne 1 (Los Angeles, California)**

[www.airborne1.com](http://www.airborne1.com)

**Horizons (Rapid City, South Dakota)**

[www.horizonsinc.com](http://www.horizonsinc.com)

**National Center for Airborne Laser Mapping  
(University of Florida & University of California)**

[www.ncalm.ufl.edu](http://www.ncalm.ufl.edu)

**Cost: few dollars per acre  
(over a thousand dollars per square mile)**

# Accuracy

- **Absolute accuracy (relative to GPS)**

**Horizontal: 1 m**

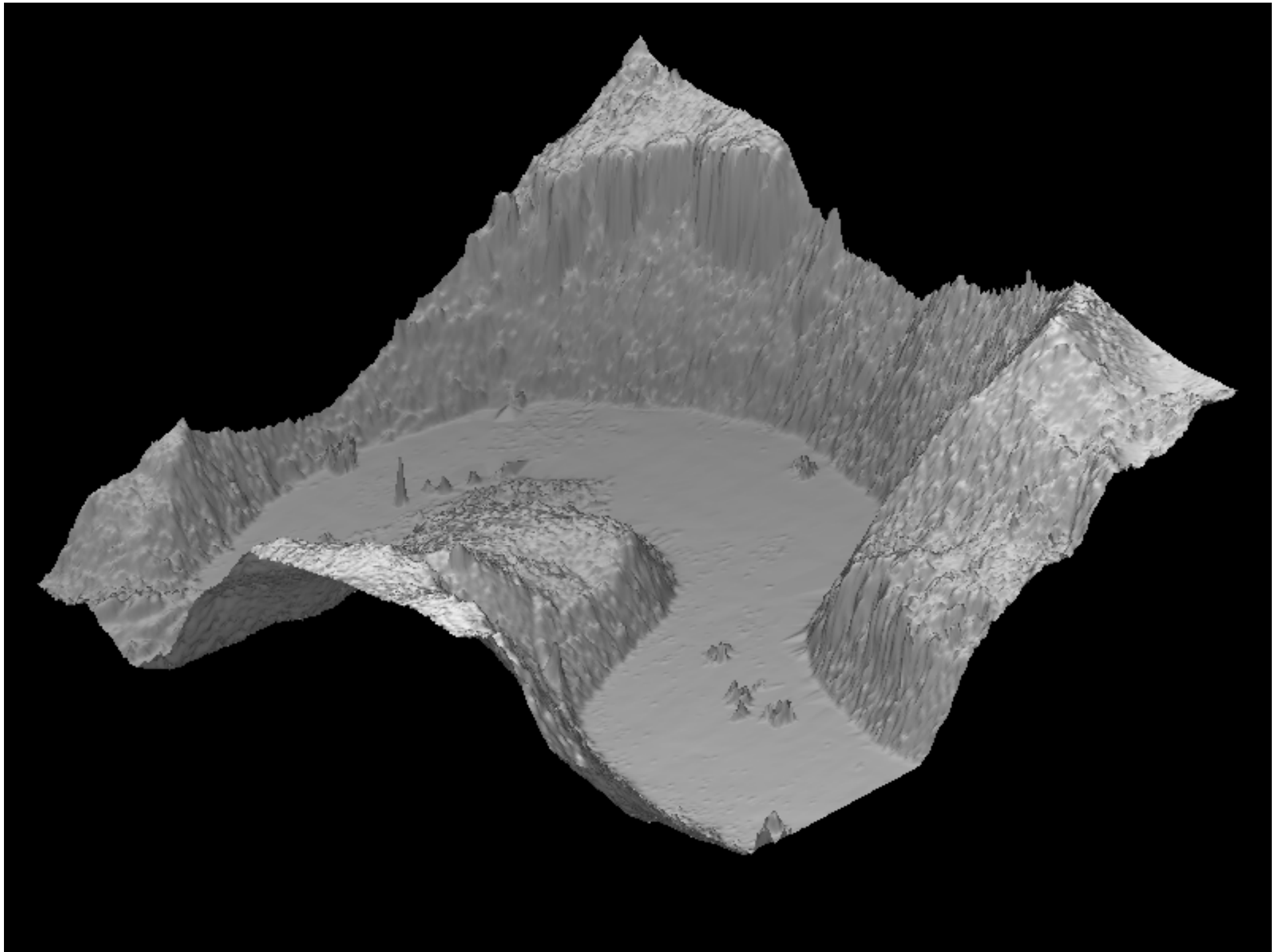
**Vertical: 15 cm**

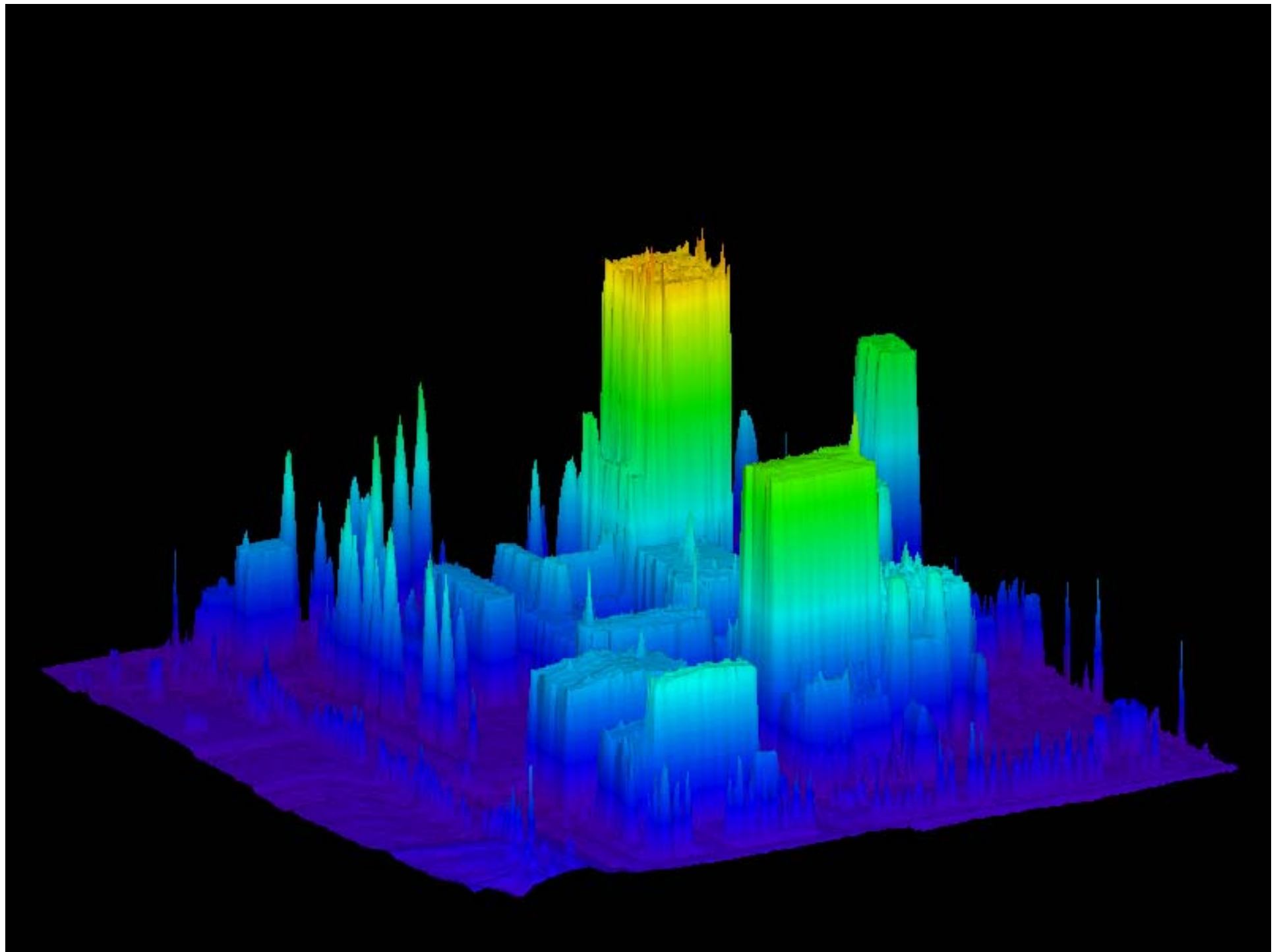
- **Relative accuracy (point-to-point)**

**Horizontal: 10 cm**

**Vertical: 5 cm**





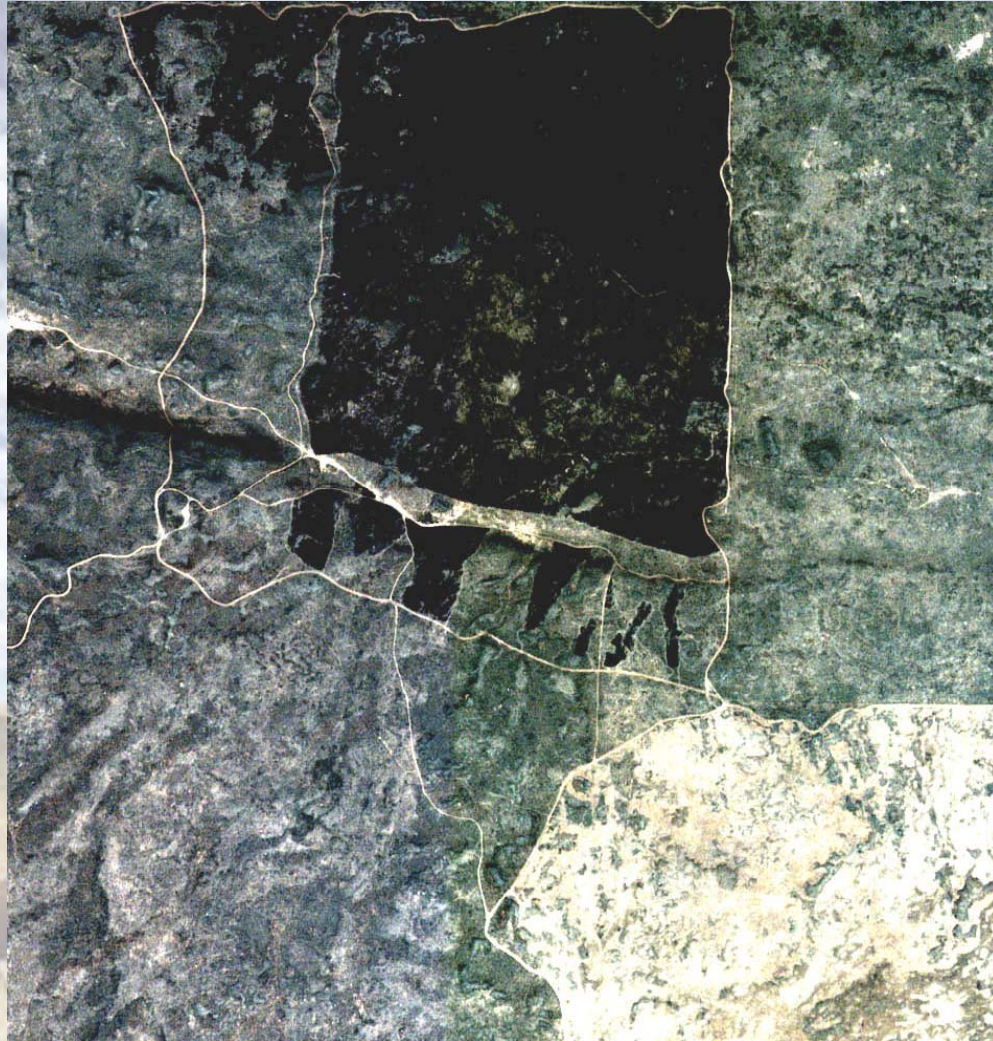


# Idaho Rangeland Examples

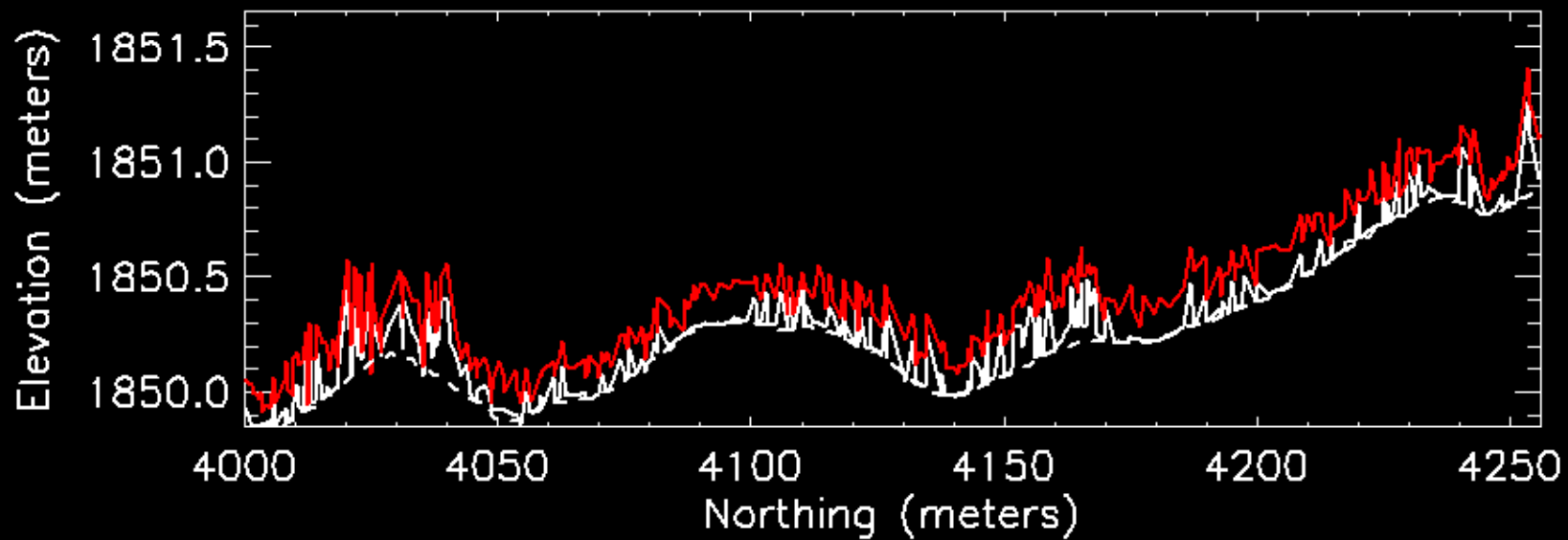
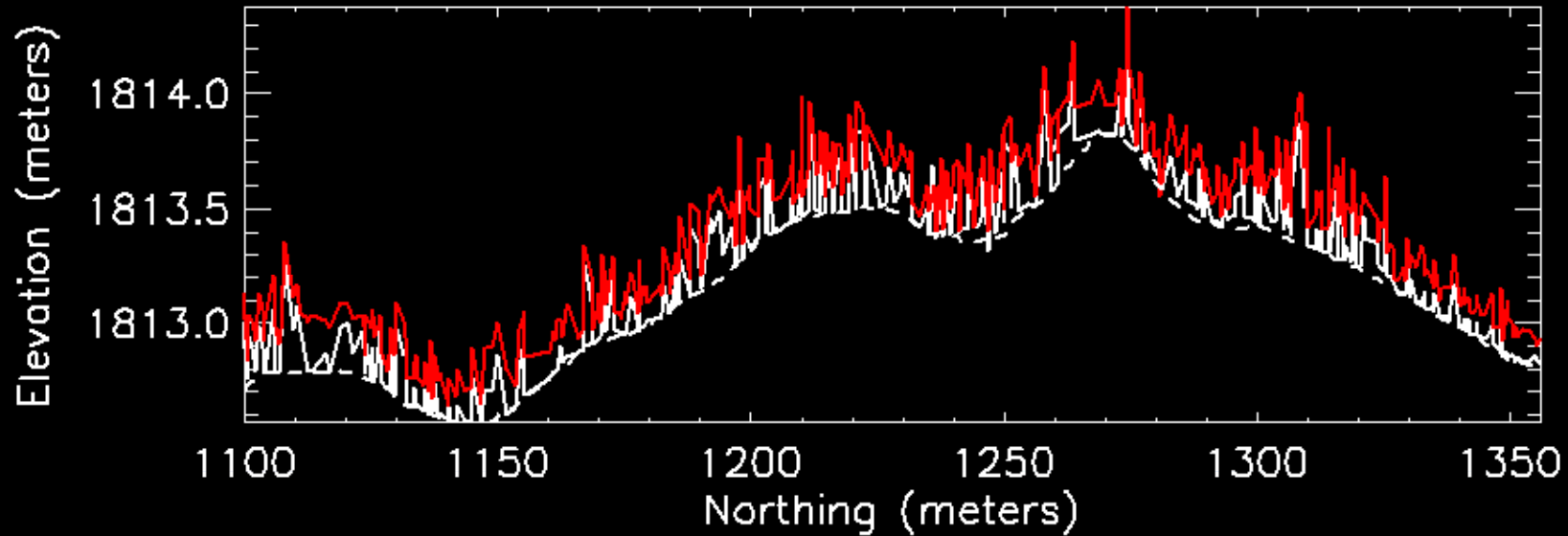
- **Sheep Experiment Station**
  - **Burn, vegetation monitoring**
- **Salmon Falls Creek**
  - **Hydrology**
- **Pine Creek**
  - **Riparian vegetation**
- **INEEL Dunes**
  - **Aeolian transport, vegetation**



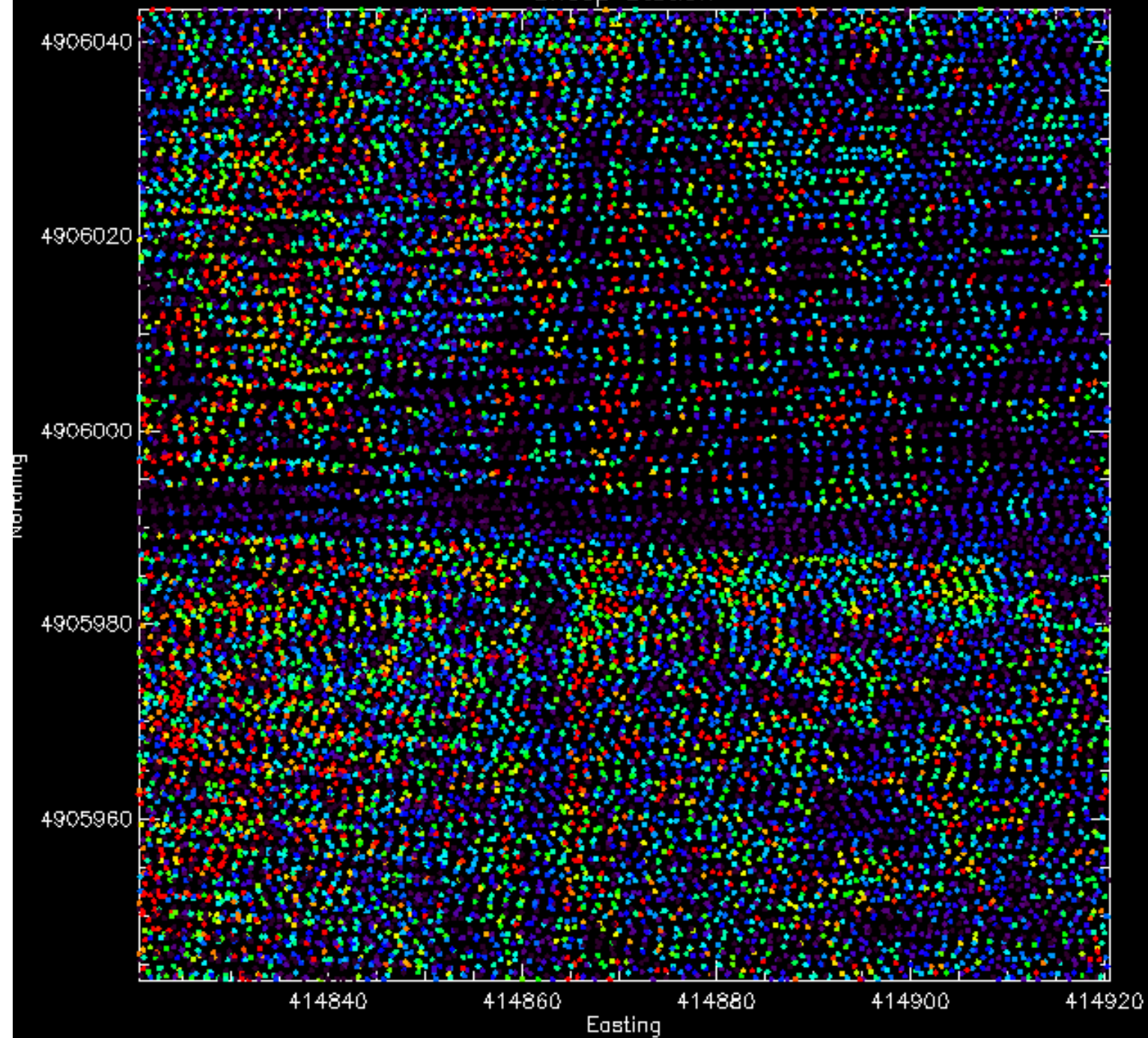
# Sheep Station



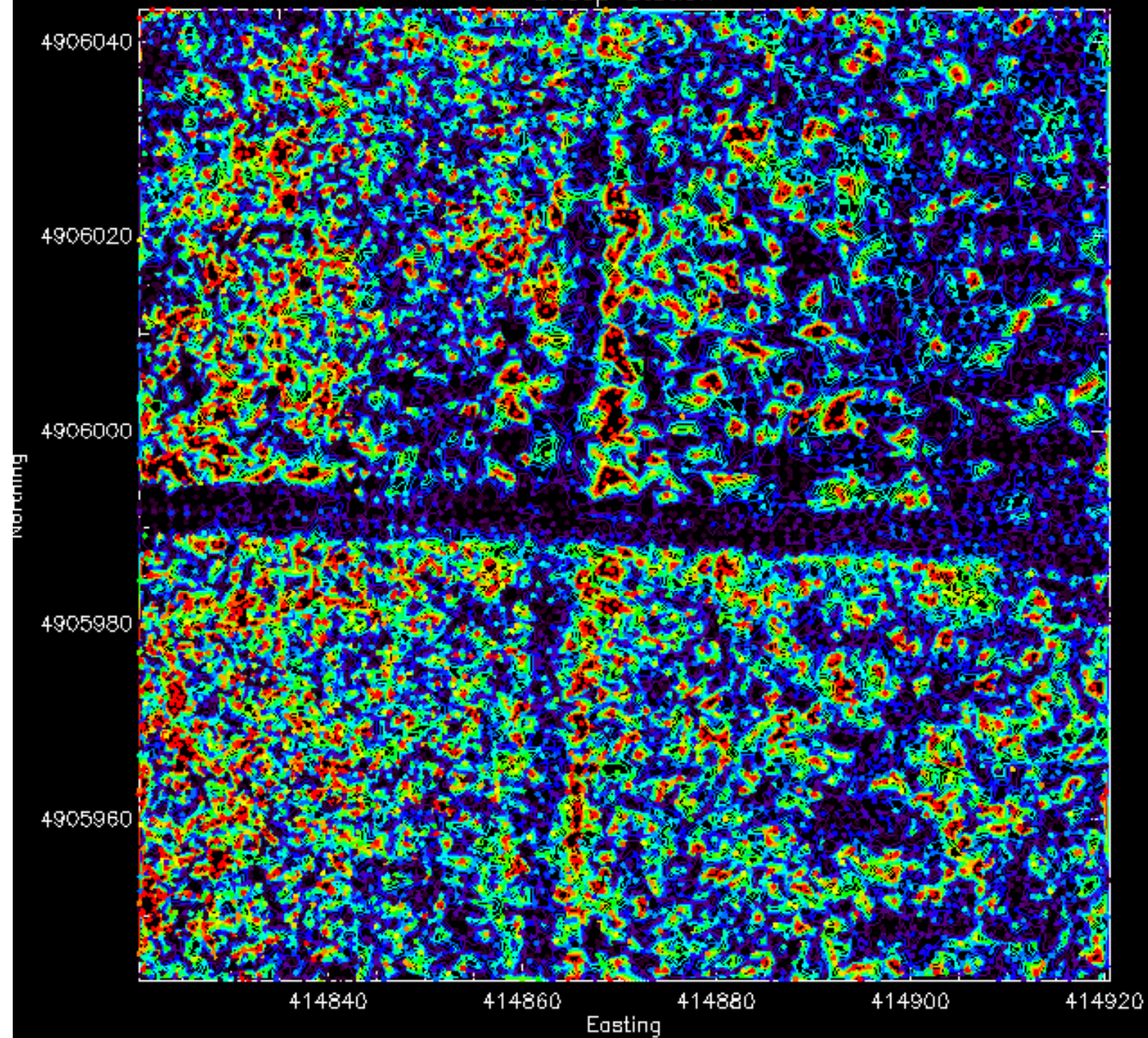




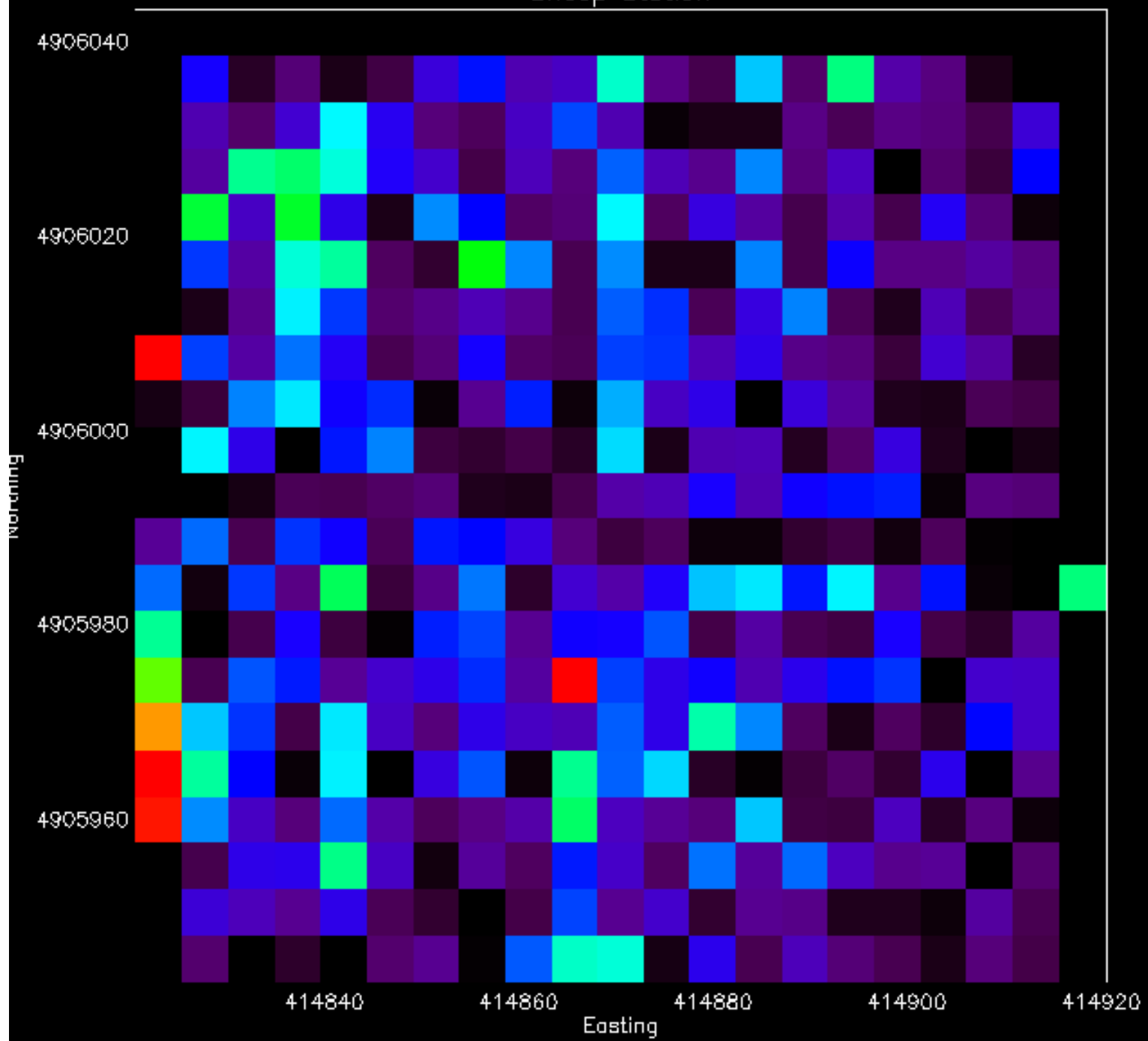
# Sheep Station

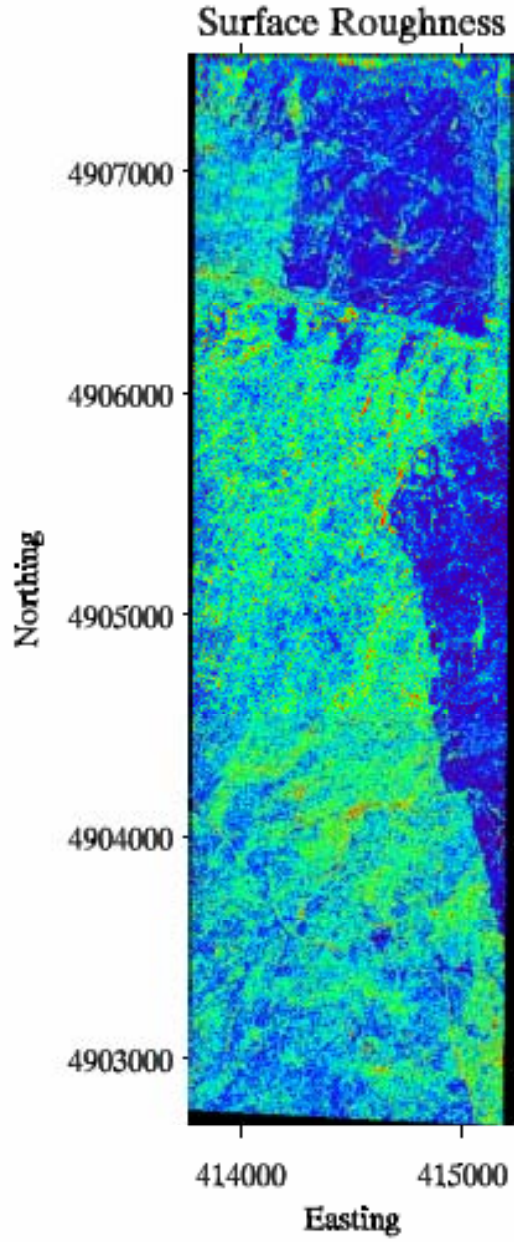


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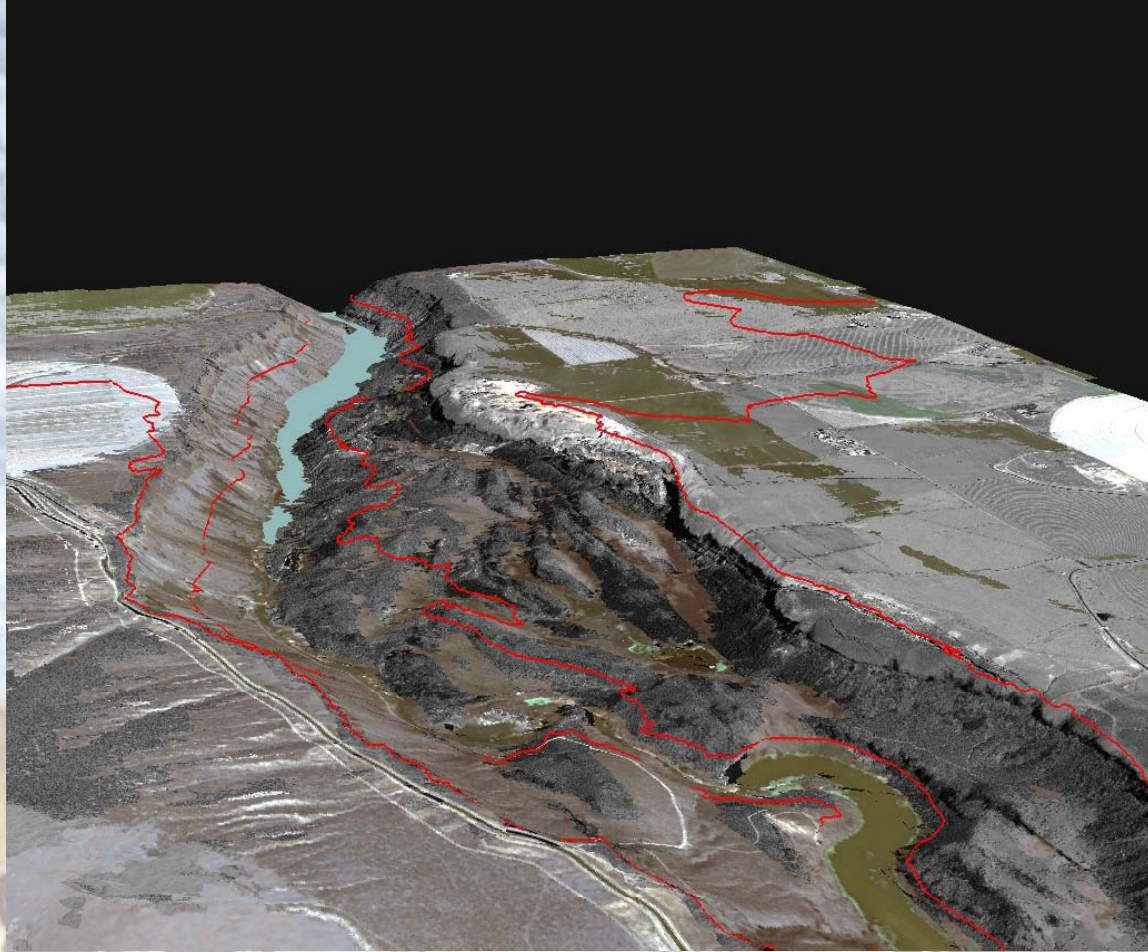


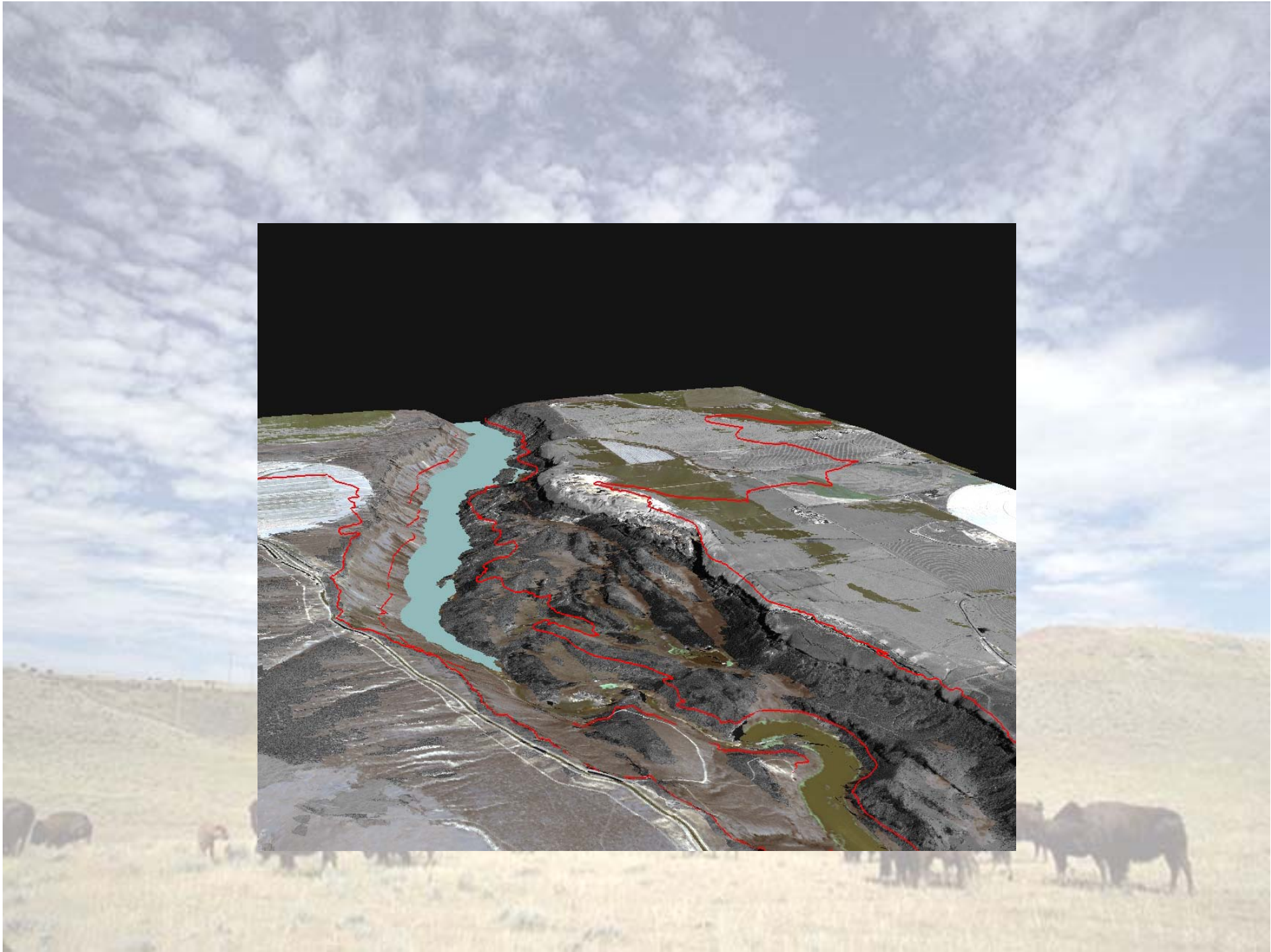
# Sheep Station

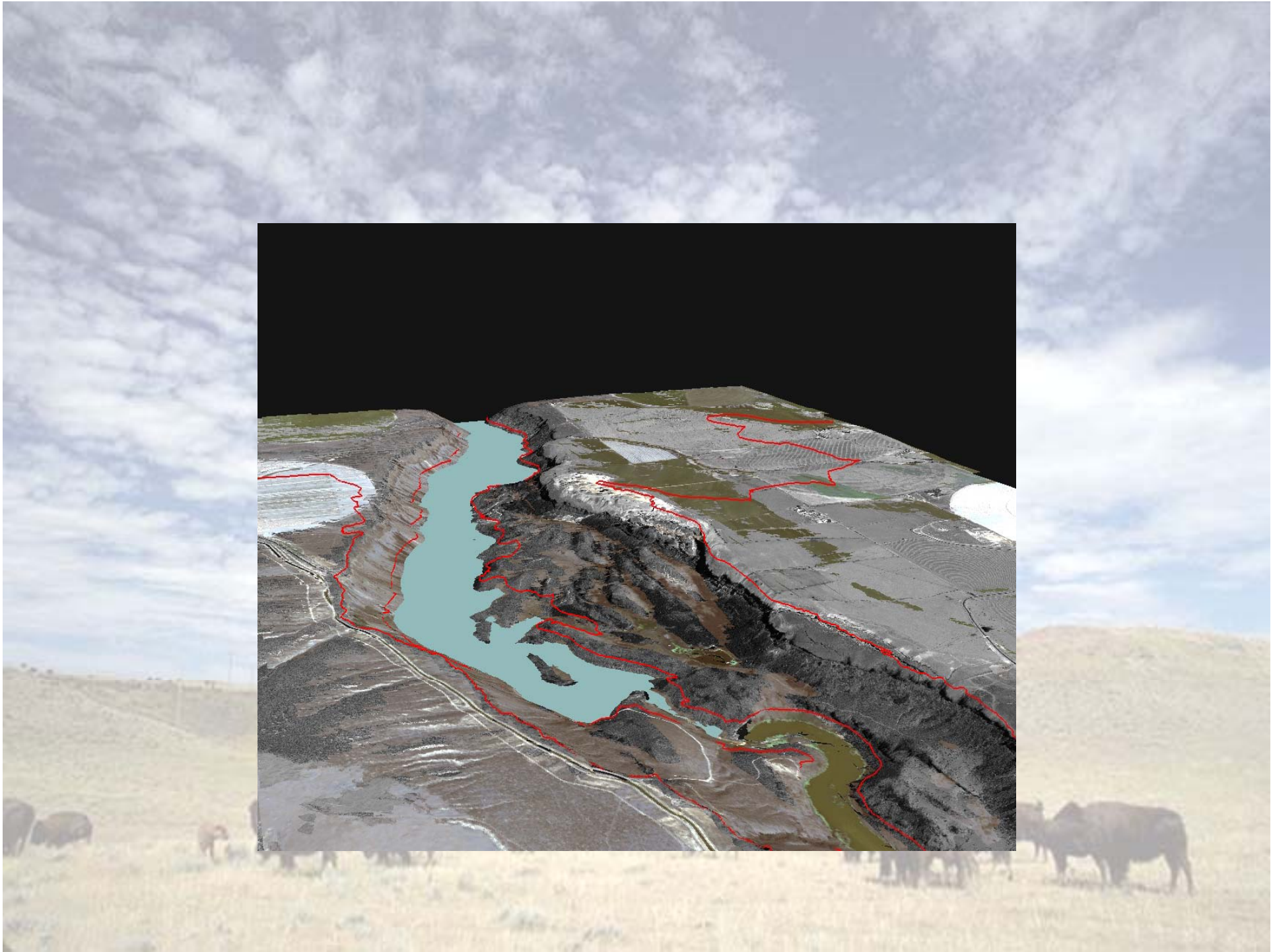




# Salmon Falls

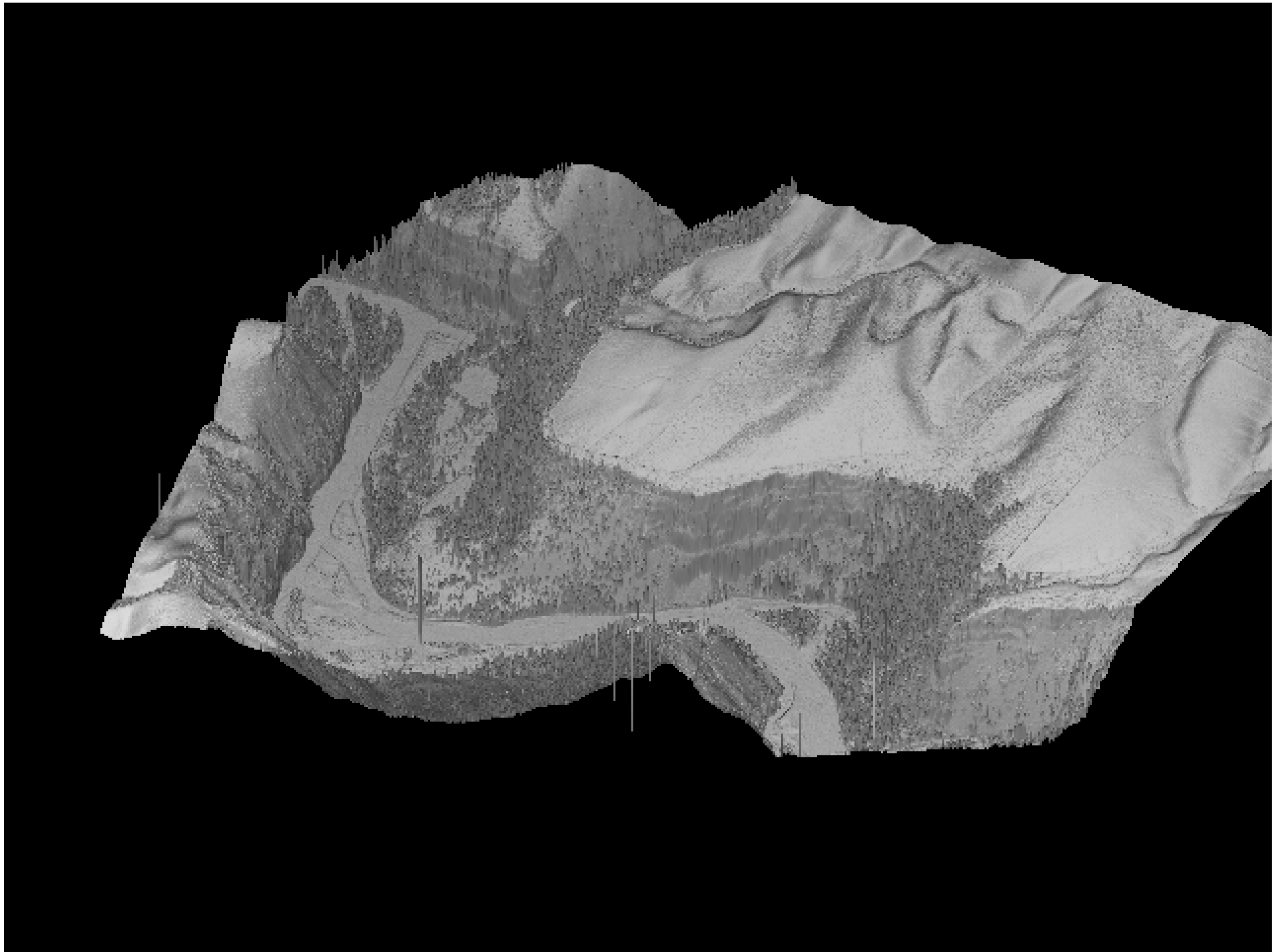


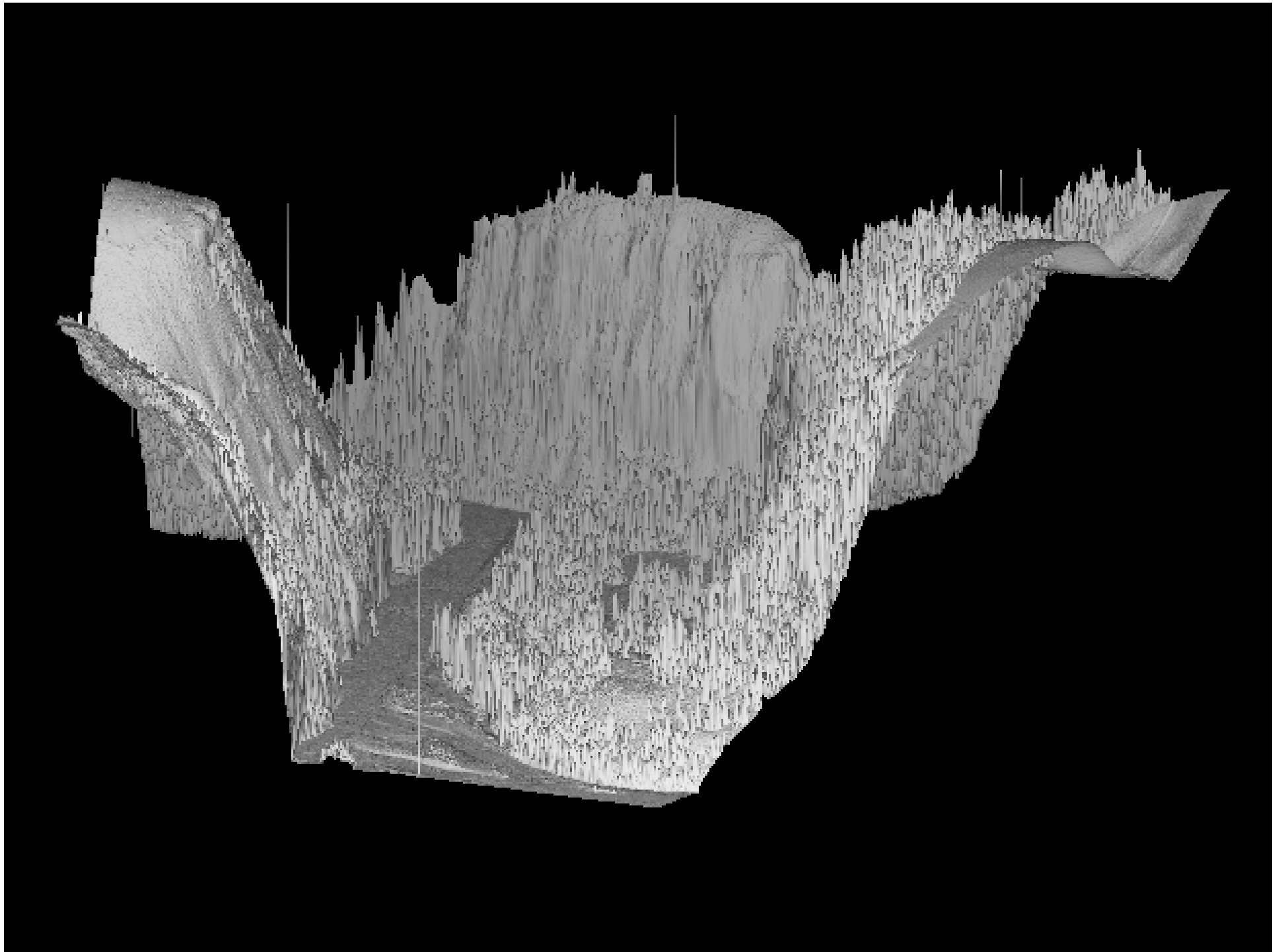




# Pine Creek



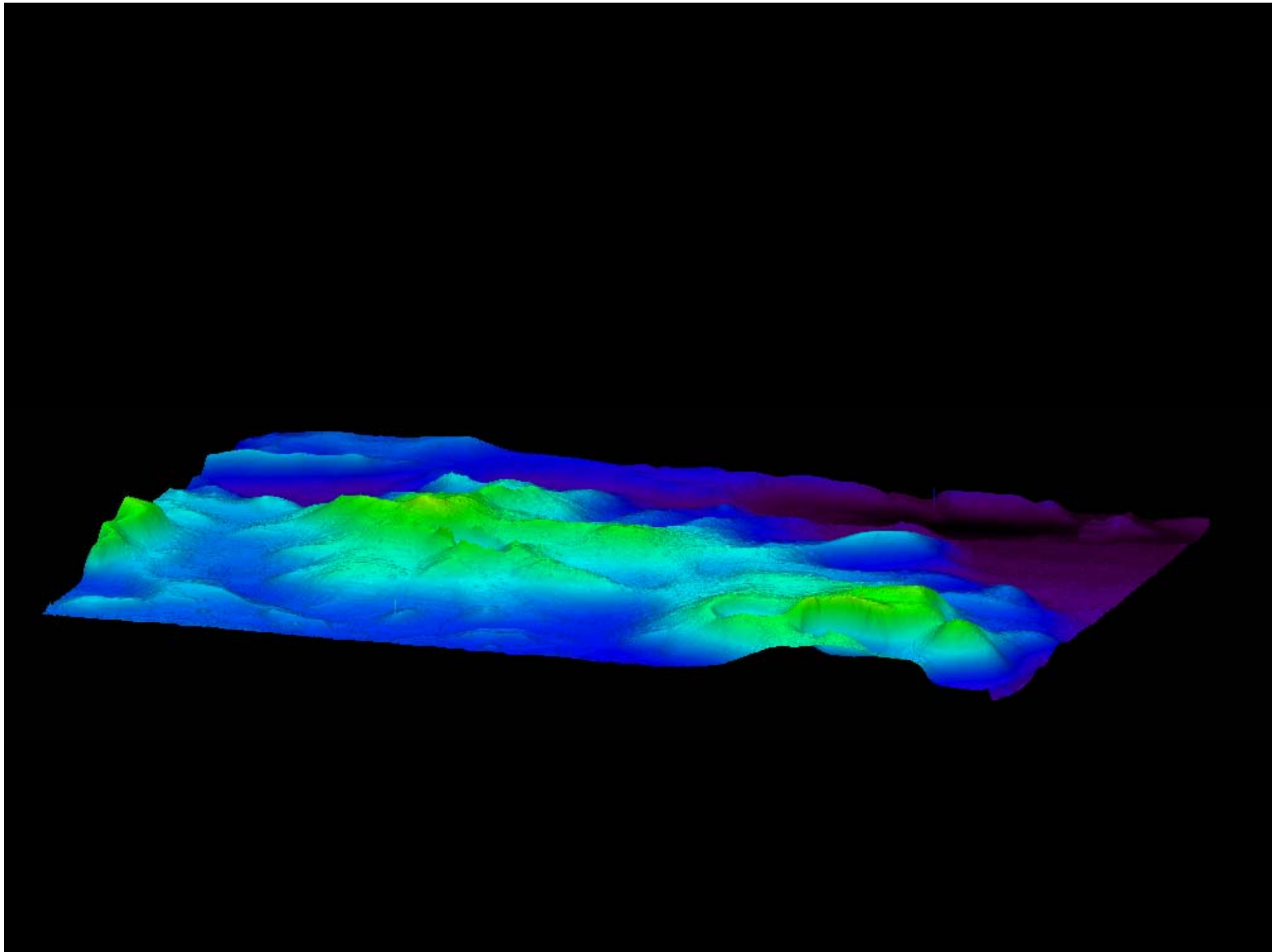


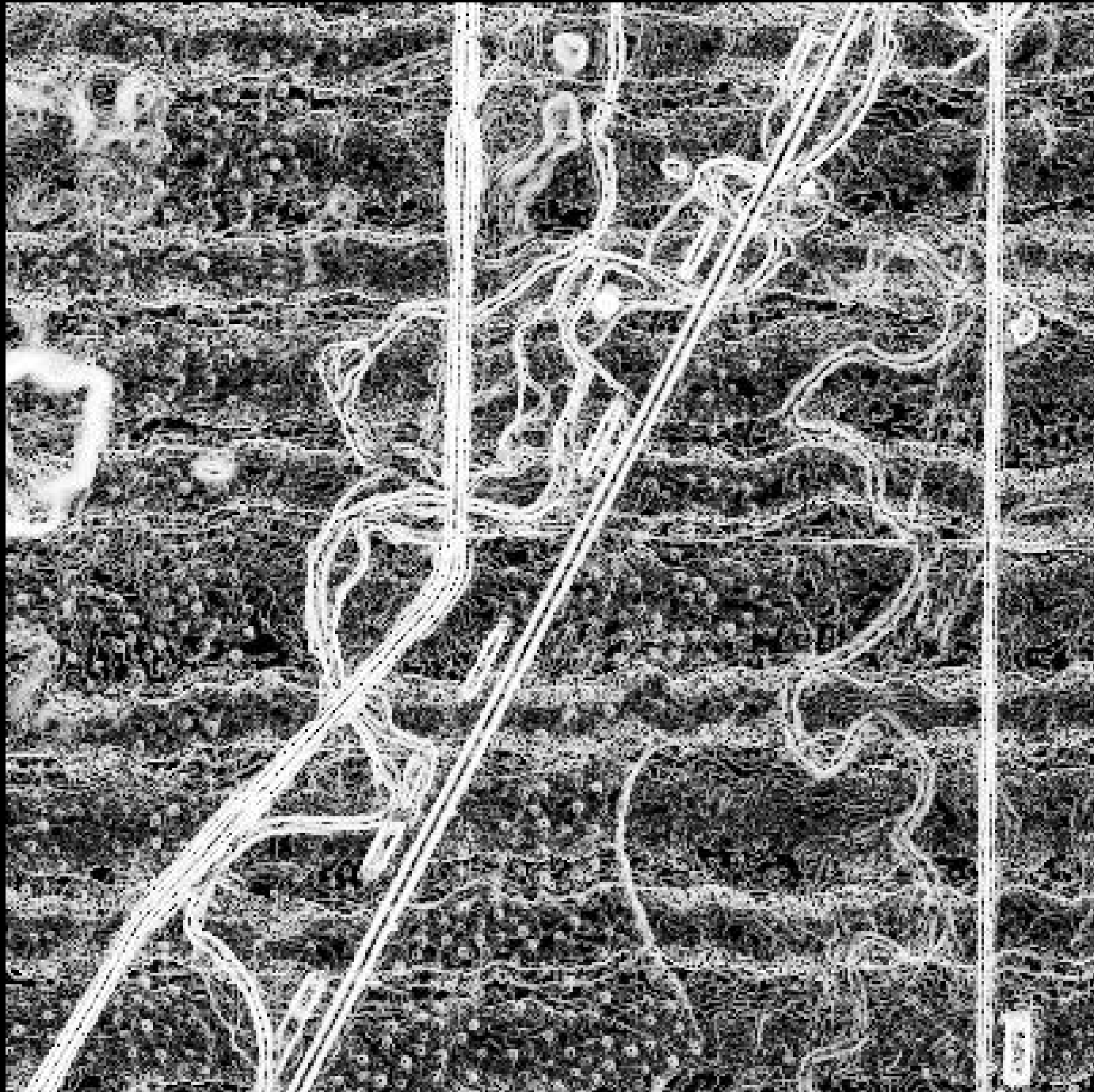


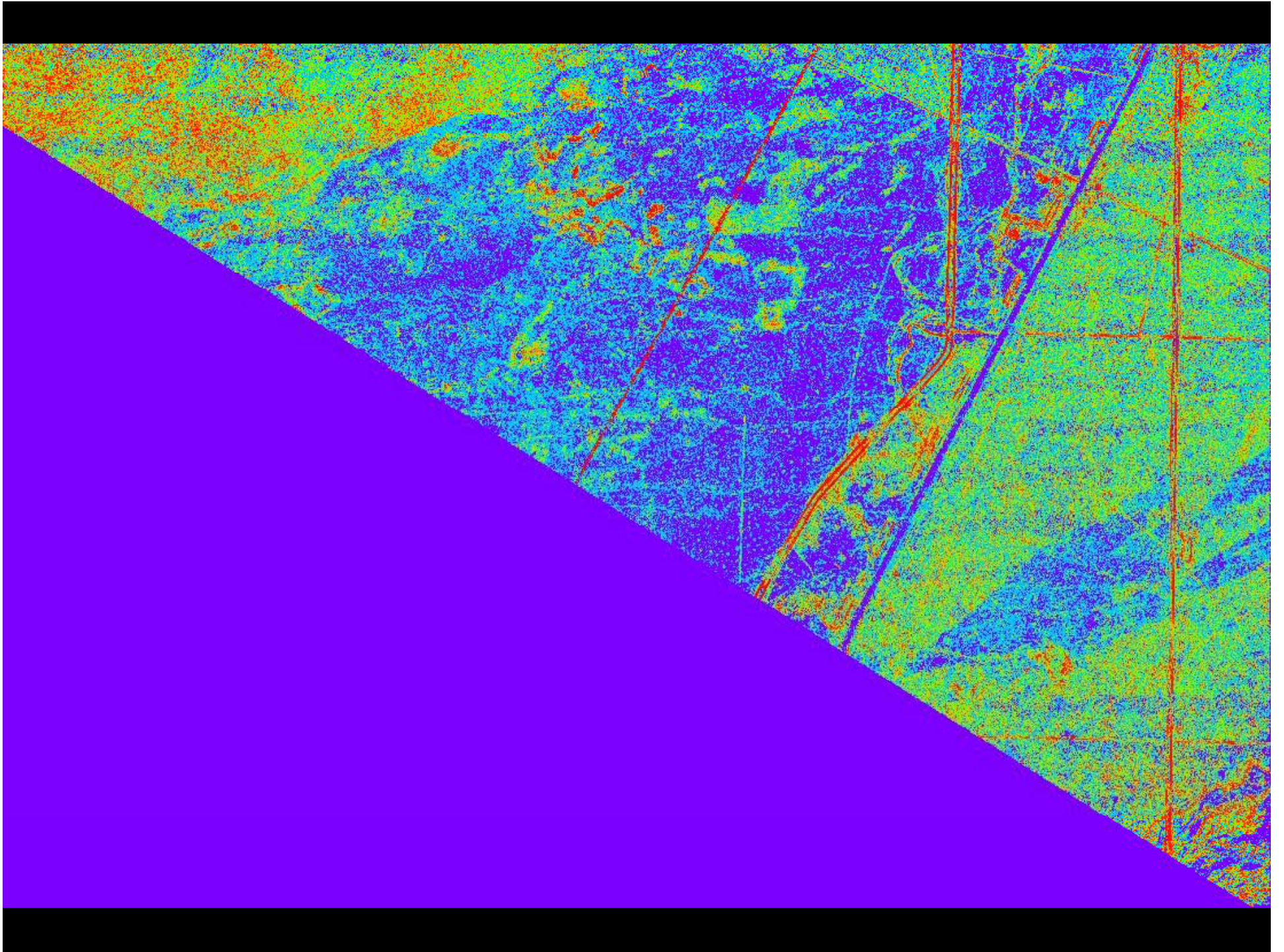
# INEEL Dunes











*To be continued...*

