Towards a 3D Immersive Visualization of the Tahoe Watershed

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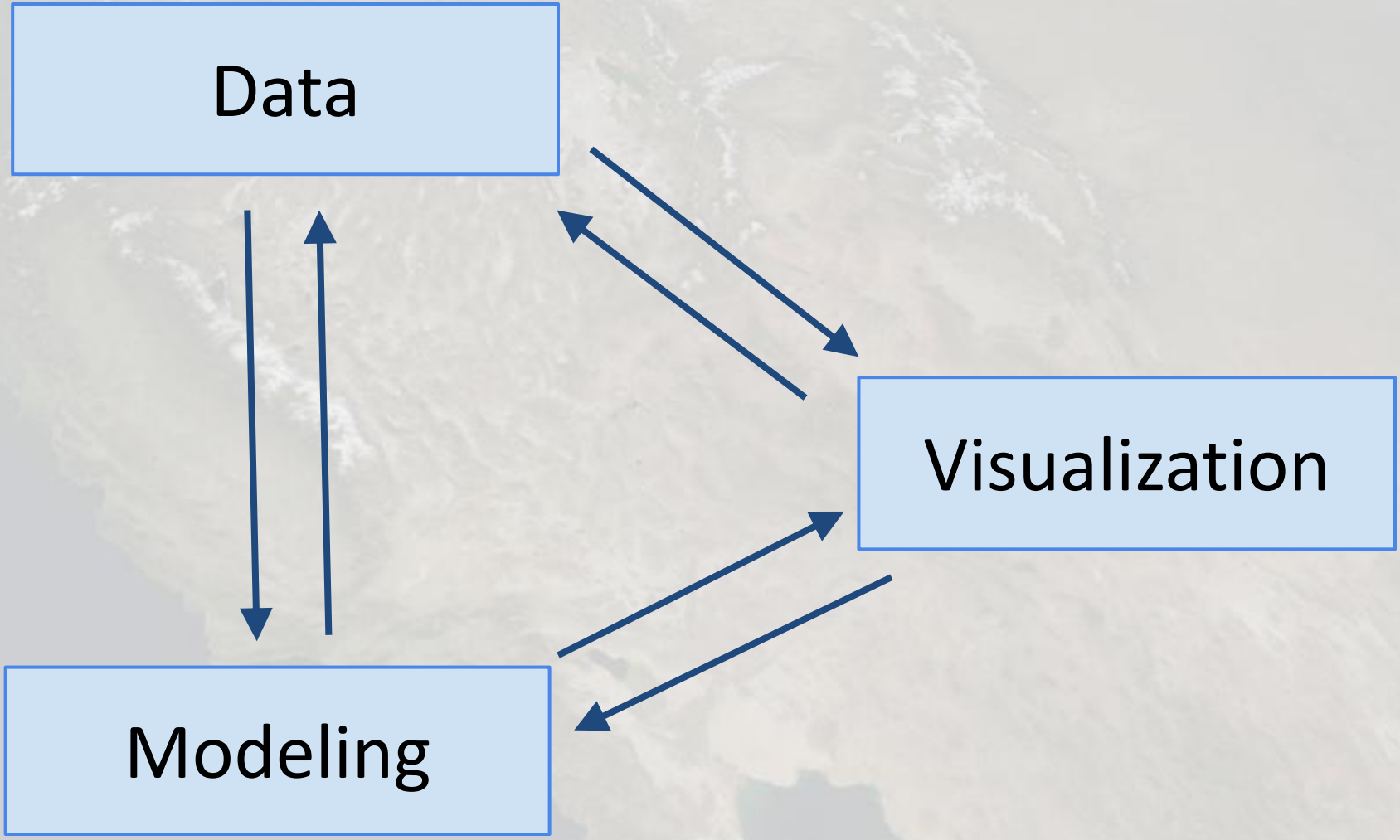
Water as a Limiting Resource

http://commons.wikimedia.org/wiki/File:Martis_Creek_Lake_and_Dam_summer.jpg

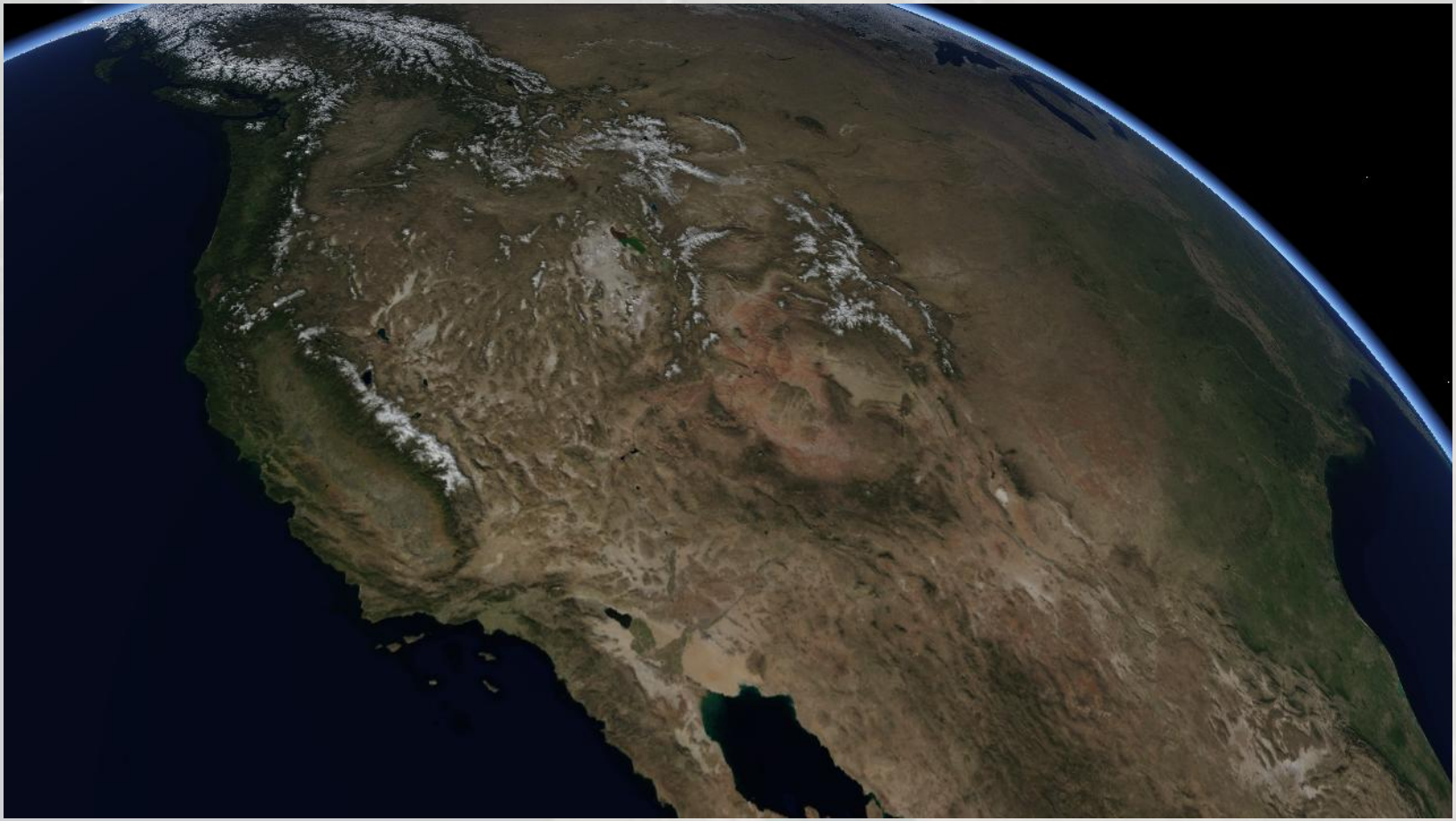
Nevada Water Resources
Data, Modeling, and Visualization (DMV)

The Three Research Directions of DMV



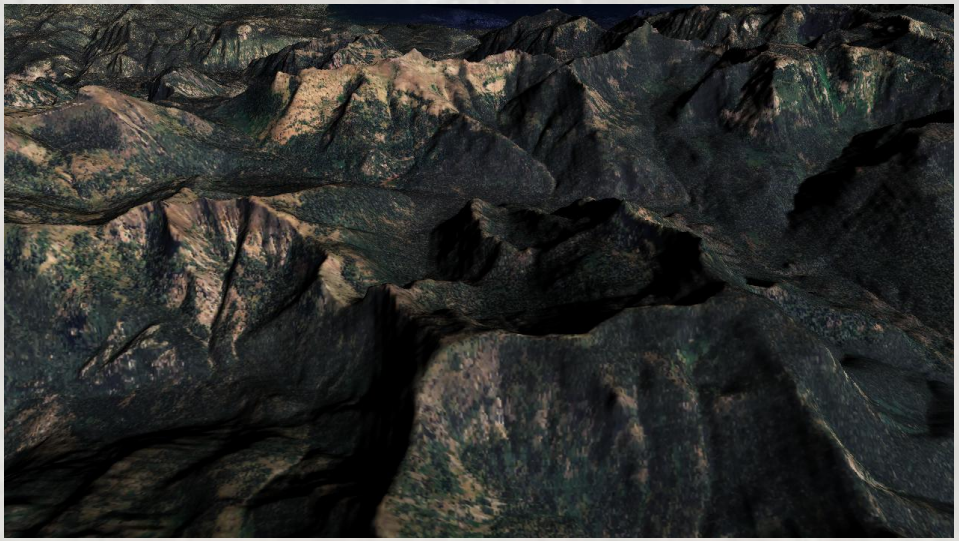
Analyzing Massive Amounts of Data

Planetary Terrain Visualization for VR



SCIENTIFIC VISUALIZATION AND VIRTUAL REALITY

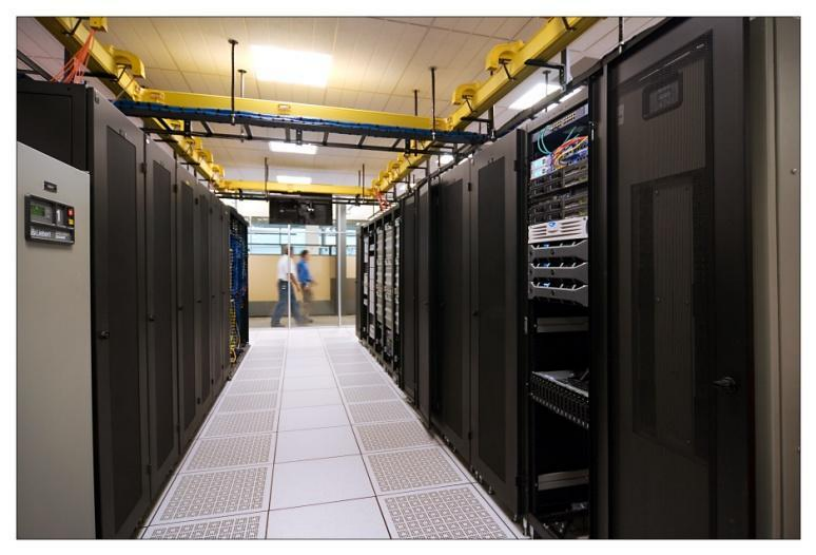
2D and 3D Visualization



Visualization in a Virtual Reality Enclosure

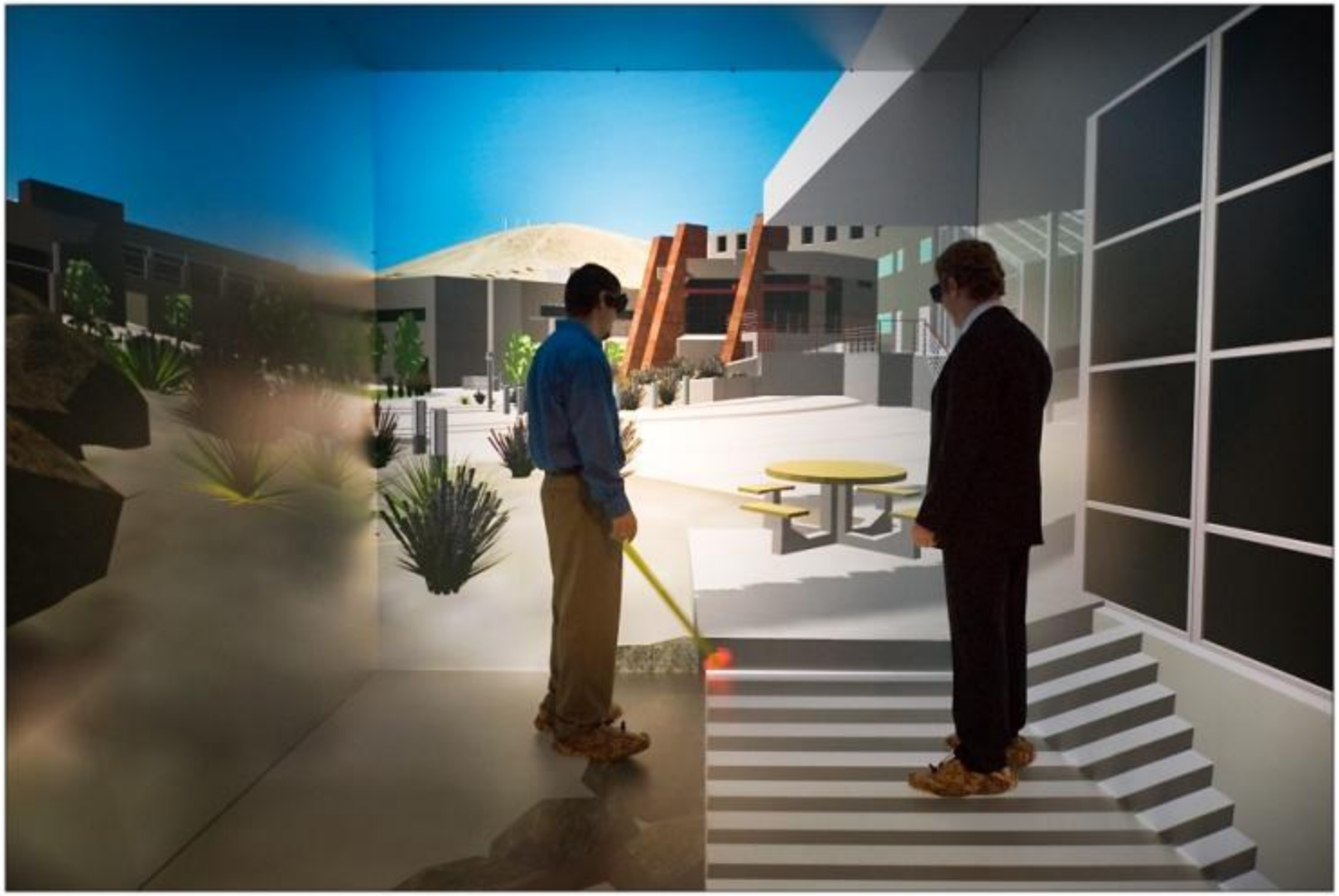
DRIVE6

- Six stereo walls
- 12x 1900x1280 projectors
- 12x compute/graphics nodes
  - 2x quad core Intel CPUs
  - 16 GB RAM
  - NVIDIA Quadro FX 5800



VR & Outreach

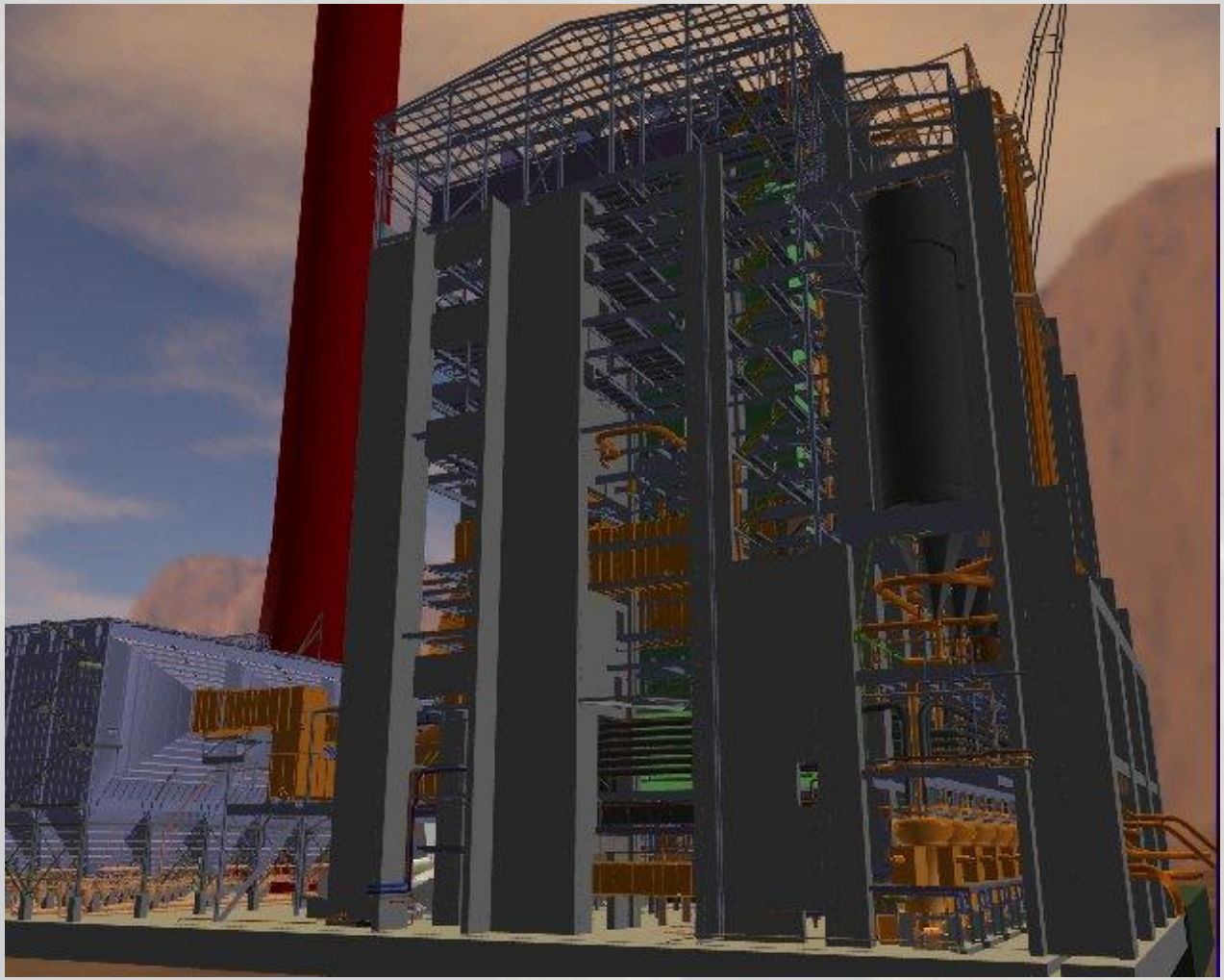
VR & Planning



VR & Simulation

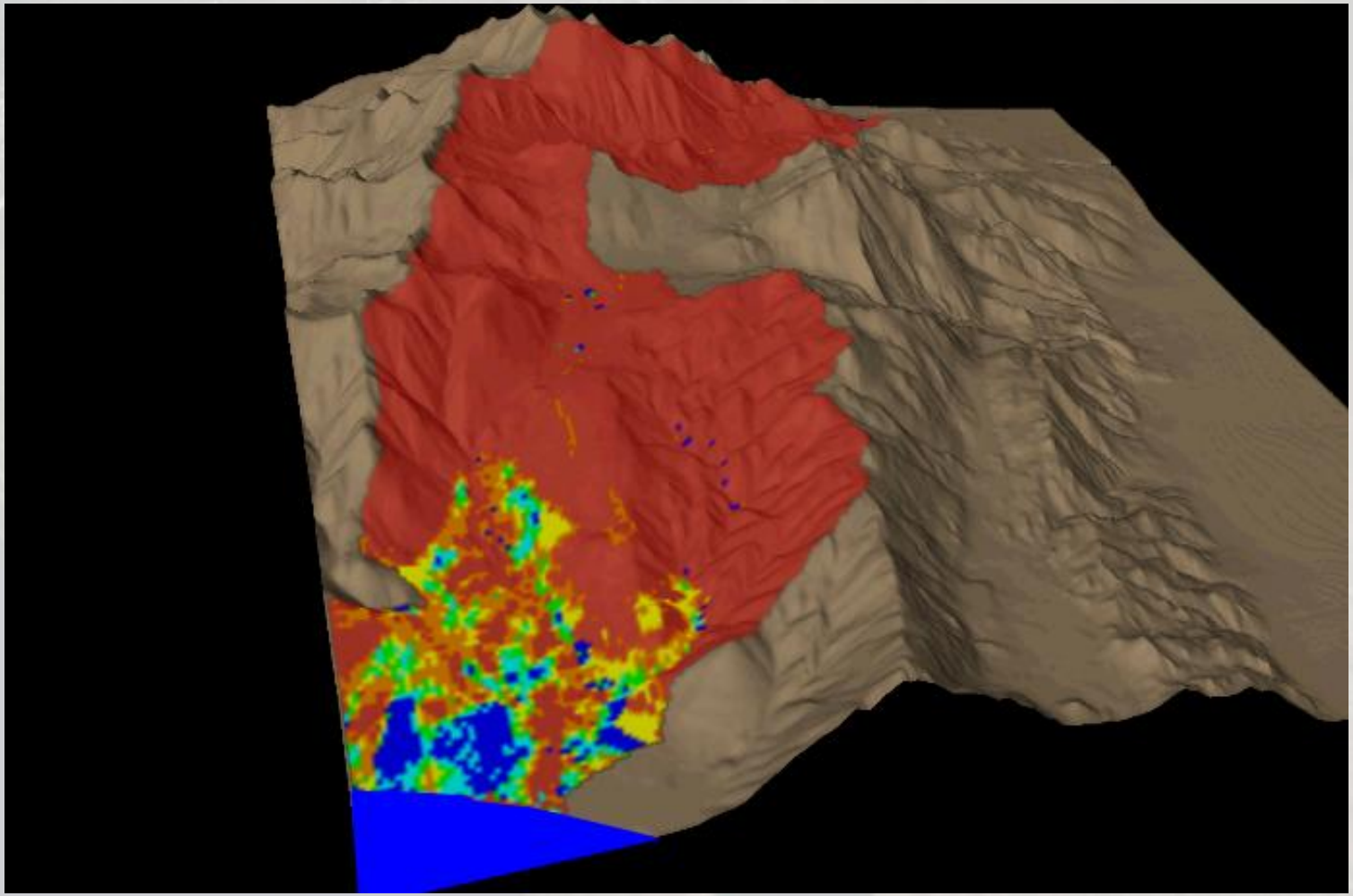
R. Hoang, et al. VFire: Immersive wildfire simulation and visualization. Computers & Graphics, 34(6):655-664, 2010.

VR & Engineering



N. Govindaraju, et al. Parallel Occlusion Culling for Interactive Walkthroughs using Multiple GPUs. http://gamma.cs.unc.edu/SWITCH

VR & Data Analysis



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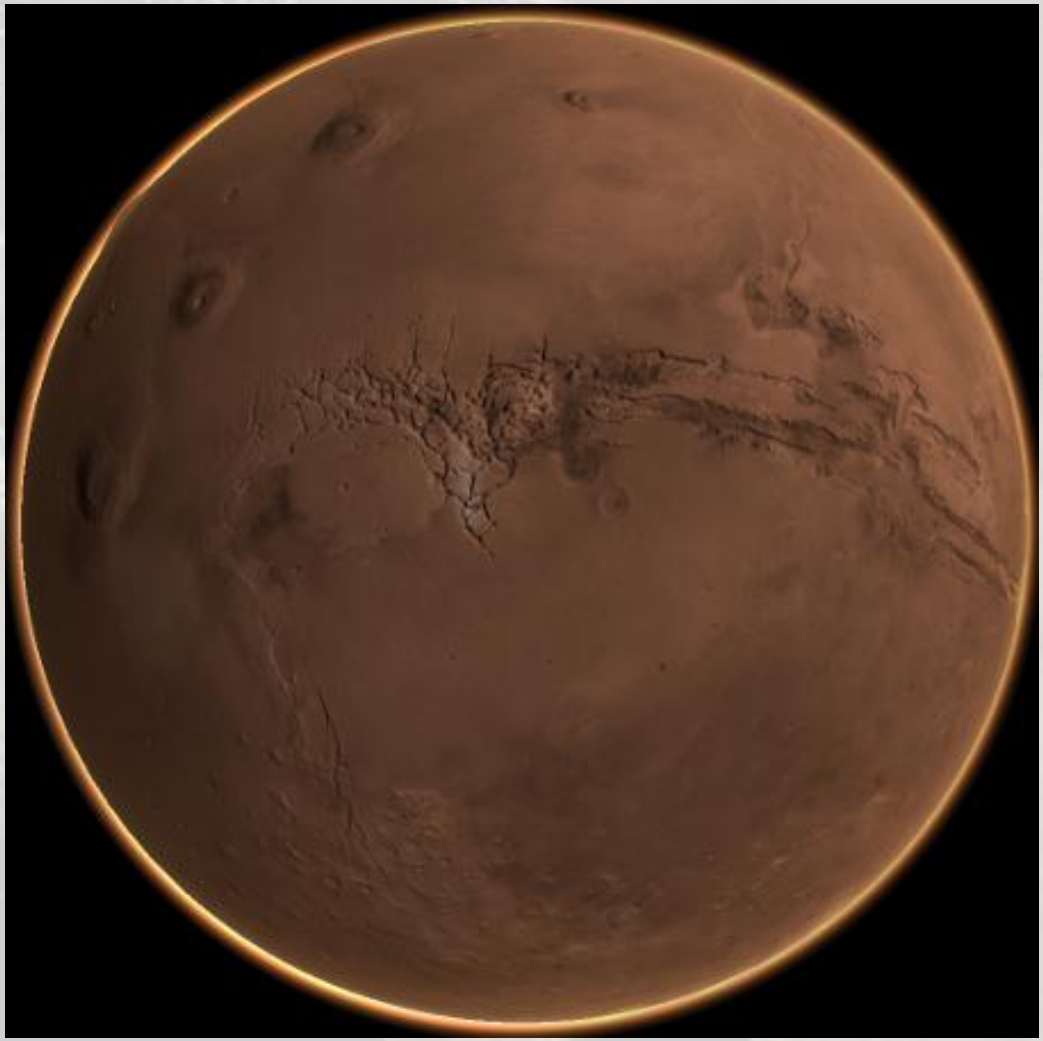
PLANETARY TERRAIN VISUALIZATION

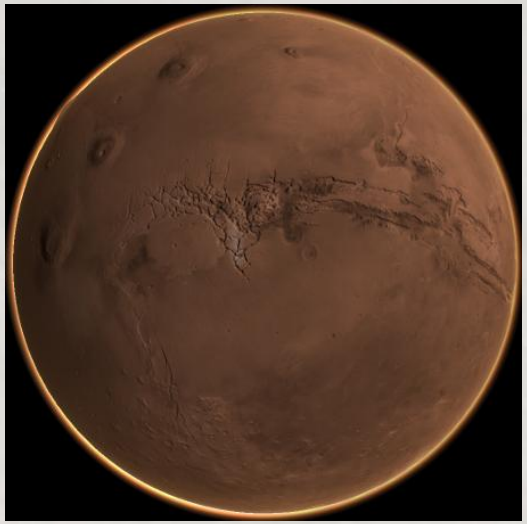
Hesperian



J. Mahsman. Projective Grid Mapping for Planetary Terrain Rendering. University of Nevada, Reno, 2010.

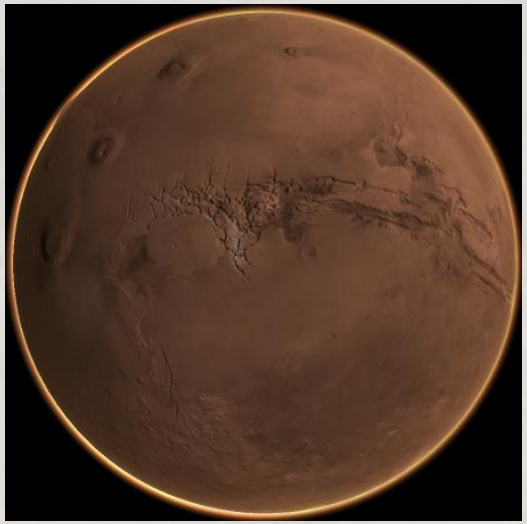
Hesperian

- Planetary approach
- GPU-based terrain construction



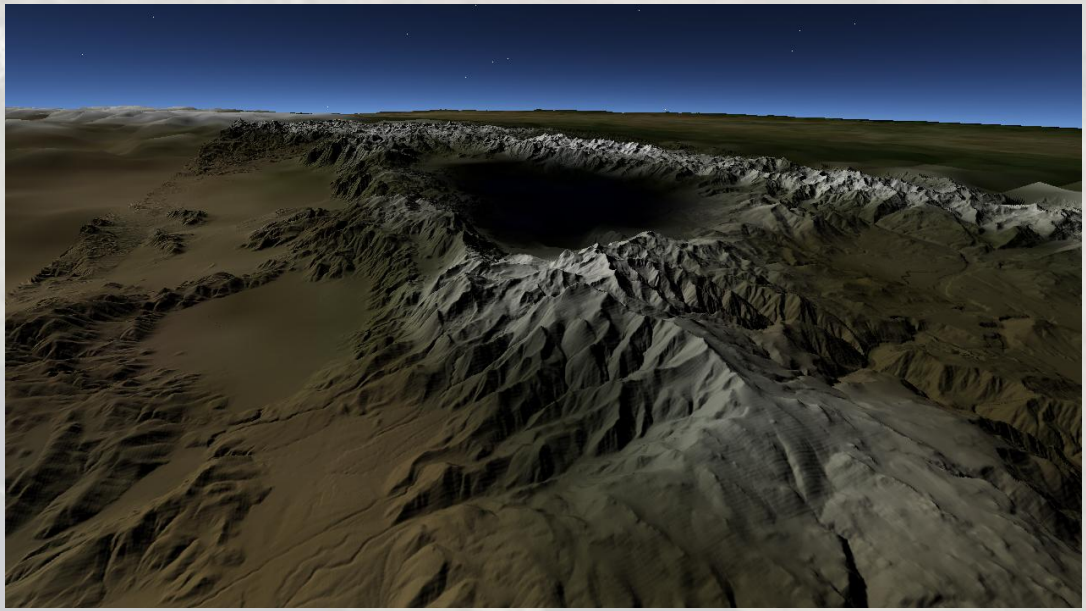
Planar vs Ellipsoidal Terrain

- Digital elevation models
- Two terrain approaches
  - Offset from a plane
  - Offset from a sphere



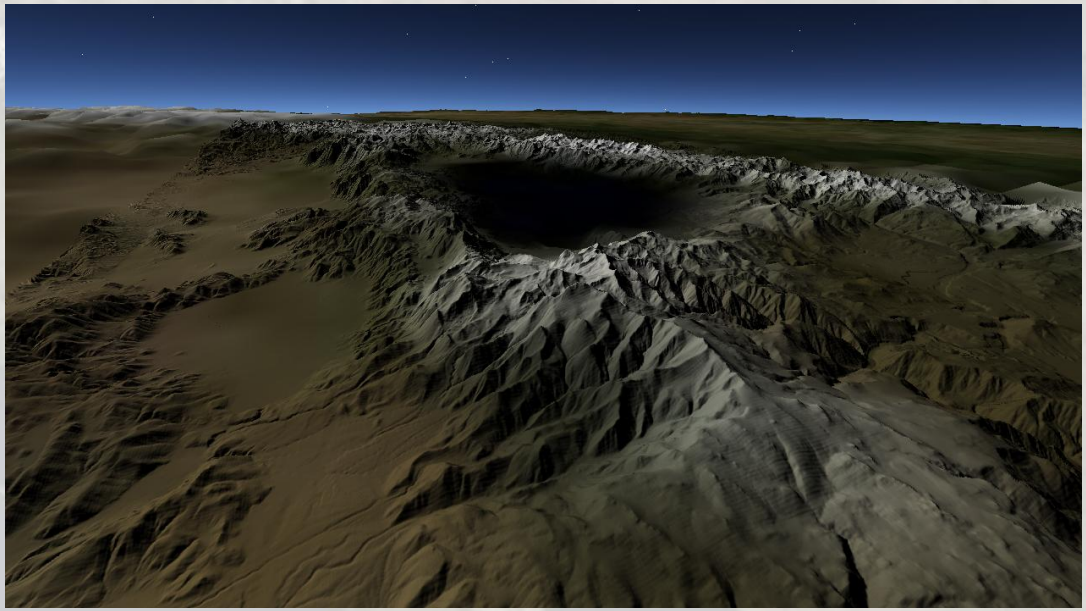
Advantages of Planetary Terrain

- Data in context
- Global to local transition
- Planet Curvature

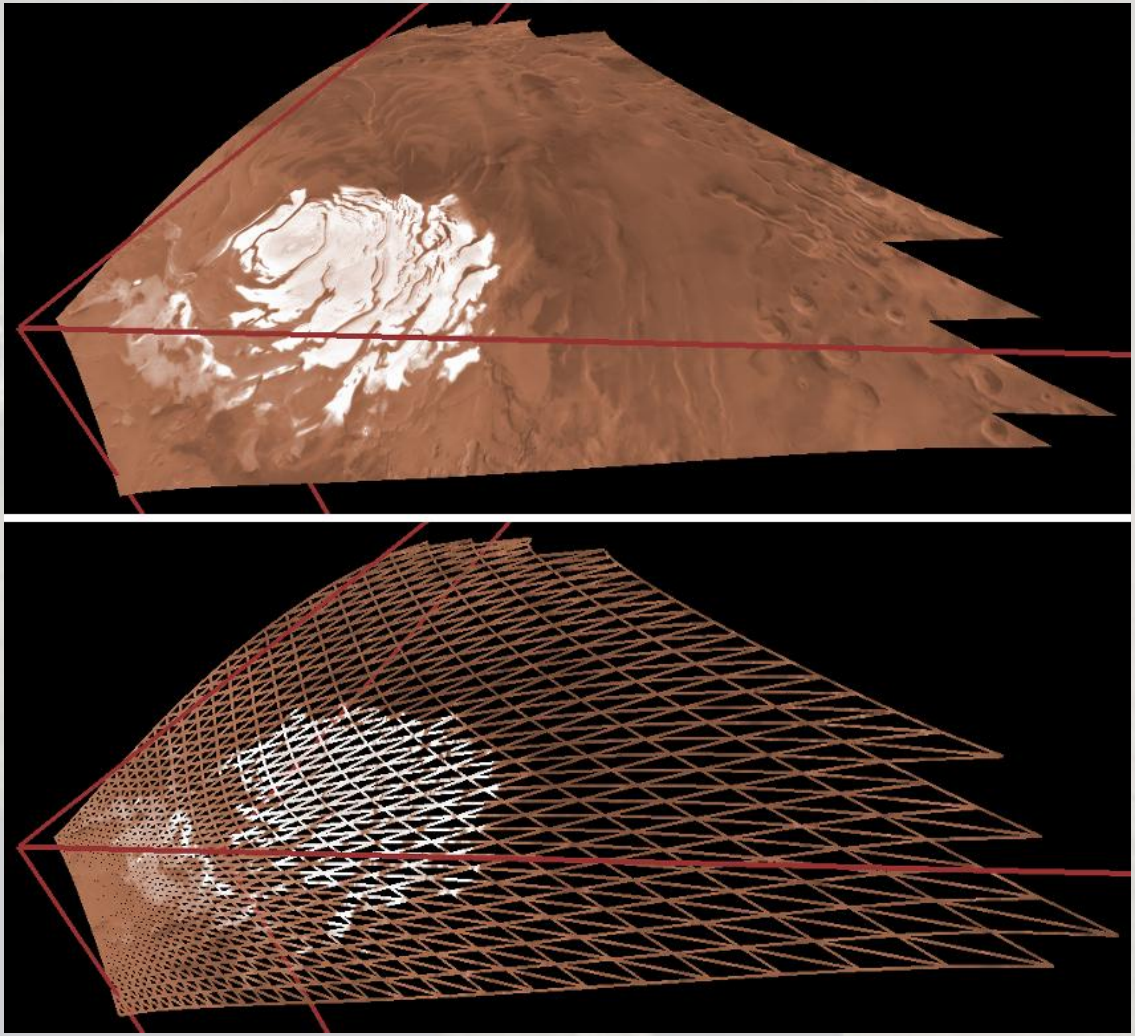


Drawbacks of Planetary Terrain

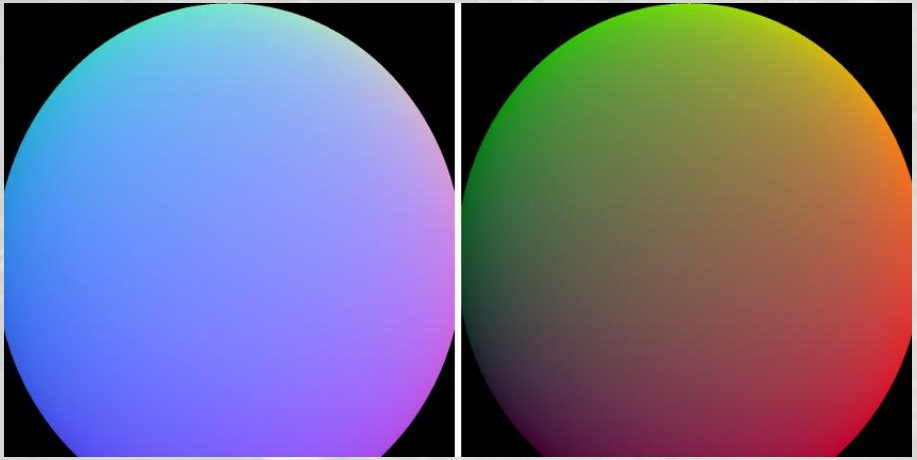
- Global coordinate systems
- Data reprojection

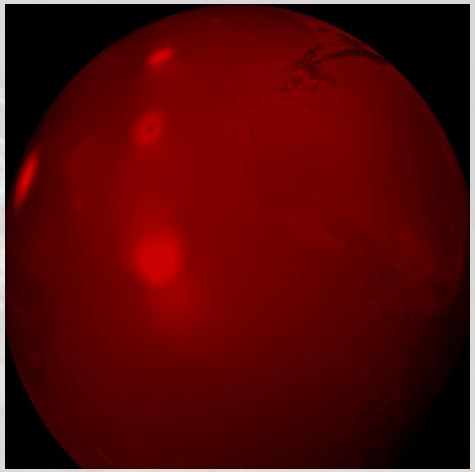


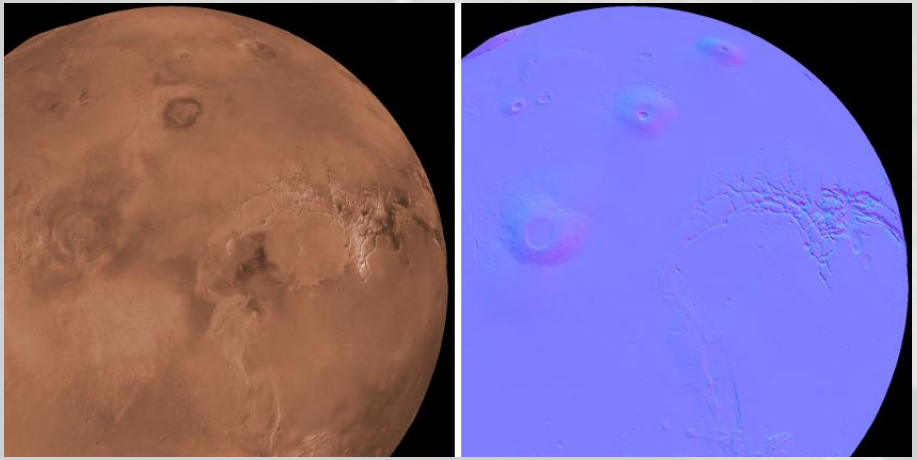
GPU-based Terrain Construction

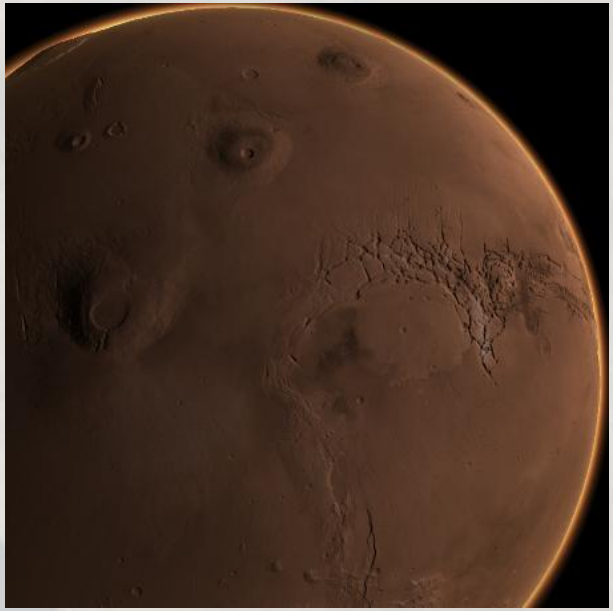


GPU-based Terrain Texturing



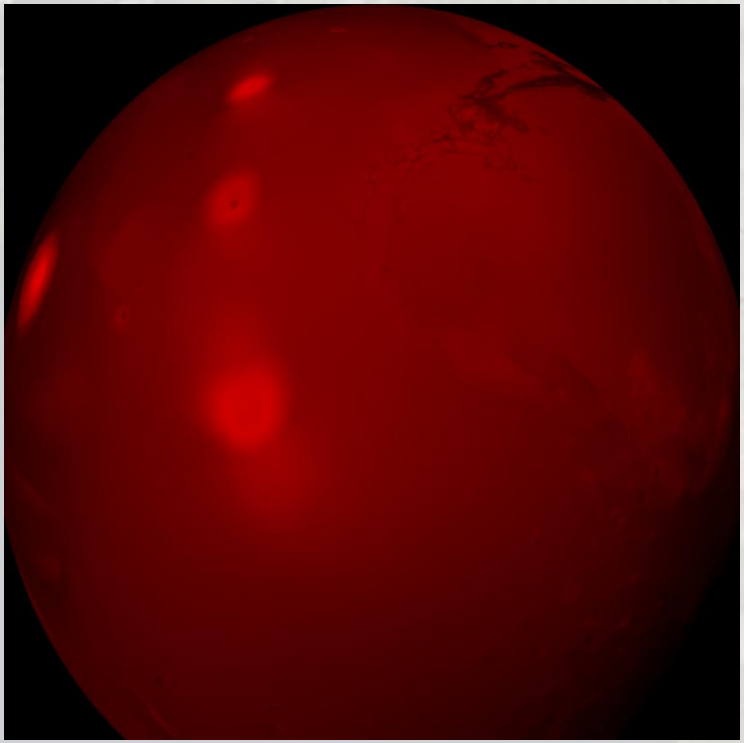


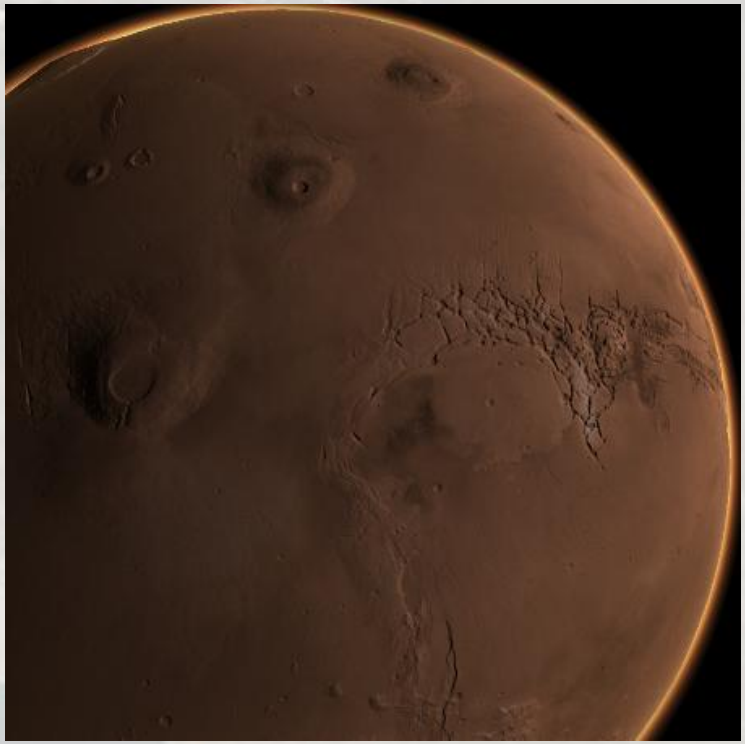




Advantages of Hesperian's GPU-based Construction

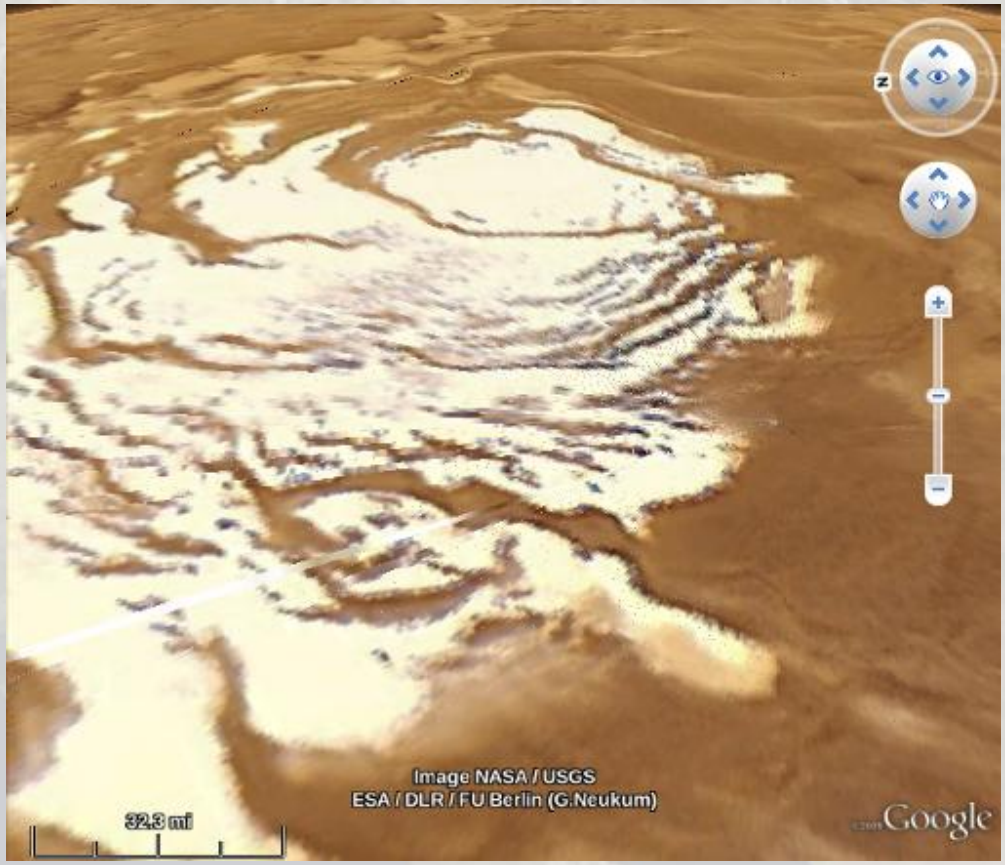
- Continuous level of detail





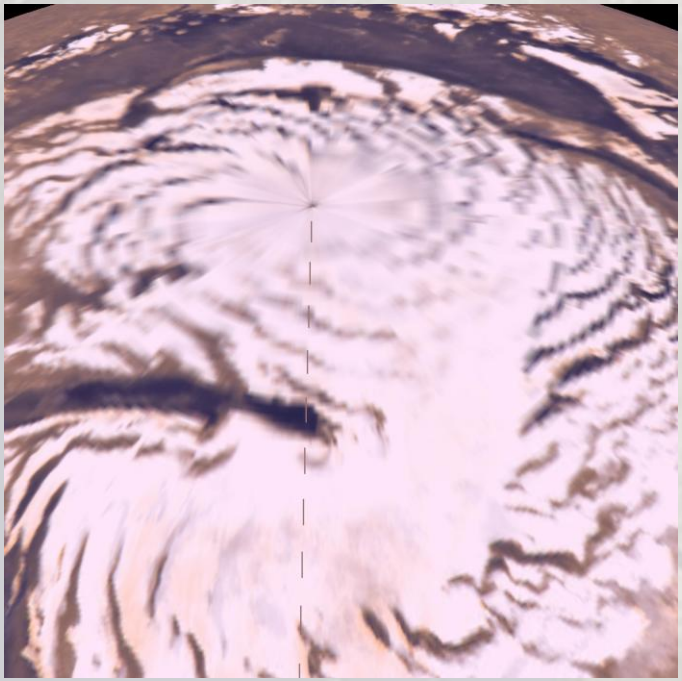
Advantages of Hesperian's GPU-based Construction

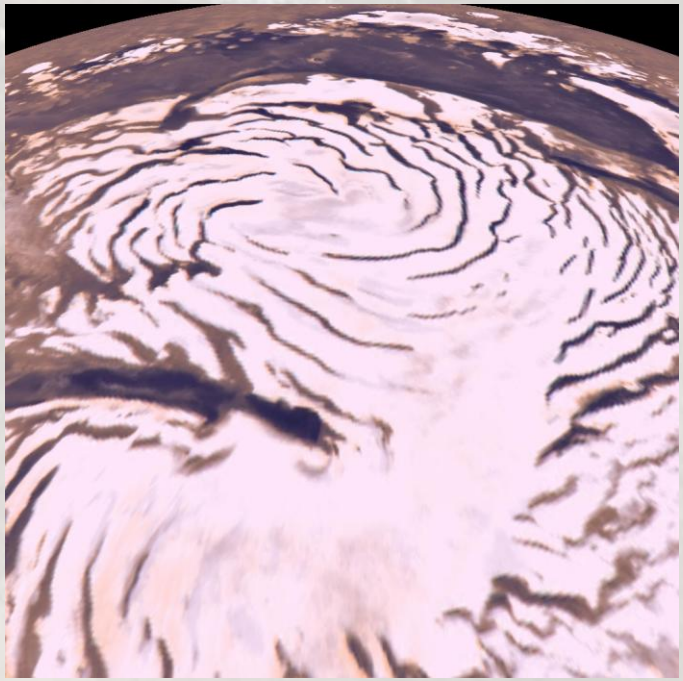
- Multiple map projections



Advantages of Hesperian's GPU-based Construction

- Multiple map projections





Advantages of Hesperian's GPU-based Construction

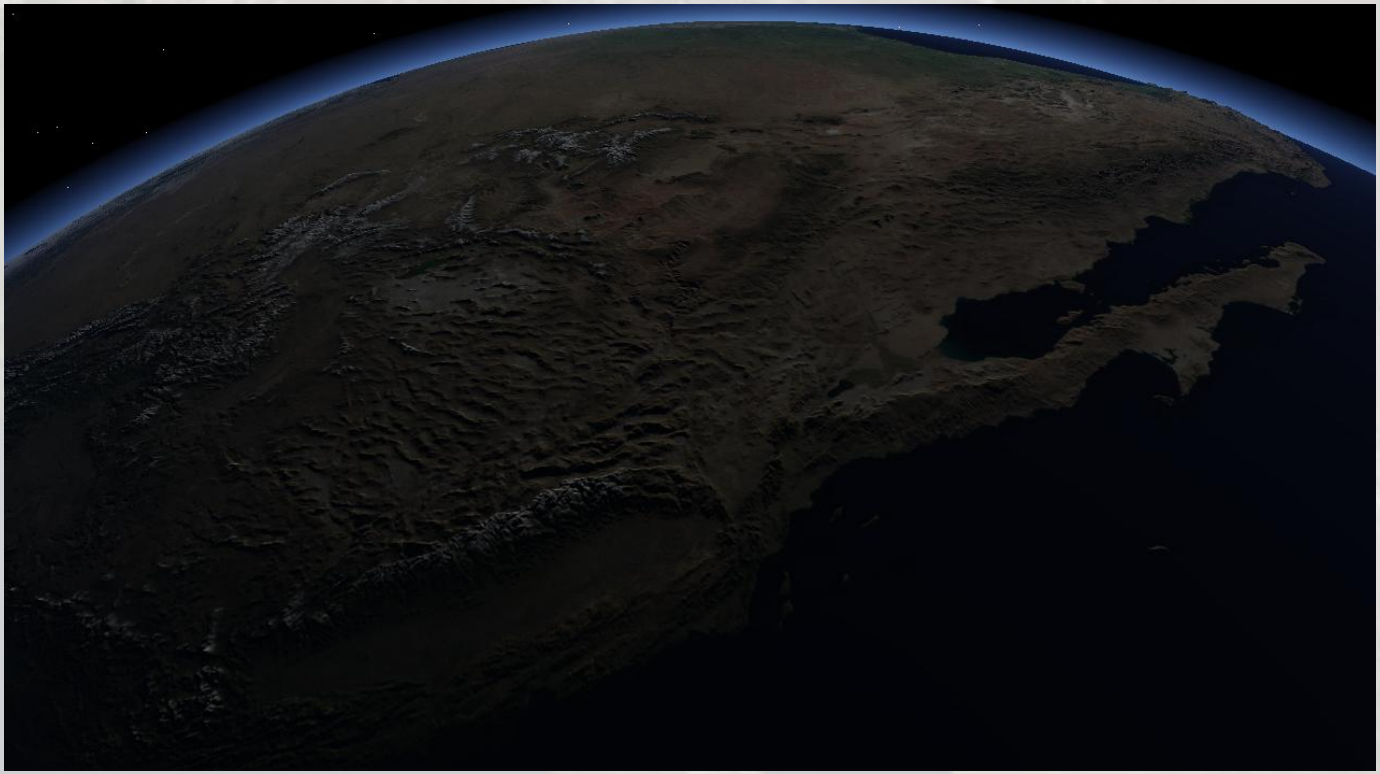
- Immediate raster display

Drawbacks of Hesperian's GPU-based Construction

- No simulation
- Precision artifacts with map projections

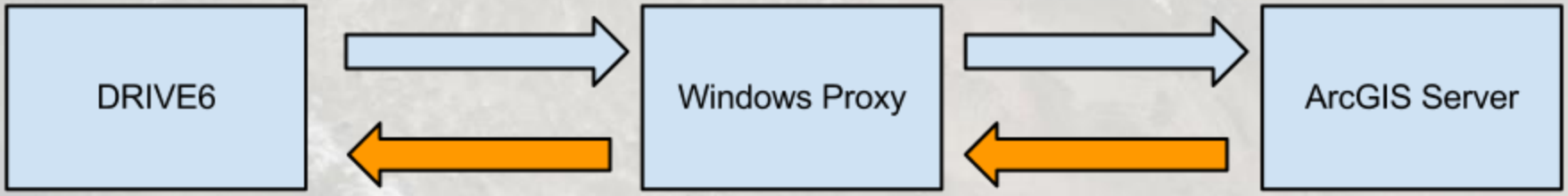
DMV Phase I Improvements

- Arbitrary Planetary Bodies



DMV Phase I Improvements

- Streaming from ArcGIS Server

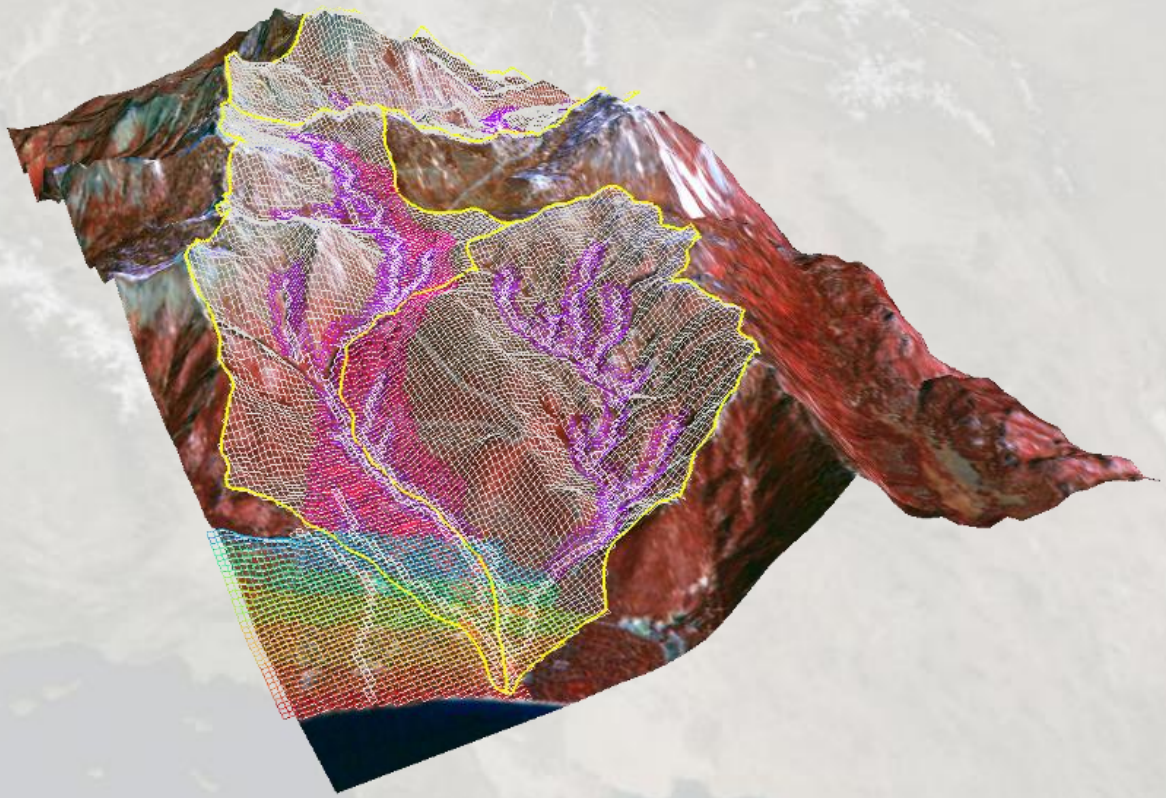


DMV Phase II

- Terrain database
  - Streaming of large datasets
  - Combine with immediacy of display

DMV Phase II

- Vector data



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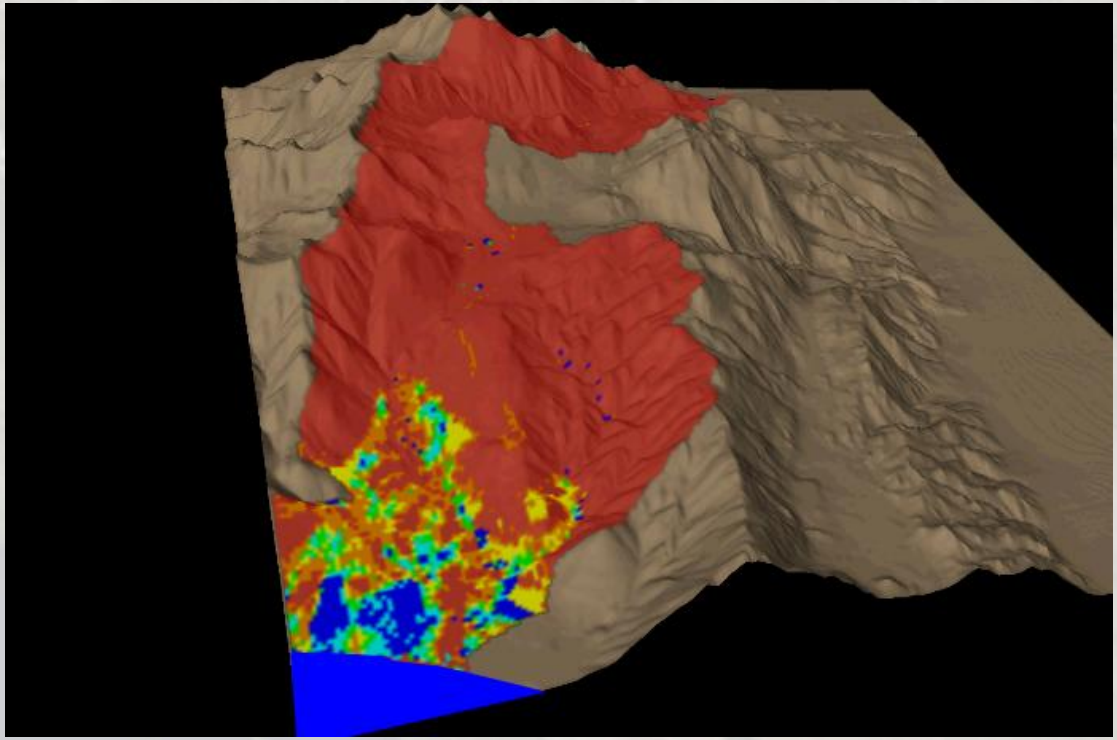
DMV Phase II

- Time varying data



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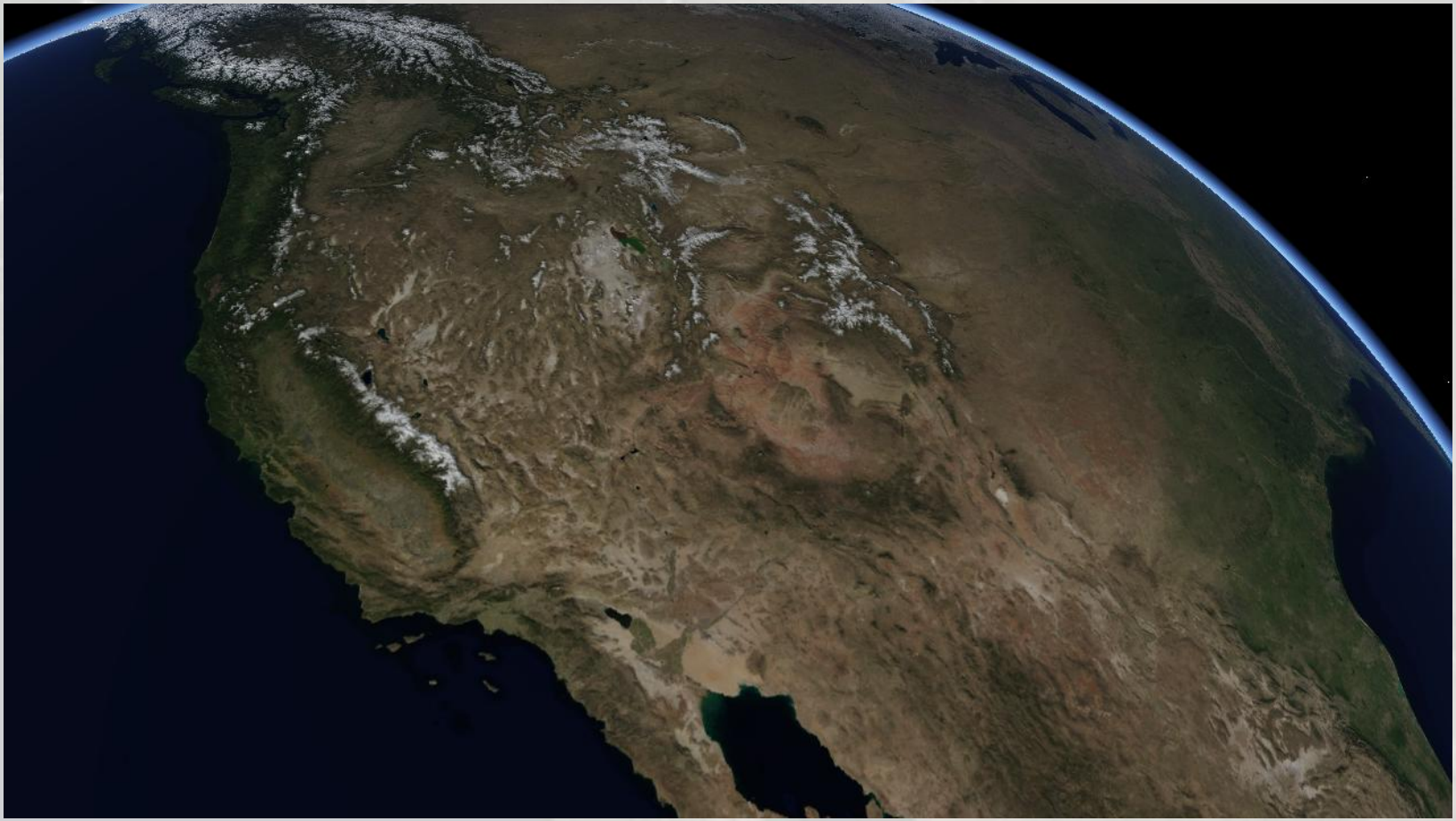
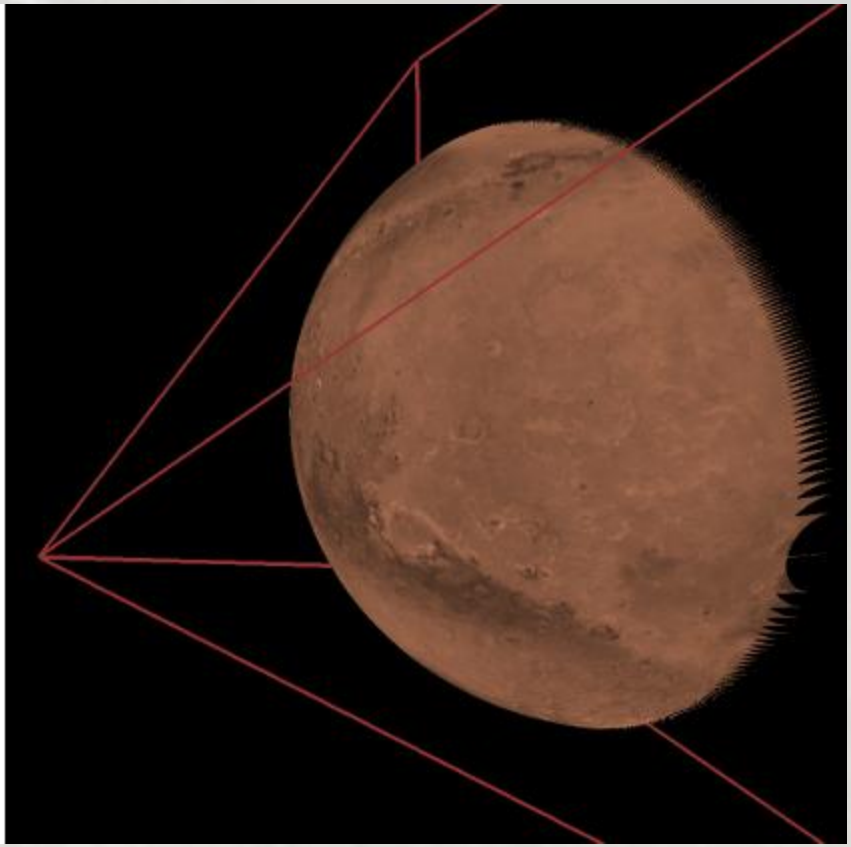
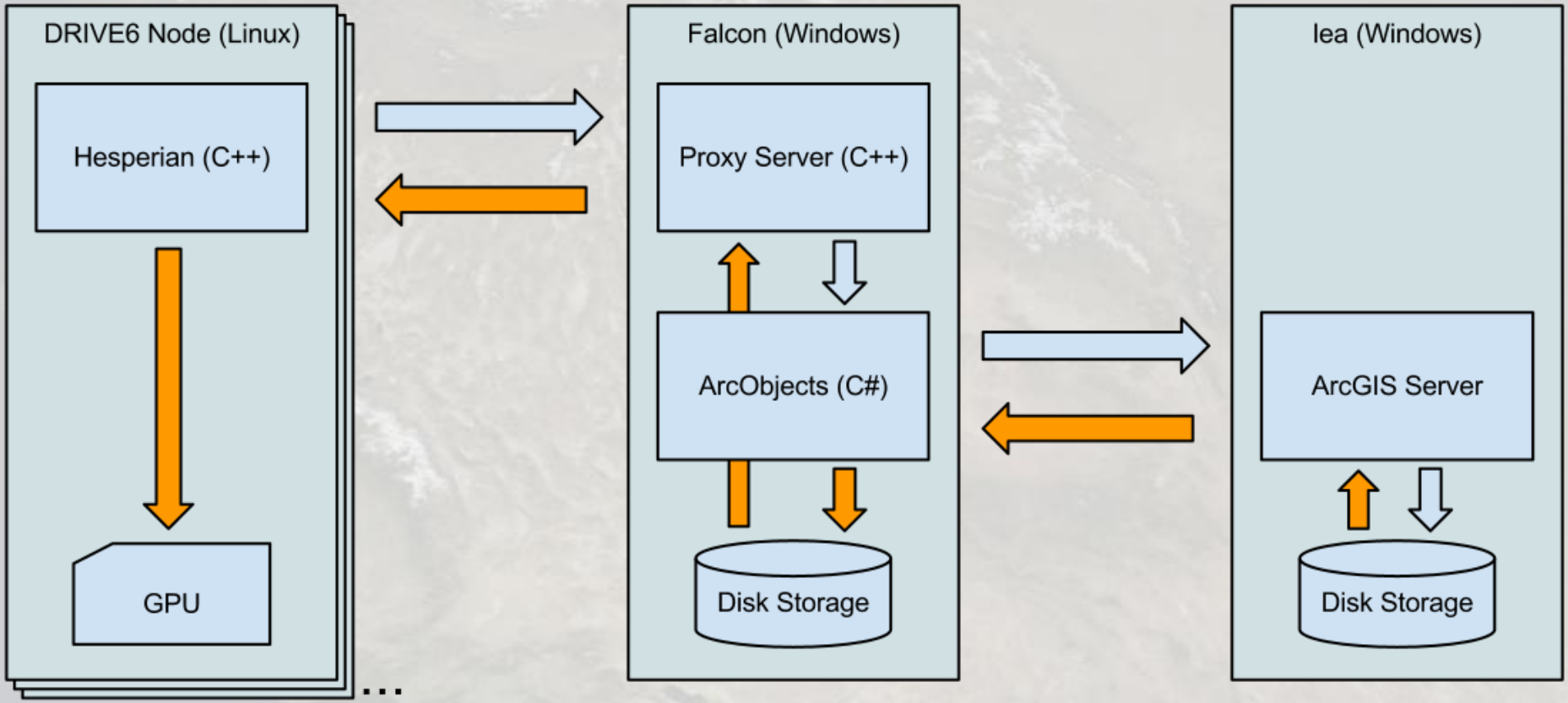
Virtual Reality and Planetary Terrain






DRIVE6 Node (Linux)
Hesperian (C++)
GPU
...
Falcon (Windows)
Proxy Server (C++)
ArcObjects (C#)
Disk Storage
Iea (Windows)
ArcGIS Server
Disk Storage