Terrain Analysis

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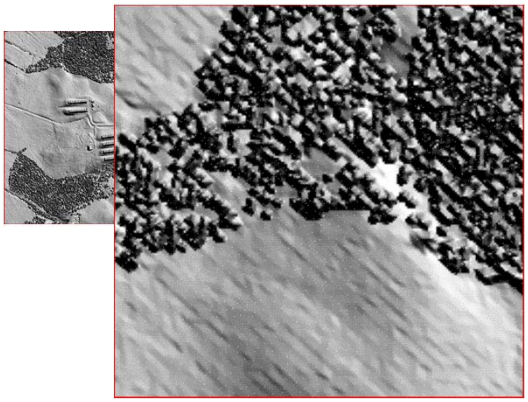
Geog 176A

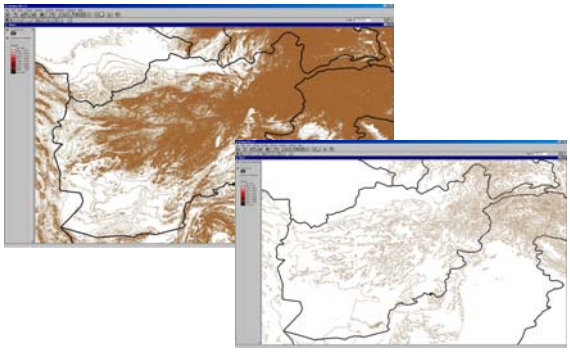
Models for terrain

- Contours: Vector
- Regular point samples
- Irregular point samples
- DEMs
- Surface patches
- TIN
- Voxel
- 3D point cloud

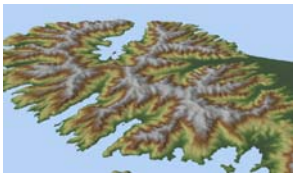
Point samples



Contours

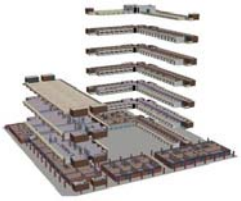


TIN



Voxels

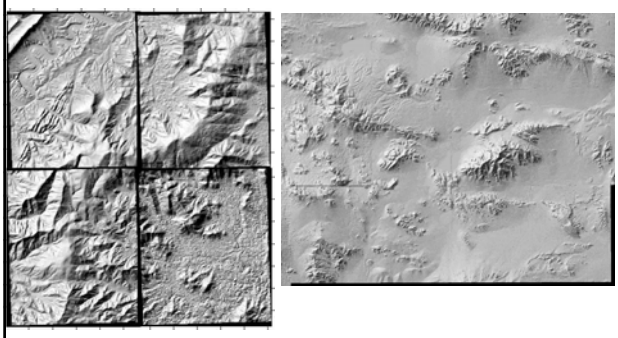
True 3D models



Terrain issues

- DEM normal reflects “bare earth”
- Heights can include surface features, natural and man-made
  - Digital elevation model
  - Digital terrain model
  - Digital surface model
  - True 3D model
  - Heights include depths
- Dynamic world: subsistence, landslides, etc.
- Technology of measurement improving faster than models and methods

Mosaicing issues



Global scale terrain data

- ETOPO5 and descendents (GLOBE) NGDC
  - Originally 5 arc sec. (9km) Geographic coords.
  - Cartographic source at 1:250K
  - Includes bathymetry
- DCW-VMAP0-Global Map
  - Vector source
  - 1:1M much data at 1km
- SRTM
  - 90 and 30m
  - Known problems with shadow and water
- GDEM
  - Aster satellite base
  - 30m globally

US terrain data

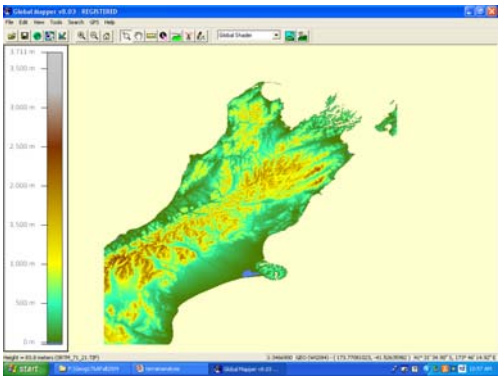
- USGS 3 arc seconds
- USGS 30m
- USGS NED 10m
- Adding
  - GeoSAR
  - LiDAR: NC
  - The National Map
- NOAA/FEMA using LiDAR in coastal area

NOAA DEM discovery portal

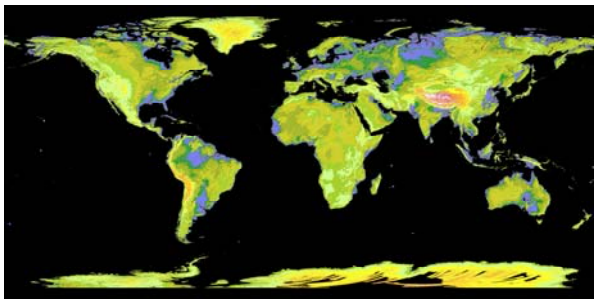
Global map

SRTM

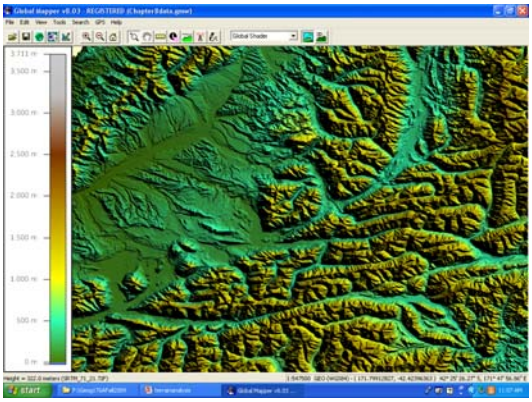
SRTM for part of New Zealand



GDEM Aster-derived 1 degree tiles



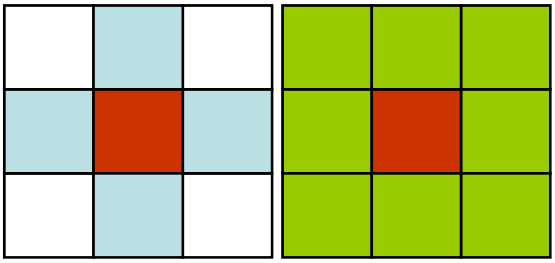
Somewhere in Afghanistan



Terrain surface transformations

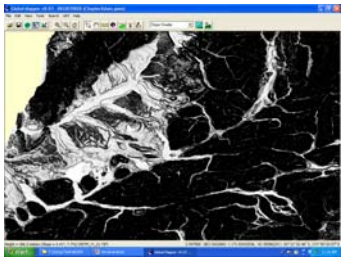
Von Neumann

Moore

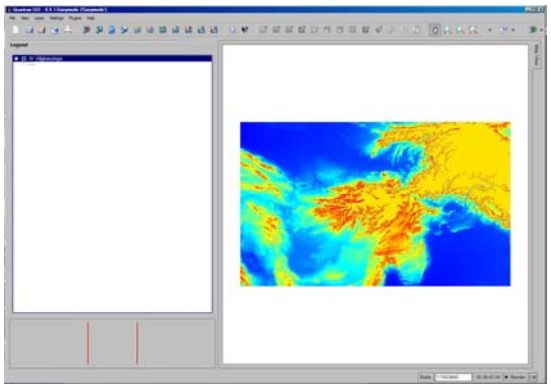


First derivative

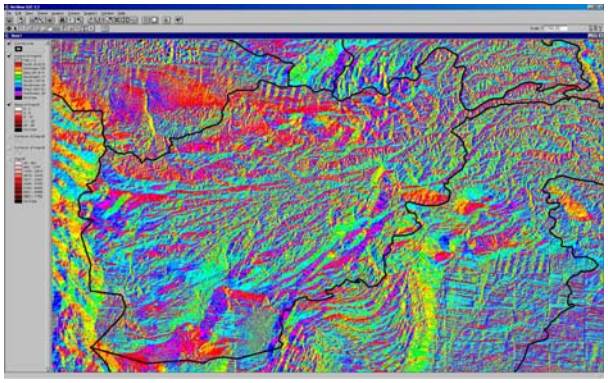
- Maximum slope in neighborhood
- Direction of maximum slope



Slope: Magnitude



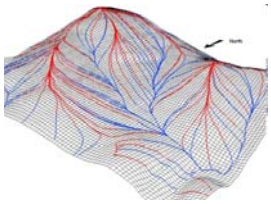
Slope: Aspect

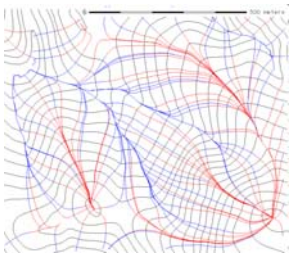


Terrain Analysis

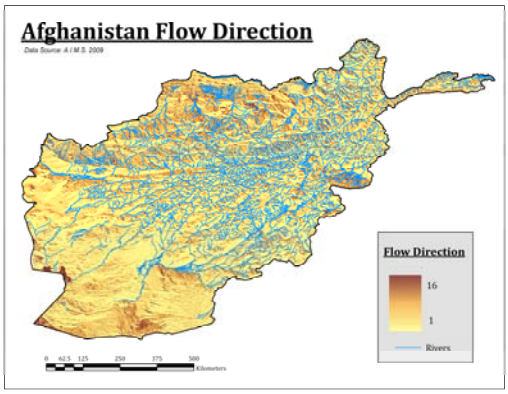
- Surface network extraction
- Surface network character, e.g. Strahler order
- Profile and Line-of-Sight
- Intervisibility and Viewshed
- Terrain modeling
- Vizualization

Terrain “skeleton” Warntz network Surface network

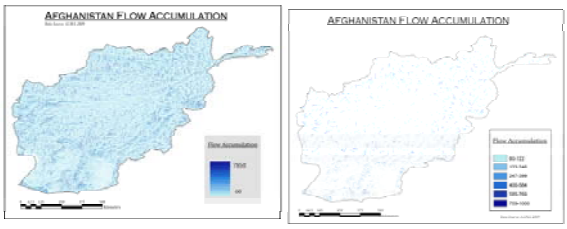




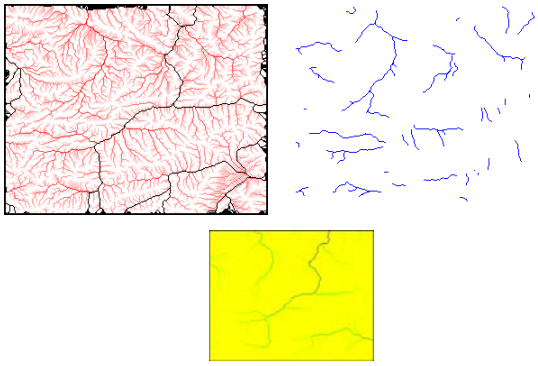
Flow direction



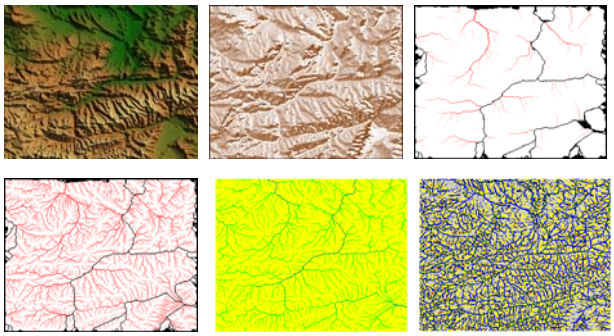
Flow accumulation: Thresholding



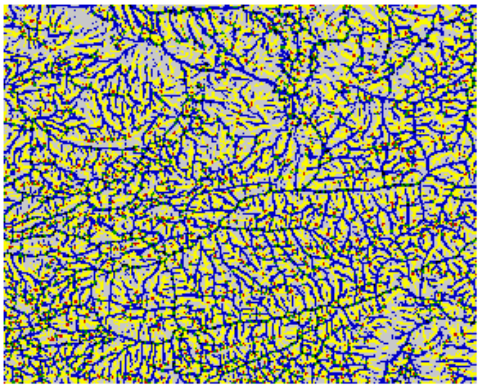
D8 and thresholding



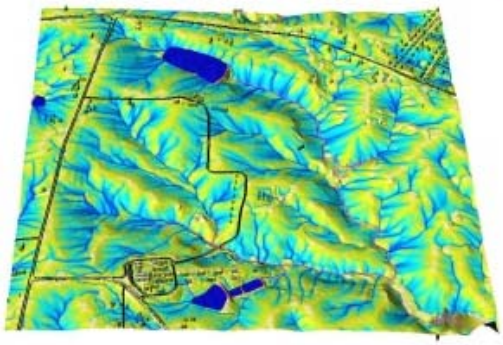
Sequence



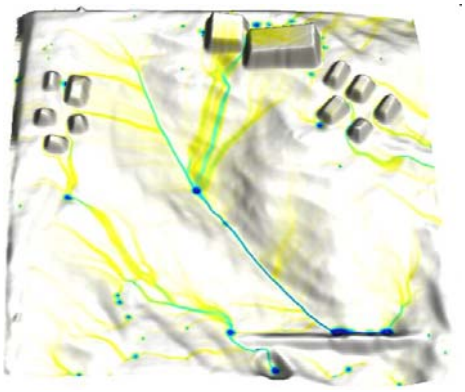
Features



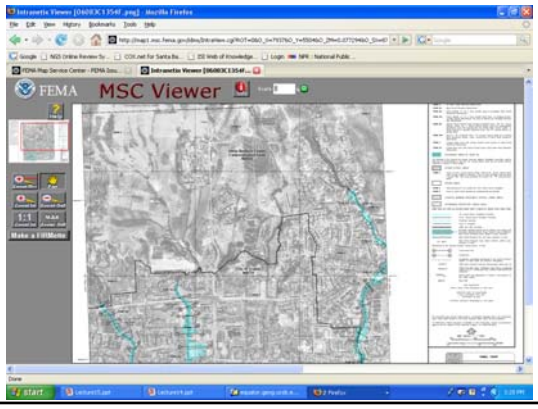
Flow modeling (H. Mitasova)



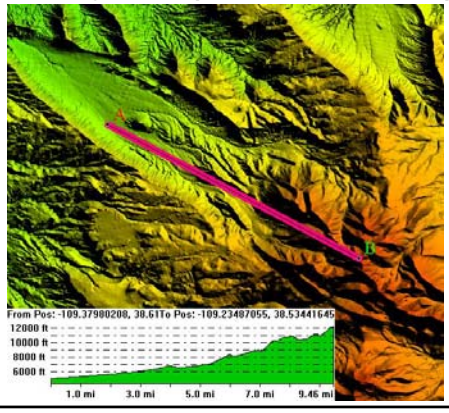
Erosion simulation (H. Mitasova)



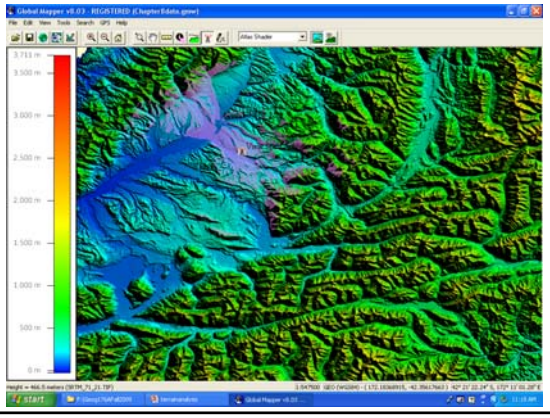
FEMA: D-FIRMs



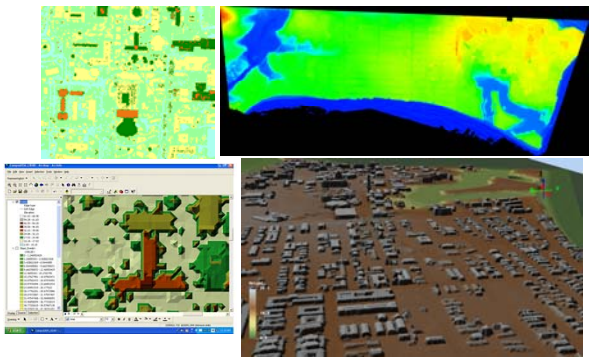
Profile by Computer: GlobalMapper



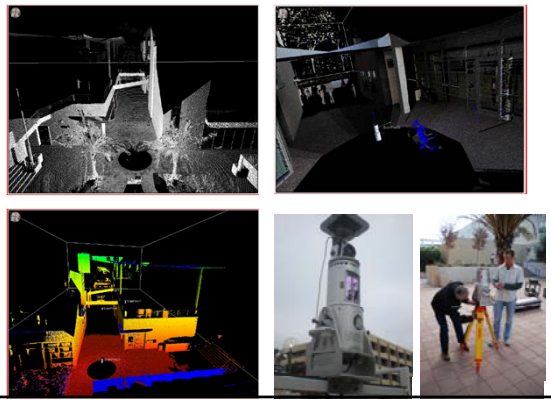
Viewshed



3D Models LiDAR

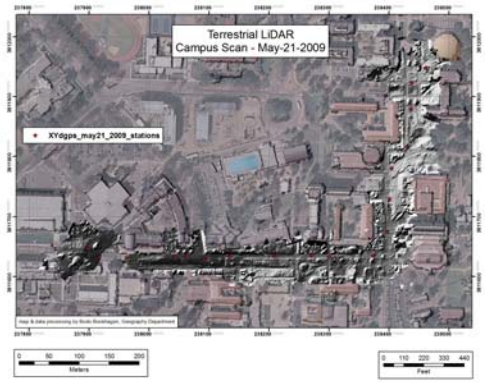


Terrestrial Scanning LiDAR

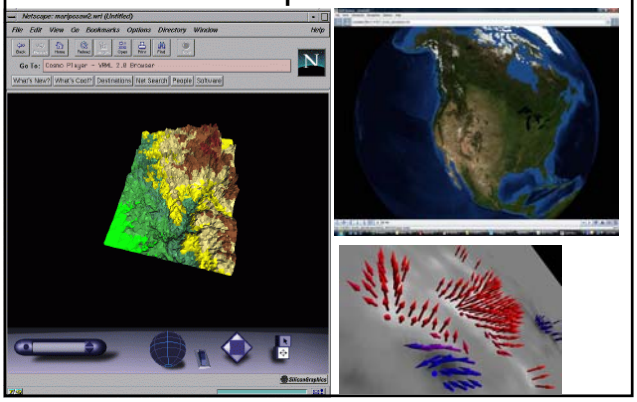


LiDAR Point Cloud

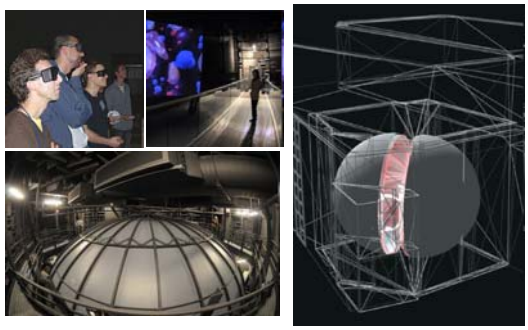
Campus scans



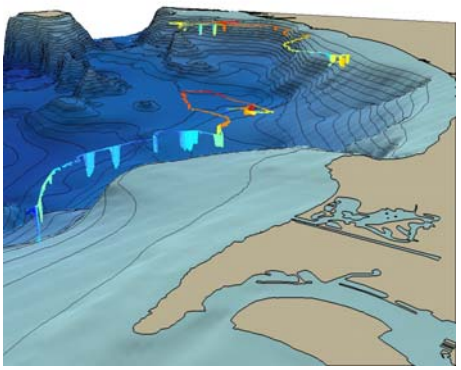
Movement depth: VRML & X3D

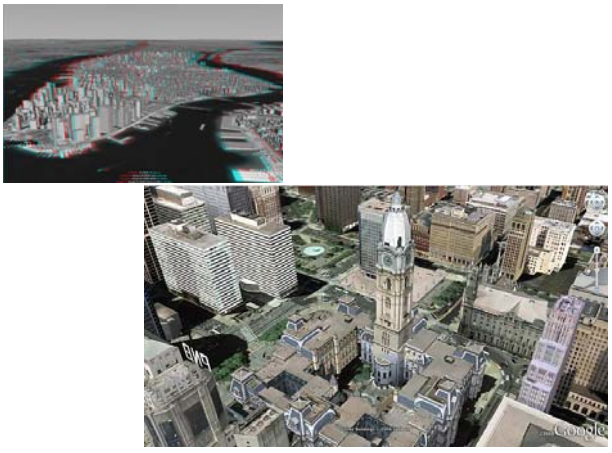


UCSB's Allosphere

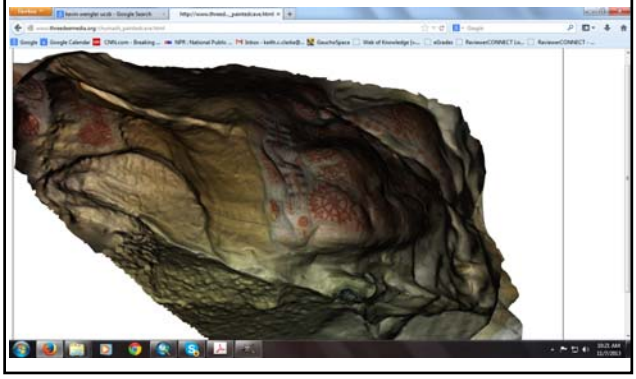


Some terrain visualizations

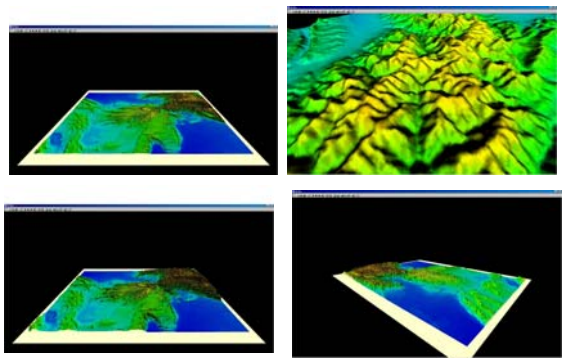




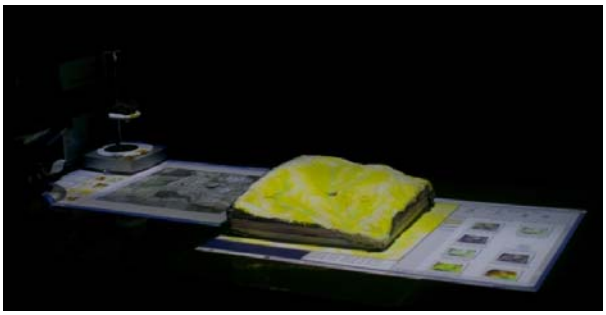
3D from camera geometry:
K. Wengler—Painted Cave



Pan-zoom-flyby-flythru



Projection systems (H. Mitasova)



Coming next…

Making Maps
with GIS