Lunar GIS
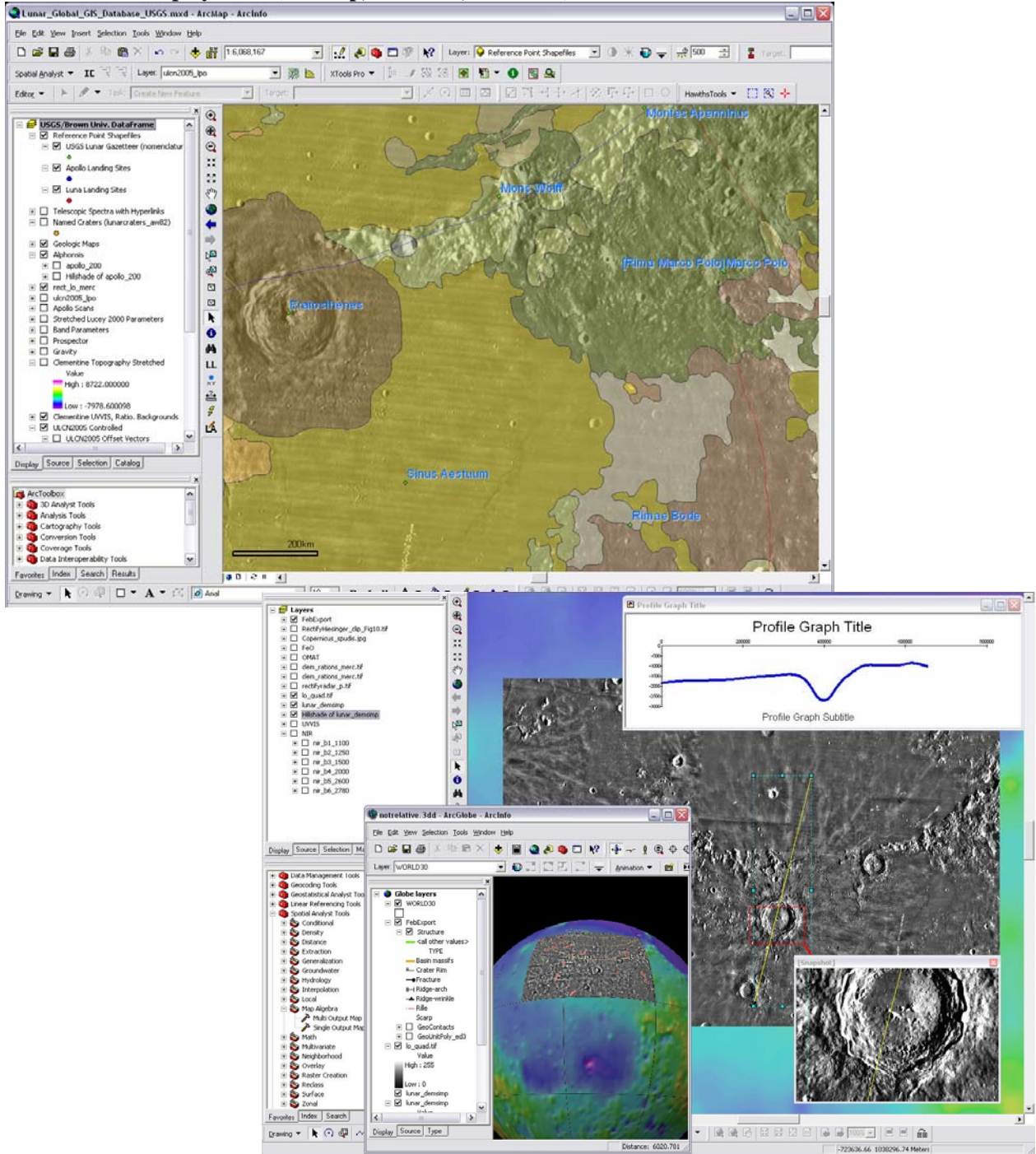
USGS, Astrogeology

GOALS:

- Missions must have a cartographic planning component, and a **consistent** cartographic coordinate system should be used for data products.

- The current effort to create a Lunar GIS needs to be continued and greatly expanded in the future, and coordinated among **multiple facilities**.

- Planetary data should be systematically processed in a coordinated way and made available in an **easily accessed** form (e.g., a GIS).

- Expand and/or connect planetary GIS-ready (**OGC compliant**) servers to broaden and coordinate data access.

- Develop toolkits and decision support systems to support further exploration and a human return to the Moon.
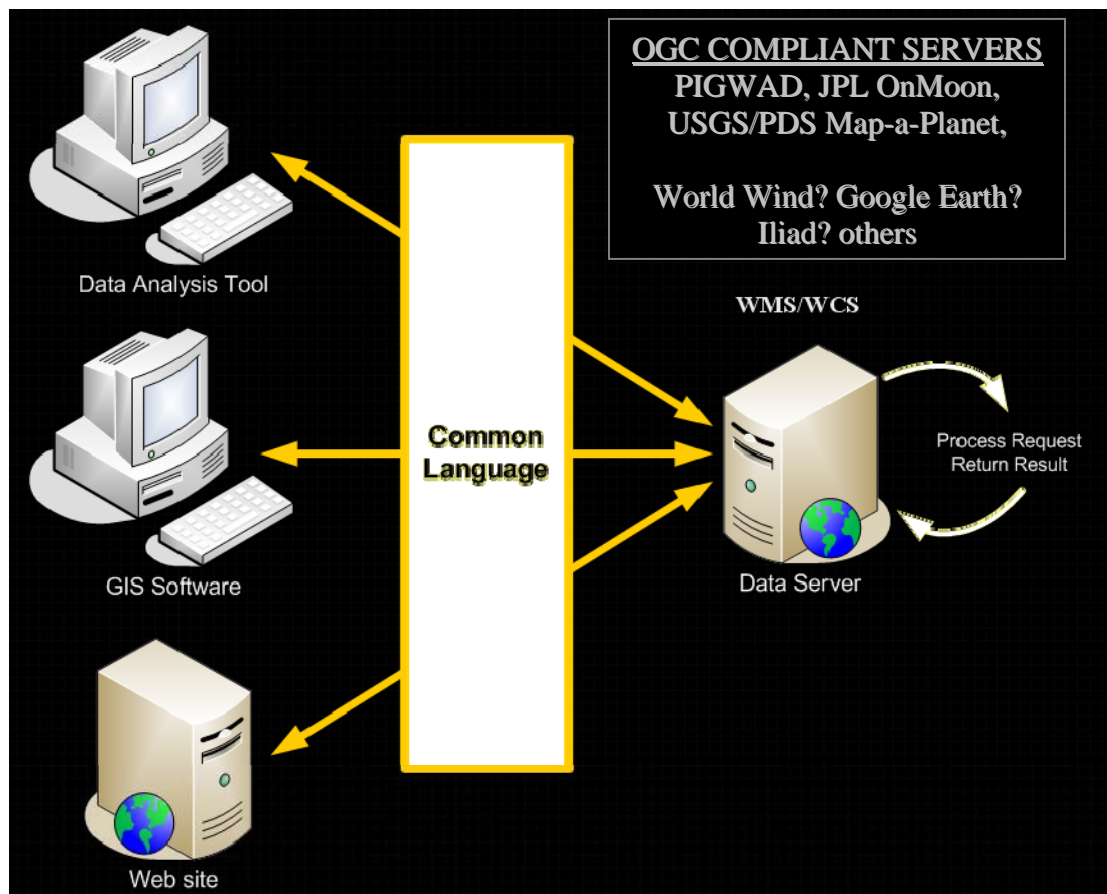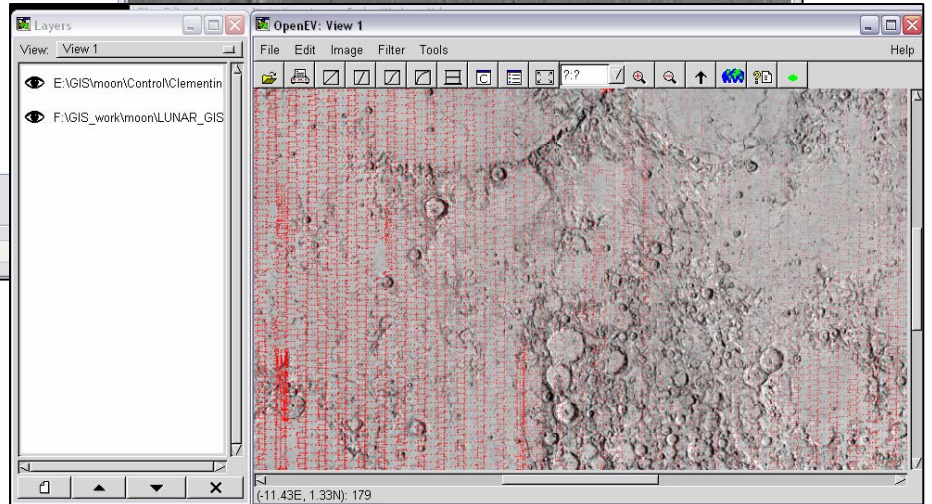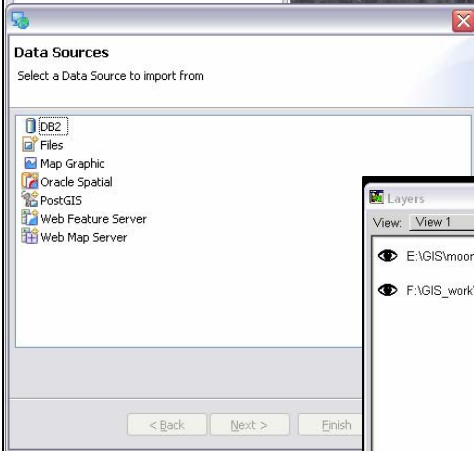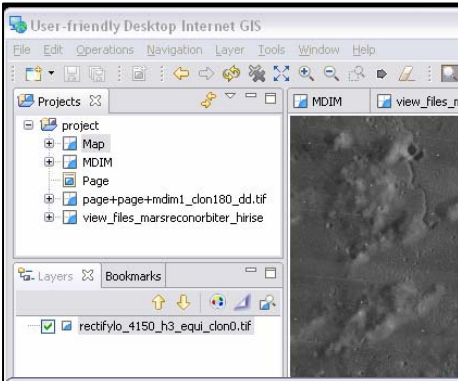
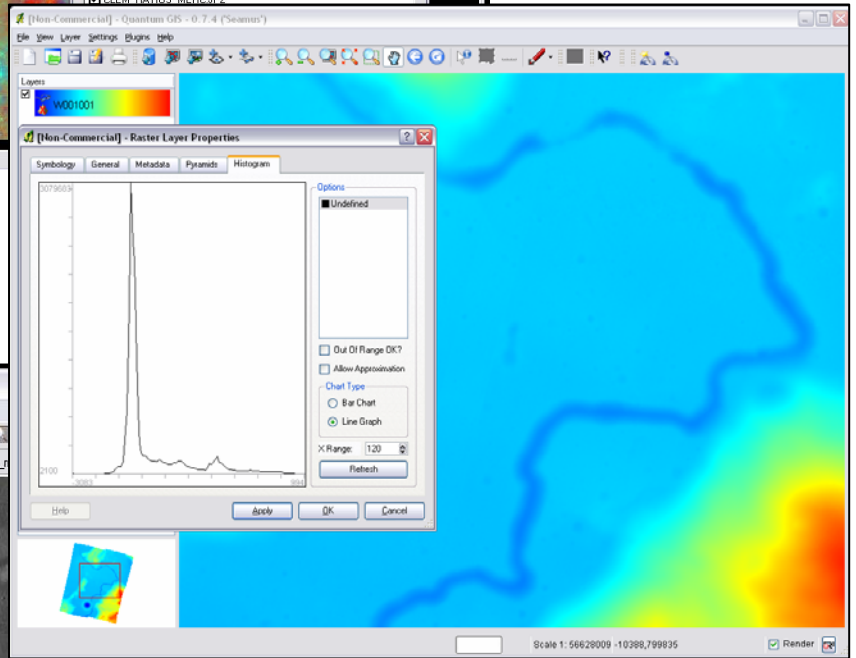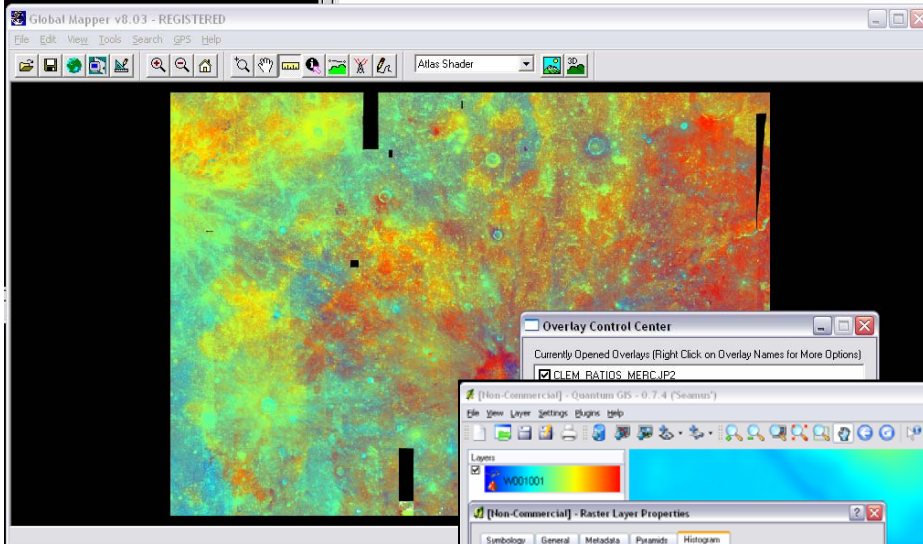# Lunar GIS Tools Overview (only a couple examples shown)

- **ArcGIS Desktop by ESRI (ArcMap, ArcScene, ArcGlobe)**

Global Mapper, QGIS, UDIG, OpenEV (part of FWTools, GDAL)

GIS Web Services – external data protocols and providers
▪ **PIGWAD (ArcIMS, supports WMS, WFS, KML for Google Earth), http://webgis.wr.usgs.gov**

GIS Web Services

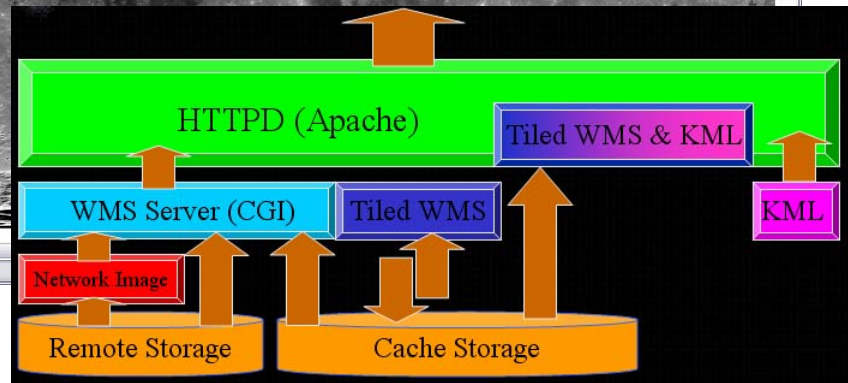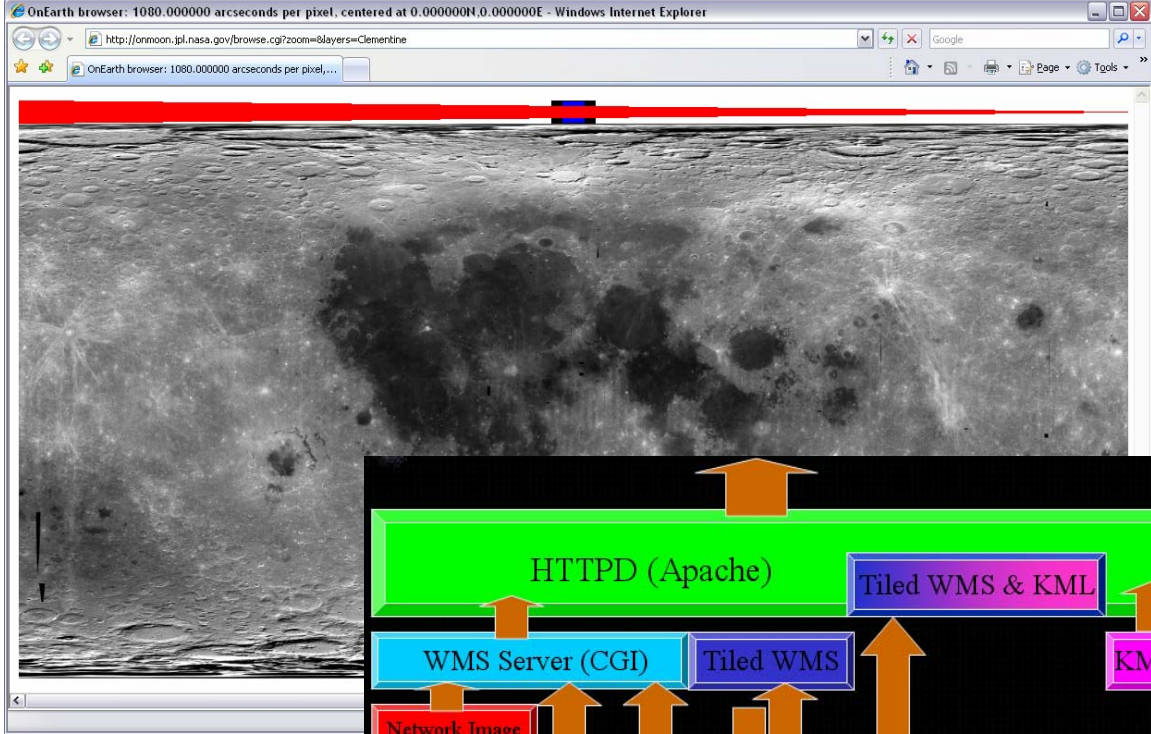▪ **USGS (PDS) Map-a-Planet - WMS (OGC Compliant GIS Server), http://www.mapaplanet.org/**
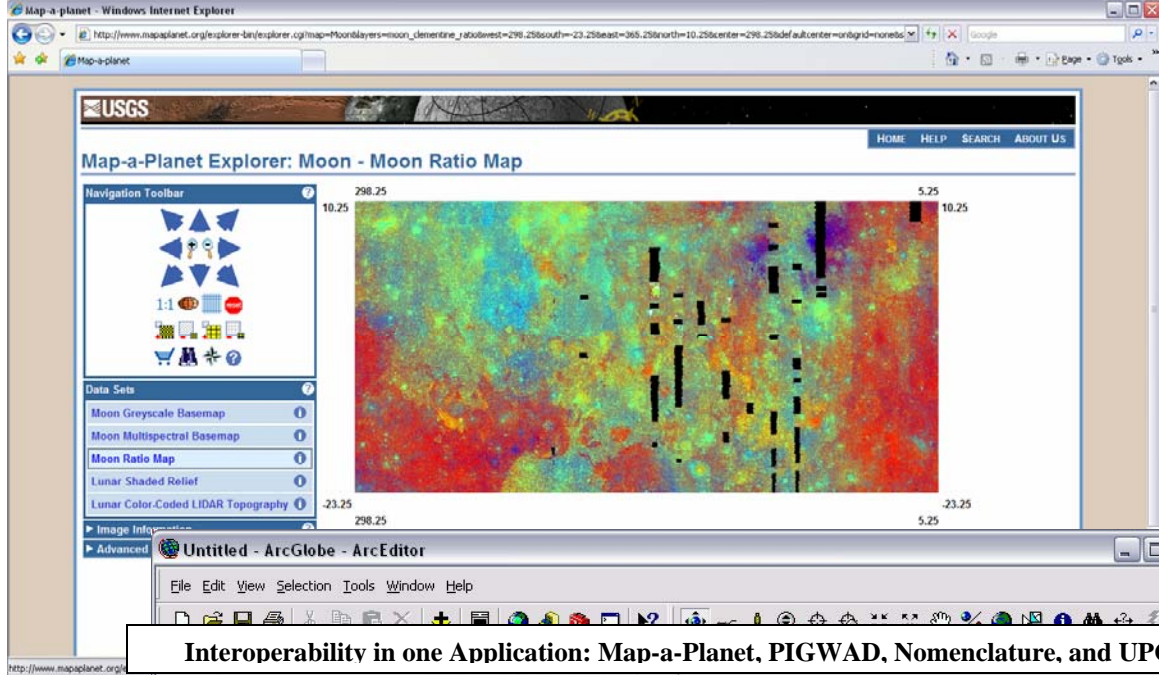
Interoperability in one Application: Map-a-Planet, PIGWAD, Nomenclature, and UPC
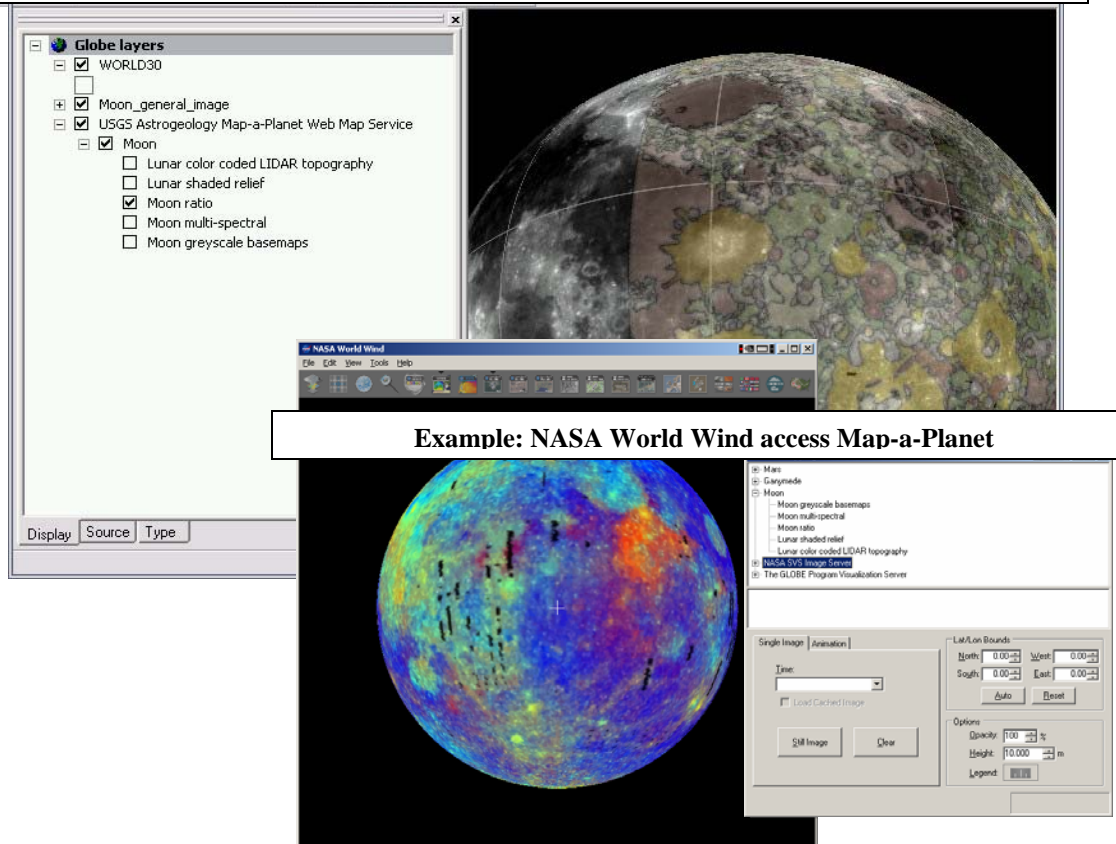
Example: NASA World Wind access Map-a-Planet

GIS Web Services

▪ **JPL OnMoon WMS (OGC Compliant GIS Server), http://webgis.wr.usgs.gov/ogc**

OGC Planetary Coordinate Reference System

• Planetary Namespace based on IAU2000 report and using NAIF codes for base value.

GEOGCS["GCS_Moon_2000",DATUM["D_Moon_2000",SPHEROID["Moon_2000_IAU_IAG",1737400.0,0.0]],
PRIMEM["Reference_Meridian",0.0],UNIT["Degree",0.0174532925199433]]

| IAU Name	Mars GIS-IAU	GEOIDS
IAU2000	49900	Mars2000, areocentric latitudes, positive East longitudes
IAU2000	49901	Mars2000, areographic latitudes, positive West longitudes
IAU2000	49902 - 49909	Available
		PROJECTIONS - Even codes=areocentric, **Odd codes**=aerographic **NOT all shown**)
IAU2000	49910	Equirectangular (Simple Cyl), clon=0º, spherical equation, areocentric
IAU2000	49911	Equirectangular (Simple Cyl), clon=0º, spherical equation, aerographic
IAU2000	49912	Equirectangular (Simple Cyl), clon=180º, spherical equation, areocentric
IAU2000	49914	Sinusoidal, clon = 0º, spherical equation, areocentric
IAU2000	49916	Sinusoidal, clon = 180º, spherical equation, areocentric
IAU2000	49918	Polar Stereographic, clat = 90º, clon = 0º, spherical eq, polar radius, areocentric
IAU2000	49920	Polar Stereographic, clat = -90º, clon = 0º, spherical eq, polar radius, areocentric
IAU2000	49922 ~ 49959	Available (1:2M Mars series handled by AUTO below)
		AUTO PROJECTIONS (parameter order)
IAU2000 or Auto	49960	Auto Sinusoidal, spherical equation, areocentric, (clon)
IAU2000 or Auto	49961	Auto Sinusoidal, spherical equation, aerographic, (clon)
IAU2000 or Auto	49962	Auto (Polar) Stereographic, spherical equation, areocentric (clon, clat, scale)

http://www.lpi.usra.edu/meetings/lpsc2006/pdf/1931.pdf

Lunar GIS Data Set Overview (subset of layers shown) – For more information please visit:
http://webgis.wr.usgs.gov/

All layers will be available for download and via on-line WMS GIS servers
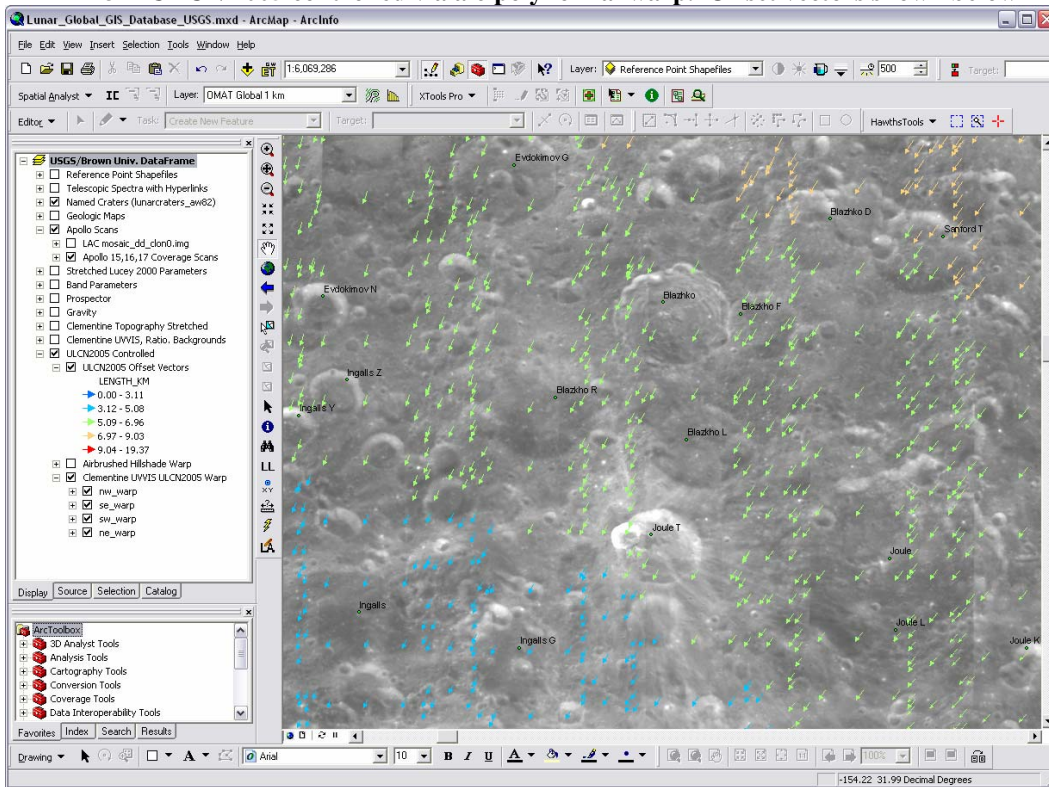
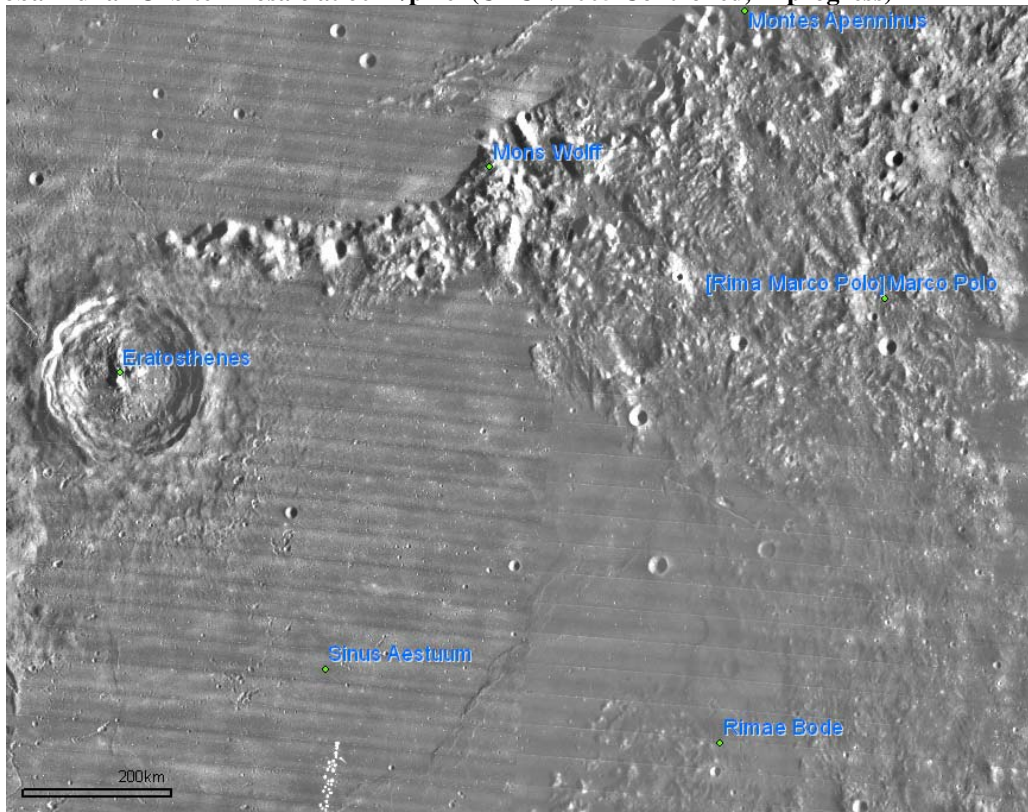- **ULCN2005: Unified Lunar Control Network 2005(ULCN2005) solution**
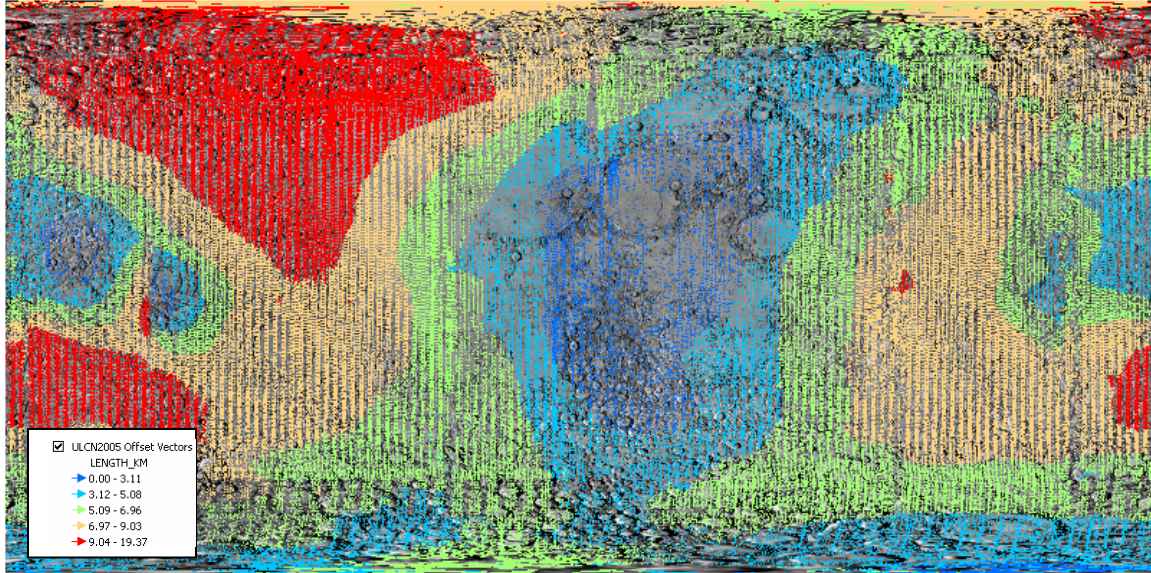
- **Derived ULCN2005 DEM**
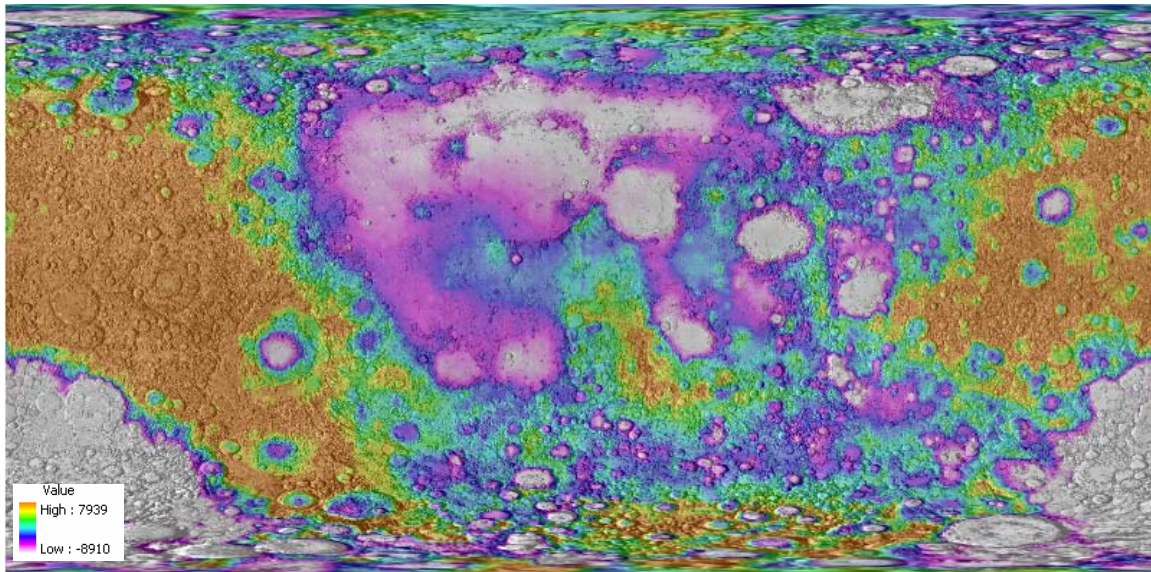
- **Clementine UVVIS (5 bands, 100m/pixel) and NIR (6 bands, 500m/pixel – 100m/p in progress)**
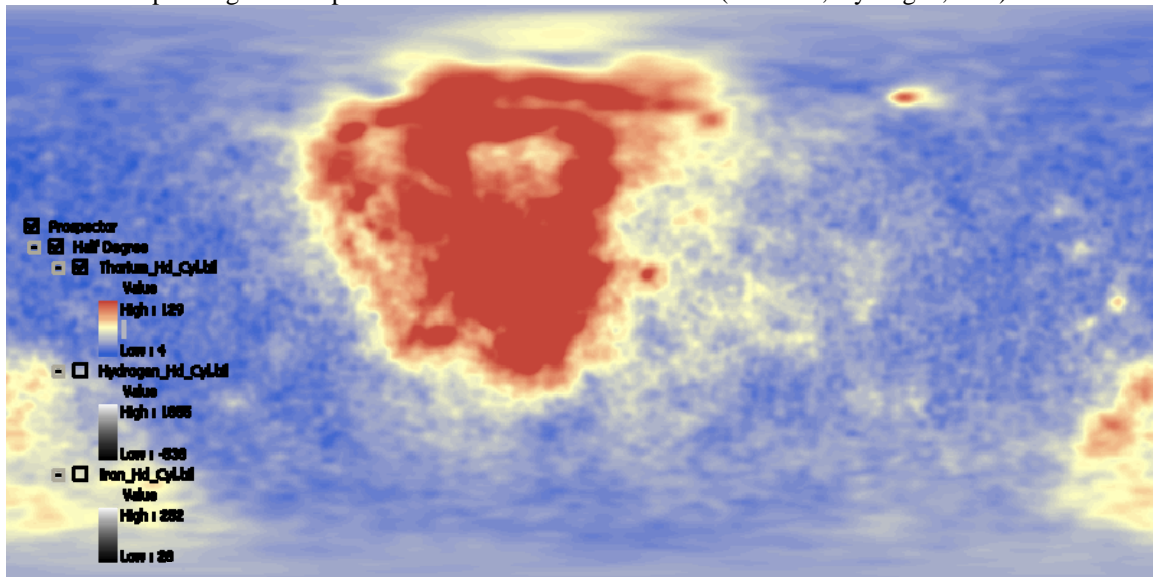 - ULCN 2005 controlled via a 6 polynomial warp. Offset vectors shown below

- **Global Lunar Orbiter mosaic at 60 m/pixel (ULCN 2005 Controlled, in progress)**

- Global 5M Geologic Maps

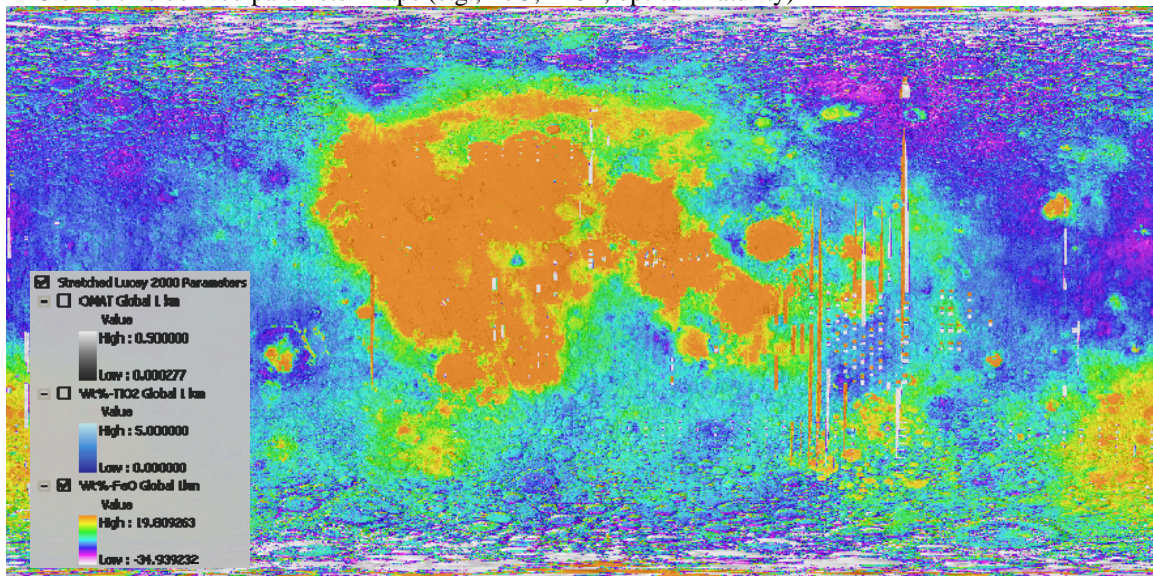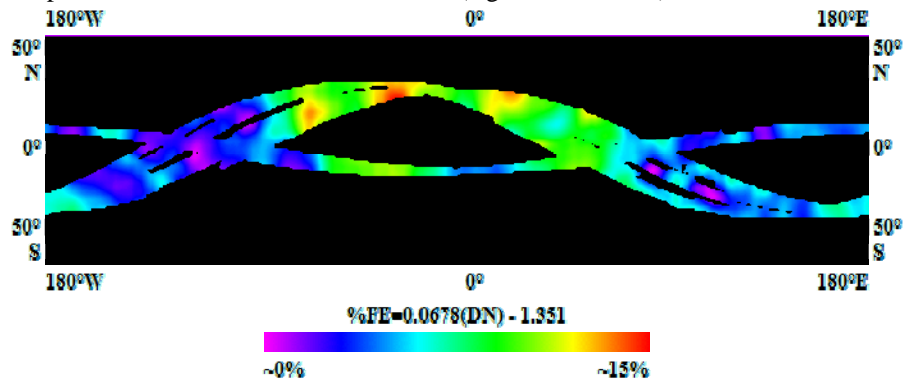- IAU Nomenclature, Named Craters, Landing Sites (backdrop Clementine and ULCN2005 DEM)

- Lunar Prospector global maps of derived elemental abundances (Thorium, Hydrogen, Iron)

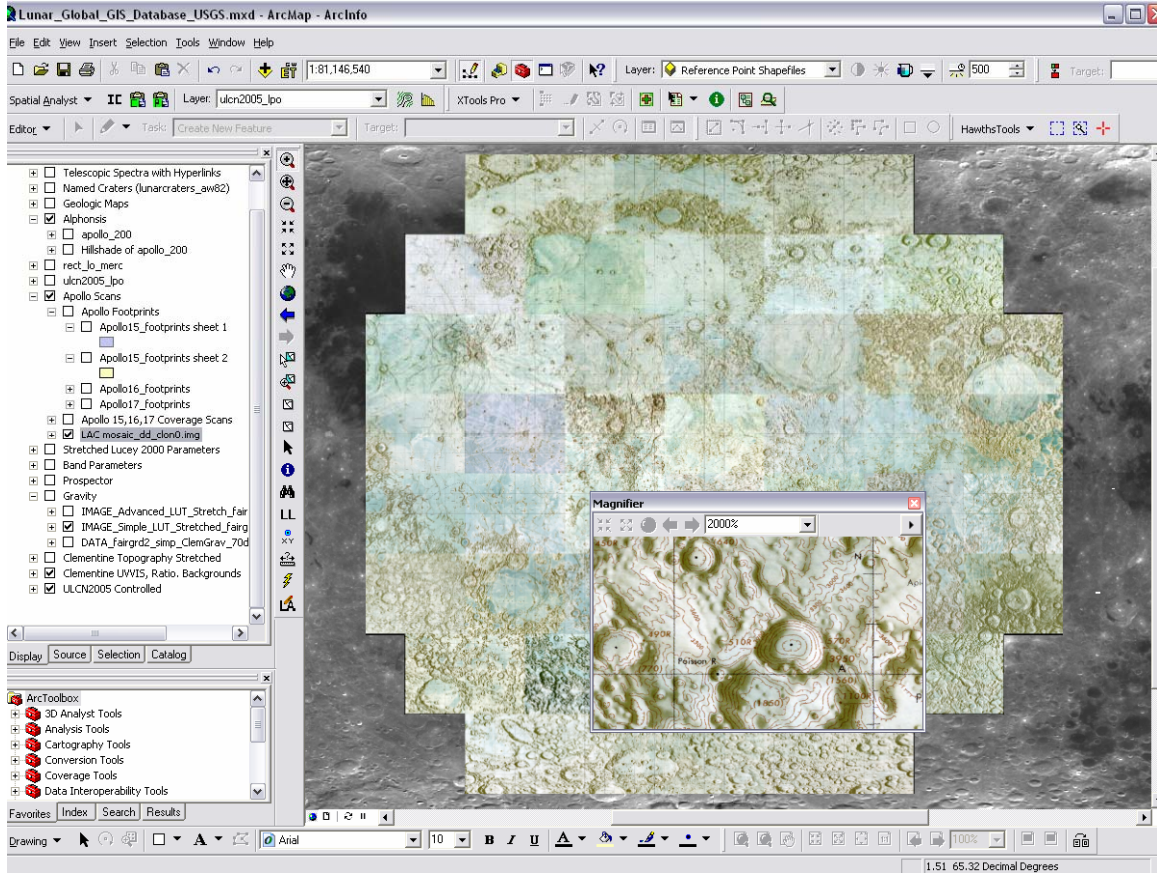- Clementine derived parameter maps (e.g., FeO, TiO2, optical maturity)

- Apollo historic 'Lunar Consortium' data (e.g., Al, Si, Fe, Ti)

%FE=0.0678(DN) - 1.351

~0%   ~15%

- Apollo topographic maps produced by USGS (Hadley Rile, Littrow, Alphonsus crater)

- Apollo Metric and Pan Camera Coverage maps (Scans by LPI and vector footprints)

- LAC Lunar Astronautical Charts (Scans by LPI)

Not yet GIS available
- Galileo SSI bands and color-ratio mosaics
- Photogrammetrically-derived topography of a Shackleton crater analog
- Cook, T., et al. and ULCN2005 merged DEM