Developing a Global Lunar Crater Database, Complete for Craters ≥1 km

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What?

Construction of a **global impact crater database** for the Moon. Database will include all craters and properties for those craters with diameters $D \geq 1$ km; many craters $D < 1$ km will be included to ensure population ≥1 km is sampled. Additionally, all craters $D \geq 0.5$ km in lunar maria will be included.

Why?

Use for numerous science applications, including:

- surface ages
- impact scaling laws
- secondary crater studies
- different cratering rates
- erosion & diffusion rates

How?

This is a **fully manual** effort because automated detection is not yet good enough for this global work over different terrain types.

Craters are **manually** identified and the rims are traced in *ArcMap* using the "streaming" tool so many points define the rim. These digitized rims are exported in units of decimal degrees and imported to *Igor Pro.* Algorithms correct for all projection effects using Great Circles [1] for each rim point.

From the code, both a circle and ellipse are fit. From the circles, location and diameter are saved. From the ellipse, major and minor axes, tilt, ellipticity, and eccentricity are saved.

What Data?

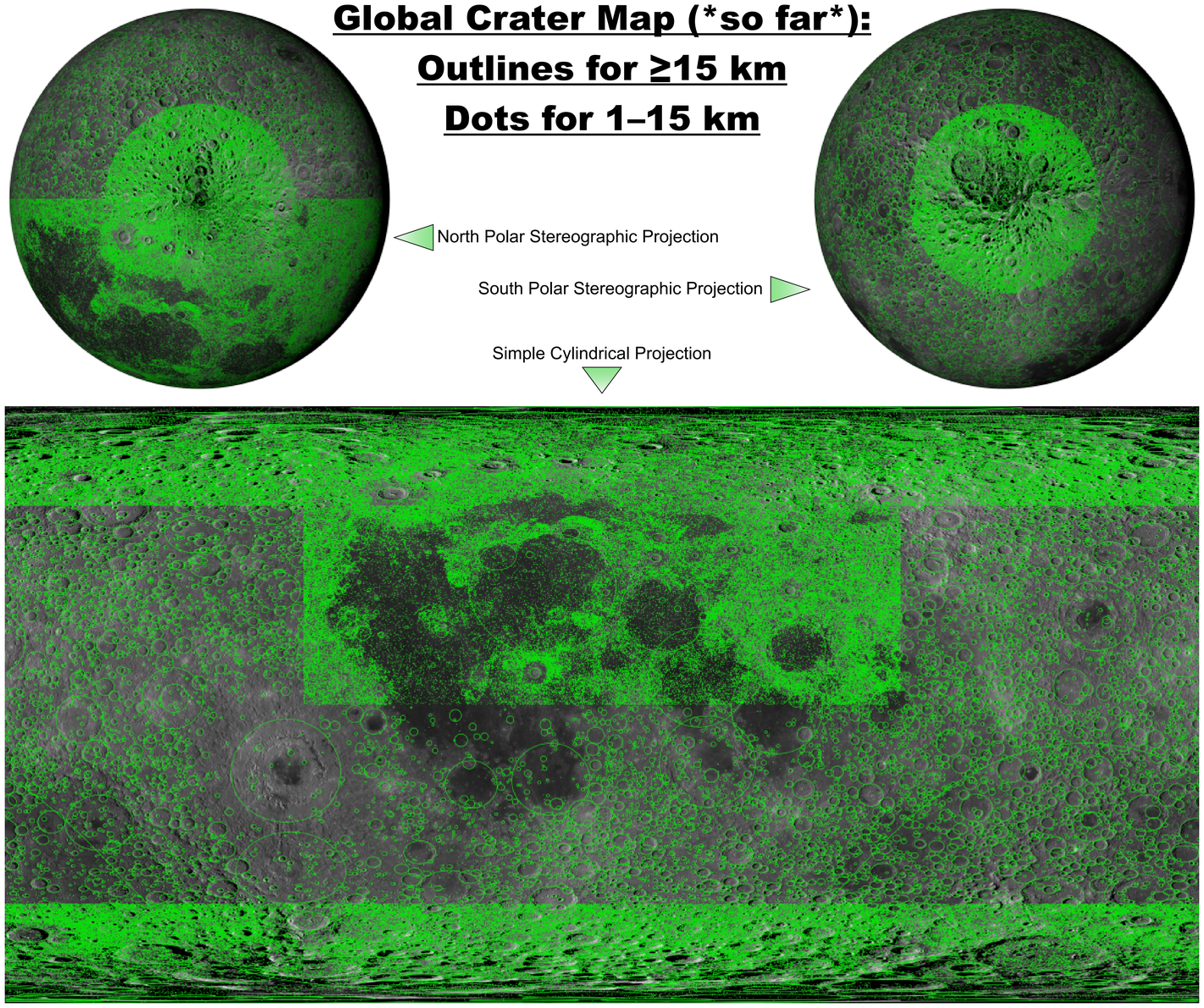
Lunar Reconnaissance Orbiter:

- $D \gtrsim 1$ km: 100m/px global, Wide-Angle Camera (WAC) mosaics
- $D \gtrsim 1$ km: ~118m/px global, up to 10 m/px (poles) Lunar Orbiter Laser Altimeter (LOLA) gridded data

Kaguya (かぐや):

- $D \geq 0.5$ km: 10m/px global, Terrain Camera mosaics

Global Crater Map (*so far*):
Outlines for ≥15 km
Dots for 1–15 km



Current Status?

Global: Craters $D \geq 15$ km
35.0%*: Craters $D \geq 1$ km

# Craters ≥15 km:	9,337
# Craters ≥1 km:	390,474
# Craters (total):	665,575

*Poleward of ±60° latitude, and -90°–+90°E by 0°–+60°N.

Expected Completion?

Summer/Autumn 2016

This time and effort is **only** for basic crater mapping: Crater center location, crater diameter, and ellipse properties.

Future Expansion?

Yes!

Available Funding: To complete global for $D \geq 1$ km. And complete maria for $D \geq 0.5$ km.

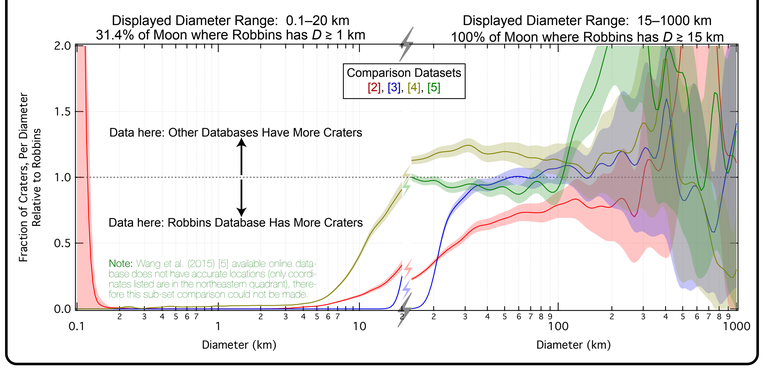
Wish List: Crater morphology, ejecta morphology, crater topography (including volume).

Comparison with Other Databases

One of the main methods to compare different crater databases is to examine a crater size-frequency distribution (SFD), the number of craters versus the crater diameter. This was done with four other recent global databases:

- [2] Named craters and the historic "LPI Catalog"
- [3] Manual $D \geq 20$ km global database
- [4] Semi-automated global database
- [5] Automated global database

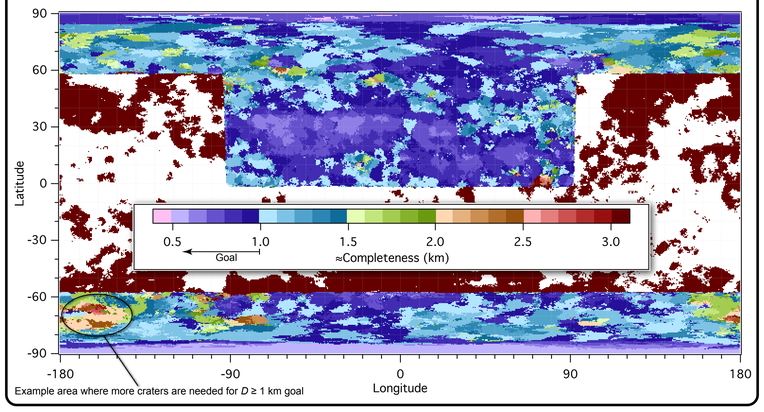
Each SFD is divided by the SFD for this new database to construct the ratio plots below (2σ uncertainty envelopes).



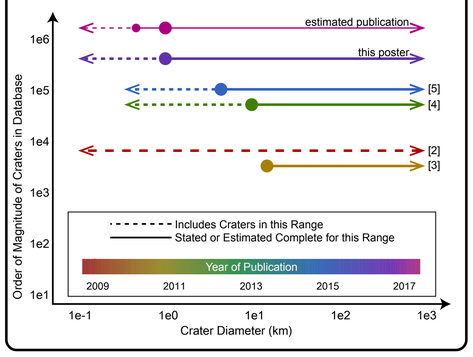
Estimating "Completeness"

Knowing whether one has a complete census requires a comparison – since this effort is the first to globally map impacts ≥1 km, there is no comparison other than for larger diameters (see adjacent panel).

A kernel density estimator smooths the population (increase number statistics at any grid point); then, a SFD is made at each grid point, and the roll-over at small diameters is found. The diameter of that roll-over is saved (below) and considered the "completeness" diameter.



Database Release, Quantity, Diameter Range Comparison



References & Acknowledgments

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