

Introduction

- Locations on the lunar surface with **strong UV absorption** and **high albedo** are considered “red spots” and suggested to be areas of **silicic volcanism** [e.g., 1,2].
- The **Gruithuisen domes** (36°N, 40°W) are steep-sided red spots with distinct morphology.
- How did these features form? The main hypotheses [e.g., 3]:
 - (i) **silicate liquid immiscibility**: fractional crystallization results in separate silica-rich and FeO-rich magmas
 - (ii) **basaltic underplating**: intrusion of basaltic mantle melts the anorthosite crust and results in rhyolitic plumes
- We focus on the Lunar Vulkan Imaging and Spectroscopy Explorer (Lunar-VISE) [4] mission’s planned landing site on Mons Gruithuisen Gamma.
- We examine **Lunar Reconnaissance Orbiter Camera Narrow Angle Camera** data to characterize the **variation of photometric properties** across the dome which has been tied to FeO composition in previous work [5]
- We fit Hapke parameters for each NAC image covering the Gamma dome using the NAC-derived digital terrain model (NAC_DTM_GRUITHUISEN) [e.g. 6, 7].

Hapke Parameter Modeling

$$I/F = LS(i, e) \times \frac{\omega}{4} (p(g)) [1 + B_{SO} B_S(g, h_s)] + M(i, e, \omega) \{1 + B_{CO} B_C(g, h_c)\} \times S(i, e, \theta, \psi)$$

(equation from [7])

Parameter	Range
ω (Single Scattering Albedo)	0.0 - 1.0 (Calculated)
b (parameter of the Single Particle Phase Function (p(g)))	0.1 - 0.4 (Calculated)
Phase Angle	30° - 87°
Emission Angle	1° - 23°
Incidence Angle	40° - 85°

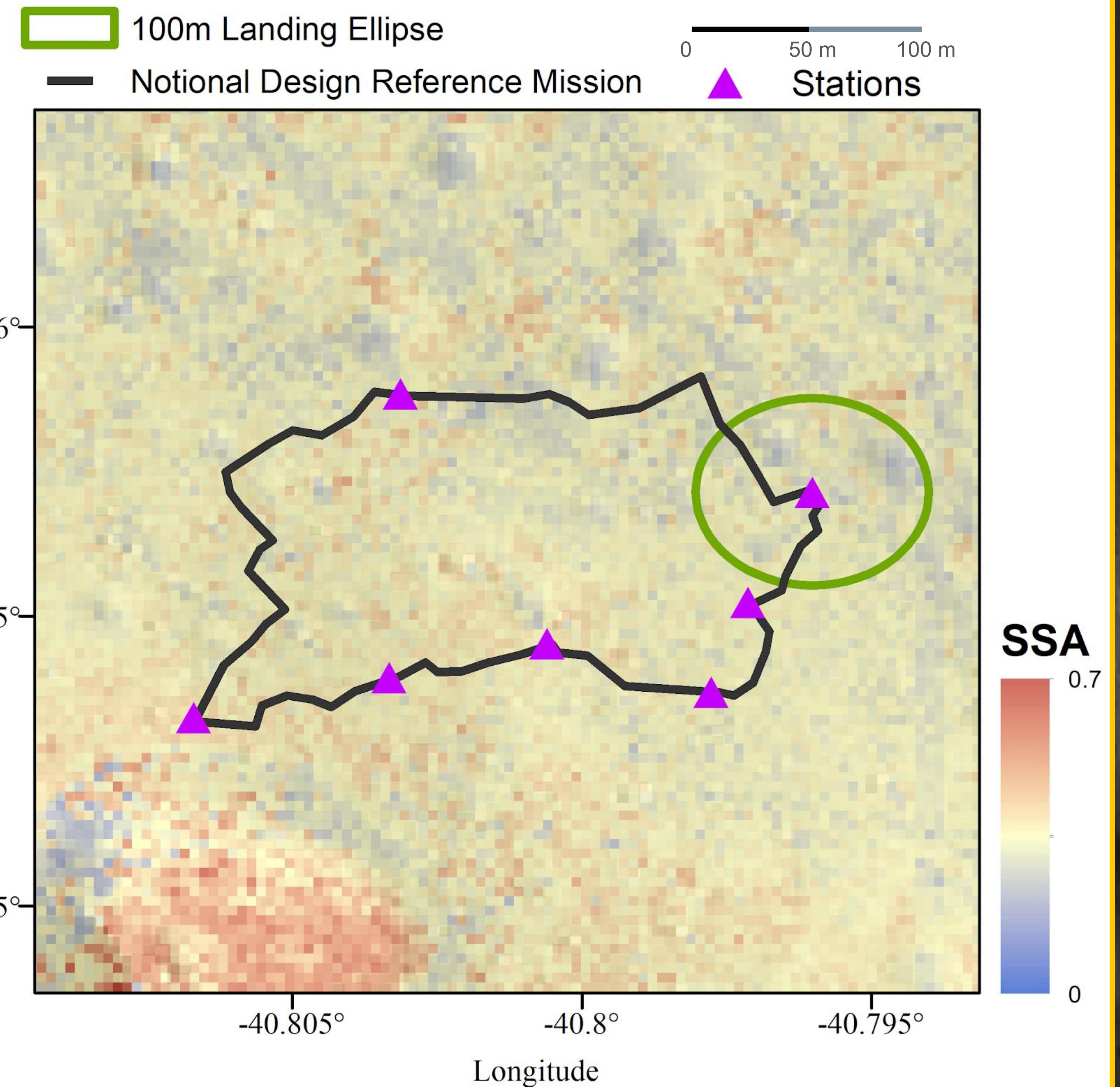
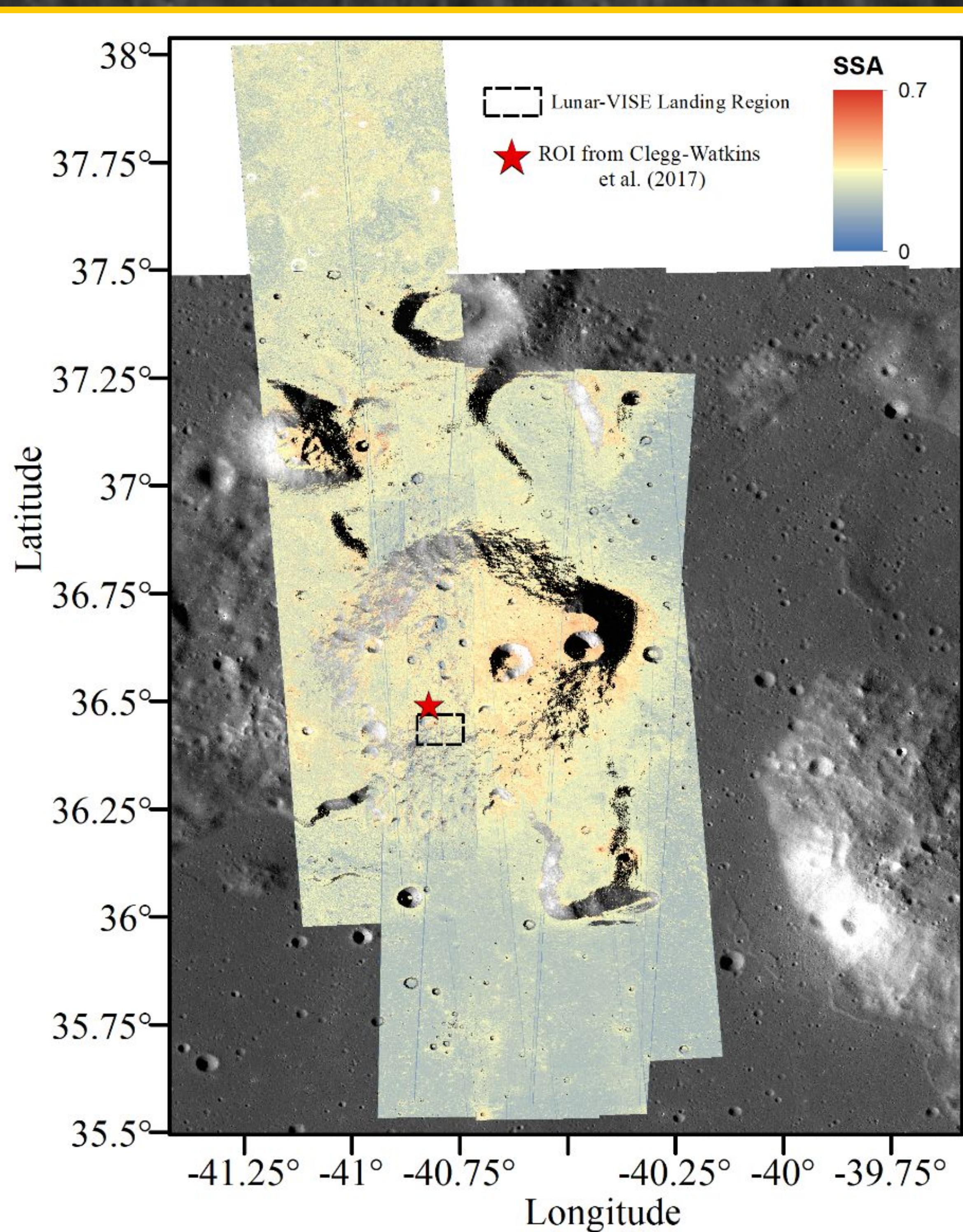


Figure 2: Averaged single scattering albedo (SSA) map of the upcoming Lunar-VISE landing site overlaid with landing ellipse and proposed rover traverse route.

Figure 1 (left):

Overview of averaged single scattering albedo maps generated from 10 NAC image pairs (M133098352, M140486159, M157859772, M150789903, M117759800, M1282710362, M1413116707, M1346163943, M1221565244, M186156197, M1178040827) processed across Mons Gruithuisen Gamma overlaid on NAC_ROI_GRUITHSNLOB. Regions with slope > 20° are masked out. The approximate region of Figure 2 and the Lunar-VISE mission area is highlighted.



Initial Results

- Our average single scattering albedo value (0.38 +/- 0.084) computed from 9 NAC images is consistent with SSA values previously published (0.38) at an ROI (36.49°N, 40.82°W) [5].
- Some variation in the single scattering albedo can be seen across the Gamma dome although further work is needed to constrain the significance.

Future Work

- Construct a database of SSA maps across the Gruithuisen region and other silicic volcanic spots.
- Correlate photometric properties to existing datasets (Diviner, M³, Lunar Trailblazer) to provide compositional and geologic context
- Constrain uncertainty values for the modeled Hapke photometric properties.

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