TOPOGRAPHIC CORRELATIONS WITHIN LUNAR SWIRLS IN MARE INGENII. D. L. Domingue, J. R. Weirich, F. C. Chuang, A. A. Sickafoose, and E. E. Palmer. 1Planetary Science Institute, 1700 E. Ft. Lowell Road, Suite 106, Tucson, AZ 85719 USA (domingue@psi.edu).

Introduction: Lunar swirls are defined by broad, bright, on-swirl areas separated by darker off-swirl lanes. Several processes have been proposed to explain swirl formation and each process has both supporting and contra-indicating evidence e.g., 1, 2.

We have analyzed two areas in Mare Ingenii and find that the lunar swirls are a few meters lower on average than the surrounding regions [3].

Data: The Mare Ingenii swirls are located in the southwest corner of the Ingenii basin. Two study areas containing swirls were chosen for detailed analysis (Fig. 1). Digital elevation models (DEM) of the two study areas were created using Lunar Reconnaissance Orbiter Camera (LROC) narrow angle camera (NAC) images employing stereophotoclinometry techniques [4,5]. Regional slopes in both Study Areas were identified and corrected to prevent slope bias. Additionally, impact craters down to 50 m in diameter and other larger topographically distinct geologic features were masked from the data.

![Image](image_url)

**Figure 1. (top)** Location of Study Areas A and B marked with red boxes, within the lunar swirls of Mare Ingenii (33.7°S, 162.5°E). **(bottom)** LROC wide-angle camera mosaics in which the locations of the defined on- and off-swirl sub-regions are denoted.

Analysis: We compared cumulative distributions between on-swirl and off-swirl locations within each study area (Fig. 2). We evaluated the statistical significance of the topographic differences using Kuiper’s variant of the Kolmogorov-Smirnov (K-S) test. We then calculated the mean height for each sub-region, including propagation of the errors. The error on the mean height is a function of the inverse of the number of data points; therefore, the mean height of each sub-region achieves millimeter accuracy even though the errors on individual points are at a meter-scale. To quantify the difference in the mean heights between the sub-regions, we derived a confidence interval assuming independent samples with unknown but equal population variances. We used the Z score, based on the cumulative standard normal distribution, and we report the difference in mean heights for a 95% confidence interval.

Results: Figure 2 demonstrates visually that the distributions of heights in the on- and off-swirl regions differ, with on-swirl being primarily lower than off-swirl. The K-S tests confirm at a confidence level of greater than four sigma that the on- and off-swirl topographic datasets are not drawn from the same samples.

From the confidence interval analysis, the mean of the on-swirl heights in study area A is 2.386±0.005 m lower than off-swirl 1 and 4.475±0.005 m lower than off-swirl 2. These height differences imply a progressive decrease in elevation from off- to on-swirl in this Study Area. For Study Area B, the mean of the on-swirl heights is lower than the off-swirl by 2.640±0.004 m.

Future work: We are currently examining additional regions in Reiner Gamma, Moscovientes, Gerasimovich, and Firsov.

![Image](image_url)

**Figure 2.** Cumulative frequency distributions of the heights in the defined on- and off-swirl sub-regions for Study Areas (left) A and (right) B. The color-shaded areas surrounding each cumulative frequency distribution line represent the height error bars; slight color variations indicate where error bars overlap.

Acknowledgments: This work was supported by NASA’s Lunar Data Analysis Program (80NSSC17K0278) and the Solar System Exploration Research Virtual Institute 2016 (SSERVI16) Cooperative Agreement (NNH16ZDA001N) SSERVI-TREX.