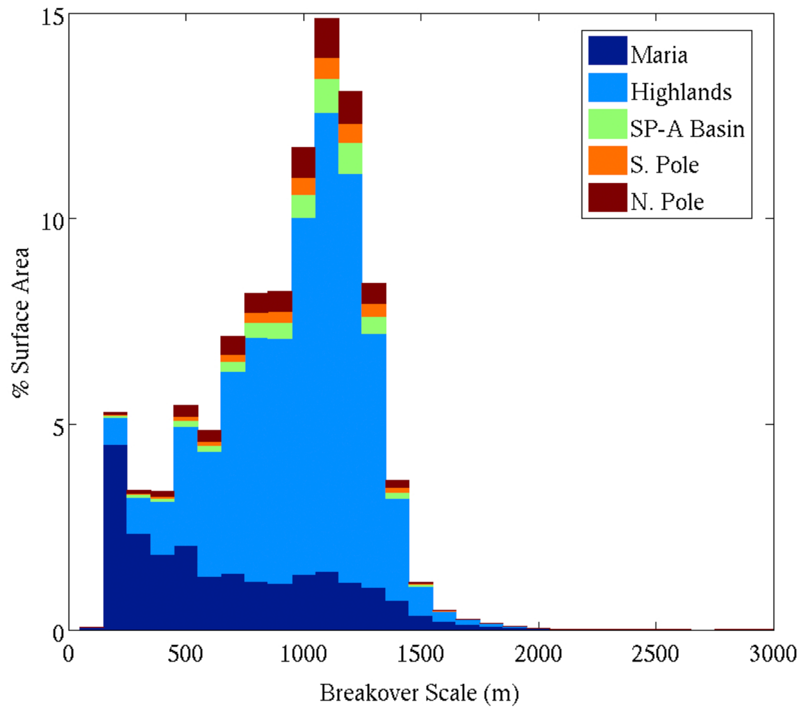

Figure 11. Breakover point histogram, sorted by region. Whereas the maria exhibit a broad range of breakover points, reflecting the complexity of deviograms in these regions, the other regions have a strongly peaked distribution of breakover points near 1 km. This characteristic baseline indicates a transition between two surface processes and may tell us about the Moon's surface history.

the deviogram is poorly fit by any linear model. We compute the least squares fits in each case and compare the sums of the residuals, adding a penalty when additional parameters are introduced into the fit (i.e., three parameters are required for a line, five for two lines). This method classifies each deviogram by its shape (Figure 9) and yields the relevant slope(s) of the deviogram, an estimate of the breakover baseline, Δx_0, and confidence intervals on all of the above.

[22] Figure 10 shows the distribution of deviogram shapes across the surface of the Moon and how they partition among major topographic regions. Polygons defining the lunar maria were taken from the U.S. Geological Survey series of geologic maps of the Moon [*Wilhelms and McCauley*, 1971; *Wilhelms and El-Baz*, 1977; *Scott et al.*, 1977; *Lucchitta*, 1977; *Stuart-Alexander*, 1978; *Wilhelms et al.*, 1979] and used to select data within the mare plains. The rim of the South Pole-Aitken basin was defined using the best-fit ellipse from the work of *Garrick-Bethell and Zuber* [2009]. The polar regions included latitudes from 60° to the pole, excluding patches of mare basalts and the South Pole-Aitken basin region. All areas falling outside these regions were designated highlands. By surface area, most deviograms are best characterized by two lines (~59%), with the remainder of the surface nearly evenly divided between monofractal (~17%) and complex (~24%) deviogram shapes, in which the slope changes continuously and rapidly with baseline, often alternating sign. Complex deviograms are mainly found in the lunar maria, whereas the highlands exhibit primarily monofractal or bifractal behavior. Other geographic regions, including the north and south poles and the South Pole-Aitken basin, behave much like the lunar highlands. This partitioning indicates a profound difference in character between the two major units; on the one hand, highland deviograms behave as nearly self-similar fractals, whereas mare topography diverges from fractal behavior altogether at the breakover point.

[23] Within areas that adhere to fractal behavior, the baseline at which the breakover occurs, Δx_0, is a significant parameter constrained by the two-line fit to the deviogram because it has a physical meaning related to the surface processes that contribute to the evolution of the Moon's topography. Formation and modification mechanisms act over a range of scales and may have distinct Hurst exponents. The breakover point is thus an estimate of the scale at which surface processes acting at longer scales are overtaken by those acting on smaller scales. In other words, it represents the baseline at which competing surface processes are equal contributors to the topography.

[24] Figure 11 is a stacked histogram showing the distribution of breakover points for all deviograms and their locations within the major geographic regions. Within the maria, breakover points are broadly distributed, reflecting the complex nature of the deviograms found there. All other regions, however, have a strong peak at ~1 km, suggesting a significant transition between surface processes acting above and below this scale. Impact cratering and mare basalt emplacement are most likely responsible for many of the key differences between the lunar highlands and the maria. Other processes that may have contributed to the observed