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Deriving morphometric parameters and the simple-to-complex transition diameter from a new, high resolution database of fresh lunar impact craters $\geq$ 3 km.

Tim Krüger, Stefan Hergarten, and Thomas Kenkmann

Albert-Ludwigs-Universität Freiburg, Institut für Geo- und Umweltnaturwissenschaften - Geologie, Freiburg, Germany (tim.krueger@geologie.uni-freiburg.de)

We derived a new, high-resolution, global lunar crater database, comprising 5640 pristine craters $\geq \sim$3km, with detailed morphologic and morphometric data for the investigated craters. We report significantly improved values for lunar crater morphometry trends and examine the respective best-fit power-laws. We compared 8 different functions for simple craters and 4 different complex craters, to find the best-fit representation of their parameters. These parameters are important for a high precision in numerical modelling, scaling laws and power law ratios [1,2,3]. Additionally, we integrate a new crater type, transitional craters, into these fits. Transitional craters are in a transitional state, between simple and complex craters, and they fill the diameter gap between the simple and complex morphologies [4]. In regard to depth / diameter ratios, simple craters behave similar all over the Moon, whereas transitional and complex craters are distinctively different in highland and mare regions. On the basis of the improved parameters, we investigated the simple-to-complex transition morphology [1,4]. The intersection of simple power-law fits is a poor representation of the simple-to-complex transition diameter. However, we report improved values describing the simple-to-complex transition diameter, based on several methods: (1) Intersection of power-laws, (2) misclassification, (3) arithmetic mean and (4) midpoint of the diameter gap between simple and complex craters. The simple morphology changes to a transitional morphology in the highlands at diameters of $\sim$17 km and at $\sim$14 km in the mare. This transitional morphology changes again into the complex form at diameters of $\sim$28 km in the highlands and at $\sim$24 km in the mare. The obliquity of an impact influences the structural evolution and changes the depth/diameter ratio of impact craters. Therefore, the aspect ratio of lunar simple craters was combined with their respective depth/diameter ratios. 78.2 % of the investigated craters are circular (ε = 1.0 – 1.1), synonymous with an impact angle > 30°. 18.9 % of the craters (Impact angle 10° - 30°) show an aspect ratio between ε = 1.1 - 1.2 and 2.9 % show an aspect ratio larger than ε = 1.2 (Impact angle < 10°). Simple craters with an aspect ratio of ε > 1.1 are shallower than craters with ε < 1.1.

References:
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