CRATER COUNTING IN A GIS ENVIRONMENT: THE IMPLEMENTATION OF NON-SPARSENESS CORRECTION IN A NEW TOOL FOR PLANETARY SURFACE DATING. C. Riedel[1], G. G. Michael[1] and T. Kneissl[1], [1]Freie Universität Berlin, Inst. of Geological Sciences, Planetary Sciences and Remote Sensing Group, Malteserstr. 74-100, 12249 Berlin, Germany, (christian.riedel@fu-berlin.de).

Introduction: The absolute and relative ages of planetary surfaces in the inner solar system have long been determined from the analysis of crater size-frequency distribution curves [1-4]. To derive such information from remote sensing data, impact craters on a geologically homogeneous surface [5] are processed by crater counting techniques [6-9]. Approaches such as Traditional Crater Counting (TCC) and Buffered Crater Counting (BCC) [6-8] are implemented in the ArcGIS Add-In CraterTools [6]. However, the recently developed Non-Sparseness Correction (NSC) and Buffered Non-Sparseness Correction (BNSC) [9] crater counting methods are not implemented and data processing in CraterTools is restricted to 32 bit single-core computing. To overcome these limitations and to efficiently implement NSC and BNSC crater counting techniques, we currently develop a new software tool for crater size-frequency measurements.

Crater Counting Techniques: Crater counting techniques determine which craters and which reference areas are considered for the determination of crater size-frequency information. Regarding the TCC approach, all craters which have their centroids inside the counting area are considered for the measurement. The reference area remains unchanged during this process (Figure 1A).

BCC is used to improve the statistics of crater size-frequency measurements. During BCC, impact craters which superpose the geologically homogeneous surface but are situated outside the reference area are included in the evaluation. Generally, craters within a distance of one crater radius to the counting area are considered. The measurement area changes for every crater during BCC and corresponds to the original area plus a surrounding buffer of one crater radius (Figure 1B). Thereby, the number of craters which are considered for crater size-frequency measurements is increased. BCC is particularly used for the investigation of linear features with a limited number of superposing impact craters [8].

NSC is applied to consider the effects of crater obliteration by larger craters. For every crater inside the counting area, the original reference area is reduced by all larger craters plus a surrounding buffer of one crater radius (Figure 1C). Here, the buffer corresponds to the zone affected by ejecta blanket and seismic degradation which eliminated smaller craters. The resulting crater size-frequency distribution better reflects the production function [9]. This is especially noticeable when many large impacts occupy a significant fraction of the area. Thus, NSC is useful for heavily cratered surfaces.

BNSC is a combination of BCC and NSC crater counting approaches [9]. It is used to improve statistics by including craters which are situated outside the counting area and to consider resurfacing events by eliminating larger impact craters with their respective ejecta blankets. For every crater, all larger craters plus a surrounding buffer of one crater radius are removed from the reference area. Subsequently, the remaining area is buffered by the radius of the investigated crater (Figure 1D). BNSC is particularly suitable for linear features and heavily cratered regions but can generally be applied to any region of interest.

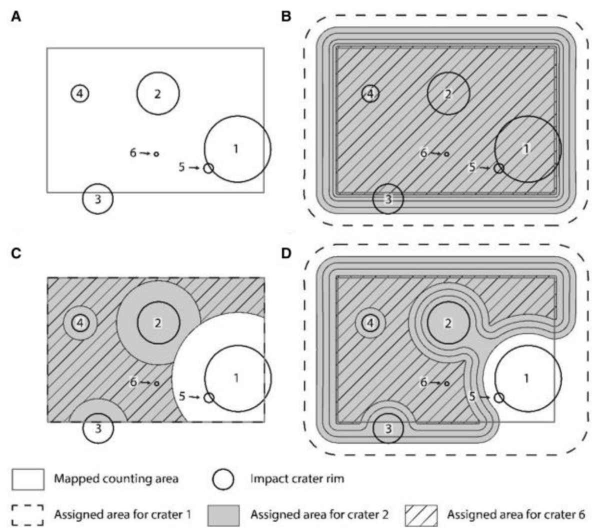

Figure 1: Reference areas of six individual craters for TCC, BCC, NSC and BNSC crater counting approaches. During TCC (A), the reference area remains unchanged. Crater 3 is excluded from the measurement. BCC (B) requires the mapped counting area to be buffered by one crater radius for each crater. Crater 3 is included in the measurement. For every crater during NSC (C), every larger crater plus a surrounding buffer of one crater radius (ejecta blanket) is removed from the counting area to simulate the effect of resurfacing by larger impacts. BNSC (D) combines NSC and BCC crater counting approaches. Resurfaced areas (larger craters plus surrounding buffer of one crater radius) are removed from the counting area while the remaining area is buffered by one crater radius [9].

Implementation of NSC and BNSC: NSC and BNSC approaches generate polygons with multiple inner rings during crater size-frequency measurements (Figure 1). Thereby, both approaches require far more computational resources than the BCC technique. As CraterTools only supports 32 bit and single-core computing, NSC and BNSC cannot be efficiently implemented in the ArcGIS Add-In. We therefore develop a new GIS application for the determination of crater size-frequency information which works independently from ArcGIS libraries and supports 64 bit computing as well as multi-core data processing.

To assess the performance of the new application, we conducted BCC crater size-frequency measurements of lunar basins using CraterTools and the new software tool. We found a significant performance increase of 60-1250 % when comparing the computational time of the new application to CraterTools. This increase is mandatory for the efficient implementation of NSC and BNSC crater counting techniques in planetary surface dating.

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