Morphological characteristics of small craters of Phobos

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The surface of Phobos is covered by plenty of small (up to meter-sized) craters. Although most of them show a bowl-shaped morphology, some of them represent concentric, flat-floored, or central-mound geometries [1], which is considered to be related to the existence of a surface layer with a thickness comparable to their crater depth [2]. Also, the blue unit of the sub-Mars side of Phobos was interpreted as a massive landslide deposit extended from the W-NW inner wall of Stickney crater [3], which remains enigmatic. If these layered deposits having a certain thickness covered small craters, they could have been partially modified or obliterated. We have recently investigated the topographic profiles of sub-kilometer craters of Phobos by creating 20 m/pixel MRO/HiRISE stereo-derived digital terrain model (DTM), and found that their crater depth/diameter ratios (d/D) are comparable between the red and blue units in a diameter range of 100 to 1,000 m, and the inner wall of a crater inside the blue unit is affected by a post-crater depositional event [Hemmi and Miyamoto, in revision]. Thus, in this study, we aim to quantitatively characterize the morphology of craters smaller than 100 m in diameter by using a highest resolution DTM.

Here we performed noise reduction and bundle adjustment of HiRISE stereo-pair images of Phobos [4] by means of the U.S. Geological Survey's ISIS3, and then created a highest-resolution (~6.5-m/pixel) DTM by using our stereo-derived DTM and the multi-view shape-from-shading technique [5]. Consequently, the resulted DTM enables us to measure precise measurements of the small craters' depths and to study unique crater floor geometries in detail. We will discuss the results of morphometric measurements of these craters in comparison with those of craters larger than 100 m at the meeting.

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