Measurement of crater ray length by analysis of lunar images: A comparison with Z model

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The information of impactor, such as impact velocity, density, or radius, is coupled into a coupling parameter C (Holsapple and Schmidt, 1987) and cannot be resolved from crater diameter only. In order to examine if we can put constraints on the information of impactor by spatial extent of ejecta, i.e., the distribution of continuous ejecta and length of ray, we performed quantitative measurement of ejecta. We analyzed images provided by Multiband Imager (MI) onboard the JAXA’s lunar orbiter, Kaguya. We analyzed 13 small craters in the southwestern region of Kepler crater on Oceanus Procellarum. First, we tried to define the region to which we could apply Z model. We measured the circularity of the area with a reflectance higher than a set-value. In the figure, the horizontal axis shows the equivalent diameter of a circle of the region and the vertical axis shows the circularity. As the reflectance increases, the circularity of the region increases. The slope changes at the diameter roughly 4 times as large as the crater diameter. From this result, we regarded that the Z model is applicable to the region within about 4 crater radii from the crater center. In the region beyond about 4 crater radii, ejecta inelastically collided one another, became collimated in discrete directions, and deposited in rays (Kadono et al., 2015). In other words we assumed that the rays next to each other had shared the ejecta released in the direction in between. Based on this assumption, we calculate the thickness of ejecta in each ray using the angles between rays on the MI images, the width of rays, and Z model, and will discuss on its relationship with the crater diameter.

Keywords: crater ray, ejecta, Kaguya