Volume estimation of ejecta lobes on Martian DLE craters.

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Characteristic ejecta morphologies of Martian craters suggest ground-hugging flow during ejecta emplacement [Carr, 1977]. Since these morphologies are distinctive about Martian craters, they are affected by the Martian surface/subsurface environment and are considered as a key to examine the properties of Martian subsurface and/or atmosphere.

Double Layered Ejecta (DLE) is one of major subclasses of Martian ejecta morphologies. DLE are composed of two lobes: a thick and concave inner lobe with deep moat at near the rim [Boyce and Mouginis-Mark, 2006] and a faint outer lobe without distal rampart. The inner and outer lobes of DLE craters obviously differ in their facies, which suggest that (at least) two different processes of ejecta emplacement would be generated in single impact.

We focus on the volume fraction between the inner and outer lobes of DLE craters. In this volume estimation, it is important to estimate the pre-impact surface. The determination of the pre-impact surface is currently only possible from the knowledge and interpolation of the topographic surface surrounding the craters. We developed the IDL program and selected five methods to determine the pre-impact surface: plane, parabolic, linear interpolation, minimum curvature surface, and Kriging method. The limitations of each methods and the uncertainties are evaluated. The determination of 3D structure of selected craters revealed that some parts of outer lobe, or less frequently some parts of the inner lobe, have a present topography which is probably below the pre-impact surface. This fact could result from erosion during the emplacement of the ejecta layer and represent insights into the dynamic aspects of the ground-hugging flow stage. The possible scenario of formation of Martian DLE craters is discussed from these new measurements and observations.