Water discharge from chaotic craters and potential fossae on Mars

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Chaotic craters are usually nearly full-closed depressions whose floors show extensive signs of collapse to form mesas. Many of such craters have outlets toward nearby lowlands and connect to channels.

We focus on one of the freshest chaotic craters (~100km in diameter, location is 289.5W, 29.5N) and test the hypothesis that the water that made the channels came from chaos blocks. We perform numerical simulations of the amount of water coming out of mesas and the erosion rate of the basement to created channels.

We identify the relationship between the expected total erosion (E), the particle size (Ds), and permeability (K) of the rock. The assumed parameter ranges are 0.125-50 [mm] for Ds and $5*10^{-12}$-$5*10^{-7}$ [m^2] for K. The results show that we typically need a set of Ds~ 1 [mm] and K~10^{-9} [m^2] to make the total erosion of 25 [m], which would modify preexisting channels but is insufficient to create the channels themselves.

We next apply our erosional model to fossae area where we also observe extensive channel formation. We hypothesize that dike intrusion under the ground occurred. This can potentially release huge amounts of water by melting a permafrost layer. Larger amounts of erosion and channel formation are possible in this case.