# Gravity's effect on landslides: A strike against Martian water

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A pile of sand, gravel, or other granular material takes on a familiar conical shape, with the slope of the pile's walls coming to rest at the static angle of repose. If the material exceeds this angle, it will trigger an avalanche, tumbling down until it comes to rest at the dynamic angle of repose.

Static angles of repose for coarse, angular materials tend to be around 40° from the horizontal, while smooth grains are stable up to 20°. As largely a matter of geometry, grain properties, and internal friction, scientists have assumed these two angles of repose are fixed for a given substance.

Observations of the angles of gully walls on Mars, found to be too shallow for the materials involved, have been used to argue that surface water must have played a part, either lubricating landslides or depositing the material directly.

But research by Kleinhans et al., using the parabolic flight of an airplane to test the effect of gravity on angles of repose, demonstrates that water need not have been present.

As the plane followed its roller coaster style path, slowly rotating cylinders containing different materials experienced one tenth of Earth's gravity (0.1 g), Martian gravity (0.38 g) and the Earth's normal pull (1 g). The authors find that at 0.1 g, the static angle of repose for all materials increases by 5°, while the dynamic angle of repose decreases by 10°.

They suggest weaker gravity would reduce internal friction for avalanching material and could explain the shallow gully walls on the Martian surface. Further, as angles of repose are commonly used as measures of material properties, this challenge to their presumed gravity independence will require a reassessment of many other surface processes at lower slopes.

**More information:** "Static and dynamic angles of repose in loose granular materials under reduced gravity" *Journal of Geophysical Research-Planets*, doi: 10.1029/2011JE003865, 2011

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