Geophysical Research Abstracts
Vol. 18, EGU2016-7637-1, 2016
EGU General Assembly 2016

Overland flow erosion inferred from Martian channel network geometry

Hansjörg Seybold (1) and James Kirchner (1,2)

(1) ETH Zurich, Zurich, Switzerland (hseybold@ethz.ch), (2) Swiss Federal Research Institute WSL, Birmensdorf, Switzerland

The controversy about the origin of Mars' channel networks is almost as old as their discovery 150 years ago. Over the last few decades, new Mars probes have revealed more detailed structures in Martian The controversy about the origin of Mars' channel networks is almost as old as their discovery 150 years ago. Over the last few decades, new Mars probes have revealed more detailed structures in Martian drainage networks, and new studies suggest that Mars once had large volumes of surface water. But how this water flowed, and how it could have carved the channels, remains unclear.

Simple scaling arguments show that networks formed by similar mechanisms should have similar branching angles on Earth and Mars, suggesting that Earth analogues can be informative here. A recent analysis of high-resolution data for the continental United States shows that climate leaves a characteristic imprint in the branching geometry of stream networks. Networks growing in humid regions have an average branching angle of $\alpha = 2\pi/5 = 72^\circ$ [1], which is characteristic of network growth by groundwater sapping [2]. Networks in arid regions, where overland flow erosion is more dominant, show much smaller branching angles. Here we show that the channel networks on Mars have branching angles that resemble those created by surficial flows on Earth. This result implies that the growth of Martian channel networks was dominated by near-surface flow, and suggests that deeper infiltration was inhibited, potentially by permafrost or by impermeable weathered soils.

[1] Climate's Watermark in the Geometry of River Networks, *Seybold et al.*; under review

[2] Ramification of stream networks, *Devauchelle et al.*; PNAS (2012)