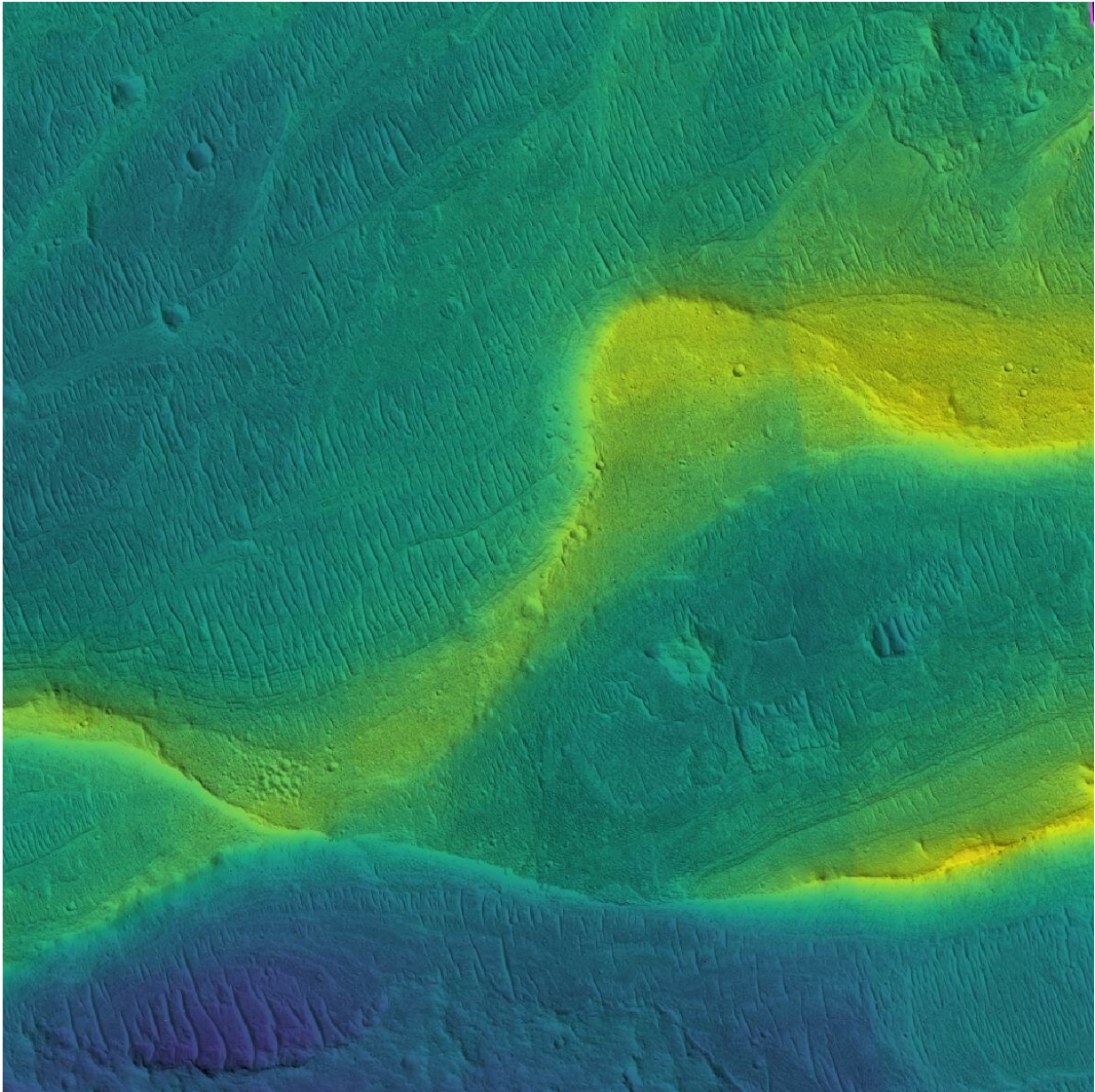


Rivers raged on Mars late into its history

March 27 2019



A photo of a preserved river channel on Mars, taken by an orbiting satellite, with

color overlaid to show different elevations (blue is low, yellow is high). Credit: NASA/JPL/Univ. Arizona/UChicago

Long ago on Mars, water carved deep riverbeds into the planet's surface—but we still don't know what kind of weather fed them. Scientists aren't sure, because their understanding of the Martian climate billions of years ago remains incomplete.

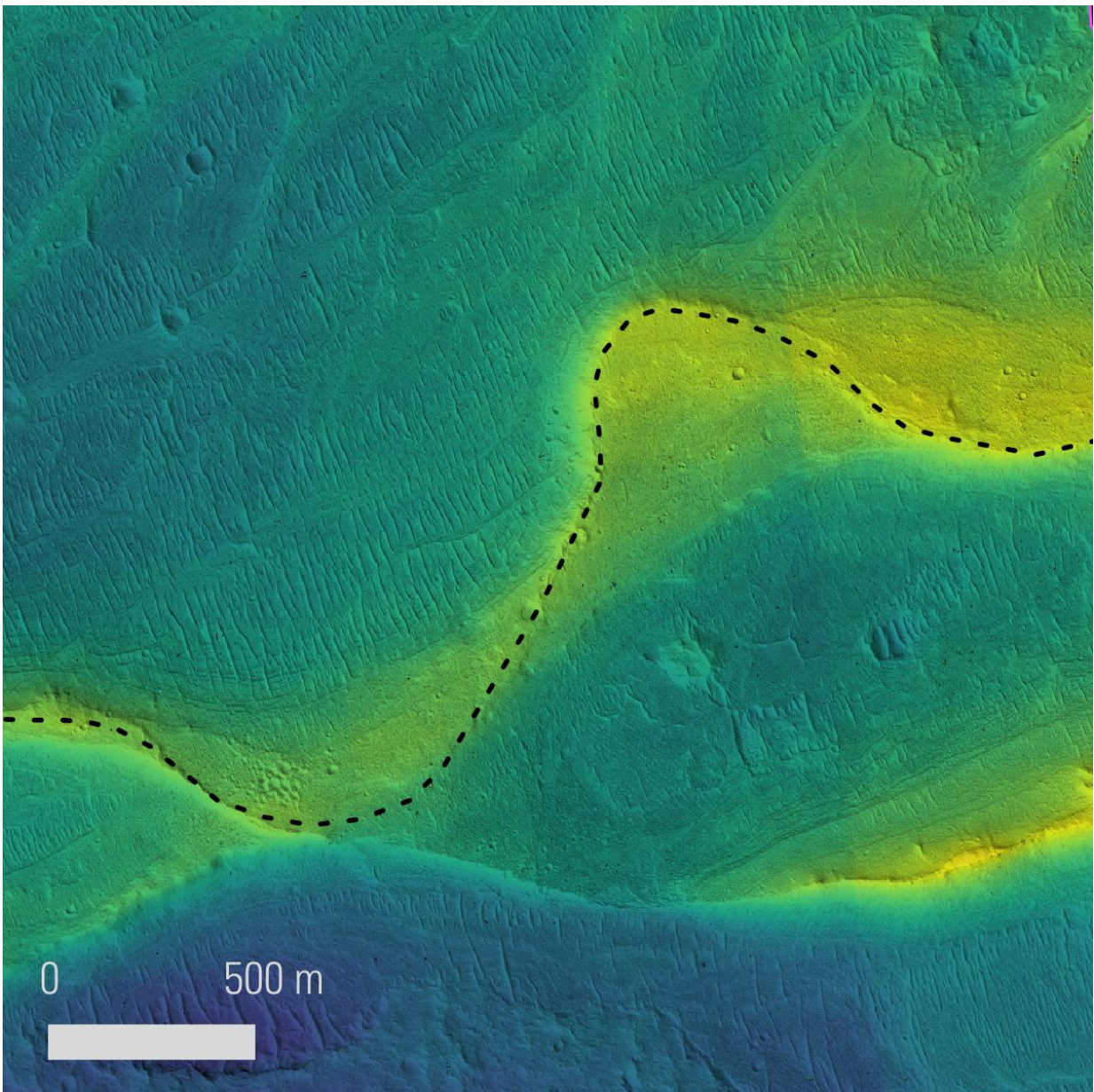
A new study by University of Chicago scientists catalogued these [rivers](#) to conclude that significant river runoff persisted on Mars later into its history than previously thought. According to the study, published March 27 in *Science Advances*, the runoff was intense—rivers on Mars were wider than those on Earth today—and occurred at hundreds of locations on the red planet.

This complicates the picture for scientists trying to model the ancient Martian climate, said lead study author Edwin Kite, assistant professor of geophysical sciences and an expert in both the history of Mars and climates of other worlds. "It's already hard to explain rivers or lakes based on the information we have," he said. "This makes a difficult problem even more difficult."

But, he said, the constraints could be useful in winnowing the many theories researchers have proposed to explain the climate.

Mars is crisscrossed with the distinctive tracks of long-dead rivers. NASA's spacecraft have taken photos of hundreds of these rivers from orbit, and when the Mars rover Curiosity landed in 2012, it sent back images of pebbles that were rounded—tumbled for a long time in the bottom of a river.

It's a puzzle why ancient Mars had [liquid water](#). Mars has an extremely thin atmosphere today, and early in the planet's history, it was also only receiving a third of the sunlight of present-day Earth, which shouldn't be enough heat to maintain liquid [water](#) "Indeed, even on ancient Mars, when it was wet enough for rivers some of the time, the rest of the data looks like Mars was extremely cold and dry most of the time," Kite said.



Marked photo of a preserved river channel on Mars, taken by NASA's Mars Reconnaissance Orbiter, with color overlaid to indicate elevation (blue is low, yellow is high.) The range of elevation in the scene is approximately 35 meters. Credit: NASA/JPL/Univ. Arizona/UChicago

Seeking a better understanding of Martian precipitation, Kite and his colleagues analyzed photographs and elevation models for more than 200 ancient Martian riverbeds spanning over a billion years. These riverbeds are a rich source of clues about the water running through them and the climate that produced it. For example, the width and steepness of the riverbeds and the size of the gravel tell scientists about the force of the water flow, and the quantity of the gravel constrains the volume of water coming through.

Their analysis shows clear evidence for persistent, strong runoff that occurred well into the last stage of the wet climate, Kite said.

The results provide guidance for those trying to reconstruct the Martian climate, Kite said. For example, the size of the rivers implies the water was flowing continuously, not just at high noon, so climate modelers need to account for a strong greenhouse effect to keep the planet warm enough for average daytime temperatures above the freezing point of water.

The rivers also show strong flow up to the last geological minute before the wet climate dries up. "You would expect them to wane gradually over time, but that's not what we see," Kite said. The rivers get shorter—hundreds of kilometers rather than thousands—but discharge is still strong. "The wettest day of the year is still very wet."

It's possible the [climate](#) had a sort of "on/off" switch, Kite speculated,

which tipped back and forth between dry and wet cycles.

"Our work answers some existing questions but raises a new one. Which is wrong: the [climate models](#), the atmosphere evolution models, or our basic understanding of inner solar system chronology?" he said.

More information: E.S. Kite et al., "Persistence of intense, climate-driven runoff late in Mars history," *Science Advances* (2019). [DOI: 10.1126/sciadv.aav7710](#) , advances.sciencemag.org/content/5/3/eaav7710

Provided by University of Chicago

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