Science of global climate modeling confirmed by discoveries on Mars

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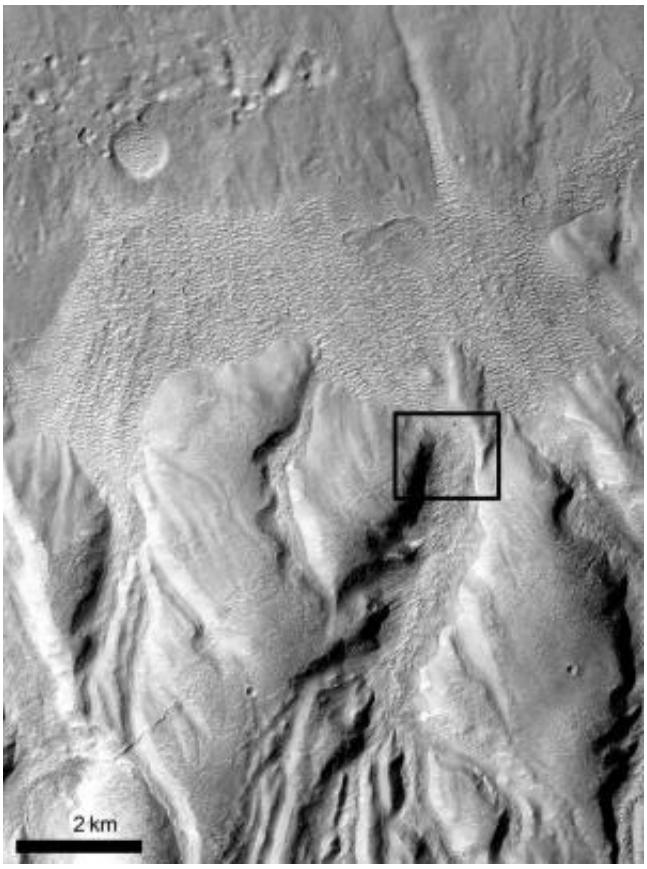
Orbital photos from NASA Mars Reconnaissance Orbiter shows lobate-shaped glacier flowing down the north inner wall of crater Greg, on the planet Mars. The wall slopes downhill to the south (bottom) part of the frame. Note how flow lines drape around a small hill, on left side of the glacier.

(Phys.org)—Scientific modeling methods that predicted climate change on Earth have been found to be accurate on Mars as well, according to a paper presented at an international planetary sciences conference Tuesday.

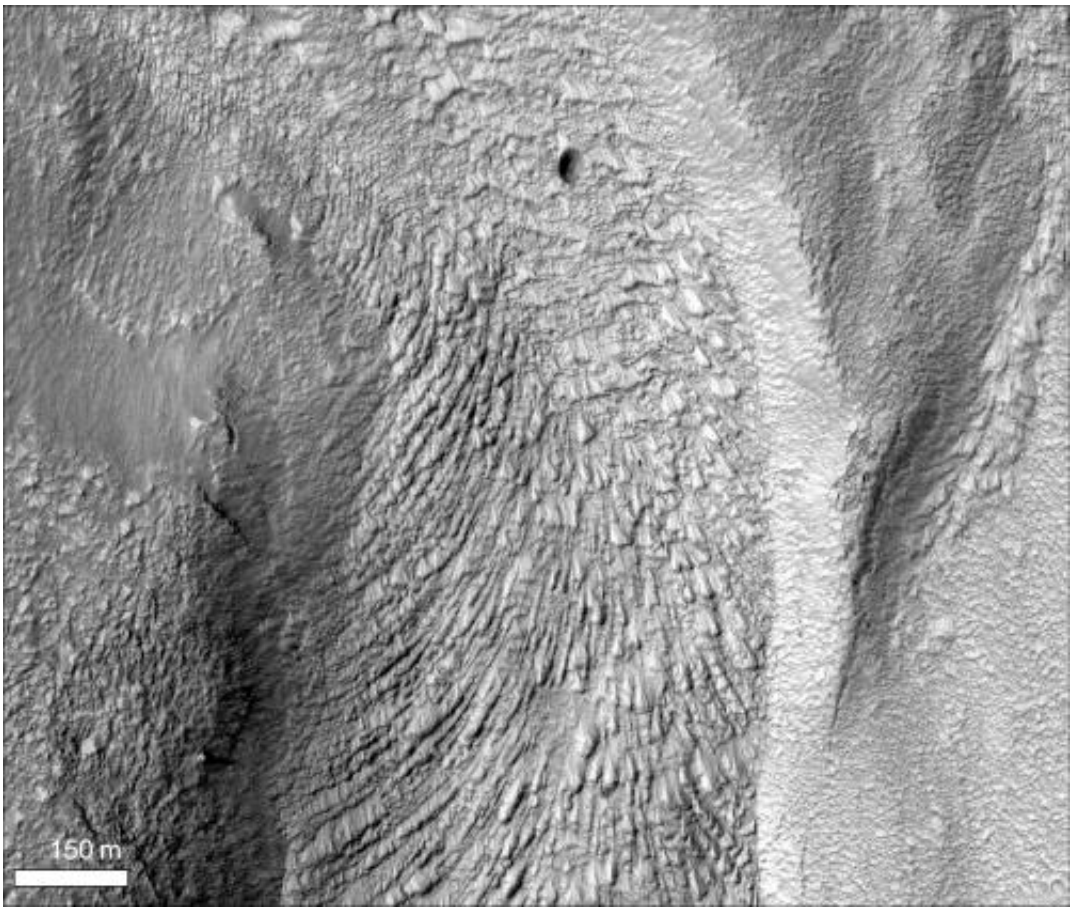
An international team of researchers from the Planetary Science Institute in Tucson, working with French colleagues, found that an unusual concentration of glacial features on Mars matches predictions made by global climate computerized models, in terms of both age and location.

PSI Senior Scientist William K. Hartmann led the team, which included François Forget (Université Paris), who did the Martian climate modeling, and Veronique Ansan and Nicolas Mangold (Université de Nantes) and Daniel Berman (PSI), all of who analyzed spacecraft measurements regarding the glaciers.

"Some public figures imply that modeling of global climate change on Earth is 'junk science,' but if climate models can explain features observed on other planets, then the models must have at least some validity," said team leader Hartmann.



Orbital photos from NASA Mars Reconnaissance Orbiter, showing ice flow features in ancient riverbeds on the south wall of crater Greg. (a). Regional view shows how hills in lower part of the frame are highly eroded by dry river channels sloping downhill to north (top). Textured, lighter toned material flows down riverbed and spreads onto the crater floor (top).



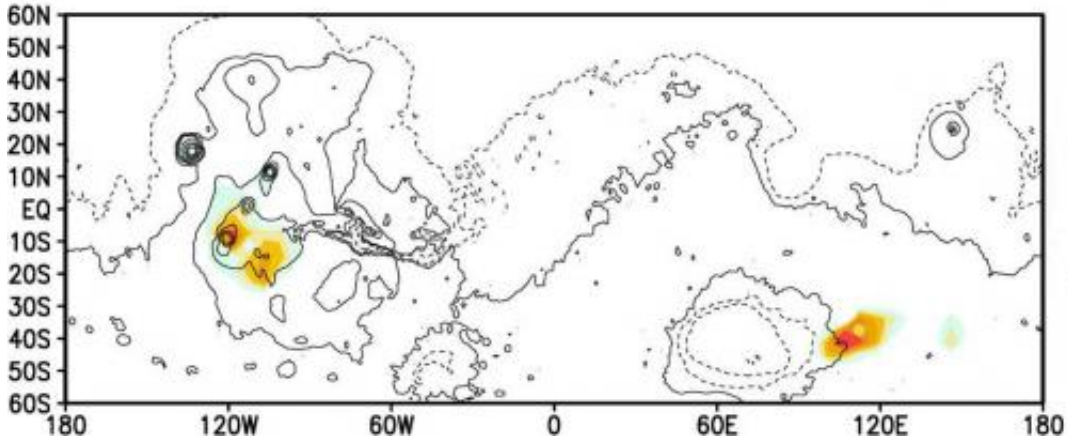
(b). Closeup view shows chevron texture on riverbed floor, indicating how the ice-rich material flowed fastest in the middle and was retarded along the channel walls.

Hartmann presented the report, "Science of Global Climate Modeling: Confirmation from Discoveries On Mars," at the annual meeting of the Division of Planetary Sciences of the American Astronomical Society in Reno, Nev.

The scientific team reached their conclusions by combining four different aspects of Martian geological mapping and Martian climate science in recent years. They noted that the climate models, the presence of glaciers, the ages of the glacial surface layers, and radar confirmation

of ice in same general area, all gave consistent results – that the glaciers formed in a specific region of Mars, due to unusual climate circumstances, just as indicated by the climate model.

The work has a long background. As early 1993, astronomers analyzed the changing tilt of Mars's rotational axis and found that during high-tilt Martian episodes, the axis tilt can exceed 45 degrees. Under this extreme condition, the summer hemisphere is strongly tilted toward the sun, and Mars's polar ice cap in that hemisphere evaporates, increasing water vapor in the Martian air, thus increasing the chances for snowfall in the dark, cold, winter hemisphere. The last such episodes happened on Mars 5 million to 20 million years ago.



Sketch map of mid-latitudes on Mars, shows colored spots marking climate model predictions of maximum ice deposition on Mars during periods of extreme axial tilt. Reddest colors indicate peak ice deposits. Crater “Greg,” with unusual concentration of strong glacial features, is light-toned circle near center of ice deposition region in the lower right.

By 2001-2006, various French and American researchers applied the global climate computer models to study this effect. The computer

programs were originally developed for planet Earth to estimate climate effects, from hurricane paths to CO2 greenhouse warming. Planetary scientists simply applied the Martian topography, atmosphere, and gravity, in order to run the computer calculations for Mars. The calculations indicated a strong concentration of winter snow and ice in a mid-latitude southern region of Mars, just east of a huge Martian impact basin named Hellas.

At the same time, the PSI scientists independently discovered an unusual concentration of glacial features in a 40-mile-wide crater named "Greg" centered in the same region. Their analysis showed that the surface layers of the glaciers formed at the same time as the predicted climate extremes, about 5 million to 20 million years ago.

"The bottom line is that the global climate models indicate that the last few intense deposits of ice occurred about 5 million to 15 million years ago, virtually centered on Greg crater, and that's just where the spacecraft data reveal glaciers whose surface layers date from that time," Hartmann said. "If global climate models indicate specific concentration of ice-rich features where and when we actually see them on a distant planet, then climate modeling should not be sarcastically dismissed. Our results provide an important, teachable refutation of the attacks on climate science on our home planet."

Provided by Planetary Science Institute

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