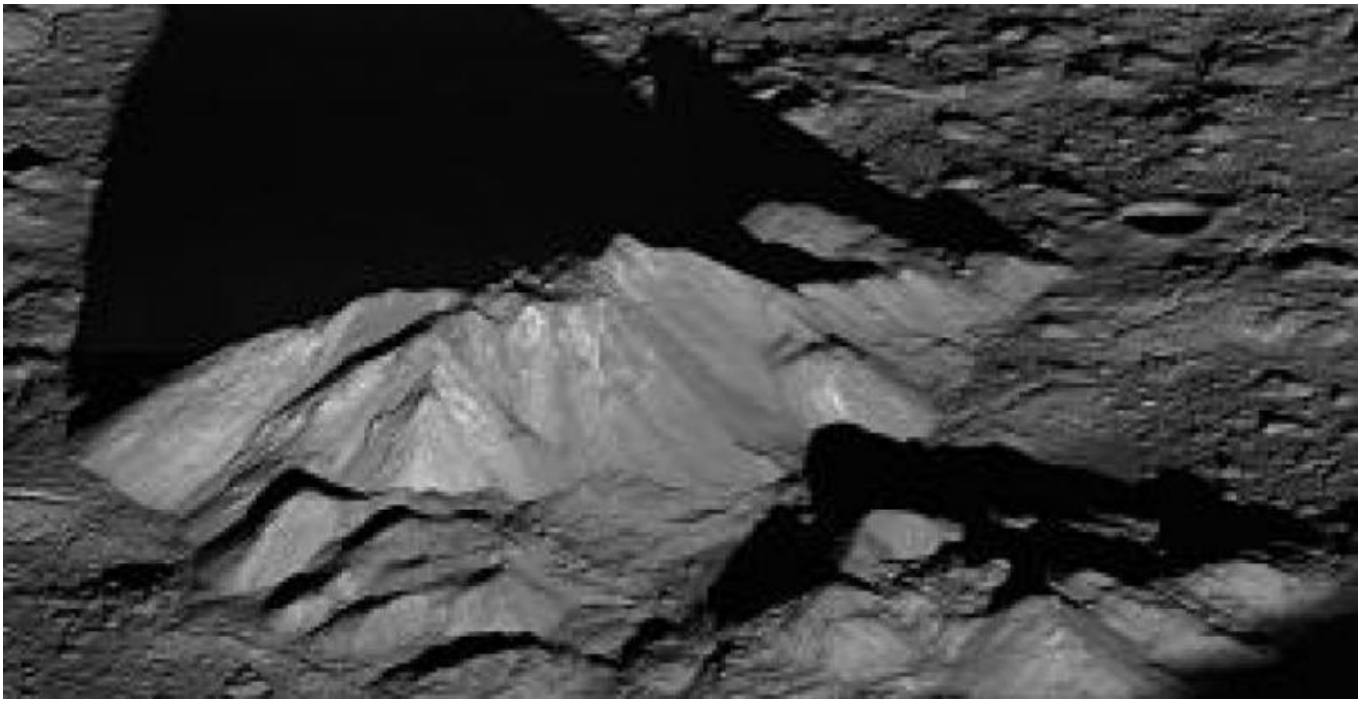
Sunlight could whip up water to slake lunar settlers' thirst

09/06/2015



Since 2009, several lunar probes have found indirect evidence of abundant water on the moon by looking for hydrogen, since the element is present in water molecules. But no one wants the hassle of mining through the dusty surface to drink it.

The moon's gravity is so low and its atmosphere so tenuous that water molecules in the ground turn directly to vapour when heated. Free to bounce around at near the speed of sound, they condense again when they get cold, piling up as frost where temperatures are low. The greatest build-up is at the dawn terminator: the region where the sun is just rising.

A lunar "day" is a full month long, so the water molecules have a lot of time to accumulate. Tim Livengood of NASA's Goddard Space Flight Center in Greenbelt, Maryland wondered how much drinkable water you could collect if you set up a solar-powered distillery to catch the morning frost.

"When the sun rises – actually, when the surface rotates into sunlight – we just drop a clear plastic dome over our collecting surface and let the sun turn it back into vapour," Livengood says. The vapour then frosts up the inside of the surface, where it can be harvested.

Terminator mimic

Using hydrogen measurements taken between 2009 and 2011 by NASA's Lunar Reconnaissance Orbiter (LRO), Livengood calculated that the frost build-up at the terminator

would be just under a fifth of a millimetre thick – enough to yield about 190 millilitres of water per square metre per lunar day, with a suitable set-up. That could include a small sun-tracking shade to cast a permanent shadow, mimicking the terminator and allowing astronauts to collect frost all day long.

"The quantity of water is much less than what we could dig up at the lunar poles, but we get it with very little energy investment on our part," Livengood says. "We just need to be patient."

But Andrew Jordan of the University of New Hampshire in Durham thinks water isn't the only possible explanation for the hydrogen peaks LRO observed in some regions.

"I would expect the amount of hydrogen to increase with depth," he says. However, since the LRO observations are in line with hydrogen decreasing with depth, he is inclined to think something else is going on. It could be that hydrogen is leaking from localised sources, he says.

Livengood says it's possible he is misinterpreting the LRO data, but he's confident there is plenty of hydrogen at the surface, where previously scientists thought there was none.

"There is something going on here that was unanticipated, which means there is something new for us to learn about the world," he says.