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<https://doi.org/10.4224/23003598>

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BLOWING DUST

Ken Tapping, 17th July, 2018

One of the most fascinating videos sent back by the Curiosity rover, currently exploring the surface of Mars, shows a number of dust storms marching across the desert, against a backdrop of distant, low hills. These are common on Earth, but it is exciting to see them on another world, with weather, geography and geology - just like ours.

Mars' resemblance to our world was discovered centuries ago. Until recently we thought it had plant life, and fantasized about its inhabitants. The other thing that fascinated us was that the planet has what we would call weather. Mars is smaller than Earth and further from the Sun; it has polar caps, seasons and, clouds in its atmosphere. Occasionally sandstorms cover most of the planet. Landers on the planet's surface show a desert with frost forming on the rocks during the night and evaporating in the warmth of the new day.

There are two big differences between Earth and Mars. The Earth has a thick, humid atmosphere and Mars has a thin dry one. Earth's thick, damp atmosphere traps heat and smooths out daily and seasonal temperature variations. Mars' atmospheric pressure at the surface level is about half a percent that of the Earth's, and the Martian atmosphere is much drier. It has very little capacity to trap heat. When the Sun rises, the dry, Martian deserts warm rapidly, heating the atmosphere in contact with it, setting up vigorous convection. Cold "air" over high ground flows downhill as strong winds. As the air descends it gets compressed and warms, like Chinooks. It rises and makes room for more cold air to flow down. The result is wind systems that can be small or huge. Winds in the thin Martian atmosphere are not able to blow heavy objects around, as hurricanes and tornadoes do on our world. However, they are very good at picking up the fine sand and dust that covers most of the Martian surface. The result is dust and sandstorms that might be small and local, or big enough to cover most of the planet. They can be thick enough to completely hide the Sun

from anyone on the surface for days, weeks or months. This presents us with a major problem. Although Curiosity, our main robot Mars explorer, is nuclear powered, others, like Spirit and Opportunity, are powered by solar energy. These two landed on Mars in 2004. Spirit has ceased to function, but Opportunity is still exploring, after 14 years, far longer than planned. Opportunity survived a severe dust storm in 2007, which forced it to go into hibernation until the returning Sun got its electrical supply started again. However, there is now a dust storm on Mars that is far larger than the 2007 event, which got started right over the rover, so Opportunity is likely to be in the dark for far longer. It can go into deep hibernation but there is a limit as to how cold its electronics can be allowed to get, and for how long.

Another problem with the dust is that it is fine and very dry. As it blows around it gets electrically charged and clings to everything. It can cover solar cells and get into all sorts of mechanical and electrical places where it's not wanted. With luck some dust-free wind following the dust storm will blow the stuff off again, as it did in 2007.

Large Martian dust storms are visible from Earth, often with quite small telescopes. Moreover, now is a good time to get out the telescope. We just overtook Mars in its orbit and we are still very close to the planet. Look for a bright, reddish-orange object in the Southeast around midnight, shining like a lamp. Mars never appears really large in small telescopes. However, be patient, and there will be moments the air stills, the shimmering vanishes and the details suddenly leap out. While you have the telescope out, there are some other planets to see. Venus lies low in the west after sunset, with Jupiter in the southwest and Saturn in the southeast after dark. The Moon will reach First Quarter on the 19th.

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