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Martian linear dunes : observation and modelling from the LMD GCM data base

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Dunes are common on Earth and Mars and have similar geometries on both planets. Martian dunes are larger than terrestrial one and are shaped by winds less efficient than terrestrial winds. Martian dunes move thus much more slowly than terrestrial dunes. Their characteristic time could be similar to the characteristic time of climate change on Mars. Their geometry could thus reflect past climate conditions. Linear dunes are a family of elongated dunes shaped by at least 2 winds that blow at an obtuse angle alternatively along the year. Contrary to simple dunes as barkhanes, it is therefore difficult to invert the shape of these dunes in term of wind direction and intensity. It is thus difficult to demonstrate if their geometry is coherent or not with the current wind regimes. We mapped 10 dune fields located inside impact craters of the southern hemisphere of Mars. Five fields are composed of barkhanes and 5 by linear dunes. For each dune field location, we extracted the annual wind velocity at 20m above the surface at a temporal resolution of 1 hour every 30 martian days from the Mars Climate Database of the LMD (www-mars.lmd.jussieu.fr/). The annual wind rose was calculated for each dune field. The sand flux along the year was also computed assuming a classical law of transport with threshold. Assuming that the avalanche face of barkhanes is perpendicular to the sand flux direction, we predicted the orientation of the avalanche face for each barkhane fields. These results are coherent with the observations. Assuming that linear dunes are aligned along the average sand flux direction, we predicted the orientation of the linear dunes and compared them to the observations. In 4 cases, the predicted dune orientation is consistent with observations. In one case, there is a strong discrepancy between the predicted and observed orientation that could indicate that this linear dune field is fossil.