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Southern hemisphere sand furrows: spatial patterning and implications for the cryo-venting process.

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Carbon dioxide is an important volatile on Mars. Seasonally, atmospheric CO_2 condenses as ice on to the Martian surface and sublimates during the spring. Links have been made between a suite of observed surface features and the sublimation of surface CO_2 ice; these include spider-like araneiform, gullies, and fans. Sand furrows are one such feature; suggested to form due to the erosive action of pressurised CO_2 gas as it escapes through cracks in surficial ice (i.e. cryo-venting, Bourke, 2013).

There are significant and important differences between the North and South Hemispheres, particularly in the seasonal CO_2 deposits. Previous investigations into the formation and distribution of sand furrows on Mars have concentrated solely on the northern hemisphere.
We present a study of furrows in the southern hemisphere which has yielded new data on their distribution and spatial patterning as well as providing insights into the cryo-venting process.

A total of 221 dune sites were surveyed over the three Martian years' of available HiRISE data to establish the overall distribution of sand furrows. A more detailed study was carried out at eight sites using data from Mars Year 30. These sites represent a latitudinal sample of dunefields located between 40°S to 72°S. Surficial CO_2 ice thickness was estimated using the Mars Climate Database (Millour et al., 2014).
Our data show that sand furrows are significantly less numerous in the study region than in the northern hemisphere where data show they occur in 95% of surveyed sites.

We found a strong correlation between latitude and furrow distribution. As one progresses polewards from 40°S, furrows become more numerous until 68°S. Furrows were not detected south of 72°S. Carbon dioxide ice thickness has been highlighted as a potentially important factor controlling furrow distribution in the northern hemisphere (Bourke and McGaley-Towle, 2014). Results from our investigation suggest there is a feedback mechanism between CO¬2 ice thickness and furrow formation; indicating a threshold thickness above which geomorphologically effective cryo-venting may not occur.

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Millour, E., et al., The Mars Climate Database (MCD version 5.1). Eighth International Conference on Mars. Lunar and Planetary Institute, Houston, 2014, pp. Abstract #1184.