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Dark Dune Spots as favorable locations for brine formation on Mars

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Using remote based analysis for the possible locations of brines on Mars we found Dark Dune Spots (DDSs) as perfect candidates. These spots appear at high latitude during the local spring in the area of the seasonal frost layer where this layer covers dark basaltic dunes. Based on our CRISM observations in Richardson crater, in the ring or penumbra-like outer area of these spots water ice is present at the surface without CO2 frost cover. Analyzing HiRISE optical data, from smaller spots located on steep slopes flow-like features emerge and move downward with the speed around 1 m/sol at both the northern and southern hemisphere. During the movement of these features the temperature at km scale spatial resolution is around 160-200 K, and inside the small spots could be even higher, above the threshold limit of Mars candidate brines like ferric-sulfates. Using HiRISE data small-scale albedo changes, e.g. darkening and brightening were observed in these spots that can not be explained satisfactorily with any present models, although eutectic freezing and melting could be compatible with the observed phenomenon.

Analyzing possible scenarios for the local conditions inside these spots, brine flow is a reasonable possibility for the formation of the flow-like features. Although if these features are produced by dry mass movements of dark basaltic grains, they are sill interesting for brine formation as these grains are in physical contact with water ice, and by solar insolation brine layer could form around them. During the later part of the season when the surface is defrosted, brines may still be present as H2O is in the shallow subsurface for an extended period based on the observations of the high thermal inertia (HTI) annulus. The possibility of brines there will be summarized as well as its possible astrobiological relevance.