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Near surface airflow modelling over dunes in Proctor Crater, Mars

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Multiple dune forms inside Martian craters is evident on much of the recent Hi-Rise imagery available. Typically, multiple length scales are present with progressively smaller bedform features superimposed on larger dunes. This has produced complex but regular topographical aeolian-driven patterns. Understanding the airflow conditions over and around these features will help in our understanding of the formational patterns and orientation of the aeolian bedforms relative to localised wind flow forcing.

Here we use computational fluid dynamics modelling and present preliminary findings within Mars' Proctor Crater over a dune area measuring 4.5km x 5.0km running with a computational cell resolution of 5m x 5m. A range of wind speed and directions are investigated and results are compared to bedform orientation, length scale and migration of ripples evident from recent HiRise imagery. Results reveal a distinctive relationship between steered airflow and localised bedform orientation, mapping orthogonally onto the crestal ridges present.

This work has important implications for evolutionary reconstruction of aeolian dunes within craters on Mars and helps lend further support to studies examining recent activity of Martian dune migration.