Do Large Dunes on Mars Migrate? Ripple and Dune Movement in Coprates Chasma, Valles Marineris.

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Introduction
For this study, we have measured and compared the rate of ripple and dune migration on the stoss side of some of the largest dunes on Mars over a 7-year time period, providing an insight into source to sink systems and erosion rates on Mars.

Study Site
The study site is a large 111 km² dune field in Southern Coprates Chasma, situated in the eastern part of Valles Marineris. The dune field is interesting for two main reasons:

1. The dune field has a potential source region located 35 km west of the dune field, offering an insight into source to sink systems and erosion rates on Mars.
2. The dune field contains barchan, barchanoid and longitudinal dunes with mean heights of ~100 m, with the largest dunes reaching ~250 m.

Methods
Ripple displacement has been measured using subpixel correlation of images from the High Resolution Imaging Science Experiment Camera (HiRISE 25 cm/pixel [1]) with the co-registration of optically sensed images and Correlation (COSI-Corr) software package [2]. Stacked profiles over 21 dunes at the dune front have been averaged to give a ripple displacement rate. The ripple flux was calculated for each dune for each time period.

Dune crest displacement
The dune crest displacement varies much more widely over time as the crest morphology changes with time. The co-registration error has been calculated as 0.09 m, which is less than a pixel (25 cm).

Dune crest flux was calculated for each of the dunes for each time period.

Dunes 2, 10 and 18 consistently show higher displacement, which may be due to the winds present. These dunes are in the centre of the valley, where there could be a channeling of the winds, leading to higher and more frequent winds and greater displacement of the ripples.

The ripple flux was calculated from the same time period as the ripple migration.

Ripple Displacement
The displacement of the ripples varies from 0.7 to 18.3 m over the full 7 years with a mean of 0.06 ± 2.2 m.

Comparison of Ripple Displacement to Dune Crest Displacement
The dune crest displacement is much smaller than the ripple displacement, this is due to the size of the dunes being larger than the ripples and therefore the volume of sand moving is much greater, explaining the larger crest flux. Both the ripple displacement and the dune displacement was greater in the centre of the valley suggesting a channeling of winds down the valley.

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