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Capturing volumetric ripple migration with a terrestrial laser scanner

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Ripples are the result of wind blowing across sandy surfaces on Earth and other planetary bodies, and therefore ripple presence is evidence that aeolian transport has occurred in that environment. Consequently, ripples are a useful indicator when predicting volumetric transport of windblown material, estimating surface roughness to calculate shear velocity, and interpreting sedimentary deposits across our solar system. Improving prediction of the fluid flow conditions that produce ripples, and the volume of material transported in the form of ripples, are both critical to interpreting landscape evolution across planetary bodies. Here, we present a set of field observations aimed at quantifying the volume and migration rate of aeolian ripples under various flow and transport conditions.

These experiments were conducted during the Aeolian Turbulence and Transport EXperiment (ATTEX) in October 2021 at NASA Wallops Island Flight Facility on the eastern shore of Virginia, USA. Ripple height, wavelength and volume were measured over a 4 x 10 m area using a Riegl VZ-1000 terrestrial laser scanner (TLS). Vertical arrays of sonic anemometers and cup anemometers were used to record 3-dimensional velocity fluctuations and mean wind profile to estimate shear velocity over the rippled surface. A vertical array of saltation traps deployed from the surface to 30 cm was used to estimate vertical flux and saltation rates. Grain size distributions of captured saltation and migrating ripples are compared.