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Measuring geomorphic stability and mobility; Interferomteric coherence data as an indicator for aeolian (wind-blown) dune stability

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Monitoring geomorphic changes on other planets is always a puzzle while on Earth measuring geomorphological dynamics can involve field work, i.e. ground truth. Dunes, wind streaks and other aeolian morphologies have been identified on Earth, Mars, Venus and Titan. These morphologies can be subjected to rapid and continuous changes when the surface is not stabilized by vegetation or crust and the wind is sufficiently strong. Thus, these sand bodies can change rapidly responding to the wind regime, rainfall, and sand particle availability. Identifying these changes by remote sensing (or even on the ground) is not straightforward because the entire surface may change concurrently. In this paper we demonstrate how synthetic aperture radar interferometry (InSAR) can be used to identify changes in dunes using the coherence which is normally a measure of phase noise prohibiting interferometric studies. We demonstrate this for dunes along the Negev and Sinai border region. This paper will show how ERS data were used to map the stability, and loss of it, over time ranges spanning from 1 day intervals to 2 years when eventually the entire surface changed including the, so called, stable areas. This methodology has advantages as it does not show potential mobility but rather the true mobility or stability. This methodology is applicable to planetary landscapes where there is no other indication of stability. Moreover, the methodology can be used also to measure the stability of surfaces susceptible to other mechanisms of landscape changes.