TEMPORAL CHANGES IN A LINEAR DUNE LOCATED IN THE CENTRAL SIMPSON DESERT, AUSTRALIA. Robert. A. Craddock,[1] Corbin L. Kling[1], Alexander Morgan[2], Adam Milewski[3]; and Stephen Tooth[4]; [1]Center for Earth and Planetary Studies, National Air and Space Museum, Smithsonian Institution, Washington, DC 20560, craddockb@si.edu, [2]Planetary Science Institute, Tucson, AZ 85719, [3]Department of Geology, University of Georgia, Athens, GA 30602, [4]Department of Geography and Earth Sciences, Aberystwyth University, Aberystwyth, Ceredigion SY23 3DB, Wales

Introduction: Linear dunes (also commonly called longitudinal dunes) are the only dune form that has been found on all the terrestrial worlds with an appreciable atmosphere [e.g. 1]. For example, thousands of linear dunes have been found on Titan where they cover more than 5% of the surface (~4 million km^2) [2]. They also cover more desert areas on Earth than any other type of dune [e.g., 3]. The fact that linear dunes are commonly found throughout the solar system indicates that gravity, atmospheric conditions, and sediment characteristics are relatively unimportant as they can form under a wide variety of conditions. However, currently we have a poor understanding as to how they form and are maintained. One of the difficulties in determining formative mechanisms is that linear dunes are enormous features and develop over long timespans. Typically, the width of an individual dune is a few tens of meters or less, but the length can often exceed tens or even hundreds of kilometers. They are also typically found in extensive dune fields, such as those found on Titan. This makes it difficult to conduct larger, contextual studies, but ultimately, the only way to determine how linear dunes form and maintain themselves for tens of thousands of years (at least) is to conduct a careful analysis of the ages and composition of an entire linear dune field.

Analyses: We are in the process of conducting a contextual study of a major linear dune field in the Simpson Desert of Australia. Part of our ongoing analyses is to quantify changes in the morphology of linear dunes that occur over time in the current aeolian environment and relate these changes to the local wind regime. This is important for unpacking changes that may have occurred over time and during the formative history of the dunes. Here we report the temporal changes in a linear dune located in the central Simpson Desert of Australia (-24.72°Lat 136.98°Lon) that occurred between April 2017 and October 2018 (Fig. 1).

Results: Over the 18 months between our two uncrewed aerial vehicle (UAV) surveys, we determined that as much as ~70 cm of new sediment was added to the crest of this linear dune, and ~50 cm removed from the nearby swales. The average wind speed nearby in Birdsville is ~16 kph with a maximum speed of 37 kph in December 2017. This confirms observations made by us elsewhere in the Simpson Desert [4] as well as similar surveys made in the Namib Desert [5] using lower spatial resolution GNSS data. Linear dunes appear to be constructed primarily by vertical accretion [6] and are capable of maintaining themselves in active aeolian environments. Essentially as long as sand is actively being transported, new sediment is added to the crest of linear dunes where wind speeds naturally decrease. This process allows linear dunes to maintain their general shape and resist erosion from rainfall, potentially long after the initial formative processes have stopped. This implies that the linear dunes on Titan, for example, may be old, relict features that are being maintained in an active aeolian environment. Additional UAV surveys over time will allow us to assess additional changes, possibly including erosional events that serve to lower the height of the dune crests.

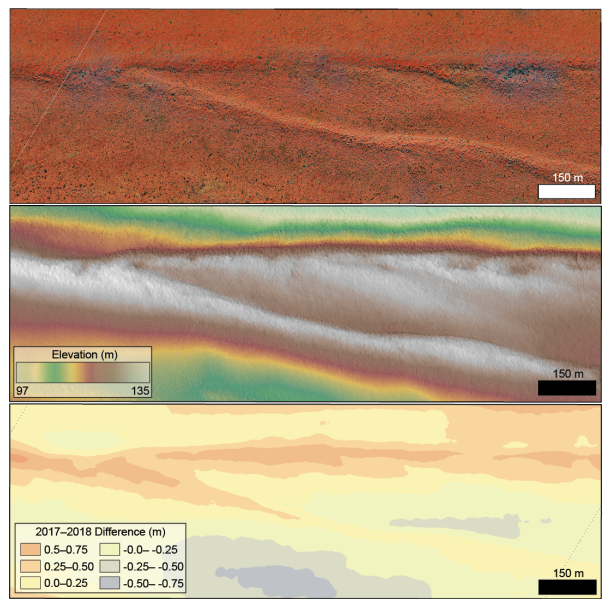

Figure 1. *Top*, An orthomosaic of a linear dune near Madigan Camp 11 in the central Simpson Desert. *Middle*, the topography derived from the April 2017 UAV survey. *Bottom*, the measured topographic changes between April 2017 and October 2018. Almost ~70 cm of sand has been deposited on the dune crest in places.

References: [1] Craddock R. A. (2012) *Prog. Phys. Geog., 36*. [2] Radebaugh J. et al. (2008) *Icarus, 194*. [3] Lancaster L. (1982) *Prog. Phys. Geog., 6*. [4] Craddock R. A. et al. (2015) JGR-Planets, *120*. [5] Livingstone I. (2003) *Earth Surf. Proc. Landforms, 28*. [6] King D. (1960) *Trans. Royal Soc. of South Australia, 83.*