

TITAN'S SEDIMENT-MOVING WINDS. Kirby Runyon¹, Shannon MacKenzie¹, Claire Newman², Xinting Yu³.
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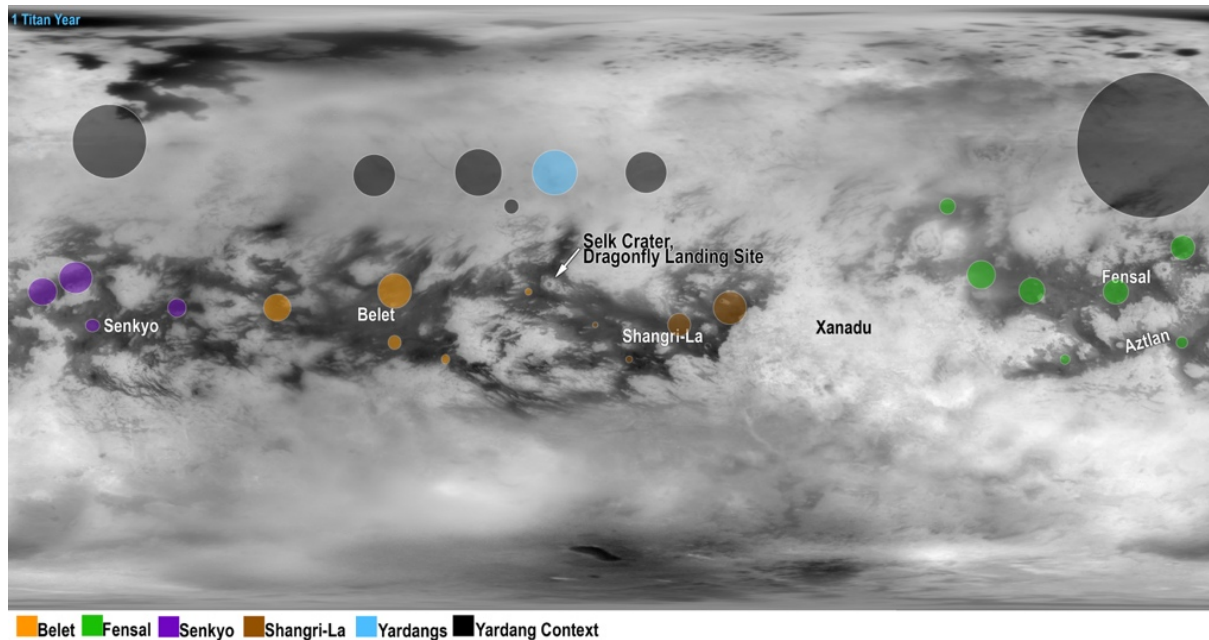


Figure 1. Wind speed intermittency (fraction of year that wind speed is above assumed threshold friction speed $u^* = 0.03$ m/s) for 25 case study sites. Circle size is proportional to wind intermittency, with a mean and standard deviation of $15 \pm 5\%$. Notably, the dune area near the Selk Crater landing site of NASA's Dragonfly rotorcraft has a predicted intermittency of 8.3%.

Introduction: Aeolian geologic processes have greatly modified the surface of Titan as manifested in sand dunes (e.g., Lorenz and Radebaugh, 2009), and possibly erosional features such as yardangs (Northrup, 2018). Linear, barchan, and star dunes indicate variable dune-forming winds over ~ 100 kyr timescales (Ewing et al., 2015). While the precise source of sand is unknown, the sand is likely an organic photolysis product (tholin) from atmospheric methane, which “snows” to the surface, and may or may not contain nuclei of water ice. However, the methane component of Titan's atmosphere is young—perhaps only 0.5-1 Gyr (Hörst, 2017)—and was likely nearly pure nitrogen prior to this time (e.g., Mandt et al., 2012; Charnay et al., 2014). It is unknown if prior methane-enriched atmospheres existed before ~ 1 Ga. Aeolian sand, if made from the photolysis of methane, is thus younger than the oldest methane atmosphere; possibly as young as the current methane atmosphere, implying aeolian landforms are at most 1 Gyr old. Here, we provide a first look at the frequency of sand mobilization on Titan. We do this by, first, using threshold friction speeds for Titan sand using results roughly informed from the Titan Wind Tunnel (Runyon et al., 2018) and the literature (Lorenz, 2014); and second, using a Titan global

circulation model of Titan's atmosphere to understand regional wind speed distributions. Our companion abstract (MacKenzie et al., 2020, this conference) investigates estimated sand fluxes and yardang abrasion rates. Using a global circulation model for Titan (TitanWRF; Newman et al., 2016) that includes effects of the seasonal methane cycle, we simulated the winds for 25 locations around Titan for one Titan/Saturn year (~ 29.5 Earth years). The results are shown and described in Figure 1 and its caption.

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