DUNE WIDTHS IN TITAN'S BELET SAND SEA REVEAL PATTERNS IN DUNE FORMATION AND STABILITY. B. Bishop[1], J. Radebaugh[1], E. H Christiansen[1]. [1]Brigham Young University, Department of Geological Sciences, Provo, UT 84602, *b.radleybish87@gmail.com*.

Introduction: Eolian dune fields found within Titan's equatorial region between ±30° latitude cover approximately 15-17% of the moon's surface [1]. These dominantly linear dunes are similar in form, size, and radar reflectivity to the large dunes of the Namib, Saharan, Saudi Arabian, and Australian deserts [2][3]. Earth analog studies indicate that the presence of linear dunes suggests adequate sediment supply, sufficient wind, and minimal sediment loss through transport or trapping by liquids [2][4][5]. The direct interaction between Titan's atmosphere and surface has produced the particular dune morphology present today [2][6]. Analysis of parameters such as dune width and spacing has revealed important aspects of dune-forming processes, regional conditions and relative ages for Earth [7], Mars [13] and Titan [8]. These studies may also help us better understand the interplay between the surface and atmosphere, and to ultimately discover potential sediment sources and global transport pathways [7][13][8].

Within Titan's dune fields, studies of dune parameters have shown that greater dune width tends to correlate with low latitudes [3,8]. The relationship between dune width and sediment supply, however, is not as well understood on Titan [9]. In this study, we discuss results from new width and spacing data gathered from images of Titan from Cassini's Synthethic Aperture Radar (SAR), and implications of the geomorphological variation throughout one of Titan's major sand seas, Belet.

Approach: To help further constrain the nature of Titan's sediment transport, we analyzed results from previous studies on dune width and spacing from Earth analogs, in particular the Namib and Australian deserts. In the Namib Sand Sea, the greatest dune width, and additionally sediment accumulation, is located near the center [10]. Conversely, the centers of the Australian sand seas are the locations of relatively narrow dunes, along with higher volumes of sediment [11]. Common to both these analogs is greater sediment volume towards the middle of the sand seas, which has also been seen on Titan [12]. Detailed analyses of width and spacing across the sand seas will help us determine the relationship between Titan's sand seas the Earth analogues.

Our current study focuses on the Belet Sand Sea located on Titan's trailing hemisphere between -5° and -9° latitude, and 65° and 150° W longitude. [3] and [12] describe Belet as the the largest sand sea on Titan with an estimated area of 3.3 + 0.6 million km^2 and a vo ume of 610,000-1,270,000 km^3. The dune forms in Belet appear to be tightly spaced, exceptionally straight and long and with sand-rich interdunes in the center of the sand sea [5,2,3]. We analyzed the relationship between approximately 2,470 measurements of dune width with their associated distance from the sand sea margins [8](Fig. 1).

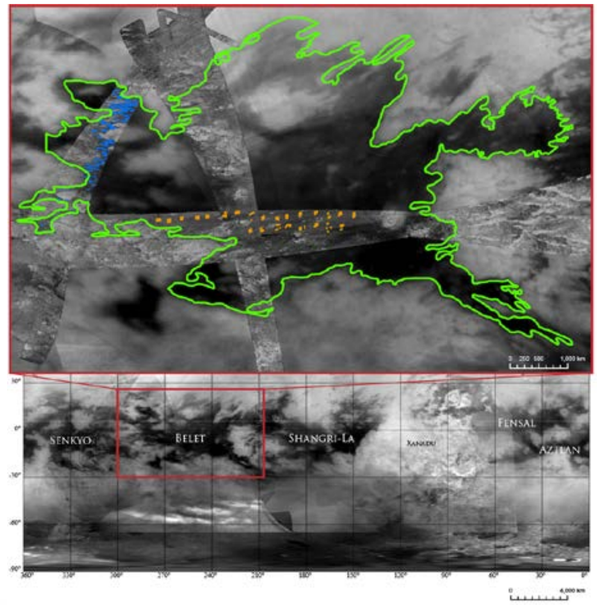

Fig. 1 Dune width and spacing locations shown on Cassini SAR swath relative to the maximum extent of the Belet dune field. *Blue points were measured from swath T21, 12 Dec, 2006 [8]. Orange points measured from swath T08 28 Oct, 2005[9].*

Dune field boundaries were previously mapped by defining a correlation of dune covered regions in SAR to near-infrared images from the Cassini Imaging Science Subsystem (ISS) [12]. Dune width and spacing measurements were obtained in discrete locations across Belet, 90 km^2 each in area (Orange markers in Fig. 1) [8]. The average width/spacing values in these areas were then compared to the distance from the nearest none-dune material, which in some cases included relatively small, bright obstacles scattered within the defined dune field [8][9]. That study revealed a slight correlation between dune width and the distance to obstacles and/or the sand sea margin [8].

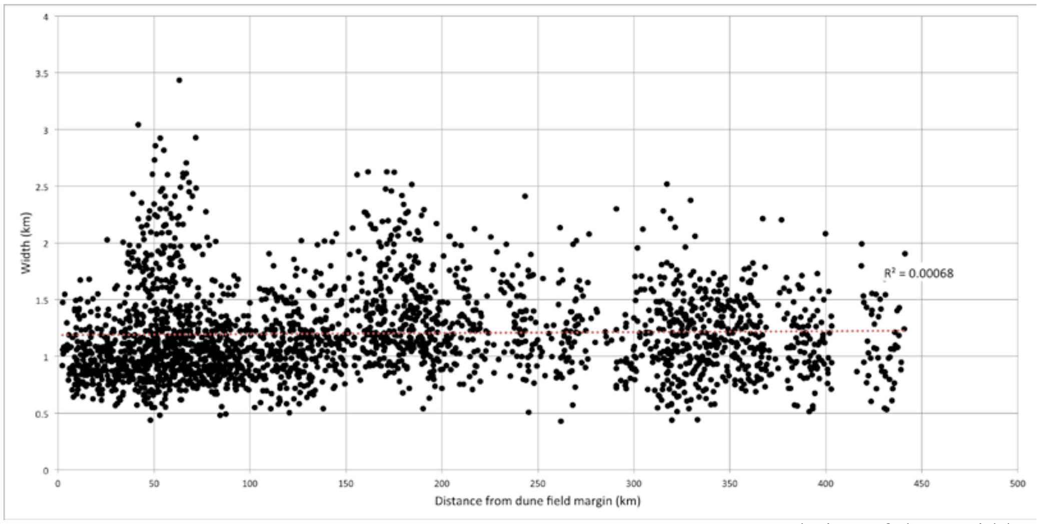

Fig. 2 Dune width versus distance from dune field margin (n= 2,470). *These initial results suggest that dune width is highly variable throughout Belet's sand sea, and in particular at approximately <100 km from the margins* [8][9]. *This also demonstrates that dune stability increases with increasing distance from the margins.*

We continued to investigate the relationship between dune width and the distance to the sand sea margin through increasing the sample size and redefining the sand sea boundaries to disclude all of the smaller obstacles not containing dunes. Instead of using the average width and spacing values for the 90 km^2 areas, we incorporated *all* the measurements in our analyses. Using the near analysis proximity tool in ESRI's ArcMap 10.1, we measured the shortest possible path from the dune field margin to a particular data point where dune width measurements were obtained.

Results and Discussion: Dune width verses the distance (in any direction) to the Belet Sand Sea margin is shown in Fig. 2. This shows that when the sand sea as a whole is analyzed, dunes of all widths can be found at all distances from the margins. Additionally, there is a greater spread in values for widths for dunes in close proximity (<100 km) to the margins. One explanation for this is that as distance from the margin increases, the variability of input parameters for dune formation likely decreases, whereas the longer-term morphological stability of dunes increases. In future studies, we should consider how dune forms are affected by the large obstacles or embayments penetrating into the sand sea's interior. These obstacles will likely have a greater impact, compared to the smaller ones, on sediment supply, wind variation and velocity, and the adjacent basin topography. The different dune morphologies within Earth's dune fields represent particular interactions between the surface and the atmosphere. Although the materials found on Titan are vastly different than what is found on Earth, the physics remain the same [2].

Conclusions: While the correlation between dune width and spacing with latitude has been demonstrated [3][8], we have yet to see a strong correlation of dune width with distance from the sand sea margin. We have shown that measuring the distance from the nearest edge of obstacles found within the dune field yields only a weak relationship to dune width and spacing [8]. Likewise, there appears to be a faint correlation, if any, when the interior obstacles are removed and destances are measured from the outermost edge of the sand sea. We will continue to collect data throughout Belet and other sand seas and refine our distance measuring methods. Ultimately, by careful study of the dunes, we seek to describe with confidence the interplay of atmospheric processes with Titan's surface.

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