A REVIEW OF SURFACE-ATMOSPHERE INTERACTIONS ON VENUS VIA OBSERVABLE AEOLIAN FEATURES. L. X. Rader[1], B. J. Thomson[1], and M. C. McCanta[1], [1]Dept. of Earth and Planetary Science, University of Tennessee, Knoxville, TN 37996 (lrader2@utk.edu).

Introduction: Due to its thick atmosphere and opaque cloud cover, the surface of Venus is difficult to observe from orbit except at radar wavelengths [1, 2, 3] and at a few nighttime infrared wavelengths [4, 5]. Apart from wind streaks and radar-dark mantles associated with impact craters, recognized aeolian features are rare and are limited to a few dune fields and a single set of yardangs. This research uses Magellan data products to revisit the first-order characteristics of bedforms and aeolian erosion features on Venus. The areas of interest include four identified dune fields and one set of yardangs [6, 7]. Our overarching objective for studying dune and yardang fields is to better understand the surface-atmospheric interactions on Venus.

Background: Only a few missions [1–4, 8, 9] have been able to map Venus' surface, with the most successful mission being NASA's Magellan orbiter in 1989. Magellan, also known as the Venus Radar Mapper, was active from 1989-1994 used synthetic aperture radar (SAR) to map the surface of the planet in three cycles: left look, right look, and left look, respectively [1, 10]. From the SAR data, the Full Resolution Radar Mosaic (FMAP) data products were produced using the SAR "noodles" of data [3].

Five locations have been identified on Venus by [6, 7] as either a dune field or a set of yardangs (**Figure 1**). The dune field locations are near Aglaonice crater, Fortuna-Meskhent, Stowe crater, and Guan Daosheng crater. The yardang field is near Mead crater.

Methods: Using the USGS Map A Planet 2 image processing tool (https://astrogeology.usgs.gov/tools/map-a-planet-2), Magellan SAR data of each target area was latitudinally and longitudinally bound, projected, and clipped to generate a geotiff of each aeolian field location. To determine the extent of each aeolian field, the location was visually examined in ArcGIS. Once the extent of the features was defined, a representative area of the field was chosen to map dune crestlines were in order to determine dune length, width, and spacing. Aeolian features on Venus are identified in SAR images by either radar-bright or radar-dark lines against the plains [3, 6, 7, 11].

Results: *Aglaonice:* The Aglaonice dune field extends from 20.9°W to 20.2°W longitude and 24.85°S to 24.4°S latitude. The dunes found in this field are around 3 kilometers long and 0.3 kilometers wide. The dunes are radar-bright bedforms that stand out against the radar-dark surface. The dunes in the Aglaonice dune field are linear dunes, with the long, skinny crestlines (**Figure 2**) [12]. The dune field in this location has been identified from radar-dark plains, with radar-bright aeolian features primarily due to the orientation and incidence angle [2, 6, 7, 11]. The dune field is located near the Aglaonice crater and the Carson crater. This area is referred to as the "crater farm" due to the relatively high number of impact craters [6, 7].

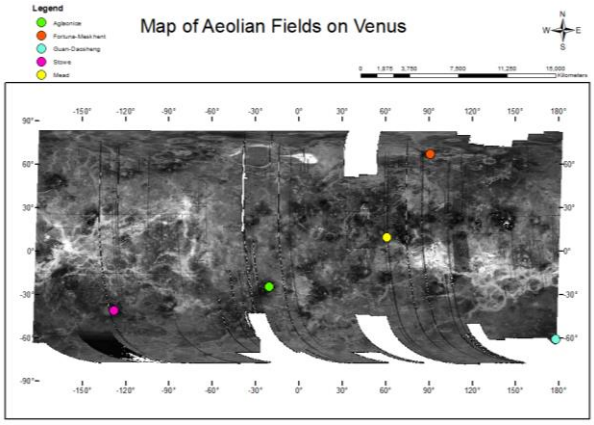

Figure 1. Global SAR mosaic of Venus from Magellan giving the five aeolian field locations.

Fortuna-Meskhent: The Fortuna-Meskhent dune field extends from 88°E to 92°E and 65.6°N to 68°N latitude. The dunes found in this field are between one and 5 kilometers long and 0.7 to 0.5 kilometers wide. The Fortuna-Meskhent dunes are radar-dark due to the contrast of the high backscatter tesserae to the relatively low backscatter from the dunes [7]. The dune field is located between the Meskhent and Fortuna tesserae and the Ishtar terra, more specifically around the Ops Corona, Al-Uzza Undae, and Jadwiga crater.

Guan-Daosheng: The Guan-Daosheng dune field extends from 179°E to 182°E longitude and 61°N to 63°N latitude. The dunes found in this field are around 2.5 kilometers long and 0.5 kilometers wide. The Guan-Daosheng dune field is identified by the radar dark plains and radar-bright features. The dune field is located between Gran Daosheng crater and Uluk crater.

Stowe Crater: The Stowe dune field extends from 128°W to 126.9°W and 40.8°S and 42°S. The dunes found in this field are around 1 kilometer long and 0.5 kilometers wide. The dunes in the Stowe dune field are only visible in the SAR right-look data, and not in the

Figure 2. Magellan SAR data of Aglaonice dune field. The extent of the field is approximated with the green outline, and a small sampling of dune crestlines have been mapped in yellow.

left-look [6, 7]. Therefore, the data for this location from the cycle 2 SAR right look, while the other locations all use SAR left-look data [6, 7, 11]. The Stowe dune field is radar-bright with radar-dark plains. The dune field was identified by a radar-bright patch in the right-look data, standing out from the radar-dark plains in the left-look data [6, 7]. The dune field is located near Stowe Crater with Alima Crater and Achek Dorsa nearby.

Mead Crater: The Mead yardang set extends from 60°E to 62°E and 8°N to 10°N. The erosional features in this field are 23 kilometers long and around 0.3 kilometers wide. The yardangs are also radar-bright with radar-dark plains, due to the difference in roughness. The yardang set is located near Mead crater, Kuro crater, and Ningal Lineae.

Discussion and Future Work: From the five locations selected for this study, aeolian fields occur near impact craters. This pattern is consistent with the current understanding of dune and yardang formation on Venus [3, 13–18]. Impact craters likely provide the needed sand-sized particles to form bedforms [13-16 19]. The aeolian fields have been named for the closest feature they occur near, usually a crater, apart from the Fortuna-Meskhent, that was named for the Fortuna and Meskhent tesserae [3]. In the case of Fortuna-Meskhent, the sand-sized particles may be sources from the tesserae formation, as well as from a nearby impact crater (i.e., Jadwiga).

More research is needed into refining the prevailing wind directions inferred from the dune and yardang directions. From there, our goal is to sample the surface of Venus in sections to develop a revised gridded wind direction map of Venus [e.g., 11], to better understand aeolian processes and the lower atmosphere interactions with the surface. In addition, there are still questions about the dune and yardang properties, such as dune height and volume of sediment involved. Future research using newer composite stereo-derived topographic products from the Jet Propulsion Lab/Caltech [20] should provide additional insights into these aeolian sites.

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