MEASURING THE RADAR PROPERTIES OF PYROCLASTIC DEPOSITS IN EISTLA REGIO, VENUS.

T.N. Henz[1], I. Ganesh[1], and L.M. Carter[1], [1] Lunar and Planetary Laboratory, University of Arizona. (thenz@email.arizona.edu)

Introduction: The surface of Venus is covered with layers of volcanic activity from the past 150 million years. Most of this activity has happened in the form of effusive volcanism, however, there are a few places that have been proposed to have pyroclastic deposits (e.g. [1]).

On Earth, pyroclastic deposits come from explosive eruptions with high volatile content, such as H_2O or CO_2 [1]. Regions with possible pyroclastic deposits on Venus could yield insight into the interior of the planet, or the local volatile content.

The focus of this project is to constrain a few key radar characteristics of areas that have been mapped as pyroclastic flows such as the radar backscatter cross section, emissivity, reflectivity and meter-scale slope.

Methods: The description of the geological units in the United States Geological Survey (USGS) quadrangle maps, [3, 4], determined what areas were selected. In Eistla Regio, the features that have mapped pyroclastic deposits near them are Irnini Mons, Anala Mons, Pavlova Corona, Didilia Corona, and Isong Corona. A Kali Mons region was also selected for study for two reasons. The first is that it is a lava flow unit in between the two areas that have pyroclastic deposits. The second reason is that Irnini Mons and Anala Mons have deposits that have been proposed to be a lava flow with a thin pyroclastic deposit on top. In Figure 1, the areas A and B have been mapped to be this type of deposit for Irnini Mons [3,4]. The Kali Mons lava flows should aid in comparing the lava flows and mapped pyroclastic deposits.

The ArcMap software was used to crop down the Magellan SAR Left-looking Backscatter, Meter Scale Slope, Emissivity, and Fresnel Reflectivity images to the focused study areas, shown in Figure 2. ArcMap has geoprocessing functions that allow for easier pixel value gathering across all four images. This feature is used to look at the different pyroclastic deposits to define the characteristics across the deposits. The value for the SAR Backscatter is calculated using the incidence angle chart in [5].

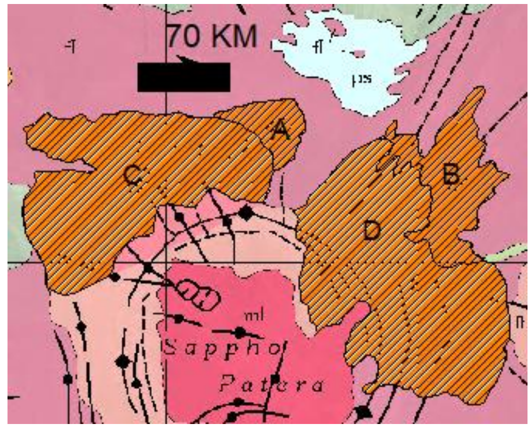

Fig 1: The USGS quadrangle of the northern part of Irnini Mons [3]. The features that are labeled fhI, hI, and ps were interpreted as possible pyroclastic deposits. The fhI areas are labeled A and B. The hI areas are labeled C and D.

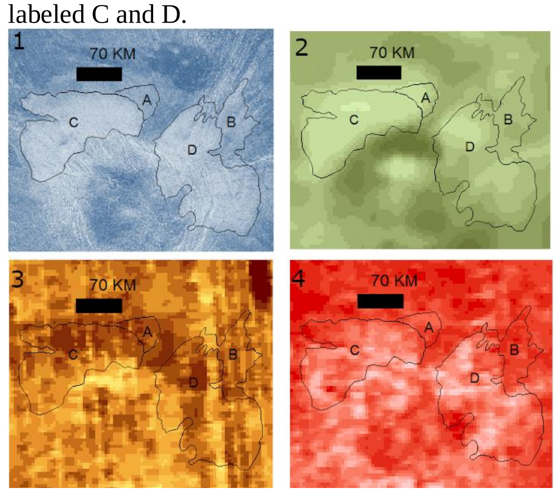

Fig 2: These four different images show the same northern Irnini Mons region in Figure 1. The SAR Left-Look Backscatter is shown in the first panel. The Microwave Emissivity is shown in the second panel. The Fresnel Reflectivity is shown in the third panel. The Meter-scale Slope is shown in the fourth panel.

Area	Emissivity		Fresnel Reflectivity	
	Mean	±1σ	Mean	±1σ
A	0.854	0.019	0.091	0.009
B	0.830	0.009	0.109	0.021
C	0.837	0.044	0.115	0.036
D	0.821	0.021	0.113	0.026

Table 1: The table shows the Microwave Emissivity and the Fresnel Reflectivity for the areas A, B, C, and D. The two columns are mean value and standard deviation value.

Preliminary Results and Discussion: The mean value and standard deviation for both the emissivity and the Fresnel reflectivity are shown in Table 1. The emissivity values for all four units are within the same statistical range of one another. The Fresnel reflectivity mean values and the standard deviation for C and D areas are similar to each other. The Meter Scale Slope values for areas C and D (Fig. 2 panel 4) seem to suggest that the areas are slightly rougher compared to the surrounding lava flows, including areas A and B.

The emissivity values for all the areas shown in Figure 1 are within the same range as the possible pyroclastic deposit units near Pavlova and Didilia; the range of emissivity being 0.80 to 0.85 [1]. The areas B, C, and D are all slightly lower than the average emissivity value for Venus, which is 0.84 [2]. According to [1], some radar bright regions just out of these images are also within this emissivity range. This would suggest that these possible pyroclastic deposits have similar surface properties. The lower emissivity for area B, compared to area A, might be due to differences in either the thickness, surface roughness, or the composition of the pyroclastic mantle for the two units [2]. Since the Fresnel reflectivity for area A is a low value compared to area B, and the Meter Scale Slope is of a similar value to B (Fig. 2), variation in surface texture would probably be less likely option.

Future Work: For future work, the slope and backscatter values will be investigated for all the different mapped pyroclastic deposits listed in the Methods section. The boundary regions of areas C and D, where the deposits sometimes appear more diffuse, will also be mapped and measured to try to constrain the thickness of the units and how it may change with distance from the upslope vents. The volcanic units at Kali Mons will be used to compare the radar properties of pyroclastic deposits with effusive flow units. Ultimately, the measured values will be used with a vector radiative transfer scattering model to determine the types of surface and subsurface structures and dielectric properties that could be present in these regions.

Acknowledgments: This study was done as part of a University of Arizona class. It was partly supported by FINESST, awarded to I. Ganesh, and SSW, granted to L.M. Carter. Magellan SAR images were processed using USGS Astrogeology Science Center's Map-A-Planet 2 (MAP2).

References: [1] Campbell B. A. et al. (2017) *JGR: Planet*, 122, 1580-1596; [2] Tyler G.L. et al. (1991) *Science* 252, 265-270; [3] McGill G. E. (2000), *USGS Sci. Inv*. Map 2637; [4] Campbell B. A. and Clark D. A. (2006), *USGS Sci. Inv*. Map 2897; [5] Saunders R. S. et al. (1992) *JGR* 97, 13067-13090