EXPANDING UPON THE COLLECTION OF KNOWN VENUSIAN LANDSLIDES. E. Jesina[1], L. Carter[1], and I. Ganesh[2], [1]The University of Arizona, Department of Lunar and Planetary Science, Tucson, AZ, USA, [2]The University of Alaska Fairbanks, Fairbanks, AK.

Introduction: Atla Regio, which is centered at approximately (4°N, 160°W), is a volcanic region that lies in Aphrodite Terra on Venus. There are three major volcanoes located within Atla Regio (Maat, Ozza, and Sapas Mons) and parts of three different chasma (Ganis, Dali, and Parga). This region was previously thought to be relatively young [1,2], but there were few identified landslides [3]. After a new review of the Magellan radar data, there is evidence of landslides occurring across most of the region.

Methods: The preliminary results of landslides on Venus were published by [3], which also described many landslide types. From this paper, we began our search for more landslides and their possible causes. We primarily used left look synthetic aperture radar (SAR) data acquired at ~100 m/pix resolution by the Magellan spacecraft in Cycle 1, which has higher surface coverage for Atla Regio than the other two Magellan mapping cycles. Wherever coverage was available, right look SAR images were compared to the left look data to validate the landslide.

In order to identify landslides in this region, we compared the morphology and morphometry of features in the SAR data with pre-determined characteristics described in [3]. From characteristics described in [3], and landslide categorization described in [3], we were able to classify the mapped landslides into 5 main categories. Characteristics that were taken into consideration included the quantity of landslide material, the darkness of this material, and whether the material tended to cluster in one location versus thinning out. The five categories were: debris avalanches, debris flows, rock/block slide avalanches, small rock/block slide avalanches, and rock slumps. The difference between a regular rock/block slide and a small rock/block slide is the size, as the smaller ones had less than 50 square kilometers of material deposited. When comparing debris flows versus debris avalanches, the rockiness of the material was the main interest. A rockier deposit meant that it was more of an avalanche than a flow, as flows are commonly smoother from being liquidized [3]. Rock slumps' main characteristic was that the material barely moved and stayed relatively close to where it initially collapsed.

Most of the main differences could be seen visually. Rockier deposits were very radar bright. For debris flows, the deposits were typically radar dark and thus less distinct when compared to the surrounding area. These changes in brightness were what drew attention to them and made it easier to identify the landslides. We also measured the sizes of the landslides, which included runout distances where applicable. We observed whether they came from an alcove or if there was a clear starting point, as well as whether they ended with a fan-shaped feature. In some cases, the distal ends of the landslide are surrounded by darker material. This helped draw our attention to some of the landslides.

Results: In total, we found over 100 potential landslides. These were broken down into four separate groups based on how likely they were to be landslides or radar anomalies. From there, the most likely landslides were documented and are being presented now. There were 29 very likely landslides that we found and broke down into subcategories.

We found 3 debris flows, 4 rock slumps, 6 small rock/block slides, 8 rock/block slides, and 8 debris avalanches. Typically, landslide deposits were less than 50 square kilometers. The area of the deposits ranged from approximately 2 square kilometers to over 120 square kilometers for the largest rock/block slide avalanches.

Conclusion and Future Work: From our work so far, we can infer that landslides are more widespread on Venus than previously thought. Steeper slopes within the chasma seem to produce the most visible landslides. The landslide types that we have found seem to be prominent because of the look angle of the Magellan SAR, so there are likely more landslides than presented here. The rarity of debris flows is consistent with Venus' surface being relatively dry since these flows are commonly a result of liquidation. The larger number of radar-bright landslides also demonstrates that blocky deposits are common.

We plan to continue to gather data on the landslides in Atla Regio, as well as continue our search in other volcanically young areas. Future missions will ideally be able to provide different radar look angles for a majority of Atla Regio to investigate if there are additional landslides and can also be used to determine whether these landslides have changed over time. Additionally, we plan to use our current mapped landslides to guide future missions to Venus to investigate the global scale of these landslides.

References:

[1] P. J. Mouginis-Mark (2016), Icarus, vol. 277, 433-441. [2] J. Brossier et al. (2021) JGR, vol. 126, e2020JE006722. [3] M. C. Malin (1992) JGR Vol. 97, NO. E10, 16, 337-16, 352

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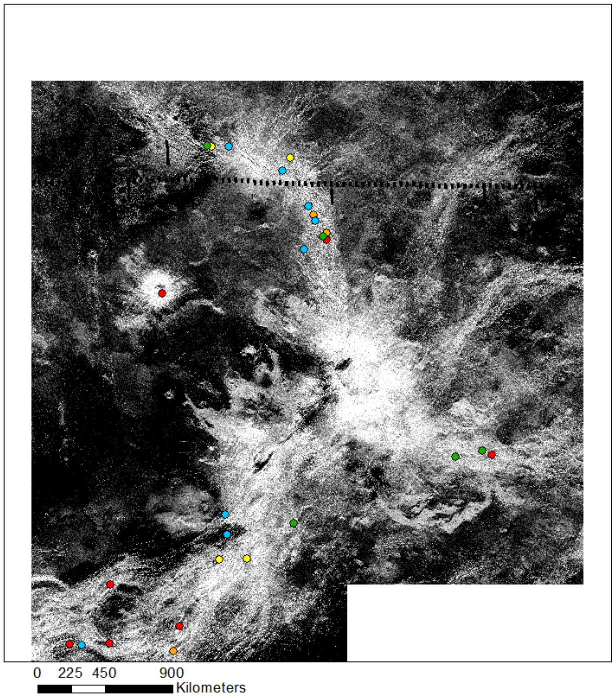

Figure 1: The Atla Regio Volcanic region on Venus, with our landslides marked in red (for rock/block slide avalanches), orange (for debris flows), yellow (for rock slumps), green (for small rock/block slide avalanches), and blue (for debris avalanches).

Figure 2: An example of a small rock/block slide avalanche near (17.5°N, -168.5°W) in Ganis Chasma.

Figure 3: An example of a rock/block slide avalanche near (8.5°N, -171.7°), within the Sapas Mons region.

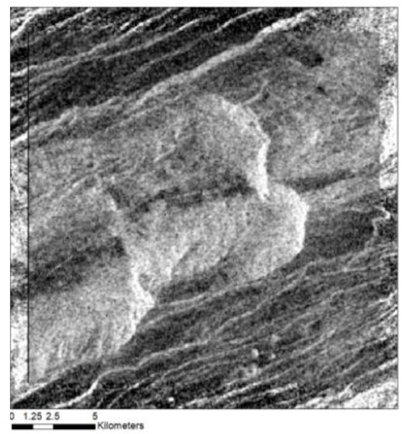

Figure 4: An example of a rock slump near (-8.4°N, -168.1°W) in Parga Chasma.