RADAR SIGNALS FROM MAGELLAN, PIONEER, AND VENERA. E. Apala[1], V. Chevrier[2] and E. Kohler[3], [1]Department of Physics, East Central University, 1100 E 14th St, Ada, OK 74820, lizzieapala@yahoo.com, [2] Arkansas Center for Space and Planetary Sciences, Stone House North, room F47, 346 ½ N. Arkansas Avenue, University of Arkansas, Feyietteville, Arkansas 72701., vchevrie@uark.edu ,[3]Arkansas Center for Space and Planetary Sciences, University of Arkansas, Stone House North, room G47, Feyietteville, Arkansas 72701,

Introduction: Between the years of 1978 and 1989 there were three missions that sought to study the surface of Venus: Pioneer, then Venera, and finally Megellan. Radar imaging had to be used in all missions to see through the thick atomosphere and clouds of Venus. These missions collected data about the geography of the foreign land such as altitude differences. They also collected the Fresnel reflectivity and emissivity at different wavelengths. Fresnel reflectivity is the inverse of emissivity. Looking at the graphs made from the Pioneer data, a direct relationship can be seen between the altitude and reflectivity/ emissitivy. As the altitude rises the reflectivity also increases making the emissivity decrease (emissitivy = 1-reflectivity) . One of the best examples that show the relationship graphically is the highest point of Venus called Maxwell Mountes. The mountain reflectivity measures about .5 (on a zero to one scale) at a altitude of 10.4 km. (on a scale of -2 to 10.4)[1]

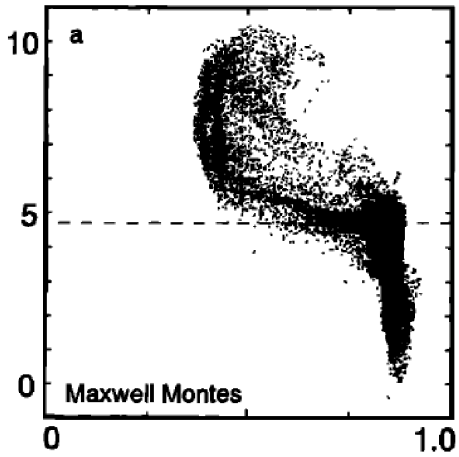

Figure 1 shows a graph of altitude verses emissivity for Maxwell Mountes published in Klose-1992-JGR-High radar reflectivity due to the prescence of pyrite

The reason for this relationship is unknown but there are popular theories suggesting a snowline, metal compounds in the atmosphere, or simply surface roughness. The most interesting is the metal compounds in the atmosphere, which suggest enriched Titanium and Iron compounds or minerals such as rutile and ilmenite[2]. Some of the suggested metals can be found on Earths moon as well[3] . By graphing altitude versus reflectivity for each mission and comparing them side to side it might be possible to eventually prove one of the earlier suggested theories.

Methods: During this research two different types of graphs were made, one being global and the other being regional. To be able to make these graphs correctly, two calculations must be made: the altitude which is calculated by subtracting 6051.8 from all given radii, and True Fresnel reflectivity calculated by taking the Fresnel reflectivity and subtracting it from the Fresnel reflectivity error. The global map was separated into multiple graphs to show the trends of altitude and reflectivity more clearly.

Figure 2 shows one of three global maps made to represent the altitude and reflectivity of Venus

For the regional graphs six regions that varied in height were chosen to graph: Maxwell Mountes, Rhea and Theia Mons, Aphrodite, Artemis Chasma, Helen Planitia, and Atlanta Planitia.

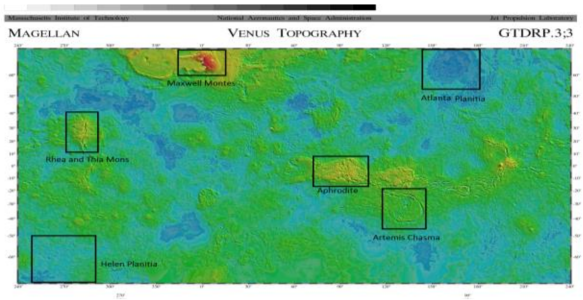

Figure 3 is a topography of Venus showing the selected regions of study

Each region will be graphed three times using Pioneer, Venera 15/16, and Magellen data so we can see the difference in time and different radar wavelengths. The first graphs made will be with the Pioneer data because

altitude versus emissivity graphs have been made with the data and can be replicated. Figure 1 is graphed with Poineer data. Magellan graphs will work similar to Pioneer but collected more data since it was used longer. To obtain graphs that match Poineer, Venera 15/16 graphs must have the layouts changed using a computer system called ArcGIS.

Results and Discussion: The graphs done through out this ten week research program show that the reflectivity rises with the altitude as expected. Below you can see this reflected in Figure 4, 5, and 6. Due to time restrictions, no comparison has been made as of yet between the data of Pioneer, Venera, and Magellan. During this time there was some issues discovered with the data which will get looked into more thoroughly in the near future by the donors of the Venus data located at MIT.The issues mainly effects the upper portion of the graph and can seen below. Looking at the graphs below you can see the that as the as the altitude gets lower than the Fresnel Reflectivity as decreases. Figure 4 is the inverse of Figure 1.

Future Work: In the future, Pioneer's graphs will continue to be made and corrected after the data has been looked at by MIT. The Venera 15/16 map will be reformatted through ArcGIS to match Pioneer's and Magellen's data will graphed also. After all data is graphed, they will be compared side by side to show the differences of Venus' surface over time and using different radar wavelengths.

Figure 4 shows a graph of Maxwells Mountes altitude versus True Fresnel Reflectivity using Pioneer data. The graph was colored to more clearly show the relationship and to color code the area as it gets higher.

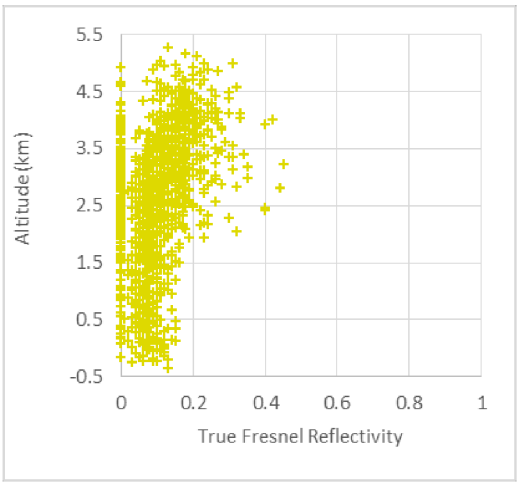

Figure 5 shows a graph of Aphrodite altitude versus True Fresnel Reflectivity. The color of the graph show that it is above the equivalent of Venus' sea level but not as high as Maxwell. Notice that the altitude is below 5.5 and the True Fresnel Reflectivity is aroud .2 and .3

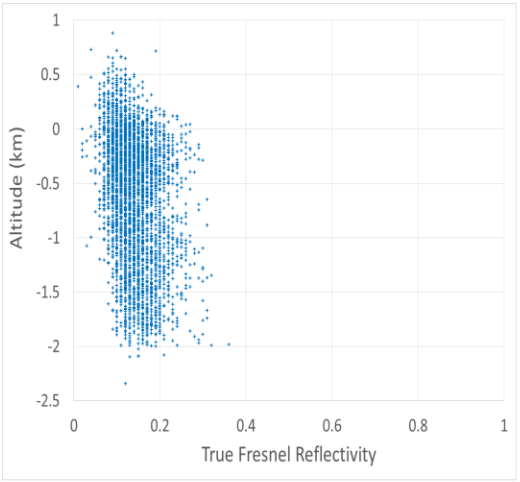

Figure 6 shows Atlanta Planitias altitude vs. True Fresnel Reflectivity. Atlanta Planitia is the lowest region that will be graphed. The altitude is below 1 kilometer making it below the average altitude of Venus and the True Fresnel Reflectivity is mainly between .1 and .2

References:

[1] Klose (1992) JGR- High radar reflectivity due to the prescence of pyrite-3. [2] Garvin (1985)-JGR-Global reflectivity of Venus an correlation with elevation- 6862 [3] IBID

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