Introduction: Europa is the second innermost of the Galilean satellites of Jupiter, with a relatively young, icy surface [1-3]. Thermal measurements of the surface can be used to determine whether endogenic activity is currently present on Europa, but passive processes must be understood and eliminated as a possible cause of any potentially endogenic thermal anomalies that are found.

The Galileo Photopolarimeter-Radiometer (PPR) instrument mapped thermal infrared radiation from Europa, but found no signs of endogenic activity [5, 6]. The data have, however, been used to determine thermophysical properties of the surface, which provide insight into the physical state of the surface.

Rathbun et al. [6] derived thermal inertia and bolometric albedo for 20% of Europa’s surface using 13 PPR data sets, selecting those with good signal to noise and large surface coverage. They then divided the Europan surface into 10 degree square bins. For each bin, they searched the data sets for observations at different times of day. For each bin with observations at night and within 30 degrees of noon, they matched the temperature curves to a thermal model in order to determine the average thermal inertia and bolometric albedo within the bin.

New Directions: This analysis was extended [7] by including 7 additional PPR observations, which allow determination of thermal properties over a wider variety of surface longitudes. The variation of thermal properties with geologic unit was analyzed by defining several circular regions, each located entirely in a single geologic unit. The geologic map from [8] was used to define regions.

Model fits to both chaos and plains units at 2 different longitudes show that chaos has a slightly lower thermal inertia and albedo. However, thermal inertia and albedo show a much stronger correlation with longitude than with geologic unit. Thermal inertia has a minimum at 180 degrees longitude while albedo decreases with increasing longitude on the trailing hemisphere only (figure 1).

Current Study: Based on these previous studies, we will continue to model the thermophysical properties of Europa using PPR data. We will use all the PPR data sets from the previous studies and loosen constraints on the model fits. This will allow us to increase our surface coverage from 20% to closer to 50% and increase our longitudinal coverage, especially in the training hemisphere. We will shrink our bins to 9 degrees in order to minimize the mixing of geologic units in a single bin. We will compare our results to geologic units and also to exogenic processes that affect the saturnian satellites [9, 10].

References: