Evaluation of Final Tile Product Backscatter Tiers, AMM1

Introduction:

Twenty-five meter (25m) AMM1 tiles with radiometric corrections were inverted to retrieve sigma naught values in dB (σ^o_{db}). Documentation of this process can be found in the document "Evaluation of Inversion of Final Tile Product to Backscatter, AMM1" (filename:amm1_sig0_evalr3.pdf). As lower resolution tiers derived from the 25m data were deemed useful from noise characteristics and file size perspectives, a procedure for degrading the σ^o_{db} to those tiers was developed. As σ^o_{db} is not a linear quantity, bilinear resampling was not possible to apply directly to the dataset. Data were instead converted to power then resampled using the degrade function in Erdas imagine to a series of tiers, half the resolution at each subsequent tier: 25m, 50m, 100m, 200m, 400m, 800m, 1600m, 3200m, and 6400m. The result of this averaging is quantitatively the same as if the same tiers were generated using bilinear resampling. The tiers were then converted back to dB in order to make the dataset internally consistent.

Procedure:

Conversion to Power

dB values (σ^o_{db}) were converted to power using the spatial modeling language in Erdas Imagine using the following two equations:

$$\sigma^\circ = \frac{\left(DN_{16-bit\_scaled\_dB} + 32766\right)}{1638.35} - 30$$

$$Power = 10^{\left(\frac{\sigma^\circ}{10}\right)}$$

The first equation converts the 16-bit scaled version of dB (thus stored for space considerations) to ratio σ^o_{db} values. The second equation converts that value to power. Power values were stored as float double values.

Resampling

Images were resampled using the Image Degradation tool in Erdas Imagine (Interpreter:Utilities:Degrade...), excluding the background value of -32767. The 25m tier was degraded to the 50m tier, the 50 to the 100m, etc.

Evaluation:

Evaluation of the tiers was performed using the analysis of global statistics, including mean, median, and visual evaluation of histograms for relatively homogenous areas.

Area of Interest Selection

Two areas were chosen as endmembers of backscatter variability in Antarctica. The first was a region of relatively high backscatter (bright region) in the Amery Iceshelf, the second, a region of relatively low backscatter (dark region) in the interior of Marie Byrd Land.

As crossing orbit boundaries could introduce both ambiguities and non-homogenous samples, both areas were chosen carefully to avoid orbit boundaries. Both areas were also chosen to be of a relatively large scale (approx. 30 km) in order to allow useful statistic at the coarser tiers.

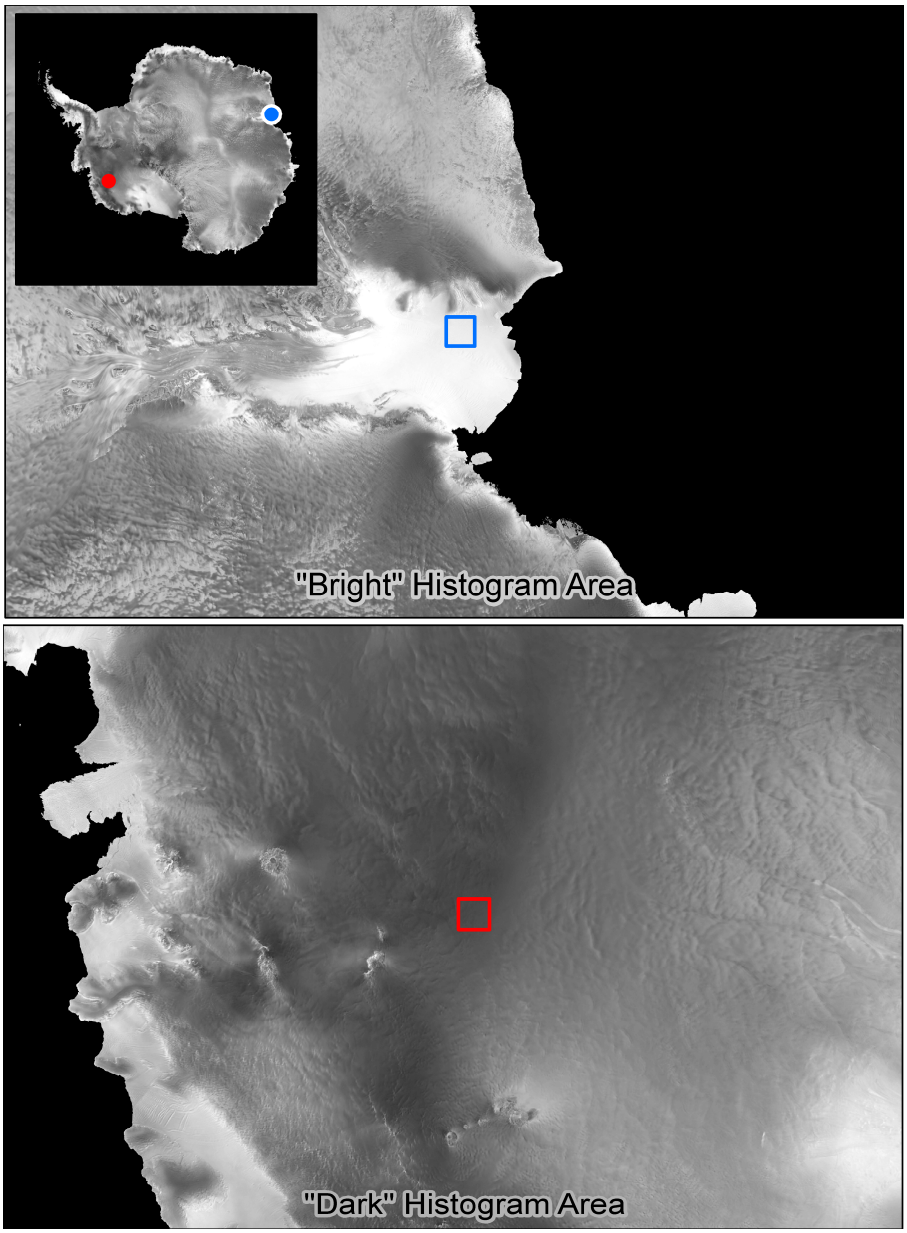


Figure 1. Evaluation Regions

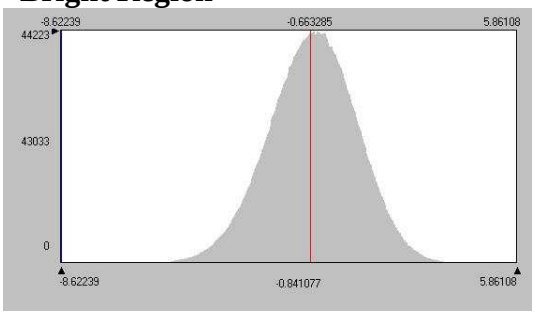
Histograms and Statistics

Histograms and statistics were generated from the above areas at all resolutions and tiers.

As can be expected based on the literature, the interior “dark” area has a mean value near -20dB, and the iceshelf “bright” area has a mean value near 0dB.

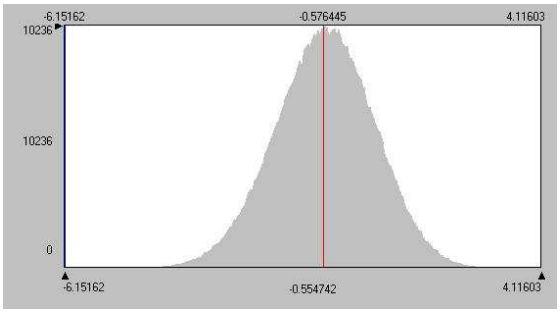
Also as expected, the mean value did not change in the averaging of the tiers, but the standard deviation decreased. Histograms are not displayed for tiers above 400m, as sample size becomes a limiting factor in the generation of meaningful histograms.

“Bright Region”



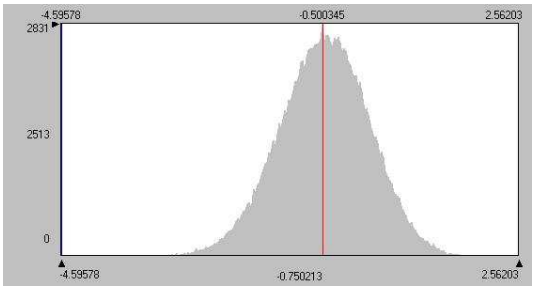
mean: -0.6, median: -0.6, mode: -0.5, Stddev: 1.4

25m



mean: -0.6, median: -0.6, mode: -0.6, Stddev: 1.1

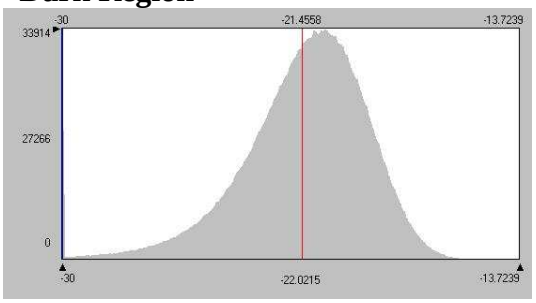
50m



mean: -0.5, median: -0.5, mode: -0.5, Stddev: 0.71

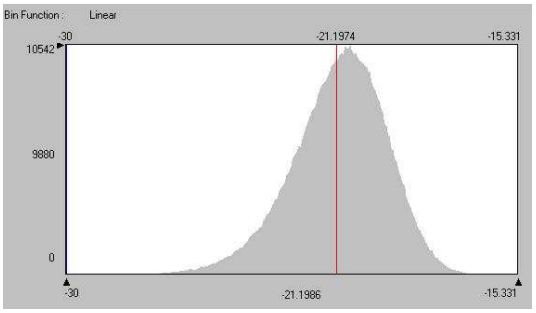
100m

“Dark Region”



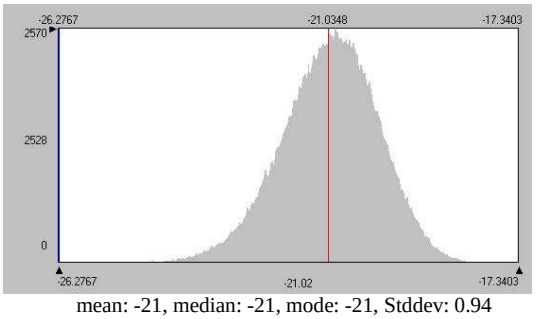
mean: -21, median: -21, mode: -21, Stddev: 2.3

25m



mean: -21, median: -21, mode: -21, Stddev: 1.6

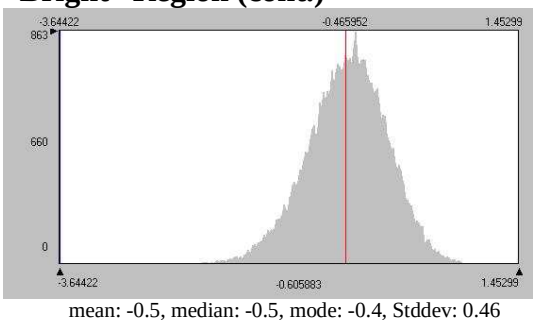
50m



mean: -21, median: -21, mode: -21, Stddev: 0.94

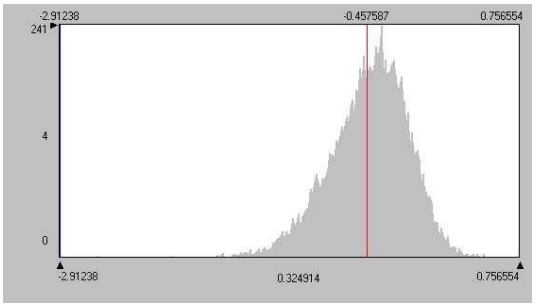
100m

“Bright” Region (cont.)



mean: -0.5, median: -0.5, mode: -0.4, Stddev: 0.46

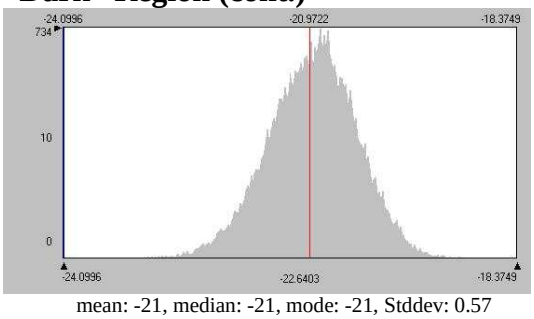
200m



mean: -0.5, median: -0.4, mode: -0.4, Stddev: 0.32

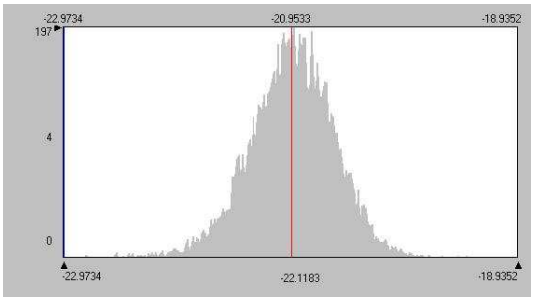
400m

“Dark” Region (cont.)



mean: -21, median: -21, mode: -21, Stddev: 0.57

200m



mean: -21, median: -21, mode: -21, Stddev: 0.39

400m