Abstract #2843

Photometric Correction of Thermal Data from the Diviner Lunar Radiometer

Diviner

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Introduction

- LRO Diviner has nine infrared channels dedicated to both lunar mineral identification and surface temperature mapping [1,2]
- The channels mapping surface temperature contain spectral features that could be useful for mineral identification [3]
- Comparing this data to laboratory spectra is complicated by a decrease in emissivity observed at high incidence angles [4,5]
- Previous work has demonstrated that fitting the data to a cosine curve and normalizing to the values along the curve can be used to remove incidence effects in the data. [6] (Fig. 1)

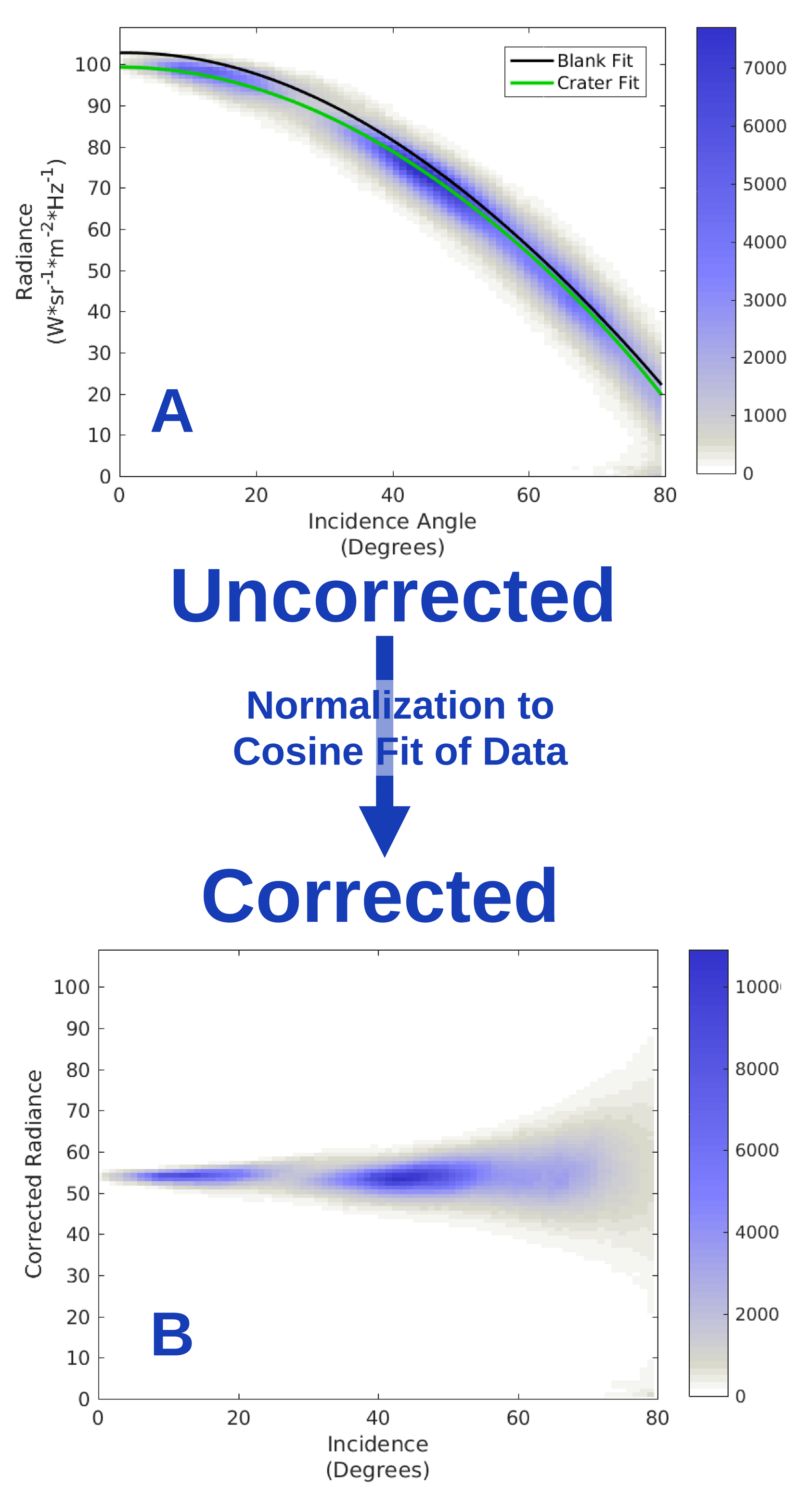
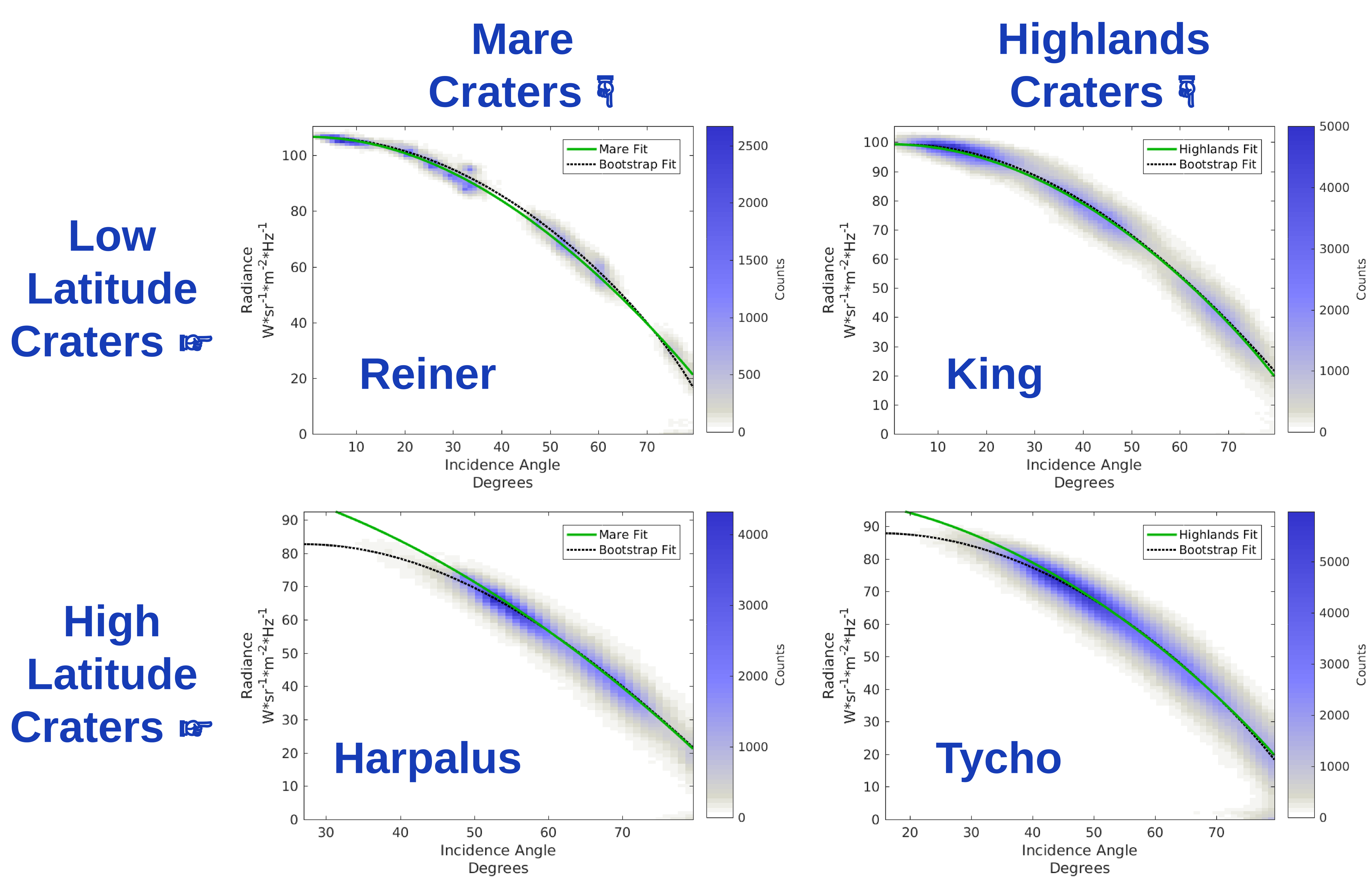


Figure 1 Demonstration of correction method. Plot A includes uncorrected data for both the low latitude (King) and high latitude (Tycho) highlands craters. Fitting to this dataset makes the fit more representative so that it can applied to similar sites at various latitudes. An analogous fit for craterless "blank" data is shown for comparison. Plot B shows the same data after being normalized to a scaled version of the crater fit.

Methods

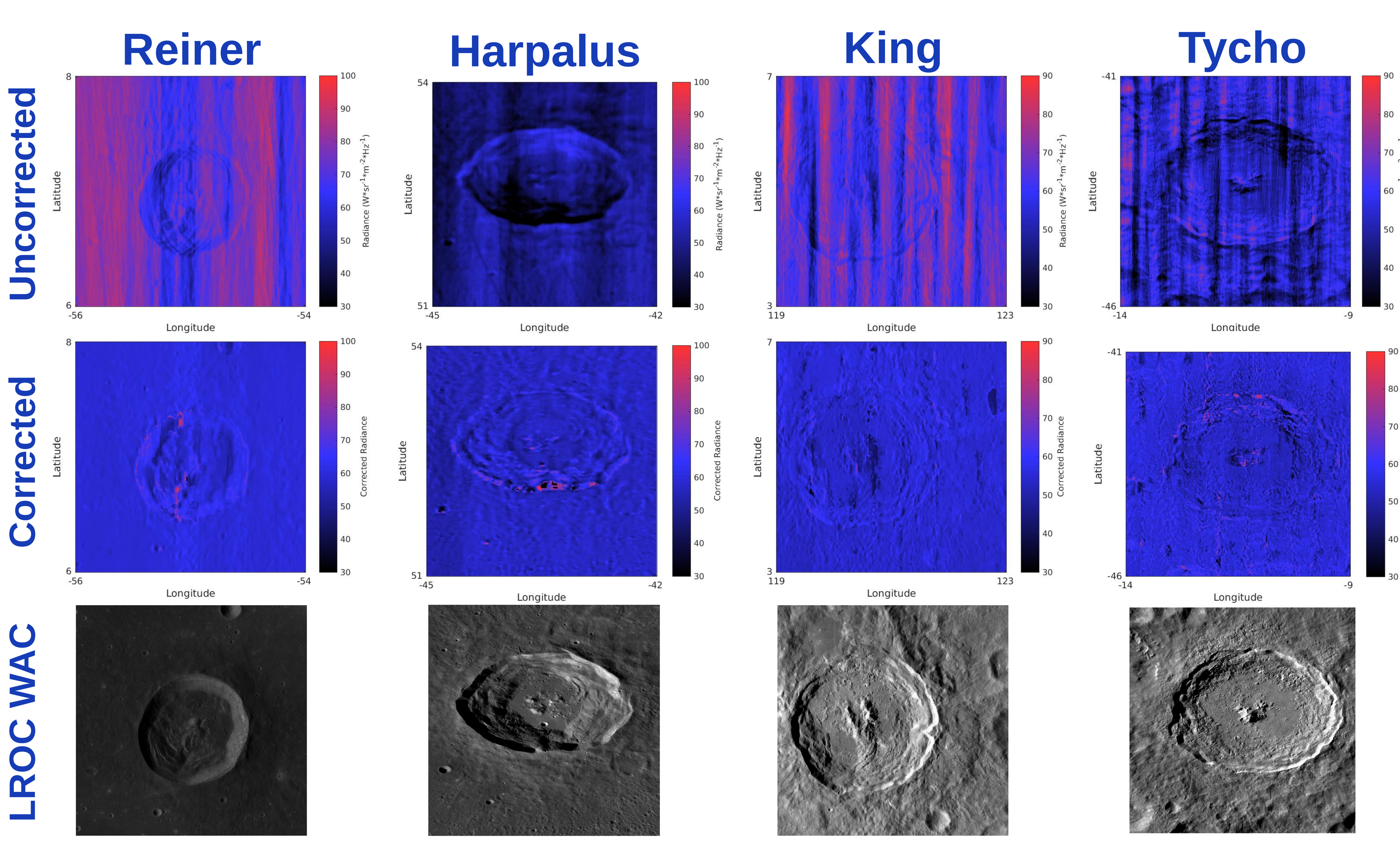
- The current correction uses a cosine fit of the form $a * \cos(b + c * \text{incidence})^d$
- The fit is created from data combined between scenes from different latitudes but with similar terrains. Data from similar terrains and different latitudes varies along the same fit equation as a function of incidence angle

Figure 2 Plots of uncorrected radiance data for four representative crater scenes. The corresponding low and high latitude scene data was combined for the inputs to the "Highlands" and "Mare" crater fits. Note that these fits differ from the "bootstrap" fits made using only the data in each scene.



Results

Figure 3 Maps of uncorrected and corrected data for four crater sites, with LROC WAC imagery for reference. The correction performs best at the low latitude mare crater (Reiner) but leaves some terrain effects visible in high incidence data at the highlands and high latitude crater sites. All sites contain overcorrected areas (red) where the fits underestimate the data.



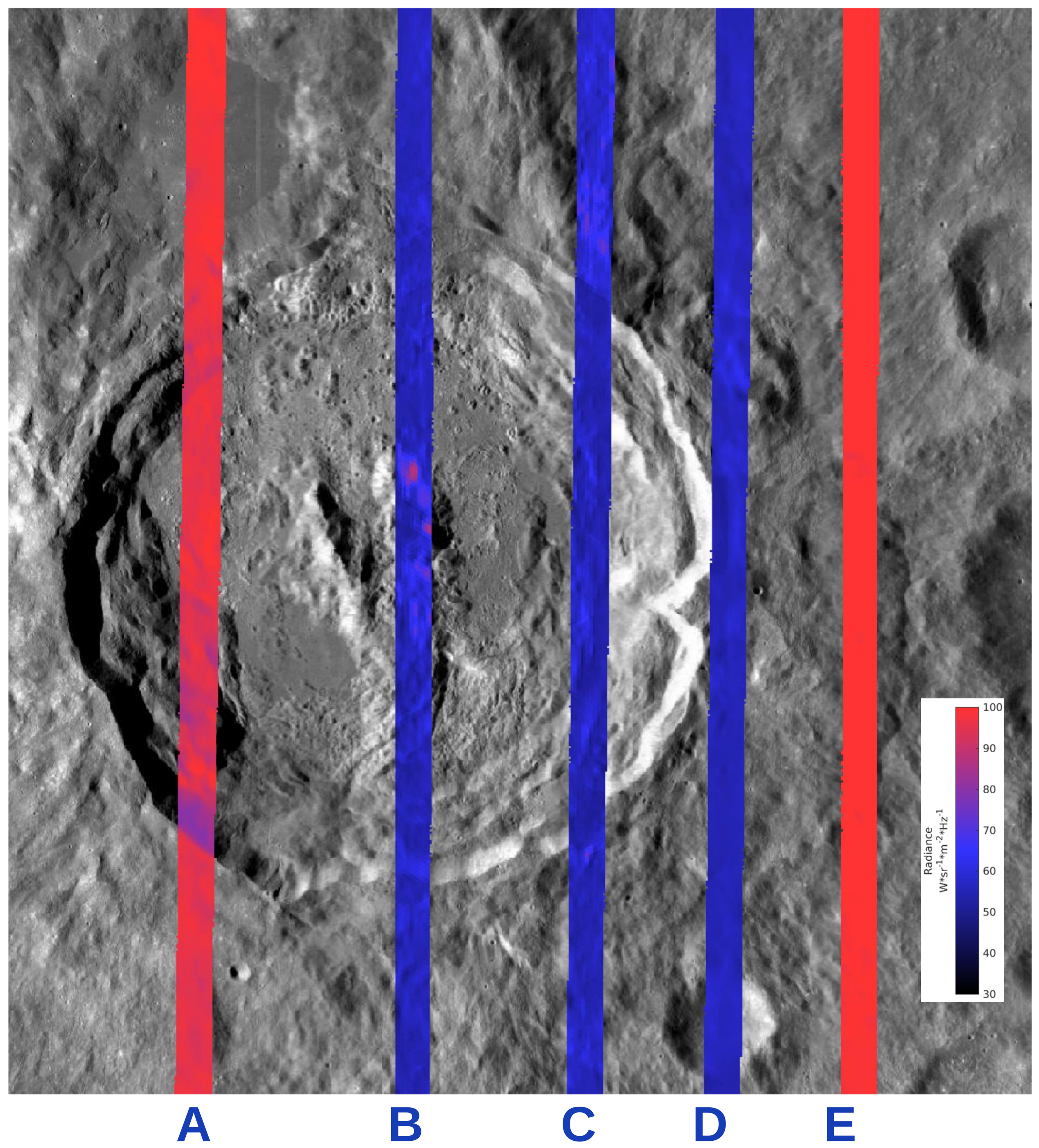


Figure 4 Comparison of data corrected using different fit equations superimposed over LROC WAC of King crater. **A** – Uncorrected. **B** – Self corrected (using "bootstrap" fit of in-scene data only). **C** – Corrected using data combining craterless blank highlands sites. **D** - Corrected using data combining highlands crater sites. (Same used in Figure 3) **E** – Corrected without scaling the fit to its value at 60°.

Future Work

- We are investigating the remaining terrain and illumination dependencies not being corrected.
- We plan to visualize the corrected data in emissivity space to enable us to make comparisons to laboratory spectra.
- An additive correction will be implemented to avoid the current asymptotic behavior (see Fig 1B) of the correction at high incidence angles.
- We plan to develop methods to dynamically modify the correction fit coefficients according to spatial and observational parameters of the data.
- We expect to develop a global corrected mapping product that will allow us to analyze the correction across large, continuous latitudinal variation.

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References: [1] Paige D.A. et al. (2010) *Space Sci. Rev.* 150, 125-160; [2] Greenhagen B.T. et al. (2010) *Science* 329, 1507-1509; [3] Shirley K.A. & Glotch T.D. (2014) *LPSC XLV*, #2399; [4] Lucey, P.G. et al. (2013) LPSC XLIV, #2890; [5] Shirley K.A. & Glotch T.D. (2014) *SSERVI Exploration Science Forum*; [6] Shirley K.A. et al. (2016) *LPSC XLVII*, #2923