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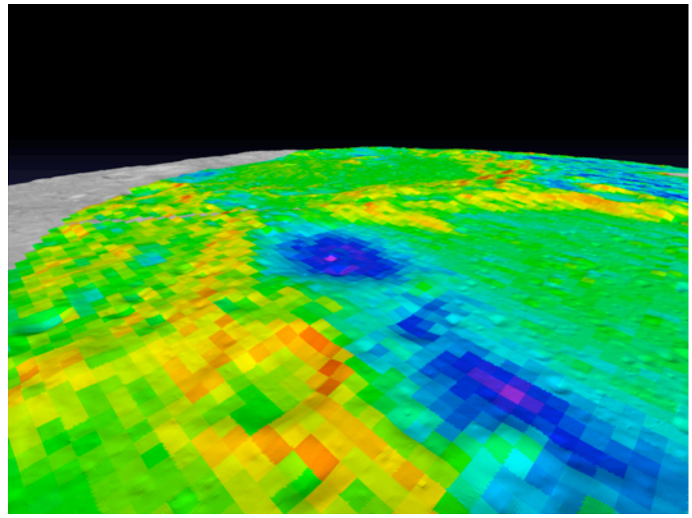
Introduction: The Diviner Lunar Radiometer Experiment is orbiting the Moon since July 2009 on the Lunar Reconnaissance Orbiter [1]. It has been mapping the infrared emission from the Moon using seven spectral channels that span a wavelength range from 7.55 to 400 µm at a spatial resolution of ~200 m, including the first radiometric measurements of surface temperatures at the lunar poles. Diviner's surface-temperature maps have revealed the existence of widespread surface and near-surface regions that extend beyond the boundaries of persistent shadow [2]. Large areas of the lunar polar regions are currently cold enough to cold-trap water ice as well as a range of both more volatile and less volatile species. Due to their low obliquity and rough topography these high latitude regions have been shown to never receive direct sunlight.

In absence of other sources, the only effect that balances the surface thermal emission is then the heat flow rate from the warmer lunar interior [3]. To constrain the models for the existence of volatile species and the heat flow properties, the lowest existing temperatures on the Moon can be used and the current minimum record observed of less than 20 K for the Channel 9 (100-400 micron) winter season nighttime brightness temperature, observed in the north polar Hermite Crater [4]. One of the foci of the currently ongoing efforts to improve the calibration of the Diviner dataset is an improved accuracy of the lowest and highest temperatures in the dataset.

Methodology: The principle method to calibrate the Diviner radiometer consists of determining regularly the offset and gain via blocks of calibration pointings to cold space and blackbodies at a defined temperature. Each pointing lasts only 10 seconds and is usually being executed in a space-blackbody-space sequenec. Difficulties arise from the fact that the instrument is cooling down when looking into space and warming up when observing the instrument internal blackbody, which is usually held at a temperature of around 320 K.

So far, these gains and offset have been determined by using the closest neighboring calibration pointings and a linear interpolation between the offsets and gains that were calculated at these points. One point we are studying now is if we could use long-time trends to estimate the current gains and offset to a lower uncertainty.



Diviner Channel 9 brightness temperatures for a portion of Hermite crater in the lunar north polar region obtained near midnight near winter solstice. The spatial resolution is 2 km. The purple regions have brightness temperatures approaching 20K.

For the coolest temperatures the error in offset determination is the dominant parameter, therefore another point of focus is the detailed analysis of how the timing and relative positioning of the calibration views and their related effect on the thermal state of the instrument influences the error on the offset.

Results: These efforts to further reduce the uncertainties in the calibration of these most difficult data points will lead to a better understanding of remaining differences in predicted temperatures from thermal models of the moon and measured surface brightness temperatures [2]. These activities will lead to a recalibrated NASA level 2 dataset for Diviner that will also serve as the input for updates for the higher level products of the Diviner PDS dataset.

References: [1] Paige, D.A. et al. (2009) *Space Science Reviews 150(1-4)*, pp.125–160. [2] Paige, D.A. et al. (2010) *Science 330(6003)*, pp.479–482. [3] Watson, K. (1967) *JGR 72* 3301-3302 [4] Paige, D.A. et. al. (2010) *AGU Fall Meeting 2010,* Abstract #P31E-04.