

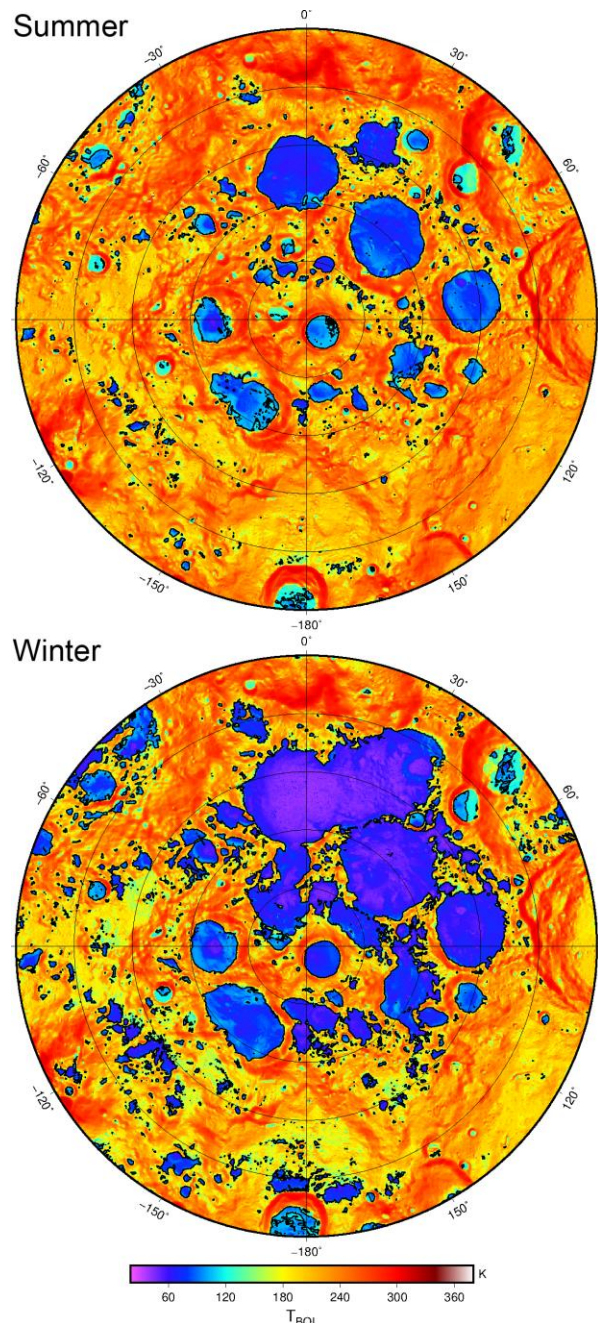
**SEASONAL TEMPERATURE VARIATIONS IN THE POLAR REGIONS OF THE MOON.** J.-P. Williams<sup>1</sup>, B. T. Greenhagen<sup>2</sup>, and D. A. Paige<sup>1</sup>, <sup>1</sup>Earth, Planetary, and Space Sciences, University of California, Los Angeles, CA, <sup>2</sup>Johns Hopkins University Applied Physics Laboratory, Laurel, MD.

**Introduction:** The Diviner Lunar Radiometer Experiment onboard the Lunar Reconnaissance Orbiter (LRO) has been systematically mapping the moon since July of 2009 [1]. The solar reflectance and mid-infrared radiance measurements acquired by Diviner provide information on how regoliths on airless bodies store and exchange thermal energy with the space environment [2][3][4]. The density of coverage in the polar regions is reaching a level where seasonal variations can begin to be characterized.

The maximum angle of the spin pole of the Moon and the normal to the ecliptic plane is  $1.54^\circ$ . Though modest enough to have minimal influence on surface temperatures at mid-to-low latitudes, in the polar regions where solar illumination is perpetually at grazing angles, seasonality can have a large influence. The polar regions are of significant interest for *in situ* exploration for the possibility of permanently shadowed regions (PSRs) cold-trapping water [5][6]. Mission planning for landing and operating in these regions will require understanding the extreme thermal environment and illumination conditions.

**Mapping:** We have begun generating seasonal maps of the poles. The initial mapping effort has focused on a  $5^\circ$  cap centered on the south pole. All data from the start of the mission thru to the end of 2017 has been split into summer and winter (defined by the subsolar latitude) and gridded at 240 m/pix in polar stereo projection and constant local time at 0.25 hour resolution. Our preliminary maps demonstrate the variation in seasonal temperatures across the south polar region which is strongly influenced by topography. Figure 1 shows maximum bolometric temperatures for summer and winter seasons. The extent of shadowed areas varies considerably between seasons. The maximum temperatures below 110 K in the summer map, denoted by the black contour, corresponds to the PSRs with an area of  $7,453 \text{ km}^2$  (~10% of the mapped area). In the winter, the shadowed areas extend to an area of  $18,653 \text{ km}^2$  (~26% of the mapped area).

**References:** [1] Paige D. A. et al. (2010) *Space Sci. Rev.*, 150, 125–160. [2] Paige D. A. et al. (2010) *Science*, 330, 479–484. [3] Vasavada A. R. et al. (2012) *JGR*, 117, E00H18. [4] Williams J.-P. et al. (2017) *Icarus*, 283, 300–325. [5] Watson K. et al. (1961) *JGR*, 66, 3033–3045. [6] Arnold J. R. (1979) *JGR*, 84, 5659–5668.



**Fig. 1:** Diviner maximum bolometric temperatures of the south pole  $85^\circ$ - $90^\circ$  S split into summer (top) and winter (bottom) seasons. The contours marks 110 K which approximates the boundary of regions shadowed throughout the season.