EPSC Abstracts
Vol. 10, EPSC2015-380, 2015
European Planetary Science Congress 2015

LRO Diviner: Viewing the Moon in a Different Light

B.T. Greenhagen (1), D.A. Paige (2) and the Diviner Lunar Radiometer Science Team
(1) Johns Hopkins University Applied Physics Laboratory, Laurel, MD USA, (2) University of California, Los Angeles, CA USA (benjamin.greenhagen@jhuapl.edu)

Abstract

After six years in operation, and well into its second extended science mission, the Diviner Lunar Radiometer continues to reveal the extreme nature of the Moon's thermal environments, thermophysical properties, and surface composition. This presentation will focus on new observations and recent results and will highlight contributions from members of the Diviner Science Team addressing a diverse range of scientific questions.

1. Diviner Lunar Radiometer

Diviner is the first multispectral thermal infrared instrument to globally map the surface of the Moon. To date, Diviner has acquired observations over twelve complete diurnal cycles and six partial seasonal cycles. Diviner daytime and nighttime observations (12 hour time bins) have essentially global coverage, and more than 80% of the surface has been measured with at least 7 different local times. The spatial resolution during the mapping orbit was ~200 m and now ranges from 150 m to 1300 m in the current elliptical "frozen" orbit. Calibrated Diviner data and global maps of visible brightness temperature, bolometric temperature, rock abundance, nighttime soil temperature, and silicate mineralogy are available through the Planetary Data System (PDS) Geosciences Node.

2. Results

Diviner was designed to accurately measure temperatures across a broad range from midday equatorial regions such as the Apollo landing sites (around 400K), typical nighttime temperatures of less than 100K, and extreme permanent shadowed regions colder than 50K. The coldest multiply-shadowed polar craters may have temperatures low enough to put constraints on lunar heat flow. Diviner data have

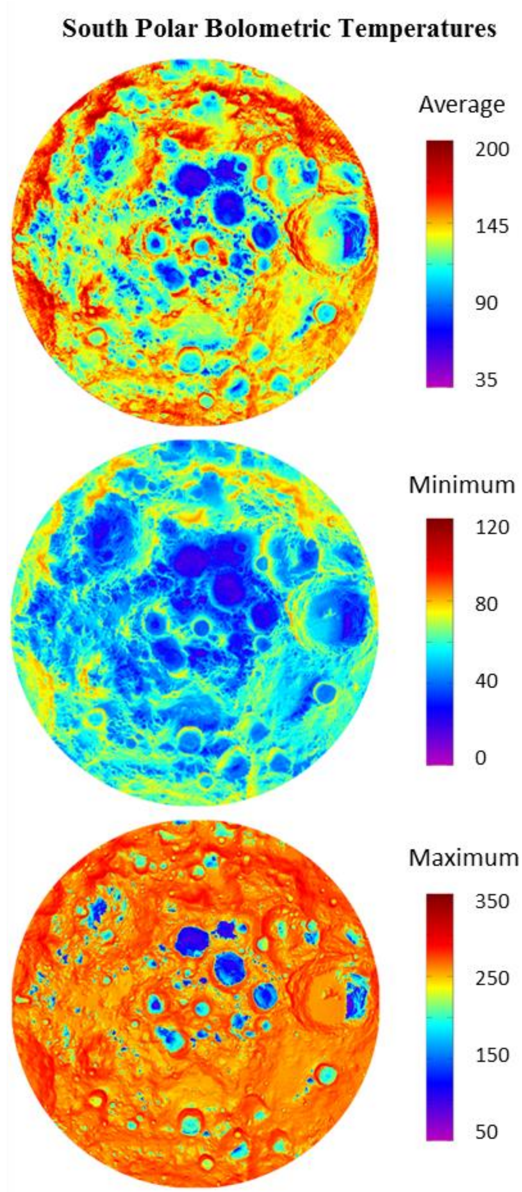

Figure 1: The temperature maps above (pole to 82°) demonstrate the extreme thermal environment of the Moon observed by the Diviner Lunar Radiometer.

also been used to estimate the thermal properties of non-polar permanently shadowed regions.

Diviner is directly sensitive to the thermophysical properties of the lunar surface including nighttime soil temperature, rock abundance, and surface roughness. During the extended science mission we have produced higher fidelity maps of these properties and used them to investigate anomalous rock abundances, "cold spots" with fluffier surface layers, regolith formation and evolution, and surface roughness.

Diviner was designed to characterize the Christiansen Feature (CF) and constrain lunar silicate mineralogy. Recent efforts in this area have focused on improving the quality of Diviner's mid-infrared "photometric" correction, groundtruthing Diviner observations to Apollo soils, using Diviner's longer wavelength channels to improve constraints on olivine abundances, and combining Diviner with visible and near-infared datasets to enhance interpretations of pyroclastic deposits, plagioclase-rich regions, high silica regions, and space weathering.

During its second extended science mission, Diviner has acquired new data to compliment the existing dataset. Diviner has observed three total lunar eclipses with geometry that enables new investigations into the top 2 cm of the regolith. Diviner has begun a systematic campaign to globally maps the Moon viewed at high emission angles, which will provide leverage on surface roughness. And Diviner has performed large quantities of targeted observations to enhance temporal coverage at critical local times for specific investigations.

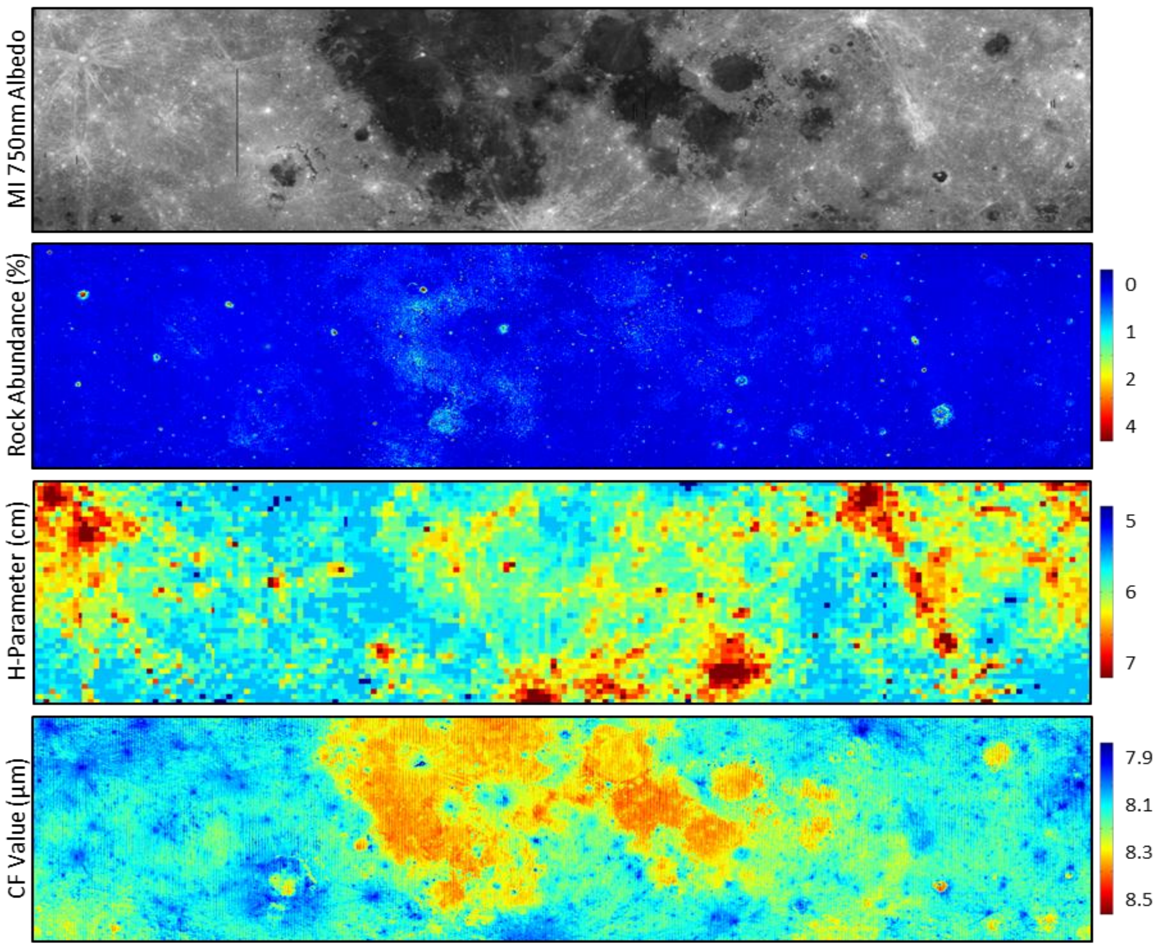

Figure 2: Diviner maps of rock abundance (RA), H-parameter (regolith insulating layer), and Christiansen Feature (CF). RA and CF maps from PDS. SELENE Multiband Imager 750 nm albedo map for context.