LRO Diviner Lunar Radiometer Experiment: First Year of Mapping

David Paige – UCLA

NLSI Forum
7/20/10

Diviner Team

Co-Investigators: C. Allen, S. Calcutt, E. DeJong, D. McCleese, B. Murray, J. Schofield, K. Snook, L. Soderblom, F. Taylor, A. Vasavada

Participating Scientists: J. Bandfield, R. Elphic, R. Ghent, T. Glotch, P. Lucey, M. Wyatt

Science/Operations Team: K. Bennett, N. Bowles, E. Foote, M. Foote, B. Greenhagen, K. Hanna, P. Hayne, S. Meeker, M. Shopland, M. Siegler, I. Thomas, T. Tran, J.P. Williams

Development/Operations Team: C. Avis, Wayne Hartford, F. Leader, R. Morris, H. Mortensen, M. Sullivan

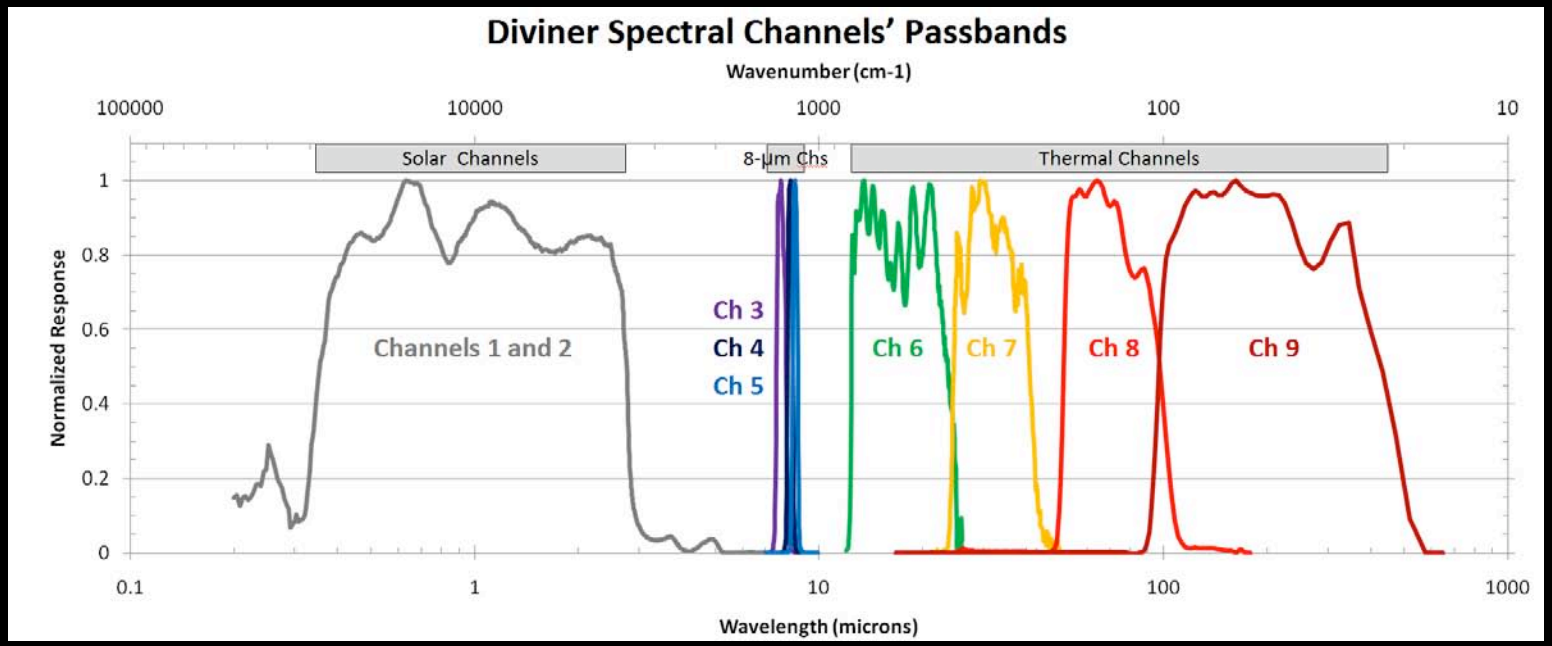
http://diviner.ucla.edu

LRO Diviner Lunar Radiometer

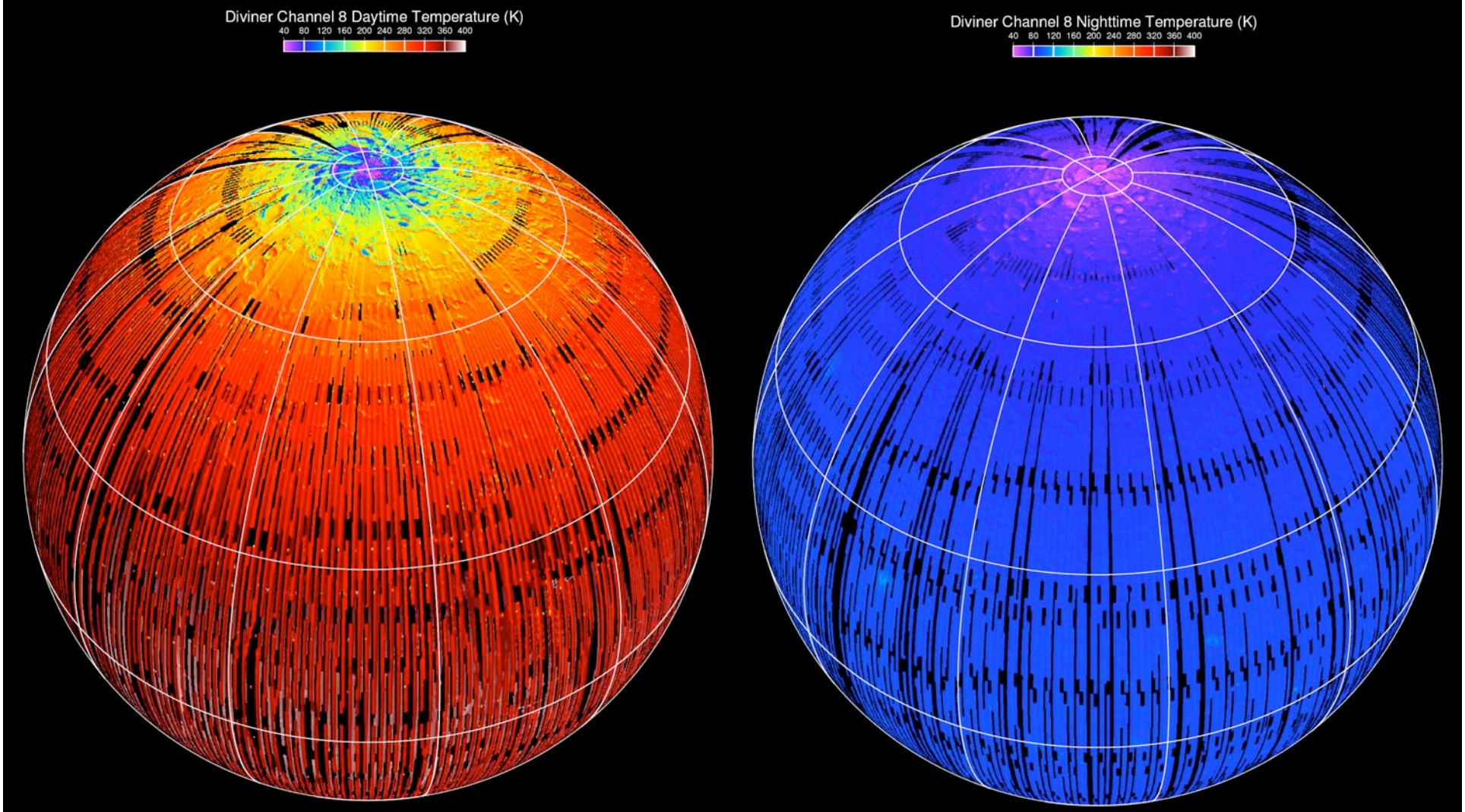
Science Goals

1. Characterize the Moon's surface thermal environments:
   - Daytime
   - Nighttime
   - Polar
2. Map properties of the lunar surface:
   - Bulk thermal properties
   - Rock abundance
   - Composition
3. Characterize polar cold traps:
   - Map cold trap locations
   - Determine their temperatures and thermophysical properties
   - Assess potential lunar volatile resources

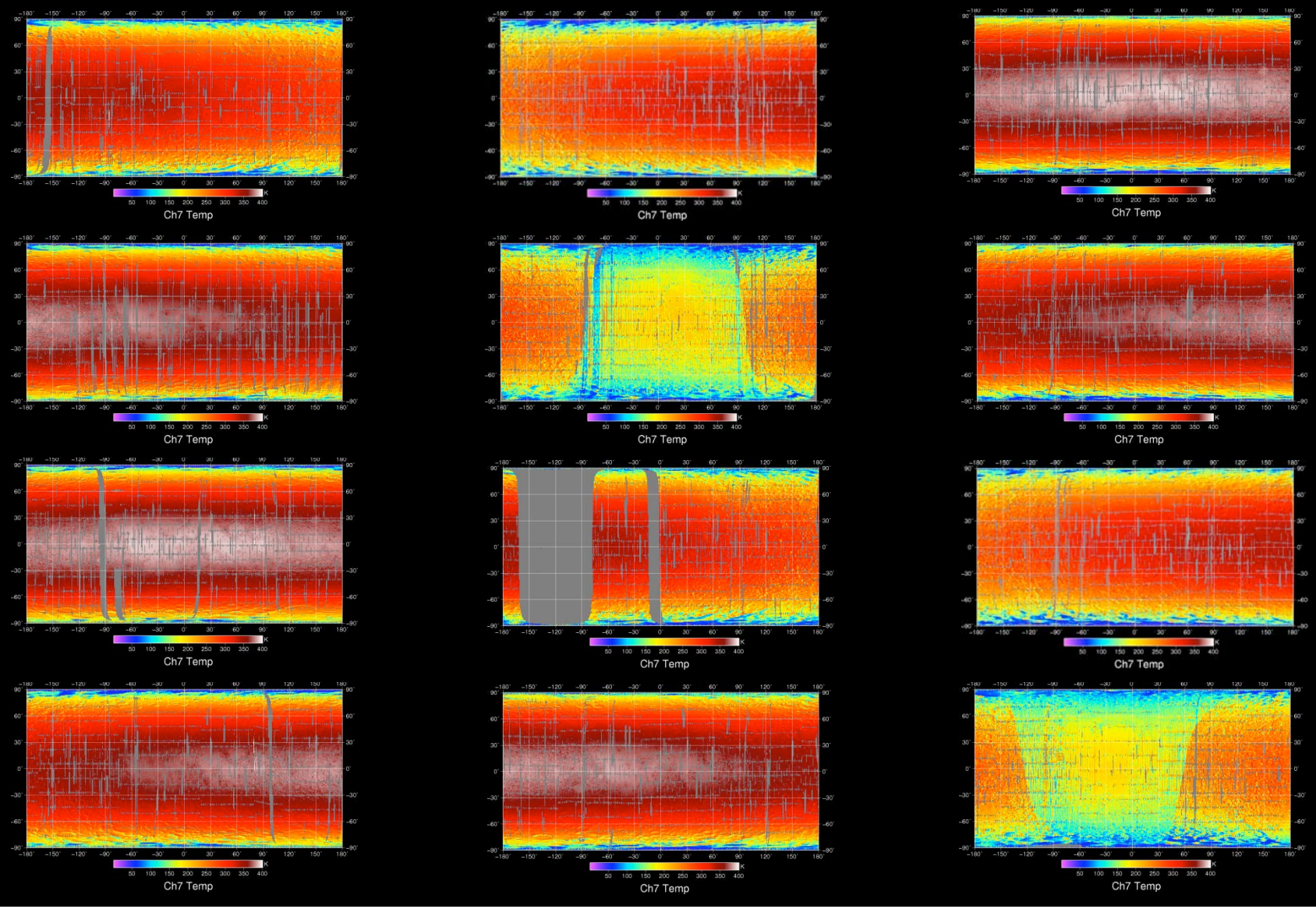
IFOV: 160 x 320m
Swath Width: 3.4 km



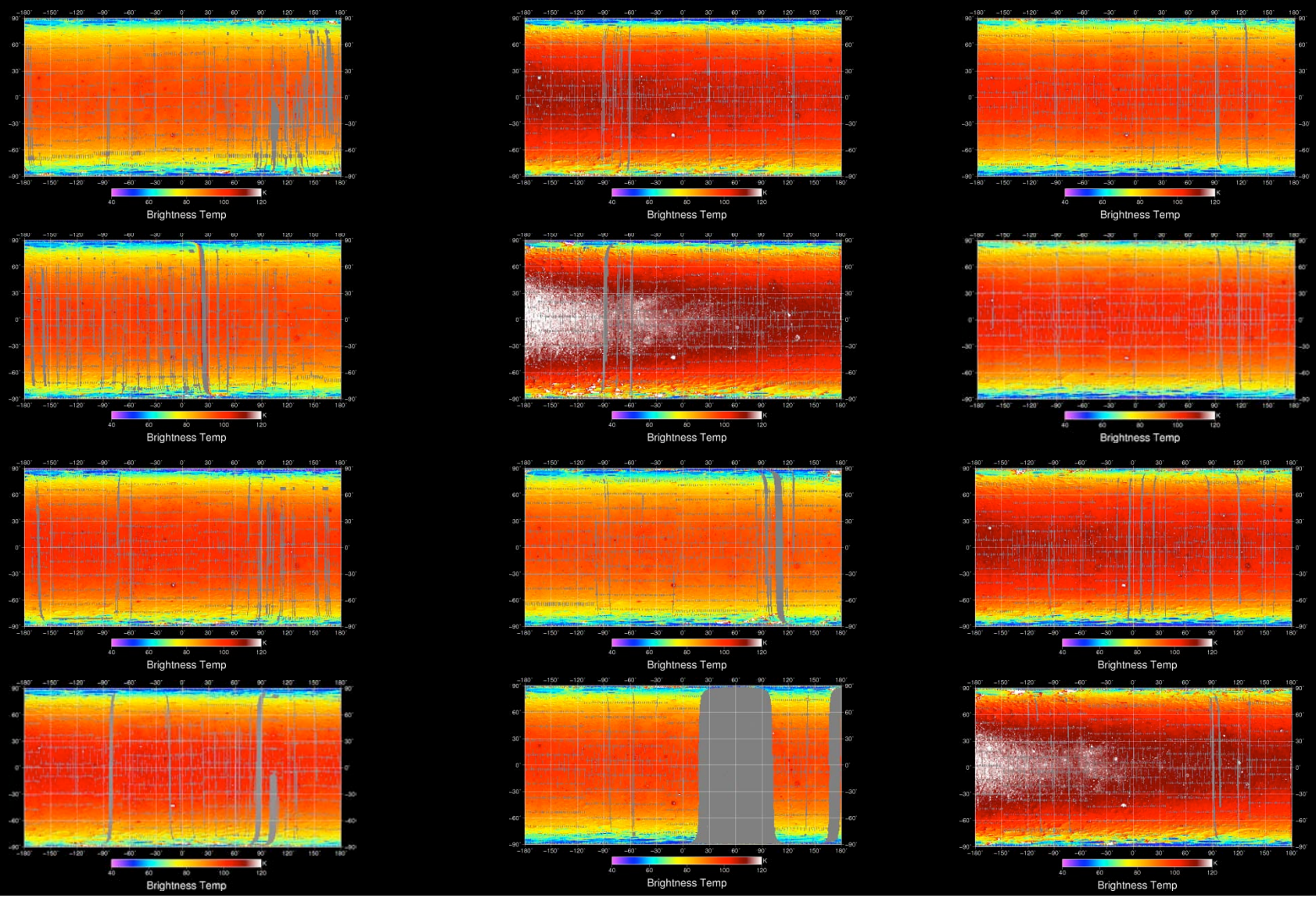
First Diviner Day and Night Global Thermal Maps



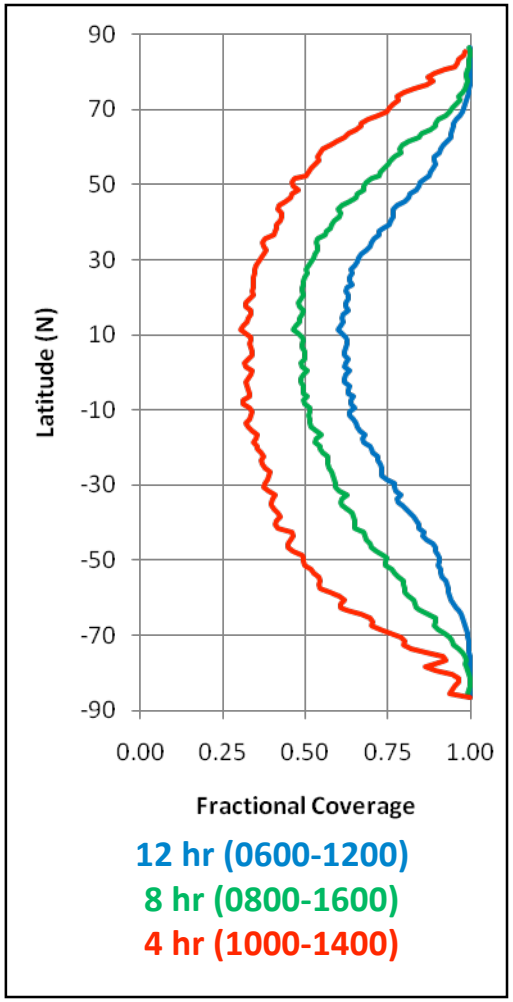
Diviner Channel 7 Global Daytime Brightness Temperature Maps

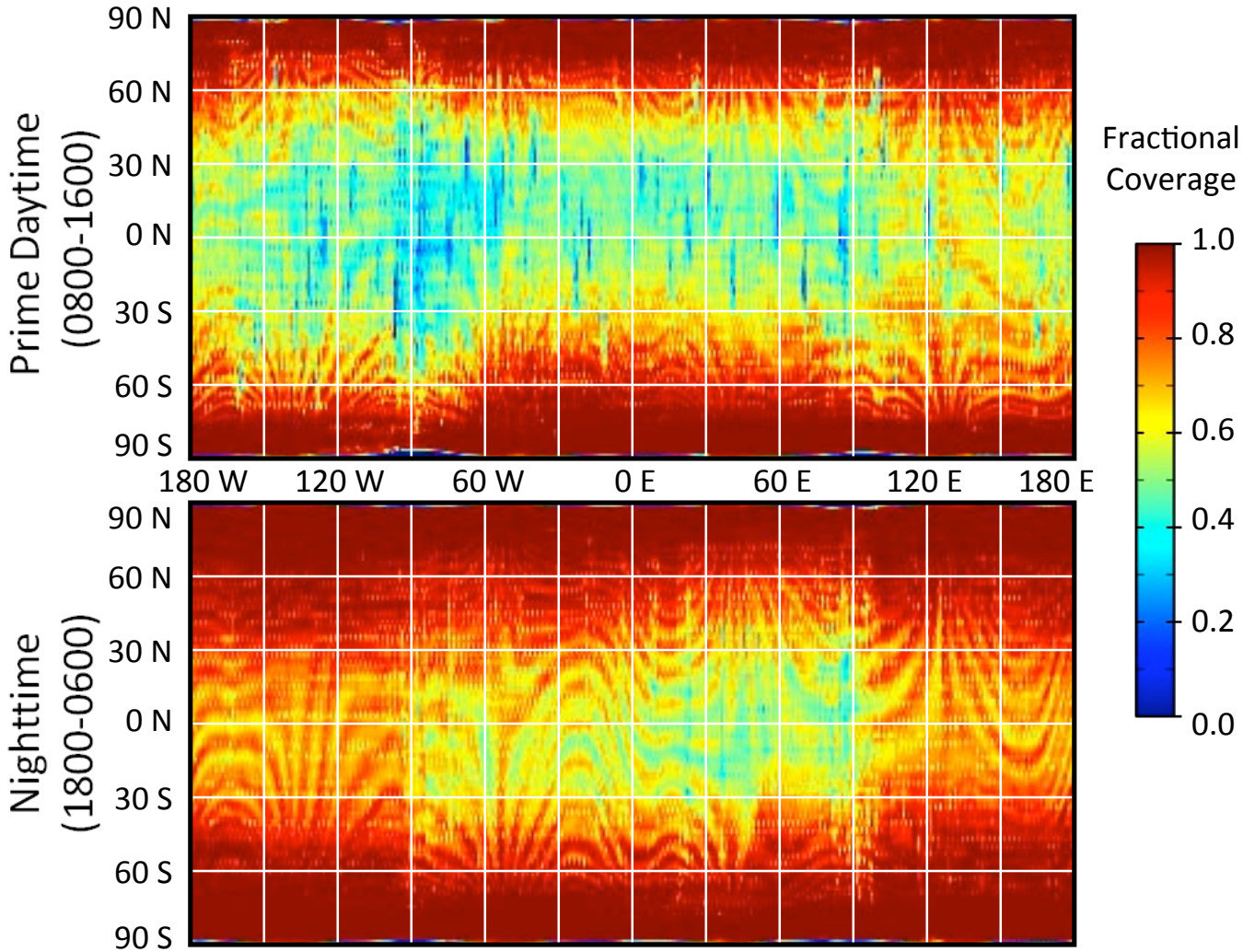


Diviner Channel 7 Global Nighttime Brightness Temperature Maps



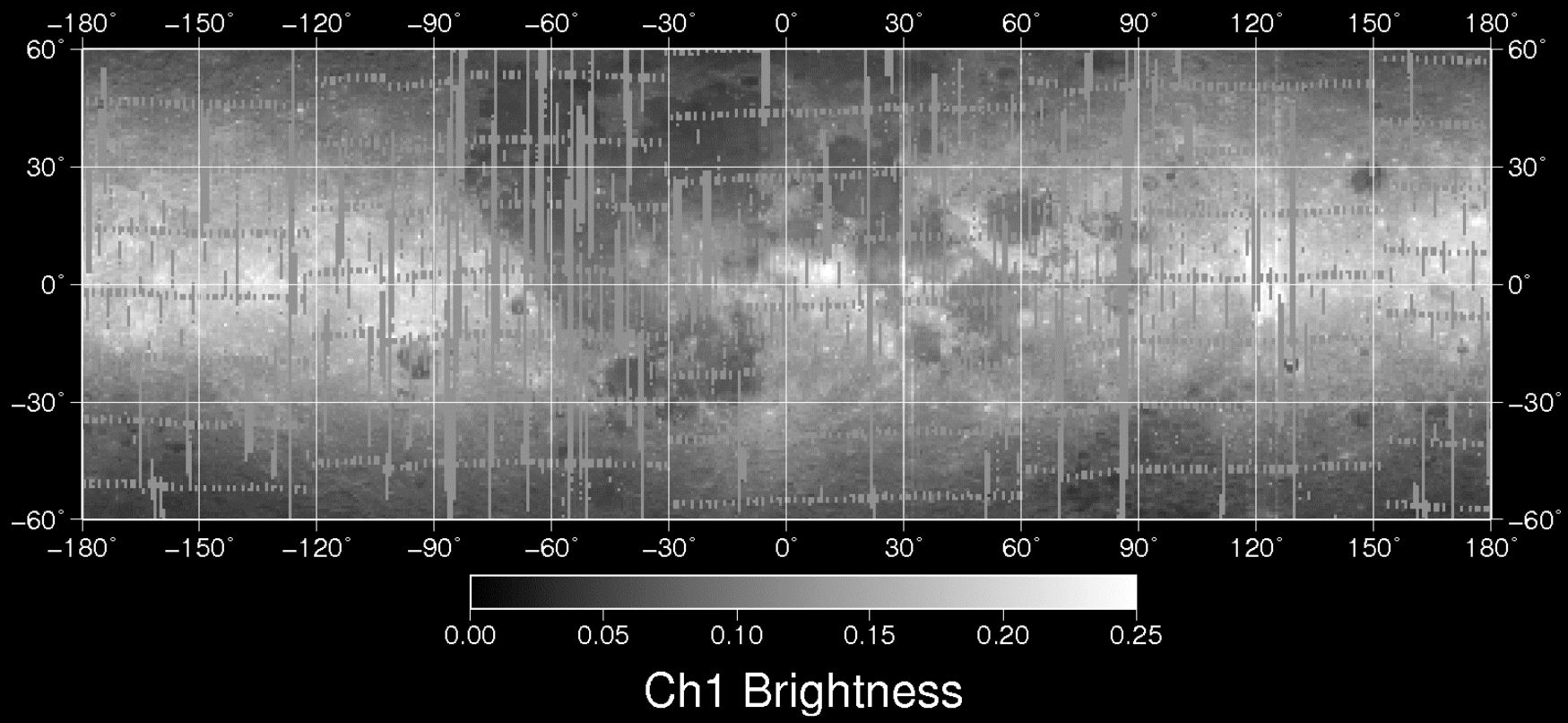
Diviner Mapping Coverage Overview



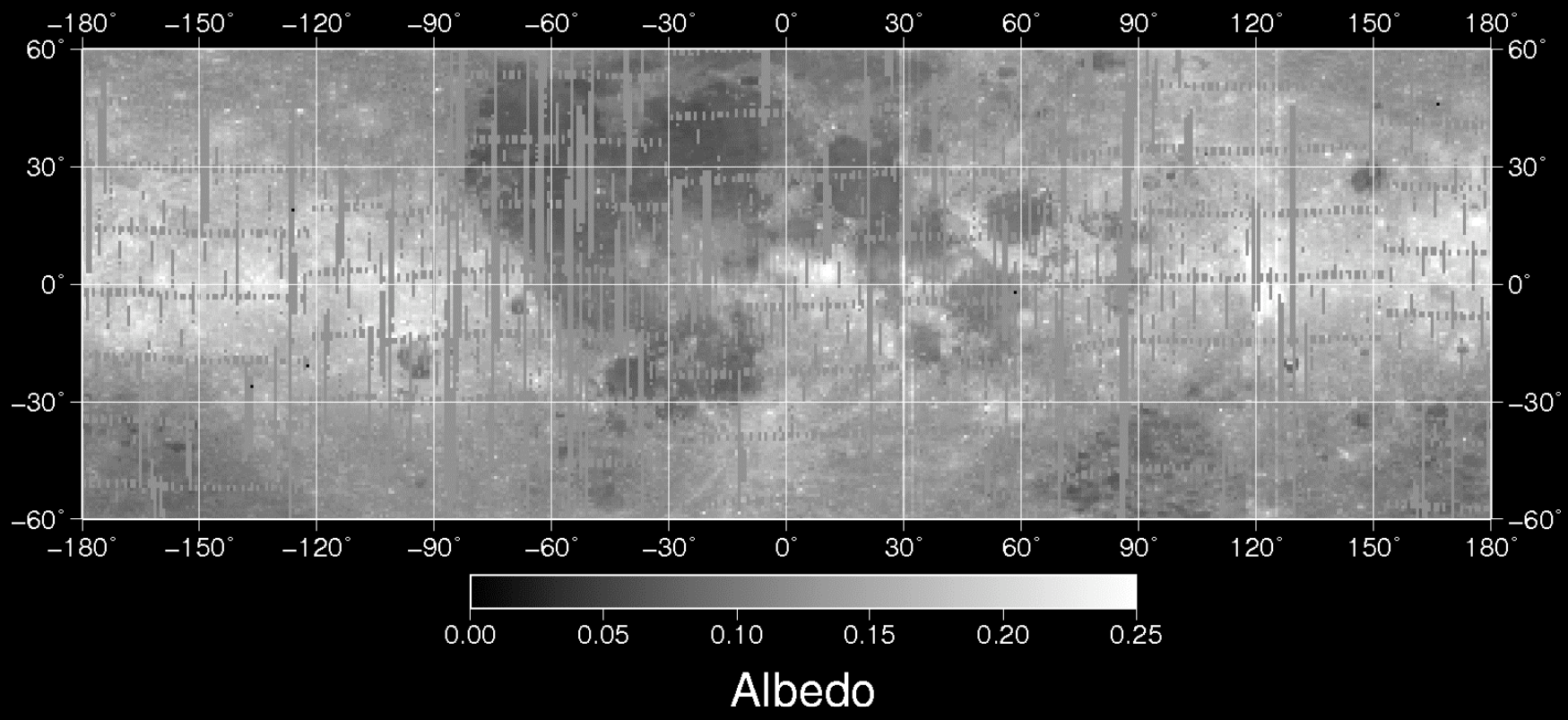


- One year of near-continuous pushbroom mapping (including commissioning data)
- 42 Billion calibrated radiometric observations
- 11 Earth observations, 2 lunar eclipses and the LCROSS impact

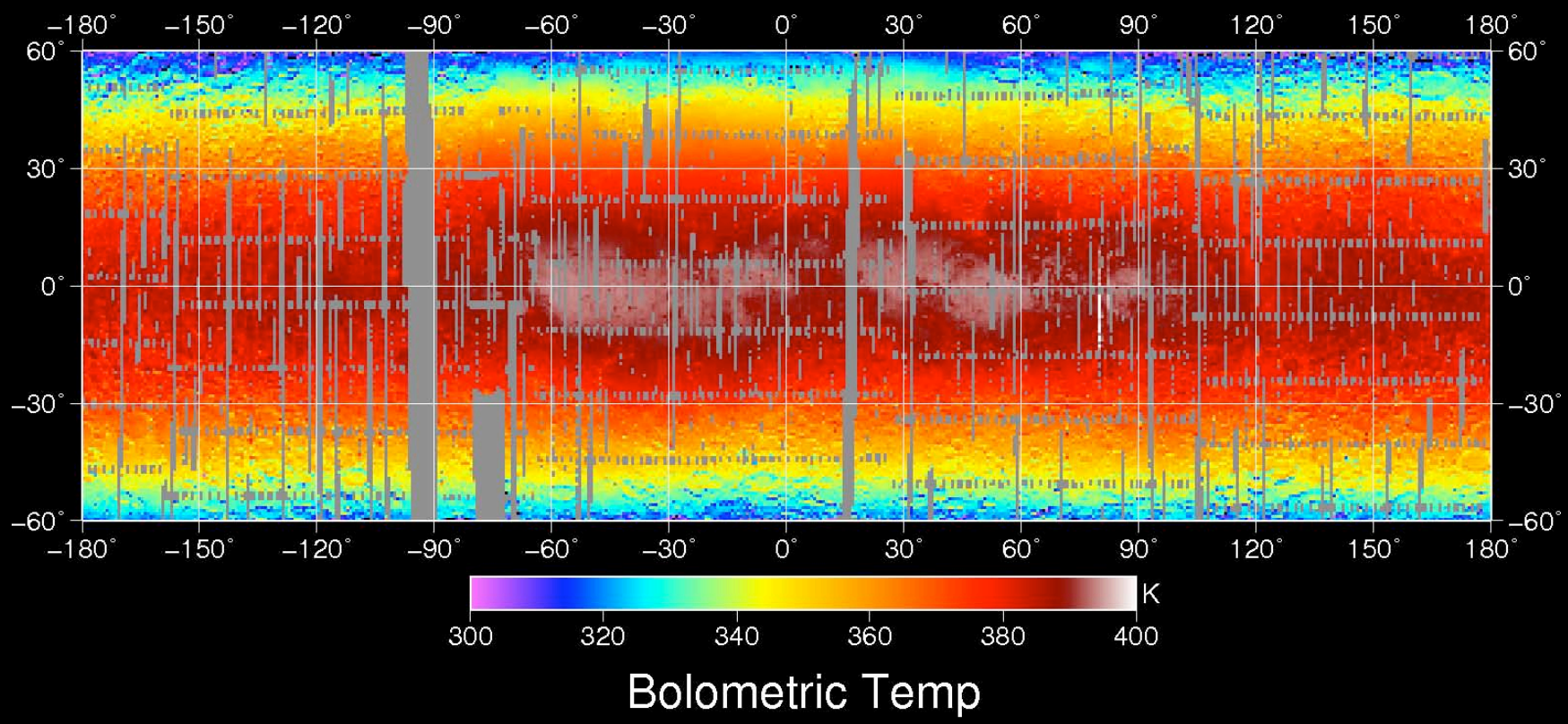
Diviner Solar Channel Brightness (3/16/10-4/12/10)



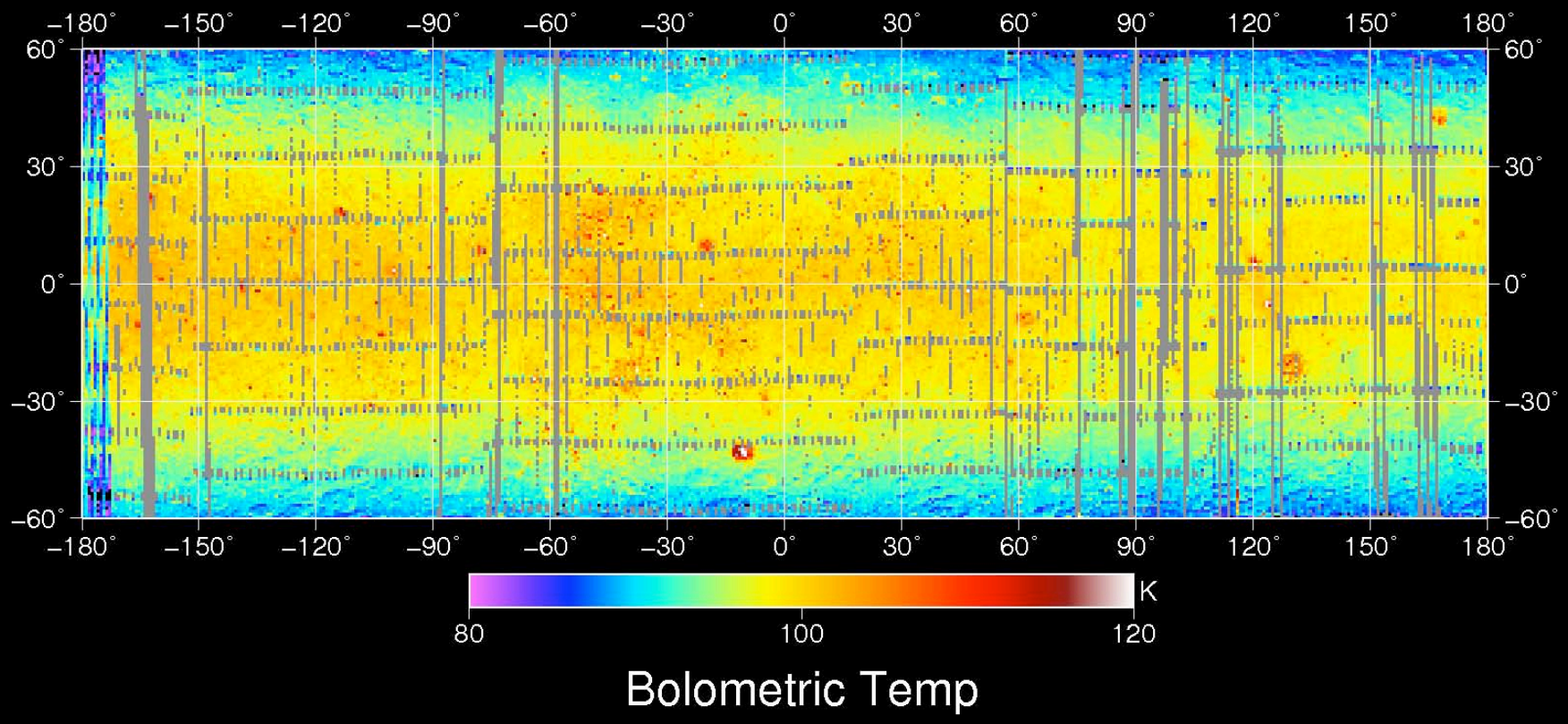
Diviner Lambert Albedo (3/16/10-4/12/10)



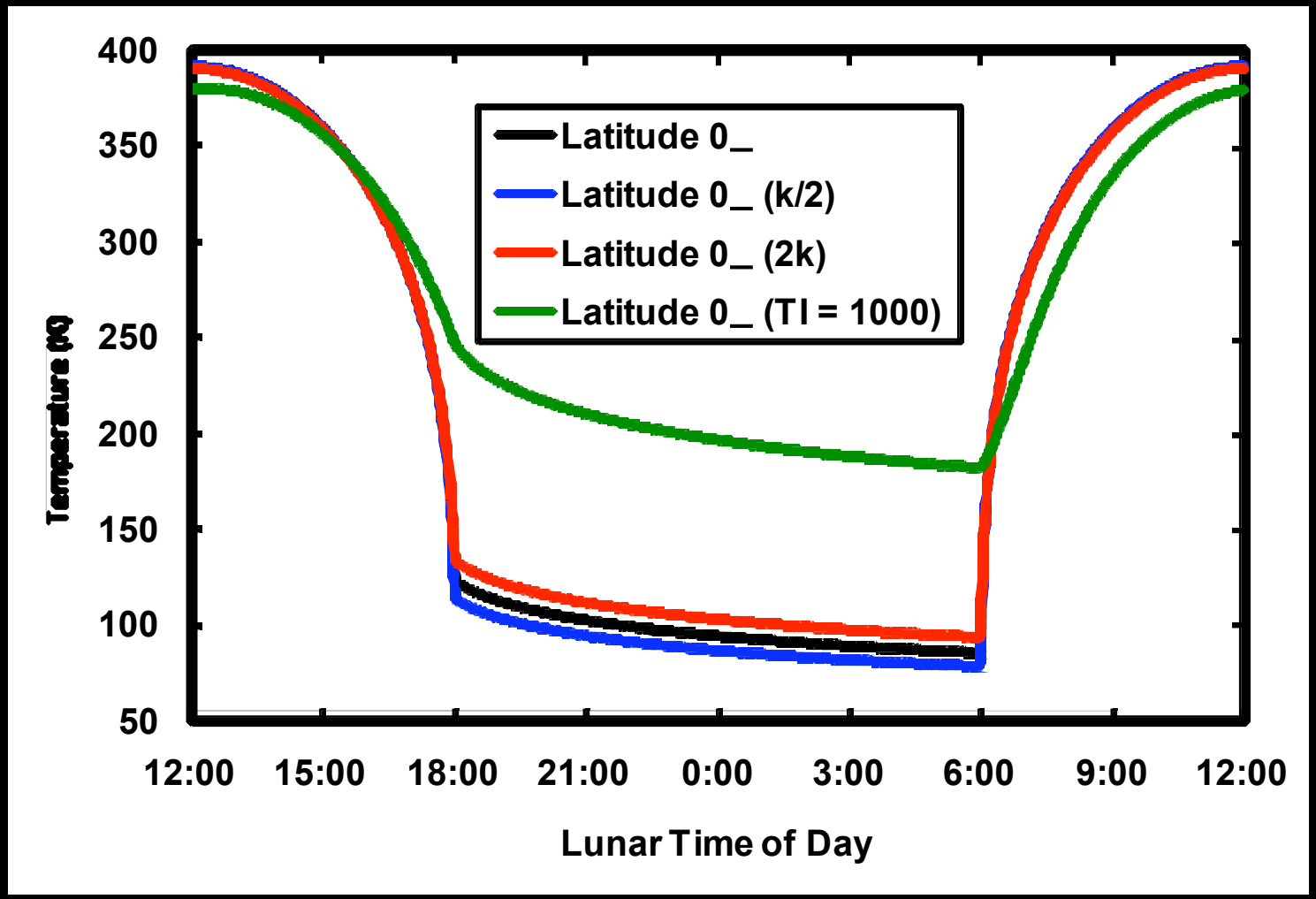
Diviner Daytime Bolometric Brightness Temperature (K) (9/20/09-10/17/09)



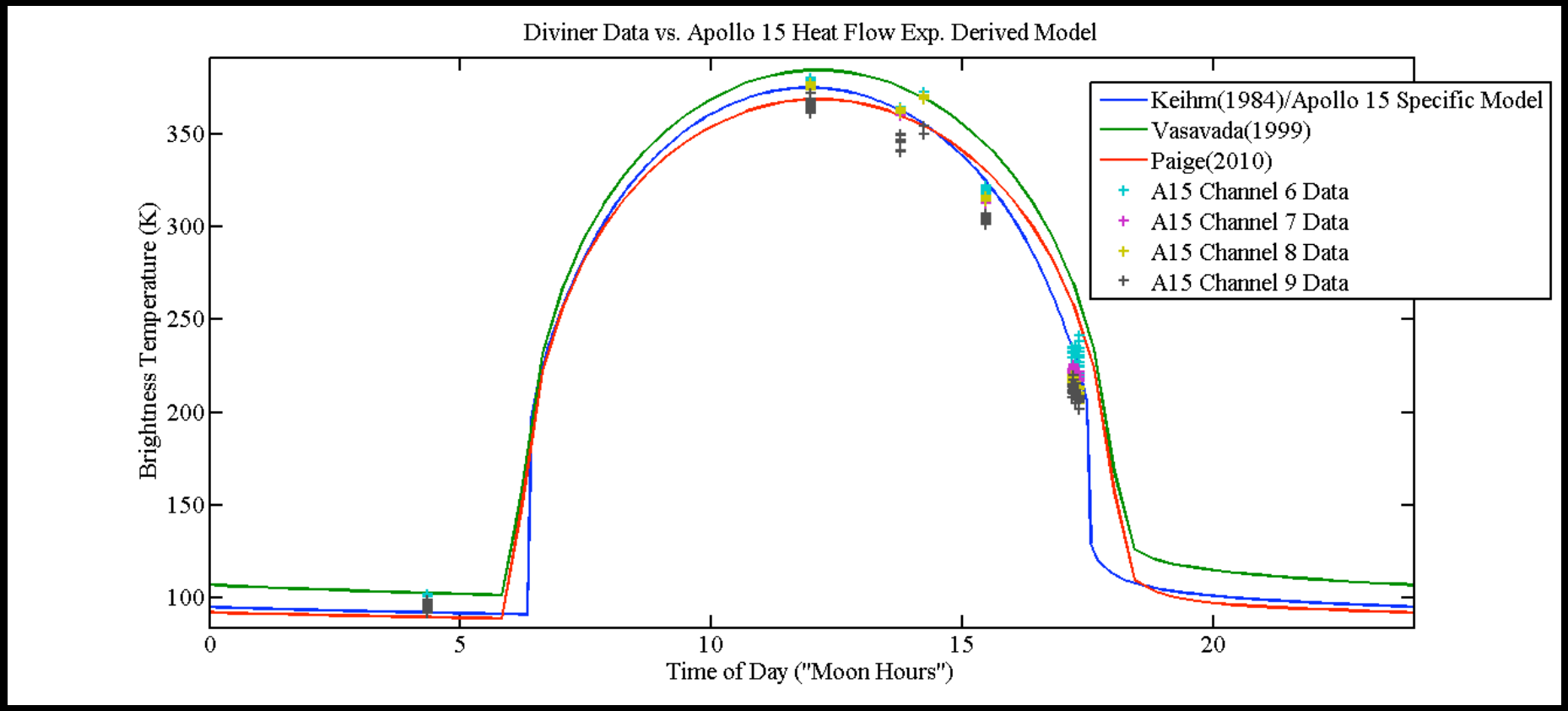
Diviner Nighttime Bolometric Brightness Temperature (K) (9/20/09-10/17/09)



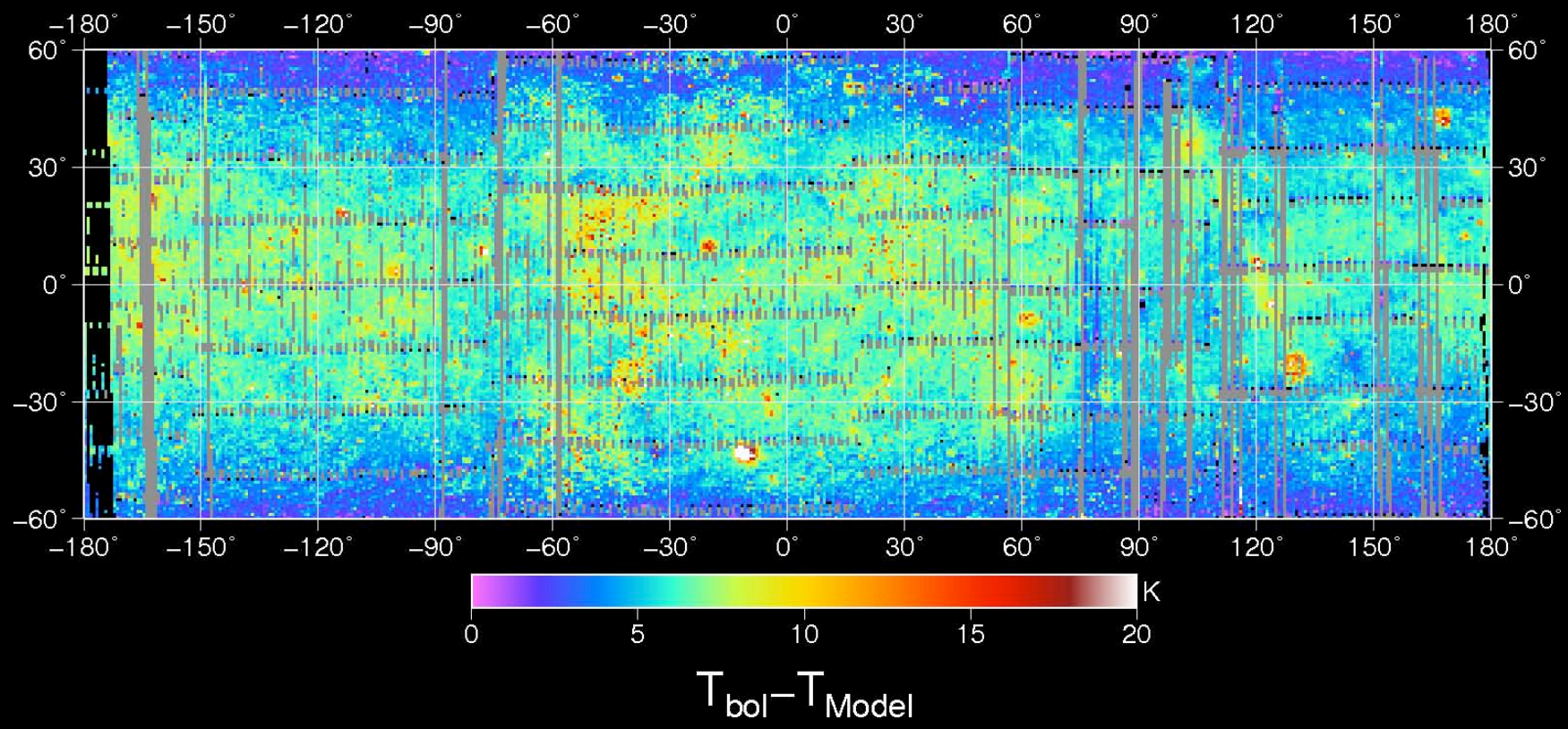
Diurnal Surface Temperature Variations



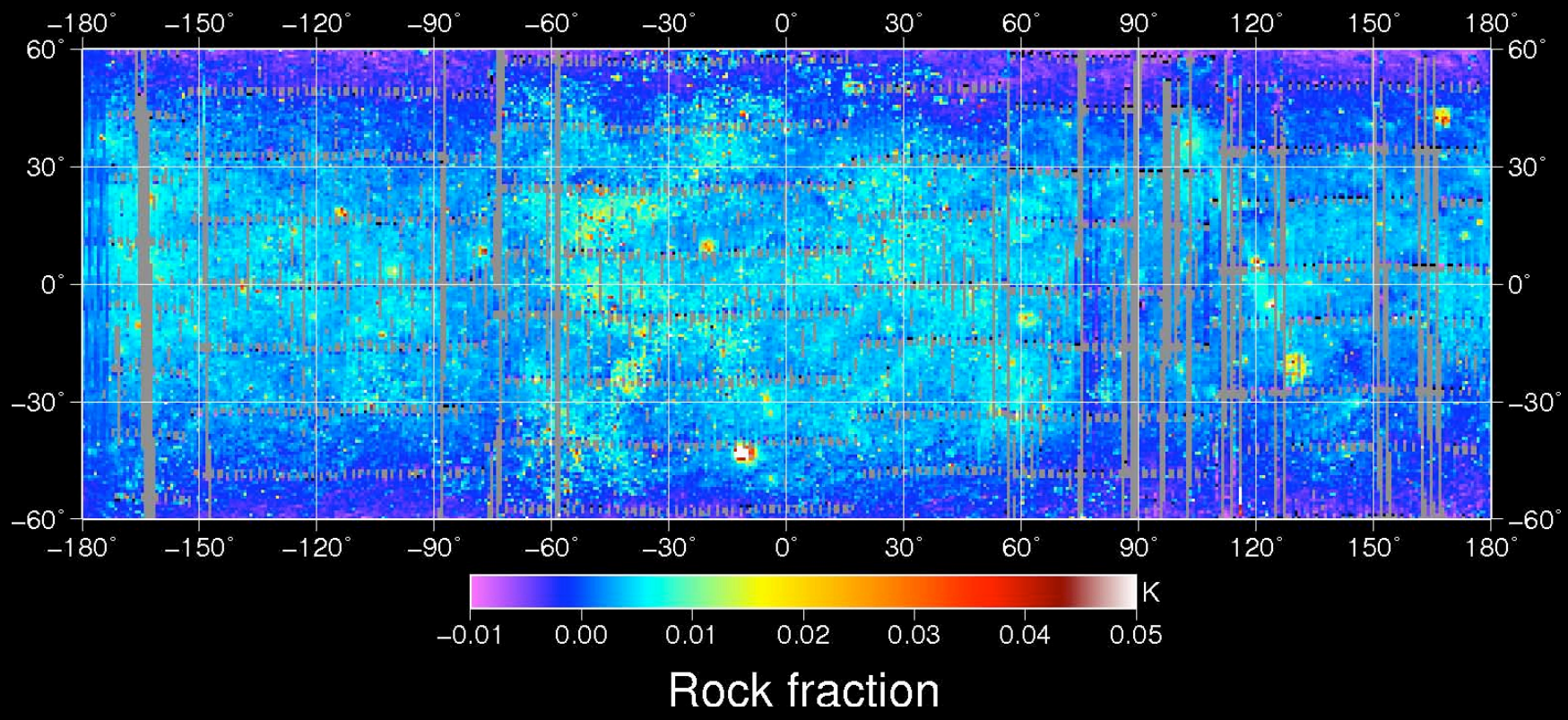
Data vs Models Comparison at Apollo 15 Landing Site



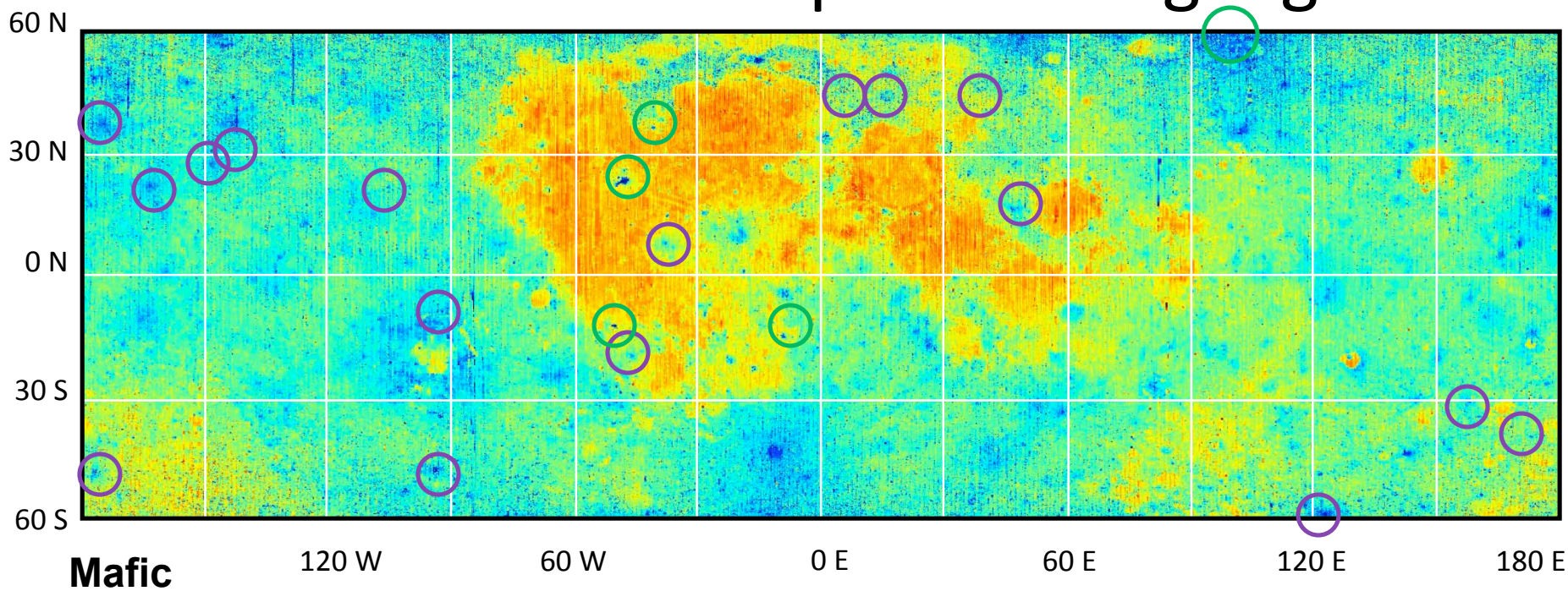
Diviner Daytime Bolometric Brightness Temperature minus Soil Thermal Model (K) (9/20/09-10/17/09)

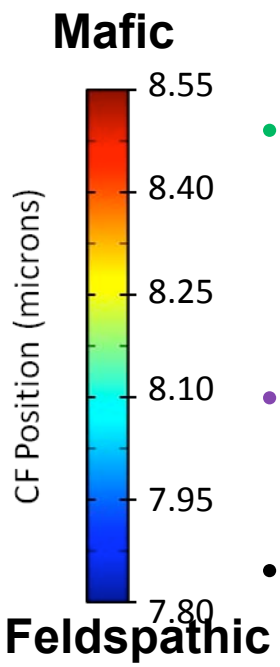


Diviner Rock Abundance Fraction (9/20/09-10/17/09)



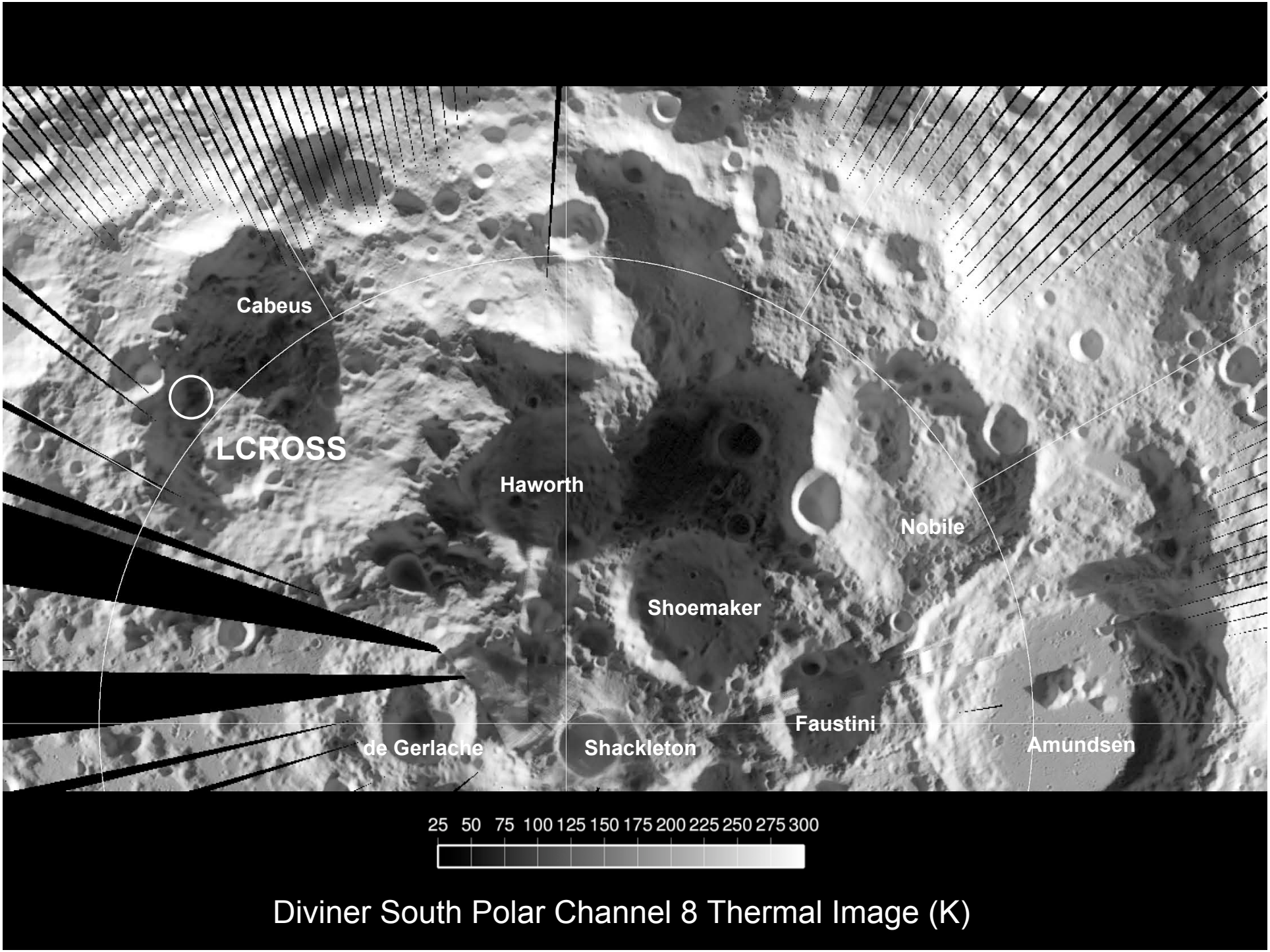
Diviner Global Composition Highlights

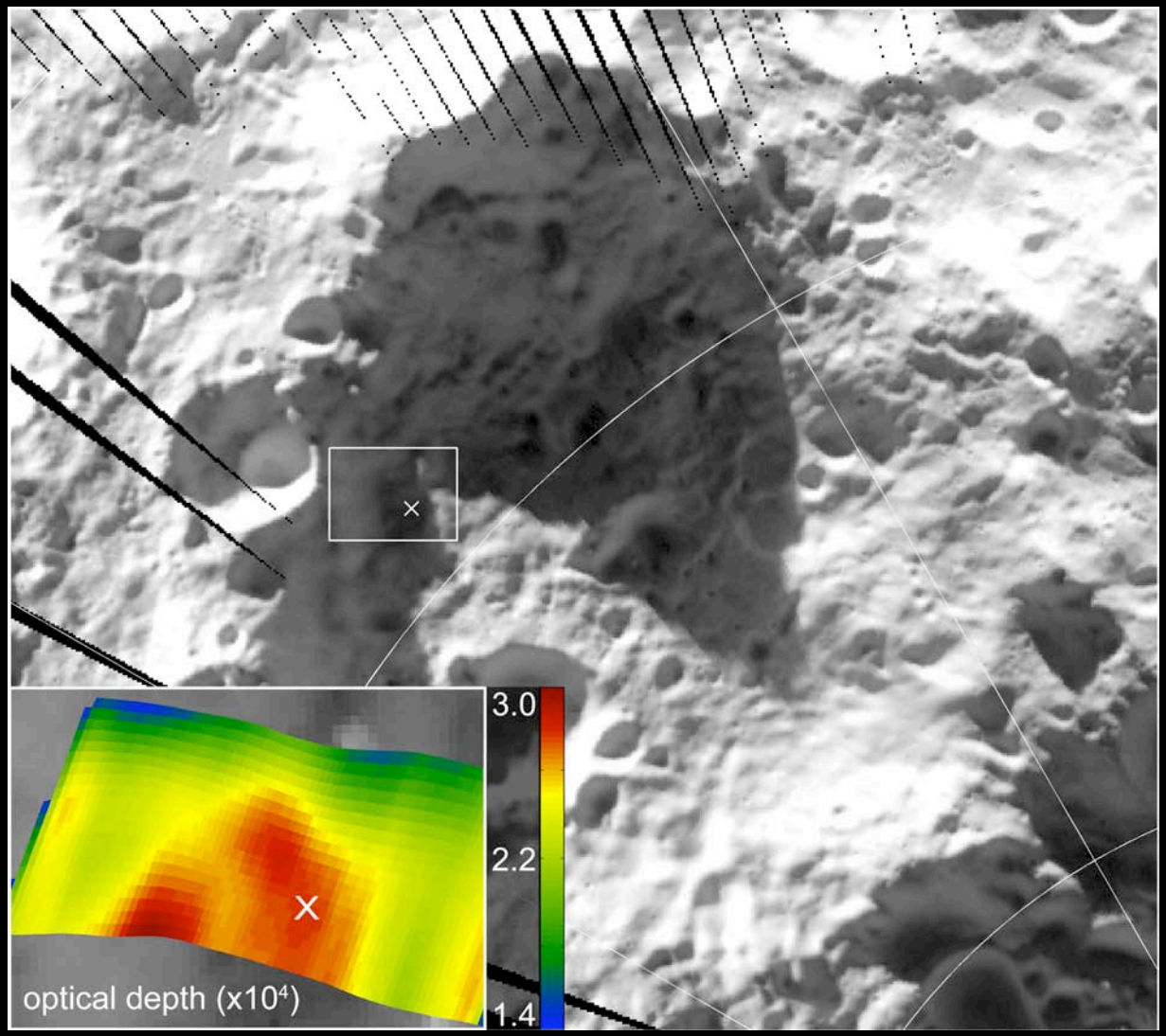


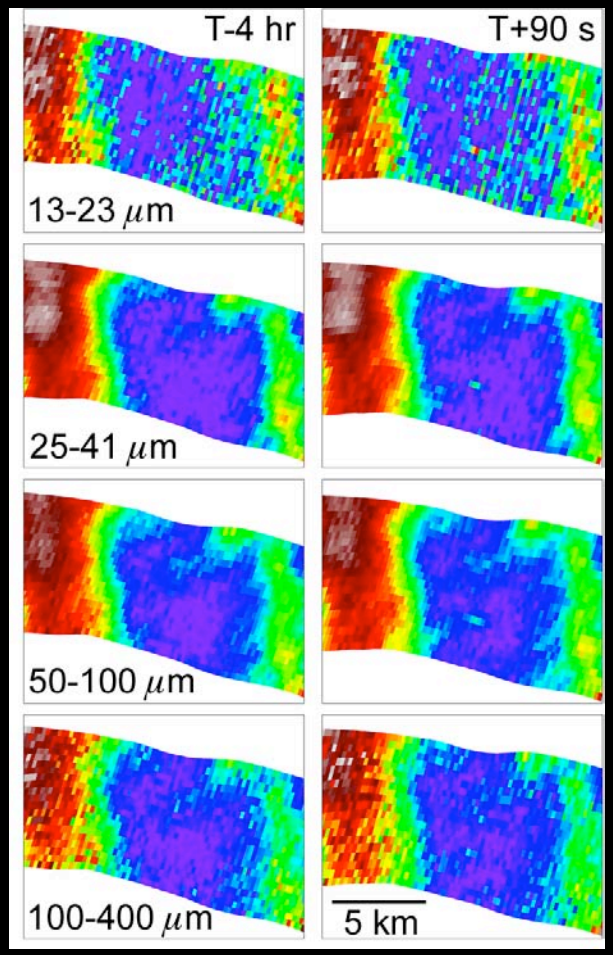


- Areas with highest silica content (CF <<7.8 microns) are associated with thorium anomalies
  - Aristarchus Crater, Gruithuisen Domes, Hansteen Alpha, Lassell, and Compton-Belkovich thorium anomaly
- Some plagioclase-rich regions are not pure anorthite (CF=7.9)
  - Including 15 of 69 Ohtake et al. 2009 plagioclase-rich sites
- No multi-kilometer exposures of extremely olivine-rich and feldspar-poor soils (CF >> 8.55)

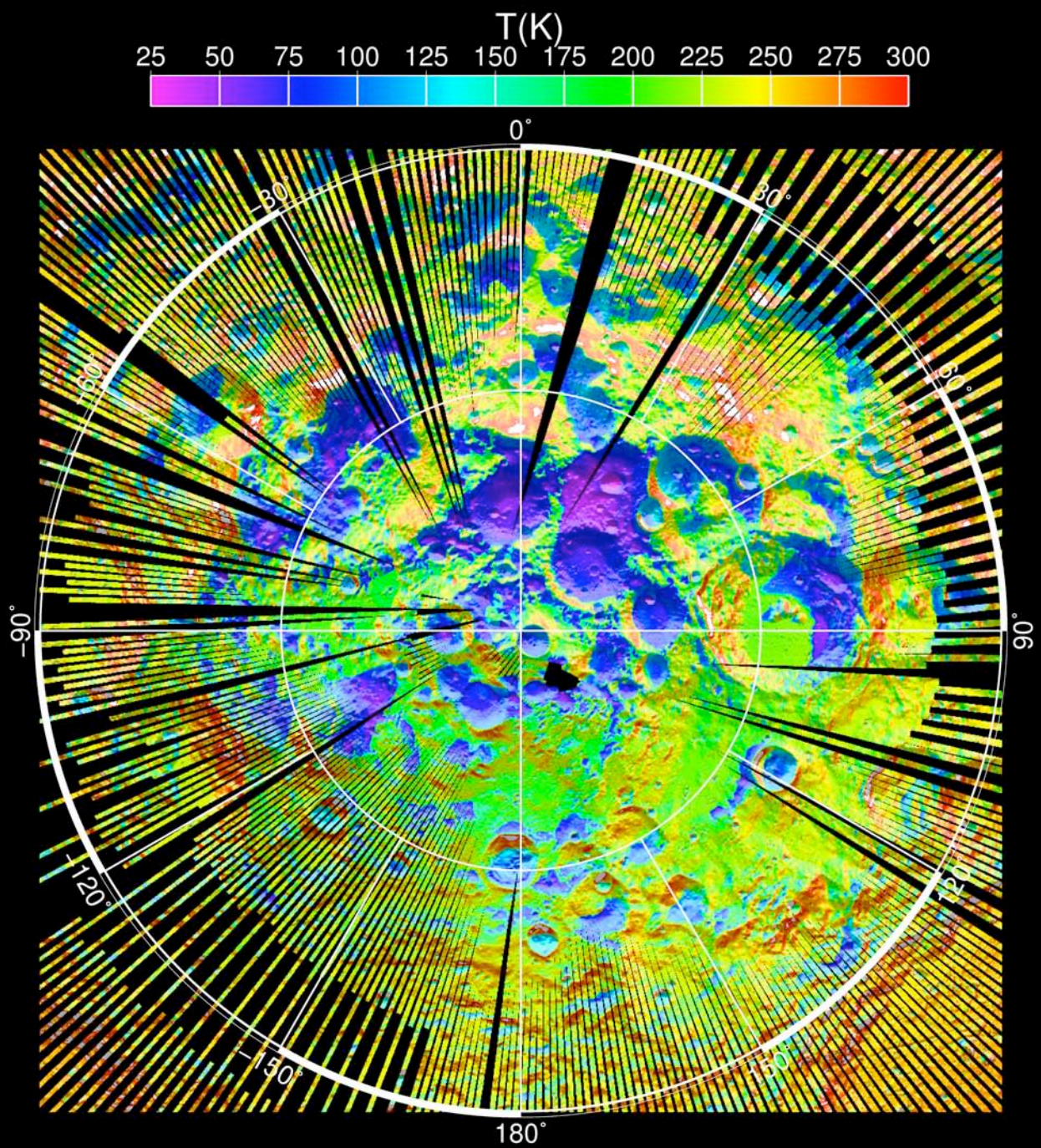
Diviner South Polar Channel 8 Thermal Image (K)


Cabeus
LCROSS
Haworth
Nobile
Shoemaker
Faustini
de Gerlache
Shackleton
Amundsen
25 50 75 100 125 150 175 200 225 250 275 300
Diviner South Polar Channel 8 Thermal Image (K)



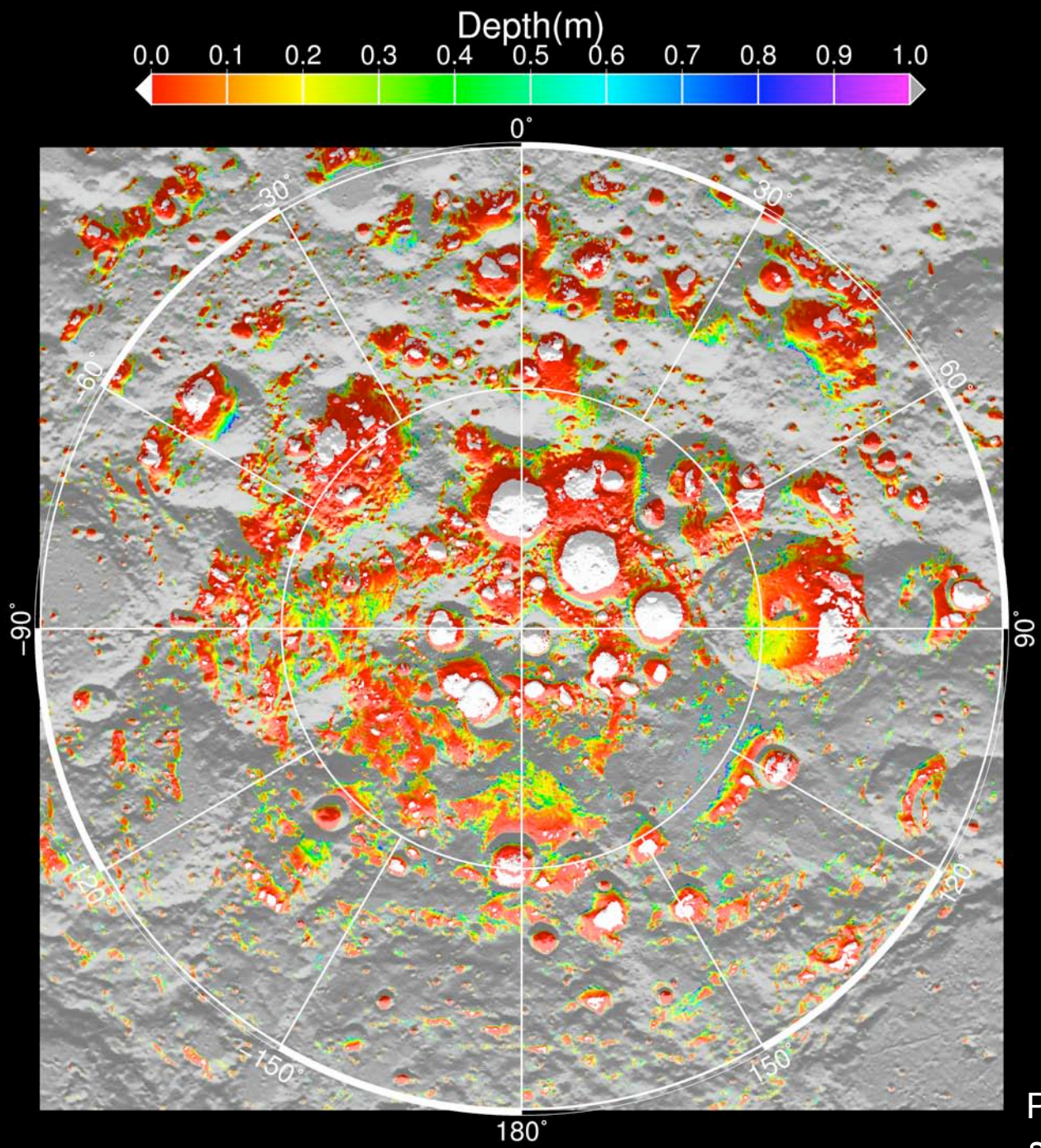


Hayne et al. *submitted to Science* (2010)



Diviner
Bolometric Daytime
Brightness
Temperature Map

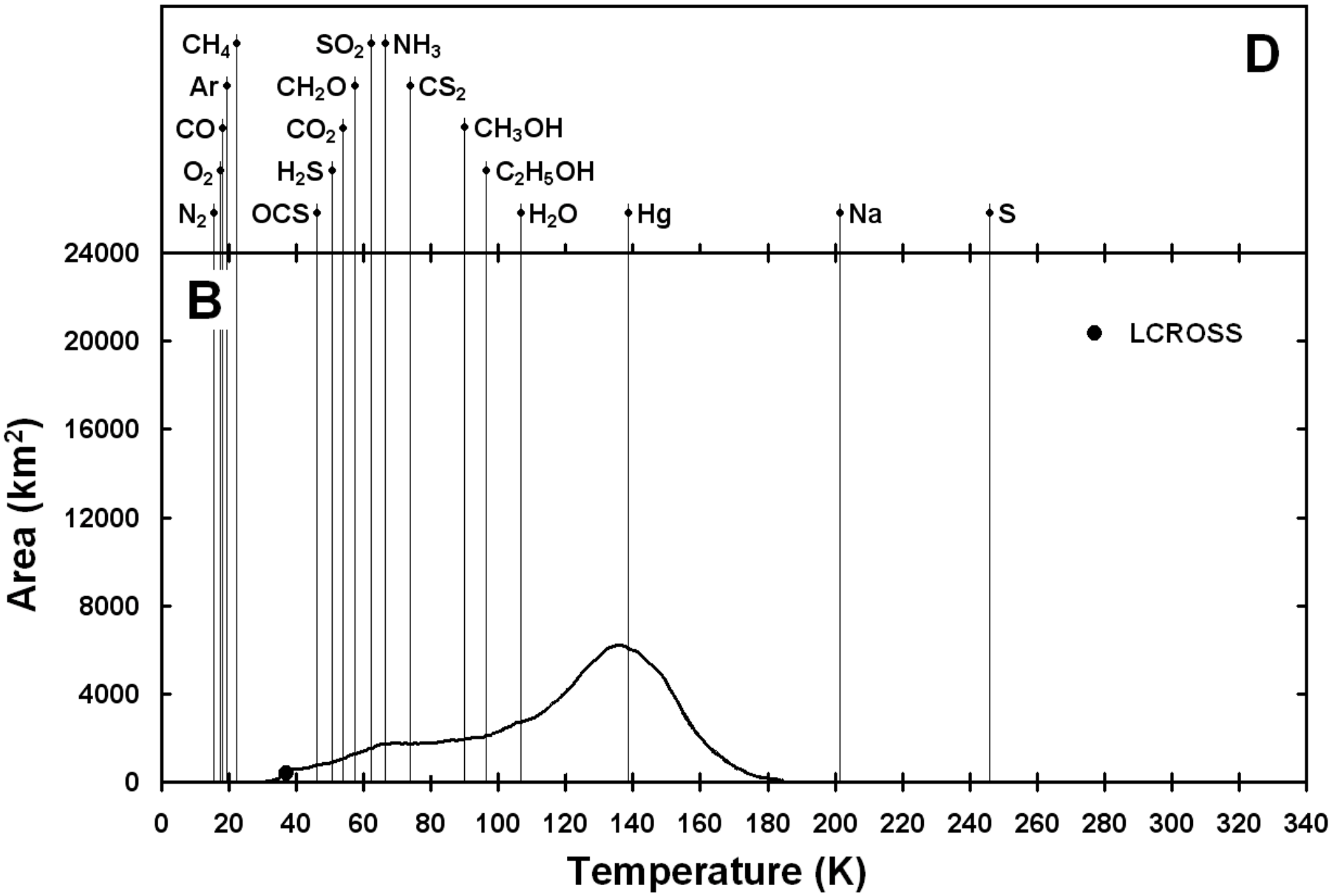
Paige et al.
submitted to Science (2010)



Depth to 1 mm water ice sublimation in 1 BY

Paige et al.
submitted to Science (2010)

South Polar Annual Averaged Temperature Histogram



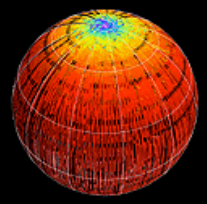
Diviner NLSI Forum 2010 Presentations

Authors	Day	Session	Time	Topic
Siegler et al.	2	4	10:15	Polar ice deposition history
Elphic et al.	2	4	10:30	Polar ice evolution and
Allen et al.	3	8	9:30	Soil composition ground truth
Bandfield et al.	3	7	10:00	Rock abundance
Greenhagen et al.	3	8	10:15	Compositional diversity
Wyatt et al.	3	8	11:00	Pure Plagioclase regions
Glotch et al.	3	7	11:15	Lunar swirls
Donaldson-Hanna et al.	3	7	11:30	Mare basalts
Greenhagen et al.	1--3	P	-	Lunar albedo
Hayne et al	1--3	P	-	LCROSS Impact
Siegler et al.	1--3	P	-	Lunar heat flow
Arnold et al.	1--3	P	-	Mafic mineralogy of impact basins

DIVINER Lunar Radiometer Experiment

One of seven instruments aboard NASA's Lunar Reconnaissance Orbiter

Principal Investigator: David Paige



- HOME
- INSTRUMENT
- SCIENCE
- NEWS
- MOVIES & IMAGES
- DATA
- PUBLICATIONS
- TEAM
- LINKS

Diviner PDS Archives

The Diviner Dataset is archived at the NASA Planetary Data System Geosciences Node. The first release date is March 15, 2010.

1. Archiving Schedule
2. Archive Software Interface Specifications
   a. Archive Volume SIS - Documentation for the PDS archive tree.
   b. EDR SIS - Diviner Level 0 (Experiment Data Record or EDR) Software Interface Specification.
      Data file/label docs and details.
   c. RDR SIS - Diviner Level 1b (Reduced Data Record or RDR) Software Interface Specification.
      Data file/label docs and details.
   d. Diviner RDR Fields and Descriptions
3. Sample RDR Files - Use the links below to download sample Diviner RDR data which we are providing to the public in advance of the first official PDS data release on March 15, 2010. The data were acquired during a 10-minute period starting December 15, 2009 at 23:50 UTC.
   a. RDR Label: 200912152350_RDR.LBL (9.7 KB)
   b. ASCII Table: 200912152350_RDR.TAB (289 MB)
   c. Zipped ASCII Table: 200912152350_RDR.ZIP (36 MB)

Diviner Results Downloads

Digital versions of maps and other published results will be posted here by the Diviner team.

The Diviner Lunar Radiometer Experiment is funded by NASA through the Lunar Reconnaissance Orbiter Project at NASA Goddard.
The instrument is built and operated by JPL.

Contact Us

http://diviner.ucla.edu