Kaguya Terrain Camera (TC):

Instrument Overview
and
Data Products

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Spacecraft Overview

Mission period	2007 Sep. to 2009 Jun
Orbit altitude (nominal)	100 km±30 km
Orbit inclination	90°（±3°）
Revolution period	118 min.
Stabilization system	Three axis stabilization

15 Mission Instruments (~ 300 kg)

XRS	X-ray Spectrometer
GRS	Gamma-ray Spectrometer
CPS	Charged Particle Spectrometer
MI	Multi-band Imager
SP	Spectral Profiler
TC	Terrain Camera
LRS	Lunar Radar Sounder
LALT	Laser Altimeter
RSAT	Relay Satellite Transponder
VRAD	VLBI Radio Source
LMAG	Lunar Magnetometer
PACE	Plasma Energy Angle and Composition
RS	Radio Science
UPI	Upper atmosphere Plasma Imager
HDTV	High Definition TV System

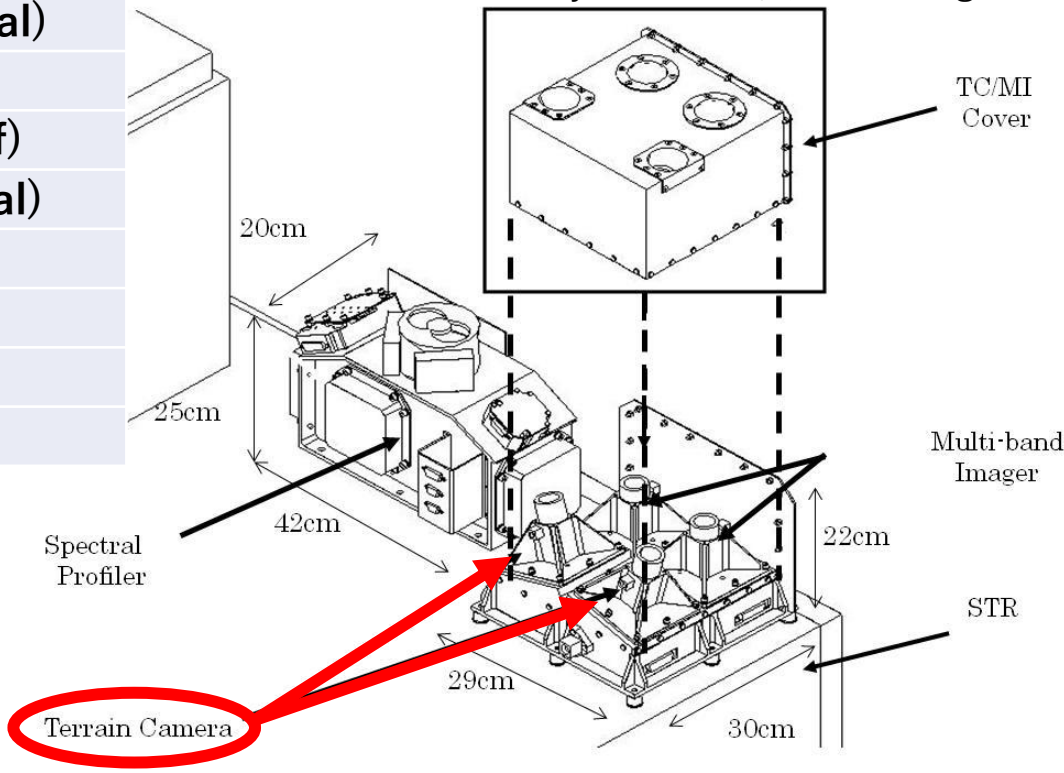
Terrain Camera Specifications

Optics	Two refracting optical heads
Detector	1D CCD (4096 pixels)
Number of bands	1
Band assignment	430–850 nm
Spatial resolution	10 m/pixel
Pitch angle	± 15°
Swath width (mode) from 100 km altitude	35 km (nominal)
	40 km (full)
	17.5 km (half)
Field of view	19.3° (nominal)
Exposure time	1.625 ms
	3.25 ms
	6.5 ms
Quantization	10 bit

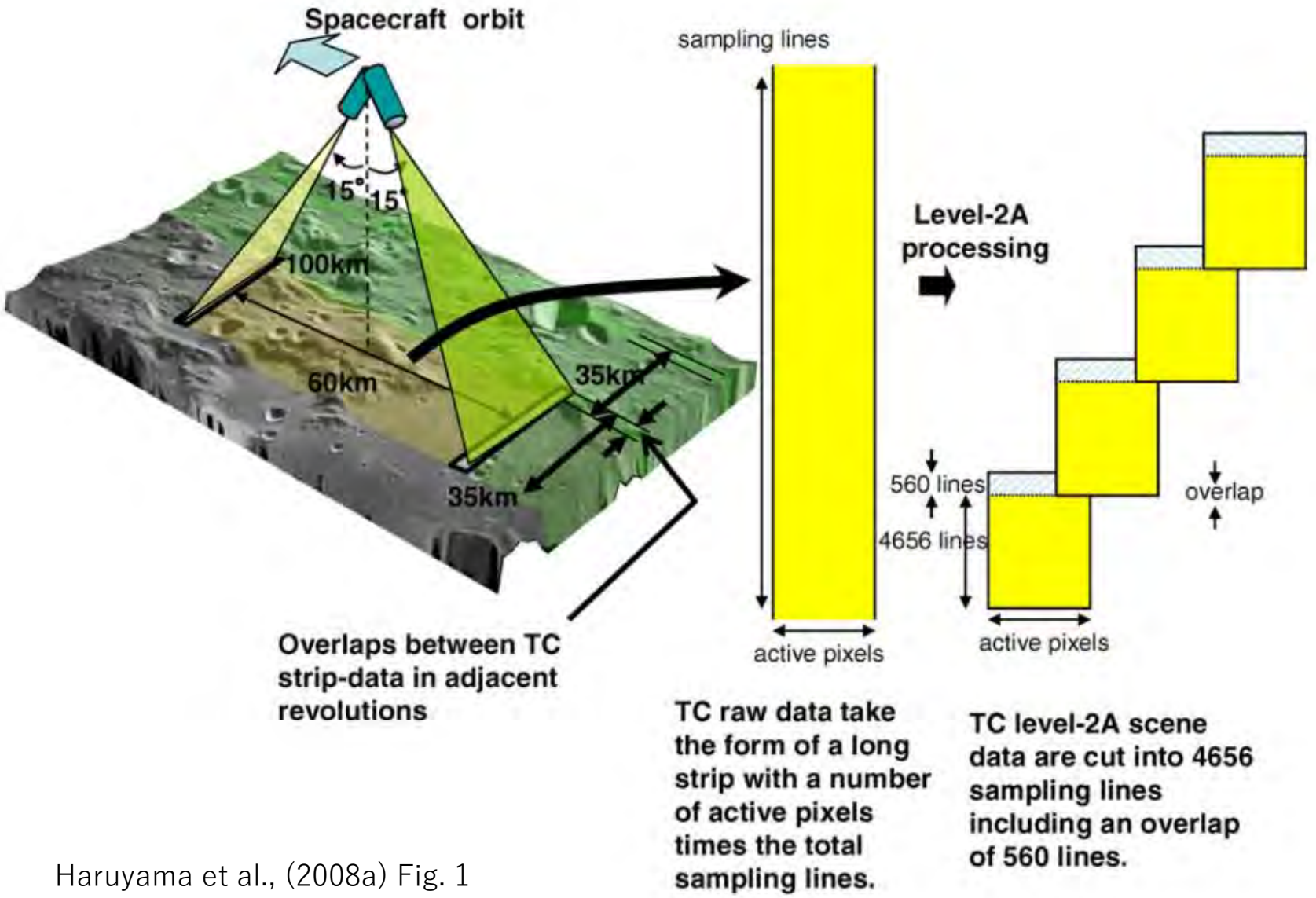
Lunar Imager/SpectroMeter (LISM):

- **Terrain Camera (TC)**
- Multiband Imager (MI)
- Spectral Profiler (SP)

Haruyama et al., (2008b) Fig. 2A



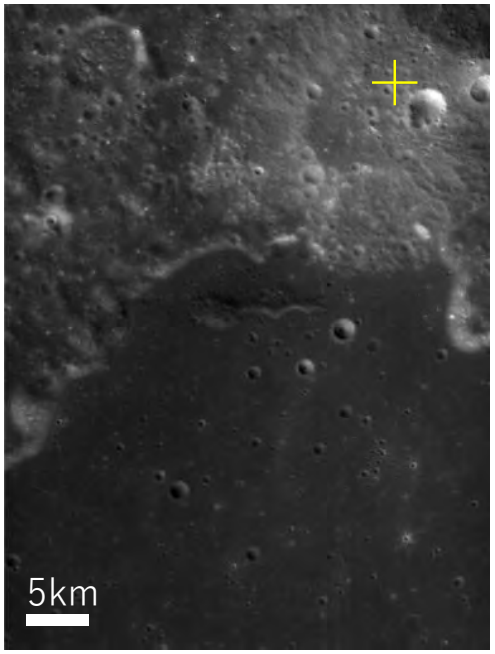
TC Geometries



Haruyama et al., (2008a) Fig. 1

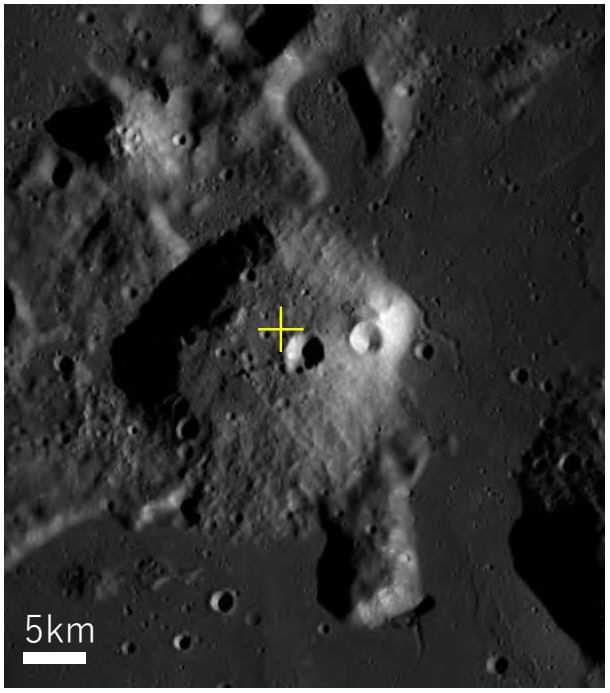
Stereo- and Mono-scopic data

Stereo



[2008-02-27]
Incidence Angle 48º
Swath mode: **Nominal** (35km)

Mono

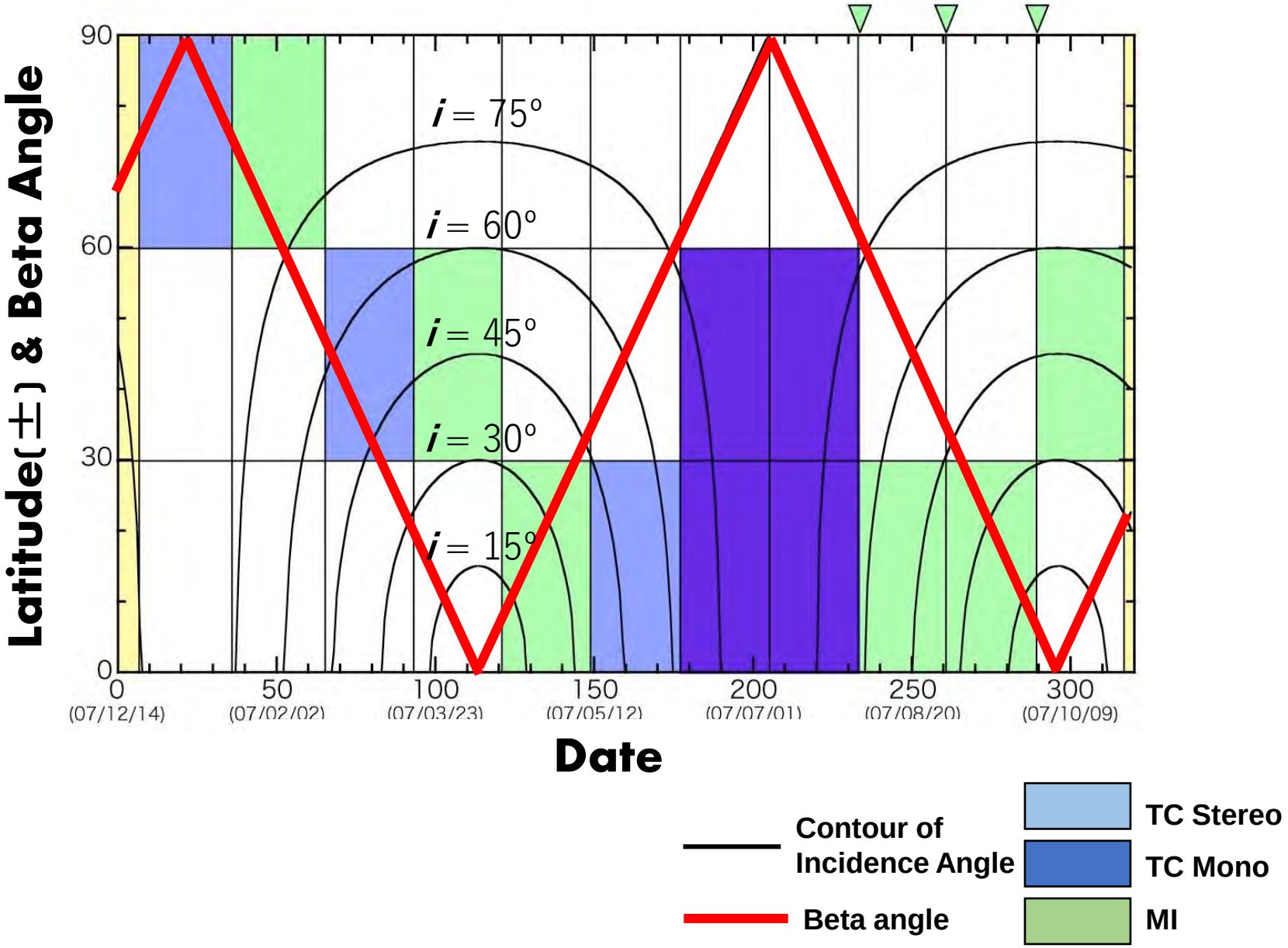


[2008-06-16]
Incidence Angle 74º
Swath mode: **Full** (40km)

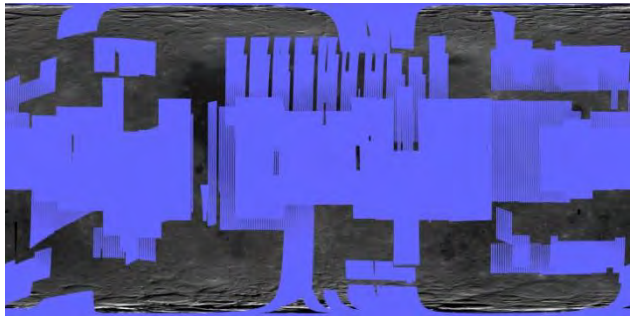
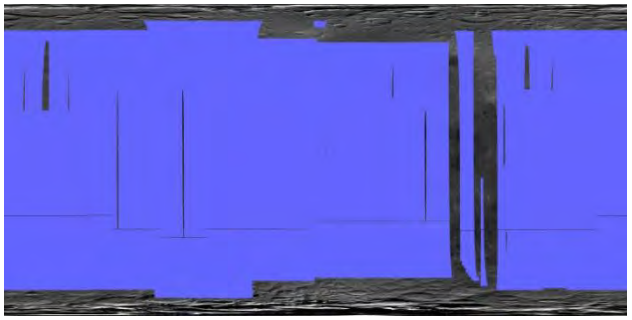
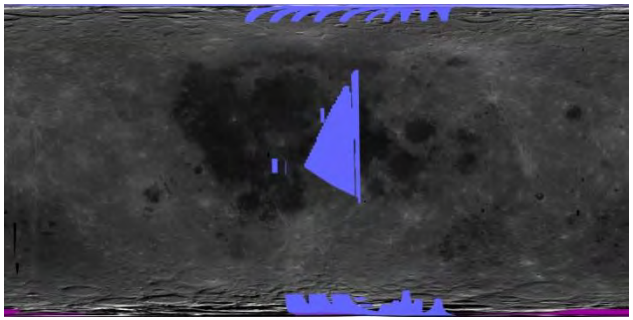
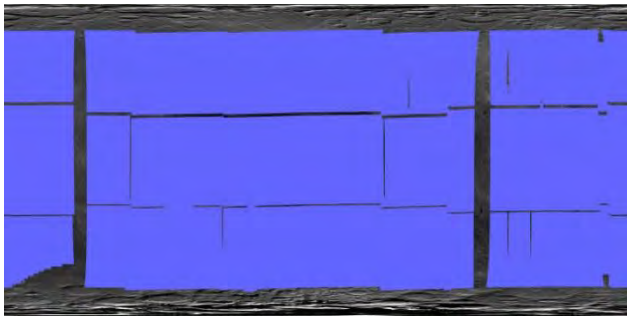
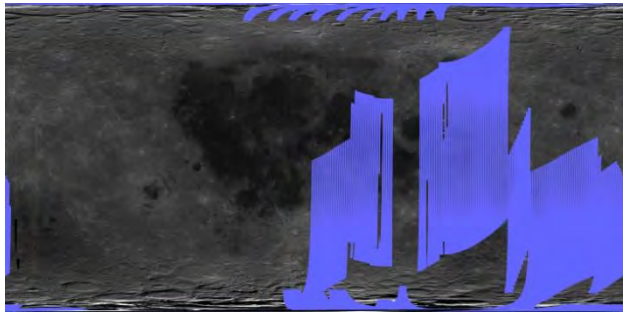
- Width of **Stereo** images are narrower (to reduce data transfer rate)
- **Mono** images are acquired on higher incidence angles

(+ Mons Gruithuisen Gamma; 319.3ºE, 36.6ºN)

TC/MI Observation Schedules

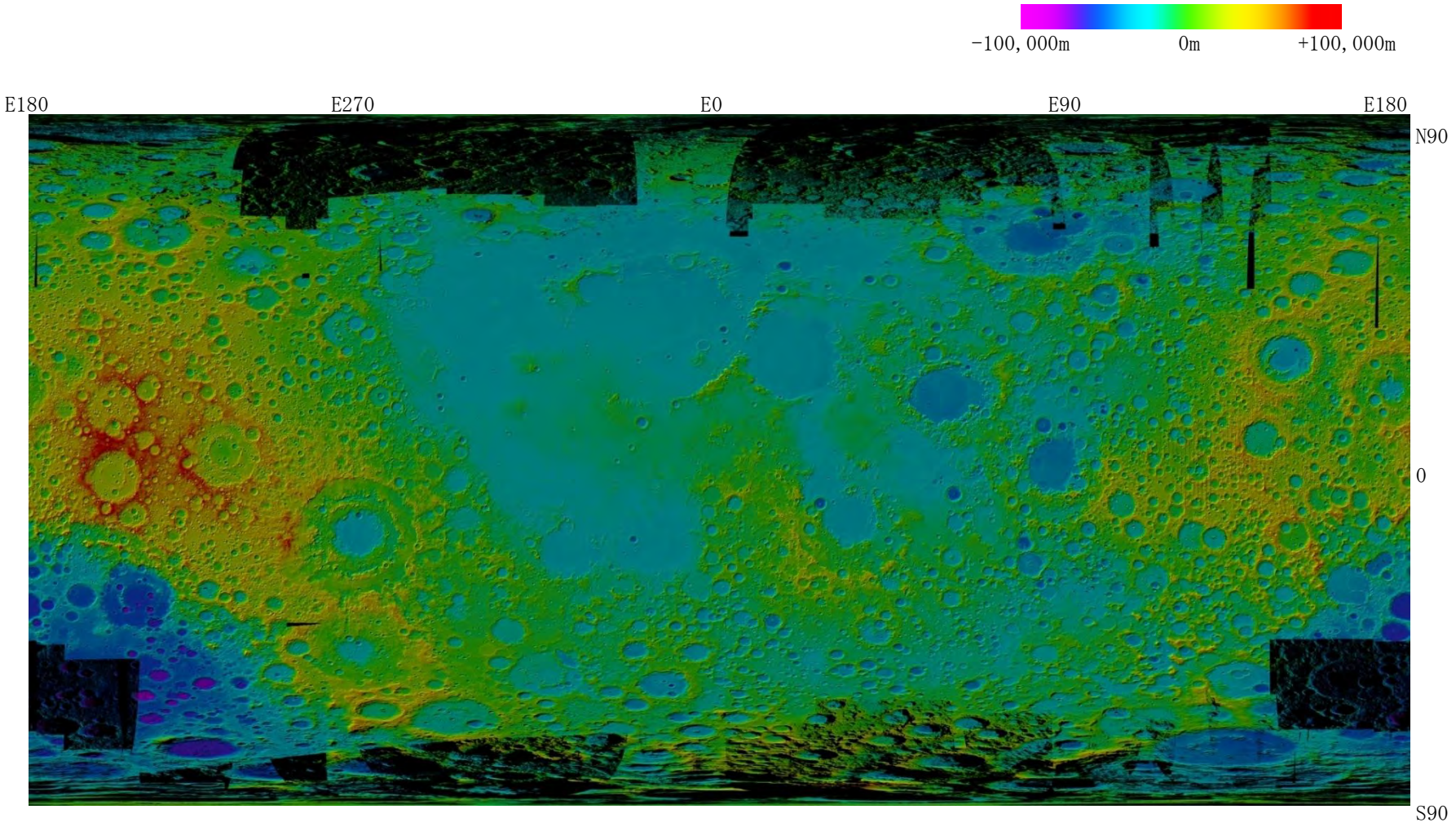


TC Coverage Map

	Nominal mission ~ 2008-10-31	Extended mission ~ 2009-06-02
Stereo Imaging		
Mono (morning)		
Mono (evening)		

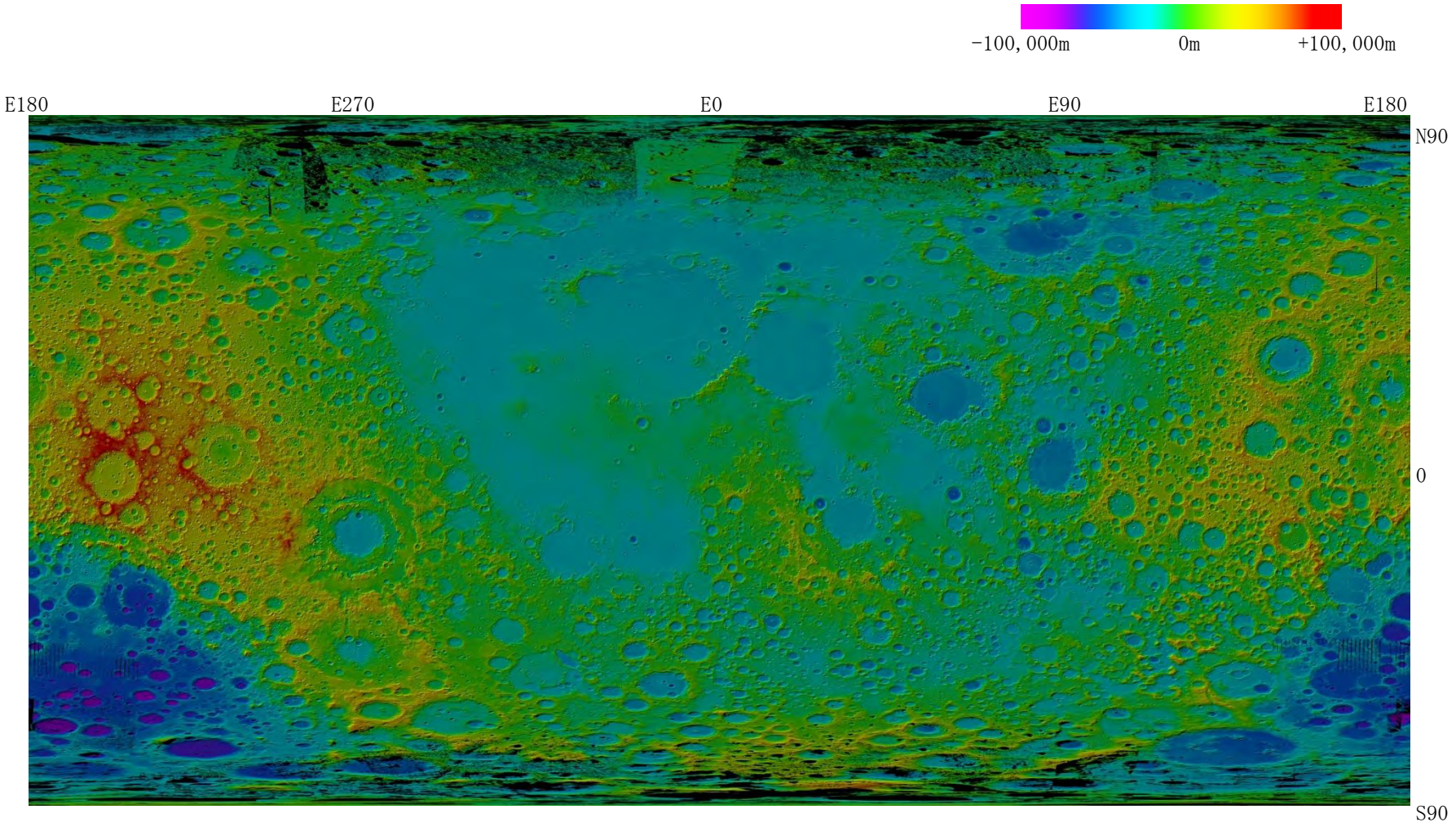
(Nearly entire surfaces are covered.)

TC DTM Mosaic



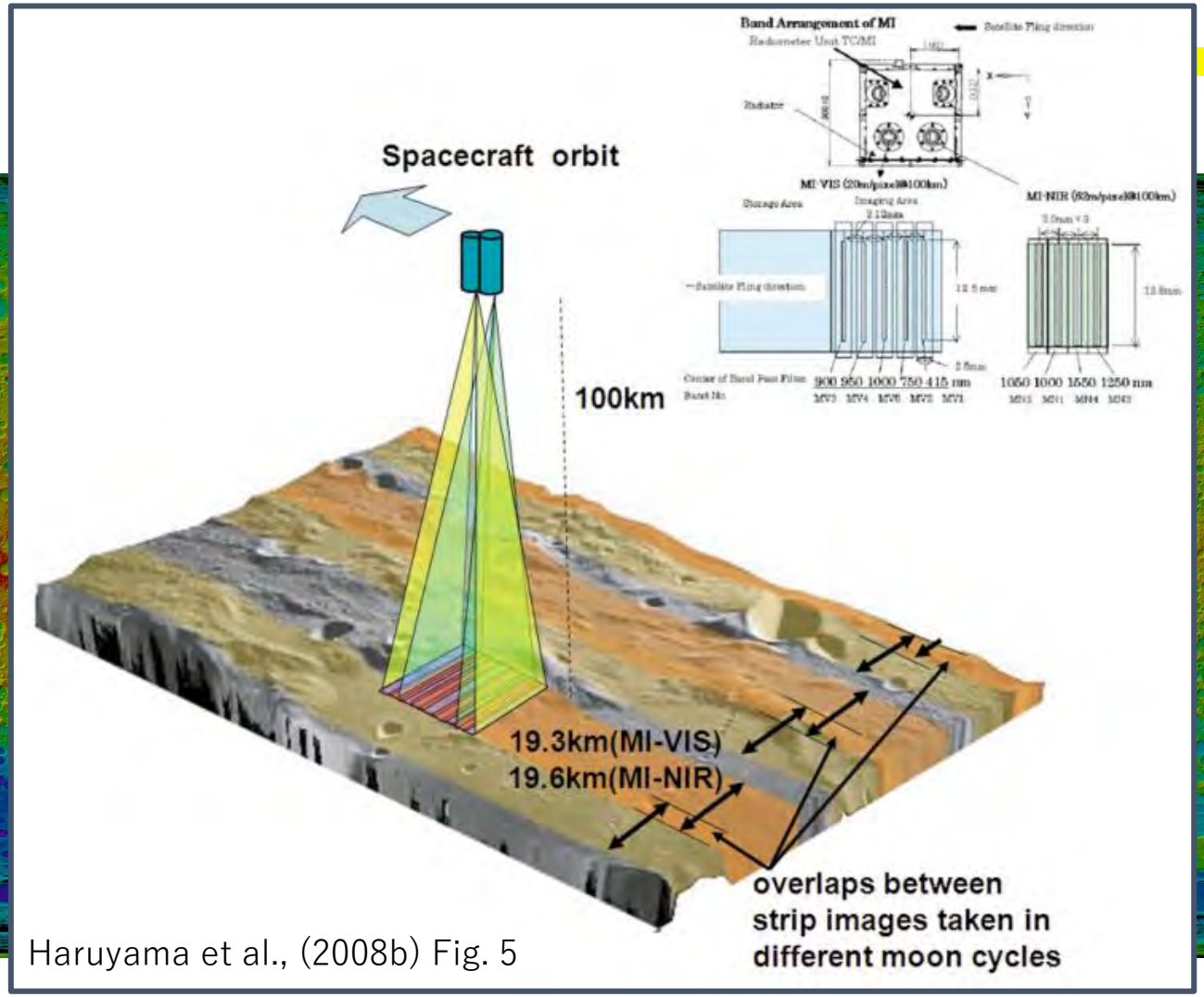
Shadows and higher (>75º) incidence images result in gores in high latitudes.

TC+MI DTM Mosaic

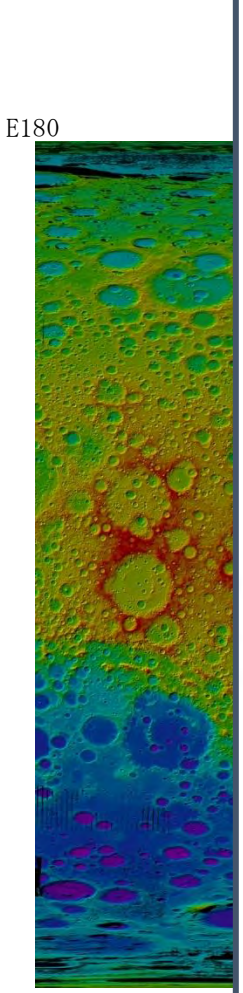


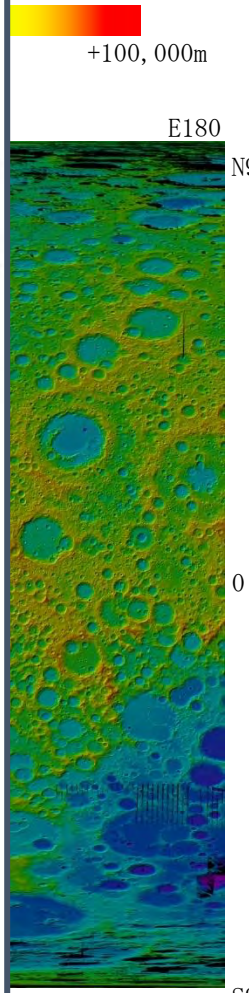
MI DTM with relatively smaller incidence angles (but lower resolution) filled most (not all) of the gores.

TC+MI DTM Mosaic



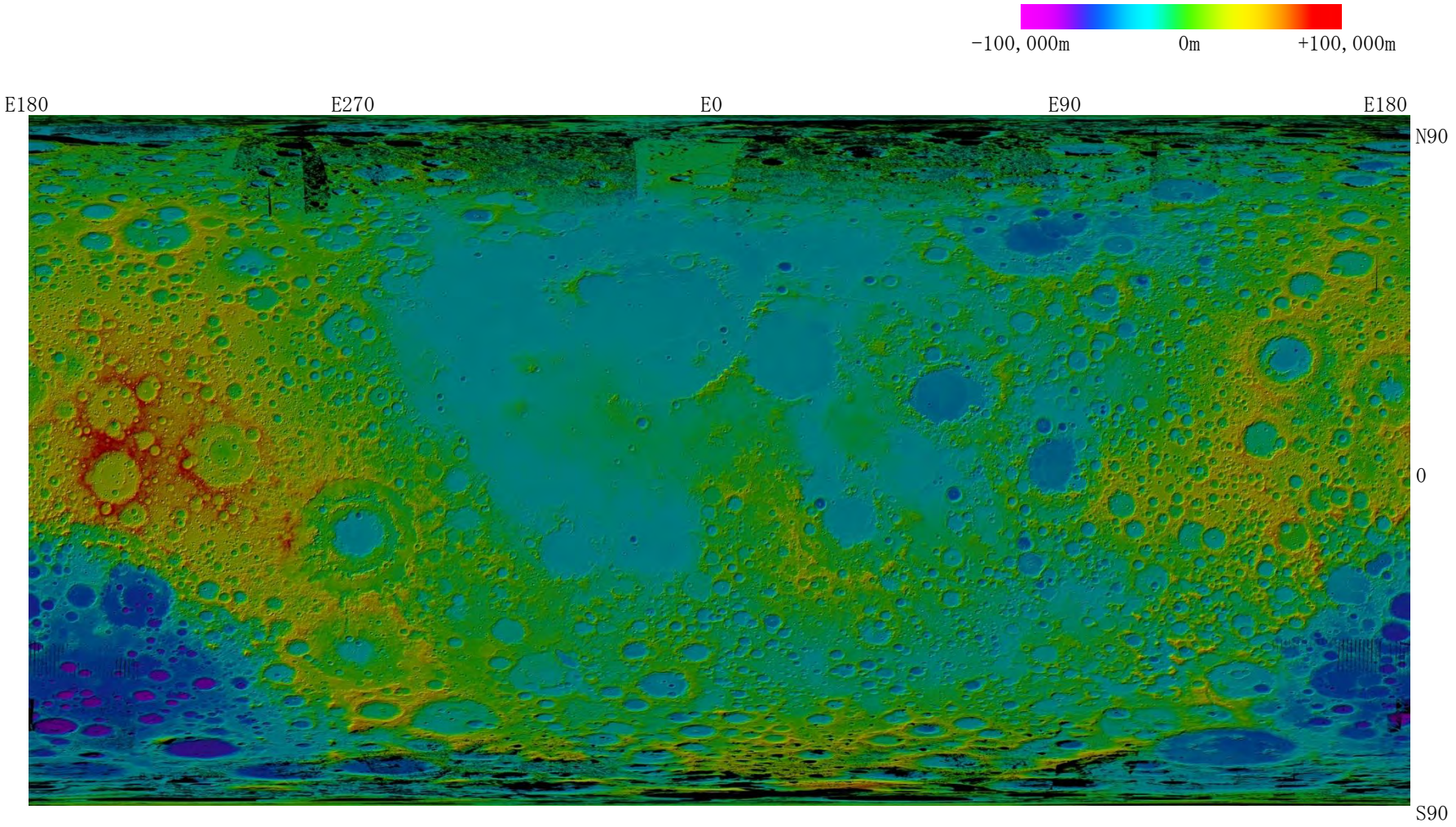
Haruyama et al., (2008b) Fig. 5





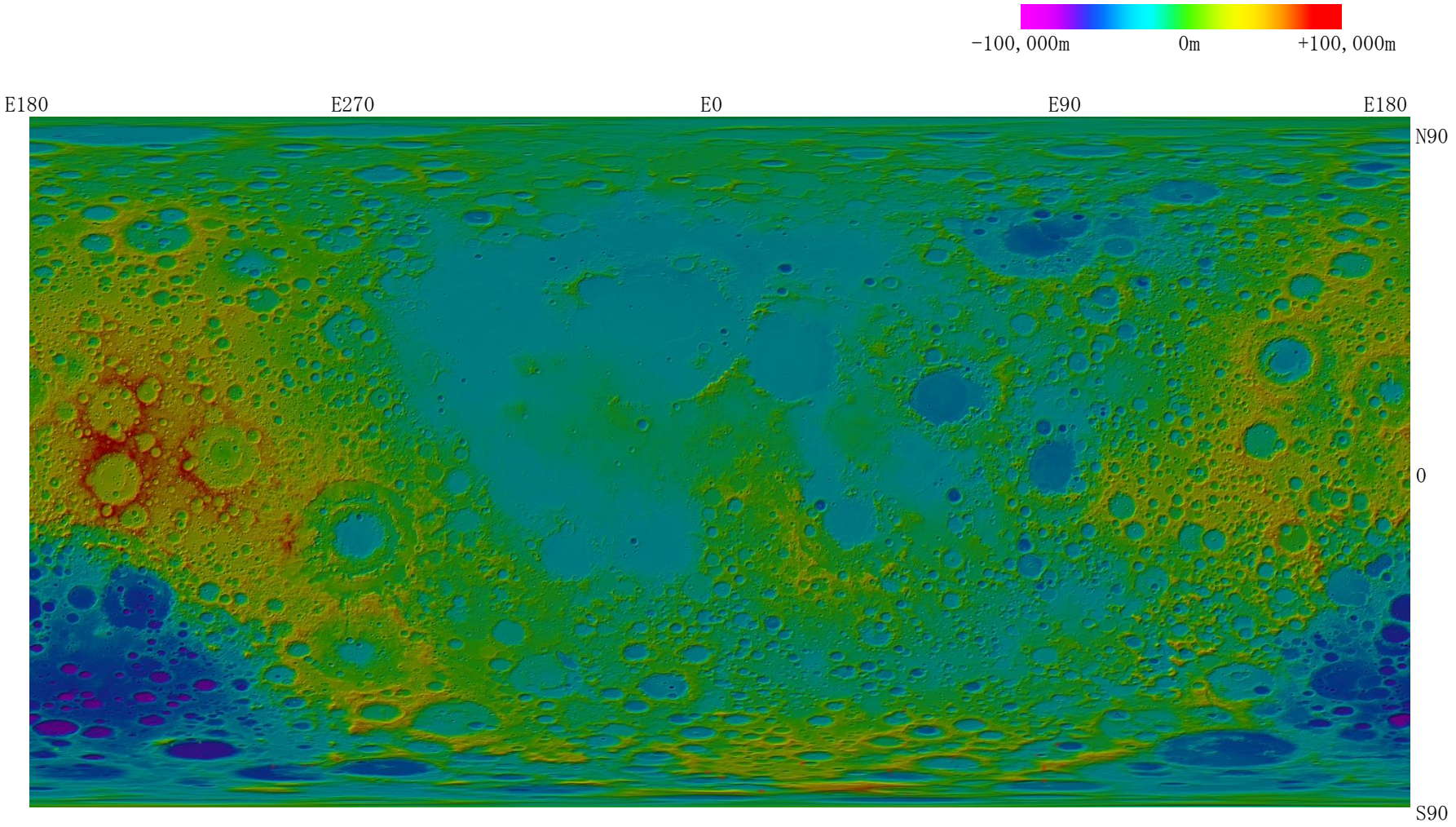
MI DTM with relatively smaller incidence angles (but lower resolution) filled most (not all) of the gores.

TC+MI DTM Mosaic



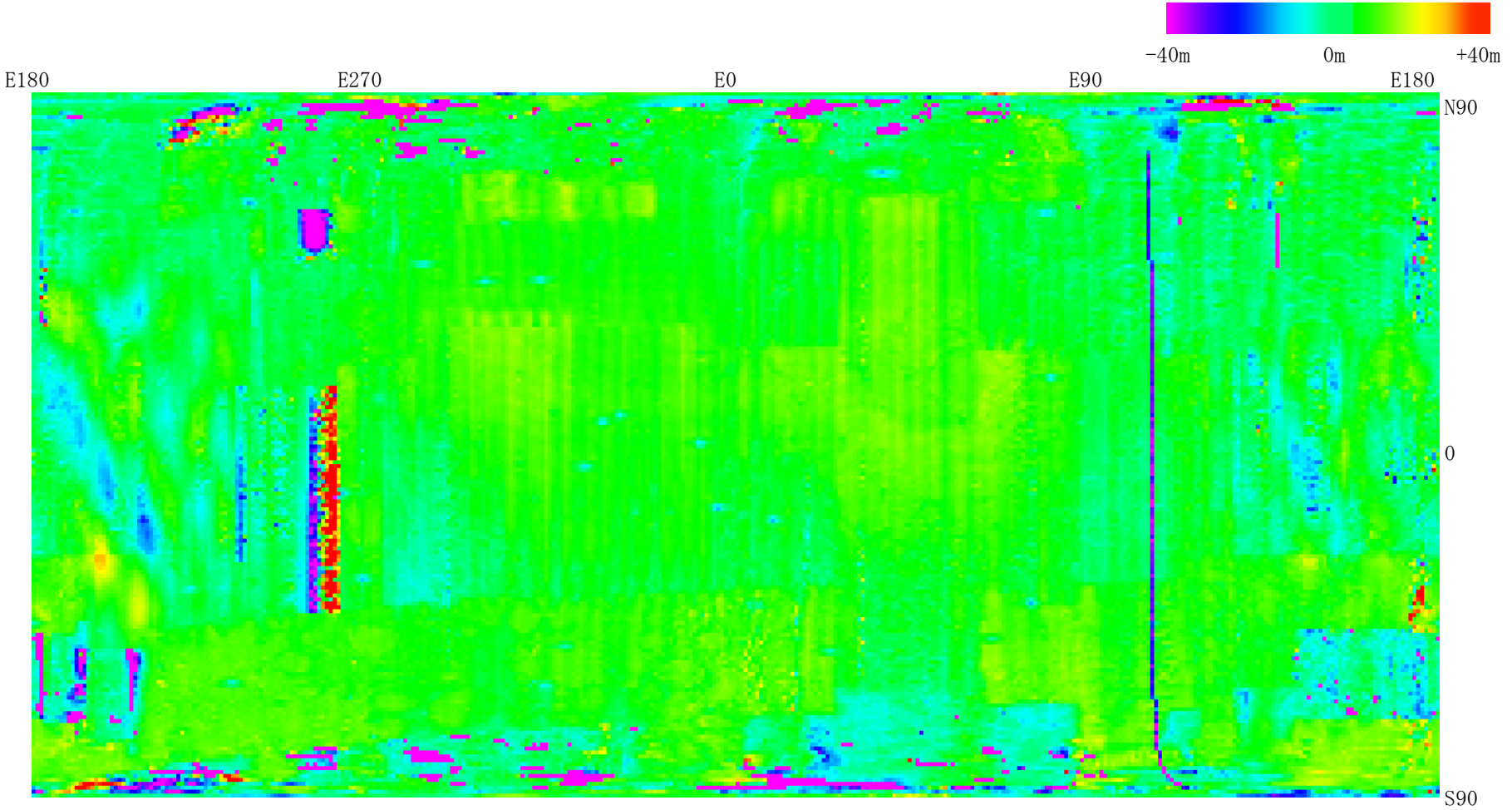
MI DTM with relatively smaller incidence angles (but lower resolution) filled most (not all) of the gores.

TC+MI+LOLA DTM



The gores in high latitudes (including PSRs) are finally filled by LOLA data → SLDEM2013 product

Offset of TCDTM - LOLA



~6m on average, possibly due to the georeferencing issue.

→ now fixed in SLDEM2015 (available from PDS-geoscience node)

Accuracy of TC DTM

Horizontal Offset	
TC (self offsets)	6.7 m on average (σ = 8.5 m) in longitude
	5.3 m on average (σ = 12 m) in latitude
Apollo LRRR†	12.3 m on average in longitude
	22.0 m on average in latitude
MI, LALT	<10 m

† Laser Ranging RetroReflector

Vertical Offset	
TC (self offsets)	5 m on average (σ = 5 m)
Apollo LRRR†	4.7 m on average (from 3 to 6 m)
LALT	0 m on average (σ = 3.2 m in mare) ※ after matching correction with LALT

- Horizontal offset is ~10 m, Vertical offset is ~5 m

TC Data Products

https://data.darts.isas.jaxa.jp/pub/pds3/

Directory Name	Data type and Specifications
sln-l-tc-3-s-level2b0-v1.0/	Monoscopic-mode, radiometric calibration
sln-l-tc-3-w-level2b0-v1.0/	Stereo-mode, radiometric calibration
sln-l-tc-3-sp-support-level2b0-v1.0/	Monoscopic-mode, radiometric calibration, supporting observation for SP
sln-l-tc-4-dem-ortho-v1.0/	Elevation from TC, MI, and LOLA, geometry correction, each scene
sln-l-tc-4-dtm-ortho-v3.0/	Elevation only from TC stereo, geometry correction, each scene
sln-l-tc-5-dtm-map-v2.0/	Elevation only from TC stereo, Map projected, 3°x3°, including neighboring orbit data
sln-l-tc-5-dtm-map-seamless-v2.0/	Elevation only from TC stereo, Map projected mosaic, 1°x1°, mixed orbit data
sln-l-tc-5-evening-map-v4.0/	Evening images from monoscopic images, Map projected, 3°x3°, including neighboring orbit data
sln-l-tc-5-morning-map-v4.0/	Morning images from monoscopic images, Map projected mosaic, 1°x1°, mixed orbit data
sln-l-tc-5-ortho-map-v2.0/	Images from monoscopic images, Map projected, 3°x3°, including neighboring orbit data
sln-l-tc-5-ortho-map-seamless-v2.0/	Images from monoscopic images, Map projected mosaic, 1°x1°, mixed orbit data
sln-l-tc-5-sldem2013-v1.0/	Elevation from TC, MI, and LOLA, Map projected mosaic

Summary

- Terrain Camera (TC) is monochrome line sensor with two heads for self-stereo imaging.
- Low-sun areas and shadows in high latitudes are filled by MI and LOLA DTM.
- Mosaic products of DTM, ortho images, morning-, and evening- images are available.