Landsat 8 Mission Status

Jeffrey Masek
Landsat Project Scientist
NASA Goddard Space Flight Center
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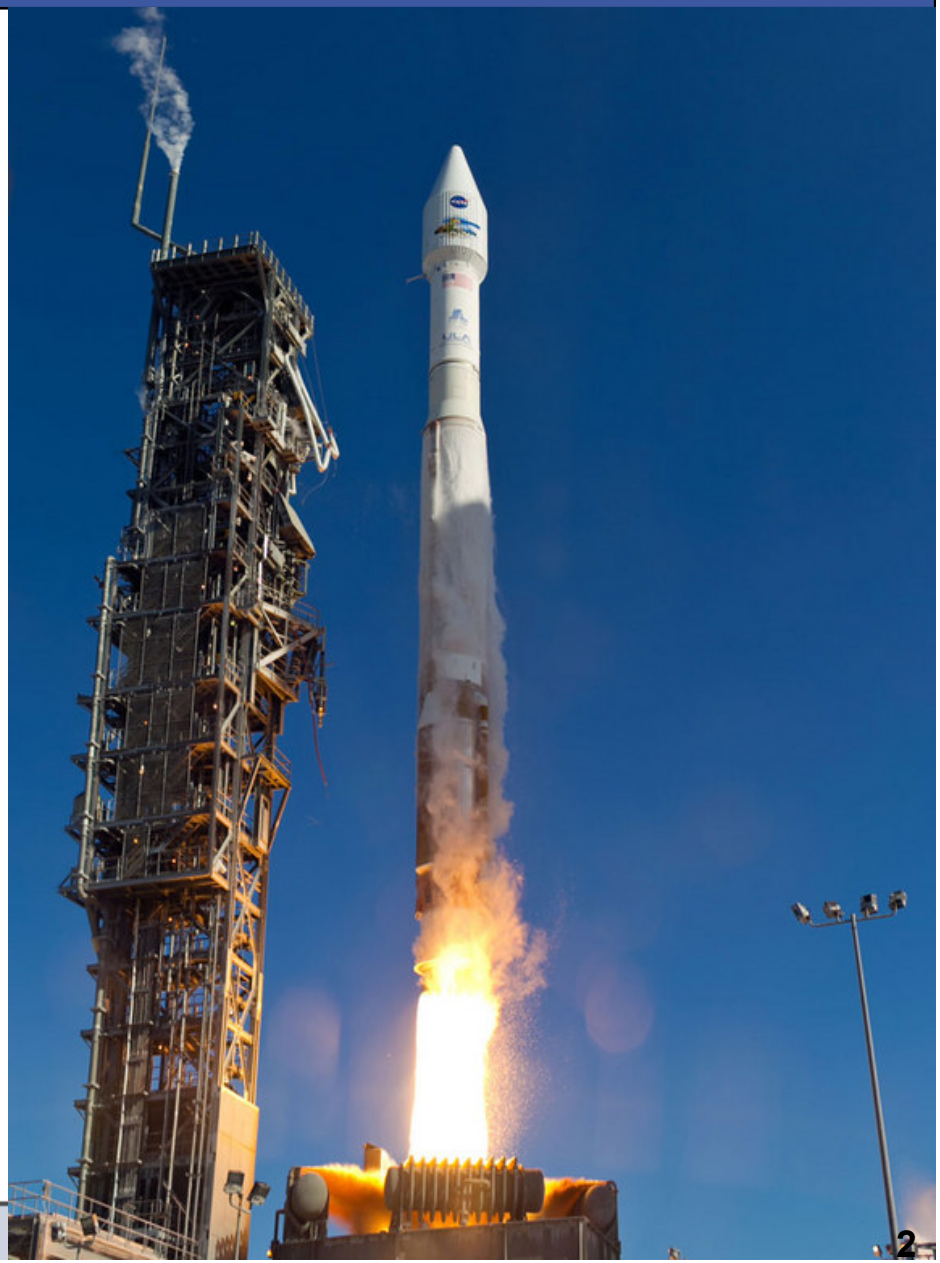
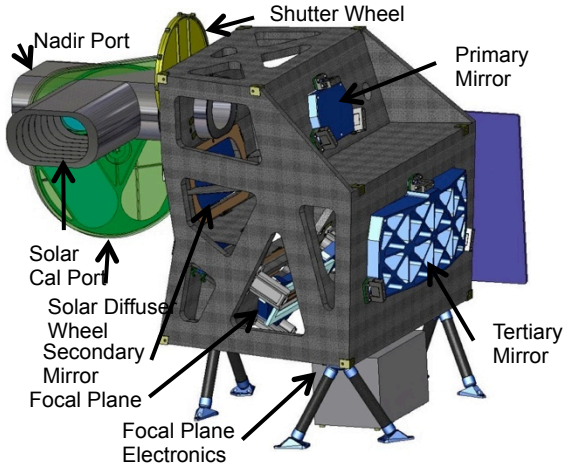
Landsat 8 Launch – Feb. 11, 2013

- **Landsat-8 launched Feb 11, 2013**
- **Latest in 42-year Landsat series**
- **Partnership between NASA (flight segment) and USGS (ground system, operations)**
- **On-orbit commissioning completed May 30, 2013**
  - USGS assumed lead responsibility for mission operations
  - Satellite renamed Landsat 8



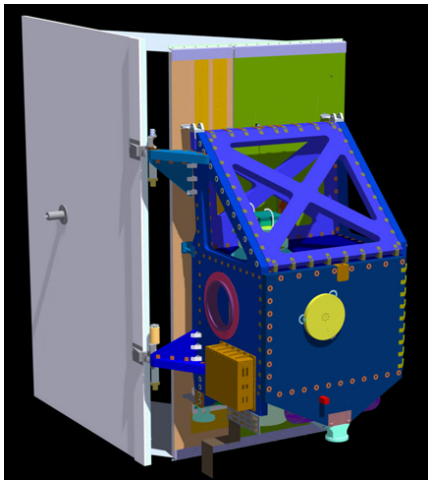
Landsat-8 Instrumentation

Operational Land Imager (OLI, Ball Aerospace)
- Push-broom VNIR/SWIR sensor
- 8 spectral bands @ 30 m + pan band @ 15m
- New bands for cirrus clouds & coastal/aerosol work
- Improved radiometry compared to ETM+



Thermal Infrared Sensor (TIRS, GSFC)
- 2 channel (10.8 and 12 μm) thermal imager
- 100 m spatial resolution

Spacecraft built by Orbital Sciences Corp.

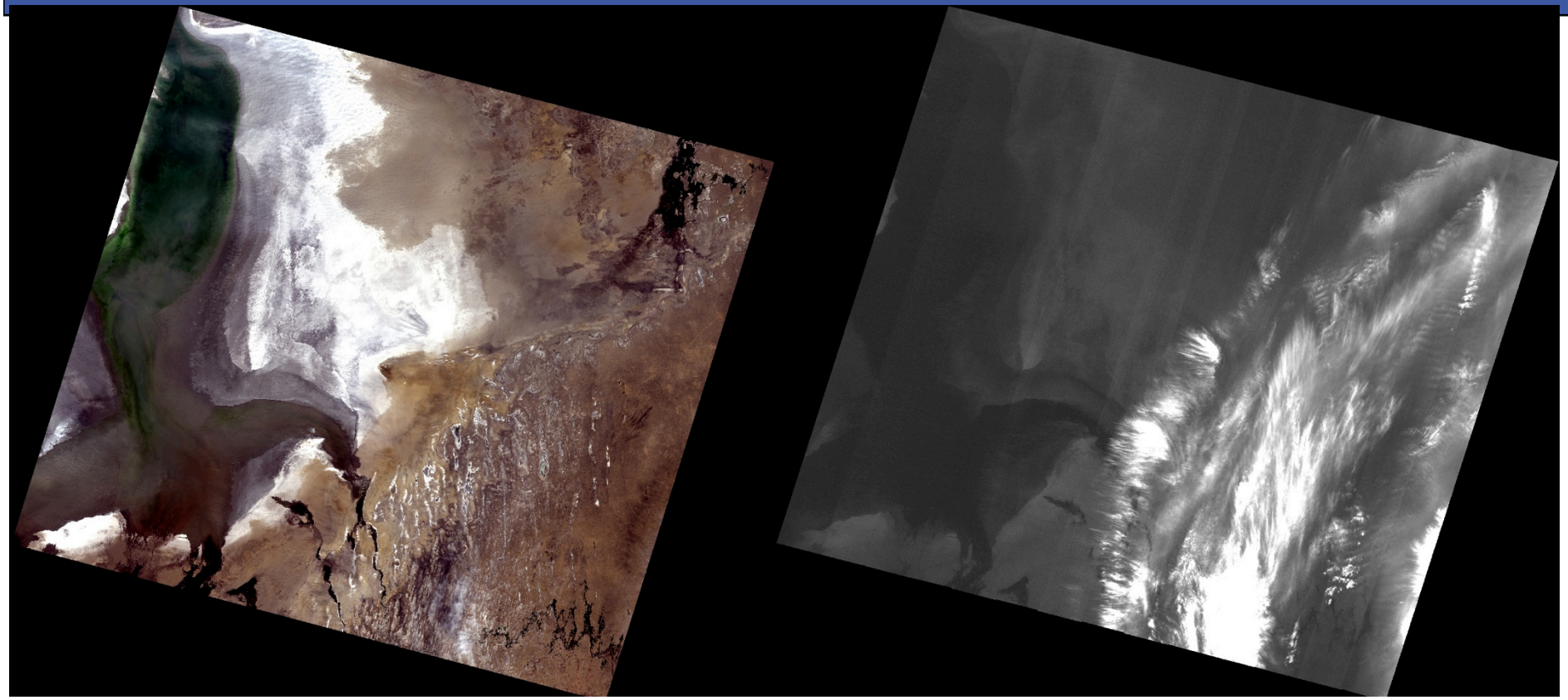


5-year Design Life (2018); 10-years of consumables
- TIRS design life is 3 years

Landsat 8 Performance Summary

- **Landsat-8 performance exceeds specifications in almost all respects**
  - Over 600 scenes per day acquired, compared to a 400 scene per day requirement
  - Imagery available within 5 hours of data collection
  - Image radiometry, geometry, and cartographic registration generally exceed requirements
    - The absolute radiometric uncertainty of TIRS data currently exceeds a 2% requirement due to a stray light issue under investigation
  - Early analyses demonstrate improved capabilities for land cover mapping, biophysical retrievals, and water resources applications

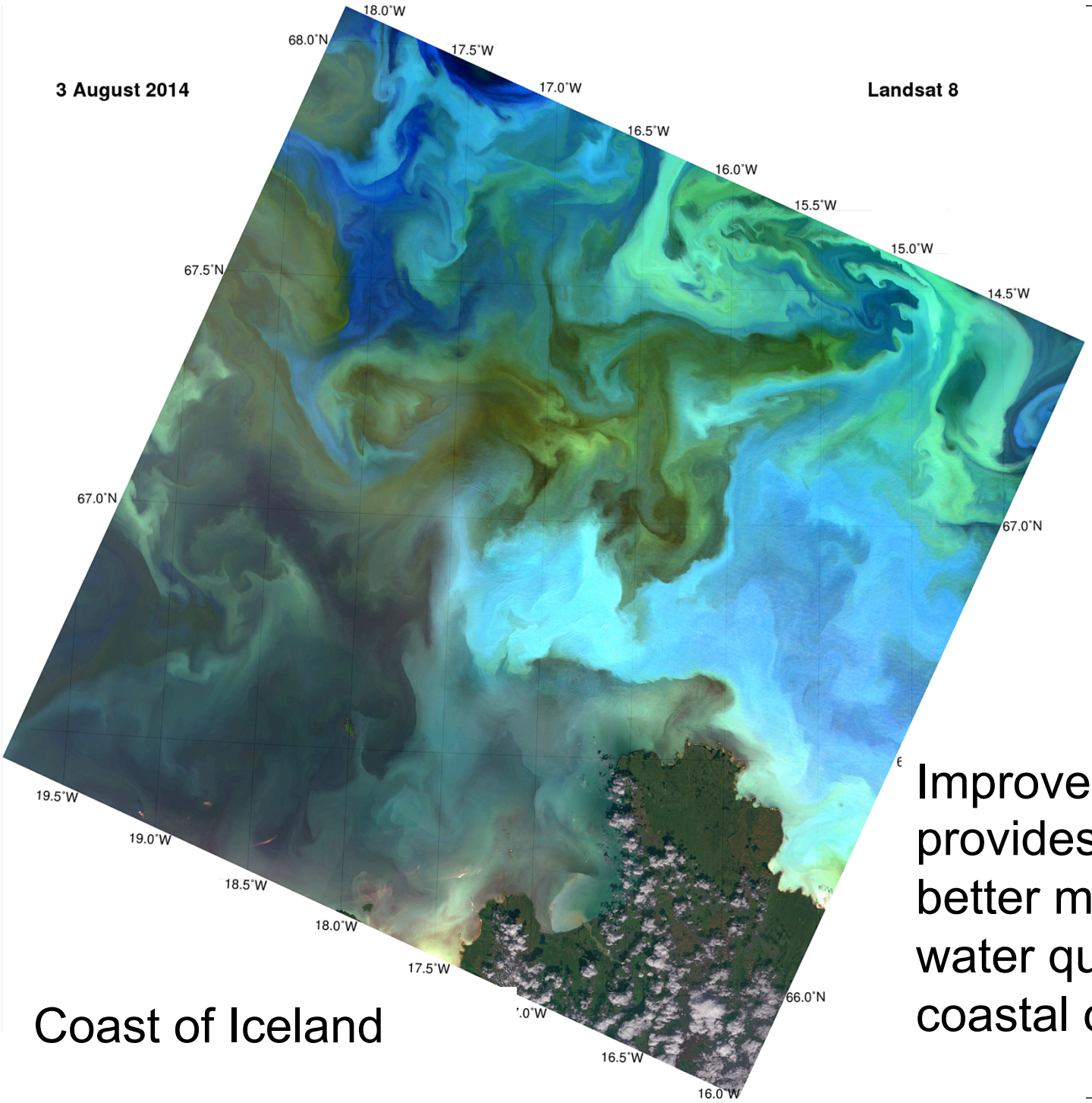
New Cirrus Detection Band



OLI natural color (4,3,2)

Cirrus band (9)

Better cloud detection and data filtering now possible



Coast of Iceland

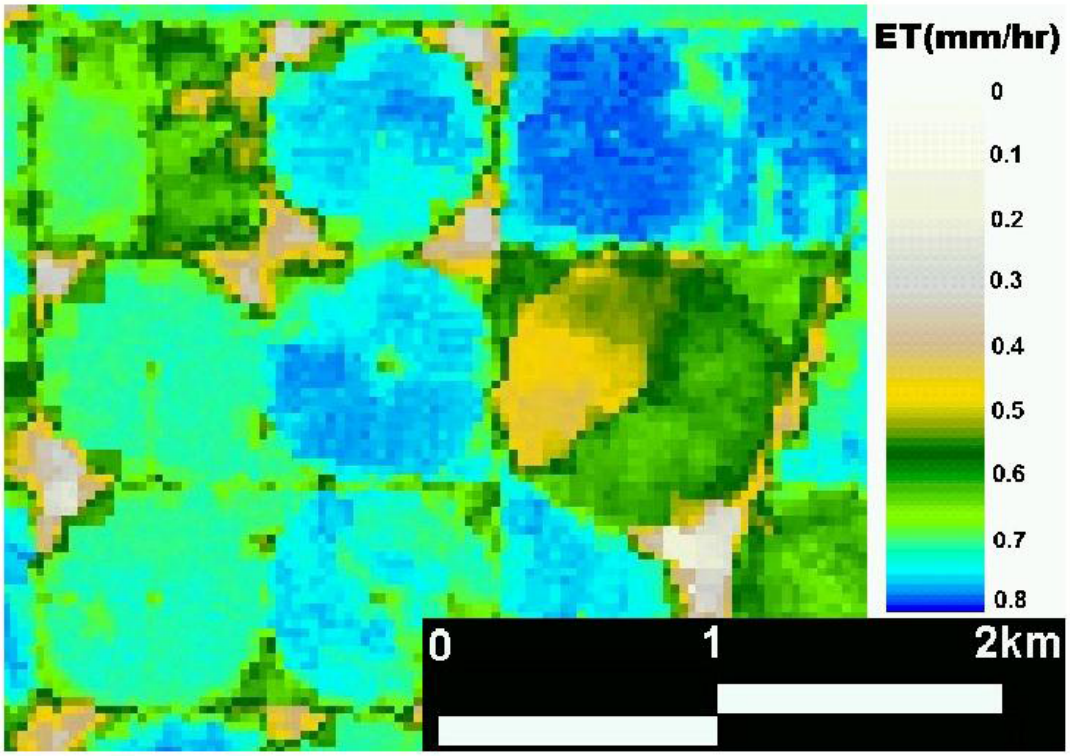
Improved radiometry provides basis for better monitoring of water quality, and coastal ocean pigments

Water Resources and Landsat

Western U.S. states and multiple countries use Landsat data to monitor and manage the use of scarce water resources for crop irrigation

Evapotranspiration at time of Landsat overpass

Oakley Fan, Idaho, July 7, 1989

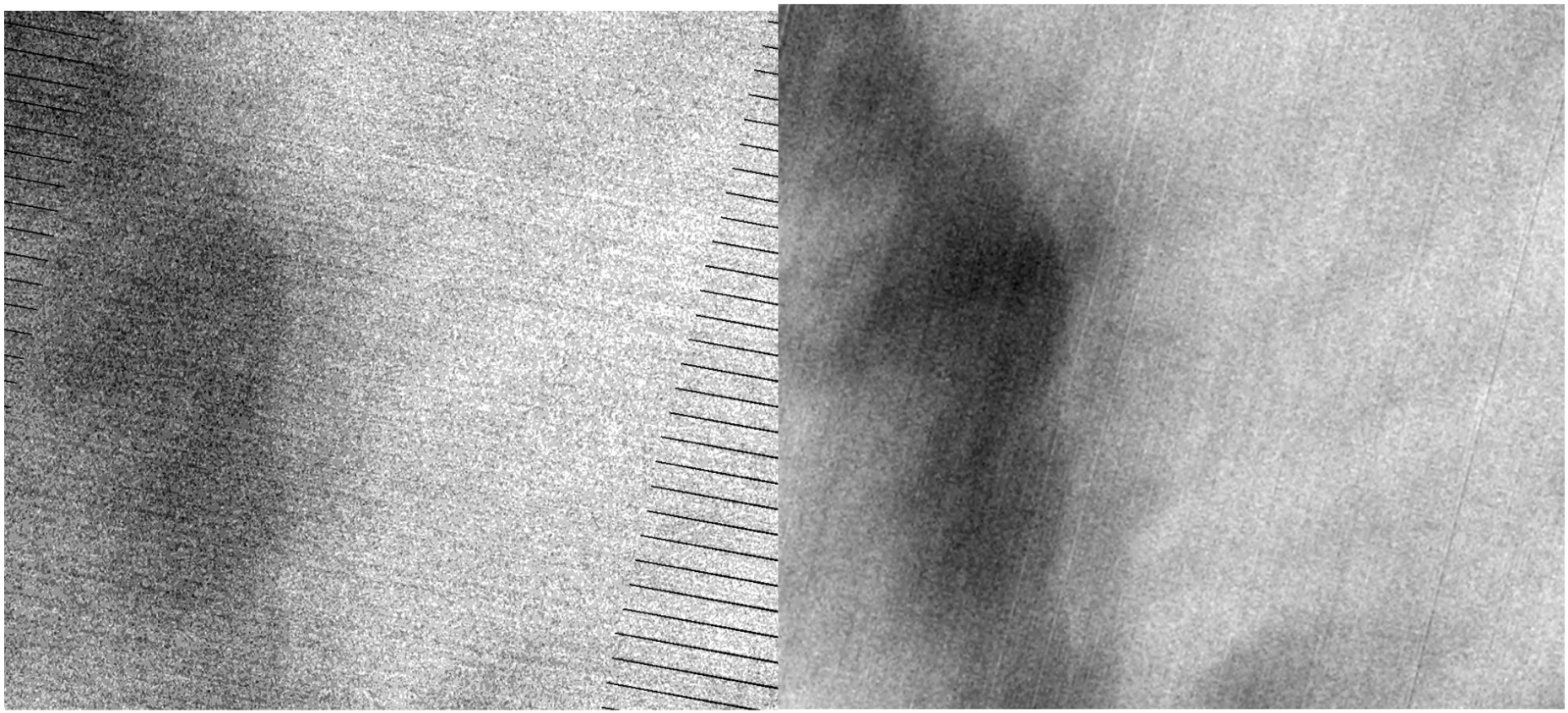


Using 120 m Landsat 5 Thermal Data

Courtesy of Richard Allen, Kimberly Research and Extension Center, University of Idaho

Reduced Thermal Band Noise

- TIRS noise better than ETM+ by factor of ~3
- Lower noise = more precise temperature retrievals



Landsat-7 ETM+ Band 6

Landsat-8 (TIRS) Band 10

TIRS Ghosting Investigation

Banding has been observed in Band 11 Earth imagery that varies from scene to scene

- Suspect stray light from outside the FOV is adding an addition “ghost” signal onto the detectors
- Ghost signal varies per detector depending on the content of the surrounding scene

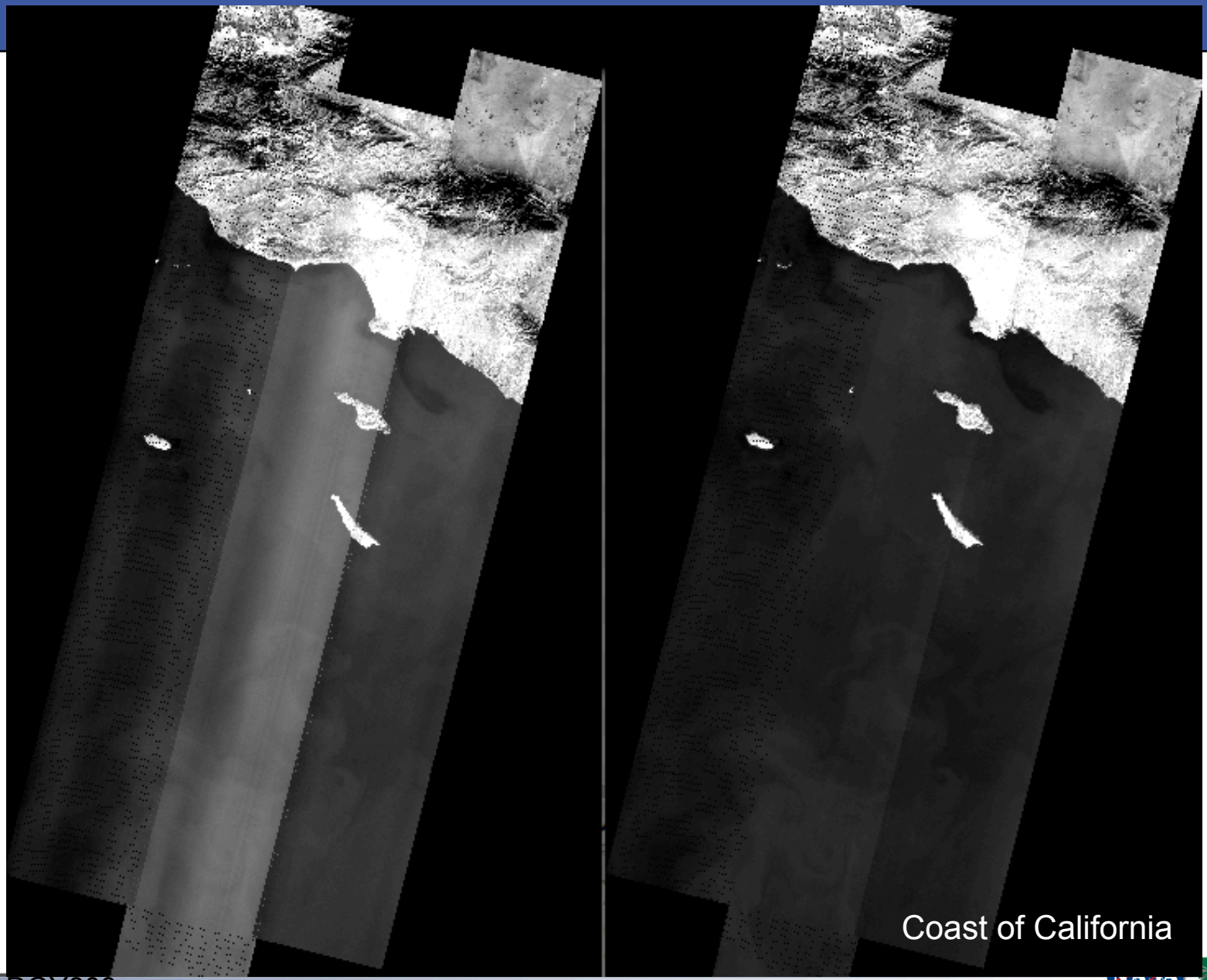
RIT researchers (John Schott, Aaron Gerace) have developed prototype correction algorithm

- Build empirical relation between “out of field” TOA temperature and banding amplitude per detector using ray trace
- Use derived mapping to correct TIRS imagery using GOES radiances as input

At present, use of band 11 for quantitative applications is discouraged

Original

Corrected



Path41, DOY309

USGS

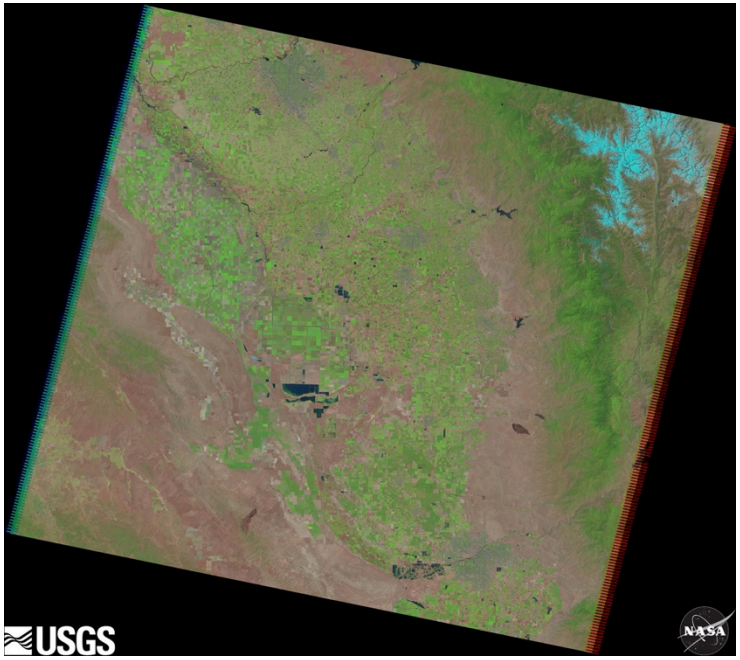
U.S. Landsat Data Archive

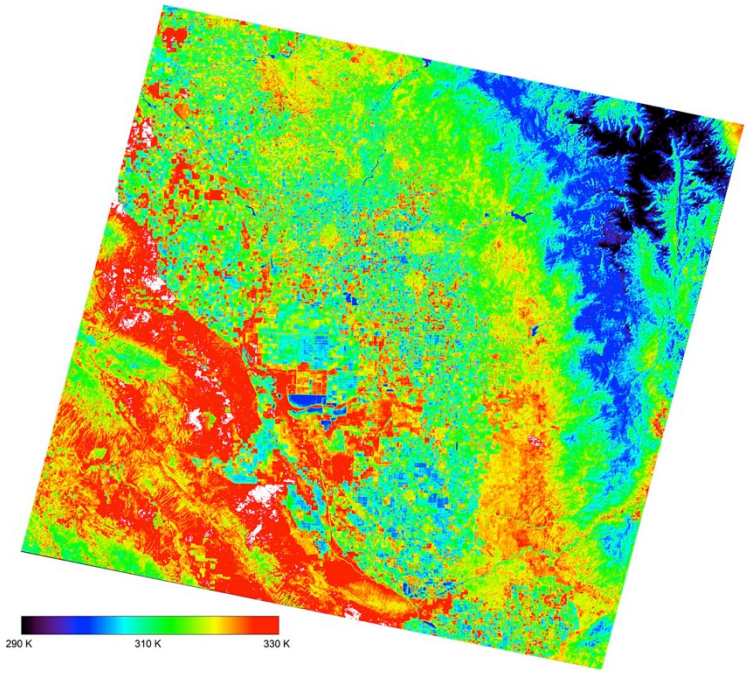
USGS Earth Resources Observation and Science (EROS) Center
Sioux Falls, South Dakota

Landsat 8 data are free (as are NASA data)

Landsat Surface Temperature Product

- Prototype LST retrieval algorithm by Simon Hook (JPL) and John Schott (RIT), supported by USGS and NASA
- Atmospheric correction using NCEP re-analysis datasets, interpolated in time & space
- Emissivity correction using ASTER emissivity datasets, seasonally adjusted via NDVI (S. Hook, G. Hulley)





USGS Plans for LST Product Deployment

- Initial sample products developed by RIT/JPL available for evaluation at:

http://espa.cr.usgs.gov/validations/LST

- "Provisional products" will be made available on-demand through USGS EROS Science Processing Architecture (ESPA) interface to enable product evaluation and feedback in June 2015

- Operational products made available on-demand through Earth Explorer December 2015:

http://earthexplorer.usgs.gov

Summary

- **Landsat-8 is collecting more data, and better data, than ever before**
- **TIRS ghosting issue remains problematic for band 11, although ground processing fixes appear feasible**
- **Landsat-7 will be available to provide 8-day coverage (in combination with Landsat-8) until early 2018**

Web Sites

http://landsat.usgs.gov

http://landsat.gsfc.nasa.gov

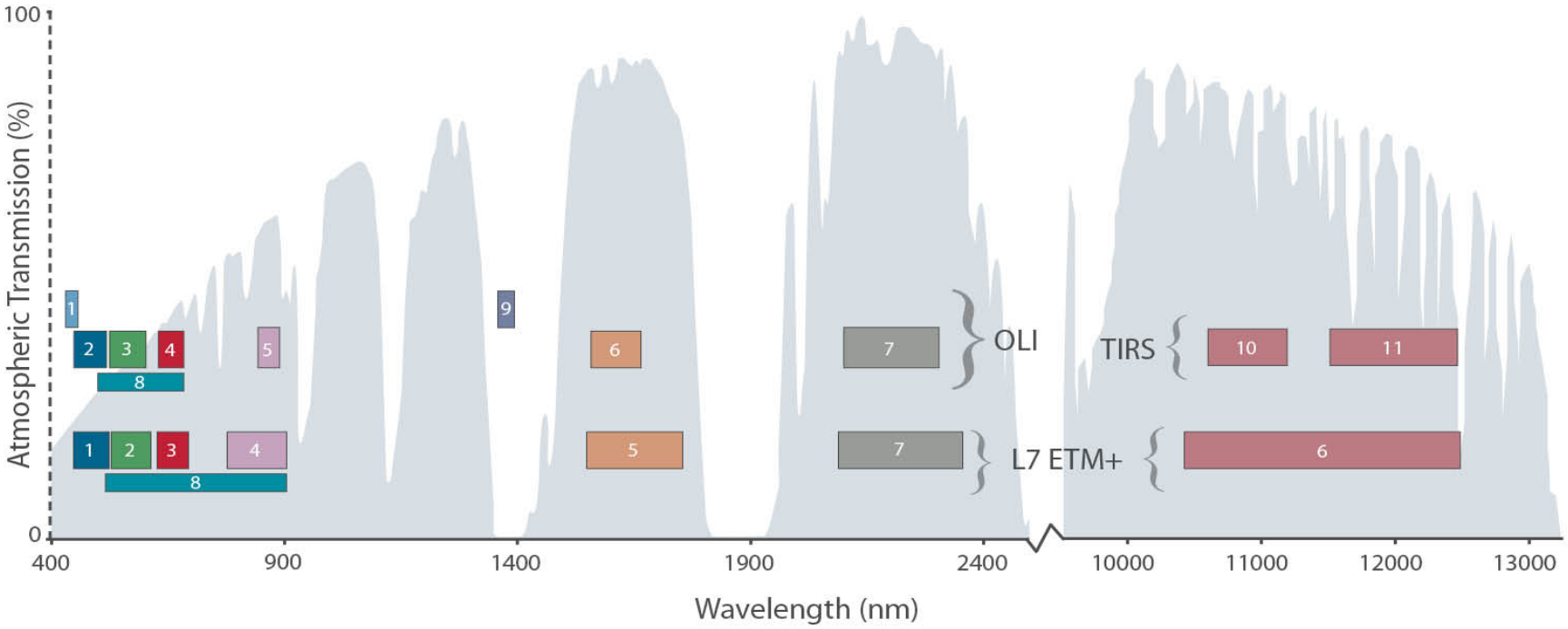
http://www.nasa.gov/landsat

FaceBook Page
http://www.facebook.com/NASA.Landsat

Twitter Site
http://twitter.com/#!/NASA_Landsat

Backup

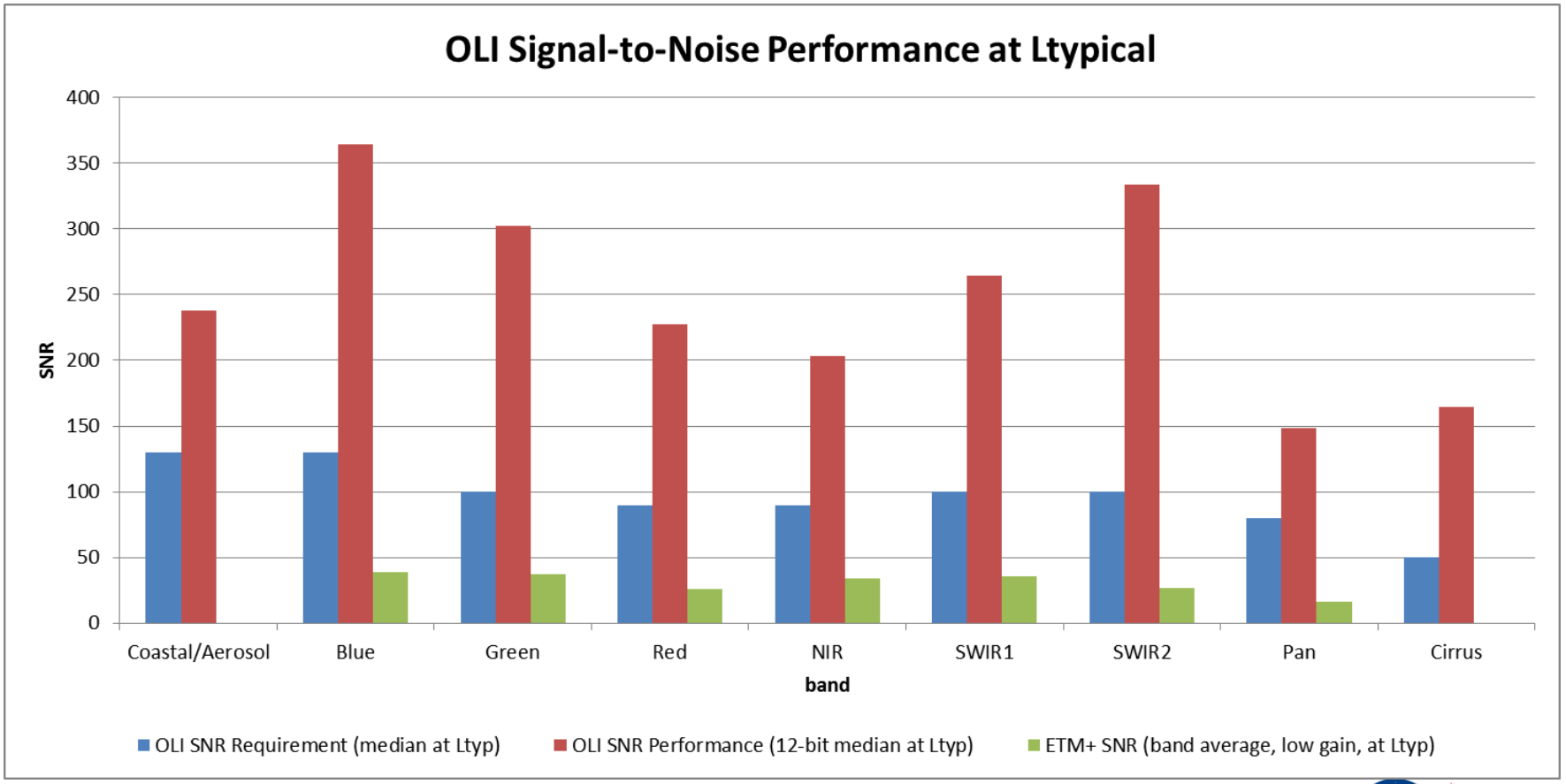
Landsat 8 Spectral Bands



- OLI & TIRS data are collected simultaneously
- OLI & TIRS collect raw data with a 12-bit radiometric resolution

OLI Radiometry

- OLI SNR ~8x better than Landsat-7 heritage, no saturation
- Radiometric response extremely stable since launch

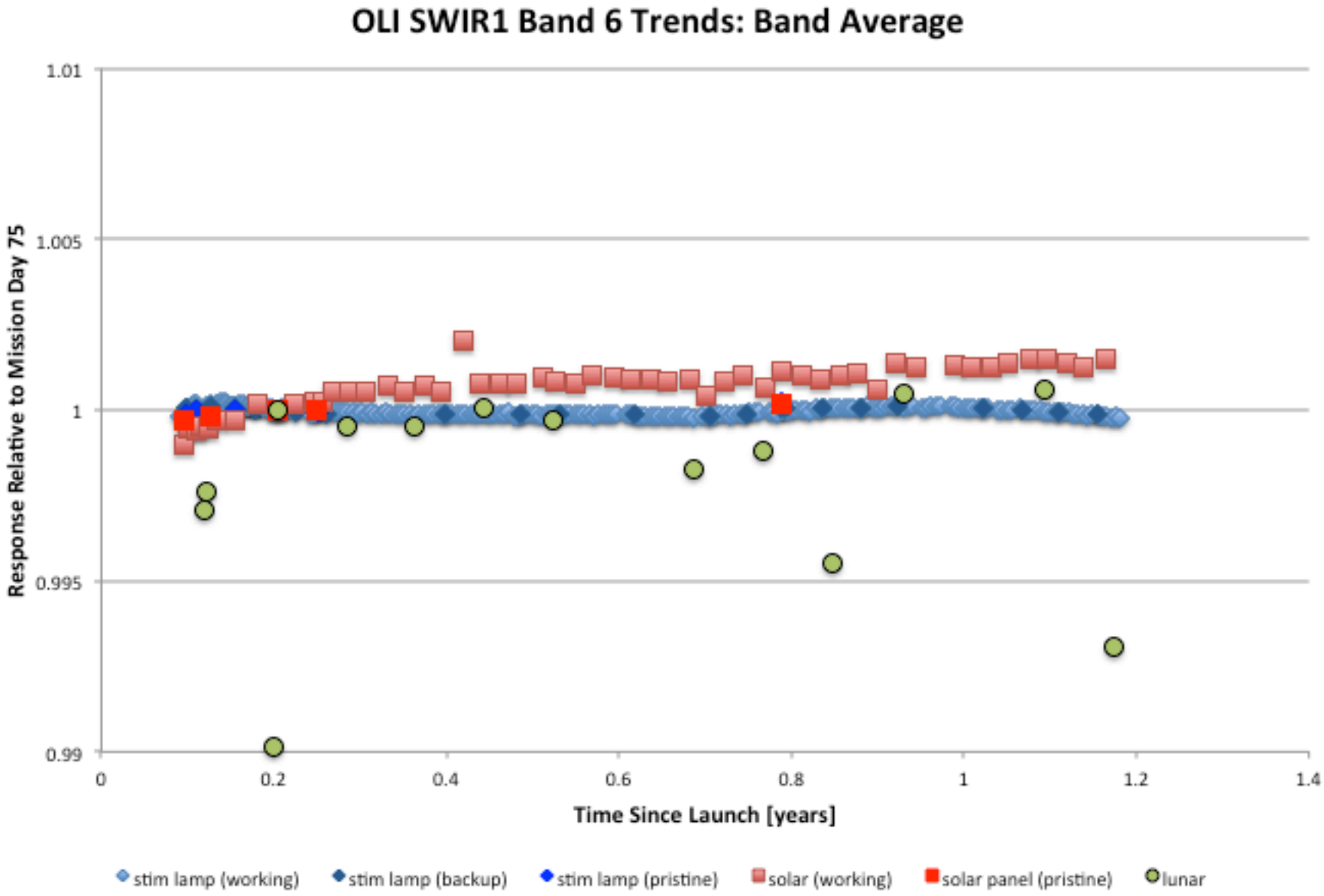


L8 Geometric Summary

- Landsat 8 on-orbit geometric performance is excellent and meets all requirements

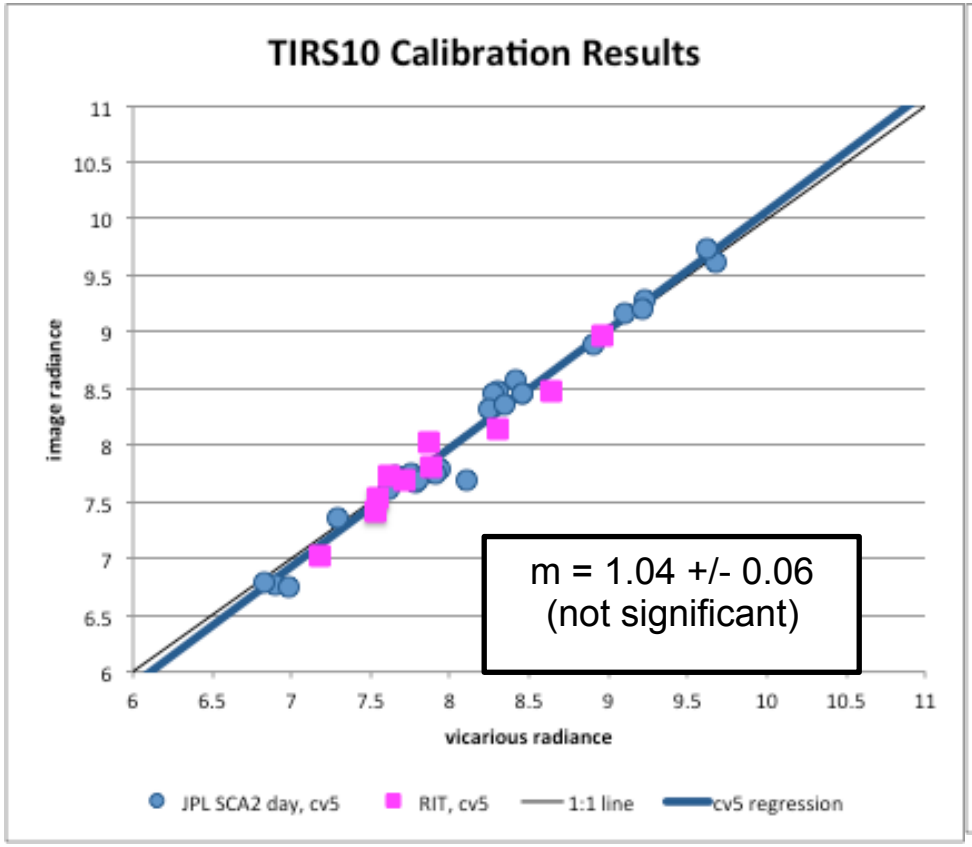
Requirement	Measured Value	Required Value	Units	Margin
OLI Swath	190.2	>185	kilometers	2.8%
OLI MS Ground Sample Distance	29.934	<30	meters	0.2%
OLI Pan Ground Sample Distance	14.932	<15	meters	0.5%
OLI Band Registration Accuracy (all bands)	3.98	<4.5	meters (LE90)	11.6%
OLI Band Registration Accuracy (no cirrus)	3.33	<4.5	meters (LE90)	26.1%
Absolute Geodetic Accuracy	36.9	<65	meters (CE90)	43.2%
Relative Geodetic Accuracy	19.9	<25	meters (CE90)	20.4%
Geometric (L1T) Accuracy	11.4	<12	meters (CE90)	5.0%
OLI Edge Slope	0.03054	>0.027	1/meters	13.1%
TIRS Swath	186.2	>185	kilometers	0.6%
TIRS Ground Sample Distance	103.424	<120	meters	13.8%
TIRS Band Registration Accuracy	10.5	<18	meters (LE90)	41.7%
TIRS-to-OLI Registration Accuracy	22.1	<30	meters (LE90)	26.2%

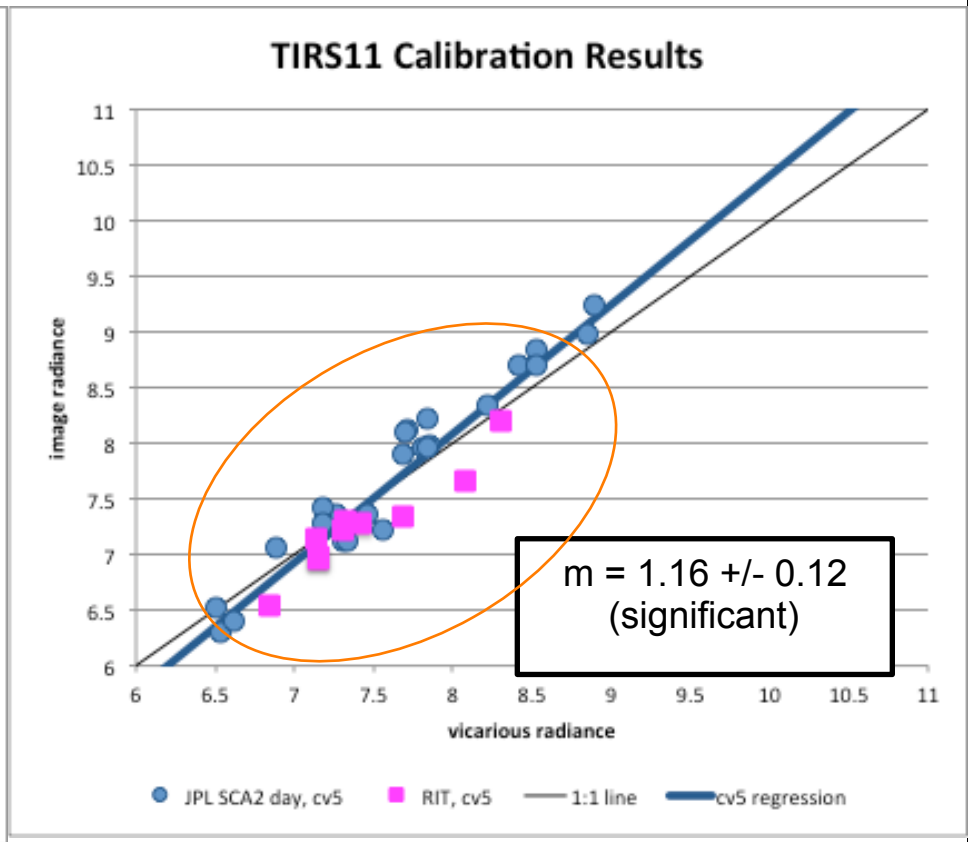
OLI Radiometric Stability



TIRS Absolute Calibration

After February, 2014 Data Reprocessing





Use of Band 11 for quantitative applications is discouraged for now