



PICS Workshop, Toulouse
November 18, 2015

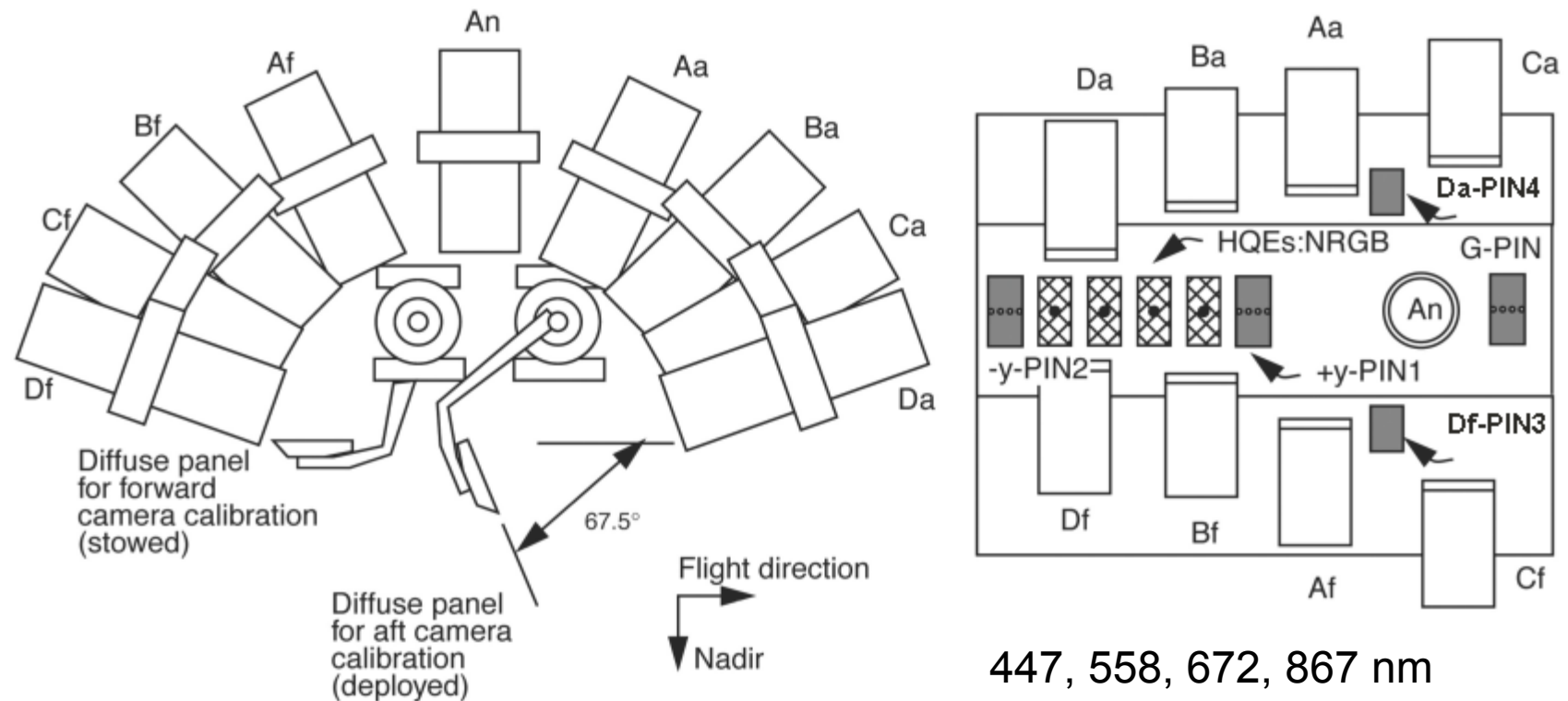
Use of PICS in MISR stability study

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Goddard Space Flight Center

Egypt-1

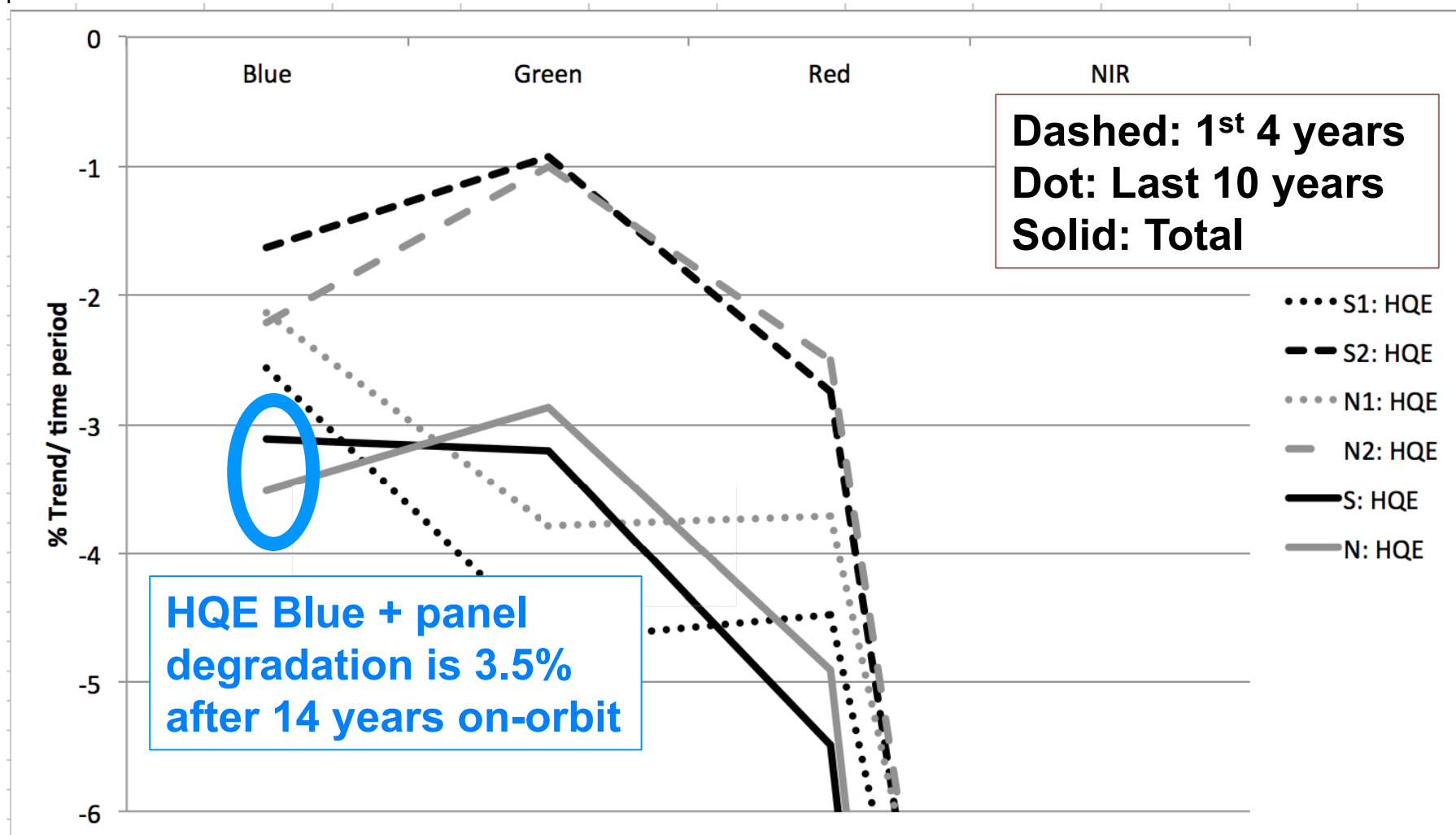
Multi-angle Imaging SpectroRadiometer (MISR)



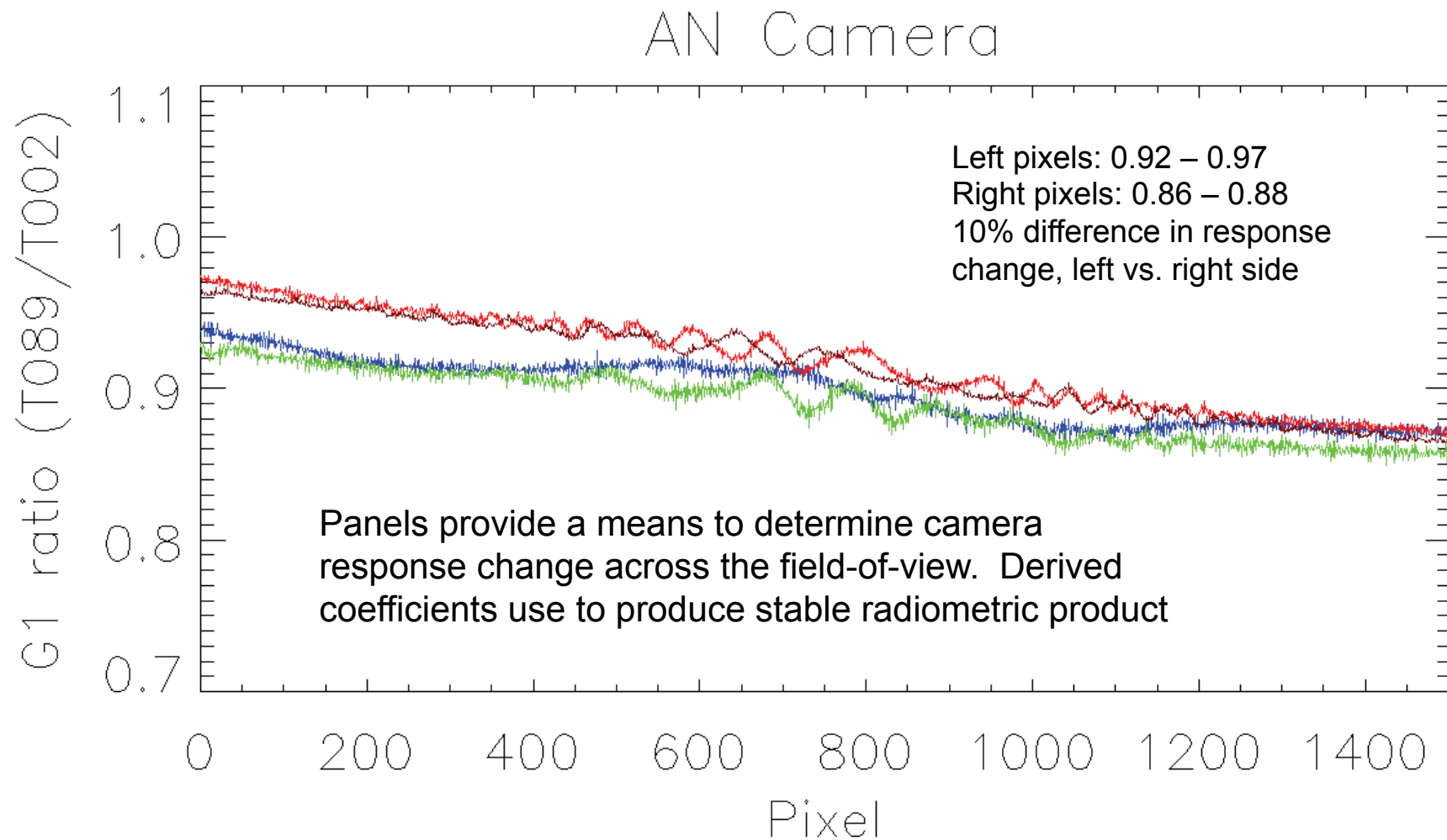
Photodiode detectors measure solar-reflected light from diffuse panels

- Removes requirement for diffuse-panel stability
- “PIN” photodiode design selected for radiation resistant properties
- High Quantum Efficiency (HQE) light-trap design chosen to provide multiple analysis pathways

On-board calibrator drift

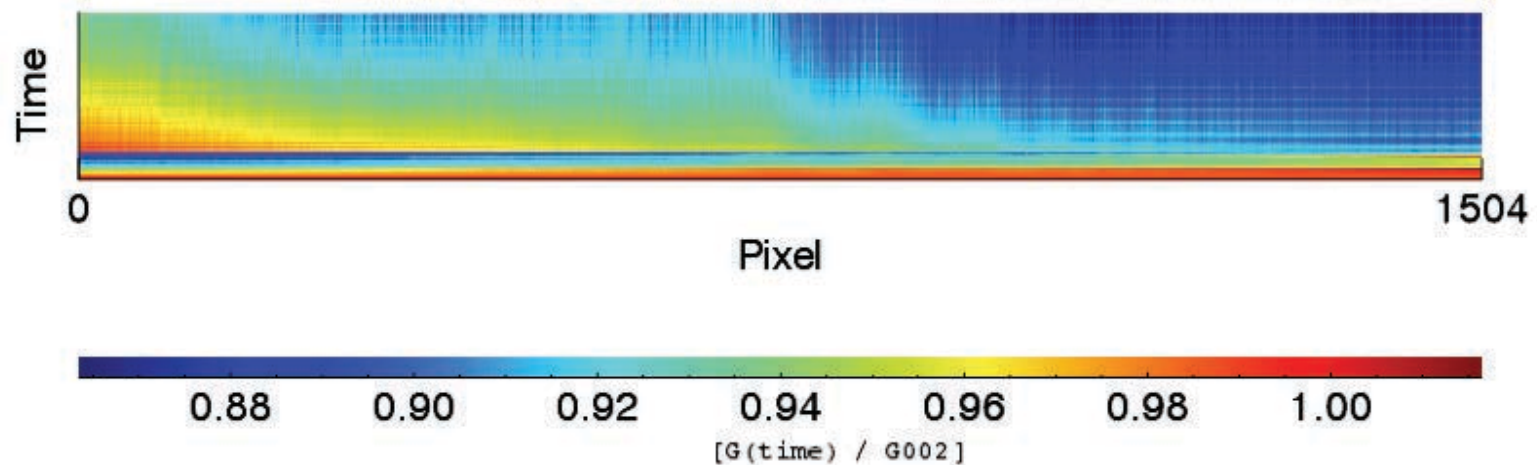


Camera response change to diffuse panel following 14 years on-orbit



Camera degradation with time

AN Camera Flat Field Response



Two Approaches

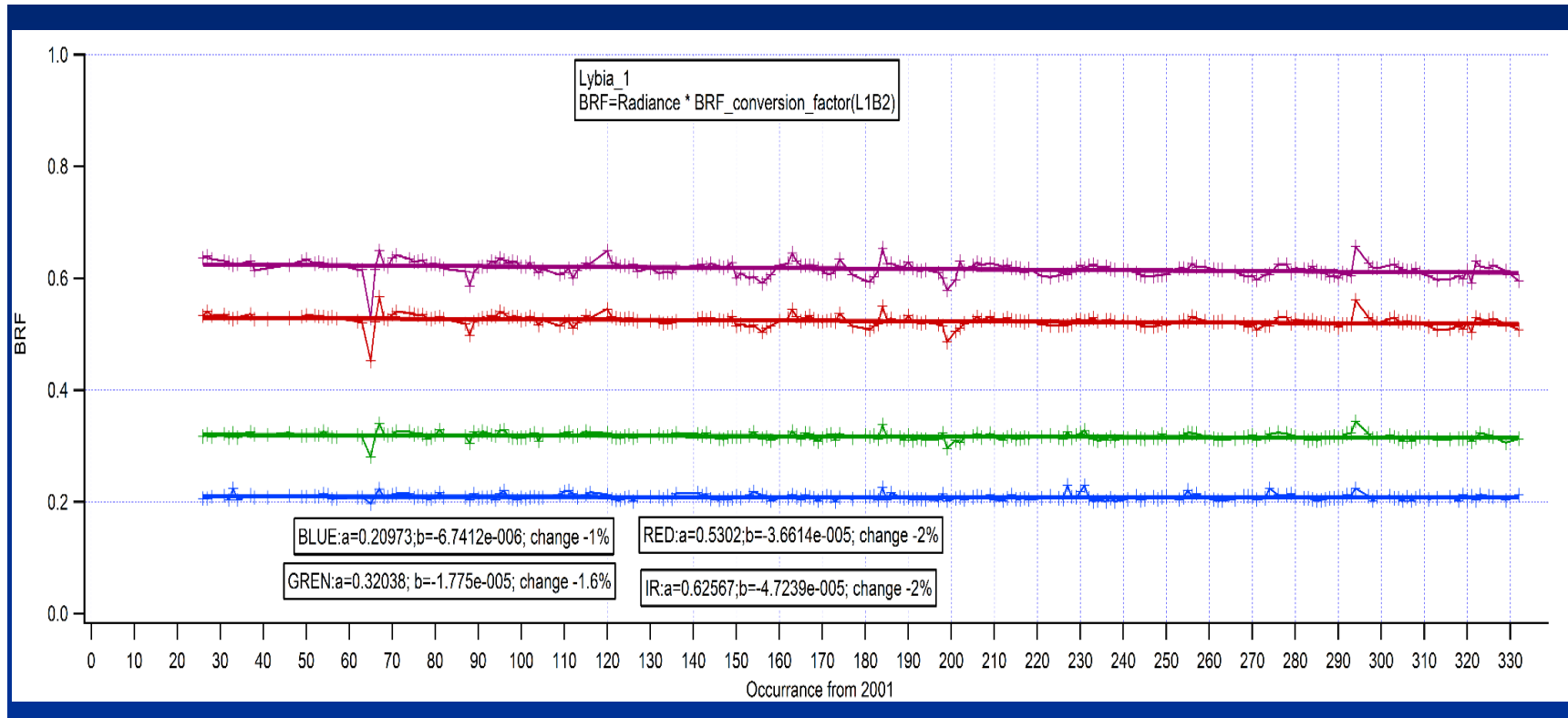
Localized target selection (JPL)

- Extract radiances, averaging 3x3 pixels around specified location
- Compute “equivalent reflectance” from normalizing radiance
$$\text{refl} = \text{radiance} * \pi * \text{earth_dist}^2 / [E_0 * \cos(\text{solar_zen})]$$
- De-seasonalize (account for surface BRF effects) by fitting integral number of years, compute slope

Regional analysis (GSFC)

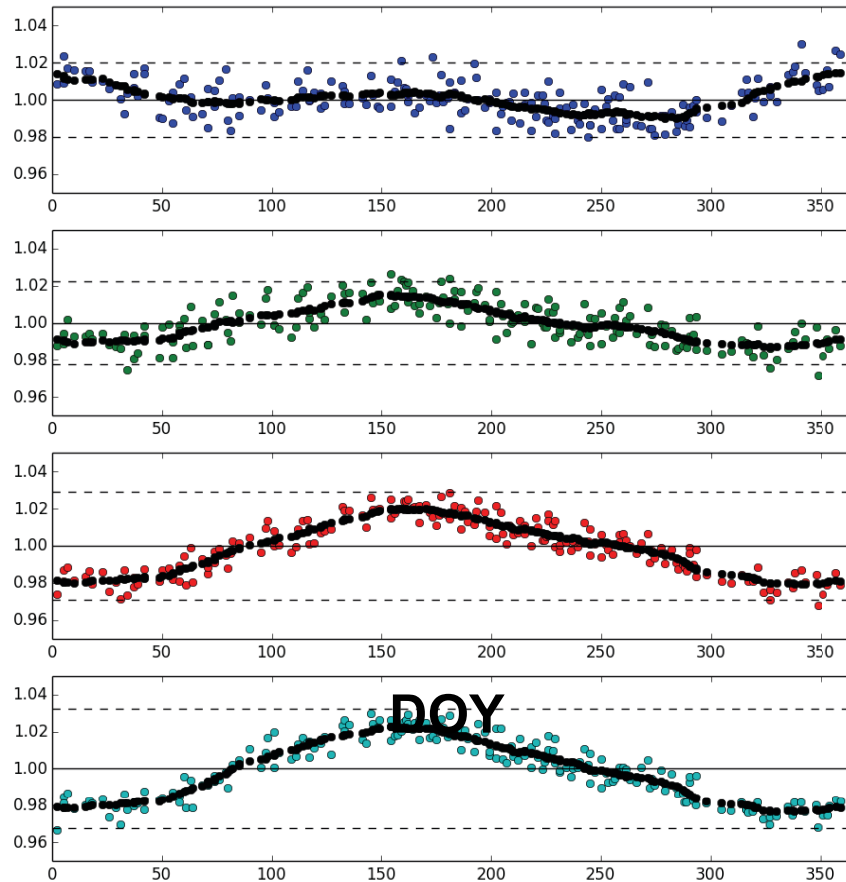
- For given target, search for most uniform 50 x 50 km sub-region
- Compute “equivalent reflectance” from normalizing radiance
- Compute average for each day-of-year where data available
- De-trend by subtracting linear trend line from data
- Fit polynomial to residuals (surface BRF effects)
- Subtract polynomial, add trend line back, compute slope

(JPL) Libya-1

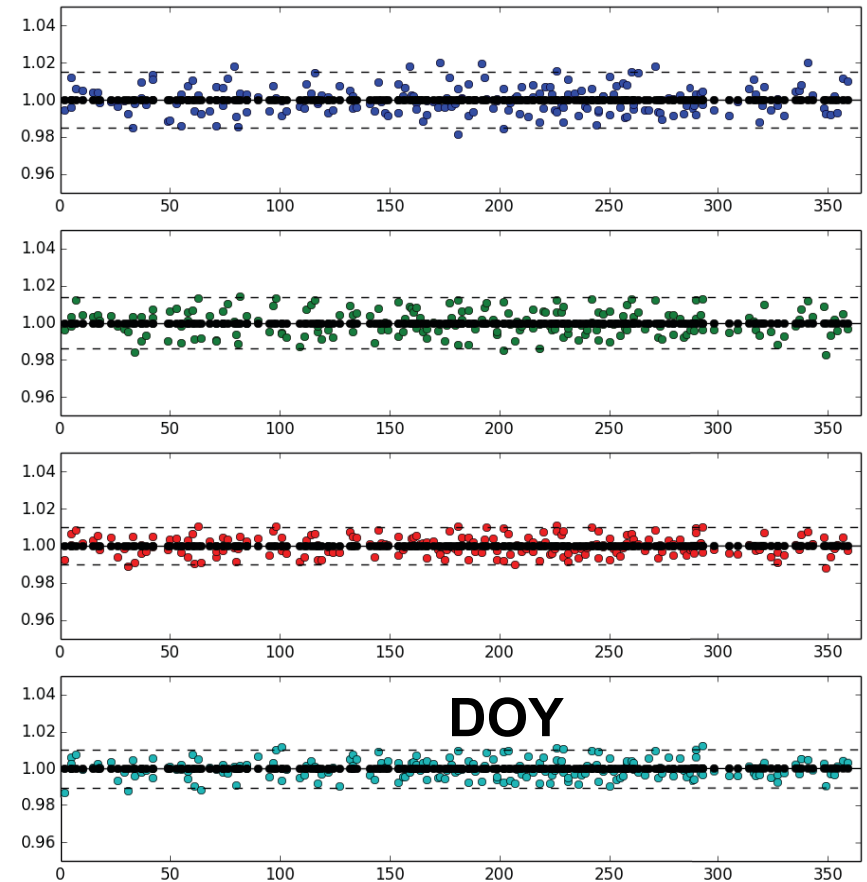


(GSFC) Libya 4 De-seasonalization example:

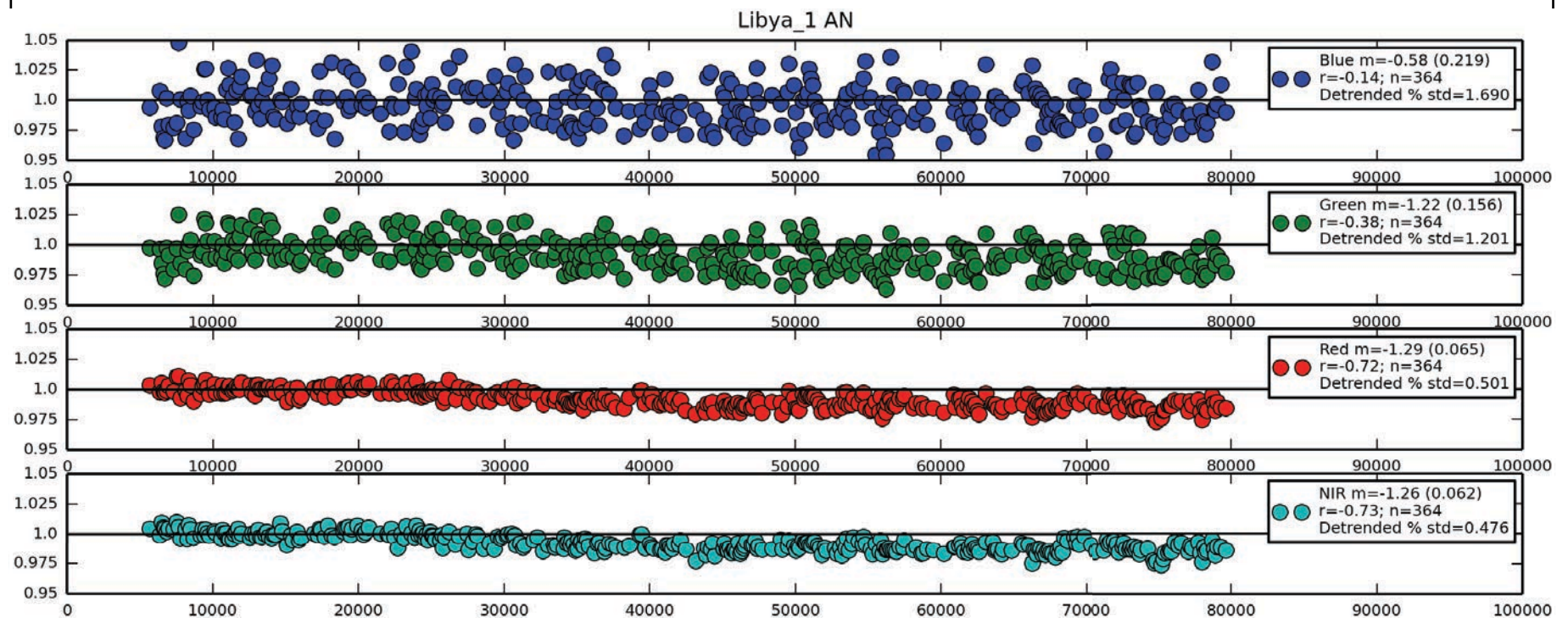
Before



After



(GSFC) Libya 1



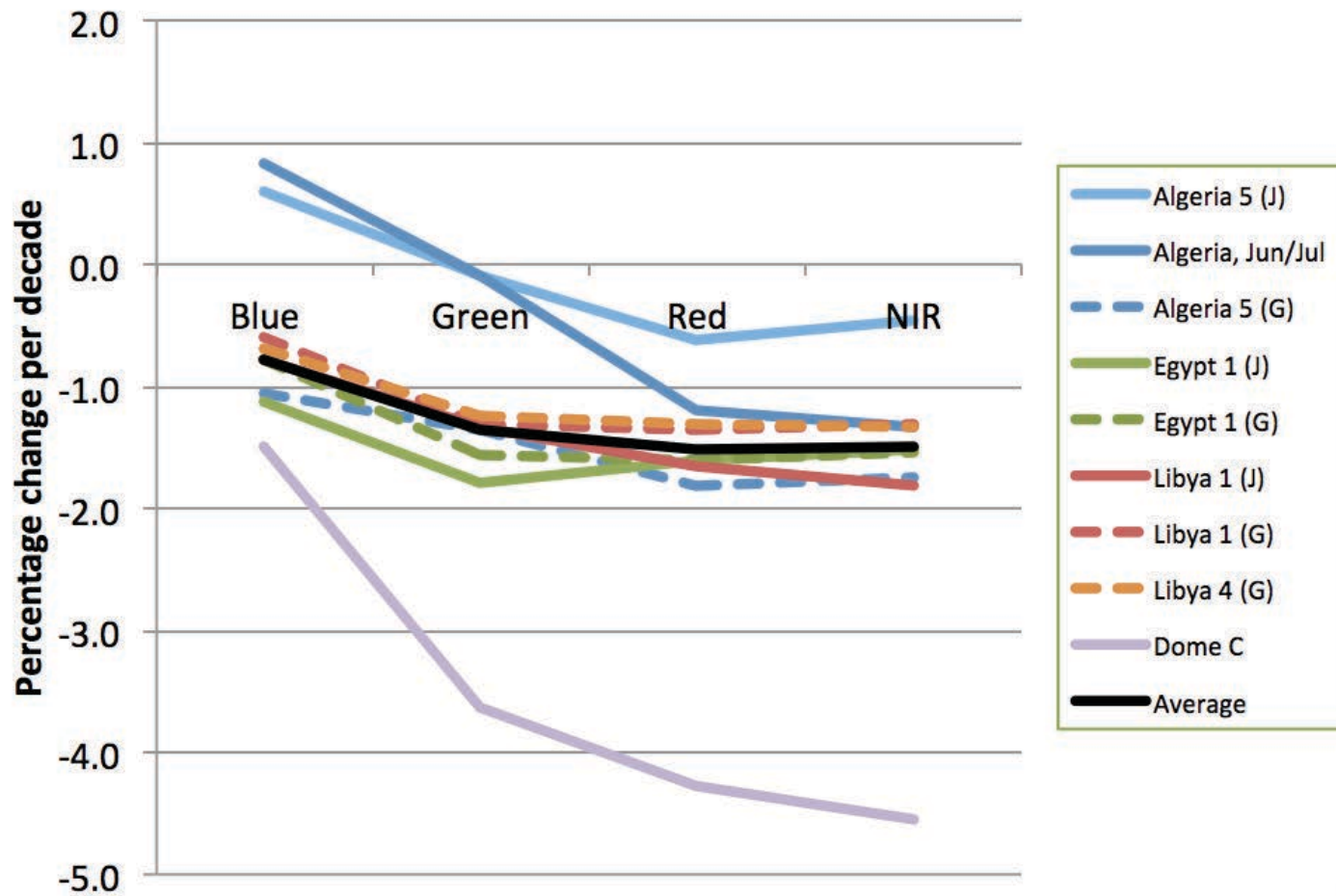
All Data, Mean Decadal Trend Values

Site	Egypt 1	Libya 1	Libya 4	Namib Desert	Algeria 5	Saudi Arabia	Taklimakan Desert	Dome C		
Latitude	26.62	24.73	28.77	-17.28	31.09	22.08	39.6	Paths 86-90		
Longitude	26.18	13.52	23.50	11.97	2.40	50.89	85.17	Block 152	Mean	Std
Blue	-0.80	-0.61	-0.66	-0.26	-0.67	1.46	1.13	0.19	-0.03	0.88
Green	-1.56	-1.27	-1.22	-1.39	-0.77	-0.50	-0.61	-1.18	-1.06	0.39
Red	-1.59	-1.32	-1.30	-1.65	-1.12	-1.38	-1.19	-1.40	-1.37	0.18
NIR	-1.53	-1.29	-1.35	-1.52	-1.11	-1.61	-1.26	-1.45	-1.39	0.17
#	446	366	410	568	182	424	678	198		

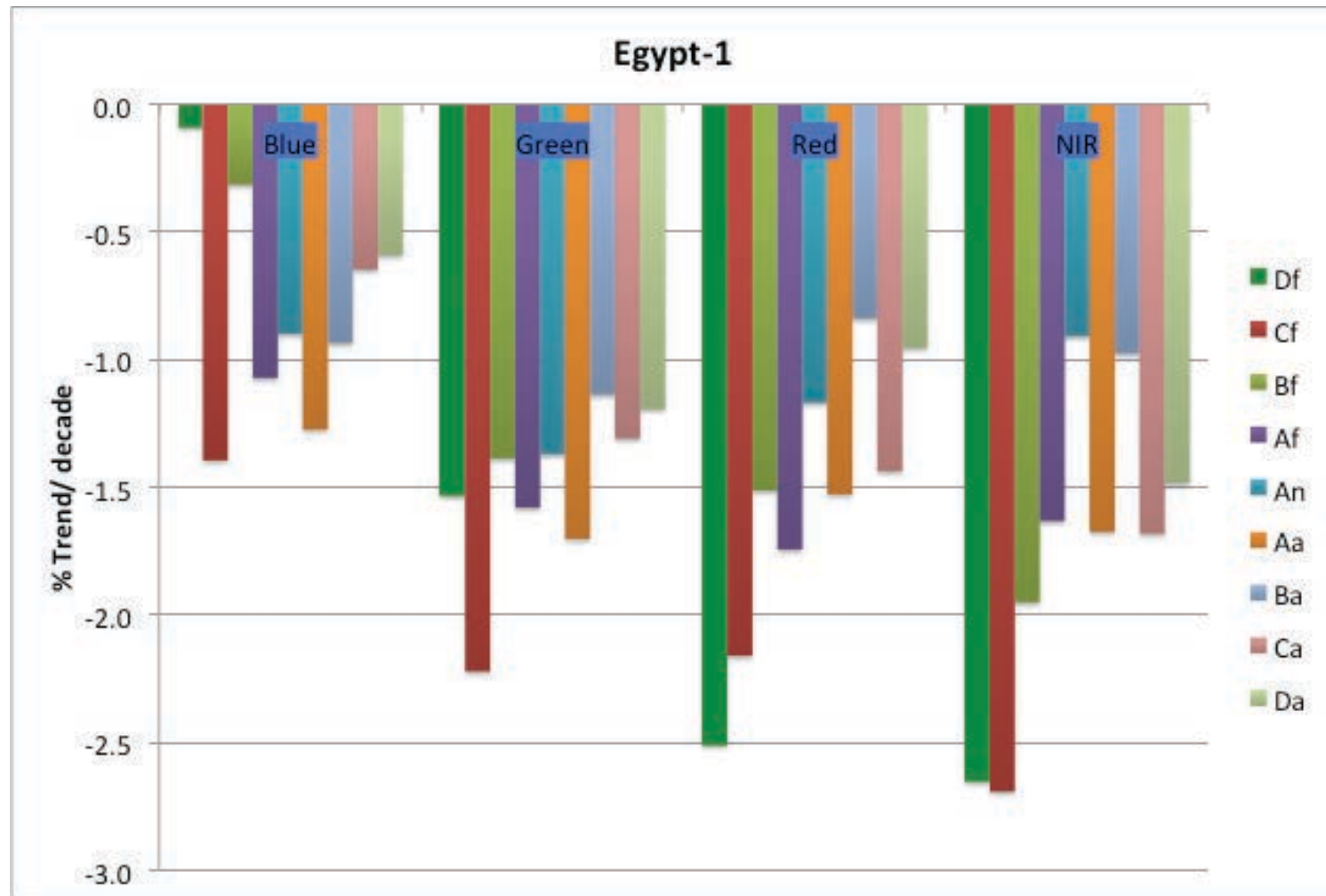
Site	Egypt 1	Libya 1	Libya 4	Namib Desert			
Latitude	26.62	24.73	28.77	-17.28			All Data
Longitude	26.18	13.52	23.50	11.97	Mean	Std	1st Order Poly
Blue	-0.80	-0.61	-0.66	-0.26	-0.58	0.23	-0.55
Green	-1.56	-1.27	-1.22	-1.39	-1.36	0.15	-1.37
Red	-1.59	-1.32	-1.30	-1.65	-1.47	0.18	-1.49
NIR	-1.53	-1.29	-1.35	-1.52	-1.42	0.12	-1.44
#	446	366	410	568			1790

Data seem inconsistent with other results, removing from analysis.

An Camera Stability



Per camera trends show Cf and Df to be largest



Uniformity study

This study will use MODIS Terra data to compare the uniformity of 9 sites

- All MODIS scenes were taken in June or July 2014. Note this might not be the optimum time for southern hemisphere sites, where there are winter conditions
- The MODIS 500 m product was used for the color images, and radiance with wavelength plot.
 - All images are 250 km width
- MODIS 250 m pixel data were used for the uniformity study, using Band 1, 645 nm center wavelength.
- The standard deviation of MODIS L1B data (top-of-atmosphere radiances) are plotted. This was computed over 9 pixels (750 m width), 25 pixels (1250 m), 225 pixels (3750 m), and 10^4 pixels (25 km).

Width:
78 km

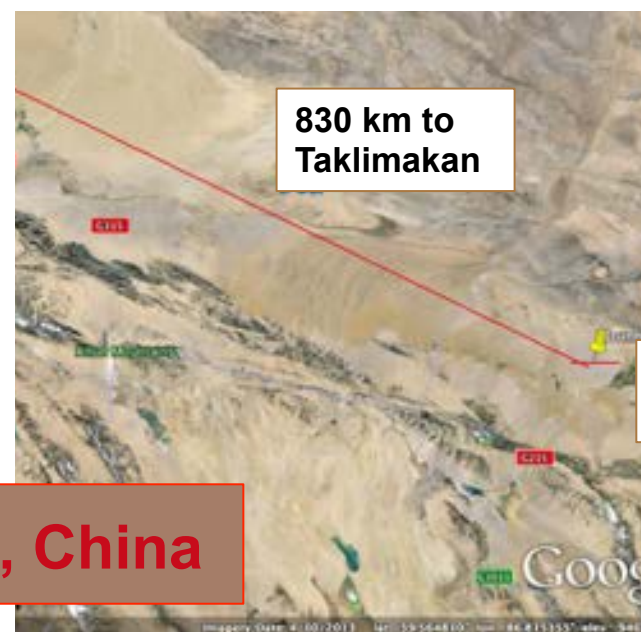


Bolivia Uyuni

Left: MODIS
Right: GE



Dunhuang, China



Width:
44 km

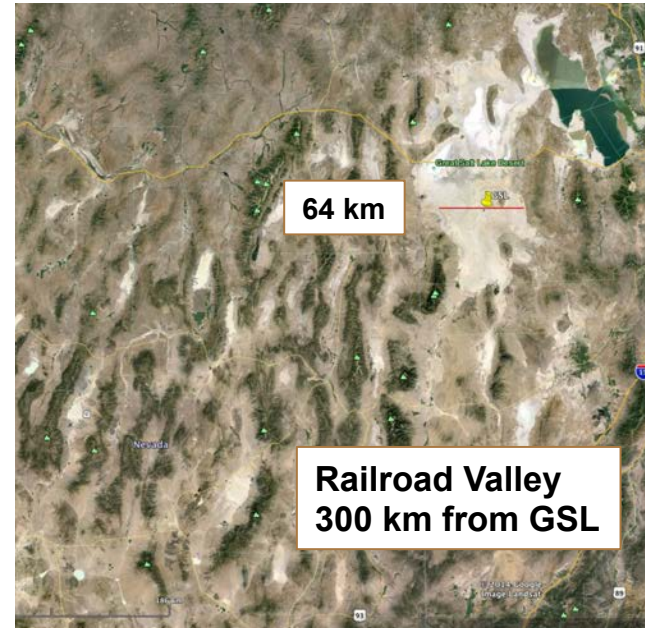
64 km

Great Salt Lake



64 km

**Railroad Valley
300 km from GSL**



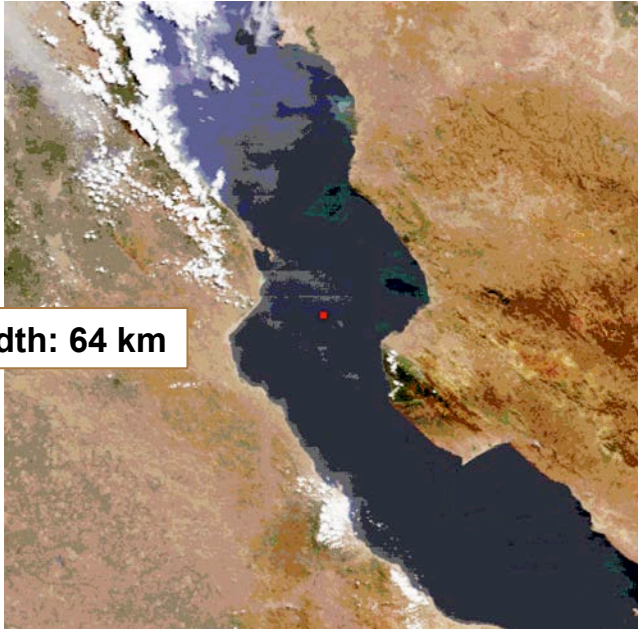
Lake Eyre



28 km

**Left: MODIS
Right: GE**

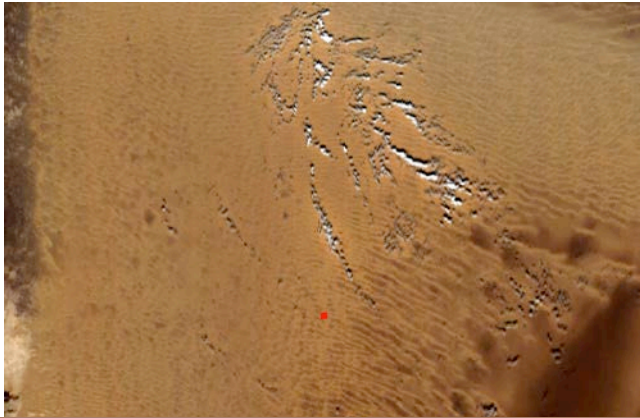




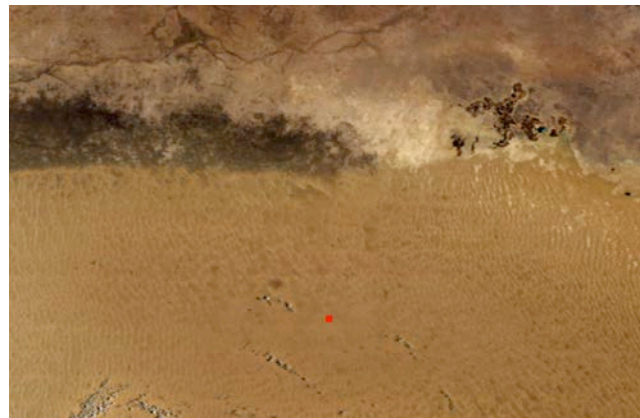
Width: 64 km

Lake Tanganyika, Zambia

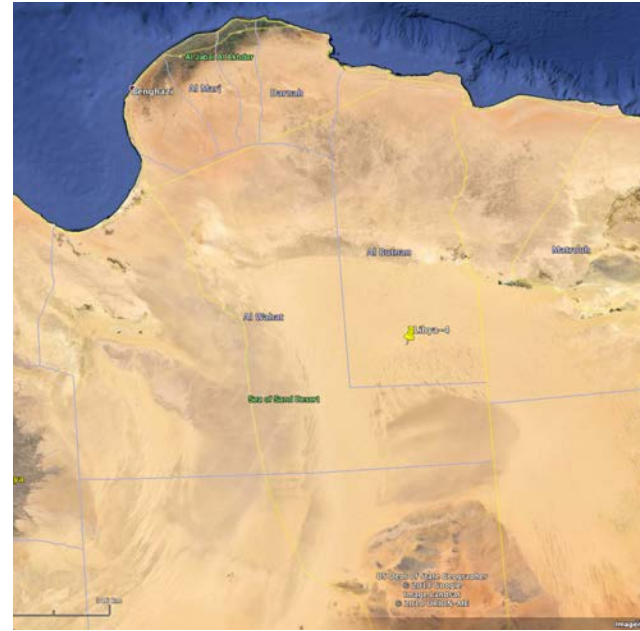




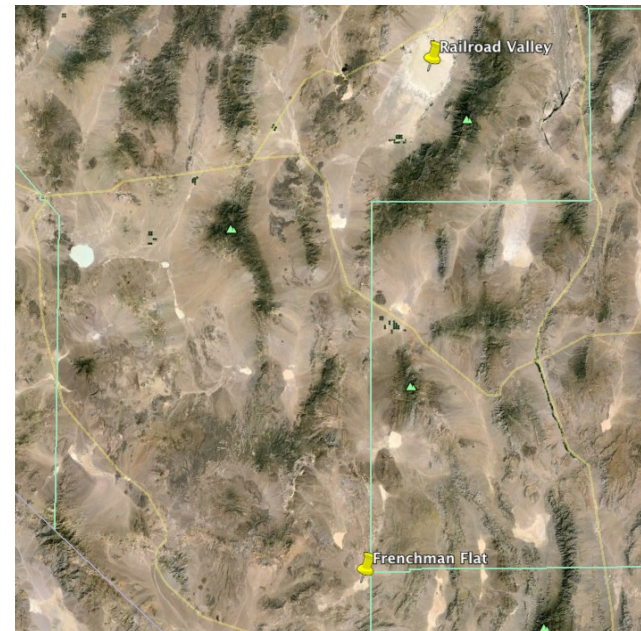
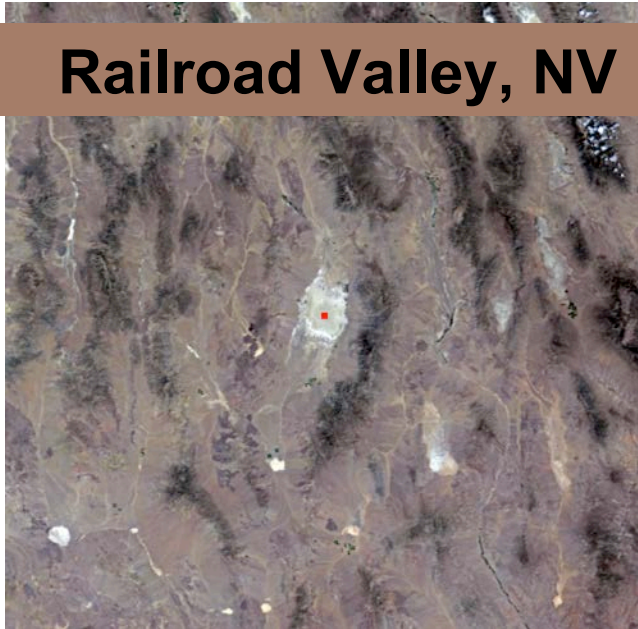
Libya-4



Libya



Railroad Valley, NV

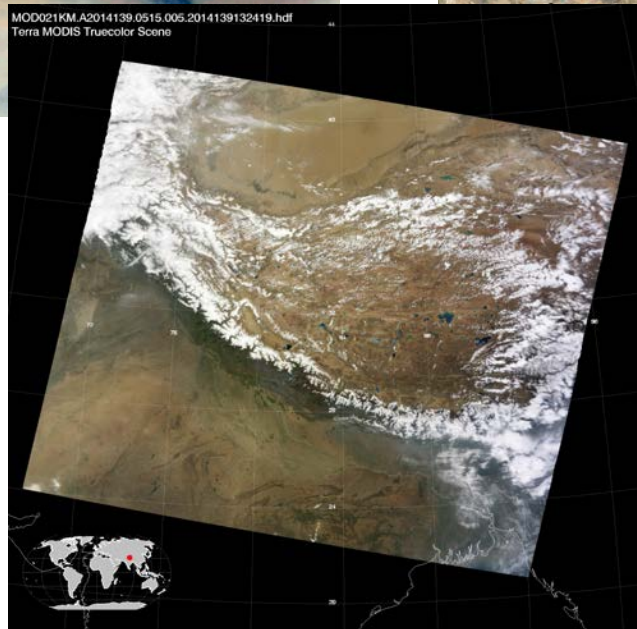
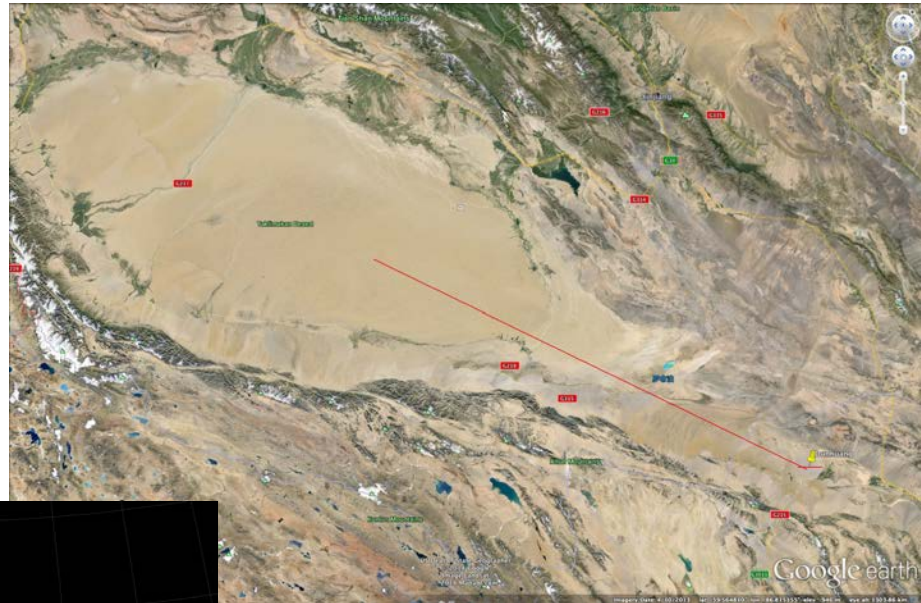
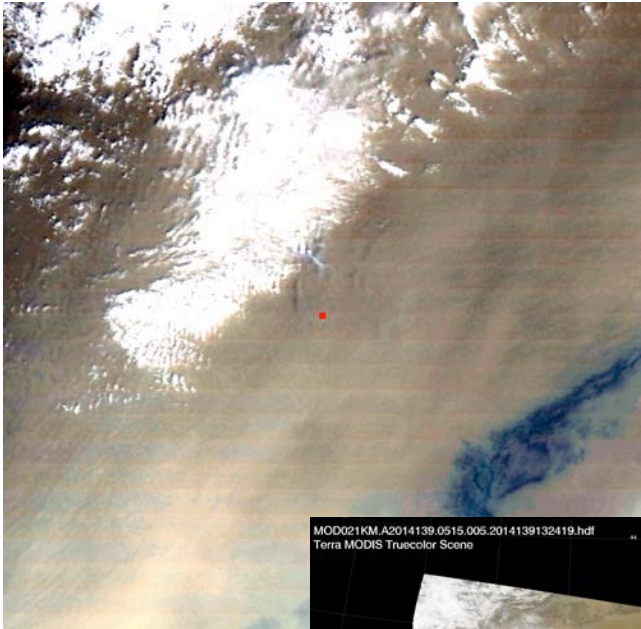


Sonoran Desert



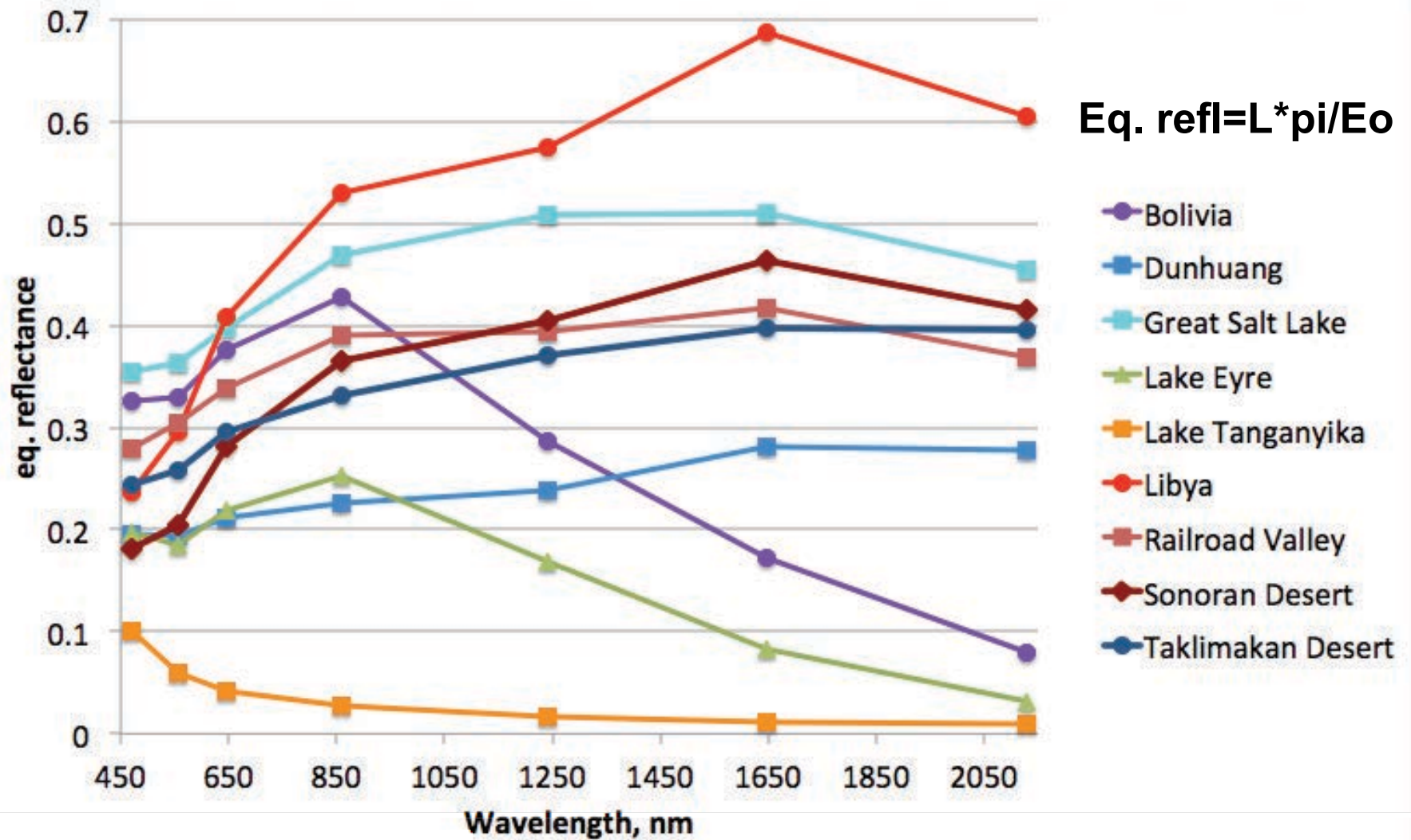
Width: 100 km

Taklimakan Desert

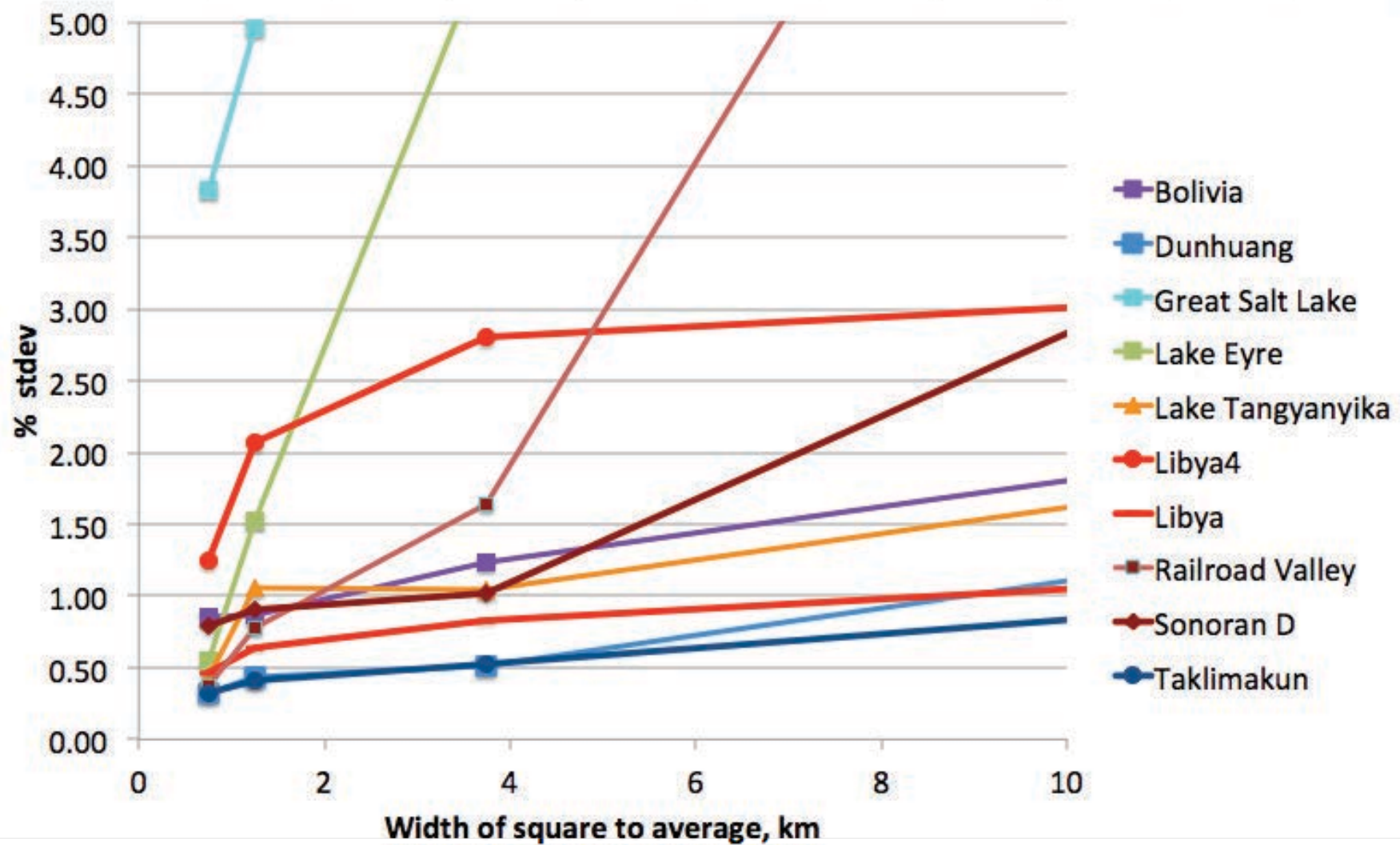


**Browsed 20 images –
all had clouds over
intended
site. Had to move site to
clear area.**

Radiance summary



Uniformity study



Site	Lat, Long	Width km	%std 750m	%std 25 km	MODIS info.
Bolivia, Uyuni	-20.088, -67.633	78	0.7	3.2	10Jun2014 (161), 14:45
Dunhuang, China	40.211, 94.208	44	0.3	2.5	28Jul2014 (209), 04:35
Great Salt Lake	40.396, -113.464	64	3.8	12.5	11Jun2014 (162), 18:30
Lake Eyre, Australia	-28.819, 137.559	28	0.5	16.	16Jun2014 (167), 01:00
Lake Tanganyika	-5.904, 29.551	67	0.4	3.0	24Jul2014 (205) 08:30
Libya	29.062, 23.840	100	0.5	1.6	14Jun2014 (165) 09:10
Railroad Valley, Nevada	38.477, -115.661	13			18Jun2014 (169) 18:35
Sonoran Desert	32.246, -114.717	100	0.8	7.1	11Jun2014 (162) 18:30
Taklimakan, China	39., 85.	>100	0.3	1.58	04Jun2014 (155) 05:15