LPGS-NLAPS Radiometric Comparison

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Disclaimer -- March 2004

This document was created in May 2002, using data from that era.

In March 2004, NLAPS changed their scaling so that their QCALMIN is now 1, duplicating the LPGS method.

That change makes this document obsolete. A new LPGS-NLAPS comparison will be available in spring/summer 2004.

Comparison Issues

Known Radiometric Differences:

- LPGS scales level 1 products to a range of 1-254 with values of 0 and 255 set aside to flag fill and high saturation, respectively. NLAPS scales images from 0 to 254, with a value of 0 DN used for both fill and the lowest radiance value in the scene.

- LPGS and NLAPS perform different sets of artifact corrections. This can cause minor, scene dependant differences in level 1 radiometry.

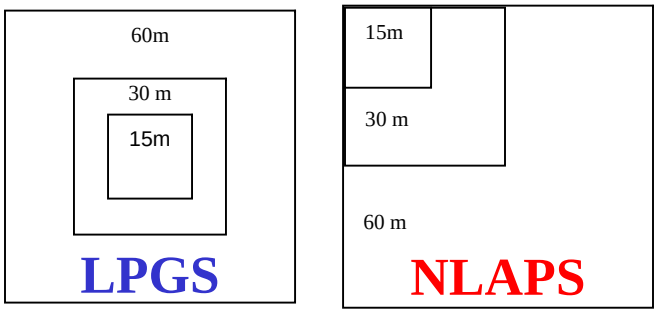
Known Geometric Differences:

- NLAPS trims the edge of ETM+ scenes. LPGS products contain all image data sampled, including the jagged scene edges and IC shutter intrusion at the end of each scan.

- 60 meter and 15 meter NLAPS and LPGS products have different image sizes. In general, the LPGS product contains one more line and sample than the corresponding NLAPS product for bands 6L, 6H, and 8.

- NLAPS and LPGS use different methods to align the bands. LPGS aligns the bands to the center of each pixel. NLAPS aligns bands to the edge of each pixel. This leads to differences in resampled product even if the resampling method were identical.

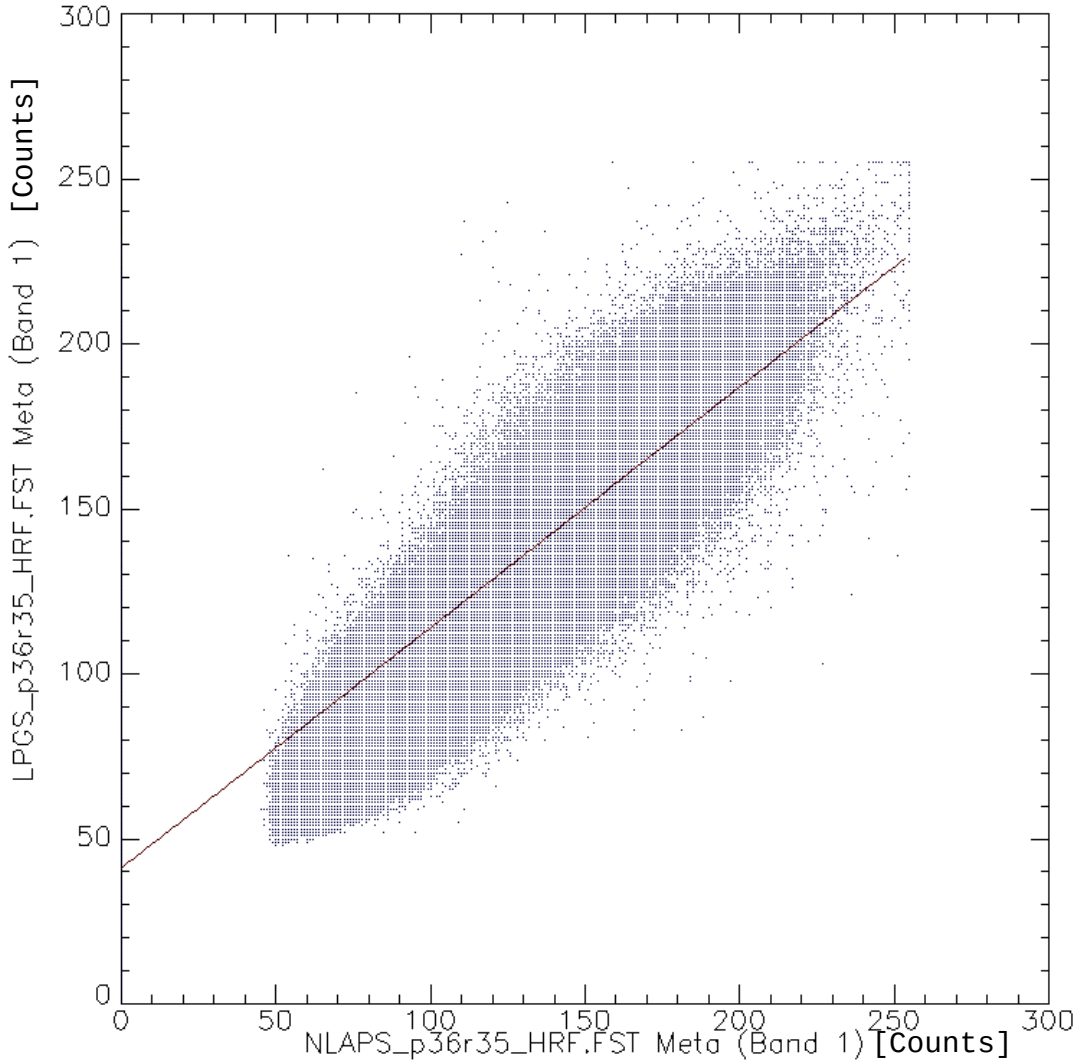
- NLAPS and LPGS resampling methods are not identical. Analysis of geometric differences by Mike Choate revealed that the two systems use different ephemeris files as well as different algorithms to process quaternion, gyro, and gyro drift data.



How <u>not</u> to compare L1 products

Plot is of LPGS L1 data versus NLAPS L1 data, over an entire scene. A chi-squared line fit was made to the data.

Because of geometric differences, edges in the scene cause large errors.

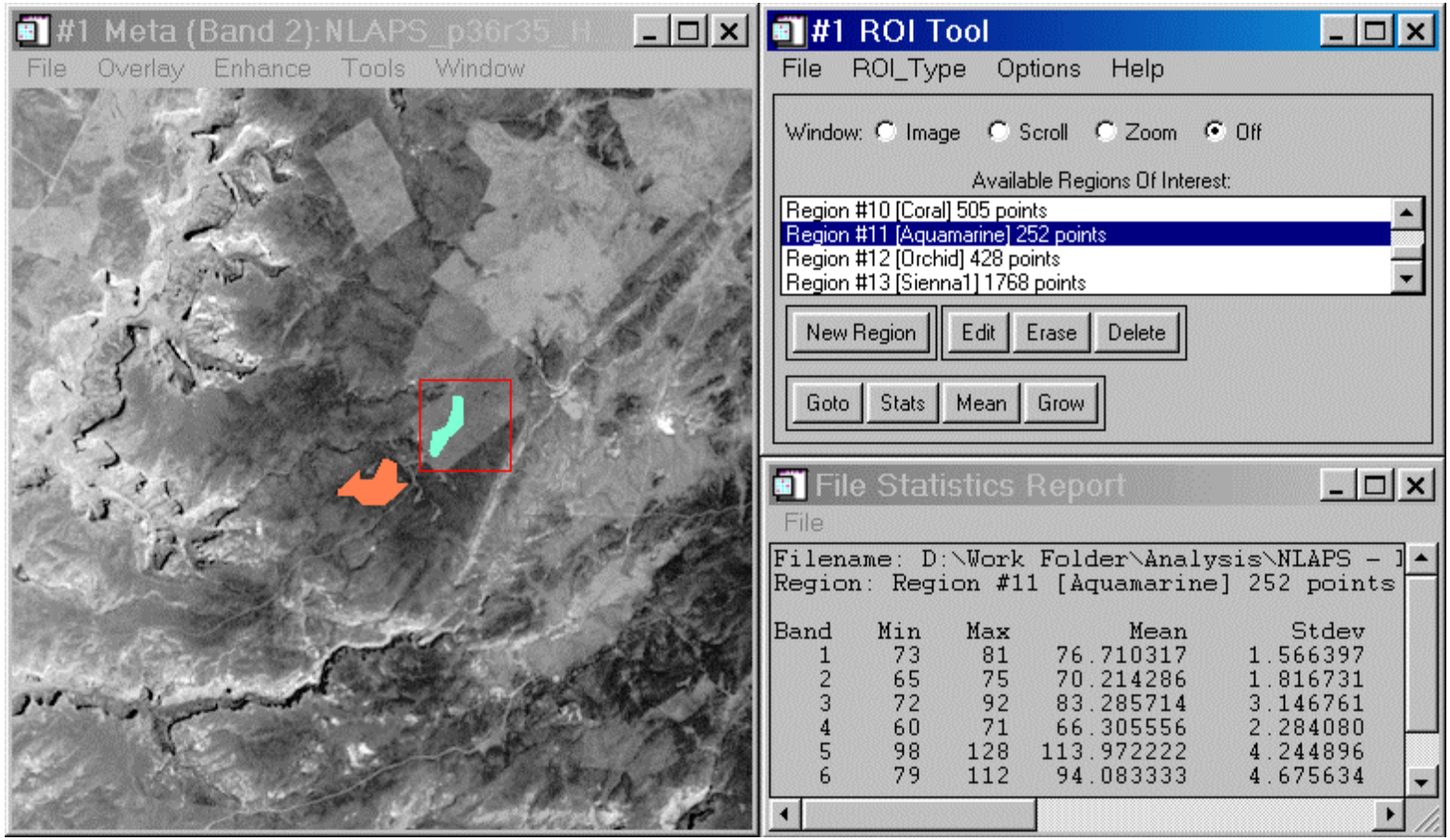


57817170 pixels in ROI (15361 unique)

Slope: 0.727895 +/- 0.00459866 Intercept: 41.2651 +/- 0.693093

Methodology used
in ESA report by Serge Riazanoff
GAEL-P041-RPT-002, 7/24/2001

Comparison Methodology



No Resampling or Rescaling

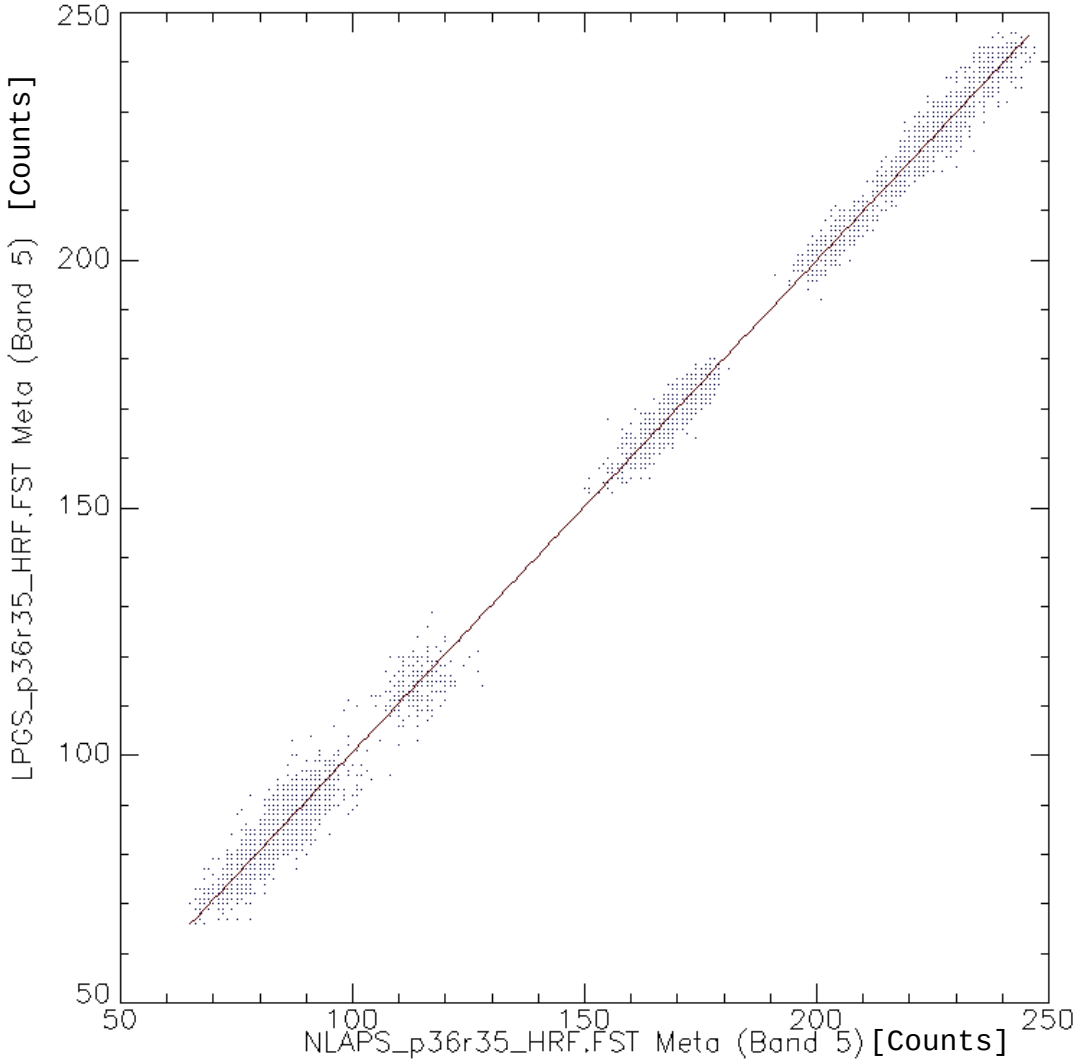
Cover dynamic range for all bands

10-20 homogenous Regions of Interest per scene

Standard deviation < 5 counts in all bands

Comparison Plots

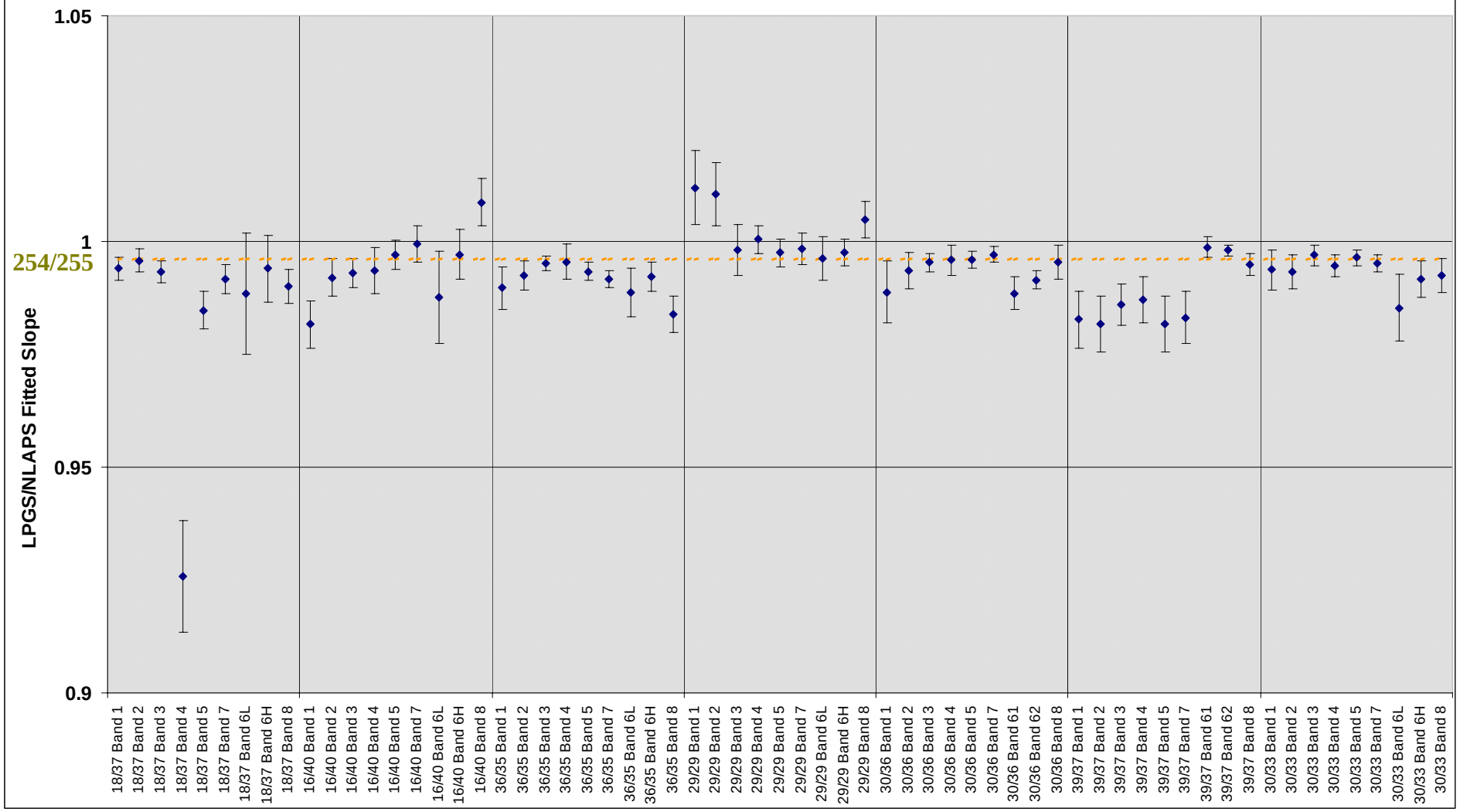
Plot is of LPGS L1 data versus NLAPS L1 data, over 13 regions of interest, each independently homogenous. A chi-squared line fit was made to the data.



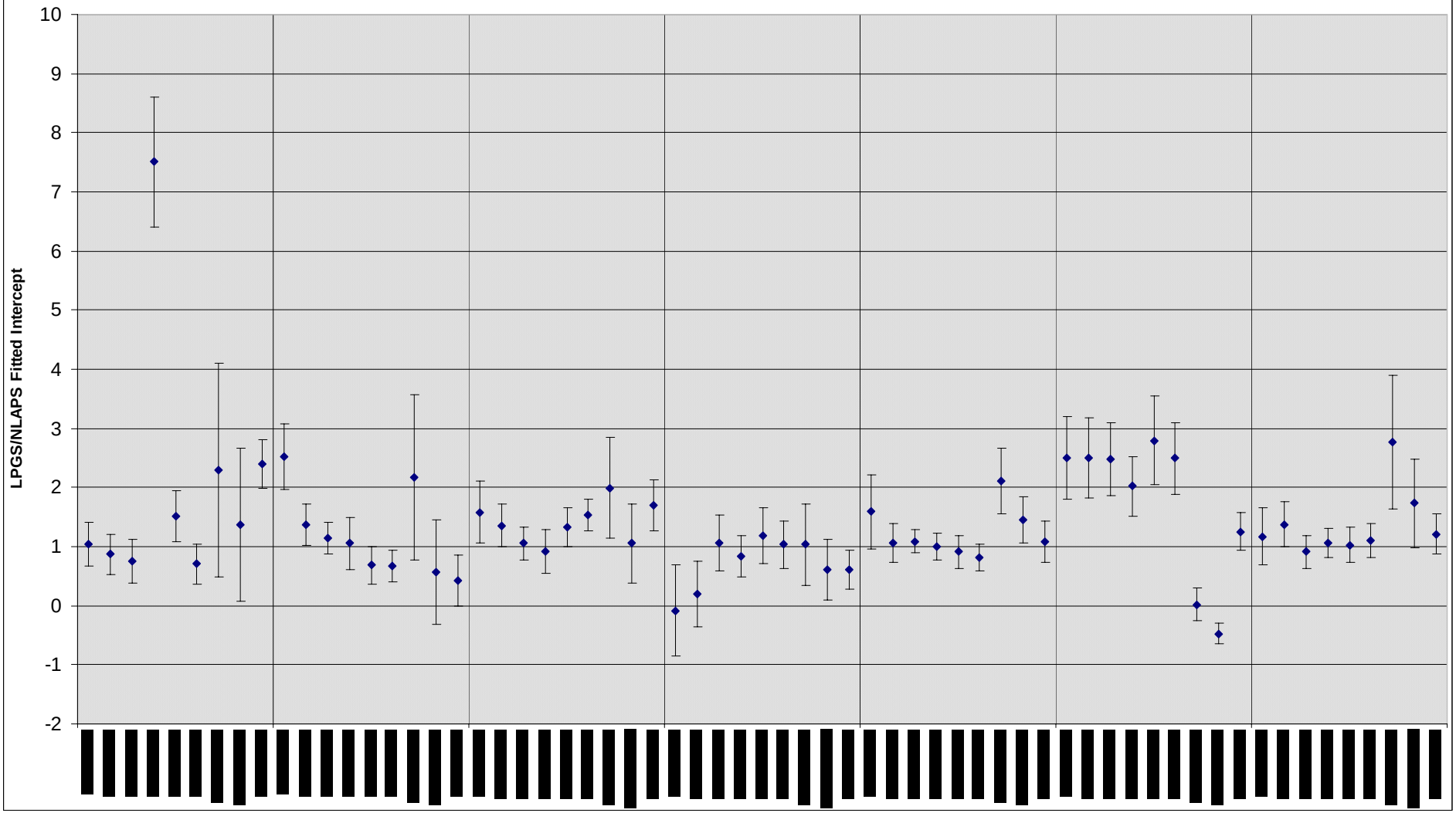
7279 pixels in ROI (1372 unique)

Slope: 0.993342 +/- 0.00197001 Intercept: 1.32884 +/- 0.328552

Fitted Slope Plot -- all bands



Fitted Intercept Plot -- all bands



Results

	Slope		Intercept		Number of samples	t value				t-test 95% confidence value
	Mean	Std. Dev.	Mean	Std. Dev.		Slope = 1	Slope = 254/255	Intercept = 0	Intercept = 1	
Band 1	0.9918	0.0055	1.4755	0.5742	7	3.9415	**2.0635**	6.7986	**2.1911**	2.4469
Band 2	0.9942	0.0044	1.2478	0.4246	7	3.5164	**1.1552**	7.7761	**1.5442**	2.4469
Band 3	0.9940	0.0031	1.2125	0.3508	7	5.1030	**1.7857**	9.1435	**1.6024**	2.4469
Band 4	0.9945	0.0038	1.1496	0.3575	6	3.5029	**0.9957**	7.8758	**1.0247**	2.5706
Band 5	0.9924	0.0032	1.3505	0.4118	7	6.3443	3.0723	8.6778	**2.2523**	2.4469
Band 6L	0.9905	0.0067	1.7682	0.9591	7	3.7277	**2.1892**	4.8779	**2.1193**	2.4469
Band 6H	0.9946	0.0038	0.9020	0.6681	7	3.8197	**1.0546**	3.5720	**0.3881**	2.4469
Band 7	0.9938	0.0031	1.1923	0.3427	7	5.2272	**1.9197**	9.2053	**1.4844**	2.4469
Band 8	0.9958	0.0039	1.2374	0.3732	7	2.8844	**0.2143**	8.7733	**1.6833**	2.4469
Reflective Bands	0.9934	0.0039	1.2743	0.4115	41	4.5112	**1.8269**	8.1924	**1.7636**	2.0211
Thermal Bands	0.9925	0.0052	1.3351	0.8136	14	3.7606	**1.7836**	4.3418	**1.0898**	2.1604
Pan Band	0.9958	0.0039	1.2374	0.3732	7	2.8844	**0.2143**	8.7733	**1.6833**	2.4469
All Bands	0.9935	0.0042	1.2839	0.4980	62	4.1277	**1.6453**	6.8210	**1.5083**	1.9996

Summary

- LPGS and NLAPS radiometry agree to within an average scaling factor of 0.65%.
- Maximum scaling factor was 1.8%.
- Known differences in processing account for 0.4%. These are corrected by converting to radiance units.

- The datasets analyzed are consistent with the expected gain ratio of 254/255 and bias of 1 DN.
- Net difference is most likely a systematic difference in gain, with LPGS scaling lower than NLAPS by 0.25%.

Further Questions

- NLAPS Anomalies / Resampling Problems

  -- Negative Radiances

  -- False Saturations

- Data is also consistent with scaling ratio of 253/255

  -- How is LPGS scaled? Is 255 reserved?