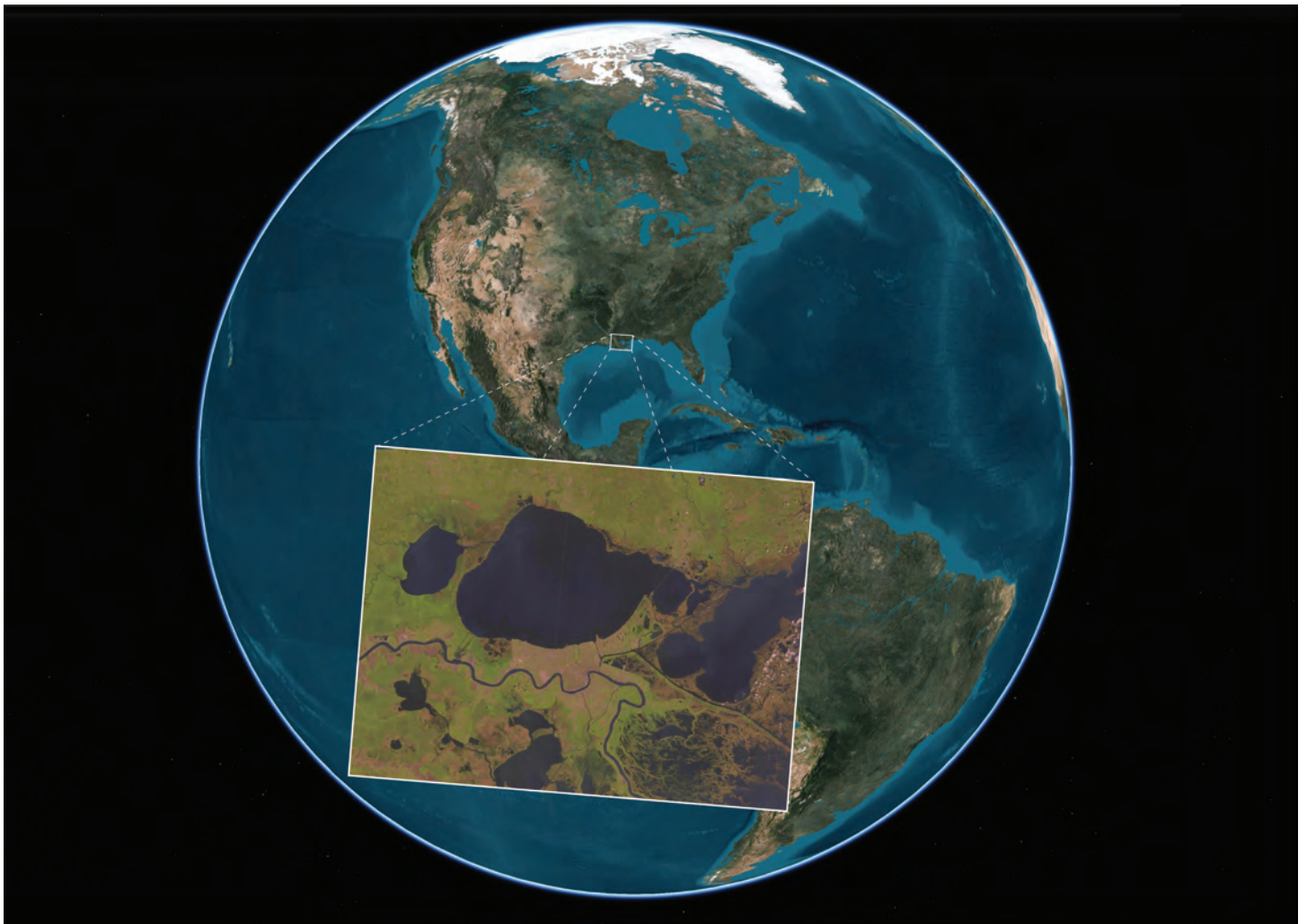


System Characterization Report on Resourcesat-2 Linear Imaging Self Scanning-3 (LISS-3) Sensor

Chapter H of
System Characterization of Earth Observation Sensors



Open-File Report 2021-1030-H
Version 1.2, December 2024

Cover: Image of Lake Pontchartrain and the coast of Louisiana captured by the Resourcesat-2 Linear Imaging Self Scanning-3 sensor. Image by the U.S. Geological Survey. Image of Earth from Analytical Graphics, Inc., Systems Tool Kit.

System Characterization Report on Resourcesat-2 Linear Imaging Self Scanning-3 (LISS-3) Sensor

By Shankar N. Ramaseri Chandra,¹ Jon Christopherson,¹ Cody Anderson,²
Gregory L. Stensaas,² and Minsu Kim¹

Chapter H of
System Characterization of Earth Observation Sensors

Compiled by Shankar N. Ramaseri Chandra¹

¹KBR, Inc., under contract to the U.S. Geological Survey.

²U.S. Geological Survey.

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Conversion Factors

International System of Units to U.S. customary units

Multiply	By	To obtain
	Length	
meter (m)	3.281	foot (ft)
meter (m)	1.094	yard (yd)

Abbreviations

ECCOE	EROS Cal/Val Center of Excellence
EROS	Earth Resources Observation and Science
EROSSC	EROS System Characterization
GSD	ground sample distance
JACIE	Joint Agency Commercial Imagery Evaluation
LISS-3	Linear Imaging Self Scanning-3
OLI	Operational Land Imager
RMSE	root mean square error
STDDEV	standard deviation
USGS	U.S. Geological Survey

System Characterization Report on Resourcesat-2 Linear Imaging Self Scanning-3 (LISS-3) Sensor

By Shankar N. Ramaseri Chandra,¹ Jon Christopherson,¹ Cody Anderson,² Gregory L. Stensaas,² and Minsu Kim¹

Executive Summary

This report addresses system characterization of the Indian Space Research Organisation Resourcesat-2 Linear Imaging Self Scanning-3 (LISS-3) sensor and is part of a series of system characterization reports produced and delivered by the U.S. Geological Survey Earth Resources Observation and Science Cal/Val Center of Excellence in 2021. These reports present and detail the methodology and procedures for characterization; present technical and operational information about the specific sensing system being evaluated; and provide a summary of test measurements, data retention practices, data analysis results, and conclusions.

Resourcesat-2 is a medium-resolution satellite launched in 2011 on the Polar Satellite Launch Vehicle-C16 launch vehicle. Resourcesat-2 carries the same sensing elements as Resourcesat-1 (launched in October 2003) and provides continuity for the mission. The objectives of the Resourcesat mission are to provide remote sensing data services to global users, focusing on data for integrated land and water resources management.

Resourcesat-2A is identical to Resourcesat-2 and was launched in 2016 on the Polar Satellite Launch Vehicle-C36 launch vehicle for continuity of data and improved temporal resolution. The two satellites operating in tandem improved the revisit capability from 5 days to 2–3 days. The Resourcesat-2 platform is of Indian Remote Sensing Satellites-1C/1D-P3 heritage and was built by the Indian Space Research Organisation. Resourcesat-2 and Resourcesat-2A carry the Advanced Wide Field Sensor and LISS-3, as well as the Linear Imaging Self Scanning-4 for medium-resolution imaging. More information on Indian Space Research Organisation satellites and sensors is available in the “2020 Joint Agency Commercial Imagery Evaluation—Remote Sensing Satellite Compendium” and from the manufacturer at <https://www.isro.gov.in/>.

The Earth Resources Observation and Science Cal/Val Center of Excellence system characterization team completed data analyses to characterize the geometric (interior and exterior), radiometric, and spatial performances. Results of these analyses indicate that LISS-3 has an interior geometric performance in the range of -4.620 (-0.154 pixel) to 13.230 meters (m ; 0.441 pixel) in easting and -12.360 (-0.412 pixel) to 1.500 m (0.050 pixel) in northing in band-to-band registration, an exterior geometric error of -27.805 (-0.927 pixel) to 26.578 m (0.886 pixel) in easting and -35.341 (-1.178 pixel) to -6.286 m (-0.210 pixel) in northing offset in comparison to the Landsat 8 Operational Land Imager, a radiometric performance in the range of -0.096 to 0.036 in offset and 0.585 – 0.946 in slope, and a spatial performance in the range of 1.87 – 1.95 pixels for full width at half maximum, with a modulation transfer function at a Nyquist frequency in the range of 0.045 – 0.070 .

Introduction

The Linear Imaging Self Scanning-3 (LISS-3) sensor onboard the Indian Space Research Organisation Resourcesat-2 satellite is a high-resolution land observation instrument consisting of four bands: green, red, near infrared, and shortwave infrared. Resourcesat-2 was launched in 2011, and an identical mission, Resourcesat-2A, was launched in 2016. The primary objectives for data acquired by LISS-3 include monitoring biomass, vegetation, land cover, leaf area index, and normalized difference vegetation index.

The data analysis results provided within this report have been derived from approved Joint Agency Commercial Imagery Evaluation (JACIE) processes and procedures. JACIE was formed to leverage resources from several Federal agencies for the characterization of remote sensing data and to share those results across the remote sensing community. More information about JACIE is available at https://www.usgs.gov/core-science-systems/eros/calval/jacie?qt-science_support_page_related_con=3#qt-science_support_page_related_con.

¹KBR, Inc., under contract to the U.S. Geological Survey.

²U.S. Geological Survey.

Purpose and Scope

The purpose of this report is to describe the specific sensor or sensing system, test its performance in three categories, complete related data analyses to quantify these performances, and report the results in a standardized document. In this chapter, the LISS-3 sensor is described. The performance of the system is limited to geometric, radiometric, and spatial analyses. The scope of the geometric assessment is limited to testing the interior alignments of spectral bands against each other and testing the exterior alignment in reference to the Landsat 8 Operational Land Imager (OLI).

The U.S. Geological Survey (USGS) Earth Resources Observation and Science (EROS) Cal/Val Center of Excellence (ECCOE) project, and the associated system characterization process used for this assessment, follows the USGS Fundamental Science Practices, which include maintaining data, information, and documentation needed to reproduce and validate the scientific analysis documented in this report. Additional information and guidance about Fundamental Science Practices and related resource information of interest to the public are available at <https://www.usgs.gov/about/organization/science-support/office-science-quality-and-integrity/fundamental-science-practices>. For additional information related to the report, please contact ECCOE at eccoe@usgs.gov.

System Description

This section describes the satellite and operational details for Resourcesat-2 and provides information about the LISS-3 sensor.

Satellite and Operational Details

The satellite and operational details of Resourcesat-2 are listed in [table 1](#).

Sensor Information

The spectral characteristics and the relative spectral response are listed in [table 2](#) and [figure 1](#), respectively.

Procedures

ECCOE has established standard processes to identify Earth observing systems of interest and to assess the geometric, radiometric, and spatial qualities of data products from these systems.

The assessment steps are as follows:

- system identification and investigation to learn the general specifications of the satellite and its sensor(s);
- data receipt and initial inspection to understand the characteristics and any overt flaws in the data product so that it may be further analyzed;
- geometry characterization, including interior geometric orientation measuring the relative alignment of spectral bands and exterior geometric orientation measuring how well the georeferenced pixels within the image are aligned to a known reference;
- radiometry characterization, including assessing how well the data product correlates with a known reference and, when possible, assessing the signal-to-noise ratio; and
- spatial characterization, assessing the two-dimensional fidelity of the image pixels to their projected ground sample distance (GSD).

Data analysis and test results are maintained at the USGS EROS Center by the ECCOE project.

Measurements

The observed USGS measurements are listed in [table 3](#). The mean of interior (band-to-band) and exterior (image-to-image) mean errors, standard deviation (STDDEV), and root mean square errors (RMSEs) are listed in meters (pixels). Details about the methodologies used are outlined in the “Analysis” section.

Table 1. Satellite and operational details for Resourcesat-2 Linear Imaging Self Scanning-3.

[kg, kilogram; NIR, near infrared; SWIR, shortwave infrared; W, watt; AH, amp hour; Ni-Cd, nickel-cadmium; Mbps, megabit per second; ~, about; km, kilometer; °, degree; min, minute; ±, plus or minus; lat., latitude; N/A, not applicable; m, meter; USGS, U.S. Geological Survey]

Product information	Resourcesat-2 Linear Imaging Self Scanning-3 data
	Satellite and operational information
Product name	Level 1T
Satellite name	Resourcesat-2
Sensor name(s)	Linear Imaging Self Scanning-3
Lift-off mass	1,206 kg
Instrument mass	106 kg
Sensor type	Multispectral, visible, and infrared (green, red, NIR, SWIR)
Scanning technique	Pushbroom; 6,000 detectors array
Power	Solar array generating 1,250 W at end of life; two 24 AH Ni-Cd batteries
Data rate	52.5 Mbps
Mission type	Global land-monitoring mission
Launch date	April 20, 2011
Number of satellites	2
Expected lifetime	~5 years
Operator	Indian Space Research Organisation
	Operational details
Operating orbit	Circular polar Sun synchronous
Orbital altitude range	817 km
Sensor angle altitude	98.7° inclination
Altitude and orbit control	Three-axis body stabilized using reaction wheels, magnetic torquers, and hydrazine thrusters
Orbit period	101.35 min
Imaging time	10:30 descending node
Geographic coverage	Land imaging ± 81.3° lat.
Temporal resolution	24 days
Temporal coverage	2011 to present
Imaging angles	N/A
Ground sample distance(s)	23.5 m
Data licensing	Free through USGS for the United States only
Data pricing	Free through USGS for the United States only
Product abstract	https://www.isro.gov.in/RESOURCESAT_2.html
Product locator	https://earthexplorer.usgs.gov/

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Table 2. Imaging sensor details for Resourcesat-2 Linear Imaging Self Scanning-3.

[The Resourcesat-2 Linear Imaging Self Scanning-3 (LISS-3) sensor has a swath width of 140 kilometers; μm , micrometer; m, meter; NIR, near infrared; SWIR, shortwave infrared]

Spectral band(s) details	Resourcesat-2 LISS-3			
	Lower band (μm)	Upper band (μm)	Radiometric resolution (bits)	Ground sample distance (m)
Band 2—green	0.52	0.59	10	23.5
Band 3—red	0.62	0.68	10	23.5
Band 4—NIR	0.77	0.86	10	23.5
Band 5—SWIR	1.55	1.70	10	23.5

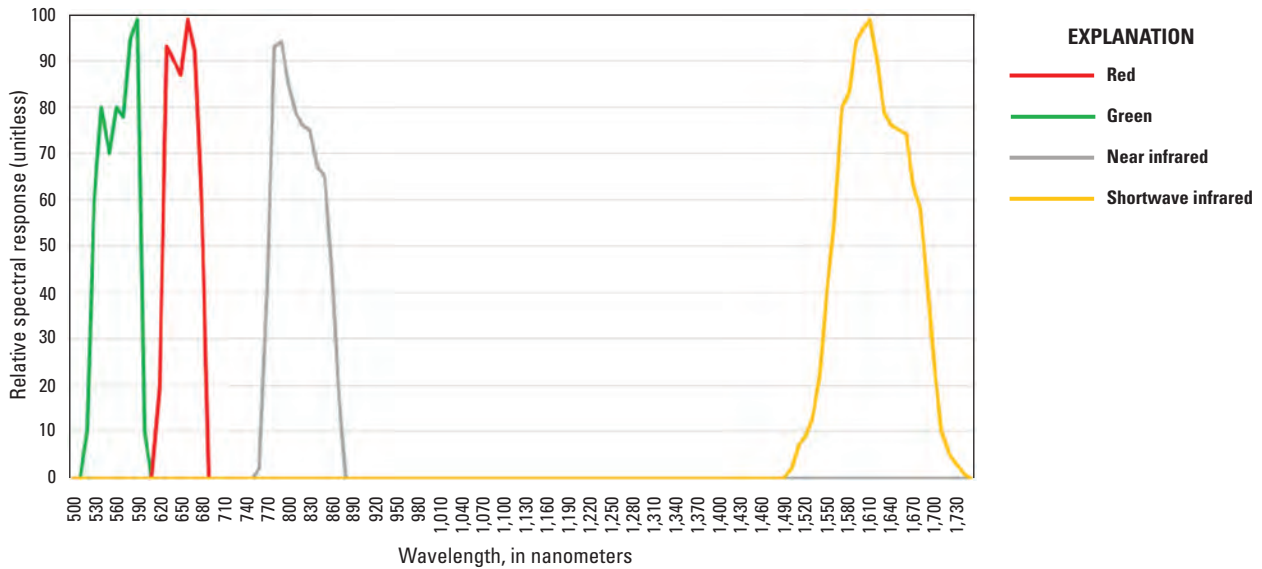


Figure 1. Resourcesat-2 Linear Imaging Self Scanning-3 relative spectral response.

Table 3. U.S. Geological Survey measurement results.

[USGS, U.S. Geological Survey; m, meter; RMSE, root mean square error; NIR, near infrared; SWIR, shortwave infrared; LISS-3, Resourcesat-2 Linear Imaging Self Scanning-3; L8 OLI, Landsat 8 Operational Land Imager; FWHM, full width at half maximum; MTF, modulation transfer function]

Description of product	Top of Atmosphere reflectance
USGS measurement results	
Geometric performance (easting, northing) in meters (pixels)	
Interior (band to band)	Band 2 (green) Mean: -4.620 to 13.230 m (-0.154 to 0.441), -12.360 to 0.510 m (-0.412 to 0.017) RMSE: 1.170 to 13.410 m (0.039 to 0.447), 1.530 to 12.450 m (0.051 to 0.415)
	Band 3 (red) Mean: -4.620 to 11.970 m (-0.154 to 0.399), -8.940 to 0.930 m (-0.298 to 0.031) RMSE: 1.170 to 12.390 m (0.039 to 0.413), 1.860 to 9.120 m (0.062 to 0.304)
	Band 4 (NIR) Mean: -4.080 to 13.230 m (-0.136 to 0.441), -9.660 to 1.500 m (-0.322 to 0.050) RMSE: 1.290 to 13.410 m (0.043 to 0.447), 1.530 to 9.810 m (0.051 to 0.327)
	Band 5 (SWIR) Mean: -4.620 to 11.970 m (-0.154 to 0.399), -12.360 to 1.500 m (-0.412 to 0.050) RMSE: 3.810 to 12.150 m (0.127 to 0.405), 3.990 to 12.450 m (0.133 to 0.415)
	Exterior (geometric location accuracy) Mean: -27.805 to 26.578 m (-0.927 to 0.886), -35.341 to -6.286 m (-1.178 to -0.210) RMSE: 0.348 to 0.939 m (10.434 to 28.177), 0.218 to 1.239 m (6.546 to 37.158)
Radiometric performance (offset, slope)	
Radiometric evaluation (linear regression—LISS-3 versus L8 OLI reflectance)	Band 2—Green (offset, slope): (0.022 to 0.029, 0.610 to 0.696)
	Band 3—Red (offset, slope): (0.015 to 0.025, 0.656 to 0.696)
	Band 4—NIR (offset, slope): (0.021 to 0.029, 0.590 to 0.658)
	Band 5—SWIR (offset, slope): (-0.096 to 0.036, 0.585 to 0.946)
Spatial performance	
Spatial performance measurement	Band 2—Green: FWHM = 1.96 pixels; MTF at Nyquist = 0.070
	Band 3—Red: FWHM = 1.88 pixels; MTF at Nyquist = 0.045
	Band 4—NIR: FWHM = 1.87 pixels; MTF at Nyquist = 0.050
	Band 5—SWIR: FWHM = 1.95 pixels; MTF at Nyquist = 0.045

Analysis

This section describes the geometric, radiometric, and spatial performance of LISS-3.

Geometric Performance

This geometric performance for LISS-3 is characterized in terms of the interior (band-to-band alignment) and exterior (geometric location accuracy) geometric analysis results.

Interior (Band to Band)

The band-to-band alignment analysis was completed using the EROS System Characterization (EROSCC) software on three separate images over the United States. Band combinations were registered against each other to determine the mean error, STDDEV, and RMSE, as listed in [table 4](#) with results represented in pixels at a 30-meter (m) GSD (the LISS-3 image was resampled to 30 m). Geometric error maps for each assessed band combination over the New Mexico image, as well as the corresponding histogram graphs, are shown in [figures 2–5](#). The geometric error maps indicate

the directional shift and relative magnitude of the shift, and the histogram and error distribution indicate frequency of observed mean error measurements within the image. Together, the interior and exterior geometric analysis results, as reported in the “Interior (Band to Band)” and “Exterior (Geometric Location Accuracy)” sections, provide a comprehensive assessment of geometric accuracy.

Exterior (Geometric Location Accuracy)

For this analysis, band 2 (green) of the LISS-3 data was compared against the corresponding band from three Landsat 8 OLI images over sites in the United States using the EROSSC software. Conjugate points in the reference and search images were identified automatically and refined using similarity measures such as normalized cross-correlation metrics, and the mean error, STDDEV, and RMSE results are listed in [table 5](#) with results represented in pixels (and meters) at a 30-m GSD (LISS-3 was resampled to 30 m). For each of the three images, geometric error maps showing the directional shift and relative magnitude of the shift, when compared with the Landsat 8 OLI, along with the corresponding histogram and error distribution, are provided in [figures 6–11](#). The Landsat 8 OLI imagery had a control uncertainty of about 8 m.

Table 4. Band-to-band registration error (in pixels).

[ID, identifier; STDDEV, standard deviation; RMSE, root mean square error]

Scene ID (location)	Band combination	Mean error (easting)	Mean error (northing)	STDDEV (easting)	STDDEV (northing)	RMSE (easting)	RMSE (northing)
R2LS310212018267036_L1T (Fargo, North Dakota)	Band 2–band 3	0.003	0.001	0.039	0.062	0.039	0.062
	Band 2–band 4	–0.000	–0.001	0.043	0.051	0.043	0.051
	Band 2–band 5	–0.139	–0.293	0.053	0.078	0.149	0.303
	Band 3–band 4	–0.004	–0.009	0.057	0.065	0.057	0.065
	Band 3–band 5	–0.0153	–0.298	0.078	0.060	0.172	0.304
	Band 4–band 5	–0.136	–0.322	0.039	0.056	0.141	0.327
R2LS305022018295036_L1T (Maine)	Band 2–band 3	0.017	–0.015	0.049	0.084	0.052	0.085
	Band 2–band 4	–0.049	0.017	0.118	0.146	0.128	0.146
	Band 2–band 5	–0.154	–0.051	0.130	0.123	0.201	0.133
	Band 3–band 4	–0.065	0.031	0.118	0.175	0.134	0.177
	Band 3–band 5	–0.154	–0.098	0.142	0.117	0.209	0.152
	Band 4–band 5	0.000	0.050	0.173	0.186	0.173	0.192
R2LS305152019264046_L1T (New Mexico)	Band 2–band 3	–0.021	–0.194	0.053	0.068	0.057	0.205
	Band 2–band 4	0.441	–0.241	0.071	0.104	0.447	0.262
	Band 2–band 5	0.367	–0.412	0.054	0.055	0.371	0.415
	Band 3–band 4	0.395	0.003	0.123	0.073	0.413	0.071
	Band 3–band 5	0.399	–0.212	0.073	0.083	0.405	0.228
	Band 4–band 5	–0.122	–0.285	0.037	0.057	0.127	0.291

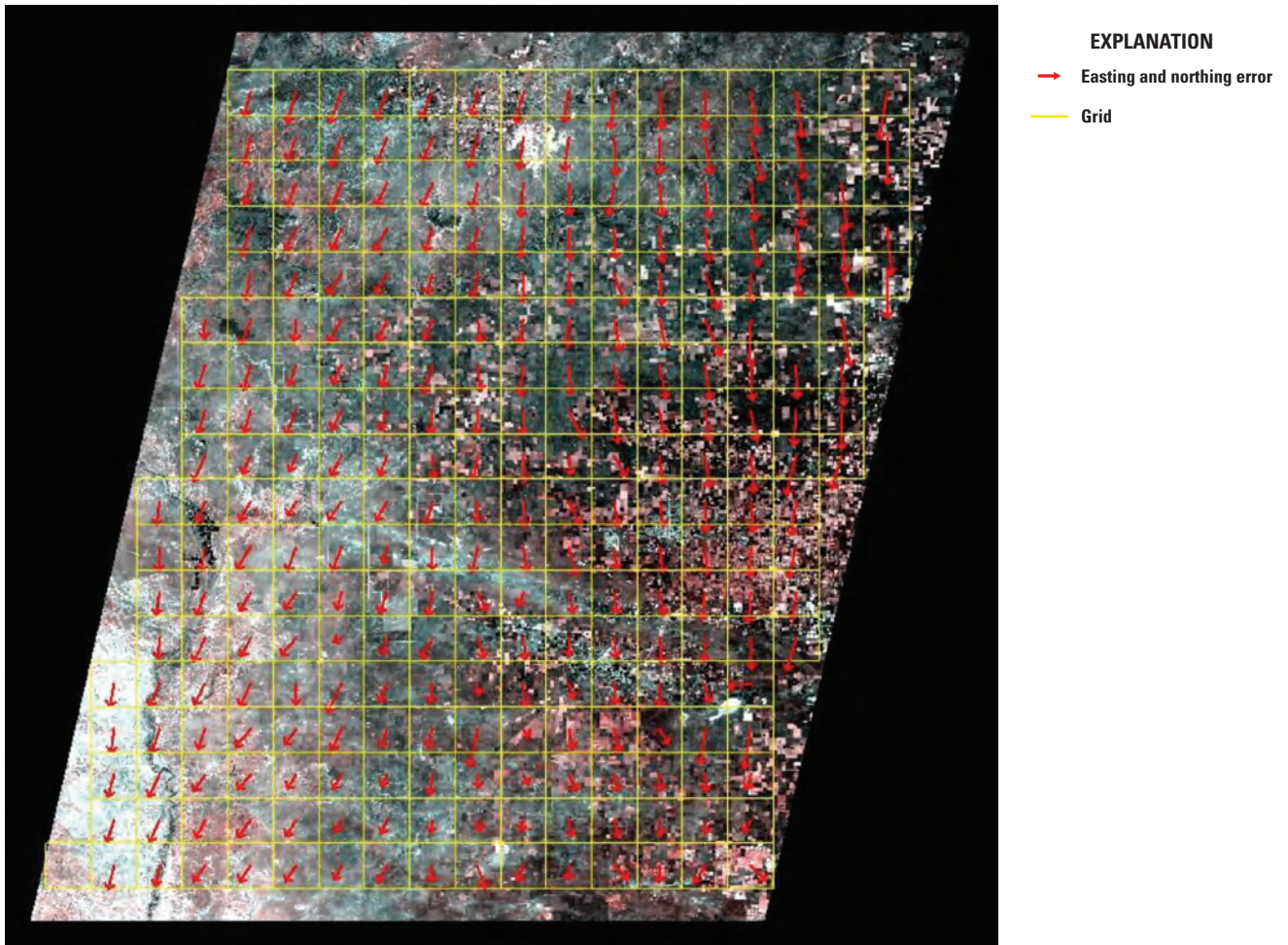


Figure 2. Band 2 (green) to band 3 (red) geometric error map for New Mexico.

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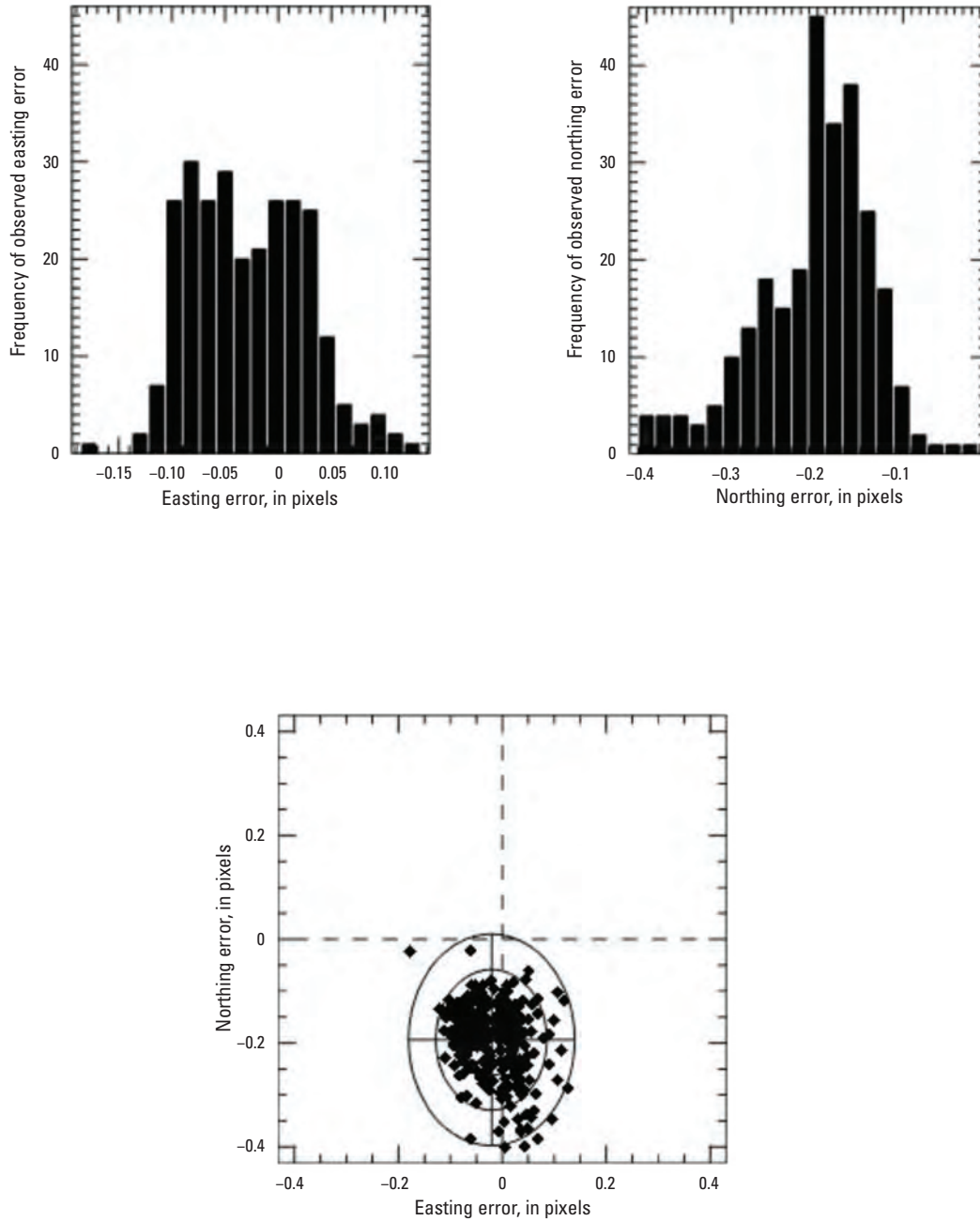


Figure 3. Band 2 (green) to band 3 (red) geometric error histogram (upper) and error distribution (lower) for New Mexico.

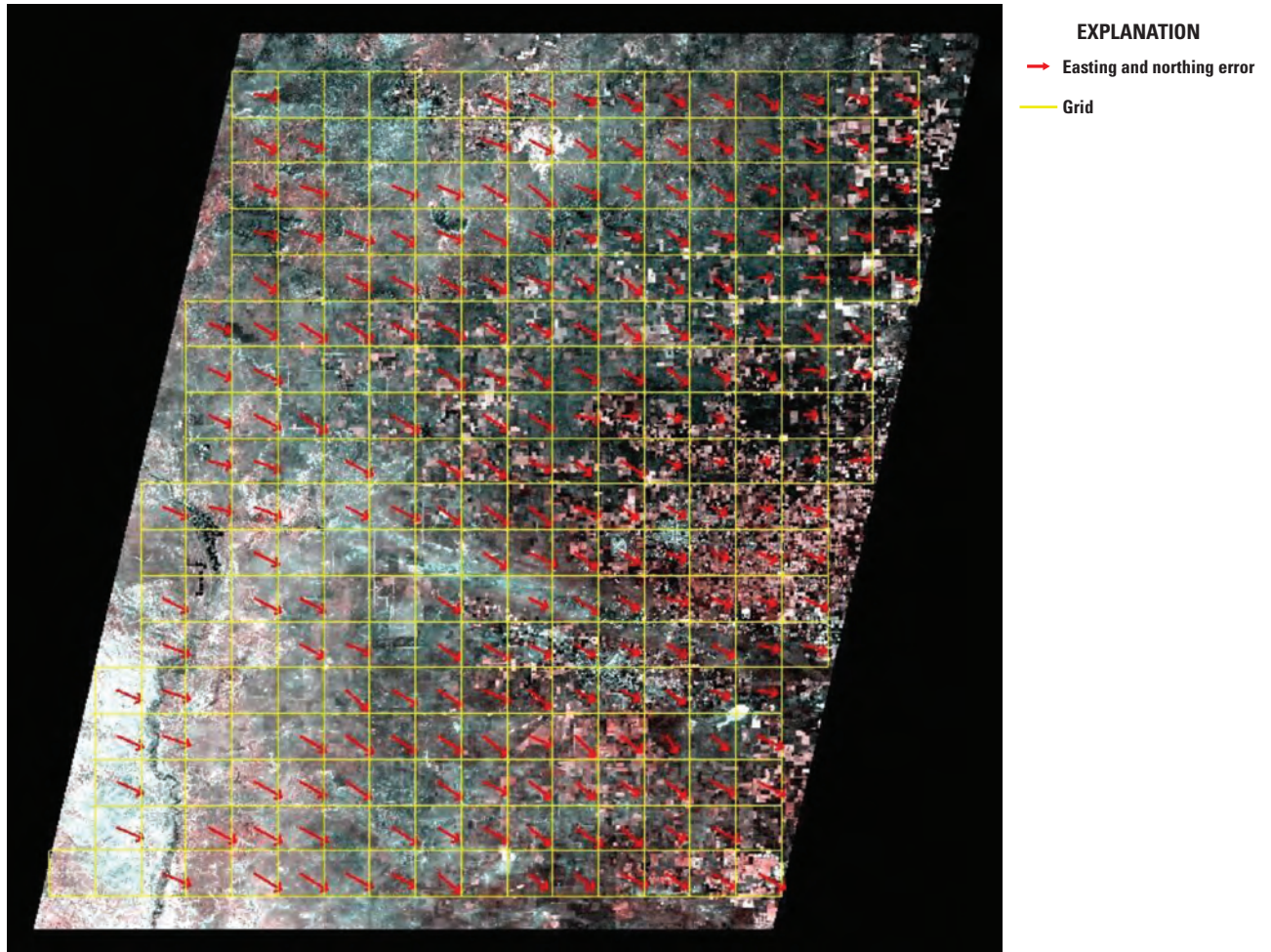


Figure 4. Band 3 (red) to band 5 (shortwave infrared) geometric error map for New Mexico.

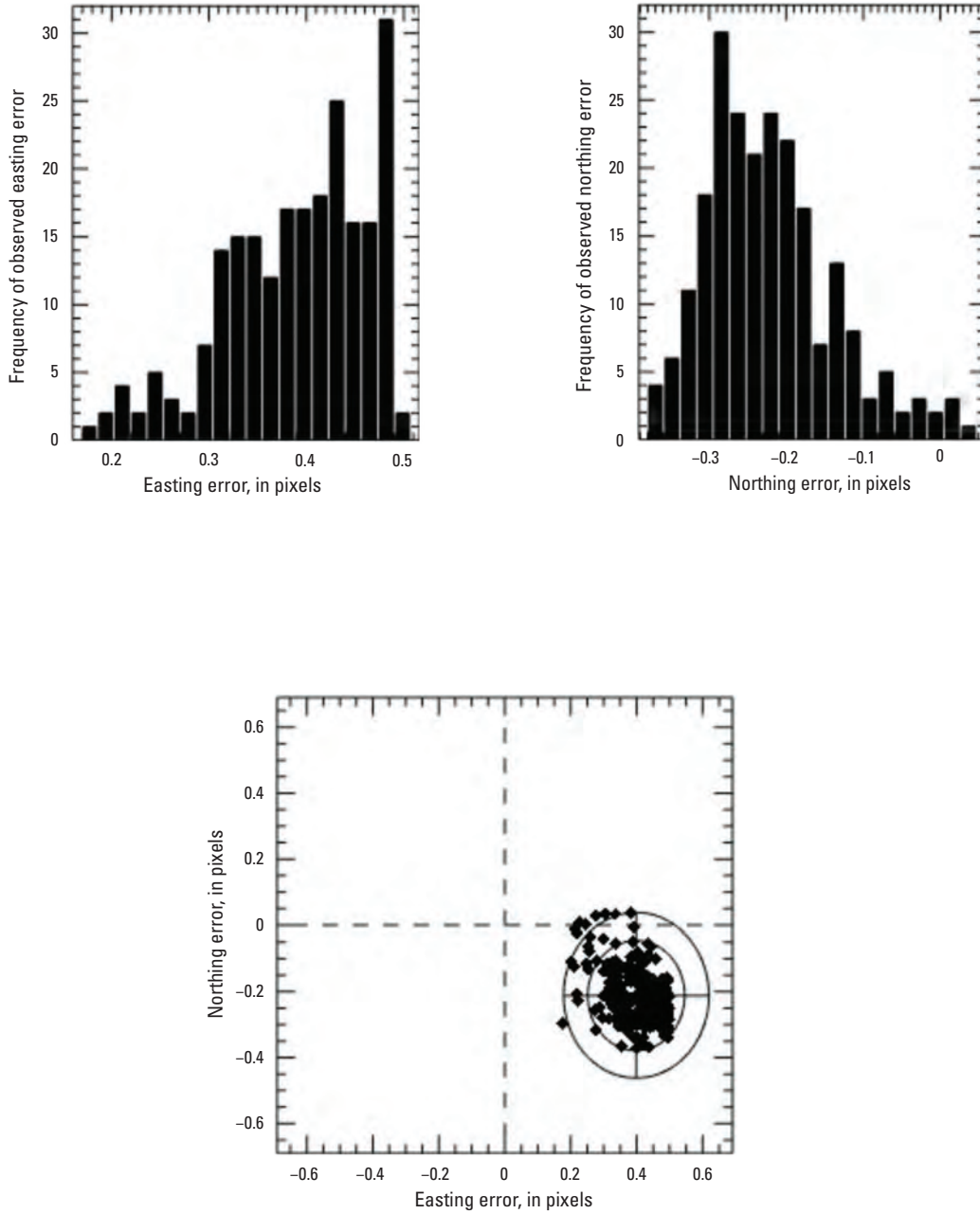


Figure 5. Band 3 (red) to band 5 (shortwave infrared) geometric error histogram (upper) and error distribution (lower) for New Mexico.

Table 5. Geometric error of Resourcesat-2 Linear Imaging Self Scanning-3 relative to Landsat 8 Operational Land Imager.

[ID, identifier; STDDEV, standard deviation; RMSE, root mean square error; m, meter]

Scene ID (location)	Mean error (easting)	Mean error (northing)	STDDEV (easting)	STDDEV (northing)	RMSE (easting)	RMSE (northing)
R2LS310212018267036_L1TLC08_L1TP_03 0027_20181021_20200830_02_T1 (Fargo, North Dakota)	-0.311 pixel (-9.342 m)	-0.209 pixel (-6.286 m)	0.156 pixel (4.667 m)	0.061 pixel (1.833 m)	0.348 pixel (10.434 m)	0.218 pixel (6.546 m)
R2LS305022018295036_L1TLC08_L1TP_01 0028_20180502_20200901_02_T1 (Maine)	0.885 pixel (26.578 m)	-1.178 pixels (-35.341 m)	0.254 pixel (7.615 m)	0.383 pixel (11.489 m)	0.921 pixel (27.646 m)	1.238 pixels (37.158 m)
R2LS305152019264046_L1TLC08_L1TP_03 2036_20190515_20200828_02_T1 (New Mexico)	-0.926 pixel (-27.805 m)	-0.567 pixel (-17.014 m)	0.152 pixel (4.569 m)	0.288 pixel (8.652 m)	0.939 pixel (28.177 m)	0.636 pixel (19.082 m)

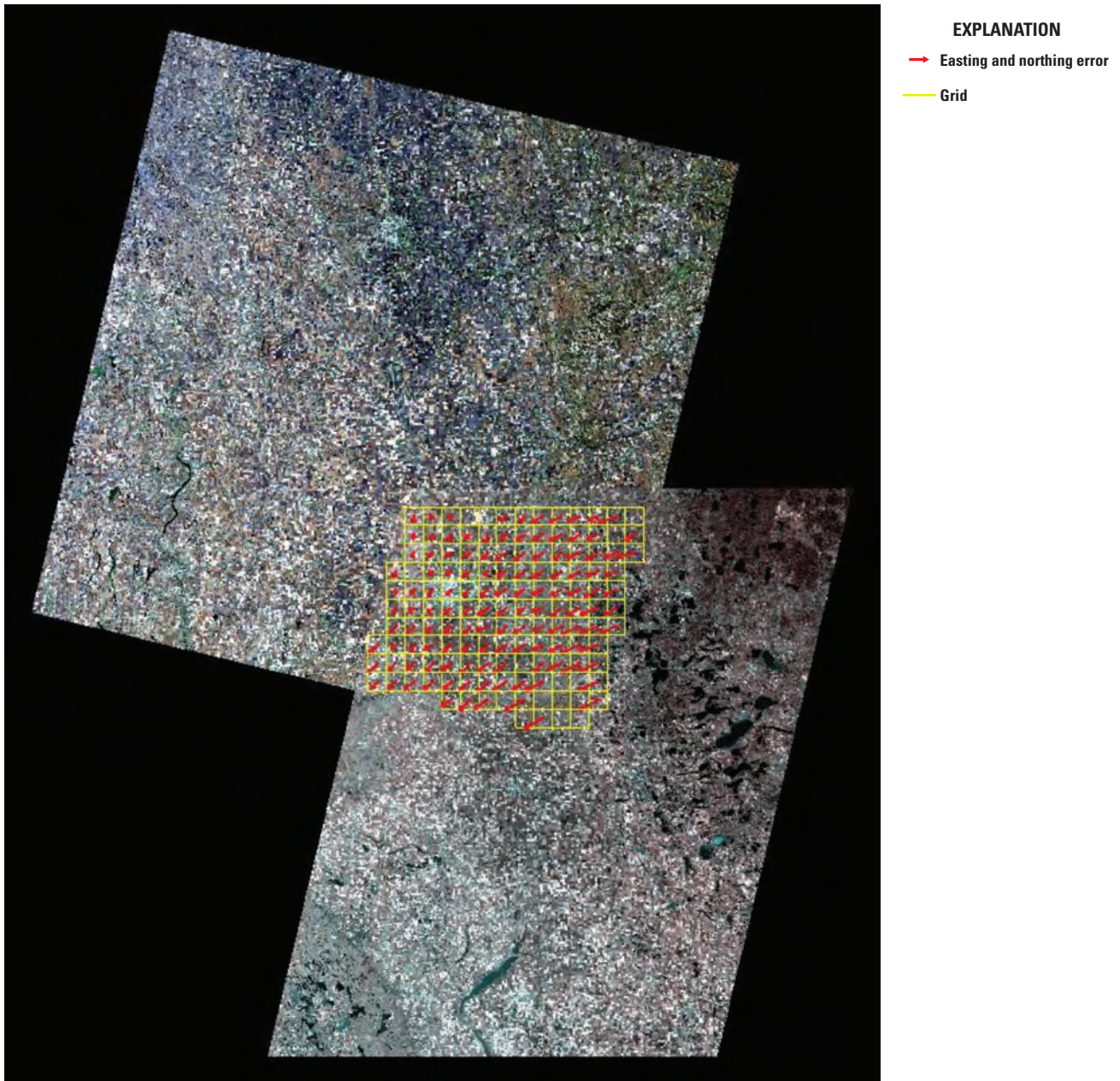


Figure 6. Relative geometric error for Landsat 8 Operational Land Imager and Resourcesat-2 Linear Imaging Self Scanning-3 for Fargo, North Dakota.

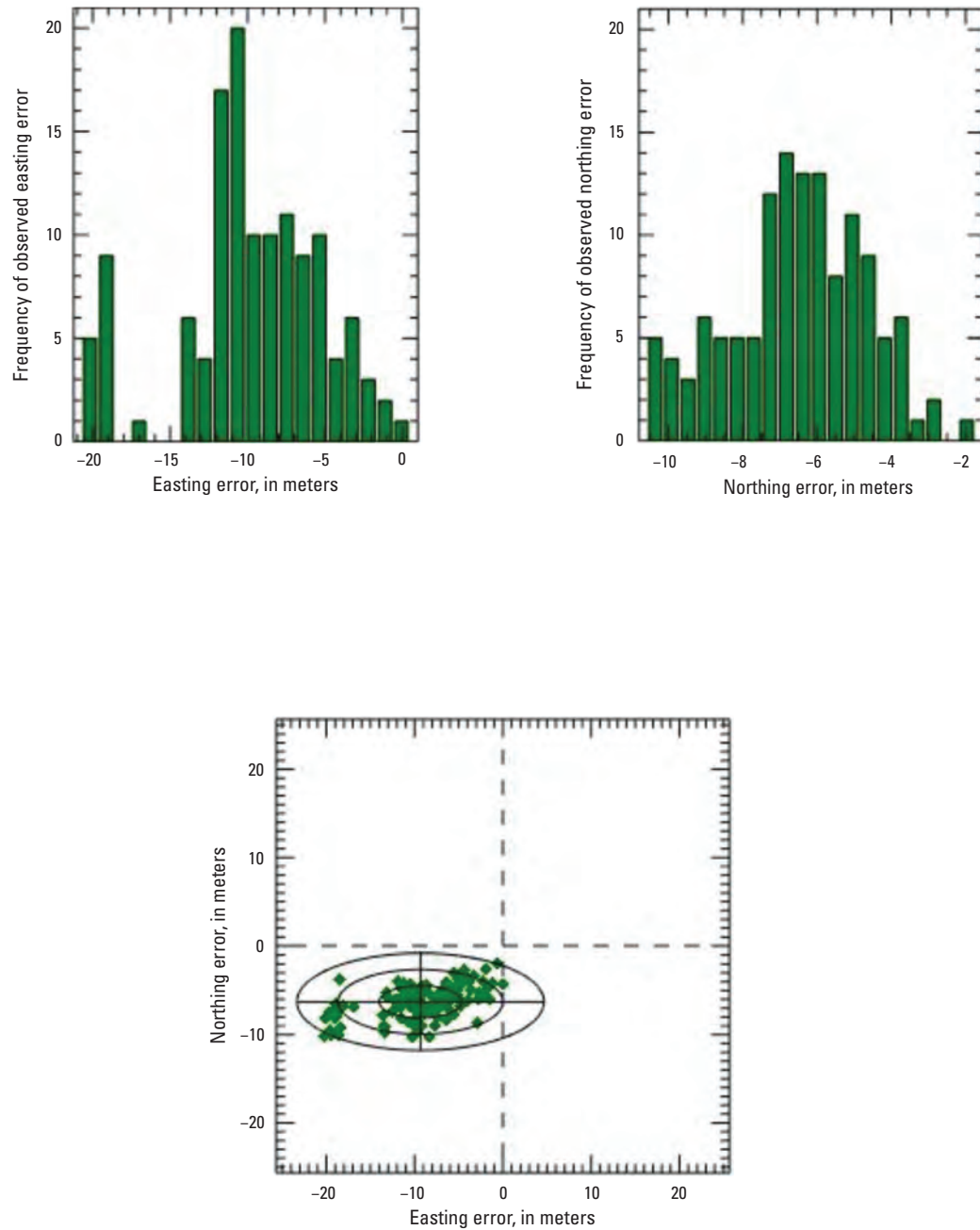


Figure 7. Relative geometric error histogram (upper) and error distribution (lower) for Fargo, North Dakota.

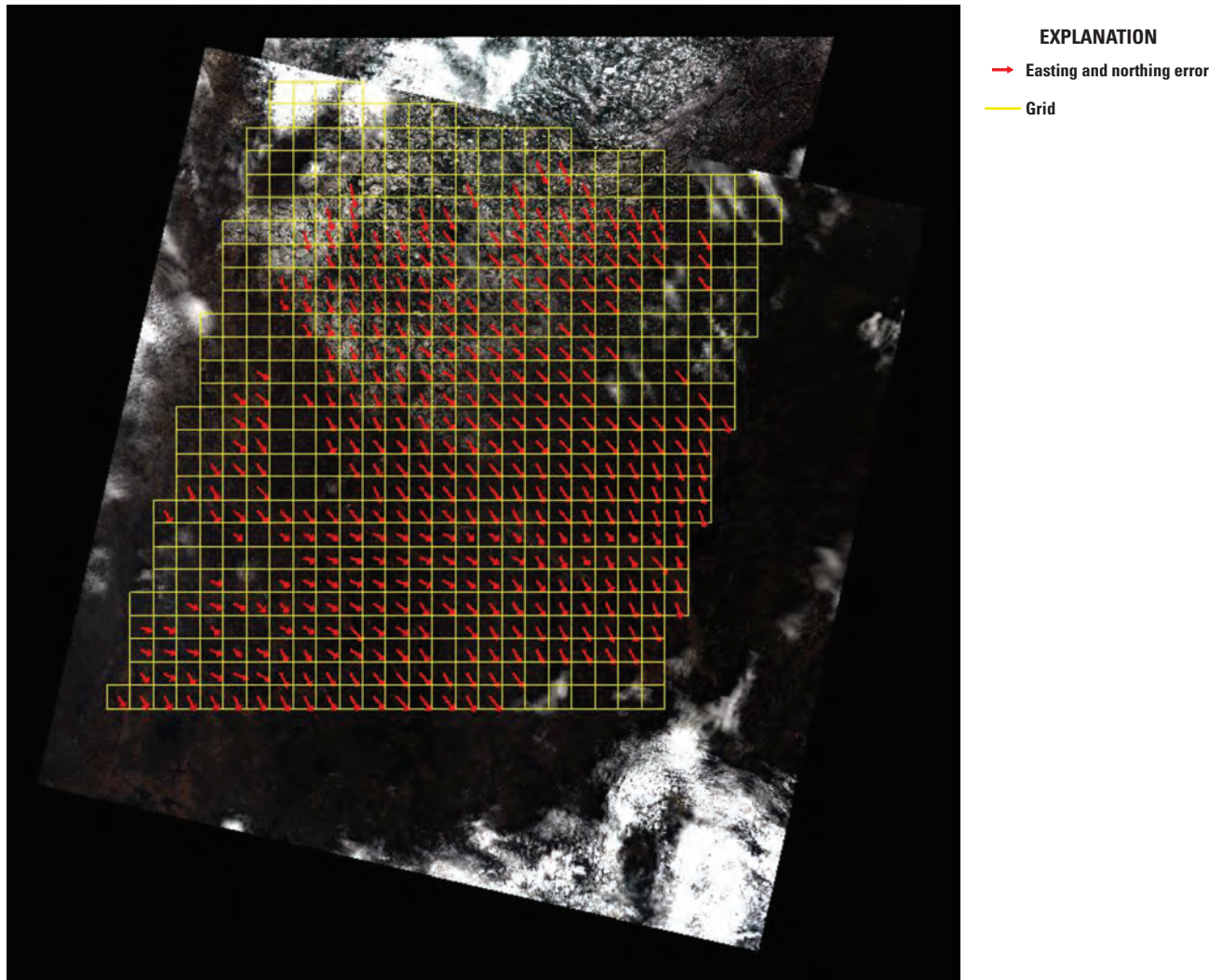


Figure 8. Relative geometric error for Landsat 8 Operational Land Imager and Resourcesat-2 Linear Imaging Self Scanning-3 for Maine.

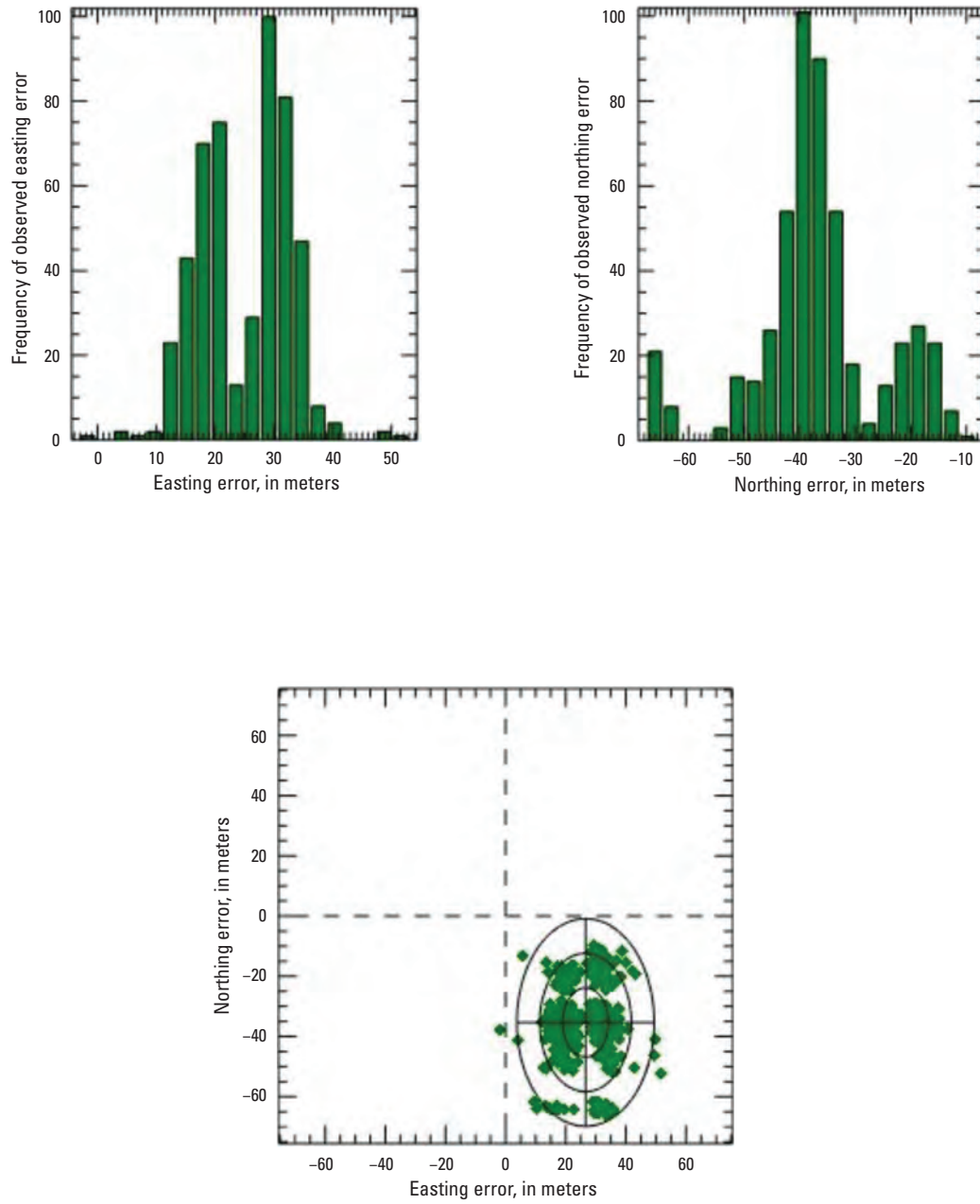


Figure 9. Relative geometric error histogram (upper) and error distribution (lower) for Maine.

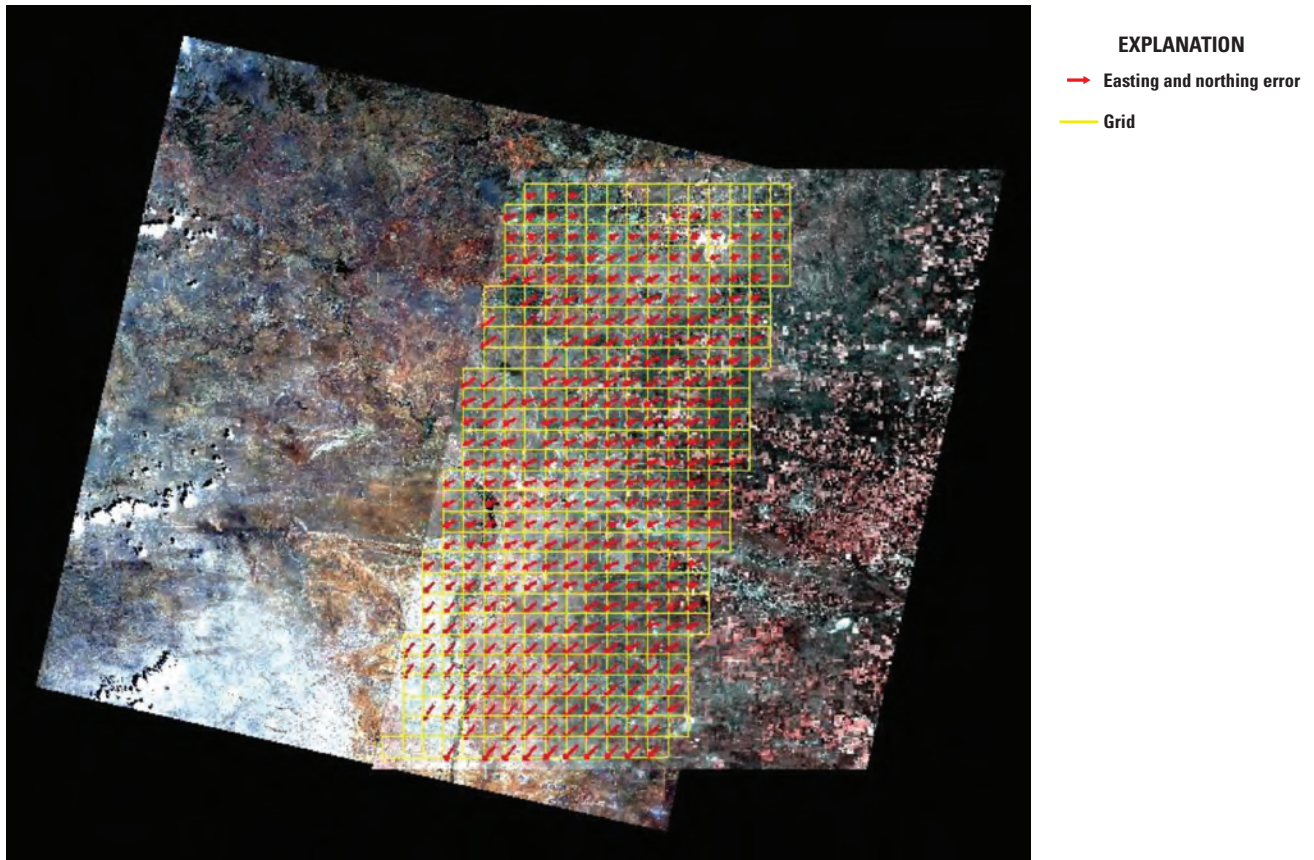


Figure 10. Relative geometric error for Landsat 8 Operational Land Imager and Resourcesat-2 Linear Imaging Self Scanning-3 for New Mexico.

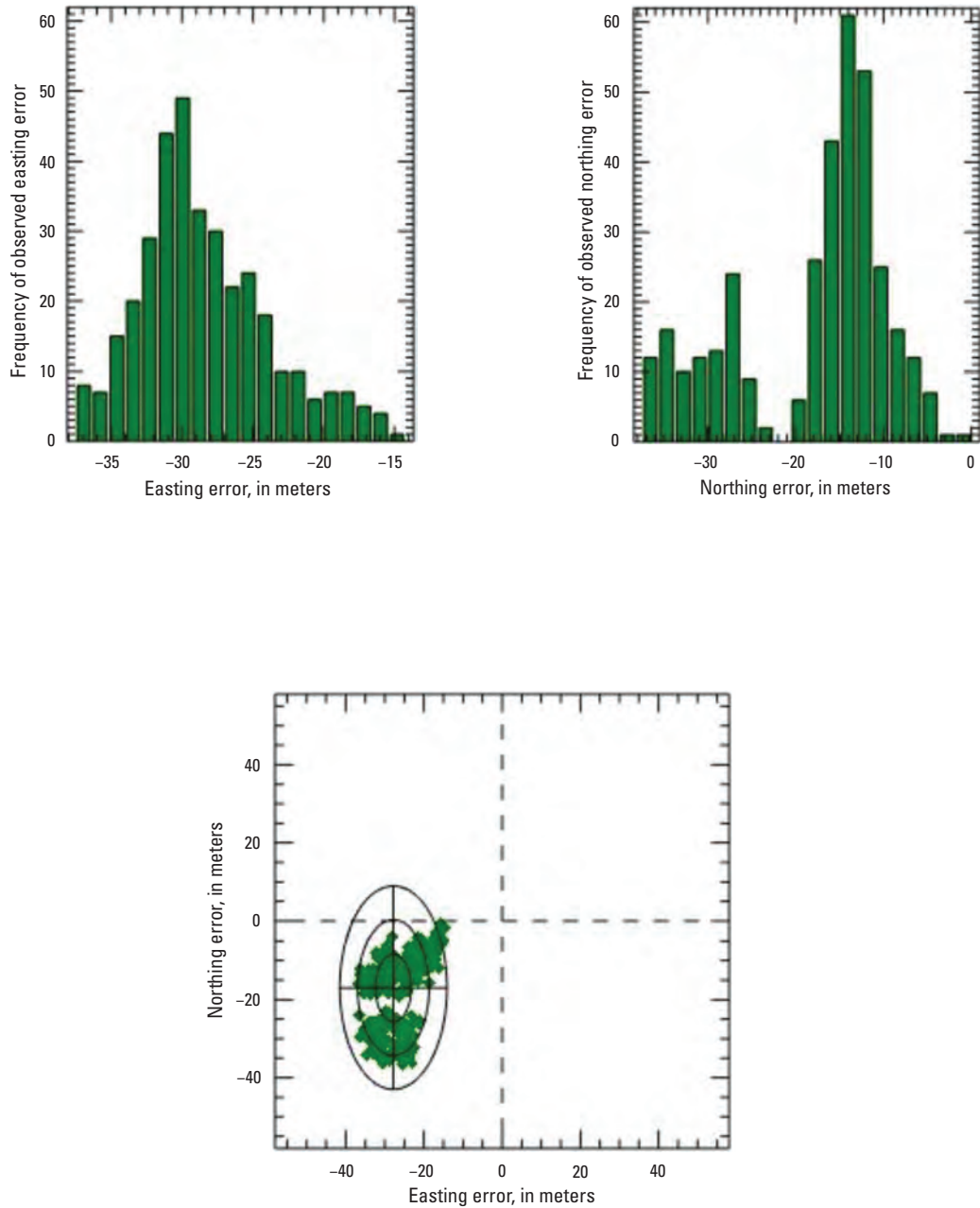


Figure 11. Relative geometric error histogram (upper) and error distribution (lower) for New Mexico.

Radiometric Performance

For this analysis, cloud-free regions of interest were selected within three near-coincident LISS-3 and Landsat 8 OLI scene pairs using the EROSSC software. Once the relative georeferencing error between Landsat 8 OLI and Resourcesat-2 LISS-3 has been corrected, Top of Atmosphere reflectance values from the two sensors are extracted. The scatterplot (fig. 12) is drawn in a way that the x-axis is the reference sensor and the y-axis is the comparison sensor.

The linear regression, thus, represents Top of Atmosphere reflectance relative to that of the reference sensor. Ideally, the slope should be near unity and the offset should be near zero. For instance, if the slope is greater than unity, that means the comparison sensor has a tendency to overestimate Top of Atmosphere reflectance compared to the reference sensor.

Top of Atmosphere reflectance comparison results are listed in table 6. A band-by-band graphical comparison between the LISS-3 image over Maine, when compared with the corresponding Landsat 8 OLI band, is shown in figure 12.

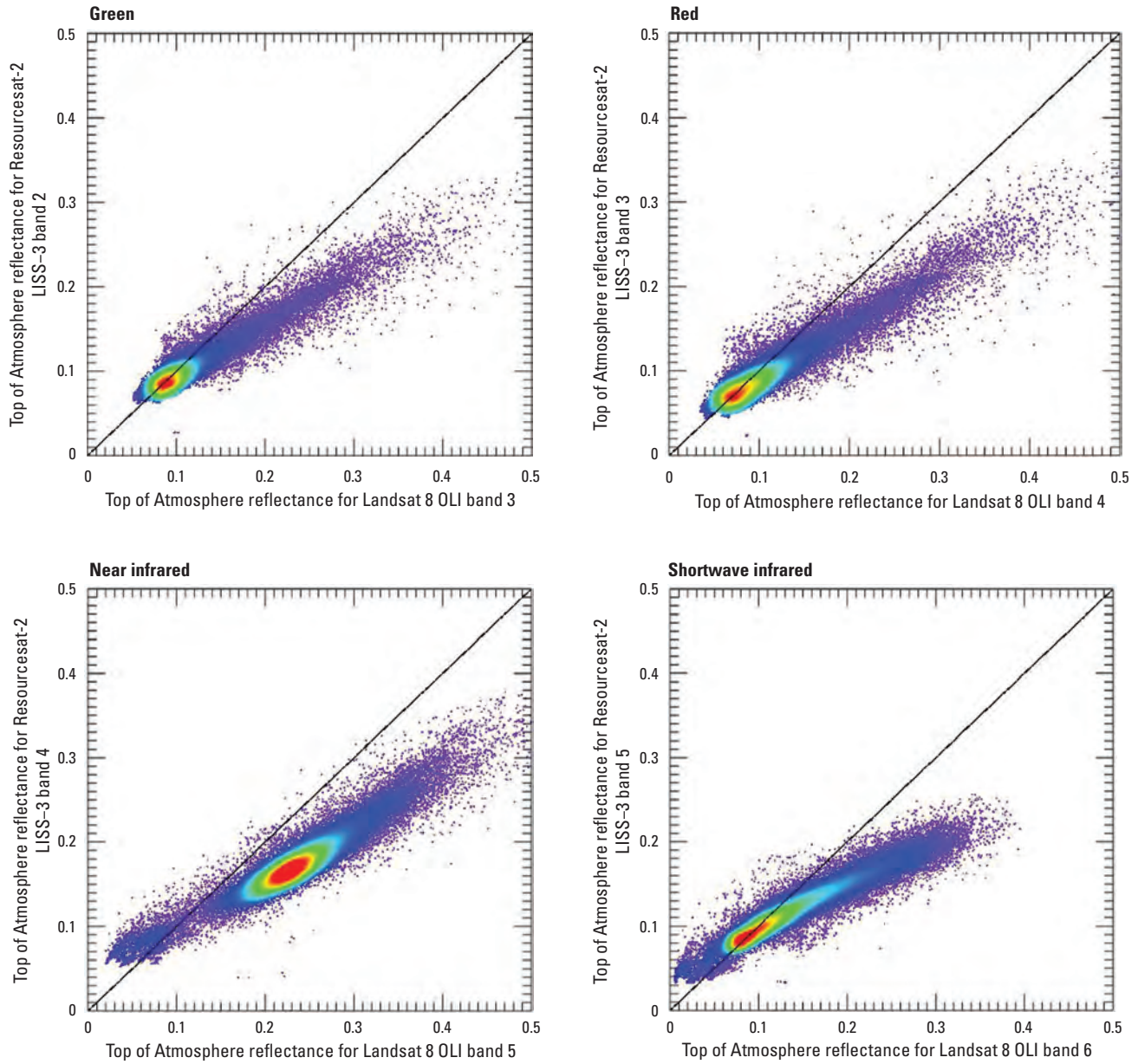


Figure 12. Top of Atmosphere reflectance comparison for Landsat 8 Operational Land Imager (OLI) and Resourcesat-2 Linear Imaging Self Scanning-3 (LISS-3; Maine).

Table 6. Top of Atmosphere reflectance comparison of Resourcesat-2 Linear Imaging Self Scanning-3 against Landsat 8 Operational Land Imager.[ID, identifier; NIR, near infrared; SWIR, shortwave infrared; %, percent; R^2 , coefficient of determination]

Scene ID (location)	Statistics	Band 2—Green	Band 3—Red	Band 4—NIR	Band 5—SWIR
R2LS310212018267036_L1TLC08_ L1TP_030027_20181021_202008 30_02_T1 (Fargo, North Dakota)	Uncertainty (%)	8.750	11.220	15.020	13.410
	R^2	0.926	0.939	0.937	0.631
	Radical offset	-0.027	0.017	0.027	-0.072
	Radical slope	0.610	0.655	0.589	0.904
R2LS305022018295036_L1TLC08_ L1TP_010028_20180502_202009 01_02_T1 (Maine)	Uncertainty (%)	13.340	17.470	12.700	24.170
	R^2	0.793	0.852	0.836	0.877
	Radical offset	0.022	0.015	0.021	0.036
	Radical slope	0.695	0.575	0.635	0.584
R2LS305152019264046_L1TLC08_ L1TP_032036_20190515_202008 28_02_T1 (New Mexico)	Uncertainty (%)	4.49	6.48	5.33	5.46
	R^2	0.904	0.908	0.894	0.665
	Radical offset	0.029	0.025	0.030	-0.096
	Radical slope	0.648	0.687	0.658	0.946

Spatial Performance

For this analysis, spatial analysis based on Helder and others (2004), was used to determine the full width at half maximum and modulation transfer function at Nyquist frequency, as listed in [table 7](#).

Table 7. Spatial performance of Resourcesat-2 Linear Imaging Self Scanning-3.

[RER, relative edge response; FWHM, full width at half maximum; MTF, modulation transfer function; NIR, near infrared; SWIR, shortwave infrared]

Spatial analysis	RER	FWHM (pixels)	MTF at Nyquist
Band 2—green	0.452	1.96	0.070
Band 3—red	0.460	1.88	0.045
Band 4—NIR	0.455	1.87	0.050
Band 5—SWIR	0.444	1.95	0.045

Summary and Conclusions

This report summarizes the sensor performance of the Resourcesat-2 Linear Imaging Self Scanning-3 (LISS-3) sensor based on the U.S. Geological Survey Earth Resources Observation and Science Cal/Val Center of Excellence (ECCOE) system characterization process. In summary, we have determined that this sensor provides an interior geometric performance in the range of -4.620 (-0.154 pixel) to 13.230 m (0.441 pixel) in easting and -12.360 (-0.412 pixel) to 1.500 m (0.050 pixel) in northing in band-to-band registration, an exterior geometric error of -27.805 (-0.927 pixel) to 26.578 m (0.886 pixel) in easting and -35.341 (-1.178 pixel) to -6.286 m (-0.210 pixel) in northing offset in comparison to the Landsat 8 Operational Land Imager, a radiometric performance in the range of -0.096 to 0.035 in offset and 0.585 – 0.946 in slope, and a spatial performance in the range of 1.87 – 1.95 pixels for full width at half maximum, with a modulation transfer function at a Nyquist frequency in the range of 0.045 – 0.070 .

In conclusion, the team has completed an ECCOE standardized system characterization of the Resourcesat-2 LISS-3 sensing system. Although the team followed characterization procedures that are standardized across the many sensors and sensing systems under evaluation, these procedures are customized to fit the individual sensor as was done with LISS-3. The team has acquired the data, defined proper testing methodologies, carried out comparative tests against specific references, recorded measurements, completed data analyses, and quantified sensor performance accordingly. The team also endeavored to retain all data, measurements, and methods. This is key to ensure that all data and measurements are archived and accessible and that the performance results are reproducible.

The ECCOE project and associated Joint Agency Commercial Imagery Evaluation partners are always interested in reviewing sensor and remote sensing application assessments and would like to see and discuss information on similar data

and product assessments and reviews. If you would like to discuss system characterization with the U.S. Geological Survey ECCOE and (or) the Joint Agency Commercial Imagery Evaluation team, please email us at eccoe@usgs.gov.

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