

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

Spectrometer L1 reflectance and L2 product QA information for LIRO

PREPARED BY	ORGANIZATION	DATE
Tristan Goulden	AOP	09/29/2017

See configuration management system for approval history.

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1 Introduction

This document includes processing information, metadata and QA results from the generation of data products derived from the NIS (NEON imaging spectrometer)aboard the NEON AOP (Airborne Observation Platform) for the site termed LIRO. Products described in this document include L1 surface directional reflectance, produced in the ATCOR software package (<http://www.rese.ch/products/atcor/atcor4/>), as well as all L2 products which include: 1) Vegetation Indices, Water Indices, Leaf Area Index (LAI), Fractional Photosynthetically Active Radiation (fPAR) and surface albedo. ATBDs which describe algorithmic details of these data products can be found in Section 2.2. All products are derived from the L1 at-sensor radiance product (available from NEON in HDF5 format) and digital surface model (DSM) derived form the NEON LiDAR sensor. ATCOR processing of surface reflectance is conducted through the ATCOR-IDL API, and stored in an HDF5 format using the h5Py Python library. Within the surface directional reflectance HDF5 files, more detailed and specific metadata and processing information is included. To fully utilize the data in the HDF5 format, the reader is encouraged to:

- 1) download a plugin for ENVI©(<http://www.harrisgeospatial.com>) designed by NEON at the following address: <https://neondata.sharefile.com/d-sa382795441341438>. The plugin works for ENVI versions 5.2 and higher and should be unzipped in the ENVI extensions folder. Normally located in (using ENVI 5.3 as an example): C:\Program Files\Exelis\ENVI53\extensions.
- 2) explore the data using HDFView (<https://support.hdfgroup.org/products/java/hdfview/>), or
- 3) visit the NEON data skills web page pertaining to geospatial data in HDF5 format (<http://neondataskills.org/HDF5/>).

L2 products are produced through in-house IDL©(<http://www.harrisgeospatial.com>) and Matlab©(<http://www.mathworks.com>) code from surface reflectance. All L2 products are provided in the popular geotiff format, users are encouraged to explore the geotiff tags for additional metadata with tools such as the AsTiffTagViewer (<http://www.awaresystems.be/imaging/tiff/astifftagviewer.html>).

This document contains information about which files were used in processing as well as their spatial attributes in Section 3, parameters used for ATCOR processing in Section 5, a summary of the input rasters to ATCOR with associated maps and histograms in Section 6, and a summary of the output L2 raster products calculated from the ATCOR reflectance results, with associated maps and histograms in Section 7.

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2 RELATED DOCUMENTS AND ACRONYMS

2.1 Applicable Documents

Applicable documents contain information that shall be applied in the current document. Examples are higher level requirements documents, standards, rules and regulations.

AD[01]	NEON.DOC.000001	NEON Observatory Design (NOD) Requirements
AD[02]	NEON.DOC.005003	NEON Scientific Data Products Catalog
AD[03]	NEON.DOC.005004	NEON Level 1-3 Data Products Catalog
AD[04]	NEON.DOC.005005	NEON Level 0 Data Product Catalog
AD[07]	NEON.DOC.002649	NEON configured site list

2.2 Reference Documents

Reference documents contain information complementing, explaining, detailing, or otherwise supporting the information included in the current document.

RD[01]	NEON.DOC.000008	NEON Acronym List
RD[02]	NEON.DOC.000243	NEON Glossary of Terms
RD[03]	NEON.DOC.001984	AOP flight plan boundaries design
RD[04]	NEON.DOC.005011	NEON Coordinate Systems Specification
RD[05]	NEON.DOC.001292	NEON L0-to-L1 discrete return lidar algorithm theoretical basis document
RD[06]	NEON.DOC.001210	NEON Algorithm Theoretical Basis Document: NEON Imaging Spectrometer Level 1B Calibrated Radiance
RD[07]	NEON.DOC.001288	NEON Imaging Spectrometer Radiance to Reflectance Algorithm Theoretical Basis Document
RD[08]	NEON.DOC.001290	NEON Algorithm Theoretical Basis Document: Imaging Spectrometer Geolocation Processing
RD[09]	NEON.DOC.002391	Spectrometer Vegetation Indices Level-2 Data Product ATBD
RD[10]	NEON.DOC.004364	NEON Algorithm Theoretical Basis Document: AOP Water Indices
RD[11]	NEON.DOC.003840	NEON Algorithm Theoretical Basis Document: AOP fPAR
RD[12]	NEON.DOC.003839	NEON Algorithm Theoretical Basis Document: AOP Leaf Area Index
RD[13]	NEON.DOC.004326	NEON Algorithm Theoretical Basis Document: AOP Surface Albedo
RD[14]	NEON.DOC.002890	NEON AOP Level 0 quality checks
RD[15]	NEON.DOC.003316	Discrete LiDAR Level-1 processing procedure
RD[16]	NEON.DOC.003314	NEON NIS Level-1 processing procedure
RD[17]	NEON.DOC.002890	NEON Elevation (DTM and DSM) Algorithm Theoretical Basis Document
RD[18]	NEON.DOC.002293	NEON discrete LiDAR datum reconciliation report
RD[19]	NEON.DOC.003791	NEON Elevation (slope and aspect) algorithm theoretical basis document
RD[20]	NEON.DOC.004363	NEON Algorithm Theoretical Basis Document: AOP Total Biomass

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2.3 Acronyms

Acronym	Definition
ARVI	Atmospherically Resistant Vegetation Index
AOP	Aiborne Operations Platform
AOT	Aerosol Optical Thickness
DTM	Digital Terrain Model
DSM	Digital Surface Model
EVI	Enhanced Vegetation Index
FBO	Fixed Base Operator
FPAR	Fractional Photosynthetically Active Radiation
ITRF00	International Terrestrial Reference Frame 2000
LAI	Leaf Area Index
LMS	Laser Mapping Suite
MSI	Moisture Stress Index
NDII	Normalized Difference Infrared Index
NDLI	Normalized Difference Lignin Index
NDMI	Normalized Multi-band Drought Index
NDNI	Normalized Difference Nitrogen Index
NDVI	Normalized Difference Vegetation Index
NDWI	Normalized Difference Water Index
PRI	Photochemical Reflectance Index (Canopy Xanthophyll Cycle)
SAVI	Soil Adjusted Vegetation Index
SBET	Smoothed Best Estimated Trajectory
UTM	Universal Transverse Mercator
WBI	Water Band Index

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3 Spectrometer files processed

Table 4 lists all of the NIS lines that were used in the processing of the L2 and L3 products, as well as spatial attributes.

Table 4: Processed lines with attributes

Line ID	Start (s)	Stop (s)	MinX (m)	MinY (m)	MaxX (m)	MaxY (m)	Mean Elev (m)	Mean Heading (°)
20170911 194724	157811.80	157883.10	291585	5099480	292415	5095727	1518.10	-17.63
20170911 195046	158014.02	158088.72	291157	5100029	291980	5095942	1494.21	-164.51
20170911 195401	158208.73	158291.12	290700	5099528	291590	5095237	1506.46	-18.10
20170911 195715	158402.84	158489.25	290374	5100238	291334	5096012	1519.69	-162.75
20170911 200100	158627.45	158700.36	289908	5099552	290791	5095703	1507.34	-17.70
20170911 200419	158827.05	158901.56	289478	5100061	290324	5096050	1504.03	-165.47
20170911 200753	159040.87	159108.56	289080	5099574	289957	5095788	1508.05	-15.37
20170911 201126	159254.18	159316.87	288939	5098314	292507	5097247	1503.50	95.15

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4 Percent cloud cover

Table 5 indicates the weather conditions for each line based on the cloud cover. The percentage of cloud cover is assessed from the aircraft by the airborne sensor operator at the beginning of each line. If lines show less than 10% cloud cover they will not be re-flown. If lines show between 10% and 50% or over 50% they will be re-flown, with priority given to those above 50%.

Table 5: Cloud Cover

Line ID	Cloud Cover (%)	Cloud Type
20170911 194724	< 10	Clear
20170911 195046	< 10	Clear
20170911 195401	< 10	Clear
20170911 195715	< 10	Clear
20170911 200100	< 10	Clear
20170911 200419	< 10	Clear
20170911 200753	< 10	Clear
20170911 201126	< 10	Clear

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5 Parameters used in ATCOR processing

The following section describes the general ATCOR processing parameters that similarly apply to all lines, as well as line specific parameters in ???. In Table 6, the input visibility (Input Vis) was entered a priori while the final visibility used was determined by ATCOR algorithms (Calc Vis). The Dark Dense Vegetation (DDV) % is an important component in the ATCOR processing which aids in determining the visibility in the image and aerosol retrieval, in combination with the water and shadow pixels (see ATCOR manual at <http://www.rese.ch/products/atcor/atcor4/>). Figure 1 displays a map of the pixels classified as DDV, water and non-reference. Where non-reference pixels are not used in the algorithm. Figure 2 shows an internal classification on the water pixels based on simple thresholds of 1% and 0.5% reflectance in the 850 nm and 1600 nm regions of the spectra respectively. This mask is used to remove pixels from some L2 products to prevent numeric instability in their calculation.

General ATCOR processing metadata

ATCOR version: ATCOR 4, Version 7.1,Build13
 Process date: Process Started on Thu Sep 28 19:15:26 2017
 Processed by: bhass
 Wavelength range: 383.534302 to 2511.894531nm
 Mean band seperation: 5.007906 nm
 Scale Factor: 10000
 Atmospheric Model: h01000 wv20 rura.atm
 Calibration file: sensor_2017_NIS1_v04.cal
 Preferences file: C:\Users\bhass\idl\rese\atcor4\preference_parameters.dat
 Adjacency range: 0.100 km
 Spatial Resolution: 1.00 m
 Spatial Reference: UTM Zone 16 North, ITRF00

Table 6: Line specific ATCOR processing pareamters

Line ID	Solar Zenith (°)	Solar Azimuth (°)	Input Vis (km)	Calc Vis (km)	AOT	Grnd Elev (m)	Water (%)	DDV (%)	Topo Shd (%)
20170911 194724	48.38	219.75	35.00	34.60	0.21	356	36.19	35.09	0
20170911 195046	48.76	220.74	35.00	34.60	0.21	353	43.60	34.91	0
20170911 195401	49.12	221.69	35.00	34.60	0.21	325	46.83	25.18	0
20170911 195715	49.50	222.62	35.00	34.60	0.21	313	52.55	23.52	0
20170911 200100	49.94	223.69	35.00	34.60	0.21	334	39.59	29.84	0
20170911 200419	50.34	224.63	35.00	34.60	0.21	347	34.18	33.71	0
20170911 200753	50.78	225.62	35.00	34.60	0.21	338	32.59	34.55	0
20170911 201126	51.23	226.62	35.00	34.60	0.21	297	41.91	33.31	0

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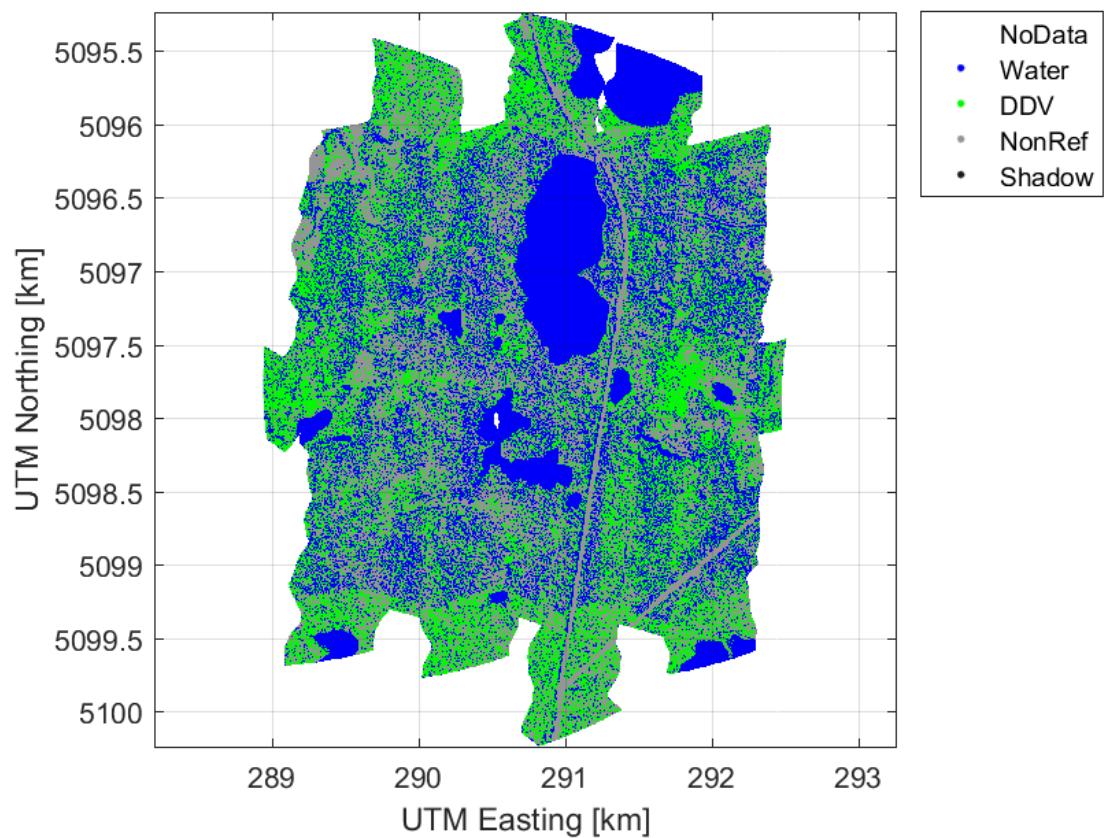


Figure 1: Dark Dense Vegetation Classification map

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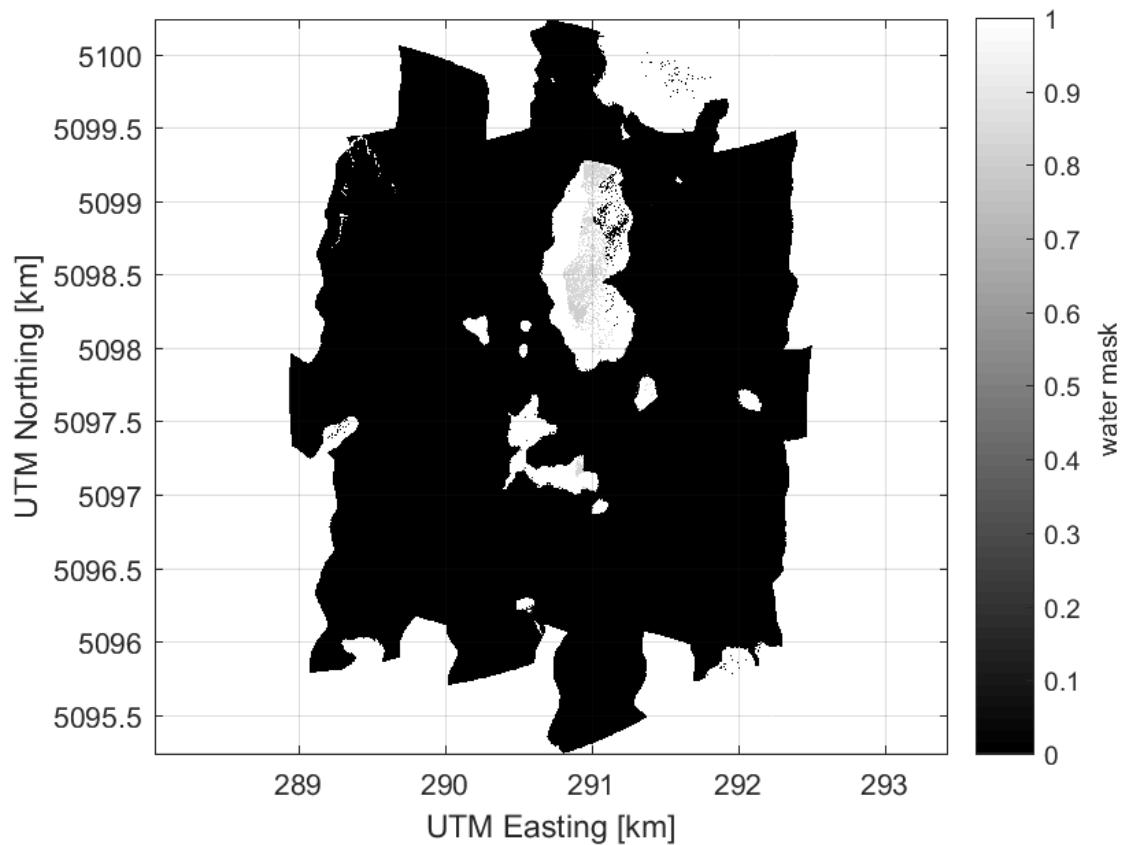


Figure 2: Water mask map

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6 ATCOR input rasters

The products given in Table 7 and Figure 3 to Figure 16 are input into ATCOR for surface reflectance retrieval. Theoretical limits have been identified for each raster, and the number of values outside these limits (below and above percentages) are identified in Table 7 to provide a QA metric that ensures rasters were appropriately calculated. The table also displays the number of cells which were determined to be zero. Too high a percentage in these categories could indicate an issue in the calculation that requires attention. Each raster is displayed with an associated histogram where the histograms show 95% of the data within the theoretical limits.

Table 7: Summary statistics of inputs to ATCOR

Product	Min	Max	Mean	Median	Theor. Min	Theor. Max	Below Limit (%)	Above Limit (%)	Equal to Zero (%)
Path Length	978.08	1169.79	1045.33	1042.66	750.00	1500.00	0.00	0.00	0.00
Smooth Surface Elevation	492.07	547.01	510.35	508.73	0.00	4000.00	0.00	0.00	0.00
Slope	0.00	39.55	7.49	5.83	0.00	90.00	0.00	0.00	0.01
Aspect	0.00	360.00	181.36	180.00	0.00	360.00	0.00	0.00	0.00
Water Vapor Column	1972.00	3667.00	2846.54	2859.00	800.00	4000.00	0.00	0.00	0.00
Illumination Factor	6.00	97.00	63.59	65.00	50.00	120.00	7.02	0.00	0.00
Sky View Factor	78.00	99.00	95.95	96.00	85.00	100.00	0.06	0.00	0.00

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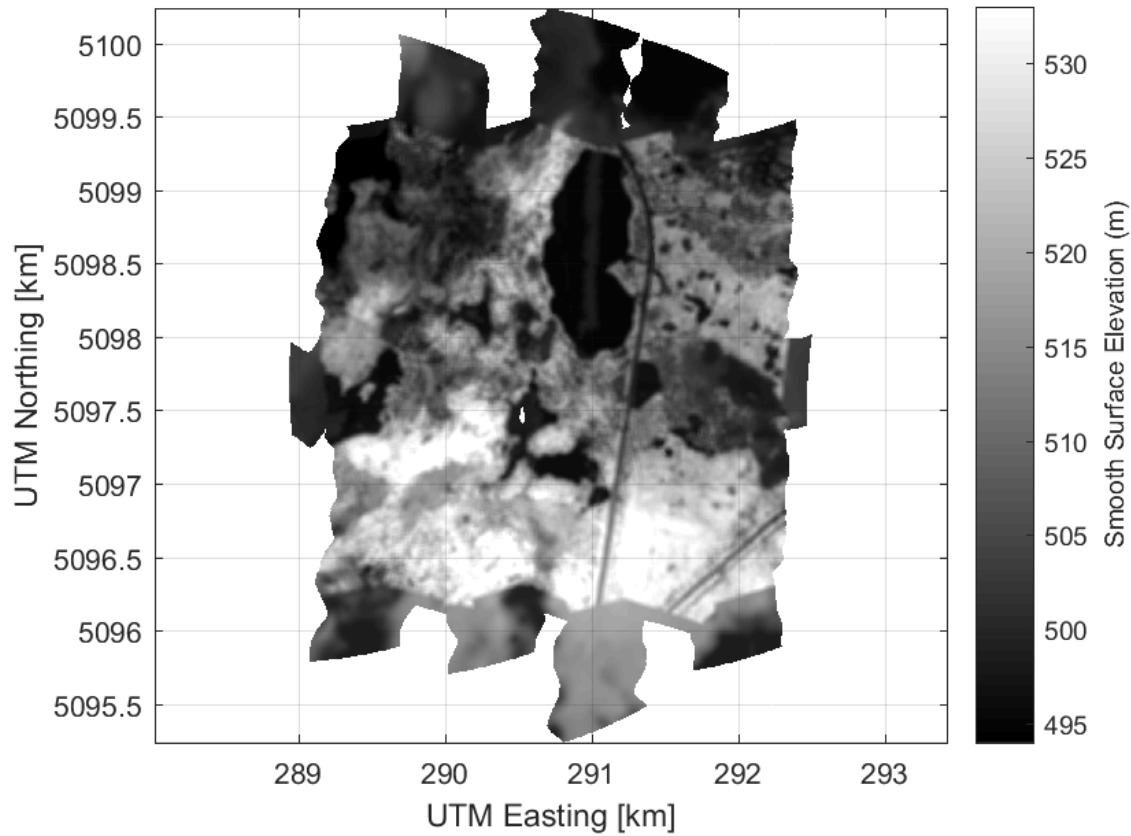


Figure 3: Elevation map

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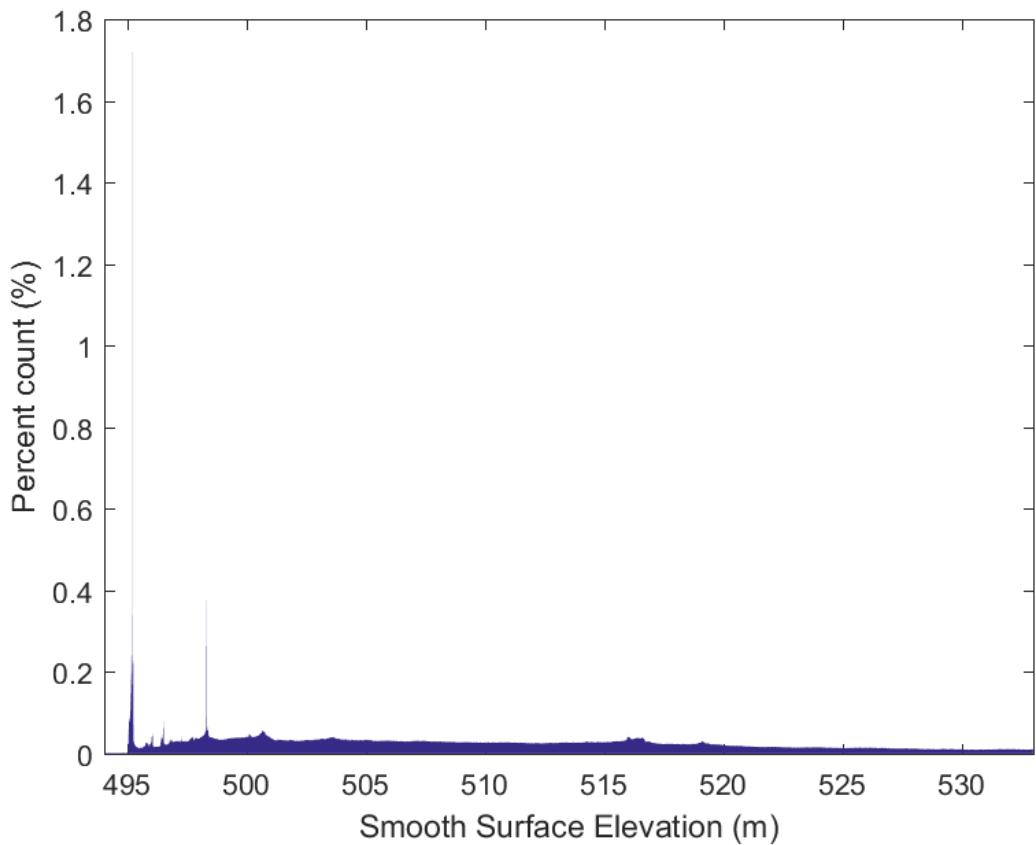


Figure 4: Elevation histogram

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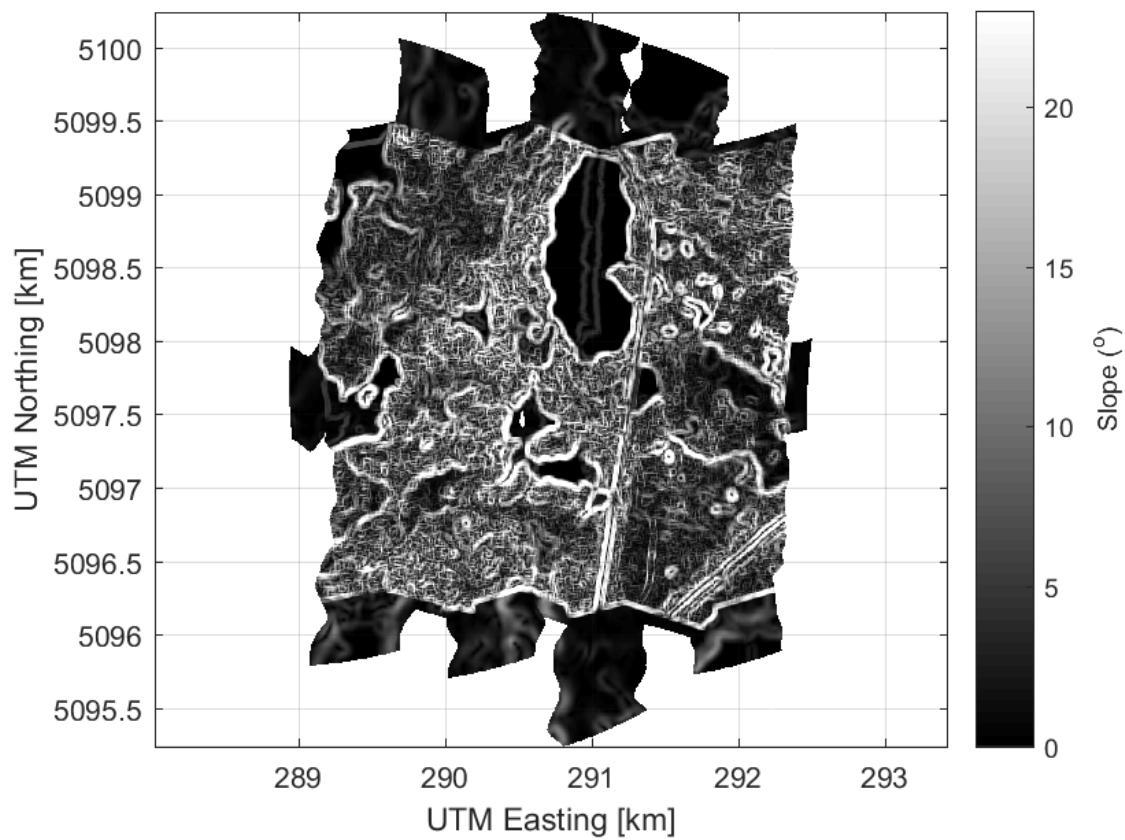


Figure 5: Slope map

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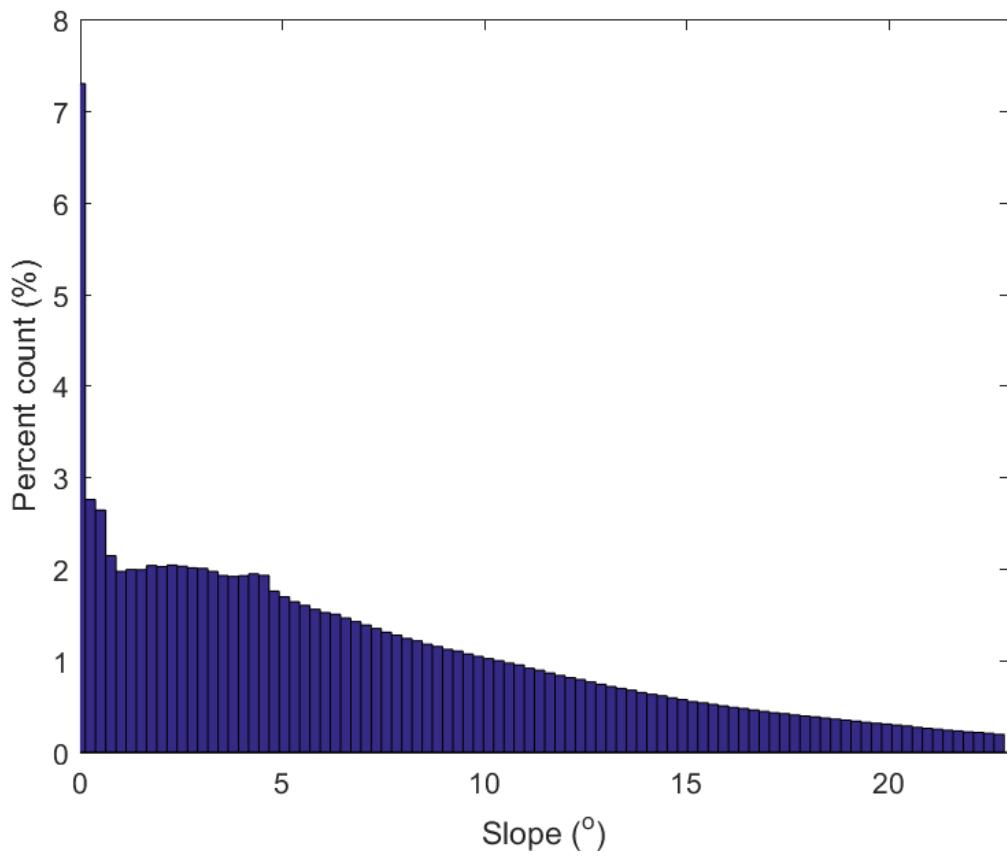


Figure 6: Slope histogram

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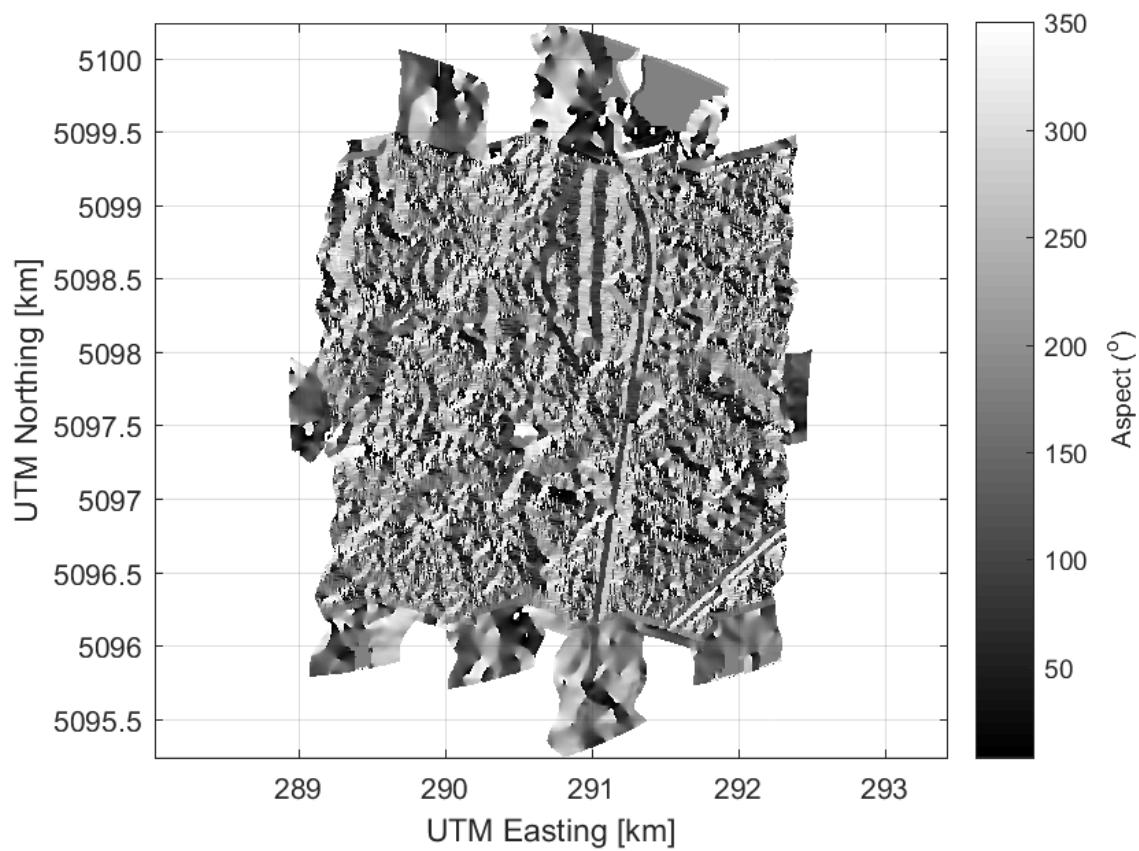


Figure 7: Aspect map

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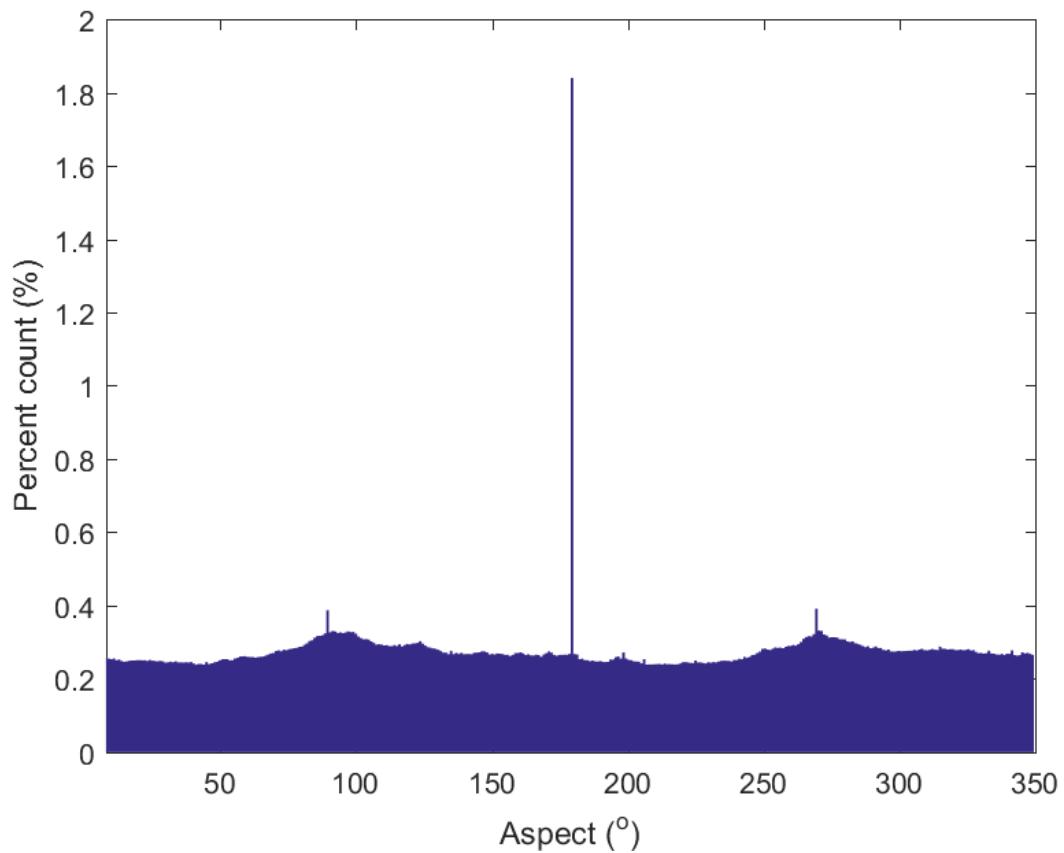


Figure 8: Aspect histogram

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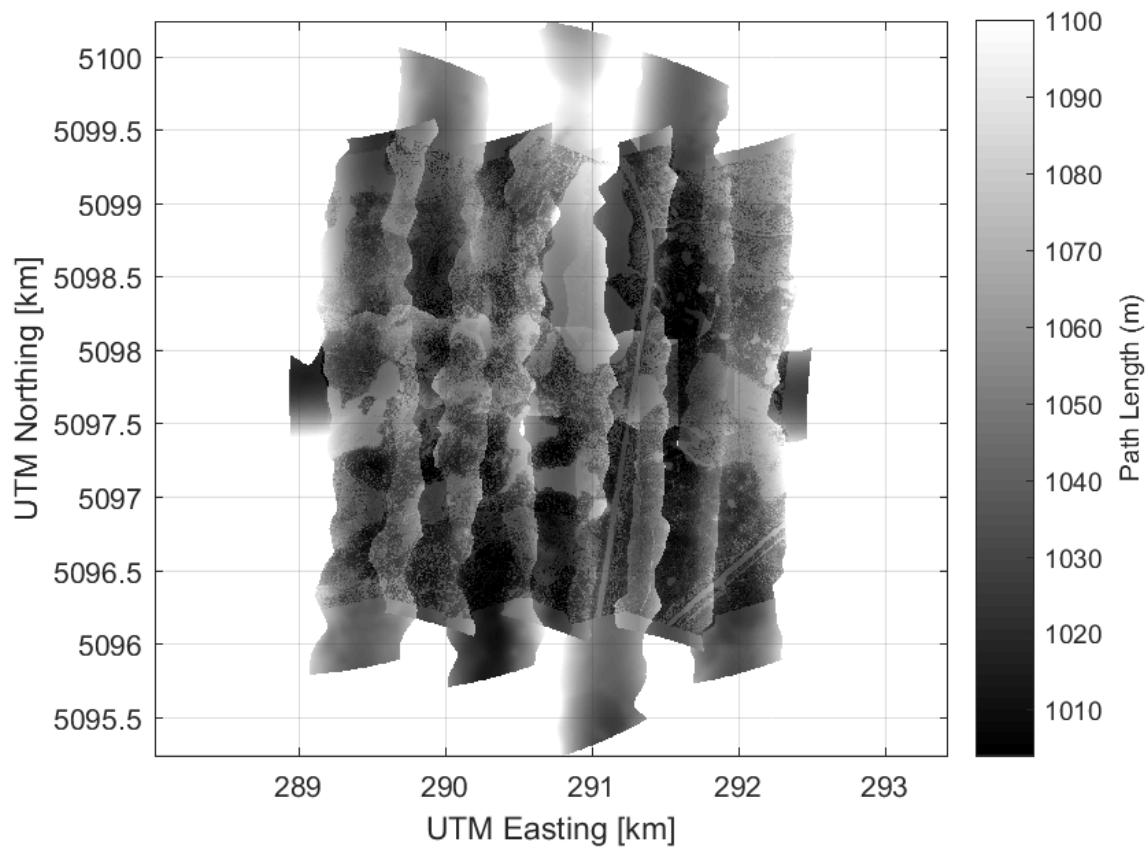


Figure 9: Path Length map

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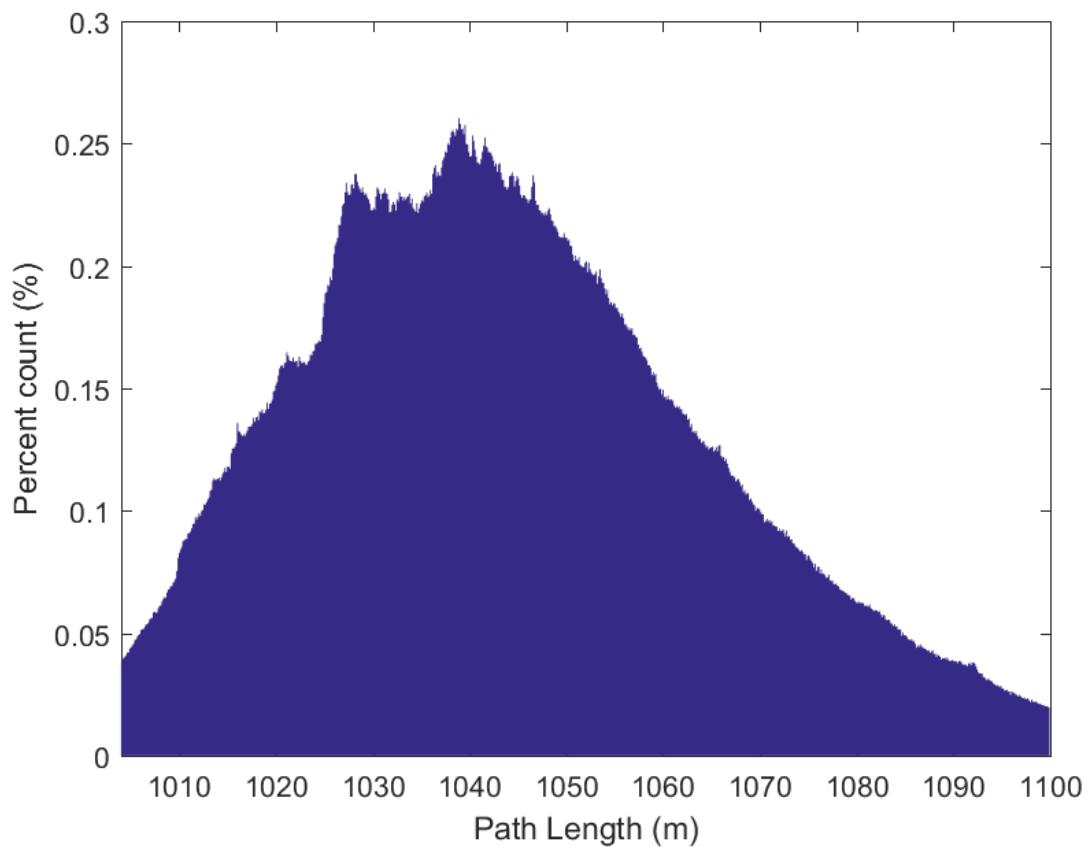


Figure 10: Path Length histogram

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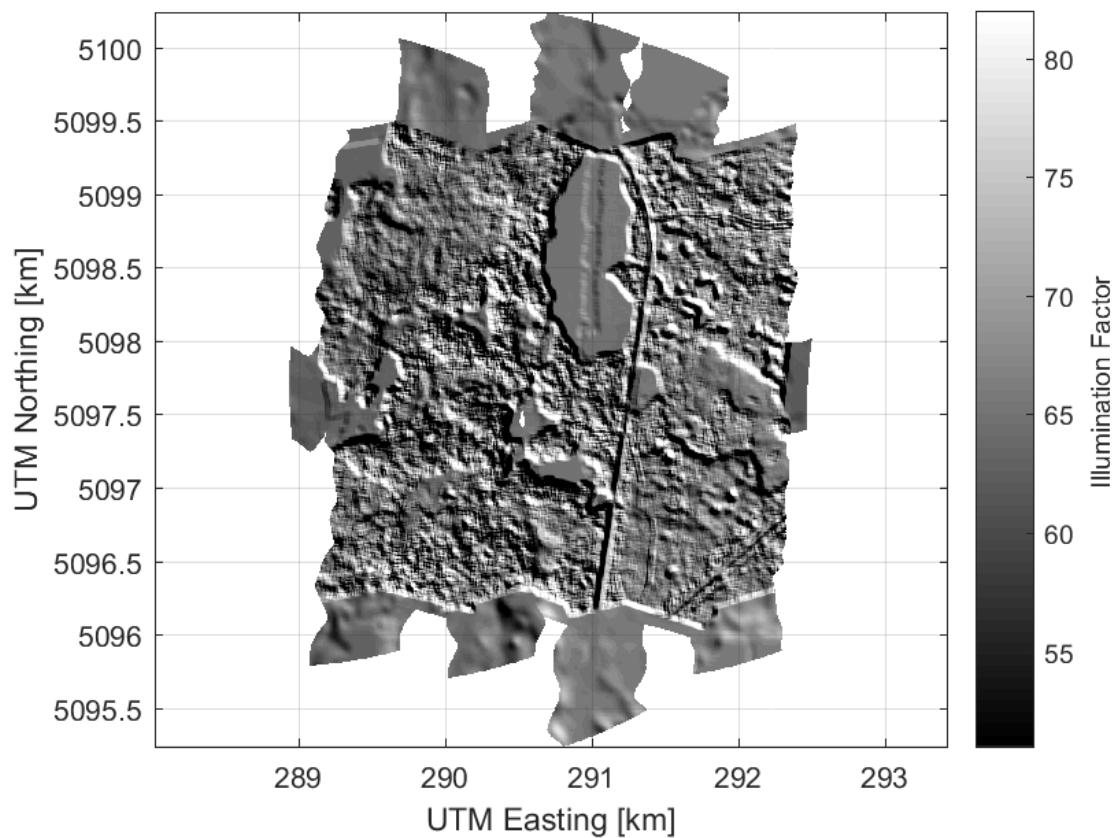


Figure 11: Illumination Factor map

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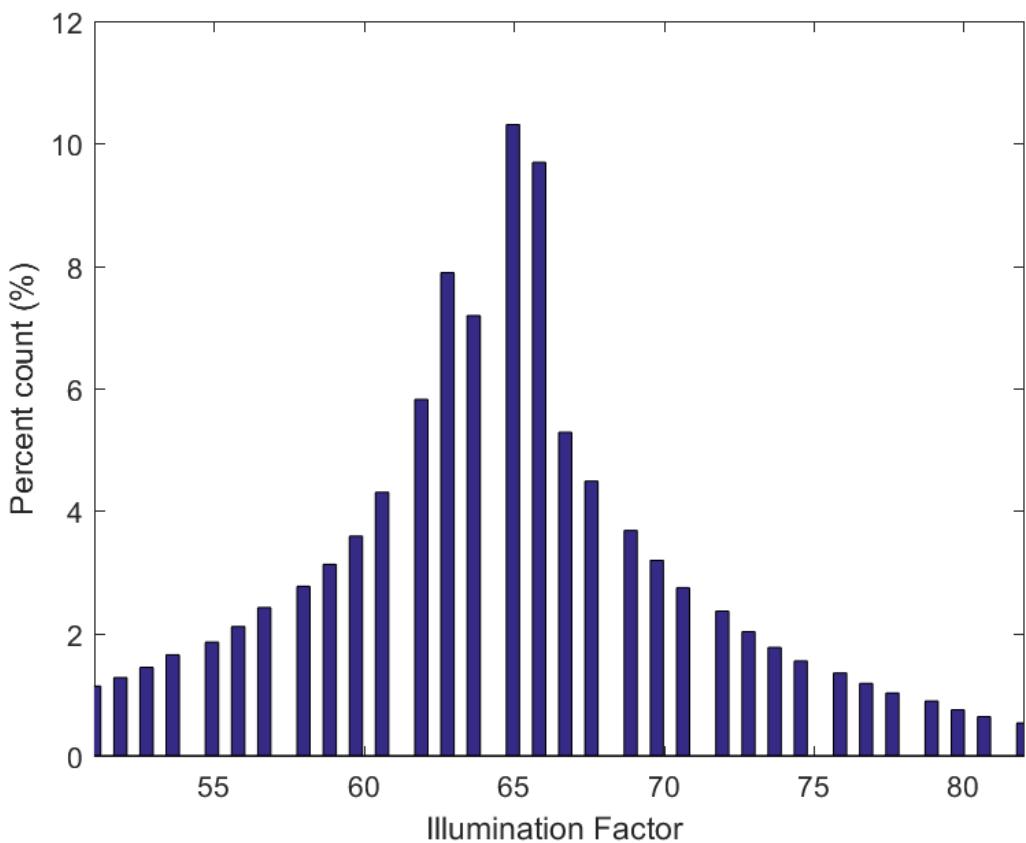


Figure 12: Illumination Factor histogram

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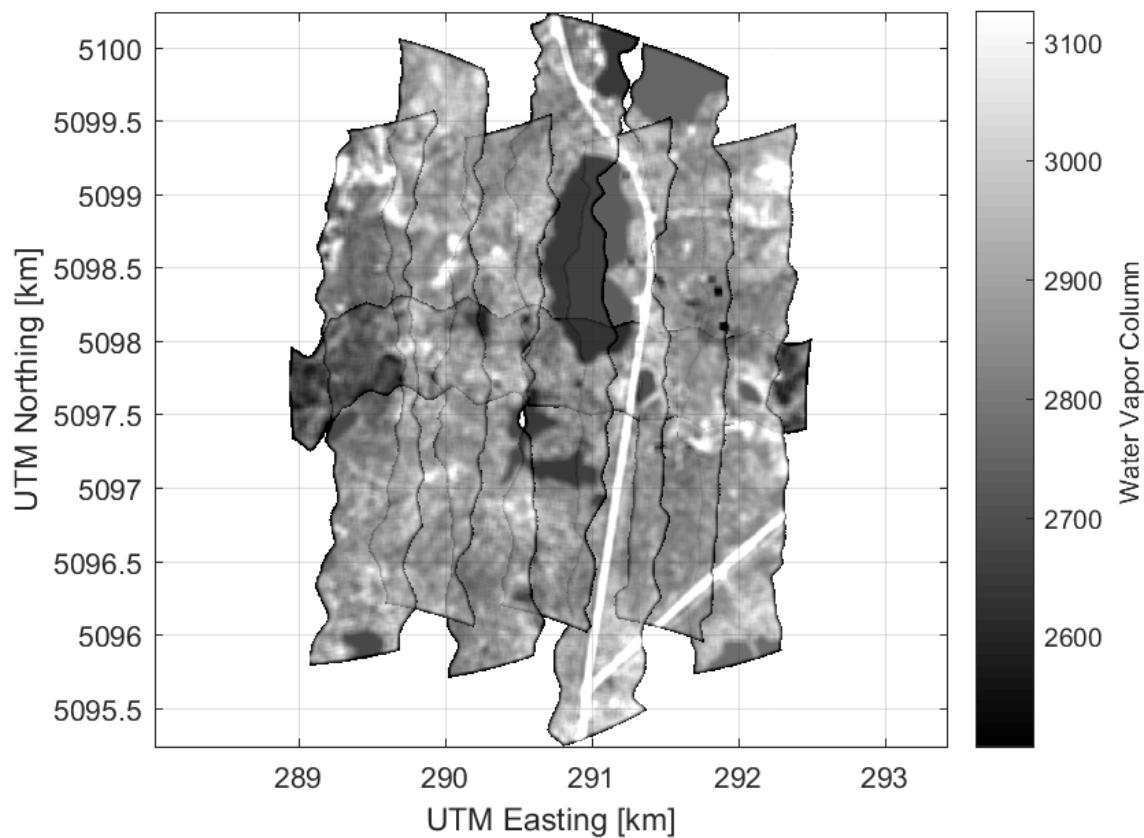


Figure 13: Water Vapor Column map

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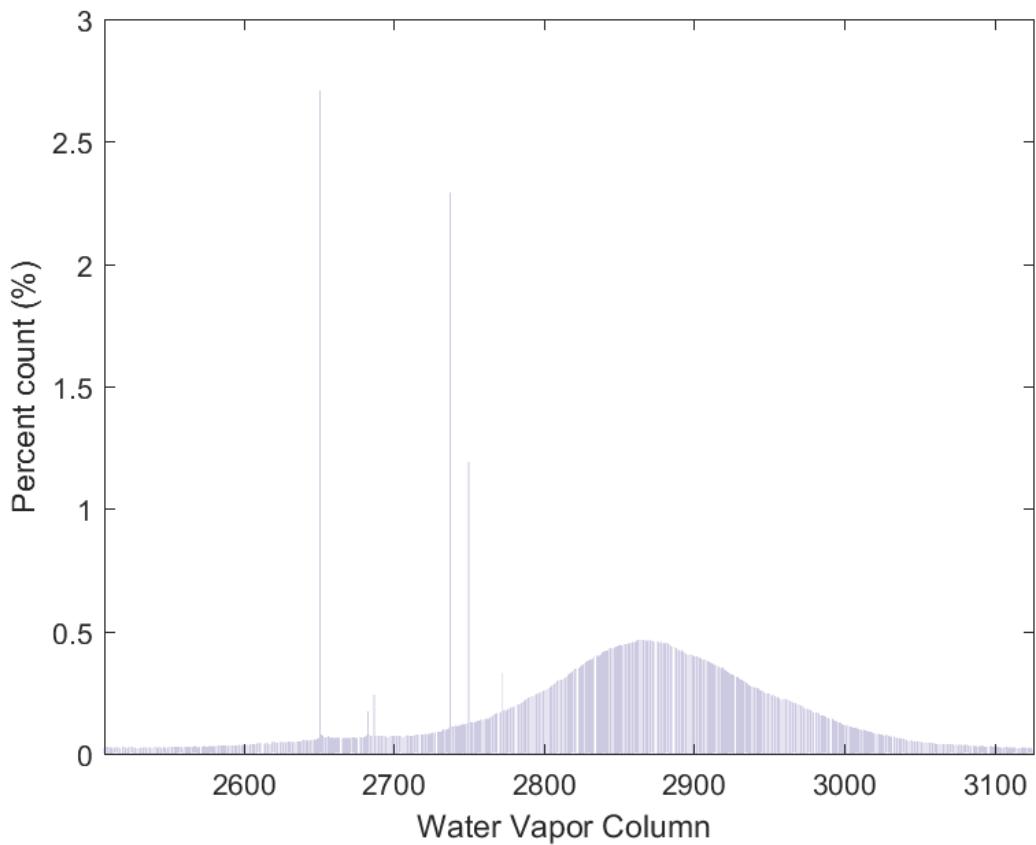


Figure 14: Water Vapor Column histogram

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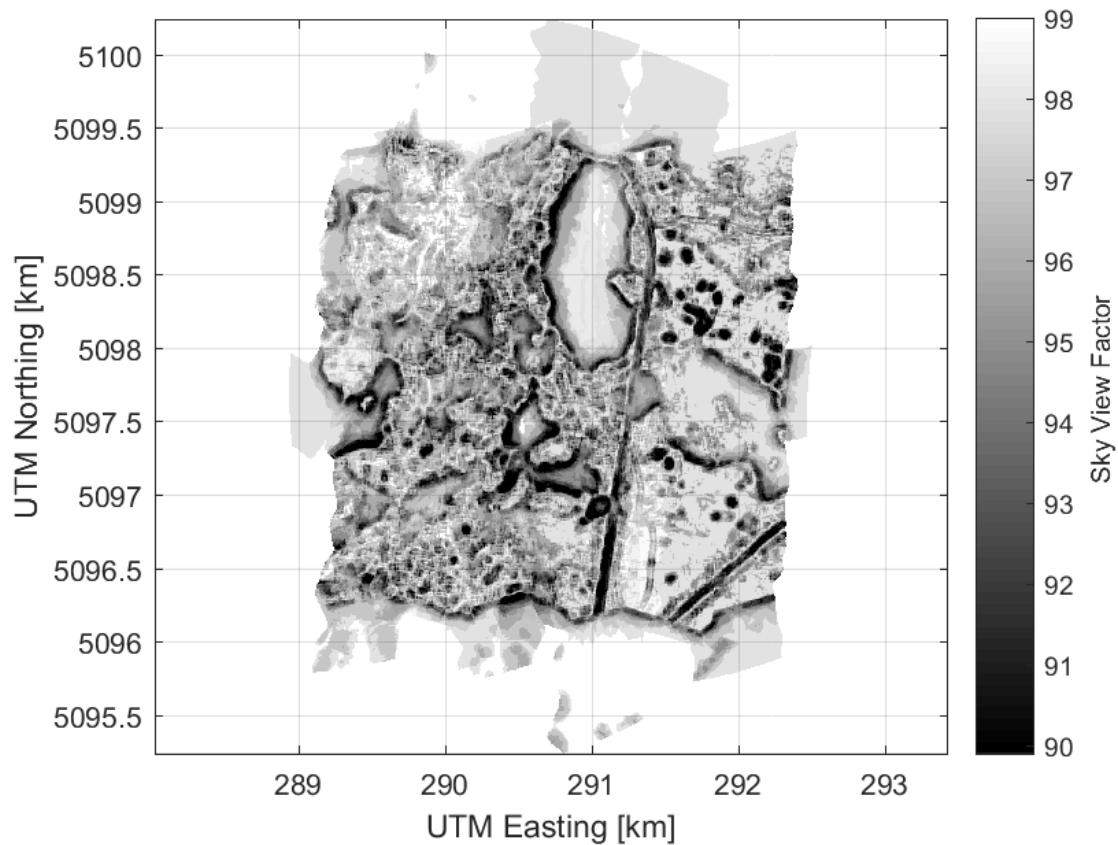


Figure 15: Sky View Factor map

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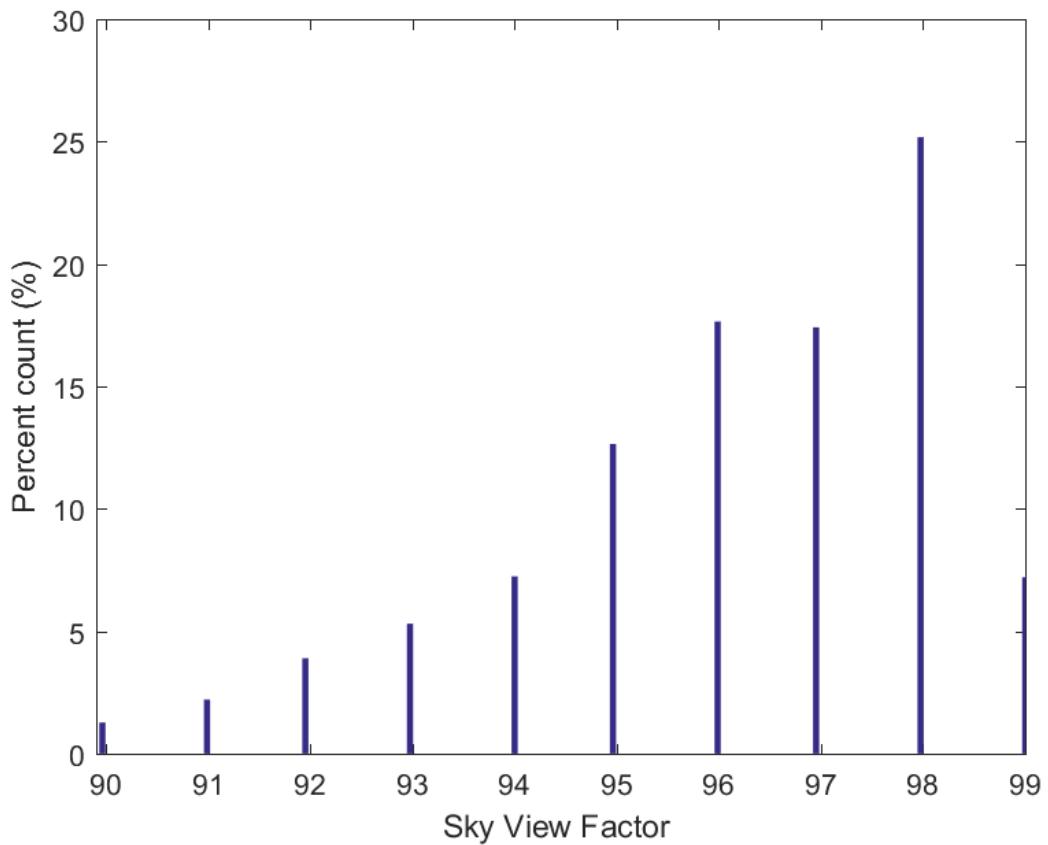


Figure 16: Sky View Factor histogram

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7 RGB / NIR-GB rasters and histograms

The products given in Table 8 and Figure 17 to Figure 19 are RGB and NIR-GB images calculated from the ATCOR derived surface reflectance. Figure 17 shows a true color (RGB) overview of the site with associated histogram in Figure 18, while Figure 19 shows a false color representation using the NIR, G, and B bands. Theoretical limits have been identified for each raster, and the number of values outside these limits (below and above percentages) are identified in Table 8 to provide a QA metric that ensures rasters were appropriately calculated. The table also displays the number of cells which were determined to be zero. Too high a percentage in these categories could indicate an issue in the calculation that requires attention. Each L2 raster product is displayed with an associated histogram in Figure 17 to Figure 19. The histograms show 95% of the data within the theoretical limits.

Table 8: Summary statistics for RGB and NIR bands

Product	Min	Max	Mean	Median	Theor. Min	Theor. Max	Below Limit (%)	Above Limit (%)	Equal to Zero (%)
Red	0.00	1.56	0.02	0.01	0.00	1.00	0.00	0.00	0.00
Green	0.00	1.04	0.03	0.03	0.00	1.00	0.00	0.00	0.00
Blue	0.00	0.78	0.01	0.01	0.00	1.00	0.00	0.00	0.00
NIR	0.00	1.51	0.24	0.24	0.00	1.00	0.00	0.00	0.00

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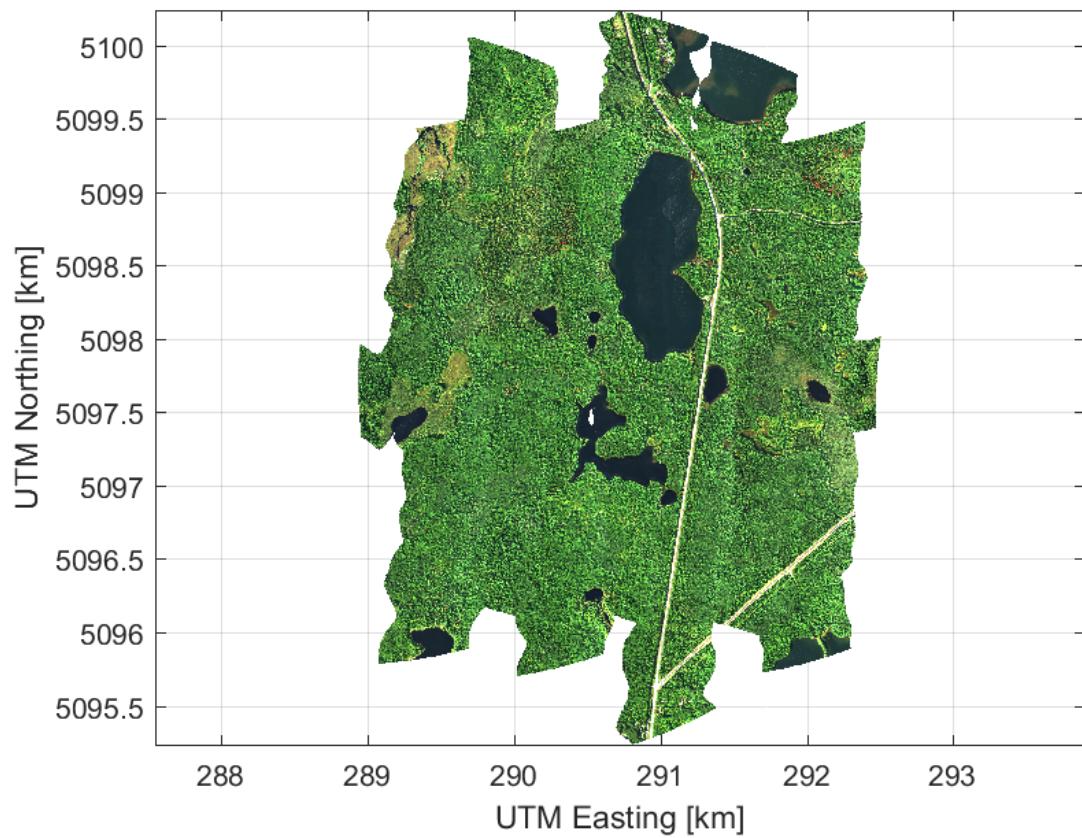


Figure 17: RGB map

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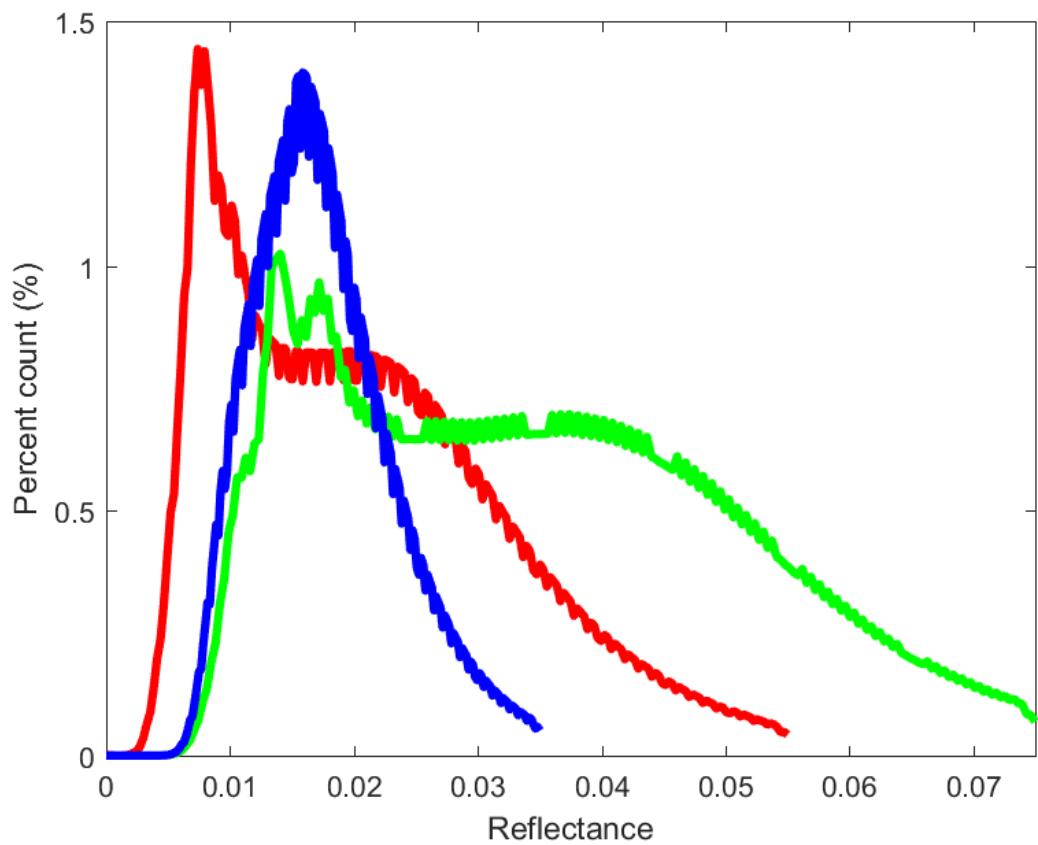


Figure 18: RGB histogram

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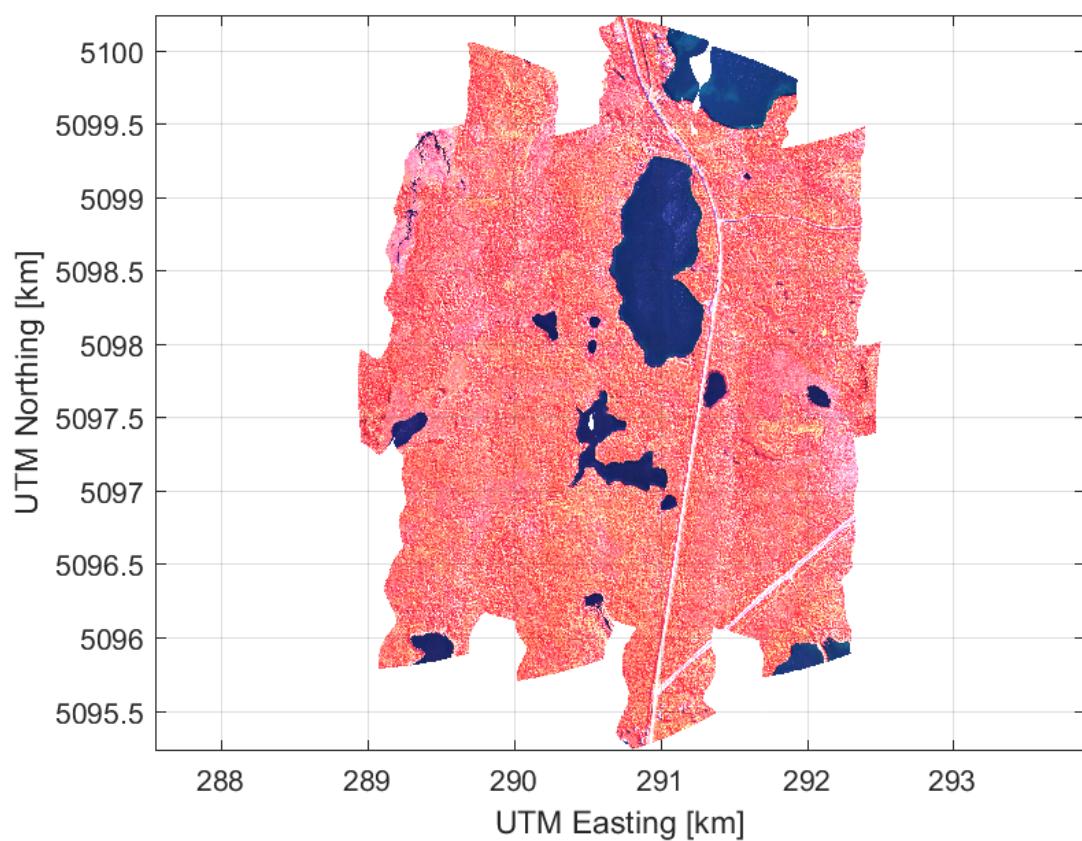


Figure 19: False color map

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

7.1 Vegetation Indices

The products given in Table 9 and Figure 20 to Figure 31 are vegetation indices calculated from the ATCOR derived surface reflectance (see RD[09]). Theoretical limits have been identified for each raster, and the number of values outside these limits (below and above percentages) are identified in Table 9 to provide a QA metric that ensures rasters were appropriately calculated. The table also displays the number of cells which were determined to be zero. Too high a percentage in these categories could indicate an issue in the calculation that requires attention. Each L2 raster product is displayed with an associated histogram in Figure 20 to Figure 31. The histograms show 95% of the data within the theoretical limits.

Table 9: Summary statistics for L2 vegetation indices

Product	Min	Max	Mean	Median	Theor. Min	Theor. Max	Below Limit (%)	Above Limit (%)	Equal to Zero (%)
NDVI	-0.67	1.00	0.82	0.86	-1.00	1.00	0.00	0.00	0.00
EVI	-0.10	1.20	0.47	0.48	-2.00	2.00	0.00	0.00	0.00
ARVI	-53.71	53.85	0.80	0.84	-1.00	1.50	0.00	0.00	0.00
PRI	-1.00	0.52	-0.05	-0.06	-1.00	1.00	0.00	0.00	0.01
NDLI	-0.16	1.56	0.05	0.05	-1.00	1.00	0.00	0.00	0.00
NDNI	-0.39	0.70	0.13	0.13	-1.00	1.00	0.00	0.00	0.00
SAVI	-0.12	0.93	0.44	0.46	-1.00	1.00	0.00	0.00	0.00

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

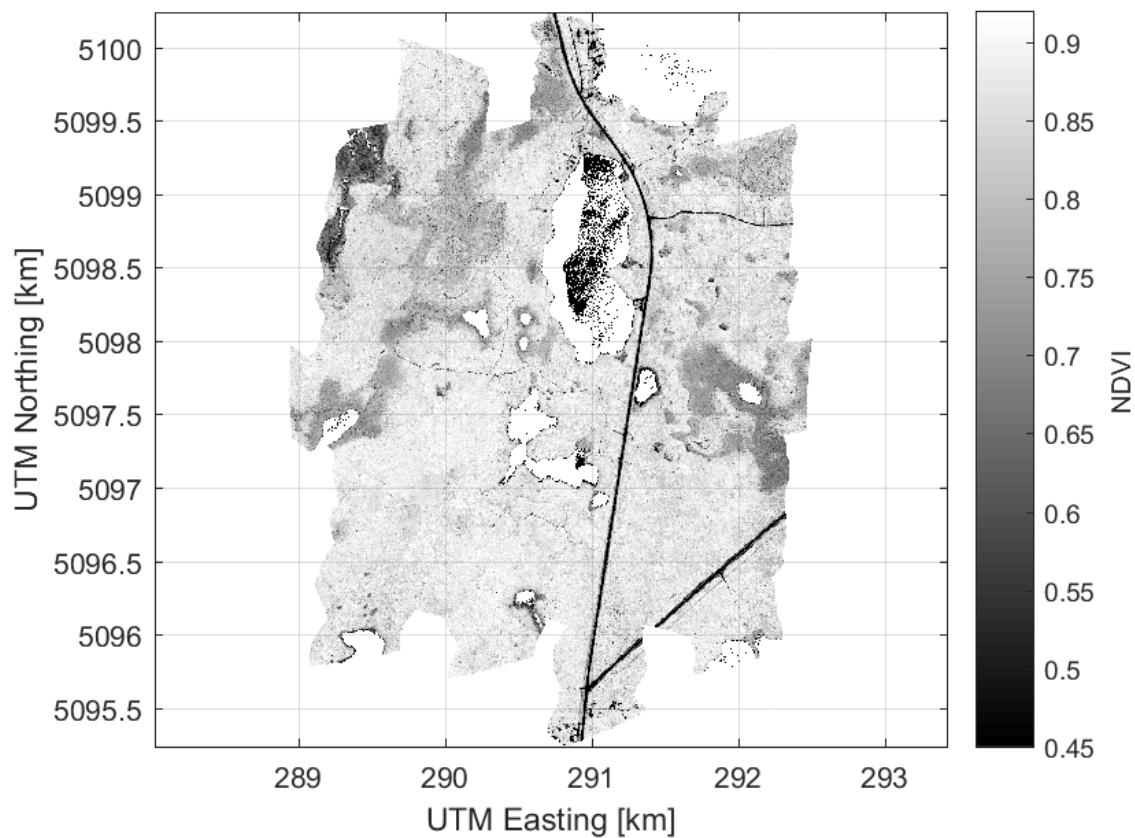


Figure 20: NDVI map

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

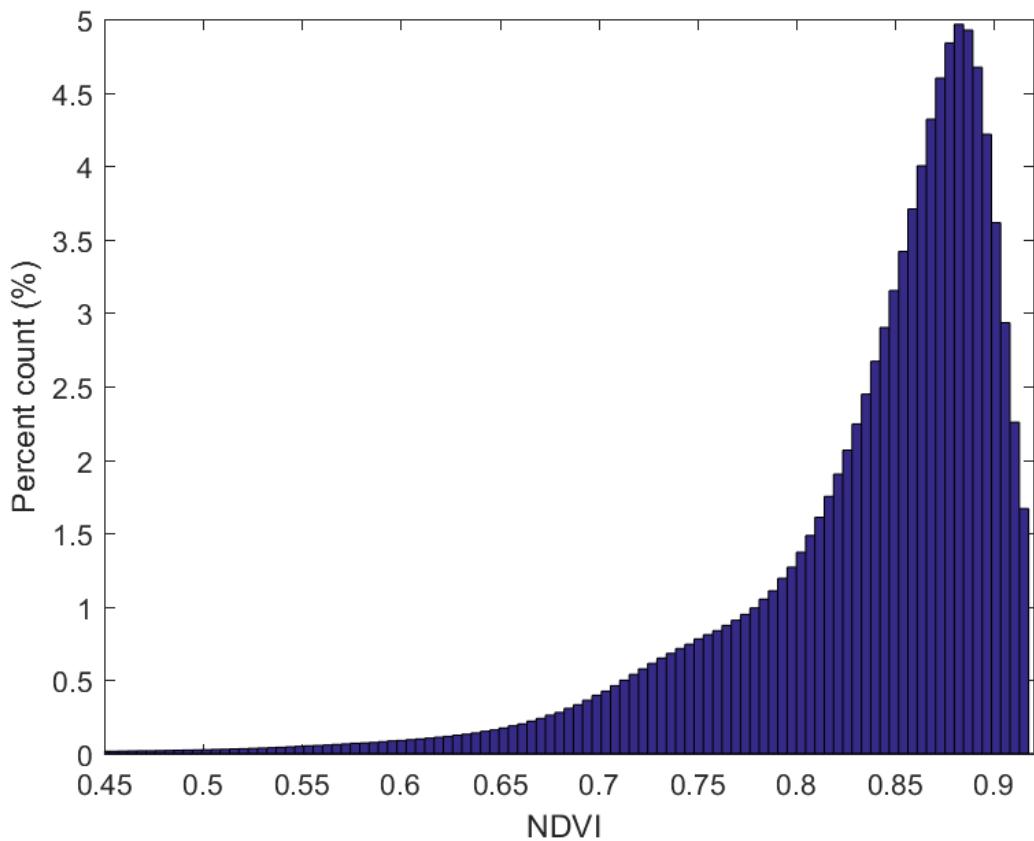


Figure 21: NDVI histogram

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

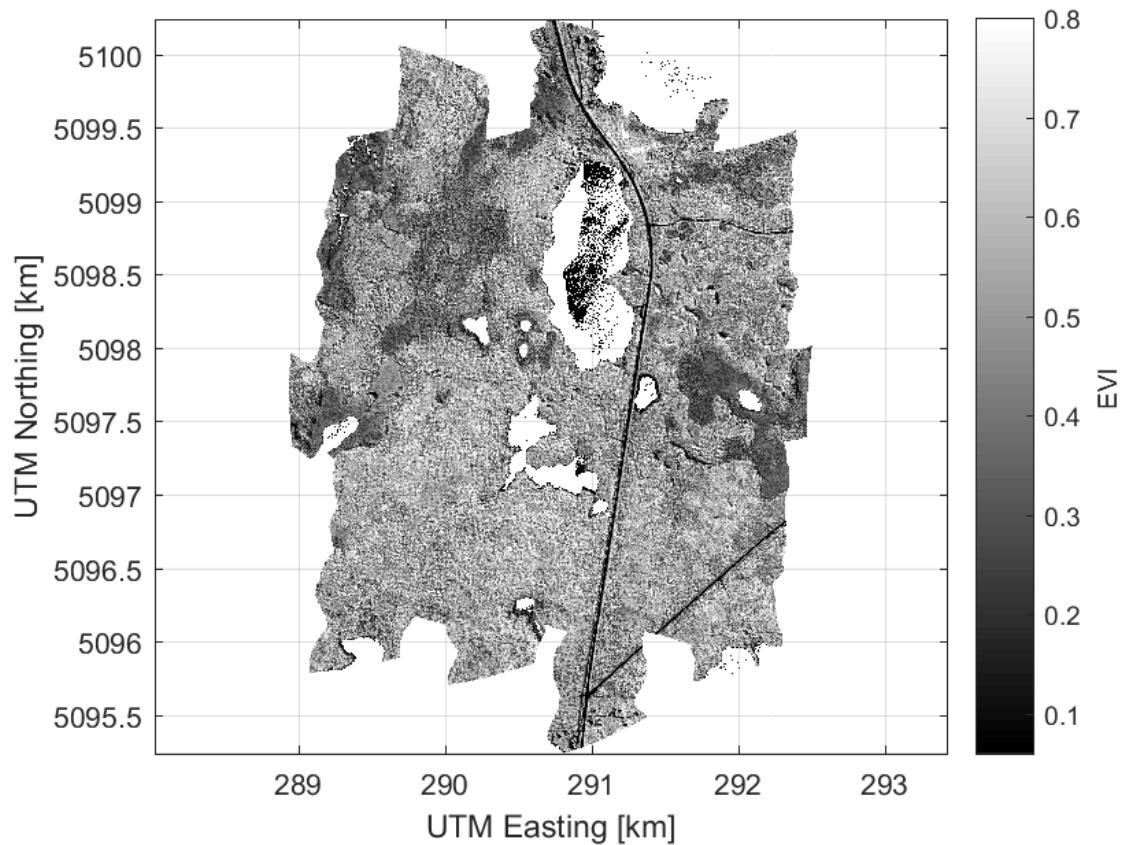


Figure 22: EVI map

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

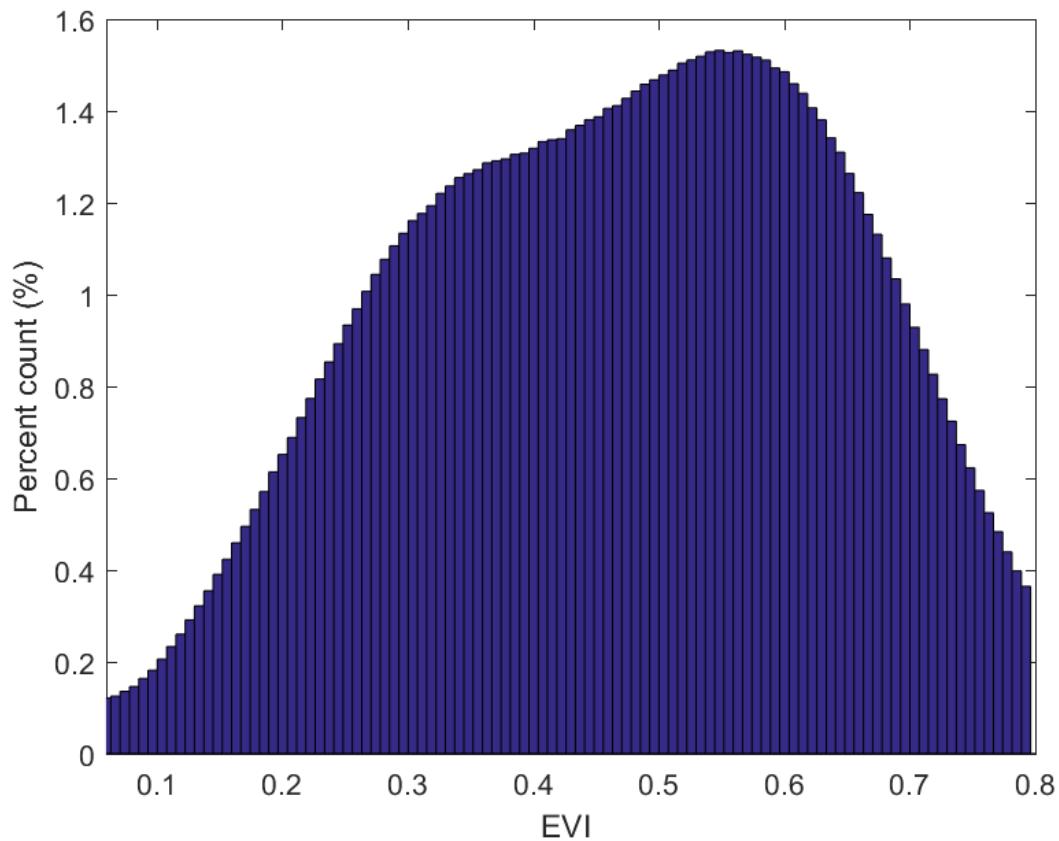


Figure 23: EVI histogram

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

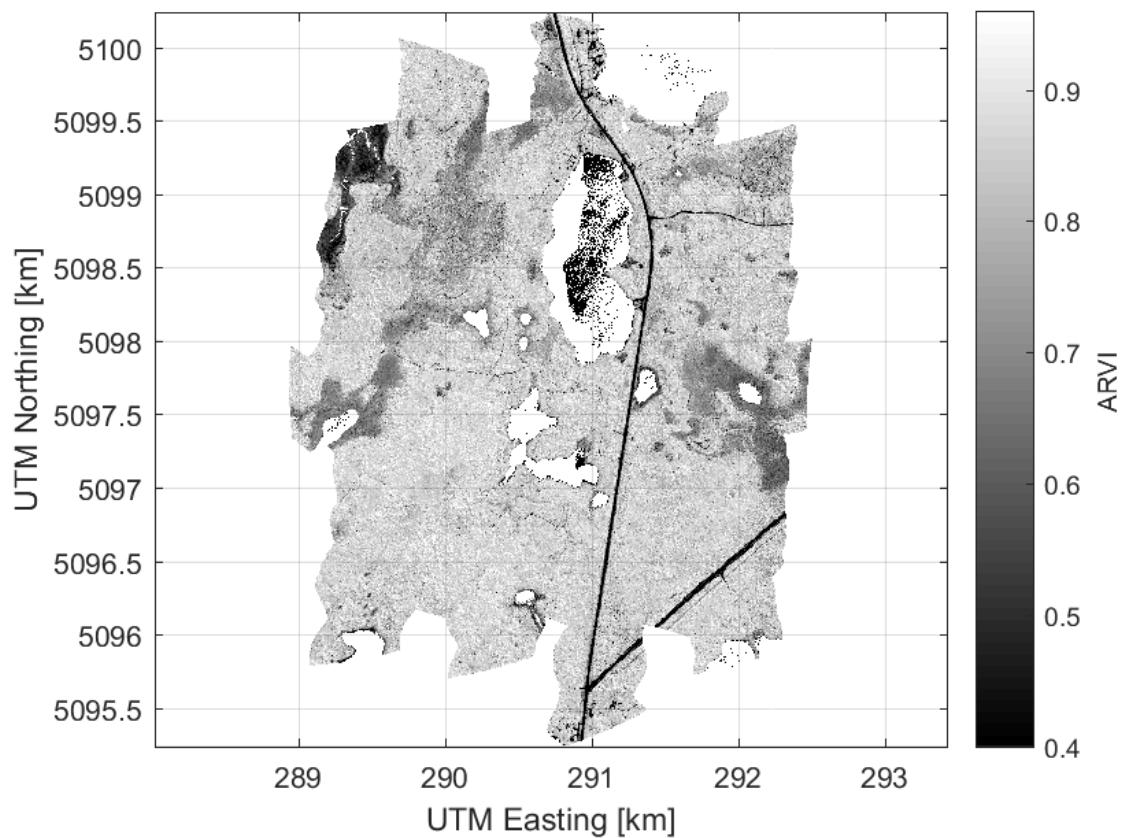


Figure 24: ARVI map

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

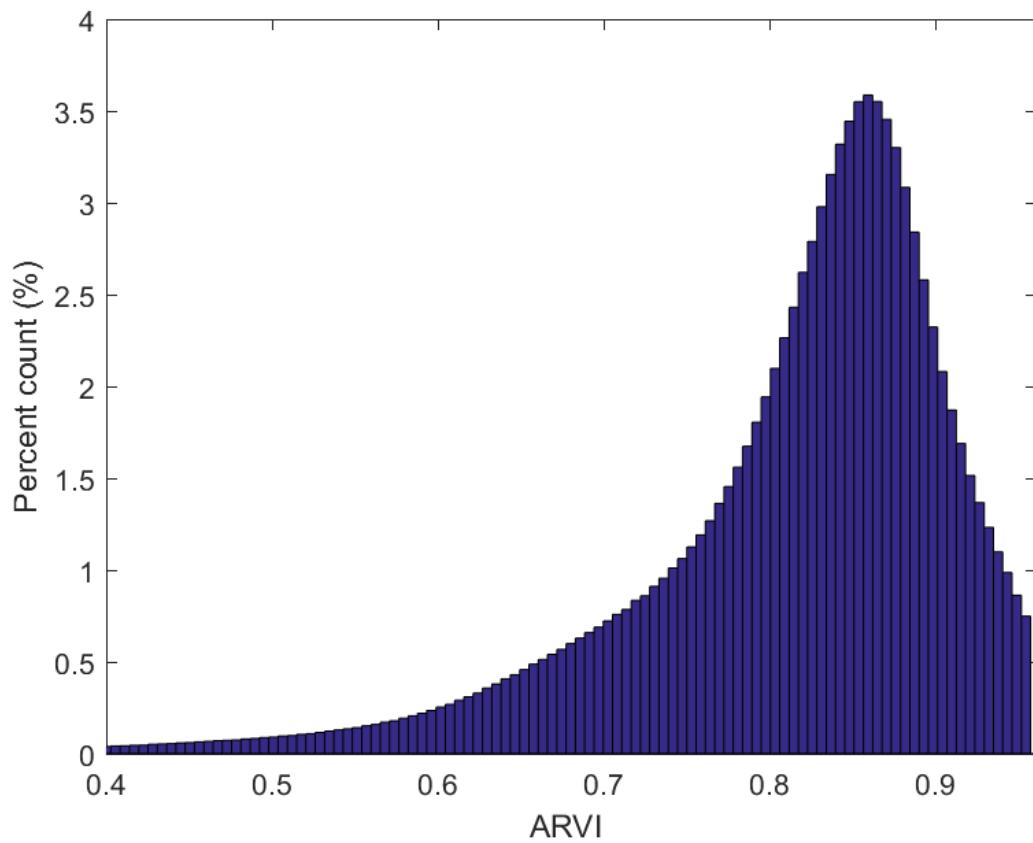


Figure 25: ARVI histogram

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

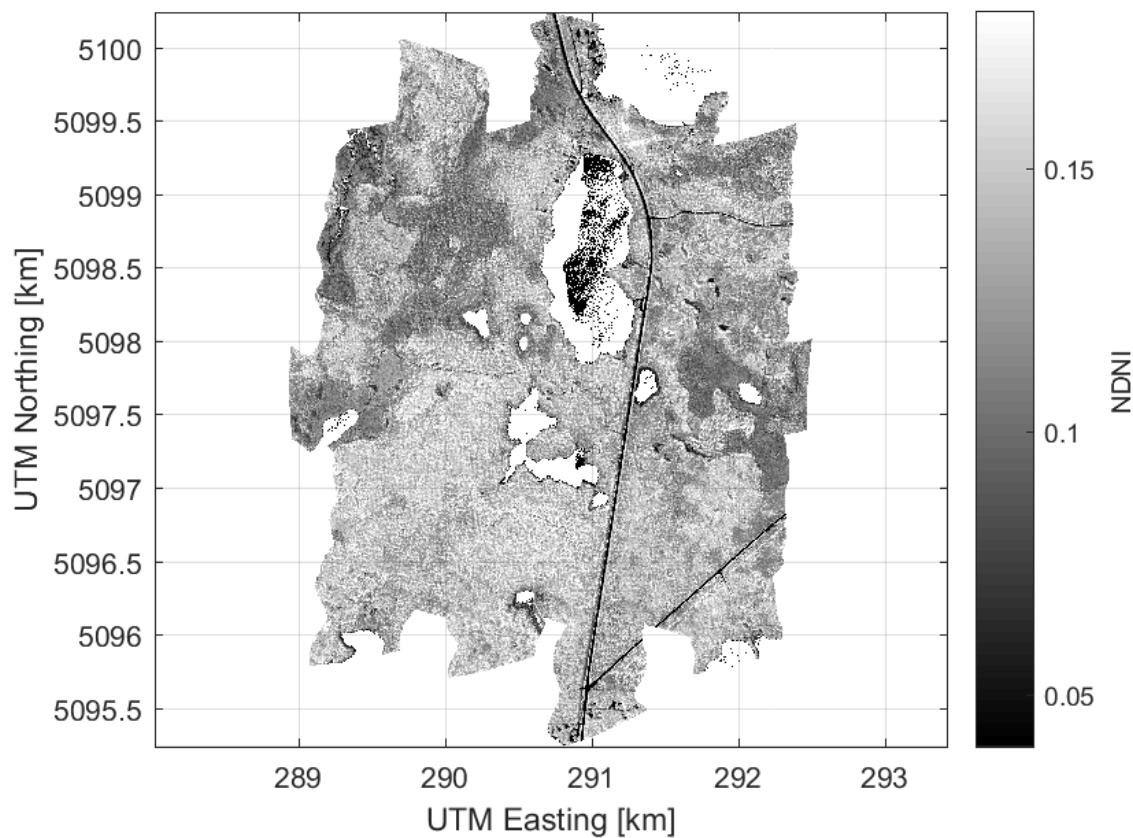


Figure 26: NDVI map

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

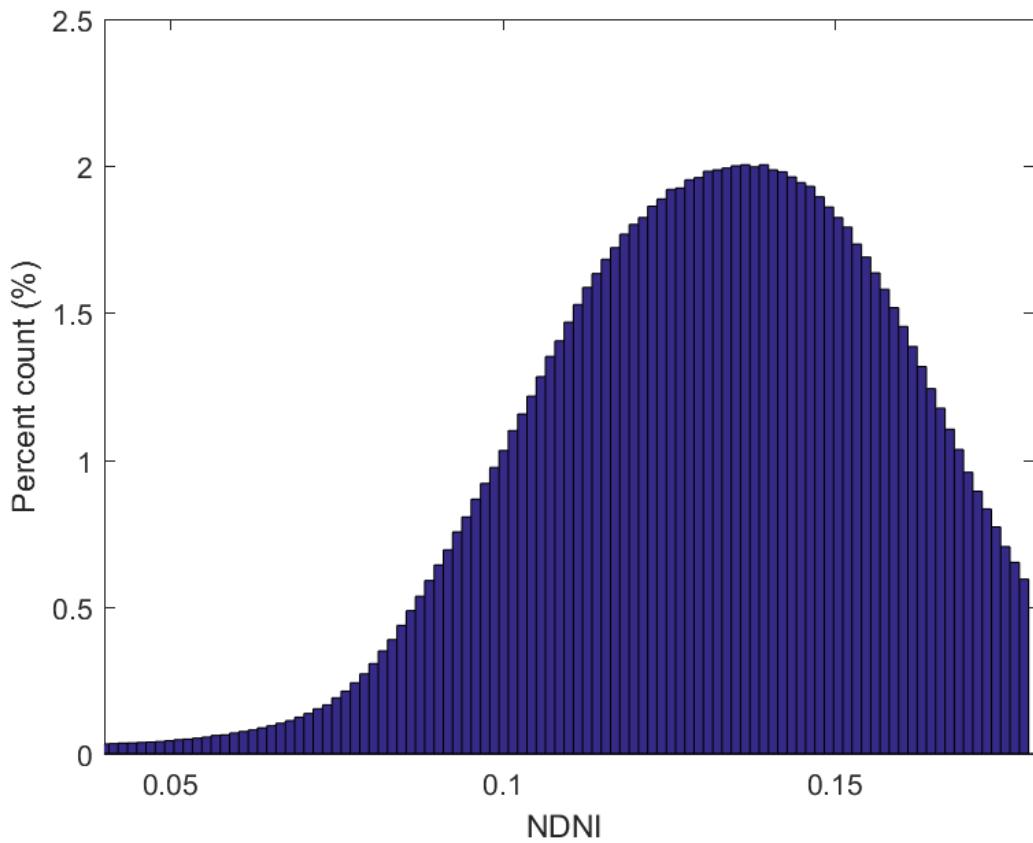


Figure 27: NDNI histogram

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

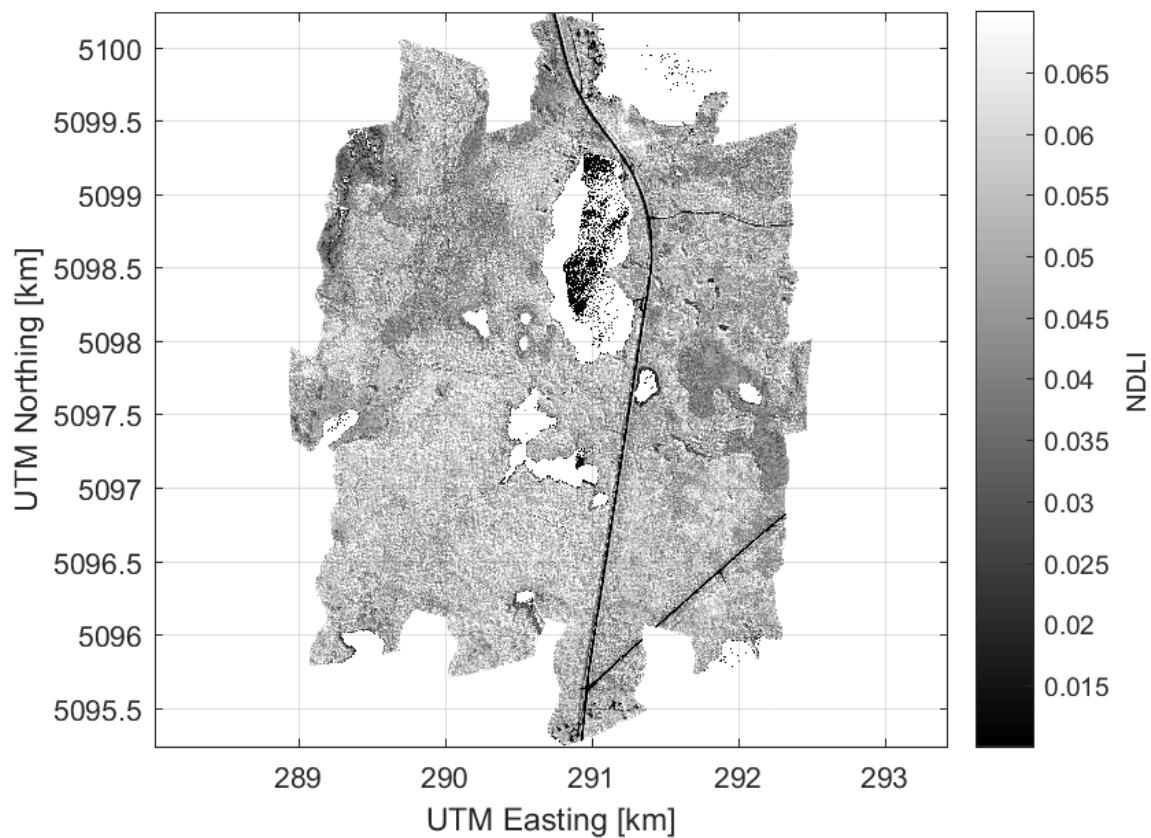


Figure 28: NDLI map

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

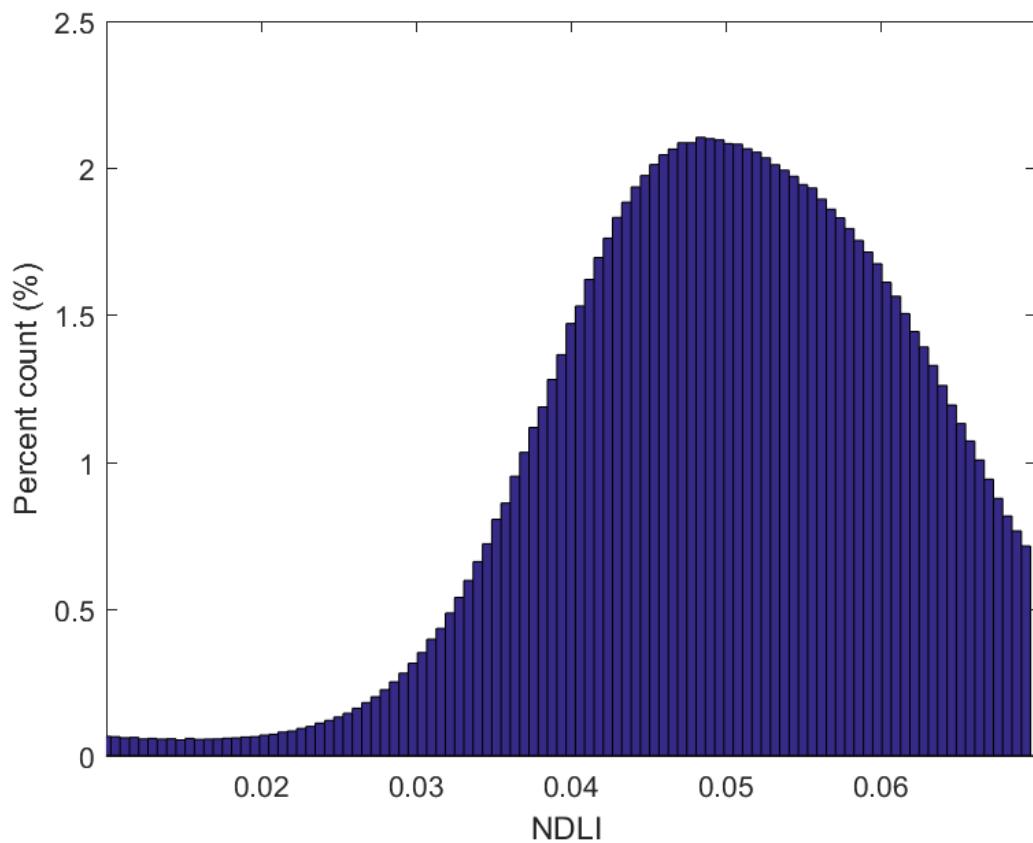


Figure 29: NDLI histogram

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

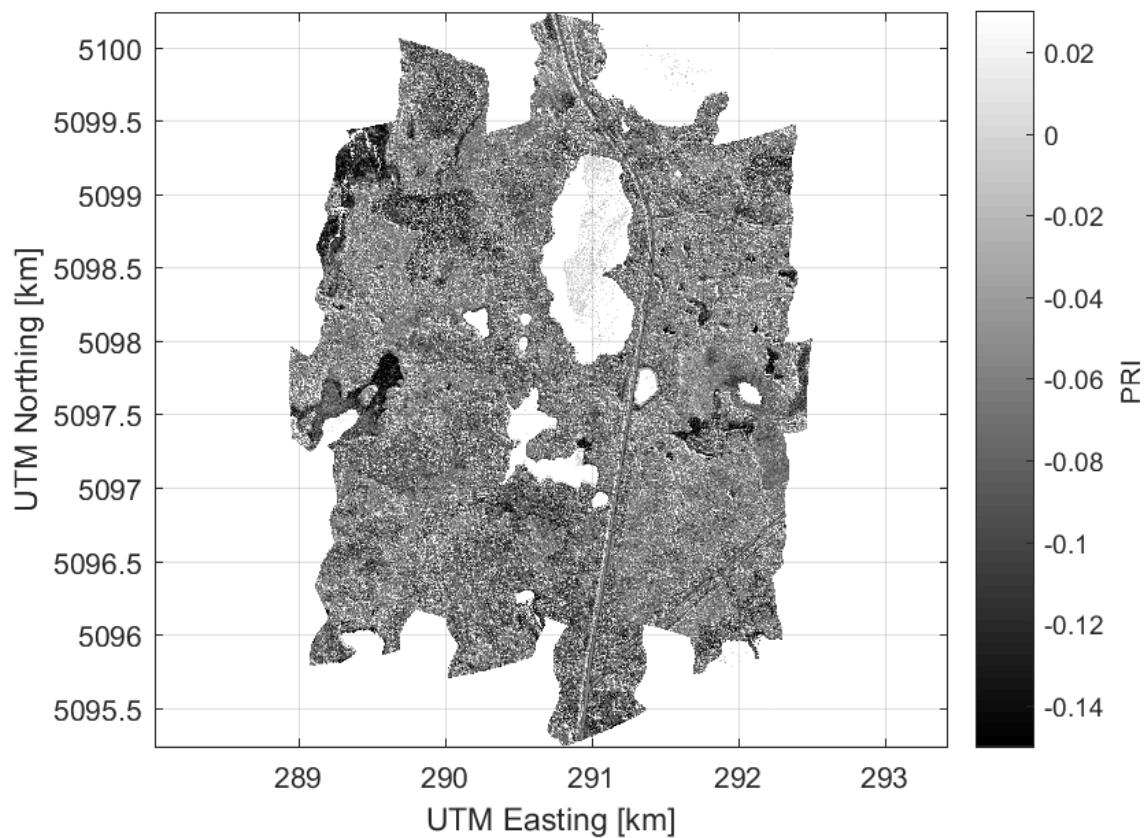


Figure 30: PRI map

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

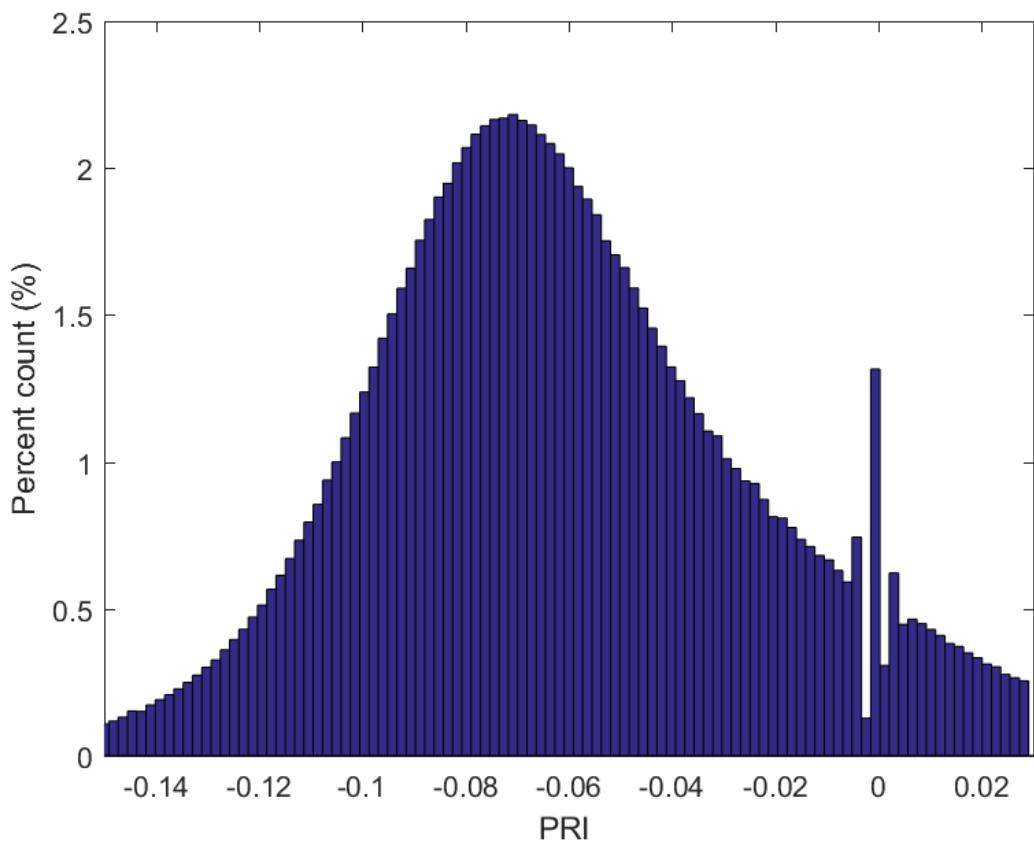


Figure 31: PRI histogram

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

7.2 Water Indices

The products given in Table 10 and shown in Figure 32 to Figure 41 are water indices calculated from the ATCOR derived surface reflectance (see RD[10]). Theoretical limits have been identified for each raster, and the number of values outside these limits (below and above percentages) are identified in Table 9 to provide a QA metric that ensures rasters were appropriately calculated. The table also displays the number of cells which were determined to be zero. Too high a percentage in these categories could indicate an issue in the calculation that requires attention. Each L2 raster product is displayed with an associated histogram in Figure 32 to Figure 41. The histograms show 95% of the data within the theoretical limits.

Table 10: Summary statistics for L2 water indices

Product	Min	Max	Mean	Median	Theor. Min	Theor. Max	Below Limit (%)	Above Limit (%)	Equal to Zero (%)
MSI	0.00	3.46	0.45	0.43	-1.00	2.00	0.00	0.00	0.00
WBI	0.00	5.64	1.03	1.03	-1.00	1.50	0.00	0.07	0.00
NDII	-0.54	0.92	0.32	0.33	-1.00	2.00	0.00	0.00	0.00
NDWI	-0.48	0.82	0.00	0.01	-1.00	1.00	0.00	0.00	0.00
NMDI	-0.03	3.89	0.53	0.53	-1.00	1.00	0.00	0.36	0.00

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

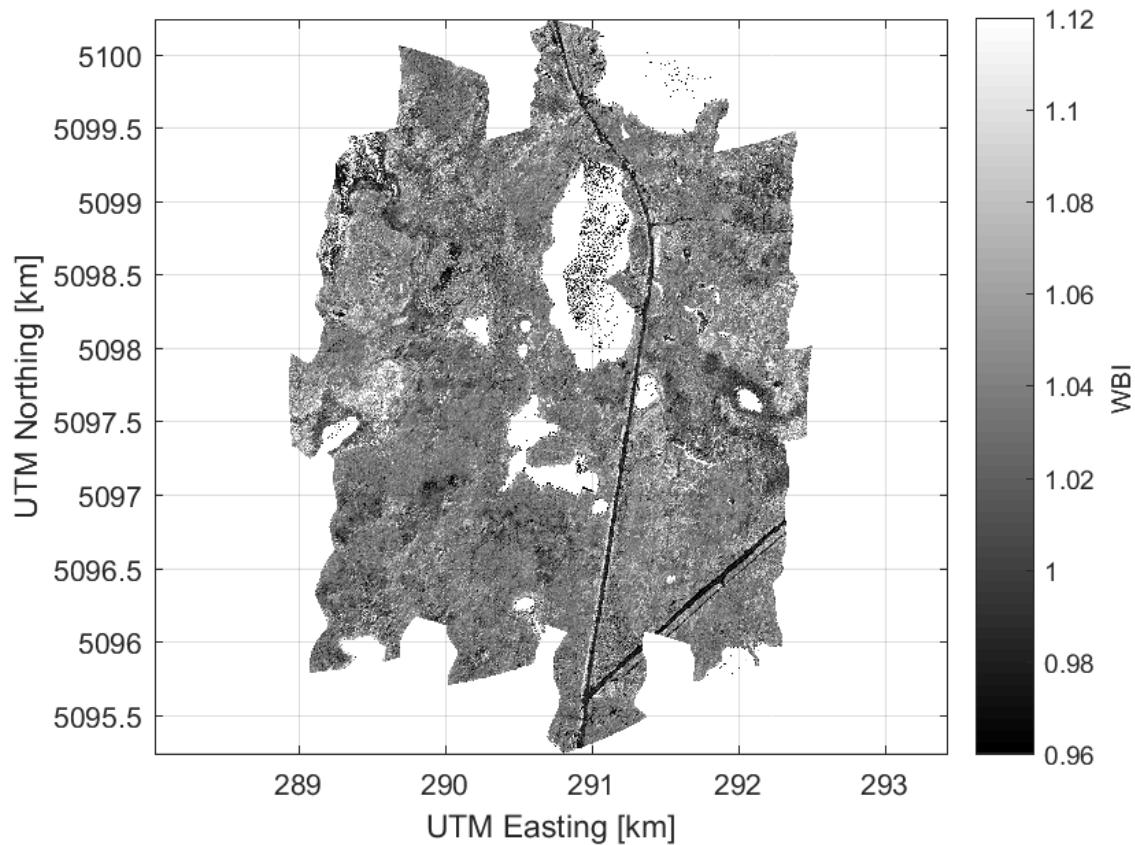


Figure 32: WBI map

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

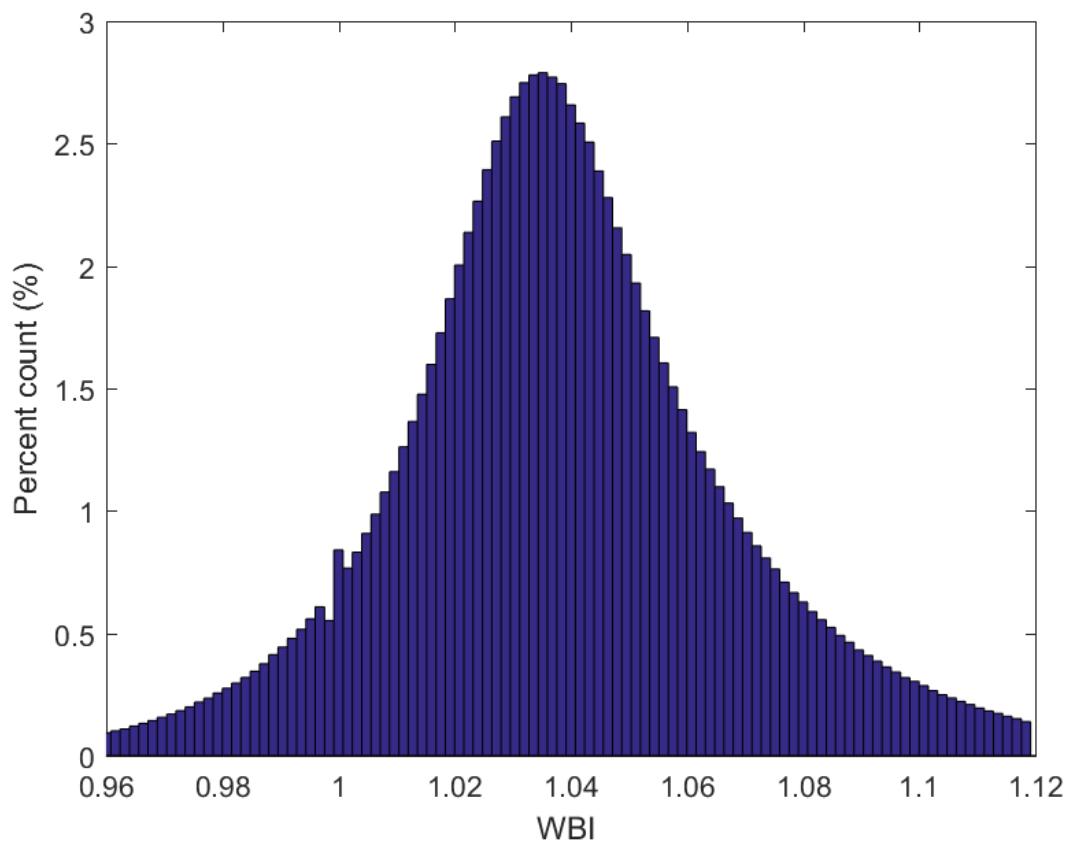


Figure 33: WBI histogram

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

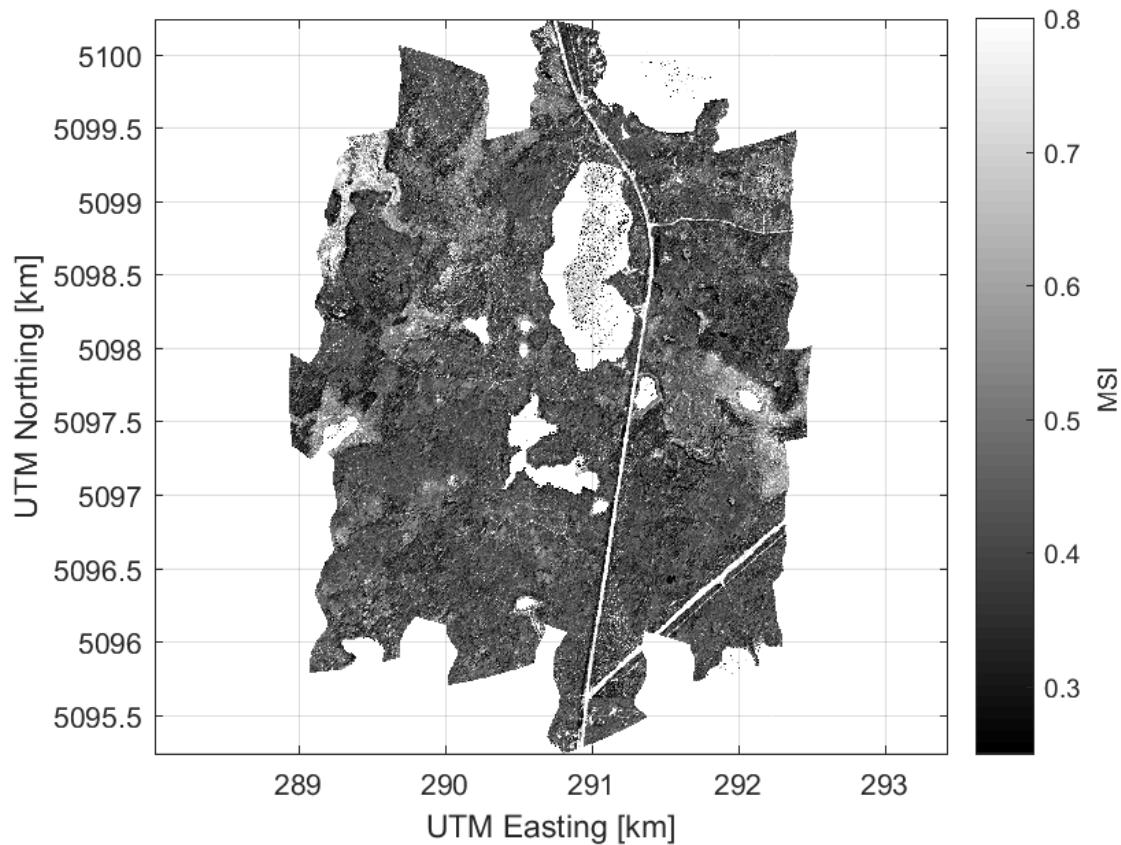


Figure 34: MSI map

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

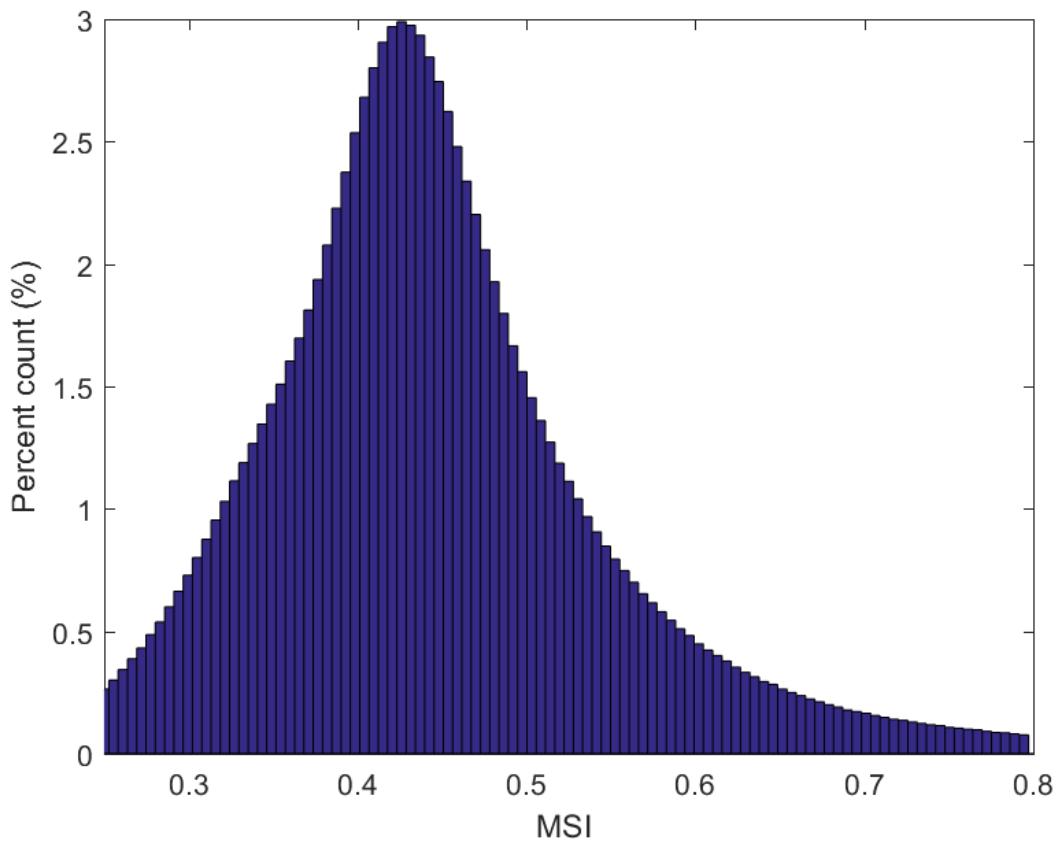


Figure 35: MSI histogram

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

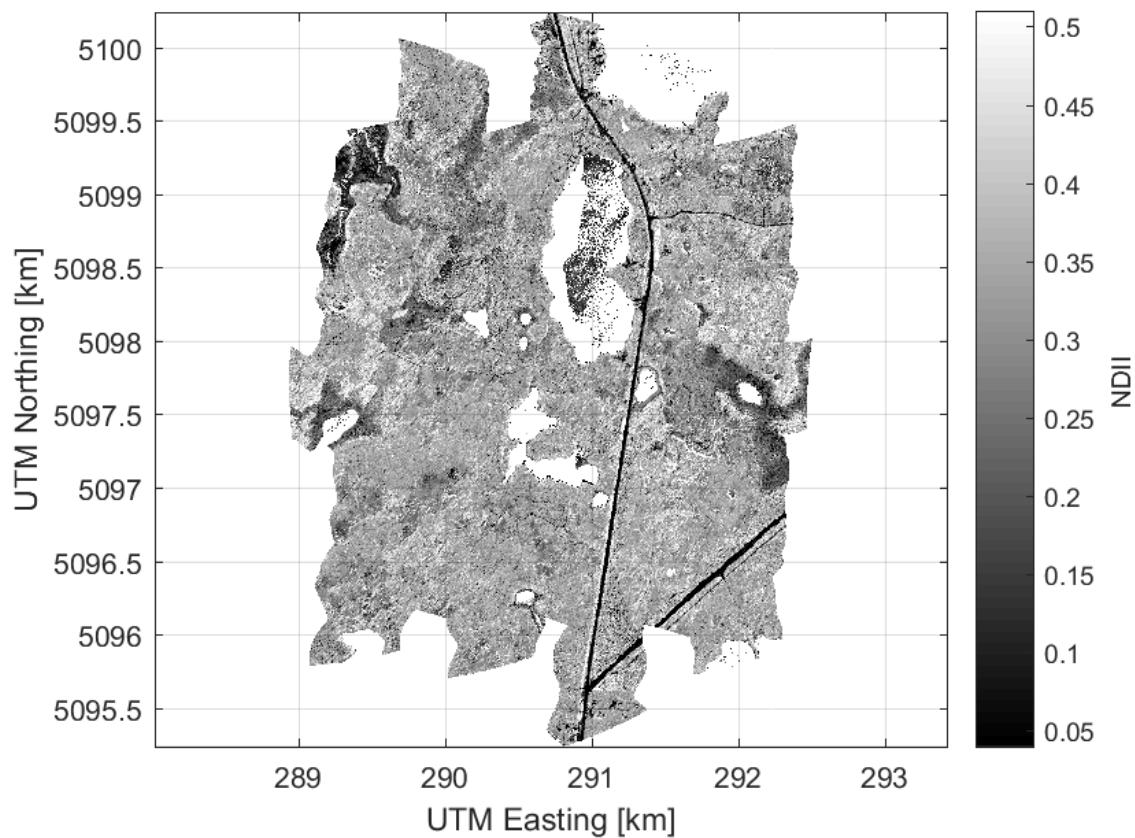


Figure 36: NDII map

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

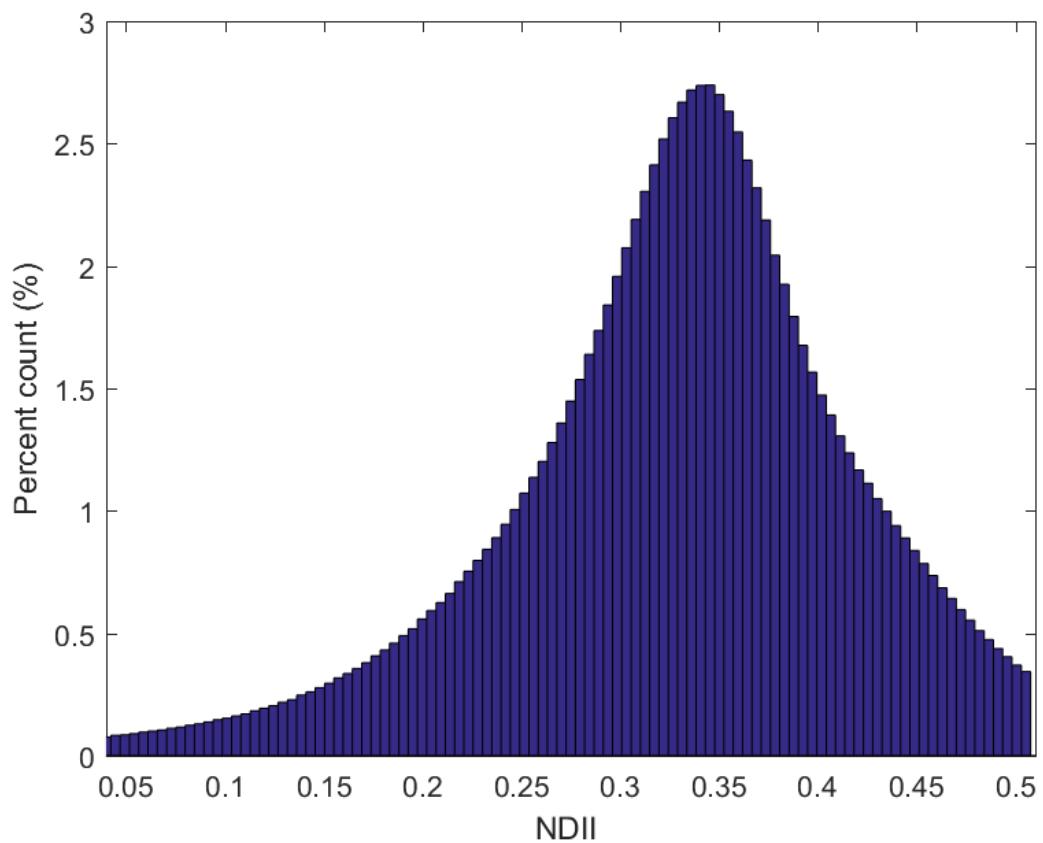


Figure 37: NDII histogram

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

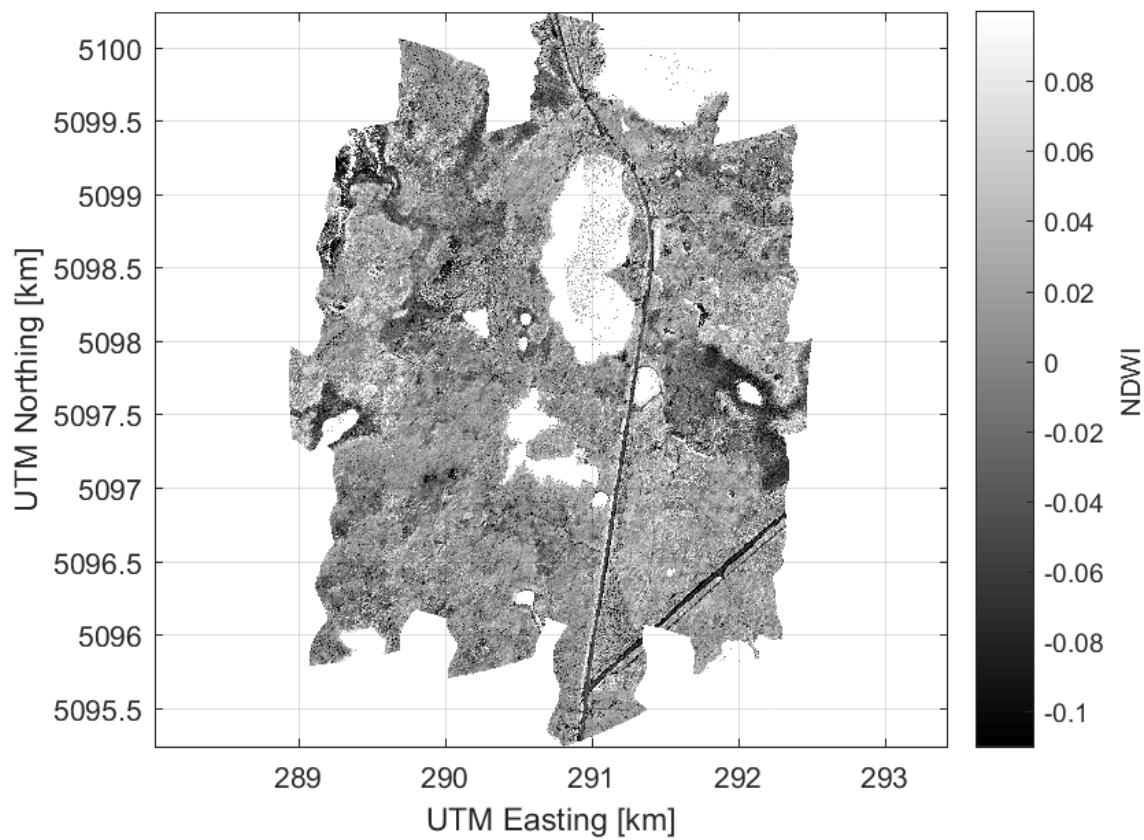


Figure 38: NDWI map

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

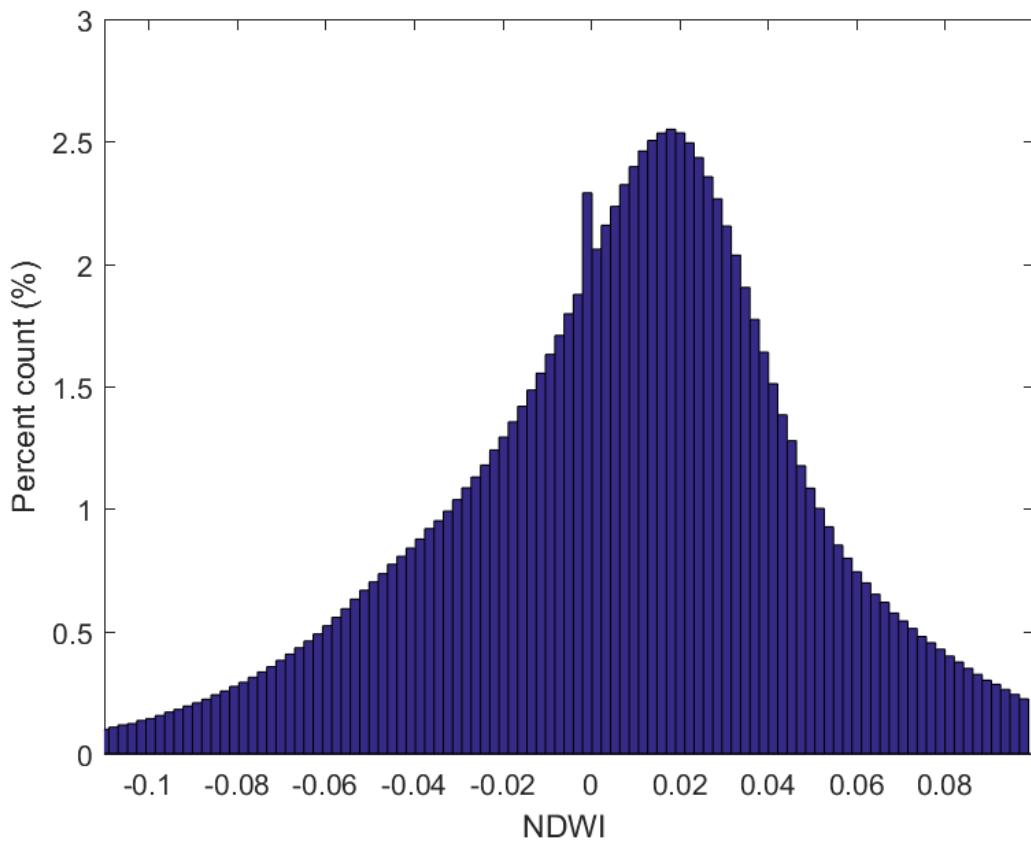


Figure 39: NDWI histogram

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

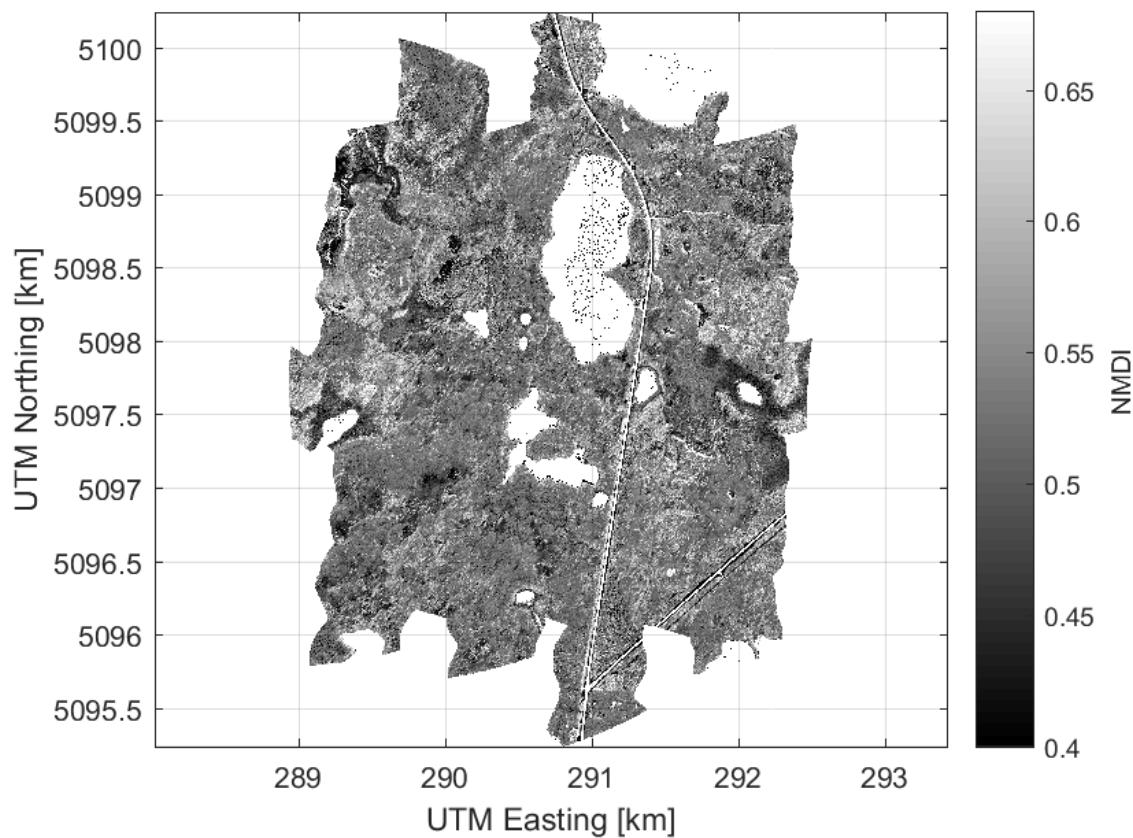


Figure 40: NMDI map

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

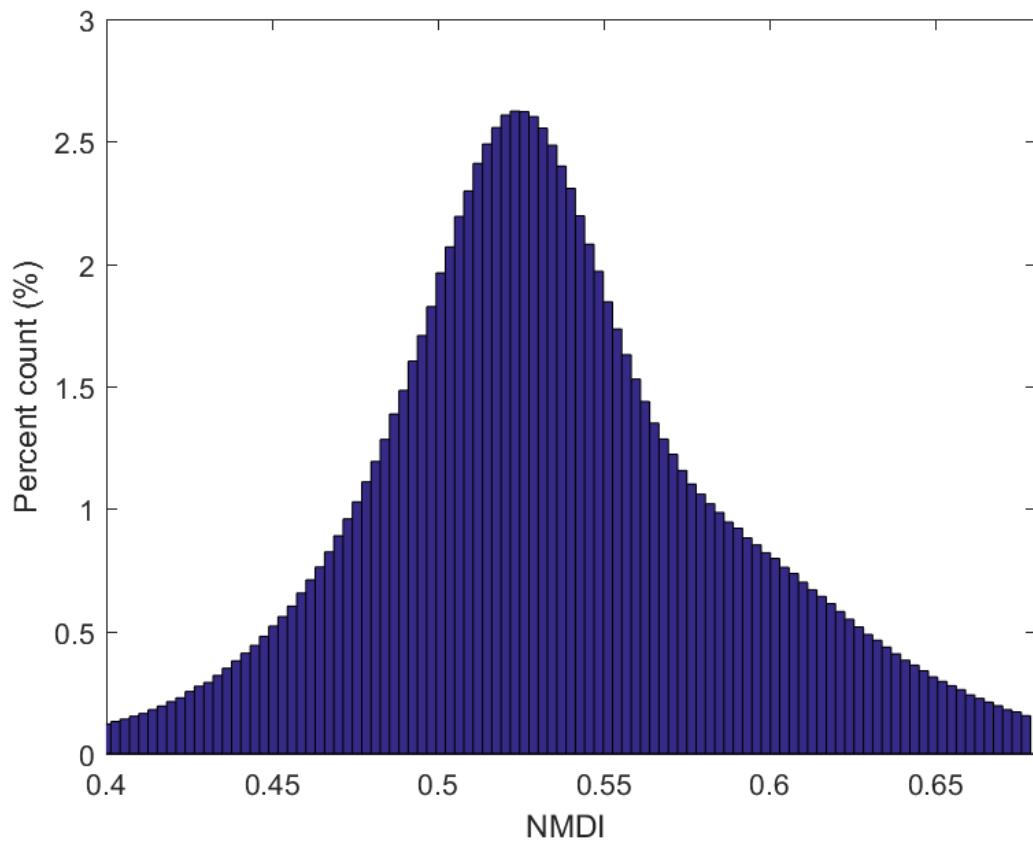


Figure 41: NMDI histogram

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

8 Derived Spectrometer Indices

The products given in Table 11 and shown in Figure 42 to Figure 51 are spectrometer indices derived from the ATCOR derived surface reflectance including LAI (RD[12]), fPAR (RD[11]), Biomass(RD[20]) and Albedo (RD[12]). Theoretical limits have been identified for each raster, and the number of values outside these limits (below and above percentages) are identified in Table 11 to provide a QA metric that ensures rasters were appropriately calculated. The table also displays the number of cells which were determined to be zero. Too high a percentage in these categories could indicate an issue in the calculation that requires attention. Each L2 raster product is displayed with an associated histogram in Figure 42 to Figure 51. The histograms show 95% of the data within the theoretical limits.

Table 11: Summary statistics for L2 derived spectrometer indices

Product	Min	Max	Mean	Median	Theor. Min	Theor. Max	Below Limit (%)	Above Limit (%)	Equal to Zero (%)
Biomass	0.00	55.95	45.95	48.07	0.00	50.00	0.00	18.69	0.01
LAI	0.00	20.82	1.39	1.31	-0.50	8.00	0.00	0.01	0.01
fPAR	0.00	0.99	0.35	0.37	-0.50	8.00	0.00	0.00	0.11
fPAR error	0.00	0.74	0.01	0.01	0.00	0.05	0.00	0.07	0.00

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

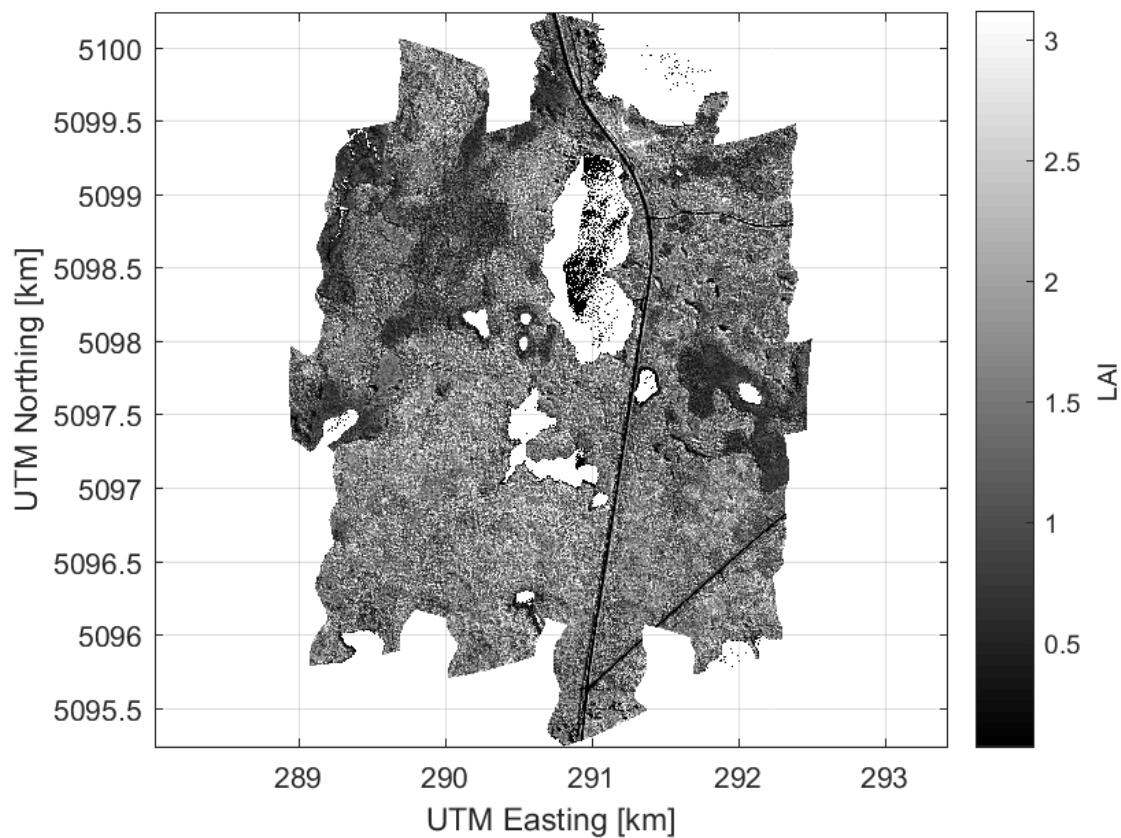


Figure 42: LAI map

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

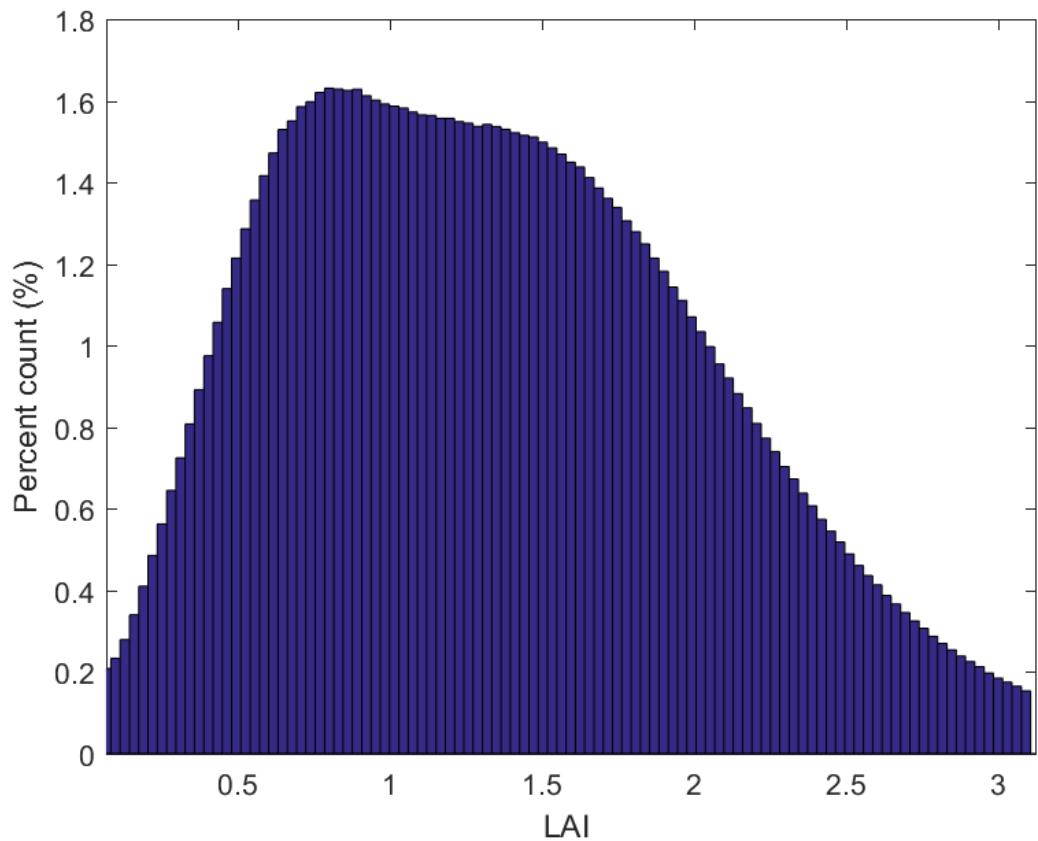


Figure 43: LAI histogram

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

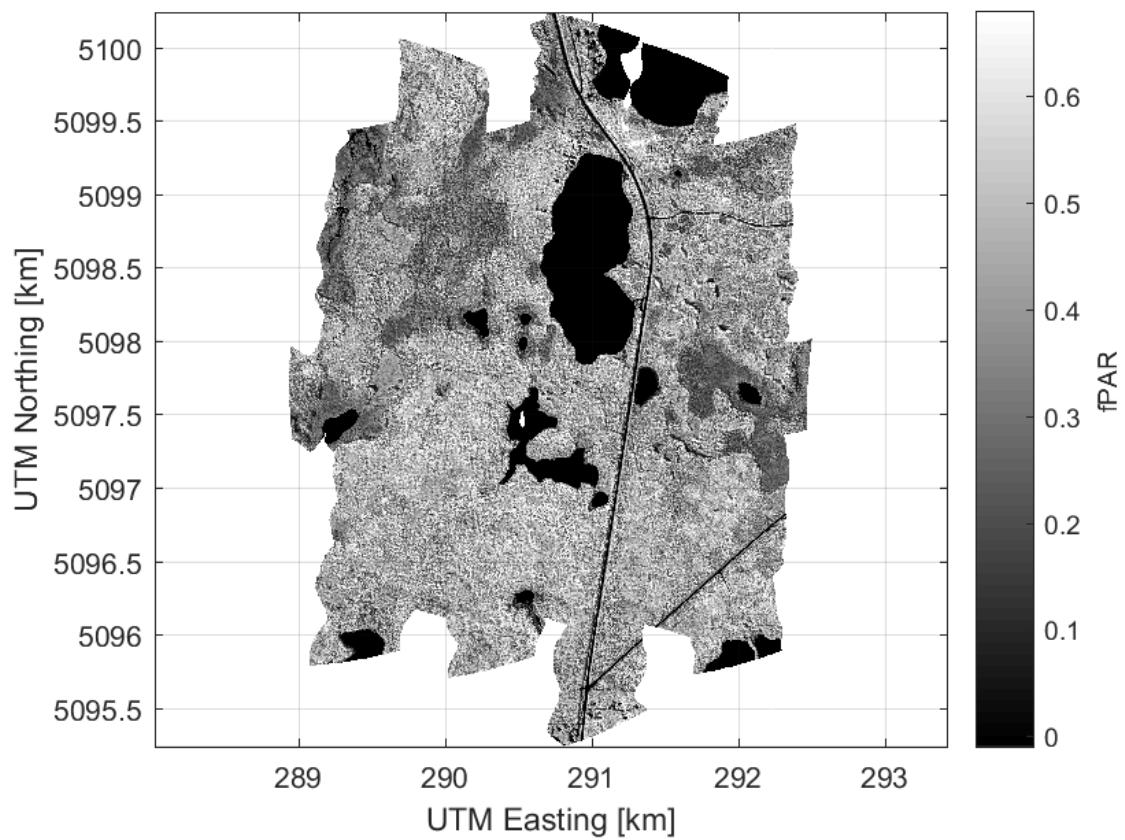


Figure 44: FPAR map

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

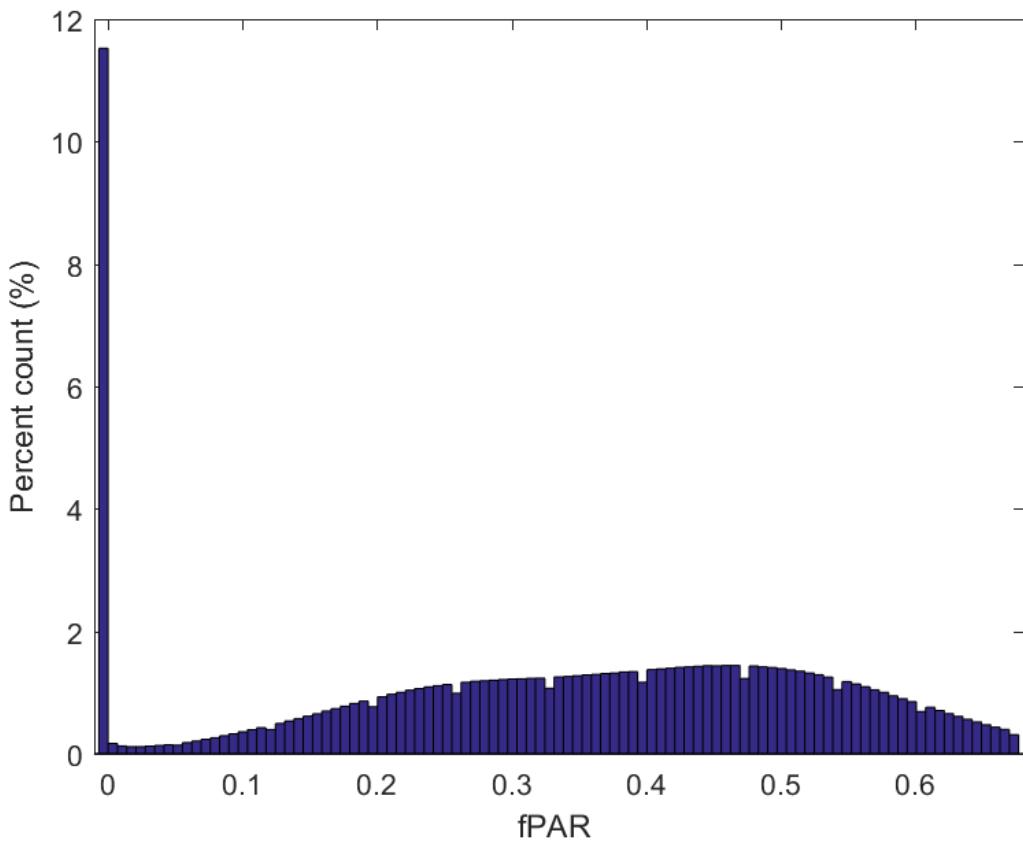


Figure 45: FPAR histogram

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

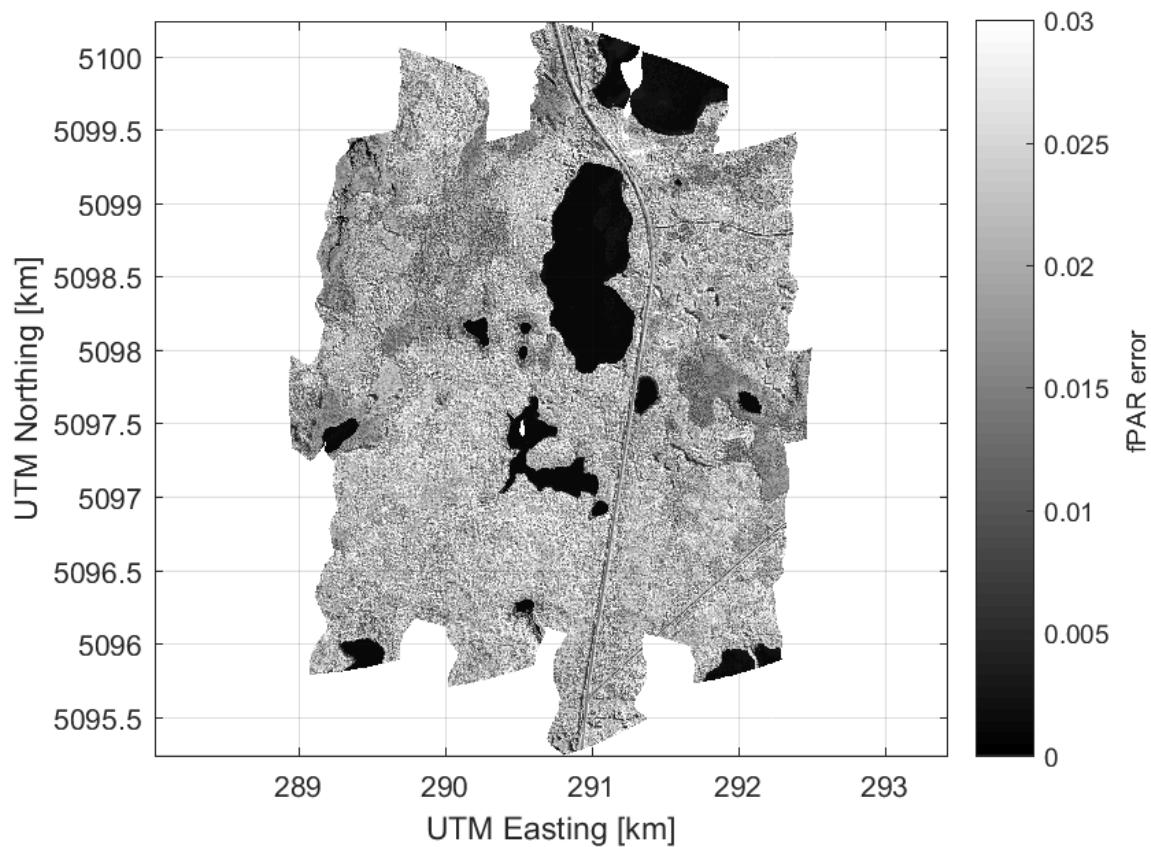


Figure 46: FPAR error map

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

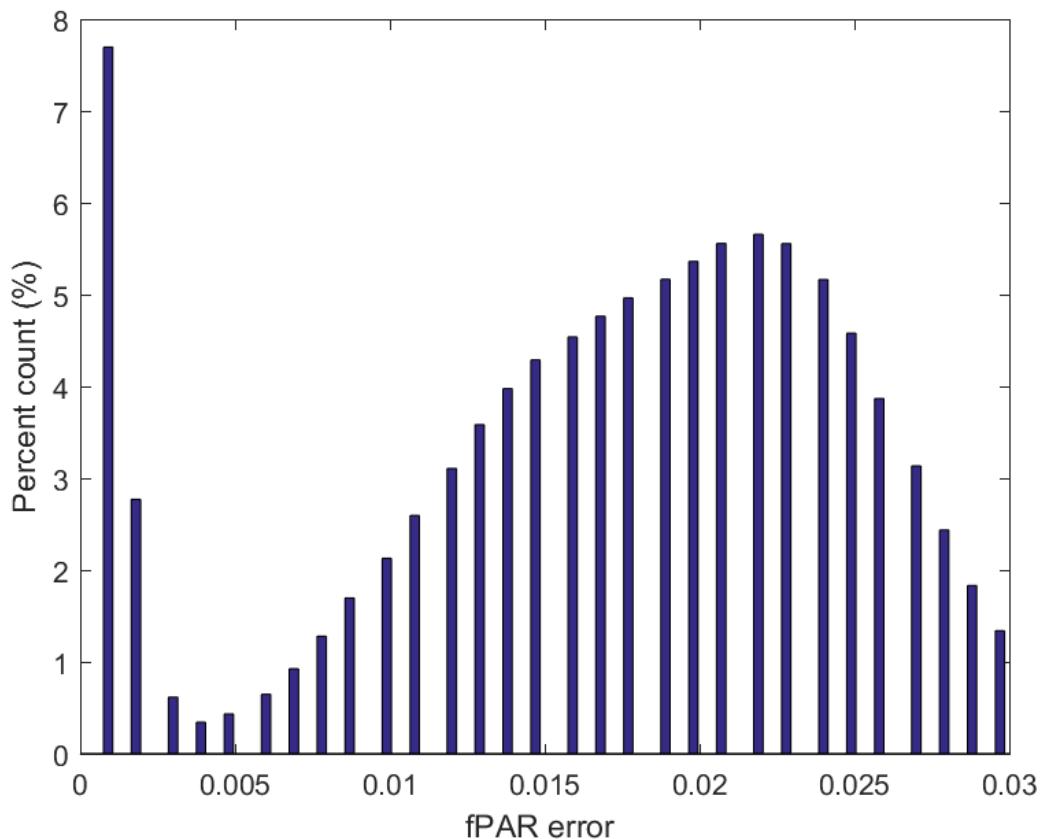


Figure 47: FPAR error histogram

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

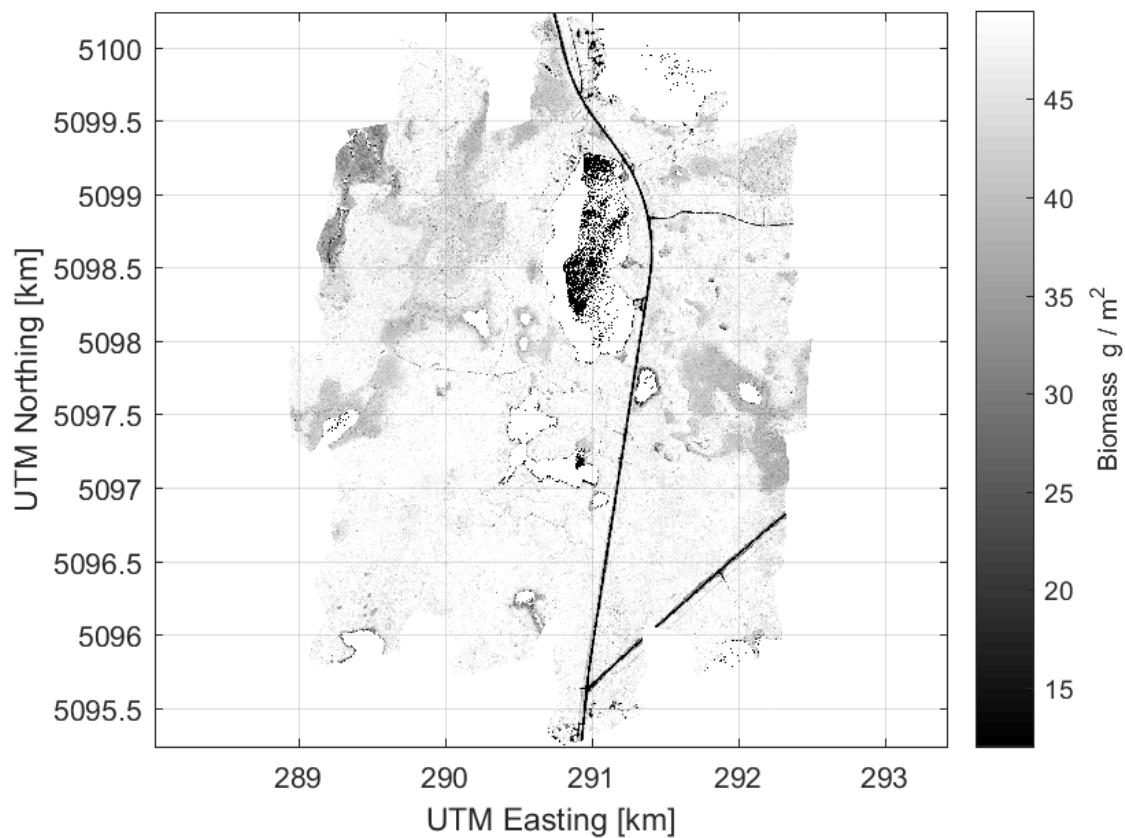


Figure 48: Biomass map

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

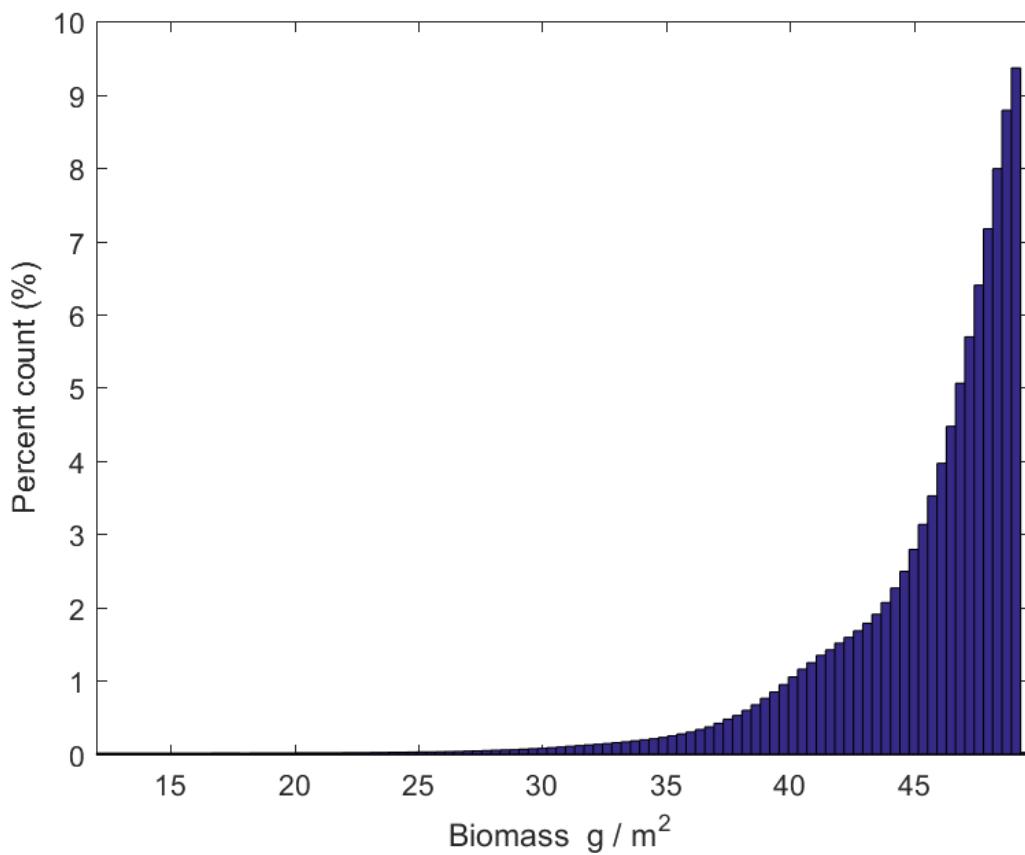


Figure 49: Biomass histogram

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

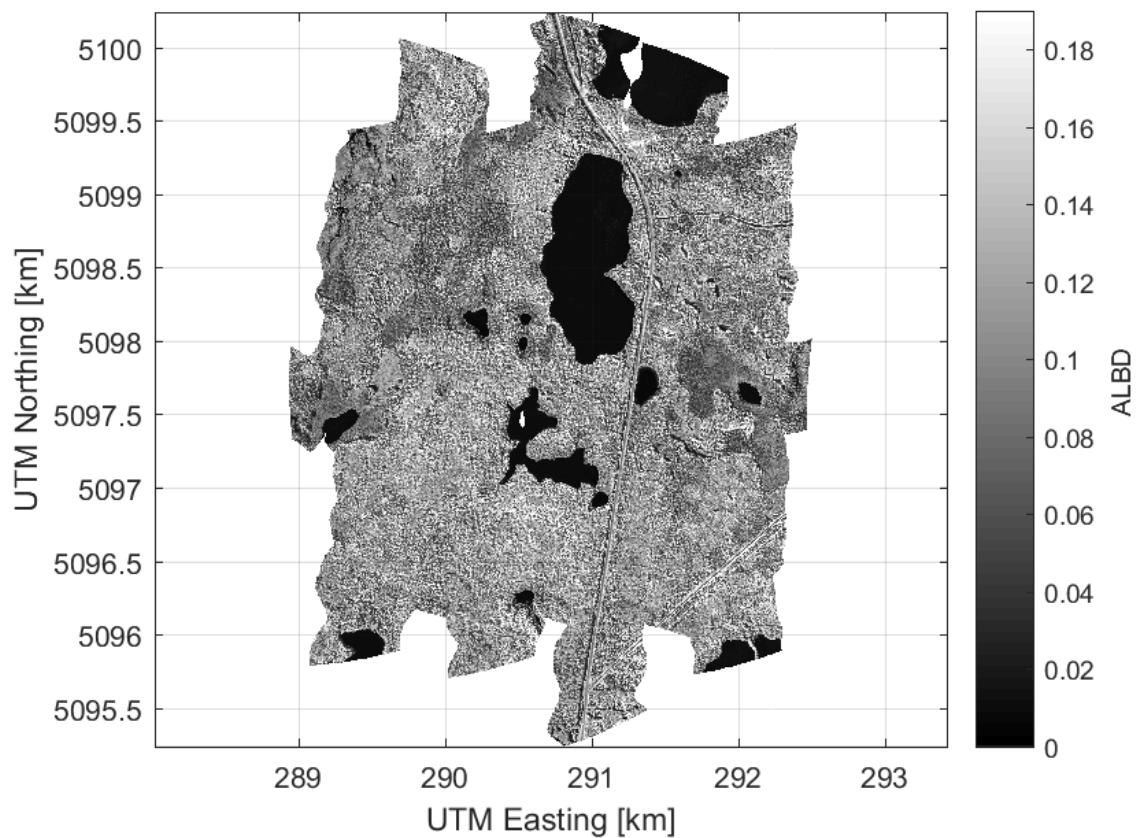


Figure 50: Albedo map

Title: Spectrometer L1 reflectance and L2 product QA information for LIRO		Date: 09/29/2017
NEON AOP QA report	Author: Tristan Goulden	Revision: 1

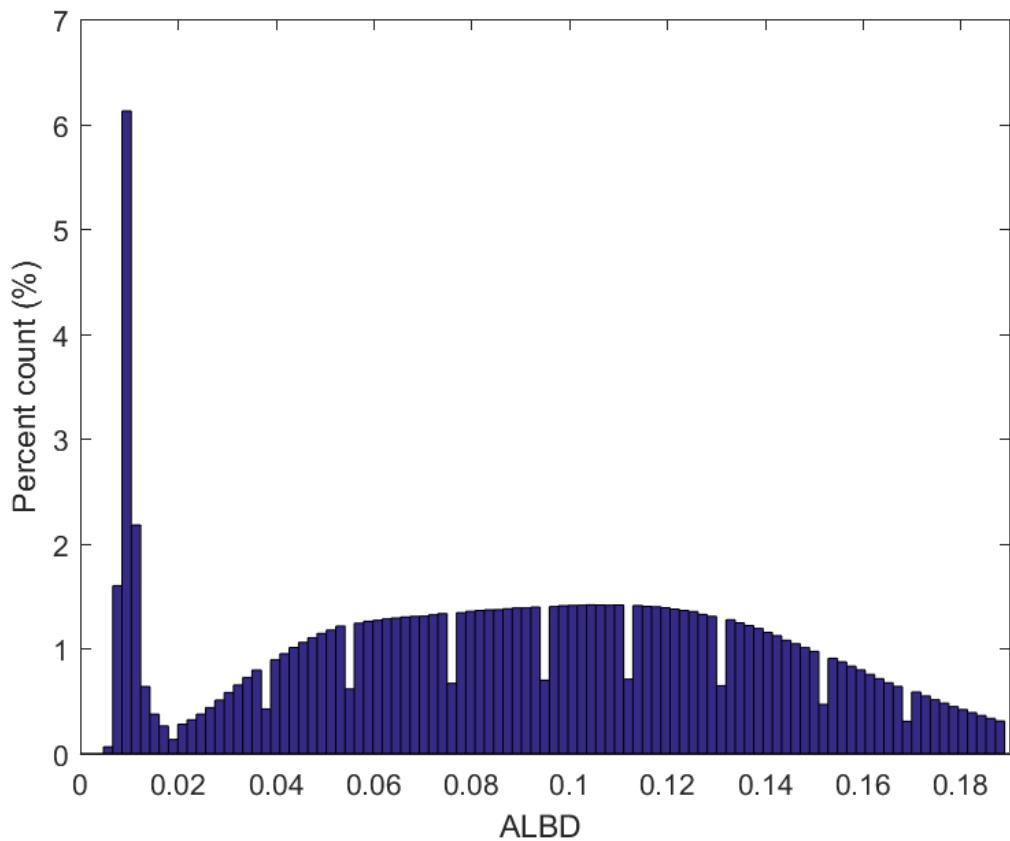


Figure 51: Albedo histogram