



Provisional Landsat 8 Surface Reflectance Data Available

Provisional Landsat 8 Operational Land Imager (OLI) Surface Reflectance (SR) data products are now available through the Earth Resources Observation and Science (EROS) Center Science Processing Architecture (ESPA) On Demand Interface (<http://espa.cr.usgs.gov/>) and EarthExplorer (EE) (<http://earthexplorer.usgs.gov>)*.

As currently produced for Landsat 4–5 and Landsat 7 scenes, top-of-atmosphere (TOA) reflectance, Surface Reflectance (SR), and SR-based spectral indices data products are available for Landsat 8 scenes through the ESPA interface. **Please Note:** currently, only Landsat 8 scenes acquired from April 11, 2013 (DOY 101) through December 18, 2014 (DOY 352) can be processed to Surface Reflectance, due to the recent change of the Thermal Infrared Sensor (TIRS) acquired data. Please see the December 22, 2014 Landsat Mission Headlines for more details: http://landsat.usgs.gov/mission_headlines2014.php.

*The Surface Reflectance (SR) data product is the only option available using EarthExplorer (EE) under the Landsat CDR Data Sets. Orders submitted from EE are sent to the ESPA On-Demand interface for processing and data delivery.

It is important to note that Landsat 8 scenes will not be processed with the same algorithm used for Landsat 4, 5, and 7 scenes. A new algorithm (L8SR) has been developed to take advantage of Landsat 8's unique characteristics.

The L8SR algorithm uses the scene center for the sun angle calculation and then hard-codes the view zenith angle to 0. The solar zenith and view zenith angles are used for calculations as part of the atmospheric correction. In the future, the surface reflectance algorithms may be modified for Landsats 4, 5, 7, and 8 to calculate sun angles on a per-pixel basis.

The tables below provide information about the L8SR algorithm and the Provisional Landsat 8 Surface Reflectance products. **Users are encouraged to review this documentation and the Provisional Landsat 8 Surface Reflectance Product Guide** (http://landsat.usgs.gov/documents/provisional_l8sr_product_guide.pdf)

Questions and feedback about Landsat 8 Surface Reflectance data products can be sent using <http://landsat.usgs.gov/contactus.php?topic=UCE> or by contacting USGS Customer Services at custserv@usgs.gov.

Landsat 8 SR algorithm compared to the existing LEDAPS algorithm (for Landsat 4–5 and 7)

Parameter	Landsat 4-5, 7 (LEDAPS)	Landsat 8 OLI (L8SR)
(Original) research grant	NASA GSFC, MEaSURES (Masek)	NASA GSFC
Global coverage	Yes	Yes
TOA	Visible (1–5,7) + Brightness temp (6) bands	Visible (1–7) + Thermal (10–11) bands
SR	Visible (1–5,7) bands	Visible (1–7) bands
Radiative transfer model	6S	Internal algorithm
Thermal correction level	TOA only	TOA only
Thermal band units	Kelvin	Kelvin
Pressure	NCEP Grid	Surface pressure is calculated internally based on the elevation
Water vapor	NCEP Grid	MODIS CMA
Air temperature	NCEP Grid	MODIS CMA
DEM	Global Climate Model DEM	Global Climate Model DEM
Ozone	OMI/TOMS	MODIS CMG Coarse resolution ozone
AOT	Correlation between chlorophyll absorption and bound water absorption of scene	MODIS CMA
Sun angle	Scene center from input metadata	Scene center from input metadata
View zenith angle	From input metadata	Hard-coded to 0
Undesirable zenith angle correction	N/A	TOA substituted for SR when solar zenith angle > 76 degrees
Pan band processed?	No	No
XML metadata?	Yes	Yes
Brightness temperature calculated	Yes (Band 6 TM/ETM+)	Yes (Bands 10 & 11 TIRS)
Cloud mask	CFmask	CFmask
Data format	INT16	INT16
Fill values	-9999	-9999
QA bands	Cloud Adjacent cloud Cloud shadow DDV Fill Land water Snow Atmospheric opacity	Cloud Adjacent cloud Cloud shadow Aerosols Cirrus

6S=Second Simulation of a Satellite Signal in the Solar Spectrum, AOT= Aerosol Optical Thickness, CFmask=C Version of Function Of Mask, CMA= Climate Modeling Grid - Aerosol, CMG= Climate Modeling Grid, DDV= Dark Dense Vegetation, DEM= Digital Elevation Model, ETM+= Enhanced Thematic Mapper Plus, GSFC= Goddard Space Flight Center, INT= Integer, MEaSURES= Making Earth Science Data Records for Use in Research Environments, MODIS= Moderate Resolution Imaging Spectroradiometer, N/A=Not Applicable, NASA=National Aeronautics and Space Administration, NCEP= National Centers for Environmental Prediction, OLI=Operational Land Imager, OMI= Ozone Monitoring Instrument, QA=Quality Assurance, SR= Surface Reflectance, TIRS= Thermal Infrared Sensor, TM= Thematic Mapper, TOA= Top of Atmosphere Reflectance, TOMS= Total Ozone Mapping Spectrometer, XML= Extensible Markup Language

Provisional Landsat 8 Surface Reflectance (SR) Specifications

Band Designation	Band Name	Data Type	Units	Range	Valid Range	Fill Value	Saturate Value	Scale Factor
sr_band1	Band 1	INT16	Reflectance	-2000 – 16000	0 - 10000	-9999	20000	0.0001
sr_band2	Band 2	INT16	Reflectance	-2000 – 16000	0 - 10000	-9999	20000	0.0001
sr_band3	Band 3	INT16	Reflectance	-2000 – 16000	0 - 10000	-9999	20000	0.0001
sr_band4	Band 4	INT16	Reflectance	-2000 – 16000	0 - 10000	-9999	20000	0.0001
sr_band5	Band 5	INT16	Reflectance	-2000 – 16000	0 - 10000	-9999	20000	0.0001
sr_band6	Band 6	INT16	Reflectance	-2000 – 16000	0 - 10000	-9999	20000	0.0001
sr_band7	Band 7	INT16	Reflectance	-2000 – 16000	0 - 10000	-9999	20000	0.0001
sr_cloud	Cloud QA	UINT8	Flag	0-7	0-7	NA	NA	NA

INT16=16-bit signed integer, UINT8=8-bit unsigned integer, QA= quality assurance, CFmask= C version of Function of Mask, NA=not applicable

Provisional Landsat 8 SR Cloud Quality Assurance Bit Values

Bit	Interpretation
0	Cirrus cloud
1	Cloud
2	Adjacent to cloud
3	Cloud shadow
4	Aerosol
5	Aerosol
6	Unused
7	Internal test

Provisional Landsat 8 SR Cloud Quality Assurance Interpreted Aerosol Values

Value	Interpretation
16	Low aerosol content
32	Moderate aerosol content
48	High aerosol content

Provisional Landsat 8 SR Top of Atmosphere Reflectance – Bands 1–7, 9 Specifications

Band Designation	Band Name	Data Type	Units	Range	Valid Range	Fill Value	Saturate Value	Scale Factor
toa_band1	Band 1 Reflectance	INT16	Reflectance	-100 – 16000	0 – 10000	-9999	20000	0.0001
toa_band2	Band 2 Reflectance	INT16	Reflectance	-100 – 16000	0 – 10000	-9999	20000	0.0001
toa_band3	Band 3 Reflectance	INT16	Reflectance	-100 – 16000	0 – 10000	-9999	20000	0.0001
toa_band4	Band 4 Reflectance	INT16	Reflectance	-100 – 16000	0 – 10000	-9999	20000	0.0001
toa_band5	Band 5 Reflectance	INT16	Reflectance	-100 – 16000	0 – 10000	-9999	20000	0.0001
toa_band6	Band 6 Reflectance	INT16	Reflectance	-100 – 16000	0 – 10000	-9999	20000	0.0001
toa_band7	Band 7 Reflectance	INT16	Reflectance	-100 – 16000	0 – 10000	-9999	20000	0.0001
toa_band9	Band 9 Reflectance	INT16	Reflectance	-100 – 16000	0 – 10000	-9999	20000	0.0001

INT16=16-bit signed integer, TOA= top of atmosphere

Provisional Landsat 8 Top of Atmosphere Reflectance – Bands 10–11 Brightness Temperature Specifications

Band Designation	Band Name	Data Type	Units	Range	Valid Range	Fill Value	Saturate Value	Scale Factor
toa_band10	Band 10 Reflectance	INT16	Reflectance	-100 - 16000	0- 10000	-9999	20000	0.1
toa_band11	Band 11 Reflectance	INT16	Reflectance	-100 - 16000	0- 10000	-9999	20000	0.1

INT16=16-bit signed integer, TOA= top of atmosphere