ASTER Standard TIR Data Products

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Terra Satellite Operating since December 1999



MODIS
ASTER (TIR)
ASTER (SWIR)
ASTER (VNIR)

- MISR - MOPITT - CERES

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ASTER Characteristics



Wide Spectral Coverage

 3 VNIR bands, 8-bit (0.52 – 0.86 μm)
 6 SWIR bands, 8-bit (1.6 – 2.43 μm)
 5 TIR bands, 16-bit (8.125 – 11.65 μm)

High Spatial Resolution
 15m for VNIR bands
 30m for SWIR bands
 90m for TIR bands

Other Characteristics
 60 km swath width
 Along-track Stereo for DEM
 Daily programming of acquisitions



ASTER Bands



Data Acquisition Strategy

- Daily acquisition schedule uploaded every day: ~500 scenes/ day
- Automatic priority function determines which scenes are acquired; acquisition request data base has ~3000 orders: global background mapping, large area monitoring, individual scientist requests, etc. Each order is assigned priorities based on who requested, amount of resources, percent of area already acquired.....

Expedited data scheduling put in place after launch. Allows "last minute" additions to daily acquisition schedule for natural disasters, national security, field campaigns. Data can be processed and delivered to requester in 2-4 hours after acquisition.

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Data Processing Strategy

All higher level data products (except for Level 1) are produced "on-demand" when a user order is placed
This is a throw-back to early 90s when the data system was being designed, and disk storage was very expensive
User has ability to customize most products, selecting projection, resampling, ancillary data inputs, etc.
Data products can be ordered from LPDAAC or Japan GDS; only electronic delivery is supported

Level	Product Name	Description
1A	Radiance at Sensor	Image data plus radiometric and geometric coefficients, separated by telescope
1B	Registered radiance at sensor	1A data with coefficients applied
2	AST09 Surface radiance VNIR,SWIR	Radiance corrected for atmosphere
2	AST09T Surface Radiance-TIR	Radiance corrected for atmosphere
2	AST09XT Surface radiance-VNIR,SWIR crosstalk corrected	VNIR & Crosstalk corrected SWIR
2	AST07 Surface Reflectance-VNIR,SWIR	Surface radiance with topo corrections
2	AST07XT Surface reflectance-VNIR,SWIR crosstalk corrected	AST07 VNIR & crosstalk corrected SWIR
2	AST08 Surface Kinetic Temperature	Temperature-emissivity separation applied to atmospherically corrected surface radiance
2	AST05 Surface Emissivity	Temperature-emissivity separation applied to atmospherically corrected surface radiance
3	ASTER GDEM	Global Digital elevation model
3	ASTER Digital Elevation Model	Single scene DEMs
3	AST14OTH Orthoimage	L1B Orthorectified

Level 1A

Radiance at the Sensor

Geometric and radiometric calibration coefficients are in the metadata

VNIR, SWIR and TIR data are included

- TIR data are 16-bit integer: L1A can be converted to radiance units by applying calibration coefficients, then scaling with conversion coefficient
- Data are not registered between telescopes
- Data are distributed in HDF format

Level 1B

Registered Radiance at the Sensor

 Geometric and radiometric calibration coefficients are applied to the L1A data

VNIR, SWIR and TIR data are included

- TIR data are 16-bit integer: L1B can be converted to radiance units by applying a gain and offset (same values all through mission): radiance = (DN-1) x conversion coefficient
- Map projection and resampling have default values (UTM and CC), but are also user specifiable
- Data are distributed in HDF format

AST09T

Surface Radiance

- Corrects at-sensor radiance for effects of atmospheric transmission, path radiance and scattering using MODIS or NCEP atmospheric profiles
- Input data are Level 1
- 16-bit data are converted from DN to radiance by multiplying by conversion factor
- Data are distributed in HDF format

AST05

Surface Emissivity

- Corrects measured at-sensor radiance for effects of atmospheric transmission, path radiance and scattering using NCEP profiles or MODIS atmospheric water vapor and temperature profiles.
- TES algorithm hybridizes two established algorithms, first estimating the temperature and band emissivities by the Normalized Emissivity Method, and then normalizing the emissivities by their average value. Next, an empirical relationship adapted from the Alpha Residual method is used to predict the minimum emissivity from the spectral contrast (min-max difference or MMD) of the normalized values,
- TIR data are 16-bit integer; they can be converted to emissivity units by multiplying by 0.001
- Data are distributed in HDF or GeoTIFF format



Surface Kinetic Temperature

 Iteratively corrects calculated land-leaving radiance for effects of downwelling atmospheric irradiance as it calculates and refines the temperatures and emissivities.

- Uses temperature-emissivity algorithm
- TIR data are 16-bit integer: data can be converted to surface temperature degrees Kelvin by multiplying by 0.1
 Data are distributed in HDF or GeoTIFF format



Orthorectified L1B

ASTER DEM is used to orthorectify the L1B bands
14 bands of data are distributed in GeoTIFF format



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Data Volume per Image

Data Product	Volume
L1A	110 MB
L1B	125 MB
AST09T Surface Radiance-TIR	14 MB
AST08 Surface Kinetic Temperature	4 MB
AST05 Surface Emissivity	9 MB
AST14OTH Orthorectified L1B	132 MB

Number of images ordered in 2009

Data Product	Volume
L1A	4,000
L1B	230,000
AST09T Surface Radiance-TIR	13,000
AST08 Surface Kinetic Temperature	40,000
AST05 Surface Emissivity	28,000
AST140TH Orthorectified L1B	13,000



CSIRO Australia Satellite ASTER Geoscience Maps

Uses all 14 ASTER bands – VNIR, SWIR, TIR

Final products are "mineral group" information: clays, carbonate, iron minerals, etc.

Maps are continental scale, available for free over the internet, in TIF, JPG or BSQ formats

Specific products: ferric and ferrous oxide composition, opaque index, ALOH content, Kaolin group index, FeOH content, MgOH content, Silica index, Carbonate index, Mafic index,