

# METimage Radiance to BT Conversion for Thermal Emissive Bands

- METimage NetCDF data contain BT conversion coefficients
  - `bt_conversion_a` and `bt_conversion_b`

The screenshot shows a NetCDF viewer interface. On the left, a list of datasets is displayed, including various wavelength bands (e.g., ISRF\_3959\_wavelength, ISRF\_4050, ISRF\_4050\_wavelength, ISRF\_443, ISRF\_443\_wavelength, ISRF\_555, ISRF\_555\_wavelength, ISRF\_668, ISRF\_668\_wavelength, ISRF\_6725, ISRF\_6725\_wavelength, ISRF\_7325, ISRF\_7325\_wavelength, ISRF\_752, ISRF\_752\_wavelength, ISRF\_763, ISRF\_763\_wavelength, ISRF\_8540, ISRF\_8540\_wavelength, ISRF\_865, ISRF\_865\_wavelength, ISRF\_914, ISRF\_914\_wavelength) and conversion coefficients (`bt_conversion_a`, `bt_conversion_b`). The `bt_conversion_a` dataset is selected and highlighted. On the right, the 'Object Attribute Info' panel for `bt_conversion_a` is shown, displaying the following information:

Name:	bt_conversion_a
Path:	/data/calibration_data/
Type:	HDF5 Dataset
Object Ref:	94750

Below this, the 'Dataset Dataspace and Datatype' section shows:

No. of Dimension(s):	1
Dimension Size(s):	9
Max Dimension Size(s):	9
Data Type:	32-bit floating-point

A 'Show Data with Options' button is visible below the data type. The 'Miscellaneous Dataset Information' section shows:

Storage Layout:	CONTIGUOUS
Compression:	NONE
Filters:	NONE
Storage:	SIZE: 36, allocation time: Late
Fill value:	524287.0

To convert from radiance to brightness temperature for thermal infrared bands of METimage, Eq. 16 in “EPS-SG VII Level 1B Product Format Spec” document should be used:

$$T = \left[ \frac{hc}{k\lambda_c \ln\left(1 + \frac{2hc^2}{\lambda_c^5 L}\right)} \right] \cdot A + B \quad (1)$$

However, the center wavelength ( $\lambda_c$ ) used in Eq. 1 should be converted to the unit of m instead of unit  $\mu\text{m}$  that was listed in the Table on page 43 of VIII1B\_Format\_DOC. Earth view radiance,  $L$ , must be given in  $\text{W}/(\text{m}^2\text{-sr-m})$  and not in  $\text{W}/(\text{m}^2\text{-sr-}\mu\text{m})$  to enable the calculation. In Eq. (1), speed of light  $c = 299792458$  m/s; Planck constant  $h = 6.626069 \times 10^{-34}$   $\text{m}^2\text{kg/s}$ ; and Boltzmann constant  $k = 1.38065 \times 10^{-23}$   $\text{m}^2\text{kg/s}^2\text{-K}$ . Conversion coefficients  $A$  and  $B$  can be directly read in from the `bt_conversion_a` and `bt_conversion_b` data field in netCDF file.

- Sample METimage netcdfs prepared by NOAA/STAR are available at
- <http://viirs.astro.umd.edu/METimage/>

# METimage Radiance to TOA Reflectance Conversion for Reflective Solar Bands

$$\text{TOA Reflectance} = \frac{\pi * \text{Radiance} * (d_{ES})^2}{(E_{SUN} * \cos(\Theta_{sol}))}$$

Inputs for above equation:

1. Radiance: Included in the product [/data/measurement\\_data/vii\\_xxxx](#)
2.  $\Theta_{sol}$ : Solar zenith angle, included in the product [/data/measurement\\_data/solar\\_zenith](#)
3.  $d_{ES}$ : Ratio between the mean and the actual Earth-Sun distance, included in the product [/status/satellite/earth\\_sun\\_distance\\_ratio](#)
4.  $E_{SUN}$ : Band integrated solar irradiance, included in the product [/data/calibration\\_data/integrated\\_solar\\_irradiance](#)

- All of these auxiliary data to calculate TOA reflectance are available in METimage netcdf files.
- Sample METimage netcdfs prepared by NOAA/STAR are available at
- <http://viirs.astro.umd.edu/METimage/>

# Terrain Correction

delta_lat_N_dem	$\Delta N$	NC_SHORT	m (North)	See valid_min and valid_max	num_pixels, num_lines
<i>long_name</i>		NC_STRING		"Distance in m (N) between latitude orthorectified using DEM and latitude on WGS84 ellipsoid"	
<i>units</i>		NC_STRING		"metres_north"	
<i>scale_factor</i>		NC_FLOAT		0.610370189520	
<i>add_offset</i>		NC_FLOAT		0.0	
<i>valid_min</i>		NC_SHORT		-32767	
<i>valid_max</i>		NC_SHORT		32767	

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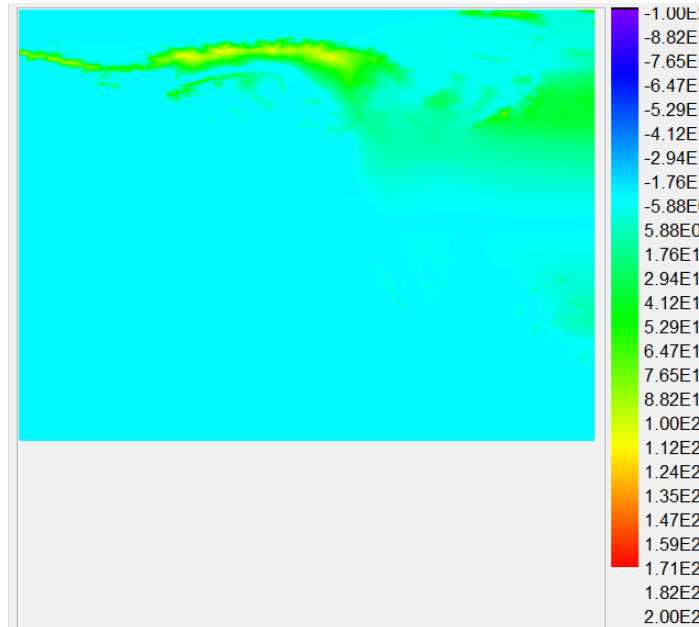


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Variables Name	Symbol	Type	Unit	Range or Value	Dimension
<i>_FillValue</i>		NC_SHORT		-32768	
delta_lon_E_dem	$\Delta E$	NC_SHORT	m (East)	See valid_min and valid_max	num_pixels, num_lines
<i>long_name</i>		NC_STRING		"Distance in m (E) between longitude orthorectified using DEM and longitude on WGS84 ellipsoid"	
<i>units</i>		NC_STRING		"metres_east"	
<i>scale_factor</i>		NC_FLOAT		0.610370189520	
<i>add_offset</i>		NC_FLOAT		0.0	
<i>valid_min</i>		NC_SHORT		-32767	
<i>valid_max</i>		NC_SHORT		32767	
<i>_FillValue</i>		NC_SHORT		-32768	

- The sample METimage NETCDFs generated by NOAA-STAR have populated the /data/measurement\_data/delta\_lat\_N\_dem and /data/measurement\_data/delta\_lon\_E\_dem fields for terrain-correction according to "EPS-SG VII Level 1B Product Format Spec".
  - Defined as Distance in m (N, E) between latitude/longitude orthorectified using DEM and latitude/longitude on WGS84 ellipsoid

Example of delta\_lon\_E\_dem



Example of delta\_lat\_N\_dem

