### OLI Reflectance Conversion

#### Background

The standard Level 1T product will be a top of atmosphere reflectance product. This algorithm will convert the radiance image to a reflectance image in a per-scene operation. The two products are linearly related to each other by a band specific coefficient that is proportional to the exoatmospheric solar irradiance in each band and the Earth-Sun distance for the scene’s day of acquisition. The per-band coefficients will be determined once on orbit, after the first look at the diffuser. For prelaunch testing, an estimate of the coefficient can be derived from the exoatmospheric solar irradiance. The reflectance values will be between 0.0 and 1.0.

Since all problem pixels should have been corrected by this point in the processing flow, this algorithm assumes that every image pixel is a valid radiance value. Thus there is no consideration for dropped frames, inoperable detectors or saturated pixels.

This algorithm will only process OLI data, not TIRS data. The equivalent algorithm for TIRS data is Temperature Conversion.

#### Inputs

The inputs to this algorithm are the image, parameters from the CPF and a parameter from the JPL ephemeris table. Table Error**! No text of specified style in document.**‑1 lists the inputs of this algorithm.

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| --- | --- | --- | --- | --- | --- |
| **Descriptions** | **Symbol** | **Units** | **Level** | **Source** | **Type** |
| Radiance image data | L | W/m2 sr um | Nband x NSCA x Ndet x Nframes |  | float |
| Earth-Sun Distance | d | AU | scalar | JPL ephemeris table | float |
| Radiance to Reflectance Conversion Coefficients | Rr | sr/(w/m2 um) | Nband | CPF | float |

Table Error! No text of specified style in document.‑1. Algorithm Inputs

#### Output

The outputs of this algorithm are the reflectance image and the coefficients needed to convert back to radiance. The coefficients will be distributed with the final product. Table Error**! No text of specified style in document.**‑2 lists the outputs of this algorithm.

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| --- | --- | --- | --- | --- | --- |
| **Descriptions** | **Symbol** | **Units** | **Level** | **Target** | **Type** |
| Reflectance image |  | [] | Nband x NSCA x Ndet x Nframes |  | float |
| Reflectance to radiance conversion coefficients | R | (w/m2 um)/sr | Nband | Radiance Rescaling | float |

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#### Options

#### Procedure

1. For each band, apply conversion coefficients (R) to radiance images (L1r). This equation converts the image radiance [W/m2 sr um] to reflectance [unitless].
   1.  (1)
   2. where L is the image radiance and d is the Earth-sun distance (AU) for the day the scene was acquired.
2. For each band, calculate reflectance-to-radiance conversion coefficient (R).
   1.  (2)
   2. This coefficient is passed to Radiance Rescaling.

#### Inputs

Radiance-to-reflectance coeff: R (arbitrary value)

Radiance image mean: L = 319.2 (an arbitrary high signal)

Earth-sun distance: d = 1.0154351 (distance for June 12, an arbitrary date)

#### Outputs

Reflectance image mean:  = 0.550

Reflectance-to-radiance coeff: R = 580.737

#### Maturity

Level 2 .It is unlikely but another version of this algorithm may need to be implemented during the level 1G processing (or after), if the decision is made to generate a reflectance product where the sun angle used is specific to the image pixel. Here, a latitude and longitude of each pixel combined with the image time, will be used to calculate a reflectance for the specific sun angle corresponding to each pixel