### Radiance Rescaling

#### Background

The standard L8/9 products are OLI reflectance and TIRS radiance products in 16-bit integer format. The OLI and TIRS data are radiometrically and geometrically processed using floating point operations. For OLI, this algorithm scales and converts the resultant L1G reflectance from floating point format to 16-bit integer format using scaling parameters from the CPF. In addition, the algorithm provides rescaling coefficients for direct conversion from 16-bit integer reflectance to floating point radiance. For TIRS, the algorithm scales and converts radiance values from floating point format to 16-bit integer format. The algorithm assumes that no scaling is applied during the Geometric Processing.

#### Inputs

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Descriptions** | **Symbol** | **Units** | **Level** | **Source** | **Type** |
| For OLI: | | | | | |
| Reflectance scene (L1G) | *ρ* |  | Nbands x NSCAs x Ndetectors x Nframes | Geometric Processing | float |
| Reflectance multiplicative scaling factor | *Mρ* | *DN-1* | Nbands | CPF | float |
| Reflectance additive scaling factor | *Aρ* |  | Nbands | CPF | float |
| Reflectance to Radiance conversion coefficient | *ρR* |  | Nbands | Reflectance Conversion | float |
| For TIRS: | | | | | |
| Radiance scene (L1G) | *L* |  | Nbands x NSCAs x Ndetectors x Nframes | Geometric Processing | float |
| Radiance multiplicative scaling factor | *ML* |  | Nbands | CPF | float |
| Radiance additive scaling factor | A*L* |  | Nbands | CPF | float |

#### Outputs

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Descriptions** | **Symbol** | **Units** | **Level** | **Target** | **Type** |
| For OLI: | | | | | |
| Scene L1G | *ρint* | *DN* | Nbands x NSCAs x Ndetectors x Nframes |  | Uint (16-bit) |
| Reflectance multiplicative scaling factor | *Mρ* | *DN-1* | Nbands | Metadata | float |
| Reflectance additive scaling factor | *Aρ* |  | Nbands | Metadata | float |
| Radiance multiplicative scaling factor | *ML* |  | Nbands | Metadata | float |
| Radiance additive scaling factor | A*L* |  | Nbands | Metadata | float |
| For TIRS: | | | | | |
| Scene (L1G) | *Lint* | *DN* | Nbands x NSCAs x Ndetectors x Nframes |  | Uint (16-bit) |
| Radiance multiplicative scaling factor | *ML* |  | Nbands | Metadata | float |
| Radiance additive scaling factor | A*L* |  | Nbands | Metadata | float |

#### Options

#### Procedure

1. For each band, apply scaling to each image pixel, except to fill data, of geometrically corrected (L1G) floating point OLI reflectance and TIRS radiance images:
   1. For OLI



* 1. For TIRS



1. Convert scaled OLI reflectance (*ρscal*), TIRS radiance (*Lscal*) and fill data pixel values from floating point to 16-bit integer format through rounding to the closest 16-bit integer values
   1. For OLI



* 1. For TIRS



1. Under the assumption that 0 will be reserved for fill data, convert all zeros in *ρint* and *Lint* images to *Qcalmin* = 1. More generally, convert all pixels with value less than *Qcalmin* to *Qcalmin*.
2. Only for OLI, calculate rescaling coefficients that will be used for direct conversion from 16-bit integer reflectance to floating point radiance



1. Write the following rescaling parameters to the product metadata
   1. For OLI:
      1. Reflectance multiplicative scaling factor, *Mρ*
      2. Reflectance additive scaling factor, *Aρ*
      3. Radiance multiplicative scaling factor, *ML*
      4. Radiance additive scaling factor, *AL*
   2. For TIRS:
      1. Radiance multiplicative scaling factor, *ML*
      2. Radiance additive scaling factor, *AL*