Brightness Temperature at Sensor

Product ID: AST04
Product Level: 2
Absolute Accuracy: 1-2 C
Horizontal Resolution: 90 m
Product Size (MB): 84

Lead Invest: Ron Alley
Production Mode: on-request
Relative Accuracy: 0.3 C
Units: degrees C

Product Description

The body of this product is the brightness temperature for ASTER's five thermal-infrared bands (8-12 μm, bands 10-14). Brightness temperature is the apparent observed temperature, assuming a surface emissivity of 1.0 (i.e., as if the object were a blackbody). The calculations are performed starting with the radiance at sensor as input; no atmospheric correction is included for this product.

Algorithm Description

The amount of radiance that an ASTER channel will observe when viewing a source of a particular temperature is calculated in the following manner. The spectral radiance at each wavelength (to a 0.01 μm precision) is computed using the Planck function. This value is multiplied by the normalized spectral response function at that wavelength, and the results of this calculation are integrated over the range of wavelengths that have a sensor response.

The above calculation was made for each of the five ASTER TIR channels at all temperatures (to a 0.01 degree C precision) that the ASTER TIR subsystem was designed to record (200 to 370 degrees Kelvin). The result is a table of observed radiances as a function of temperature. This table was used to construct a second table, which lists temperature as a function of radiance. This second table is stored as a lookup table, to be used to generate this product.

Applications

Brightness temperature has been used to observe volcanic ash clouds, detect ice leads in the Arctic, and to identify anthropogenic and natural fires, to name a few examples. The ASTER brightness temperature will be used as an alternate to radiance in the temperature/emissivity separation algorithm to report relative cloud-top temperature because there will be no routinely available applicable atmospheric correction to enable a calculation of exact cloud-top temperature. ASTER brightness temperatures can be acquired during the day or night and over all surface types (land, water, cloud, etc.).

Constraints

The algorithm is constrained only by the fact that it requires unsaturated input radiance values. The algorithm should work on TIR data acquired during the day or night and over land, clouds, water, or anything else not hotter than about 120 degrees C or colder than about –100 degrees C.