Surface Radiance – TIR

Product ID: AST09
Lead Invest: Frank Palluconi
Product Level: 2
Production Mode: on-request
Absolute Accuracy: 2%
Relative Accuracy: 1%
Horizontal Resolution: 90 m
Units: W m^{-2} sr^{-1} μm^{-1}
Product Size (MB): 13

Product Description

This product provides surface leaving radiance, in W m^{-2} sr^{-1} μm^{-1}, for the five ASTER TIR channels at 90 m spatial resolution. In addition, the down welling sky irradiance in W m^{-2} μm^{-1} for the five ASTER TIR channels is also provided. Atmospheric correction has been applied and the surface leaving radiance is valid for the clear sky portion of scenes. This radiance includes both surface emitted and surface reflected components. The surface radiance is only of known accuracy for cloud-free pixels since insufficient information is available about cloud properties for a valid correction of cloudy pixels.

Accurate atmospheric correction is intended to remove the effect of the atmosphere providing the opportunity to use these radiances in the determination of surface spectral emissivity and surface kinetic temperature. This atmospheric correction, along with similar corrections for other Terra instruments, marks the first implementation of operational atmospheric correction in environmental satellites. This parameter is generated only upon request, and the data can be collected during either the daytime or nighttime.

Algorithm Description

The radiance measured by the ASTER instrument includes emission, absorption, and scattering by the constituents of the earth's atmosphere. The purpose of atmospheric correction is to remove these effects providing estimates of the radiation emitted and reflected at the surface. Atmospheric correction is necessary to isolate those features of the observation that are intrinsic to the surface from those caused by the atmosphere.

The approach involves two fundamental elements: 1) the use of a radiation transfer model capable of estimating the magnitude of atmosphere emission, absorption, and scattering, and 2) the acquisition of all the necessary atmospheric parameters (i.e. temperature, water vapor, ozone, aerosols) at the time and location of the measurement to be corrected. MODTRAN is the chosen radiation transfer model.

Applications

Surface leaving radiance is closely associated with the thermal properties of the surface itself nearly independent of the overlying atmosphere. If the spectral emissivity of the surface is known, the surface kinetic temperature can be directly obtained given the information provided with this product. Surface kinetic temperature can be used in a number of applications ranging from derivations of sensible heat flux to estimates of plant stress. Several methods of separating surface leaving radiance

into estimates of spectral emissivity and surface kinetic temperature exist including the algorithm used for this process by ASTER. Spectral emissivity can be used to estimate surface composition, which has wide application in geology, environmental assessment and urban planning.

Constraints

The surface leaving radiance is only of known accuracy for cloud-free pixels. As this data product does not correct for the presence of water or ice clouds it is of uncertain value when such clouds are present, however, a cloud mask is included in the quality assurance "QA plane" portion of the product, allowing the user to avoid cloudy pixels. In addition, the cloud identity products from MODIS and MISR may be used if the spatial resolution of these products is acceptable. This product is used within the ASTER operational data product production framework as an input to the generation of surface spectral emissivity for the five ASTER TIR channels and the derivation of surface kinetic temperature.