Surface Reflectance

Product ID: AST07 **Lead Invest:** Kurt Thome
Product Level: 2 **Production Mode:** on-request
Absolute Accuracy: 0.01 for reflectance <0.15, 7% for reflectance >0.15
Relative Accuracy: 0.005
Horizontal Resolution: 15, 30 m **Units:** none
Product Size (MB): 215

Product Description

The Level 2 surface reflectance data set (AST07) contains surface reflectance for each of the nine VNIR and SWIR bands at 15-m and 30-m resolutions, respectively. The results are obtained by applying an atmospheric correction to radiances reported by the ASTER sensor. The atmospheric correction removes effects due to changes in satellite-sun geometry and atmospheric conditions. The atmospheric correction algorithm is applied to clear-sky pixels only and the results are reported as a number between 0 and 1.

Algorithm Description

The atmospheric correction algorithm used to retrieve the surface reflectance relies on a look-up table (LUT) approach. The LUT contains forward radiative transfer calculations from a Gauss-Seidel iteration code to compute at-satellite radiance for a set of assumed surface reflectance values and a variety of atmospheric conditions. The atmospheric correction is applied by using a set of input atmospheric conditions relating to the ASTER scene of interest to select a portion of the LUT. The output of the LUT search is a set of surface reflectance/at-sensor radiance pairs. Using linear interpolation on these pairs, a radiance reported by ASTER is converted to a surface reflectance. The atmospheric conditions are defined by the aerosol size distribution (or equivalently the aerosol type), the aerosol amount, surface pressure, and the sun-satellite geometry, The aerosol information is obtained from outside sources, for example MISR, MODIS, or climatological means. The scattering phase functions of the aerosol particles in the atmosphere are assumed to scatter as mie particles using the aerosol size distribution information supplied by MISR or MODIS. The results from this method will be in reflectance units (values between 0 and 1) with an accuracy dependent upon the accuracy of input atmospheric conditions and the surface slope. The model is expected to lose accuracy in terrain with high relief due to the assumption of horizontal homogeneity made in the radiative transfer code. Also because of this assumption, the model will give less accurate results in regions where the atmosphere or surface are not horizontally homogeneous on the scale of several pixels.

Applications

Accurate atmospheric correction removes effects of changes in satellite-sun geometry and atmospheric conditions and improves surface type classification and estimates of the Earth's radiation budget, and use of ASTER data for applications such as agricultural management requires atmospheric correction.

Constraints

This description applies to the atmospheric correction method used for the solar-reflective bands only for clear-sky pixels. This algorithm requires a digital elevation model providing slope and elevation for accurate modeling of surface reflectance. The model requires total and component optical depths as input. The algorithm is computed only for daytime image data for the VNIR - SWIR bands. The algorithm begins to break down at large view angles (not applicable for ASTER) and large solar zenith angles (>75 degrees). The algorithm's accuracy also degrades somewhat in regions around the backscatter direction due to strong surface BRDF effects. Uncertainty in the results also increases in regions of atmospheric heterogeneity.