ASTER Surface Reflectance/Radiance VNIR/SWIR Product
Version 2.3, November 2000

This initial version of the Surface Radiance/Reflectance product in the visible and near infrared (VNIR) bands and the shortwave infrared (SWIR) bands is designed to remove atmospheric effects from the solar reflective bands of ASTER (bands 1-9).

Table of Contents

1. Where to get detailed information on this product

There are several sources of information that users will find useful:

* ASTER Surface Reflectance/Radiance Algorithm Theoretical Basis Document. Describes the algorithm used to create the product. Available at

http://eospso.gsfc.nasa.gov/atbd/astertables.html

* ASTER Higher-Level Product User Guide. Describes each of the ASTER Higher Level products in detail, including definitions of each metadata attribute and the science data fields. Available at the ASTER website (see below).

* US ASTER Website. Describes the ASTER instrument, how to obtain data, the various data products that are available, the activities of the US ASTER Science Team, etc.

http://asterweb.jpl.nasa.gov/

* Level 1 product information. Because the Surface Reflectance/Radiance product is derived from a Level 1 product, understanding the L1 products is useful.

Level 1 ATBD available at http://eospso.gsfc.nasa.gov/atbd/astertables.html

Level 1 User Guide available at http://www.science.aster.ersdac.or.jp/users/defaulte.htm

2. How to report problems

To report a problem with the product, please send mail to edc@eos.nasa.gov or call EDC DAAC User Services at (605) 594-6116.

3. Description of this version

Surface reflectance/radiance V2.3

Changes
This is the product' 's initial release, thus there are no changes to report at this time.

Product Quality
The initial release of the product is limited to some extent by the lack of aerosol information (as described in the next section). Thus, the quality of this data product will be strongly dependent upon the level of aerosol amount and wavelength. The product still corrects for solar illumination effects, gaseous absorption, and molecular scattering.

For regions of small terrain relief, the expected uncertainties will be less than 0.01 reflectance units for surface reflectance less than 0.2. At higher reflectance, the uncertainty is expected to be 5% of the reflectance. For the current version of the software, these uncertainties will be true for cases where the aerosol scattering optical depth is less than 0.05. For larger aerosol loadings, the uncertainty will increase by approximately 0.005 in reflectance for each additional 0.05 aerosol optical depth increment at low reflectance (<0.20). At higher reflectance, each additional 0.05 optical depth increment will cause approximately an additional 5% uncertainty. These uncertainties have been derived for aerosol types with low absorption, thus, in regions dominated by anthropogenic aerosols will have larger uncertainties. Because scattering optical depths decrease with wavelength, results will typically be more accurate at longer wavelengths where scattering effects are smaller.

Terrain relief also degrades the accuracy of this product. This effect is due to reasons. The first is that the algorithm itself breaks down due to an assumption of homogeneity in regions of large changes in terrain relief. In addition, there is additional uncertainty due to the resolution of the digital elevation model that is available. In most cases, it is expected that digital elevation models with spatial resolution better than 100 m will be available. In these cases, there will be no added uncertainty due to the elevation model. In other cases, the input model will revert to a 1-km model. There are two effects in this case. The first is that the poorer accuracy of the input elevation at the 15 and 30 m spatial scale will increase the uncertainty of the results. This effect will again be more important in regions of strong relief. The second effect is that the 1-km resolution will create a noticeable artifact in the corrected data when the data moves from a pixel within one 1-km grid cell to another and this problem will be more visible in areas of strong relief.

Bands that are more affected by atmospheric absorption will have poorer accuracies due to uncertainties in the correction for these effects as well as uncertainties in the input parameters needed to correct for these effects. Bands where these effects are most important are Bands 6-9. All bands except band 1 have significant absorption effects, but these effects in bands 2-5 are either readily characterized or small enough that uncertainties in both inputs and treatment of the absorption will be minimal. For regions of high humidity the uncertainties in this band can be more than 20% over bright surfaces. The effect is small over dark objects.

Problems and limitations
The primary limitation to this product is the lack of aerosol correction. This has been done so as to create a product corrected for solar zenith angle changes and gaseous absorption, but not to overcorrect for the unknown aerosol inputs. Thus, the current data product will always overestimate the surface reflectance and surface radiance.

A second limitation is the lack of an adjacency correction. For pixels with a surface reflectance much smaller than the overall reflectance of the region surrounding it, the retrieved reflectance will be larger than the actual value and for bright surfaces the reflectance will be underestimated. The effect is also larger at larger scattering optical depths.

4. Version History

Initial version