

Geolocation Discrepancies with ASTER Level-1 Data (October 31, 2005)

Over the last couple of years, the ASTER Science Team has discovered three discrepancies that potentially affect the accuracy of the latitude/longitude values in ASTER data. Users need to be aware of these as they consider the accuracy of the coordinates in their specific ASTER data applications.

Description of Error	Affected Date	GDS Action
Earth Rotation Angle Error	Pre-June 3, 2004	Level-1s > June 3, 2004 Corrected
Earth Nutation-Related Longitudinal Error	Post-Sept 2003*	Level-1s > May 20, 2005 Corrected
Earth Ellipsoid-Related Terrain Error	Universal	No corrections planned

* The nutation error was less than 50 m before July 2003, and has since increased to about 200 m by end of 2004

Earth Rotation Angle Error

The first discrepancy is an incorrect calculation of the Earth's rotation angle. This produced a geolocation error of up to 300 meters near the poles for daytime scenes and less than 100 meters below 70 degrees latitude. The longitude error for nighttime scenes is largest at the equator, and decreases to ~100 meters at the poles. The correction was completely modeled with a polynomial, and applied to all Level-1 data produced after June 3, 2004. Additional information is available from the following URL:

http://www.science.aster.ersdac.or.jp/en/documnts/users_guide/part2/07_03.html

Earth Nutation-related Longitudinal Error

The second discrepancy is omission of compensation for nutation in the Earth's rotation. Nutation is defined as a slightly irregular oscillatory movement or wobble in the axis of the Earth's rotation. The omission of compensation for nutation results in a longitude error that is dependent on the date of ASTER data acquisition. In general, the strength of error is less than 50 meters before July 2003, and has since increased to about 200 meters through the end of 2004. A correction is applied to all Level-1 data acquired after May 20, 2005. Additional information is available from the following URL:

http://www.gds.aster.ersdac.or.jp/gds_www2002/service_e/release_e/set_release_e152.html

Earth Ellipsoid-related Terrain Error

The third discrepancy is due to the fact that ASTER processing uses the Earth ellipsoid (WGS-84) as the reference datum, and does not take into account the actual elevation. Therefore, a terrain error is included in the latitude and longitude values caused by a difference between the WGS-84 ellipsoid and the actual Earth's surface. The maximum displacement is about 400 meters over the Tibetan Plateau, with an 8.5 degrees off-nadir view angle. JPL provides a correction mechanism that uses a digital elevation model to reduce or remove this discrepancy as described below.

JPL's Web-based Correction Tool: JPL has implemented a web-based correction tool (<http://asterweb.jpl.nasa.gov/latlon.asp>) that performs all three corrections to a user-supplied

ASTER data set. Users physically provide their ASTER Level-1B data sets by uploading them to an ftp server. The requisite corrections are applied to make the necessary coordinate adjustments to the provided data sets. The corrected data sets are then staged for the user to download them from the same ftp server. It is important that your ASTER data qualify for these corrections. Refer to the following FAQ answers for details and a comprehensive description of the process:

- Which Level-1 ASTER data sets qualify for correction?

ASTER Level-1B data sets (falling in the defined time frames) qualify for correction.

- What time frames of ASTER data acquisitions qualify for correction?

Earth rotation correction: ASTER Level-1 data acquired before June 3, 2004 are in the affected category. To ascertain the acquisition date, look for “CALENDARDATE” in the hdf metadata (under core metadata) or in the attached .met file (under inventory metadata). All ASTER Level-1 data acquired after June 3, 2004 were corrected by GDS in Japan.

Earth nutation correction: ASTER Level-1 data acquired between September 2003 and May 20, 2005 are in the affected category. All ASTER Level-1 data acquired after May 20, 2005 were corrected by GDS in Japan.

Earth elevation correction: This applies universally to all ASTER data acquisitions regardless of acquisition time frame.

- Can you describe the end-to-end process for these corrections?

- I. You provide all the necessary basic information on JPL’s latitude/longitude coordinate correction tool site (<http://asterweb.jpl.nasa.gov/lcor.asp>). They include, name, address, e-mail address, telephone number, choice of format (HDF &/or GeoTiff), projection (UTM, equal-angle, grid), and resampling (nearest neighbor, cubic convolution).
- II. Once you submit the above details, you are provided, via e-mail, the location and address of an ftp server where you upload your ASTER data sets. Resource constraints require you to limit your order to a maximum of 5 scenes. There is a 3-day threshold for both uploading your data sets, and later, downloading your corrected data sets.
- III. Following corrections to your data, they are staged on JPL’s ftp server, and the location, address and other details are e-mailed to the user. Users have up to three days to download their data from this location before they are purged.