Release Notes
for GOSAT CAI L1B and L1B+ Products
(Release to General Users)

2009/11/19

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NIES GOSAT Project

Change history

Revised date	Page	Description
19 Nov. 2009	-	First version
16 Dec. 2009	5	“Table 2. Correction coefficients obtained as a result of vicarious calibration” has been corrected.
21 Dec. 2009	5	“Table 2. Correction coefficients obtained as a result of vicarious calibration” (Band3, b) has been corrected.

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Level 1B (L1B) and Level 1B+ (L1B+) products generated from the observation data of the Cloud and Aerosol Imager (CAI), one of the instruments composing the Thermal And Near infrared Sensor for carbon Observation (TANSO) on-board the Greenhouse gases Observing SATellite (GOSAT), are now released to registered general users. The following notes provide an overview of the CAI and points to be noted when using the products. As for the details of the algorithms, please refer to an algorithm description document to be released shortly.

The CAI data have been distributed in different versions from this version to those who responded to the research announcements prior to this release to the public. The differences between the versions will be explained as necessary.

1. Main purposes of the CAI
   a. Detect clouds to evaluate the cloud cover status within the Field of View (FOV) of the FTS (*1).
   b. Calculate cloud and aerosol properties for the scientific research on clouds and aerosols. And, for the analyses of FTS observation data, calculate the information on aerosol in addition to cloud flag information within the FOV of the FTS.
   c. Extract vegetation activity (vegetation index) on land.

      *1 TANSO-FTS (Fourier Transform Spectrometer) is the main sensor on board the GOSAT.

2. Major specifications of the CAI

	Central wavelength	Resolution	Swath	Characteristics
Band 1	380 nm	0.5 km	1000 km	Aerosols on land Absorption characteristics of aerosol
Band 2	674 nm	0.5 km	1000 km	Aerosol/cloud
Band 3	870 nm	0.5 km	1000 km	Aerosol/cloud/vegetation
Band 4	1600 nm	1.5 km	750 km	Absorption characteristics of cloud

3. Definitions of the CAI L1B and L1B+ products

- CAI data are composed of four bands and provided as two-dimensional datasets with a swath of approximately 1,000 km. Japan Aerospace Exploration Agency (JAXA) provides NIES with CAI L1A products, whose one scene corresponds to one revolution of the satellite. The received products are then generated into L1B and L1B+ data at NIES to be distributed to general users.
- L1B data have been processed in reply to requests not to interpolate in consideration of further processing them into cloud flag, aerosol property, and cloud property data products. L1B+ products, on the other hand, have been processed based on requests, to make them easier for positional and band-to-band registration, which is an important element for an imager, even by using interpolation.
- L1B and L1B+ products are generated on the "frame" basis: a datatake over the satellite ground pass of one orbit is divided into equidistant 60 frames. Since daylight (daytime) data only are effective as observation data to be provided, an L1A scene contains approximately 31 frames (see Figure 1 below.)

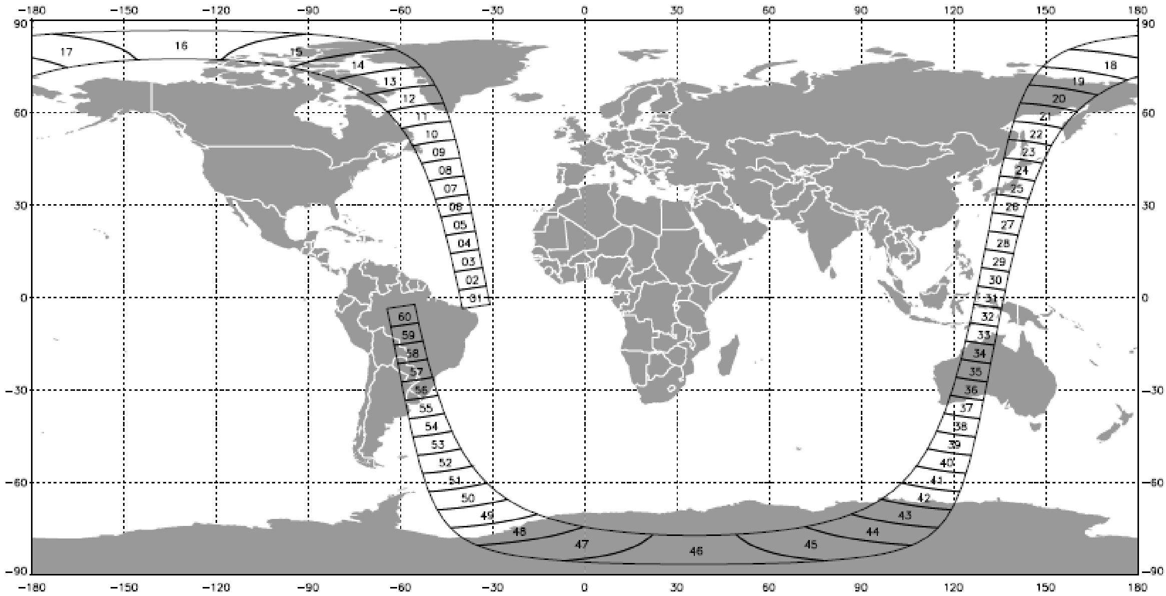

Figure 1　CAI scenes and frames (example)

-The L1B products are based on the sensor coordinate system, which is located on the sequence of sensor elements. Each pixel has relevant geometric information, such as latitude and longitude, in itself. The latitude and longitude values are orthorectified (*2) with the aid of elevation data, and the spacing between adjacent pixels is approximately 500 m at the nadir. On the other hand, L1B+ products have a map-projected coordinate system, where the Mercator projection is used with regard to the frames whose centers are located between latitudes 60 degrees North and 60 degrees South and the Polar Stereo projection with regard to the frame whose centers are at latitude more than 60 degrees. The map projections are applied at the same time as orthorectification. The size of one pixel is 500 m at the Equator with the Mercator projection and 1,000 m at the Poles with the Polar Stereo projection.
- In L1B data, the band-to-band registration process (while the Poles are not observed in fact), the radiance data of the pixel whose line-of-sight vector is the closest to that of Band 3 is used without interpolation as a radiance data of the pixel of a band (other than 3) corresponding to the pixel of band 3. In L1B+ products, the radiance data at the map projected location is interpolated with the radiance values of adjacent pixels.

- In the L1B data, as the resolution of Band 4 is different from that of Band 3, 3 x 3 pixels are filled with the same values of Band 4, while for the L1B+, interpolation is performed during the map projection process.

*2 Orthorectification is a process of orthogonally projecting data taking into account the ground elevation, by correcting the position of each pixel with reference to elevation data.

4. Differences between the CAI L1B and L1B+ products

Table 1 Differences between the CAI L1B and L1B+ products

Parameter	L1B product	L1B+ product
Pixel value/unit	Radiance value (4-byte real) / W/m2/sr/μ m	Radiance value (2-byte integer number) / W/m2/sr/μ m (provided that conversion coefficients and offset values are given.)
Order of lines, order of pixels	Sensor coordinate system	Mercator projection for the frames whose centers are positioned between latitude 60 degrees North and 60 degrees South and the Polar Stereo projections with regard to those whose centers are at or above 60 degrees.
Handling of Band 4	Same resolution as that of Band 3	Same resolution as Bands 1 to 3 achieved by interpolation.
Time stamp	Every line	At the center of frame only
Latitude/longitude	Given per pixel. Orthorectified.	Map projection conditions are included. Orthorectified. Displacement due to the integration time of the sensor is taken into consideration.
Elevation data	Given per pixel	Given per pixel
Land/sea information	Given per pixel	Included in the elevation data.
Solar/satellite zenith angle/azimuthal angles	Given per pixel	Given at a constant pixel skipping interval
Latitude/longitude at the four corners	Latitude and longitude of each of the four corners of the image	Provided in two types: 1) for the four corners of the whole image including the non-data areas generated as a result of map projection, and 2) for the four corners of the scene data excluding the non-data areas.

5. Changes applied as of the release to general users on November 19, 2009

(1) Radiance calibration

The following table presents vicarious calibration coefficients derived through post-launch comparison with the MODIS sensor on board NASA's Aqua mission. The radiance values are corrected using the following equation, where x is the radiance value before the correction and y is that after the correction.

$$y = a * x + b$$

Table 2 Correction coefficients obtained as a result of vicarious calibration

Band	a	b
1	1.138	0.00
2	0.946	- 1.372
3	1.033	- 0.189
4	1.144	0.00

The results of the vicarious calibration are applied to L1B+ products and not to L1B products.

(2) Geometric calibration

Displacement between even pixels and odd pixels is estimated as 0.9 pixels. This displacement is corrected in L1B+ products, while it is not in L1B products. The correction of L1B products is scheduled for mid-December.