

NIES-GOSAT2-SYS-20220701-007-01

**NIES GOSAT-2
Product File Format Descriptions
(Product edition)**

Vol.8

GOSAT-2 L4A Global CO₂ Flux Product

March 2024

National Institute for Environmental Studies
GOSAT-2 Project

Revision History

Version	Revised	Page	Description
00	Oct. 2022	-	-
01	Mar. 2024	Entire	Modified document format (No revision line)
		p.1	Changed product version
			Fixed the product description
		p.2	Removed the following variables <ul style="list-style-type: none"> • <i>A posteriori</i> gross primary productivity flux • <i>A posteriori</i> ecosystem respiration flux • <i>A posteriori</i> land use change and disturbance CO₂ flux
			Added the following variable <ul style="list-style-type: none"> • <i>A posteriori</i> terrestrial biosphere CO₂ flux
			Added the special mention about "Variables"
p.3	Removed the following variables <ul style="list-style-type: none"> • flux_apos_gpp • flux_apos_re • flux_apos_luc 		
	Added the following variable <ul style="list-style-type: none"> • flux_apos_teb 		

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1 Introduction

1.1 Purpose

The purpose of this document is to define the file format of GOSAT-2 L4A Global CO₂ Flux Product which is one of the Greenhouse gases Observing SATellite-2 (hereinafter referred to as “GOSAT-2”) products generated by the National Institute for Environmental Studies, Japan.

1.2 Product and version

The product and its version described in this document are listed in Table 1-1.

Table 1-1 Product and version

Product name	Product version
GOSAT-2 L4A Global CO ₂ Flux Product	01.02

| 01

2 GOSAT-2 L4A Global CO₂ Flux Product

(1) Product description

GOSAT-2 L4A Global CO₂ Flux Product stores monthly global CO₂ surface fluxes estimated from atmospheric CO₂ concentration data such as GOSAT-2 TANSO-FTS-2 SWIR L2 column-averaged dry-air mole fraction product (CO₂).

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(2) Major contents

CO₂ surface flux (2.5-degree mesh, monthly)

(3) Category

Standard

(4) Unit

Annually

(5) Format

NetCDF

(6) File naming convention

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
G	O	S	A	T	2	Y	Y	Y	Y	M	M	y	y	y	y	m	m	_	4	A	C	O	2	F	V	M	M	N	N	R	R	o	o	o	o	.	n	c

GOSAT2: Satellite name (Fixed)

YYYYMM: Start month of flux estimation (Year, Month) (UTC)

yyyymm: End month of flux estimation (Year, Month) (UTC)

4A: Processing level (Fixed)

CO2F: Product code (Fixed)

V: Processing identifier (V: Steady, T: Test), added as necessary

MMNN: Product version (MM: Major version, NN: Minor version)

RR: Revision

oooo: Input data version

nc: Extension (Fixed)

(7) File size

Approx. 7 MB

3 File format

3.1 Components

The components of the product are shown in Table 3-1.

Table 3-1 Components of GOSAT-2 L4A Global CO₂ Flux Product

Dimensions	<ul style="list-style-type: none"> • Number of grid points along the longitudes • Number of grid points along the latitudes • Number of time steps
Variables	<ul style="list-style-type: none"> • Longitude • Latitude • Time • <i>A priori</i> fossil fuel CO₂ emissions • <i>A priori</i> gross primary productivity flux • <i>A priori</i> ecosystem respiration flux • <i>A priori</i> land use change and disturbance CO₂ flux • <i>A priori</i> biomass burning CO₂ flux • <i>A priori</i> ocean CO₂ flux • <i>A posteriori</i> fossil fuel CO₂ emissions • <i>A posteriori</i> terrestrial biosphere CO₂ flux • <i>A posteriori</i> biomass burning CO₂ flux • <i>A posteriori</i> ocean CO₂ flux • <i>A posteriori</i> total surface CO₂ flux

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The special mention about “Variables” above is shown as follows:

- Time
A day at the middle of the month, at 00:00:00, is given for indicating “Time” of the month.
- *A posteriori* terrestrial biosphere CO₂ flux
A posteriori terrestrial biosphere CO₂ flux (flux_apos_teb) is calculated using a *posteriori* gross primary productivity flux (flux_apos_gpp), a *posteriori* ecosystem respiration flux (flux_apos_re), and a *posteriori* land use change and disturbance CO₂ flux (flux_apos_luc) as follows.

$$\text{flux_apos_teb} = \text{flux_apos_re} + \text{flux_apos_luc} - \text{flux_apos_gpp}$$

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- *A posteriori* total surface CO₂ flux
A posteriori total surface CO₂ flux (flux_apos_tot) is calculated using a *posteriori* fossil fuel CO₂ emissions (flux_apos_fos), a *posteriori* terrestrial biosphere CO₂ flux (flux_apos_teb), a *posteriori* biomass burning CO₂ flux (flux_apos_bmb), and a *posteriori* ocean CO₂ flux (flux_apos_ocn) as follows.

$$\text{flux_apos_tot} = \text{flux_apos_fos} + \text{flux_apos_teb} + \text{flux_apos_bmb} + \text{flux_apos_ocn}$$

3.2 File format details

The file format details of the product are shown in Table 3-2.

Table 3-2 File format of GOSAT-2 L4A Global CO₂ Flux Product

DIMENSIONAL VARIABLE / DATA VARIABLE / GLOBAL ATTRIBUTE	DIMENSION	ATTRIBUTE		DATA TYPE	VARIABLE NAME / GLOBAL ATTRIBUTE NAME	DESCRIPTION
		ATTRIBUTE NAME	CONTENT			
dimensions						
lon	-	-	-	-	Number of grid points along the longitudes	144
lat	-	-	-	-	Number of grid points along the latitudes	72
time	-	-	-	-	Number of time steps	Number of monthly data
variables						
lon	lon	units	degrees_east	float	Longitude	East longitude as positive, west longitude as negative
		standard_name	longitude			
lat	lat	units	degrees_north	float	Latitude	North latitude as positive, south latitude as negative
		standard_name	latitude			
time	time	units	hours since YYYY-1-1 00:00:00	float	Time	Hour since 00:00:00 UTC on January 1st of the respective year
		standard_name	time			
flux_apri_fos	time, lat, lon	units	g C m-2 day-1	float	A priori fossil fuel CO2 emissions	Emission as positive
		missing_value	-9999.0			
		long_name	A priori fossil fuel emissions			
flux_apri_gpp	time, lat, lon	units	g C m-2 day-1	float	A priori gross primary productivity flux	Absorption as positive
		missing_value	-9999.0			
		long_name	A priori gross primary productivity flux			
flux_apri_re	time, lat, lon	units	g C m-2 day-1	float	A priori ecosystem respiration flux	Emission as positive
		missing_value	-9999.0			
		long_name	A priori ecosystem respiration flux			
flux_apri_luc	time, lat, lon	units	g C m-2 day-1	float	A priori land use change and disturbance CO2 flux	Emission as positive
		missing_value	-9999.0			
		long_name	A priori land use change flux			
flux_apri_bmb	time, lat, lon	units	g C m-2 day-1	float	A priori biomass burning CO2 flux	Emission as positive
		missing_value	-9999.0			
		long_name	A priori biomass burning flux			
flux_apri_ocn	time, lat, lon	units	g C m-2 day-1	float	A priori ocean CO2 flux	Emission as positive, absorption as negative
		missing_value	-9999.0			
		long_name	A priori ocean flux			
flux_apos_fos	time, lat, lon	units	g C m-2 day-1	float	A posteriori fossil fuel CO2 emissions	Emission as positive
		missing_value	-9999.0			
		long_name	A posteriori fossil fuel emissions			
flux_apos_teb	time, lat, lon	units	g C m-2 day-1	float	A posteriori terrestrial biosphere CO2 flux	Emission as positive, absorption as negative
		missing_value	-9999.0			
		long_name	A posteriori terrestrial biosphere flux			
flux_apos_bmb	time, lat, lon	units	g C m-2 day-1	float	A posteriori biomass burning CO2 flux	Emission as positive
		missing_value	-9999.0			
		long_name	A posteriori biomass burning flux			
flux_apos_ocn	time, lat, lon	units	g C m-2 day-1	float	A posteriori ocean CO2 flux	Emission as positive, absorption as negative
		missing_value	-9999.0			
		long_name	A posteriori ocean flux			
flux_apos_tot	time, lat, lon	units	g C m-2 day-1	float	A posteriori total surface CO2 flux	Emission as positive, absorption as negative
		missing_value	-9999.0			
		long_name	A posteriori total surface CO2 flux			
global attributes						
title	-	-	-	char	Product name	GOSAT-2 L4A Global CO2 Flux Product
product_version	-	-	-	char	Product version	VMM.NN (MM: Major version, NN: Minor version)
source	-	-	-	char	Source data	TANSO-FTS-2 SWIR L2 Column-averaged Dry-air Mole Fraction Product VMM.NN (MM: Major version, NN: Minor version)
history	-	-	-	char	Data production date	YYYY-MM-DD
references	-	-	-	char	References	Reference information about the product
comment	-	-	-	char	Product description	Monthly global surface CO2 fluxes estimated from TANSO-FTS-2 SWIR L2 Column-averaged Dry-air Mole Fraction Product
institution	-	-	-	char	Data producing agency	National Institute for Environmental Studies
email	-	-	-	char	E-mail address	gosat-2_desk@nies.go.jp
Conventions	-	-	-	char	NetCDF Climate and Forecast Metadata Conventions	CF-1.6

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