Algorithm Theoretical Basis Document

GCOM-C/SGLI Level-2 Statistics (G4A)

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Masahiro Hori

Japan Aerospace Exploration Agency

Contents

1. Introduction

1.1 Objectives

The objective of the G4A algorithm is to take temporal statistics of SGLI Level-2 (L2) Tile geophysical variable (GV) products for land and cryosphere. The temporal interval of the statistics is 8-day or 1-month. The spatial resolutions of the tile products are kept the same.

1.2 Development strategy

The G4A algorithm is designed to use a same program code for taking statistics of all GVs in order to make the maintenance of the code simple. Basically the output of the G4A processing contains the same statistics variables except for the case of snow and ice cover extent (SICE) product (see next sub-section). The SICE is a flag product and the output of SICE statistics is customized so that the number of snow/ice cover observation during the temporal interval can be calculated. Finally, to make the addition or deletion of GVs quite easy, the GV names of the statistical targets are defined in an external text file so that the change could be made without compiling the code.

1.3 Processing targets and outputs

Processing targets of the L2 Tile GV statistics are the land and cryosphere products. Input and output variables are summarized in Table 1.

Table. 1 List of the target products, GVs, and output types of the G4A processing

Product ID	Long Name	Geophysical Variables (GVs)	Output Variables*1
VGI_	Vegetation index	NDVI, EVI, and SDI	AVE, RMS, N_{used}, N_{input}, MIN, MAX, Date, QA_flag
LAI_	Leaf area index	LAI and FAPAR	Same as above
AGB_	Above-ground biomass	AGB and VRI	Same as above
LST_	Land surface temperature	LST	Same as above
SIPR	Snow and ice physical properties	SGSL and SIST	Same as above
SICE	Snow and ice cover extent	SICE	N_{snow1}, N_{snow2}, N_{snow3}, N_{used}, N_{input}, Date, QA_flag

*1 AVE: Average of valid GV data, RMS: Root Mean Square of valid GV data, N_{used}: Number of valid GV data actually used in the statistics, N_{input}: Number of input GV data, Min: Minimum of valid GV data, Max: Maximum of valid GV data, Date: Dates of the SGLI observations during the 8-day or 1-month interval period, QA_flag: Flag for quality assurance information, N_{snow1}: Number of snow or ice cover, N_{snow2}: Number of snow with vegetation or bare ice, N_{snow3}: Number of melting snow

Basically (except for the case of snow and ice cover extent (SICE) products) the statistics taken and stored in the output files are the eight values or flag shown in Table1. When processing the SICE product which stores surface classification flags including snow and ice covers, the statistics of Ave, RMS, Min, and Max are not taken. Instead, only three snow/ice-related counts are stored in the output file.

2. Theoretical Description

2.1 Processing flow

Figure 1 indicate the flow of the G4A L2 Tile GV statistics processing. Input is the L2 tile daily GV products with spatial resolution of 250m or 1km. Output is the 8-day or 1-month statistics product of individual GVs. In case that an input file contains multiple GVs, the G4A process generates output files for every GVs separately. For example, the "VGI_" product contains three GVs of NDVI, EVI and SDI as shown in Table 1. The outputs of the G4A processing for VGI_ are three files with the following product IDs, i.e., NDVI, EVI_, and SDI_.

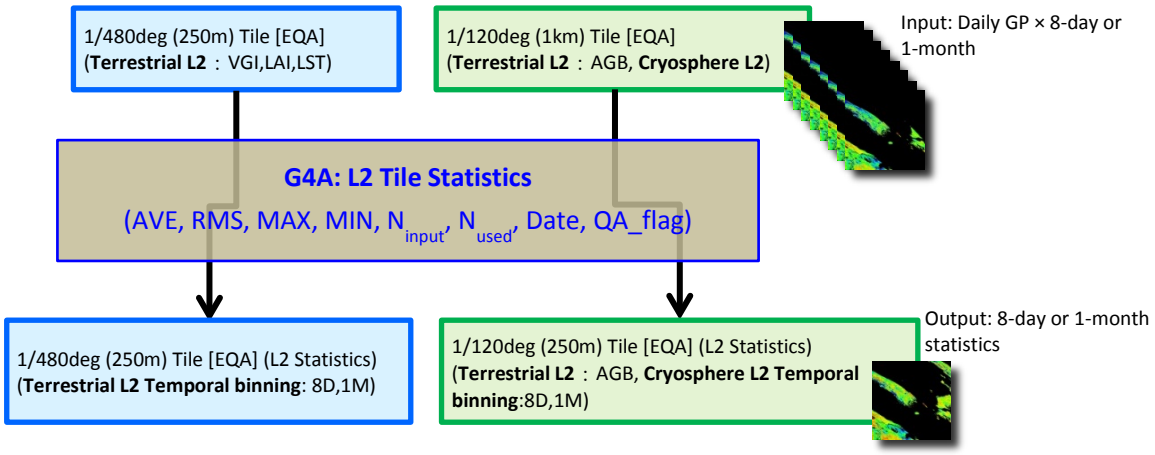


Fig. 1 Flow of the G4A L2 Tile GV statistics processing

2.2 Definition of the statistics

Equations for calculating "AVE" and "RMS" are the followings;

$$AVE = \frac{1}{n}\sum_i xi$$

$$RMS = \sqrt{\frac{1}{n}(\sum_i xi^2)}$$

Where n is the total number of observation days with valid GVs, xi is the daily value of a GV to be processed.

"N_{used}" is the number of valid GV data actually used in the statistics, whereas "N_{input}"

is the number of all the input GV data.

"MIN" and "MAX" are the minimum and maximum of valid GVs data during the temporal interval.

"Date" is a 8-bit value storing the dates of SGLI observations employed in the statistics calculation. For example, when the Date value is 40 (i.e., 101000), then SGLI observations of 4th and 6th days are used in the statistics.

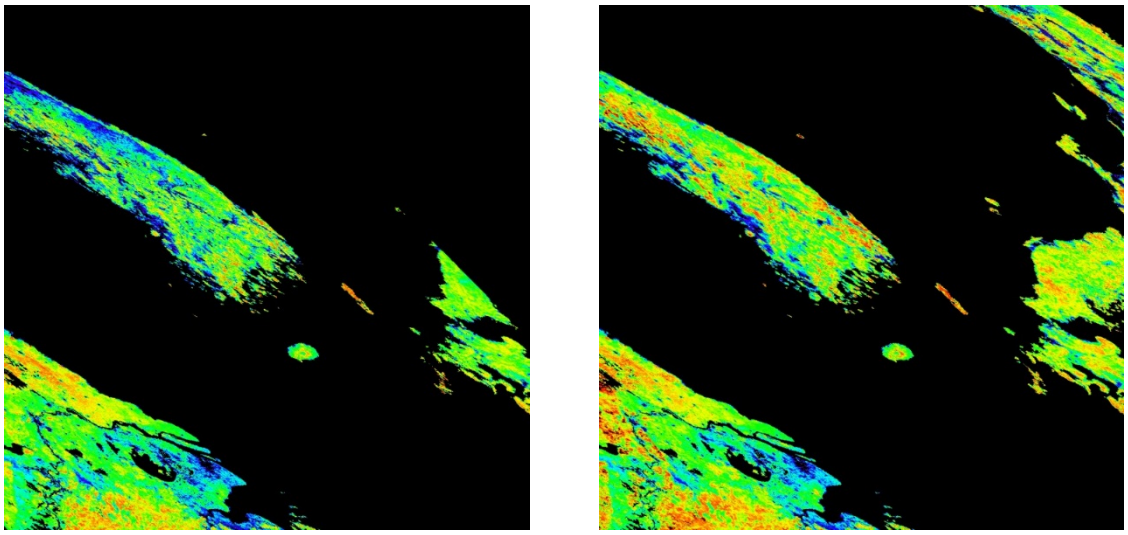
2.3 QA process

"QA_flag" currently stores flags for discriminating land and water. In future update, QA information for GVs will be included.

2.4. Sample images

2.4.1 NDVI

Figure 2 indicate sample images for the input and output of G4A processing (GV is NDVI and the temporal interval is 8-day).



Input: Daily NDVI　　Output: 8-day averaged NDVI

Fig. 2 Sample images of the G4A processing. (NDVI, Tile No.: 0528, 8-day)

3. Current status and remaining issues of the G4A code implementation

The G4A process works well without system errors. Processing speed and memory size are also within the expectations. Remaining tasks are the implementation of the QA_flag for the output of quality assurance information.