Earth observation satellite data processing for GPM/DPR

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Abstract

In recent years, worldwide interest has been increasing about the necessity of grasping the global environmental change. To deal with such problems, various approaches using observation technology from space have been carried out by satellites.

Global Precipitation Measurement (GPM) mission, as follow-on and expansion of Tropical Rainfall Measurement Mission (TRMM) satellite, is an international mission to achieve highly accurate and frequent global rainfall observation. it is carried with multiple satellite, GPM core satellite with Dual-frequency Precipitation Radar (DPR) jointly developed by JAXA and NICT, and with GPM Microwave Imager (GMI) developed by NASA, and another constellation satellites with Microwave Imager.

It also implements a system for estimating the global precipitation distribution based on the data acquired from GPM core satellite and another constellation satellites. It is named "GSMaP" (Global Satellite Mapping of Precipitation).

In addition, accumulation of long-term data is important to understand long-term climate change on a global scale. It is important to be able to use the data of the TRMM satellite operated from 1997 to 2015 as well as the data of the GPM satellite.

Ref. URL: http://global.jaxa.jp/projects/sat/gpm/

Reasons and benefits of using JAXA Supercomputer System

Processing of earth observation data includes "operational processing" performed routinely and "re-processing" performed once a year or so for several year data. The purpose of re-processing is to correspond with version-up of computing model and algorithm performed periodically. The amount of observation data grows year by year.

Then, we need more and more time to complete reprocessing of all archived observation data. By using supercomputers, the calculation time is greatly shortened, and it is possible to provide products quickly to users.

In addition, the frequency of re-processing is about once every one to two years, so the necessary period of computer resource for re-processing is limited. If this computer resource is prepared on ourselves, it is inefficient in terms of the computer utilization. The use of JSS2 is advantageous in that it can relatively flexibly secure computer resources when we needed.

In this project, the total re-processing time is reduced by increasing the number of concurrently executing processes using MPI parallel processing called "workflow control".

Achievements of the Year

In FY2020, we conducted latent heat reprocessing, which is a part of GPM processing, using the released version 6. The overview of GPM reprocessing is as follows.

<GPM / LATENT HEAT>

period of observation : 2014/3/8 - 2020/06/30

CPU usage time : Approx. 475.5 hours

Number of output files : 74,125 files

Total output file capacity : 1.4 TB

In addition, we plan to upgrade GPM(DPR), TRMM(PR), and GSMaP processing algorithm in FY2021, we transferred input data for them to JSS3 in FY2020.

Publications

N/A

Usage of JSS

Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	N/A
Number of Processes	2 - 10
Elapsed Time per Case	120.8 Second(s)

- **Resources Used(JSS2)**

Fraction of Usage in Total Resources[*1](%): 3.84

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage[*2](%)
SORA-MA	23,007,787.40	4.35
SORA-PP	4,994.01	0.04
SORA-LM	0.00	0.00
SORA-TPP	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage[*2](%)
/home	204.12	0.19
/data	101,315.68	1.96
/ltmp	33,612.37	2.86

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage[*2](%)
J-SPACE	26.10	0.86

[*1]: Fraction of Usage in Total Resources: Weighted average of three resource types (Computing, File System, and Archiver).

[*2]: Fraction of Usage：Percentage of usage relative to each resource used in one year.

- **Resources Used(JSS3)**

Fraction of Usage in Total Resources[*1](%): 0.11

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	0.00	0.00
TOKI-RURI	13,694.57	0.08
TOKI-TRURI	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage[*2](%)
/home	341.00	0.23
/data	128,163.87	2.15
/ssd	1,837.41	0.96

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage[*2](%)
J-SPACE	26.10	0.86

[*1]: Fraction of Usage in Total Resources: Weighted average of three resource types (Computing, File System, and Archiver).

[*2]: Fraction of Usage：Percentage of usage relative to each resource used in one year.