Trial of GPU usage in earth observation satellite product generation processing

Report Number: R24EER49902
Subject Category: Space Technology
URL: https://www.jss.jaxa.jp/en/ar/e2024/27065/

Responsible Representative

Hironori Maejima, Senior Chief Officer of Earth Observation Missions, Space Technology Directorate I

Contact Information

Akira Yamauchi(yamauchi.akira@jaxa.jp)

Members

Kohtaro Araragi, Takaaki Aizawa, Akira Deguchi, Makoto Imanaka, Keisuke Kimura, Hiroo Kii, Michihiro Koide, Sachiko Kawase, Wataru Matsumoto, Masanori Toyoda, Yui Maeda, Takuya Nakayama, Akira Yamauchi

Abstract

The Earth observation satellite product processing software was modified for parallel execution using GPUs. The effectiveness of GPU utilization was tested using the results of execution and measurement on the JAXA Super Computer System 3 (JSS3).

Reasons and benefits of using JAXA Supercomputer System

JSS3 is equipped with numerous GPUs, enabling efficient large-scale parallel computation, making it ideal for verifying GPU acceleration in this project. Additionally, JSS3 already has a well-established environment for configuring the computing system, allowing the project to proceed smoothly.

Achievements of the Year

The verification of GPU acceleration for Earth observation satellite product creation software revealed that the current source code has a small scale of parallel computation, making acceleration difficult due to memory operation overhead. The processing of target software requires a review of the algorithm itself, such as applying loop processing optimal for GPU computation. Fortran language tends to be faster than C language in numerical computation, but this difference can be reduced by increasing the optimization level. GPU acceleration requires consideration of libraries, compiler functions, unified language specifications, and memory operations.

In the future, to adapt the algorithms of Earth observation satellite products to GPU computation, it will be necessary to make modifications that separate I/O processing and initialization processing, and consider memory operation timing while maintaining the validity of the output results.

Publications

N/A

Usage of JSS

Computational Information

Process Parallelization Methods	N/A
Thread Parallelization Methods	N/A
Number of Processes	1
Elapsed Time per Case	120 Minute(s)

JSS3 Resources Used

Fraction of Usage in Total Resources[*1](%): 0.01

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	0.00	0.00
TOKI-ST	2,251.59	0.00
TOKI-GP	1,820.25	0.03
TOKI-XM	0.00	0.00
TOKI-LM	0.00	0.00
TOKI-TST	0.00	0.00
TOKI-TGP	0.00	0.00
TOKI-TLM	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage*2 (%)
/home	1,040.35	0.70
/data and /data2	104,090.00	0.50
/ssd	30,720.00	1.65

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage*2 (%)
J-SPACE	0.00	0.00

*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.

- **ISV Software Licenses Used**

ISV Software Licenses Resources		
	ISV Software Licenses Used (Hours)	Fraction of Usage*2 (%)
ISV Software Licenses (Total)	0.00	0.00

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