Large-scale analysis of multi-droplet evaporation by interface-resolved DNS

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Abstract

In order to improve the accuracy of the spray model for analyses of an aircraft engine combustor, detailed analyses of fuel droplet group evaporation was conducted using a two-phase flow analysis solver with an evaporation model.

Reasons and benefits of using JAXA Supercomputer System

This analysis was conducted in JSS3 large-scale analysis challenge. The occupation usage of the large computational resources made it possible to carry out the analysis involving a large number of droplets.

Achievements of the Year

Droplet group evaporation analyses were conducted in two-types situations where there were 640 droplets with a diameter of 0.5 mm and 2963 droplets with a diameter of 0.3 mm.

We succeeded to obtain data as follows;

1.Variation of the whole evaporation rate by the difference in droplet diameter

2.Variation of the temperature History by the difference in droplet location

3.Variation of the evaporation rate of each droplet by the difference in distance between Droplets.

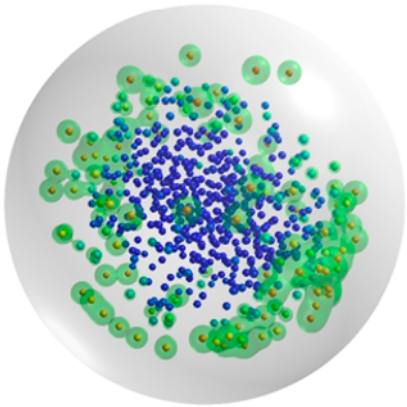

Fig. 1: Time variations of the temperature distribution on the liquid-gas interface and the iso-surface of the fuel component.

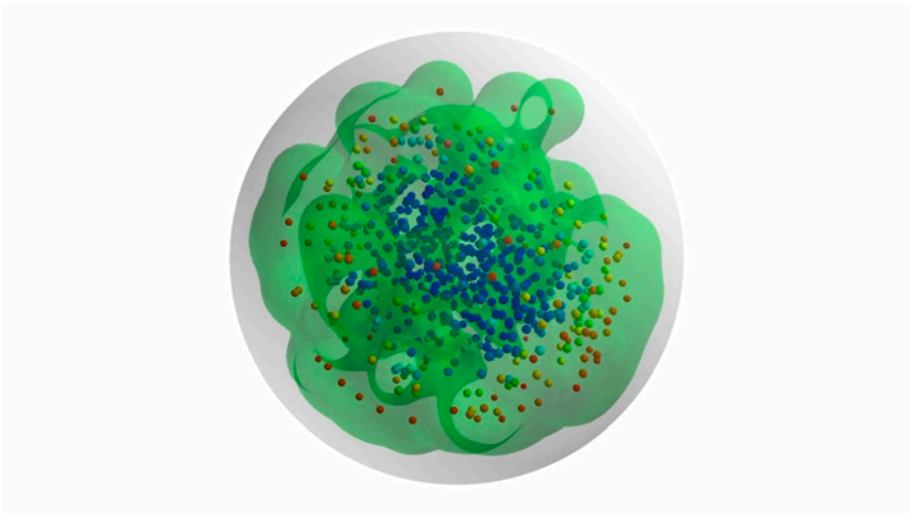

Fig. 2: Time variations of the temperature distribution on the liquid-gas interface and the iso-surface of the fuel component (movie). (Video. Video is available on the web.)

Publications

N/A

Usage of JSS

Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	N/A
Number of Processes	66944
Elapsed Time per Case	240 Hour(s)

- **Resources Used(JSS2)**

Fraction of Usage in Total Resources[*1](%): 0.00

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage[*2](%)
SORA-MA	0.00	0.00
SORA-PP	0.00	0.00
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	11.96	0.01
/data	2,480.16	0.05
/ltmp	496.03	0.04

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.

- **Resources Used(JSS3)**

Fraction of Usage in Total Resources[*1](%): 8.54

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	47,053,305.01	10.12
TOKI-RURI	1,089.17	0.01
TOKI-TRURI	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage[*2](%)
/home	54.89	0.04
/data	8,463.55	0.14
/ssd	561.61	0.29

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.