Numerical study of the convection structure in Venus' atmospheres

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Abstract

Our purpose is to support the observation performed by AKATSUKI (Venus Climate Orbiter) by developing a numerical fluid dynamics model (cloud resolving model) and providing a lot of numerical simulation data. The motion of Venus' cloud-level convection and the propagation of gravity wave driven by convection obtained by our numerical simulation are very useful to analysis the cloud morphology at various altitudes and characteristics of gravity wave obtained by AKATSUKI. By comparing our numerical simulations data and the observation data of AKATSUKI, it is expected that atmospheric structure of Venus' cloud-level will be more clearly understood.

Reasons for using of JSS2

Supercomputer is used for developing and running our cloud resolving model. To reproduce the structure of convective motion and gravity wave propagation, it is necessary that the resolution of the model is set to be several tens to several hundred meters. To avoid the influence of the computational boundary and to compare with AKATSUKI's data, horizontal region of hundreds to thousands of kilometers is required. The numerical simulations with such high resolution and wide computational region can be performed using supercomputer only.

Achievements of the Year

We proceed further analysis of our previously performed two-dimensional simulation and find that the altitude at which gravity wave breaking occurs and amplitude of gravity waves are consistent with those obtained by the observational results of radio occultation measurements. We also start to perform a numerical simulation in order to investigate a possible three-dimensional structure of Venus' cloud-level convection and propagation of gravity wave driven by the convection. The preliminary results show that

the convective motion and gravity wave propagation are obtained successfully (Fig.1, 2).

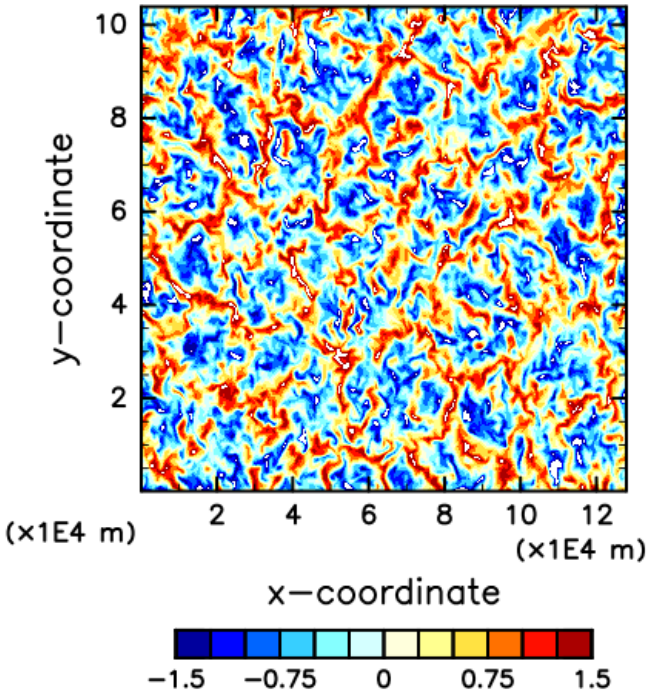

Fig.1 Horizontal cross-section of vertical velocity associated with convection at 51 km altitude.

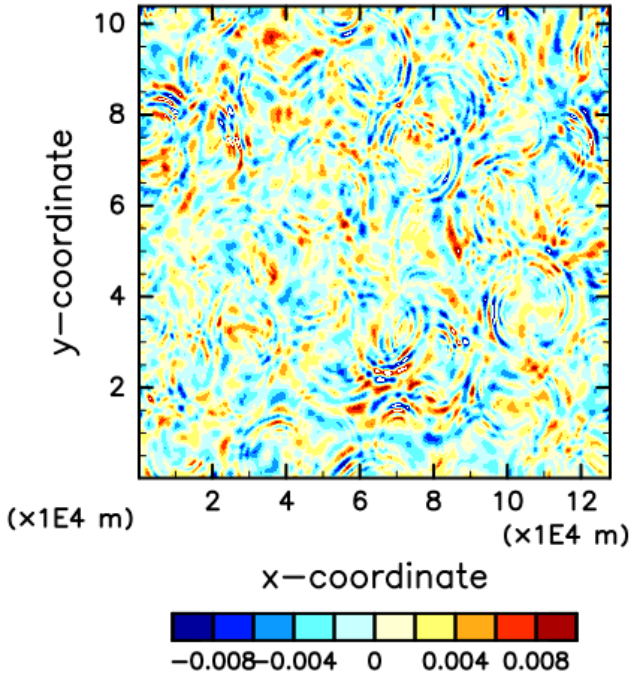

Fig.2 Horizontal cross-section of vertical velocity associated with gravity wave at 59 km altitude.

Publications

N/A

Usage of JSS2

Computational Information

Parallelization Methods	MPI
Thread Parallelization Methods	N/A
Number of Processes	128 - 1024
Elapsed Time per Case	100.00 hours

Resources Used

Fraction of Usage in Total Resources*1 (%): 0.03

Details

Computing Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage*2 (%)
SORA-MA	226,607.97	0.03
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	356.71	0.25
/data	3,287.00	0.06
/ltmp	1,302.08	0.10

Archiver Resources		
Archiver System 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