

## An attempt to simulate multiple equilibrium states of Venusian atmospheric general circulation

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### Introduction

Venus rotates so slowly and the period of the rotation is 243 days, but the zonal wind with a velocity of about 100m/s exists at an altitude of about 70km and it is called super-rotation. The velocity is 60 times faster than that of the solid surface rotation. At present, there is not definitive answer about how to make and maintain the superrotation. But there are some scenarios which generate meridional circulation, and the one is called Gierasch mechanism (Gierasch 1975). Furthermore, Matsuda (1980,1982) examined Gierasch mechanism, and He suggested the presence of the multiple equilibrium states in Venusian atmospheric general circulation, so utterly different state, which has a strong meridional circulation with a slight zonal wind, can also exist as a stable solution. In this study, we tried to simulate the multiple equilibrium states using a modified General Circulation Model (CCSR/NIES AGCM5.4) for Venusian atmosphere.

### Model

The horizontal resolution is T10, and the vertical domain between 0 and 100 km has 60 layers. The physical parameters such as the rotation period and gravity acceleration are changed to Venus's value. Since radiative process in Venus atmosphere is unknown, in this model, we set zonally uniform heating in the cloud layer and the temperature relaxes to the reference value by Newtonian cooling, referring to Yamamoto and Takahashi (2003). The unknown physical processes, i.e. clouds, precipitation etc., are omitted and the geography on the surface are not considered.

### Summary

In this model, we simulated the super-rotation obtained by Yamamoto and Takahashi (2003). And so, the heating rate and the rotation period of the planet are changed, and the dependence of the zonal wind on these parameters are investigated. At present, distinct evidence of the multiple equilibrium states are not obtained. However, we keep up computation now, we will report also these issues.