Toward simulations of weather and climate of planetaries in general

*Yoshi-Yuki Hayashi[1]

1.Department of Planetology/CPS, Graduate School of Science, Kobe University

The aim of this presentation is to visit quickly the present status of numerical simulations for possible weather and/or climate on a planet or a satellite with an atmosphere other than the Earth, and to place some foresight of development of simulation in the near future.
Until almost the end of 20th century, it had not been recognized as a fruitful research but as a hobby work to consider generality and particularity of a surface environment of a planet by demonstrating weather and climate, which may be realized on a given planet, by constructing its virtual atmosphere in a computer. There have been vigorous research activities on the evolution of planetary surface environment from the viewpoint of energy budget analyses by solving the radiation transfer equation for a given set of atmospheric chemical species, but little from the viewpoint of atmospheric circulation with an explicit representation of material transport by the atmospheric motion.
Unfortunately, the present understandings of the weather and climate on the planets in our solar system, for which we can utilize observational data by the use of exploration devices and/or telescopes to a certain extent is not enough for us to predict confidently the environments of exoplanets or the planets of our solar system in the early stages of its evolution. The a-periodic appearance of the Martian global dust storms still remains to be understood. The four day circulation (the rapid zonal wind) which characterize the looks of Venus remains to be understood in a dynamically consistent fashion where atmospheric disturbances and their roles are revealed. The banded structure observed in the atmospheres of the giant planets still remains in a stage with many controversial arguments. This is because the development of observations for the Earth's environment which enables the development of weather and/or climate prediction can not be expected for the planets in our solar system and for
exoplanets. The issue to proceed the research activities in these fields is to establish reliable ways of verification for numerical
methods with the lack of such observational backups. As an effort to respond this issue, our group is now constructing a series of
hierarchical models and a group of software libraries to support them.

Keywords: numerical simulation, planetary environment in general, weather and climate

