

Atmospheric dynamics and material transport in the Martian lower atmosphere: towards the connection to upper atmosphere

Takeshi Kuroda
Tohoku University, Japan

It is well known that the features of lower atmosphere on Mars are strongly governed by dust storms with various scales. Also there are two kinds of clouds which are made from CO₂ and water, respectively. CO₂ ice clouds exist in the winter polar region below ~40km altitude and the equatorial region above ~60km. Though water is one of the minor species in the current Martian atmosphere, it still affects the temperature fields with the radiative effects of ice clouds. Vertical distributions of water vapor in the current Martian atmosphere contain some mysteries, e.g. extremely large supersaturation ratio (~10) and the existence in ~80km height. Investigations of water cycle and related chemical processes are important to understand the evolutions of Martian environment which is thought to have had plenty of liquid water on surface.

Mars general circulation models (MGCMs) has been developed since 1969, and well reproduced the temperature fields below ~60km height in the end of 20th century. Since the beginning of 21st century the material transport and chemical processes started to be implemented into MGCMs, as well as the trials to increase the model top height. For the simulations of Martian atmosphere above 60km, the implementation of the effects of gravity waves is essential as well as the consideration of non-LTE effects on the CO₂ radiation. Several studies of the gravity waves in the Martian atmosphere have been done using the observational data sets, but the property of the gravity waves is still not clear. Further investigations are expected.