

High resolution Large eddy simulation on Martian planetary boundary layer

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A large-eddy simulation (LES) on Martian planetary boundary layer has been performed to examine structure and characteristics of turbulence in the layer and their dependency on experimental resolution. SCALE-LES, which is an LES model for large domain and high resolution experiments developed in RIKEN AICS (<http://scale.aics.riken.jp/>), is used in this study. Spatial resolution is swept from 100m to 5m. Domain size is about 20km in horizontal and vertical. Horizontal boundary condition is double periodic condition. Heating rate calculated by an offline one-dimensional experiment (Odaka et al. 2001) is used instead of explicit calculation of the radiative transform process.

Well-known features of the boundary layer, such as hexagonal structure of convective cells and the -5/3 energy spectrum, are reasonably simulated. Dependency of several physical quantities at 14:00-15:00 local time, when the boundary layer is almost mature, on the resolution is analyzed. We found that vertical heat flux and variance of vertical velocity of resolved component show convergence or systematic tendency with the resolution. Convective vortices are developed and most of them are located near the upward reasion.

Keywords: Martian Planetary Boundary Layer