Investigation of inter-annual and seasonal variations of the Martian convective PBL by GCM simulations

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The Martian planetary boundary layer (PBL) is an important component of the Martian climate. It is the lowest portion of the atmosphere where the strong buoyant and shear forces influence the interaction between surface and atmosphere [1]. The Martian PBL exhibits extreme events compared to the Earth’s PBL, such as global dust storms, local dust devils, turbulent gusts and strong updraughts. Due to the thinner atmosphere of Mars and lower surface thermal inertia, the Martian planetary boundary layer shows stronger diurnal variations compared to its terrestrial counterpart. Moreover, as a result of the thinner atmosphere, radiative heat forcing is stronger, such that the Martian planetary boundary layer height can reach up to 10 km. Radiative forcing on Mars is affected by the atmospheric cycles, i.e. CO₂, water and dust cycles. In this study, we perform GCM simulations, using dust climatologies corresponding to the last 10 Mars years and present the inter-annual and seasonal variations in the planetary boundary layer height, mixed-layer potential temperature, convective velocity scale, friction velocity and Richardson number. To perform these GCM simulations, the Mars version of planetWRF (MarsWRF) model [2] is utilized, that solves the fully-compressible, non-hydrostatic Euler equations in a finite difference framework.
