



Winter polar warmings and the meridional transport on Mars simulated with a general circulation model

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Winter polar warmings in the middle atmosphere of Mars are the manifestation of the global meridional circulation. A recently developed general circulation model (GCM) of the Martian atmosphere was applied to examine the relative roles of the mechanical and thermal forcing on the meridional transport. The experiments were focused on answering the question of whether the Martian circulation is consistent with the thermally driven nearly inviscid Hadley cell, or it is forced mainly by zonally asymmetric eddies. It is demonstrated that, under realistic conditions in the middle atmosphere, the meridional transport is maintained primarily by dissipating large-scale planetary waves and solar tides. This mechanism is similar to the “extratropical pump” in the middle atmosphere on Earth. Only in the run with artificially low zonal disturbances, the circulation was reminiscent of thermally induced Hadley cells. The wave-mean flow interaction concept was applied to demonstrate the mechanism of the winter polar warmings enhancement during global dust storms in the atmosphere of Mars.