



Spurious sensitivity of a general circulation model to model lid height due to nonconservation of angular momentum

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We examine the sensitivity of the zonal-mean climate of the Canadian Middle Atmosphere Model to raising the model lid height from 10 to 0.001 hPa, with and without conservation of angular momentum. The two models are identical below 10 hPa. Here nonconservation is considered in terms of the neglect of parameterized gravity wave momentum flux at the model lid. When the model lid is placed at 10 hPa, and parameterized momentum flux is conserved, the zonal-mean climate below 10 hPa is very similar for the 10 hPa and 0.001 hPa model lids. However, when momentum is not conserved there are missing vertical mass fluxes at the top of the 10 hPa model because of missing torques and the zonal-mean climates below 10 hPa are very different. The impact of this sensitivity on the troposphere is found to be particularly large in winter at high latitudes. The sensitivity to model lid height is quantified via changes in the vertical component of the residual circulation due to both parameterized and resolved waves. Similar sensitivity is found when the climate is perturbed by a radiative forcing characteristic of that due to the ozone hole.