Abstract Submitted
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Direct Statistical Simulation of a Two-Layer Primitive Equation Model[1] WANMING QI, BRAD MARSTON, Brown University — Low-order statistics of the large-scale circulation of planetary atmospheres may be directly accessed by solving the equations of motion for the equal-time statistics. We implement such Direct Statistical Simulation of a two-layer primitive equation model by systematic expansion in the cumulants. The first cumulant is the zonally averaged vorticity, divergence, and temperature as a function of latitude and level, and the second cumulant contains information about nonlocal teleconnections. At second order (CE2) the expansion retains the eddy – mean-flow interaction but neglects eddy-eddy interactions and is realizable. Eddy-eddy interactions appear at third (CE3) order, but care must be taken to maintain realizability with a non-negative probability distribution function. The cumulant expansion is conservative, order-by-order, in the total angular momentum, total energy, and mean-squared potential temperature. First and second cumulants accumulated by time-integration of the two-layer primitive equations are compared with those obtained at the fixed points found at CE2 and CE3 levels of approximation. CE2 reproduces qualitative features of the zonal mean general circulation such as the mid-latitude jets. CE3 improves quantitative agreement in the teleconnections.

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