

Supplement for "LEX v1.4: A New Large-Eddy Simulation Model in JAX with GPU Acceleration and Automatic Differentiation"

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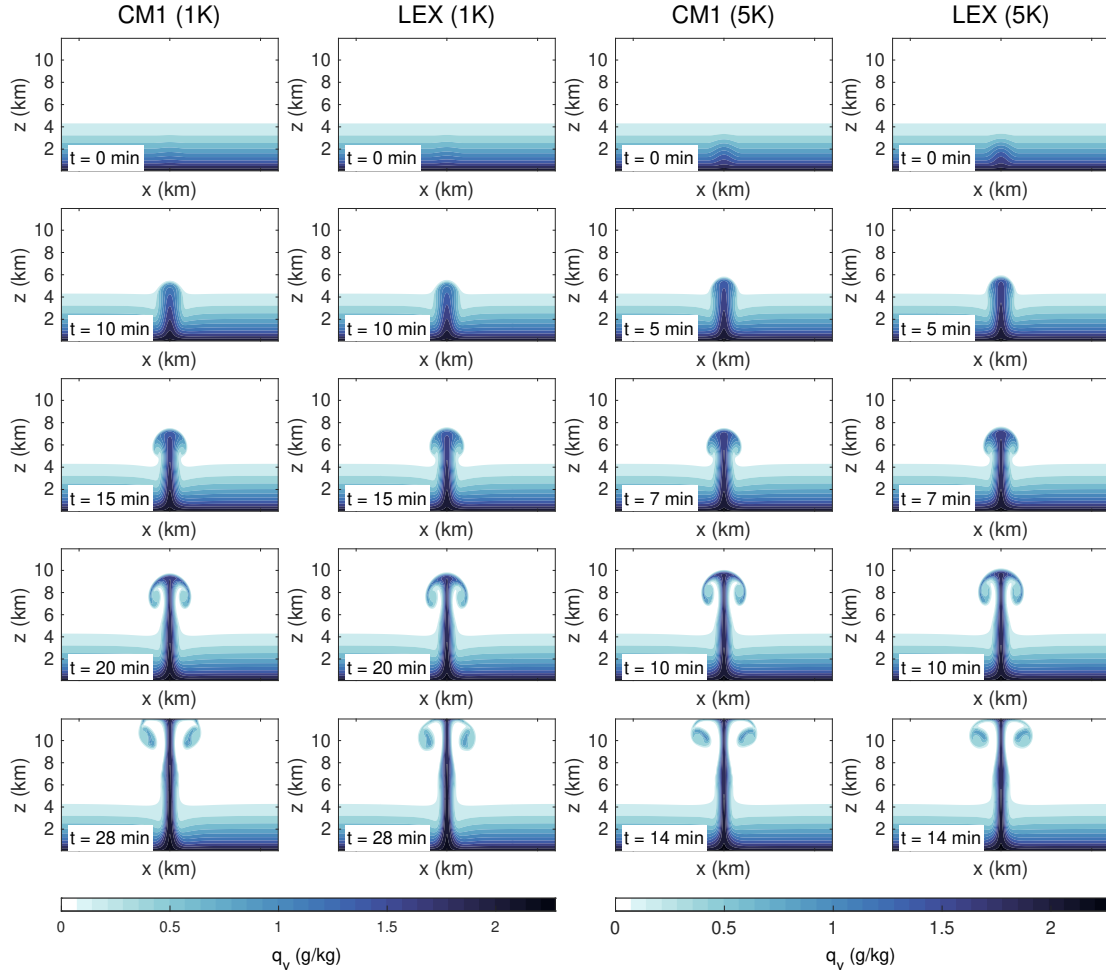


Figure S1. Snapshots of simulated mixing ratio of water vapour (q_v) in CM1 and LEX under different initial central potential temperature perturbations: 1 K at $t = 0, 10, 15, 20$, and 28 min (the first and second columns) and 5 K at $t = 0, 5, 7, 10$, and 14 min (the third and fourth columns).

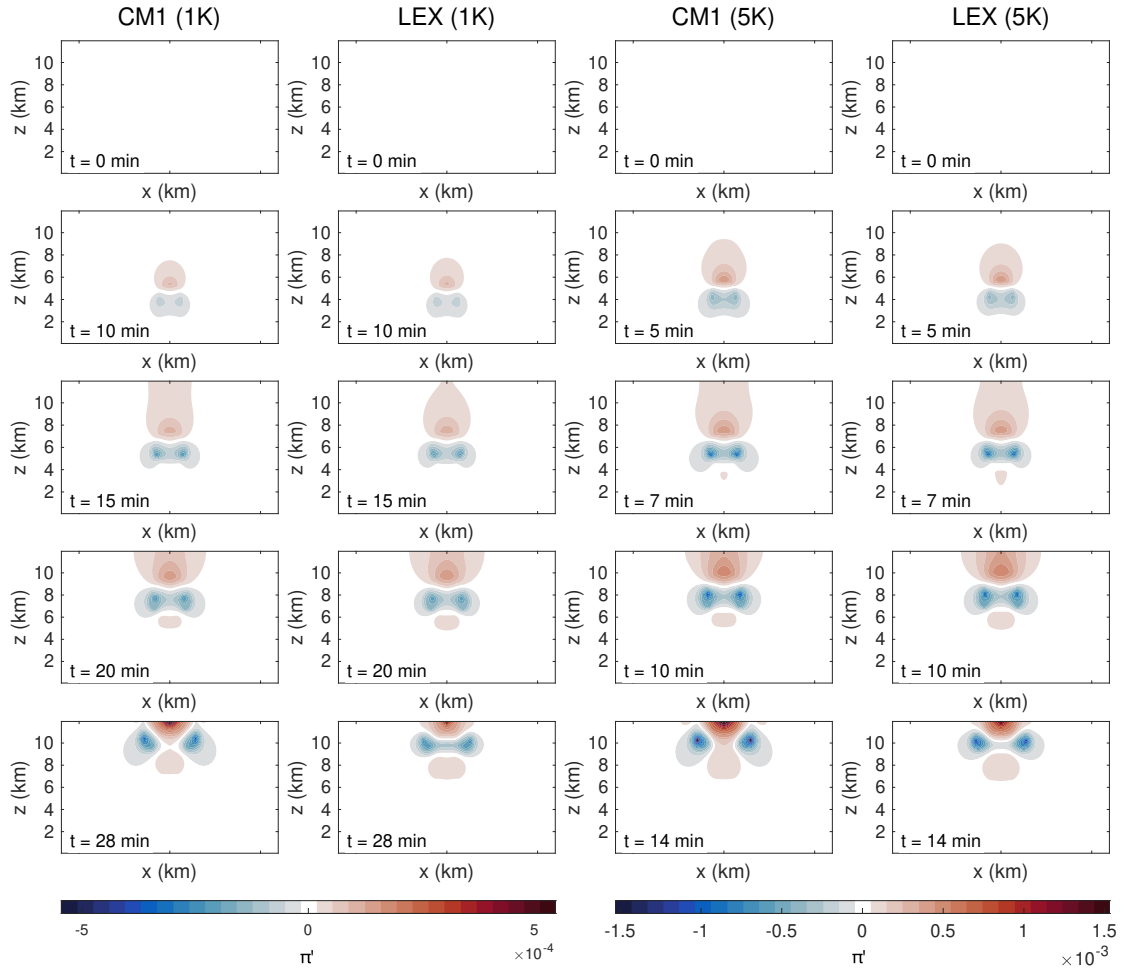


Figure S2. Snapshots of simulated pressure perturbations (π') in CM1 and LEX under different initial central potential temperature perturbations: 1 K at t = 0, 10, 15, 20, and 28 min (the first and second columns) and 5 K at t = 0, 5, 7, 10, and 14 min (the third and fourth columns).

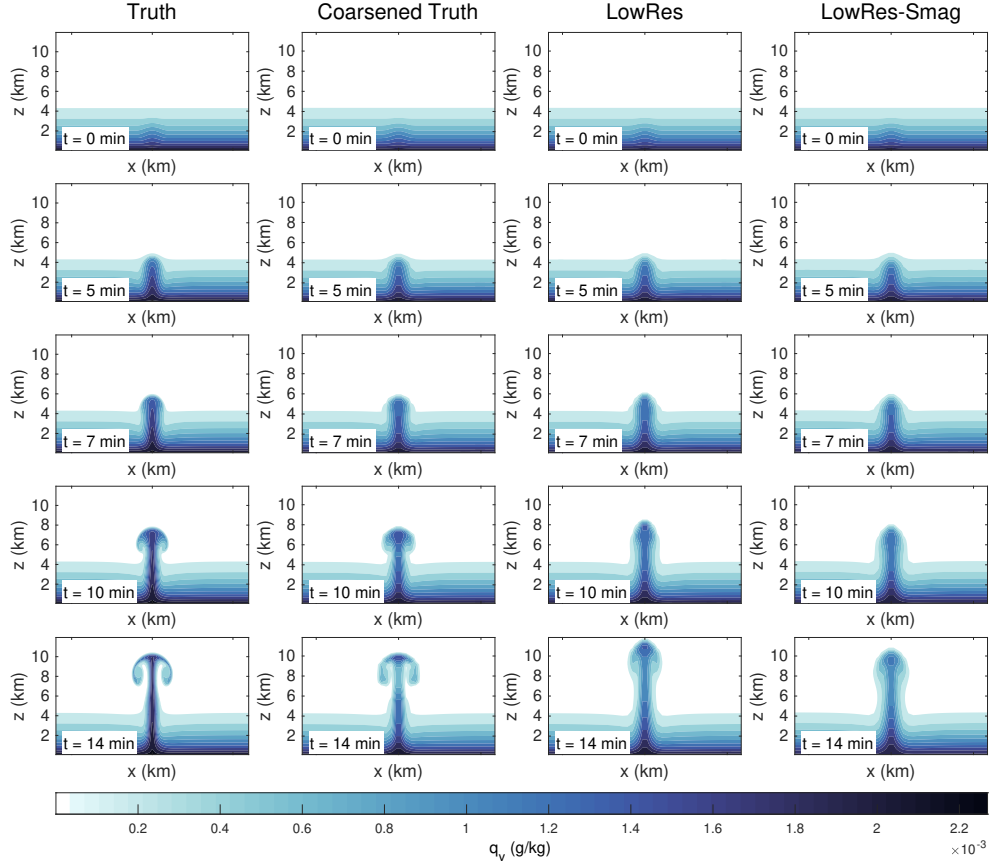


Figure S3. Snapshots of simulated water vapor mixing ratio (q_v) at $t = 0, 5, 7, 10$, and 14 min, with $\theta_c = 5K$, where the first column is the 'Truth' simulation with a high resolution of $100 \times 100 \times 100m$, the second column is coarsen-grained from the Truth simulation with a coarse resolution of $600 \times 600 \times 300m$, the third column is the numerical simulation results with the coarse grids, and the forth column is the LowRes simulation with the Smargorinsky scheme to deal with the SGS turbulence.

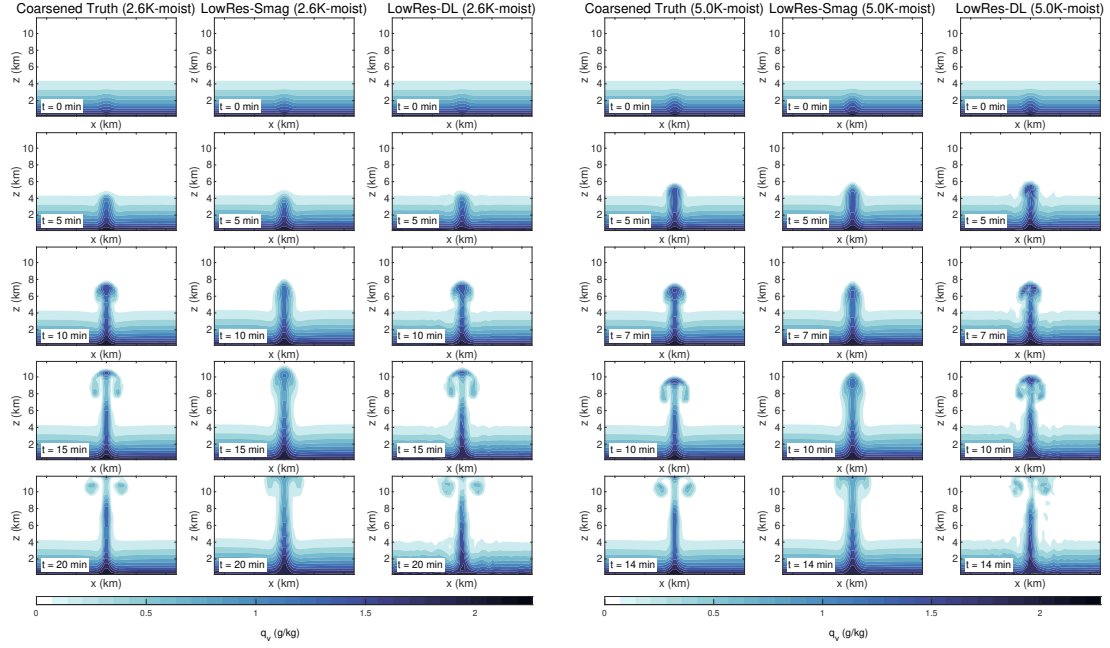


Figure S4. Snapshots of simulated water vapor mixing ratio (q_v) at $t = 0, 5, 10, 15$, and 20 min for moist cases, with $\theta_c = 2.6K$ (the first to the third columns), and $\theta_c = 5.0K$ (the fourth to the sixth columns), where the first and fourth columns are the ‘Coarsened Truth’ simulations with a coarse resolution of $600 \times 600 \times 300m$, the second and fifth columns are the ‘LowRes-Smag’ simulations with the Smagorinsky scheme to deal with the SGS turbulence, and the third and sixth columns are ‘LowRes-DL’ simulations with the trained CNN model to serve as the turbulence parameterization scheme.

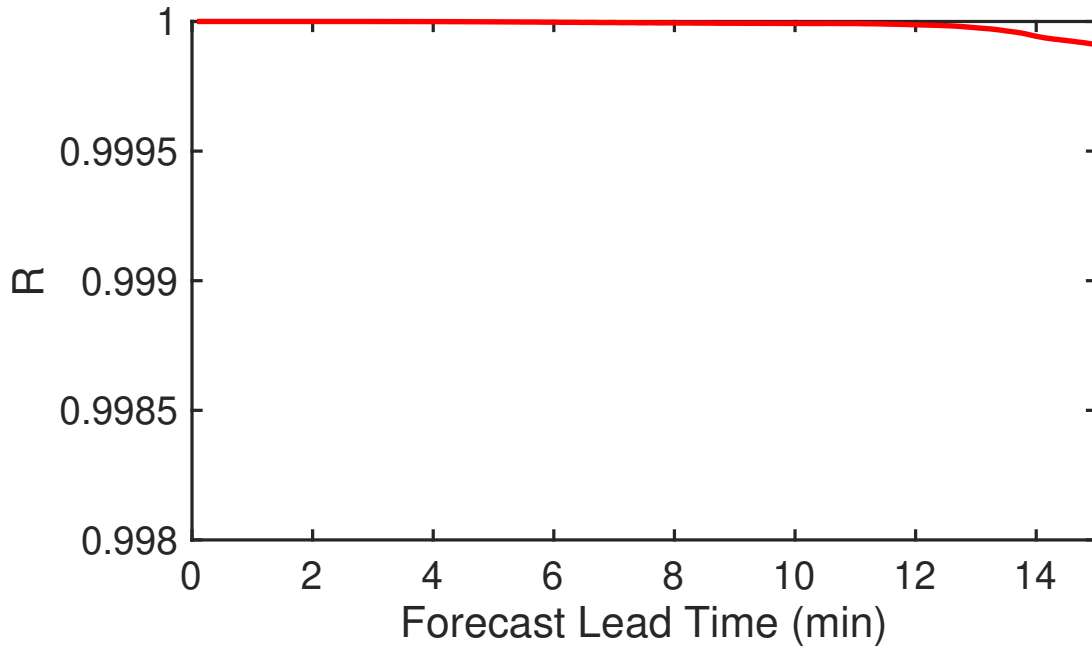


Figure S5. The correlation coefficient (R) between LEX-DL model with double precision of float64 and single precision of float32 with a moist case testing simulations and $\theta_c = 5.0K$.

Double Precision (5.0K-moist) Mixed Precision (5.0K-moist)

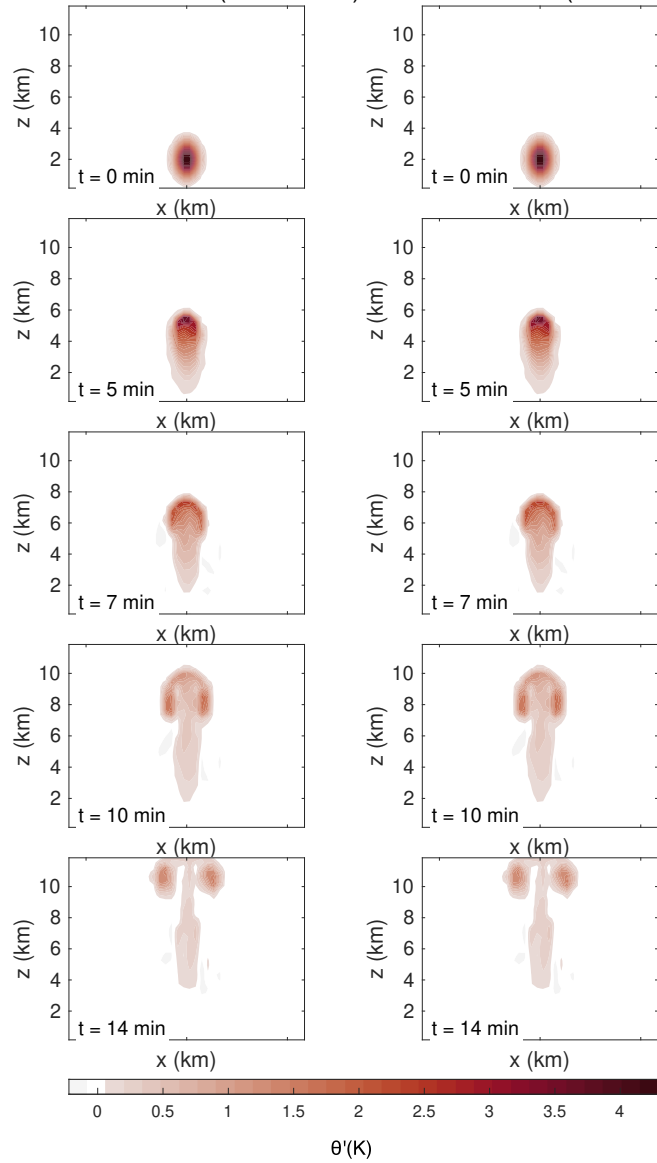


Figure S6. Snapshots of simulated potential temperature perturbation (θ') at $t = 0, 5, 7, 10,$ and 14 min, with $\theta_c = 5K$, where the first column is the simulation with a double precision, and the second column is the simulation with a mixed precision.