# Toward all-scale simulation of moist atmospheric flows with soundproof equations

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This research seeks to advance theoretical methodologies and their efficient implementations for very-high-resolution nonhydrostatic simulation of the Earth's atmosphere general circulation using soundproof equations. Numerical simulation of moist processes in nonhydrostatic general circulation models applying soundproof equations remains an uncharted territory. Using scale analysis, we demonstrate that the key issue for the soundproof system is to include pressure perturbations (especially larger-scale near-hydrostatic perturbations) in the representation of moist thermodynamics. By comparing numerical solutions from the EULAG model applying either fully compressible or soundproof equations for idealized dry and moist flows, we document that the pressure fields (either directly calculated in the compressible model or derived from the elliptic pressure solver in the soundproof model) agree well. This demonstrates that the soundproof pressure fluctuations accurately approximate the thermodynamic pressure fluctuations, and thus should be included in the mathematical representation of moist phase changes. The results illustrating this thesis will be presented at the workshop.