Abstract Submitted
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Reduced-Basis Determination of Planetary Boundary-Layer Flow Statistics for a Novel Turbulence Model[1] JOSEPH SKITKA, BRAD MARSTON, Brown University, Department of Physics, BAYLOR FOX-KEMPER, Brown University, Department of Earth, Environmental and Planetary Sciences — Uncertainty in climate modeling and weather forecasting can largely be attributed to the omission or inaccurate representation of oceanic and atmospheric subgrid processes. Existing subgrid turbulence models are built on assumptions of isotropy, homogeneity, and the locality of correlations. Direct statistical simulation (DSS) using expansion in equal-time cumulants is a novel approach to subgrid modeling that does not make these assumptions. In prior work, a second-order closure, CE2, was shown to capture important vertical turbulent transports in Langmuir turbulence and Rayleigh-Bénard convection, but to run efficiently, this approach to turbulence modeling requires a drastic reduction in dimensionality. The present work addresses how accurately these systems can be represented with a truncated principal orthogonal decomposition (POD). The representation of turbulent transports by truncated POD bases are studied by static projection of fully resolved statistics and dynamical evolution of a reduced model. Results indicate the projected truncated turbulent statistics in these flows are less sensitive to flow details, like mixed-layer depth, than the truncated basis itself. The question of whether POD is an optimal truncation technique for these purposes is considered.

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Joseph Skitka
Brown University

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