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Convective dynamics and chemical disequilibrium in the atmospheres of substellar objects BAYLEE BORDWELL, BENJAMIN P. BROWN, Laboratory for Atmospheric and Space Physics, University of Colorado Boulder, JEFFREY S. OISHI, Bates College — The thousands of substellar objects now known provide a unique opportunity to test our understanding of atmospheric dynamics across a range of environments. The chemical timescales of certain species transition from being much shorter than the dynamical timescales to being much longer than them at a point in the atmosphere known as the quench point. This transition leads to a state of dynamical disequilibrium, the effects of which can be used to probe the atmospheric dynamics of these objects. Unfortunately, due to computational constraints, models that inform the interpretation of these observations are run at dynamical parameters which are far from realistic values. In this study, we explore the behavior of a disequilibrium chemical process with increasingly realistic planetary conditions, to quantify the effects of the approximations used in current models. We simulate convection in 2-D, plane-parallel, polytropically-stratified atmospheres, into which we add reactive passive tracers that explore disequilibrium behavior. We find that as we increase the Rayleigh number, and thus achieve more realistic planetary conditions, the behavior of these tracers does not conform to the classical predictions of disequilibrium chemistry.

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