

# Supporting Information for "The Effect of Different Implementations of the Weak Temperature Gradient Approximation in Cloud Resolving Models"

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1. Figures S1

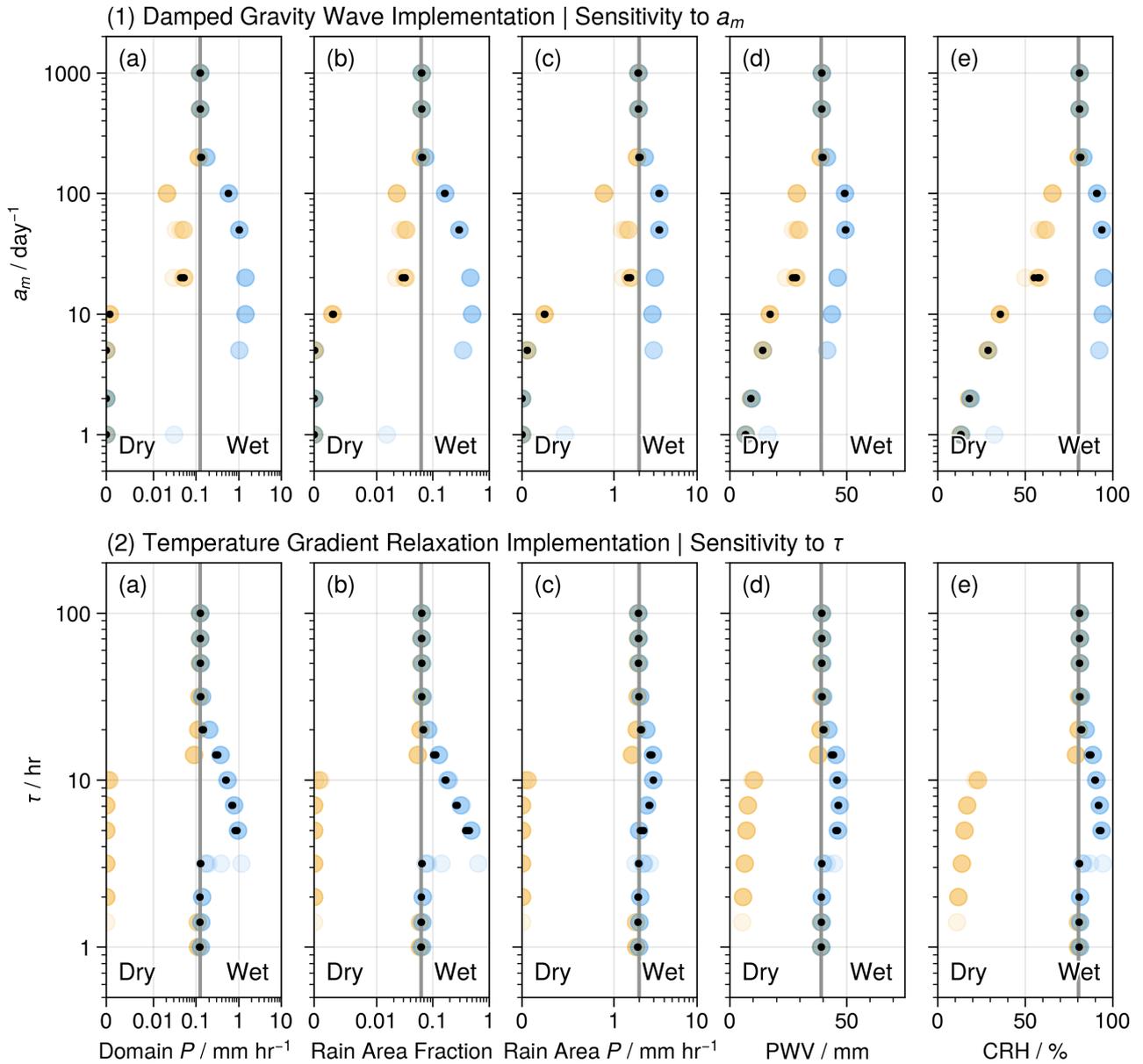
## Introduction

This supplementary contains an additional figure that shows our model setup qualitatively reproduces the multiple-equilibrium states found by Emanuel, Wing, and Vincent (2014).

## References

- Blossey, P. N., Bretherton, C. S., & Wyant, M. C. (2009, 3). Subtropical Low Cloud Response to a Warmer Climate in a Superparameterized Climate Model. Part II: Column Modeling with a Cloud Resolving Model. *Journal of Advances in Modeling Earth Systems*, 1(3), n/a-n/a. Retrieved from <http://doi.wiley.com/10.3894/JAMES.2009.1.8> doi: 10.3894/JAMES.2009.1.8
- Emanuel, K., Wing, A. A., & Vincent, E. M. (2014, 3). Radiative-convective instability. *Journal of Advances in Modeling Earth Systems*, 6(1), 75–90. Retrieved from <http://doi.wiley.com/10.1002/2013MS000270> doi: 10.1002/2013MS000270
- Kuang, Z. (2008, 2). Modeling the Interaction between Cumulus Convection and Linear Gravity Waves Using a Limited-Domain Cloud System-Resolving Model. *Journal of the Atmospheric Sciences*, 65(2), 576–591. Retrieved from <https://journals.ametsoc.org/doi/10.1175/2007JAS2399.1> doi: 10.1175/2007JAS2399.1
- Raymond, D. J., & Zeng, X. (2005, 4). Modelling tropical atmospheric convection in the context of the weak temperature gradient approximation. *Quarterly Journal of the Royal Meteorological Society*, 131(608), 1301–1320. Retrieved from <http://doi.wiley.com/10.1256/qj.03.97> doi: 10.1256/qj.03.97
- Sessions, S. L., Sugaya, S., Raymond, D. J., & Sobel, A. H. (2010, 6). Multiple equilibria in a cloud-resolving model using the weak temperature gradient approximation. *Journal of Geophysical Research*, 115(D12), D12110. Retrieved from <http://doi.wiley.com/10.1029/2009JD013376> doi: 10.1029/2009JD013376

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**Figure S1.** We plot (a) domain-mean precipitation, (b) rain area fraction, (c) rain area precipitation rate, (d) domain-mean precipitable water vapour and (e) domain-mean column relative humidity that result when the DGW (Kuang, 2008; Blossey et al., 2009) and TGR (Raymond & Zeng, 2005; Sessions et al., 2010) schemes are implemented with different strengths to three different 5-member small-domain model ensembles when **interactive radiative and surface flux** schemes are used. Black dots denote the model ensemble using the default reference profile, yellow dots represent the ensemble results from a reference profile perturbed by +0.05 K at all levels, and blue dots indicate ensemble results from a reference profile perturbed by -0.05 K at all levels.

These results are qualitatively similar to those of Emanuel et al. (2014).