

# Testing Cumulus Parameterizations Using Process Study Results and Cumulus Ensemble Models

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Process studies such as EPIC2001 and new computational methods provide insight into the factors controlling atmospheric convection over tropical oceans. Together, these lead to objective means to test cumulus parameterizations outside the context of a full global circulation model.

EPIC2001 showed in particular that deep convection is controlled much more by convective inhibition (CIN) than by convective available potential energy. The CIN is a function of the planetary boundary layer (PBL) moist entropy and of the saturated moist entropy (or potential temperature) of air just above the PBL. The PBL moist entropy budget is controlled by a balance between several factors, but most strongly by surface total heat flux and by the ingestion into the PBL of low moist entropy air via convective downdrafts. Other observations, particularly those of Larissa Back and Chris Bretherton (personal communication), show that in addition the humidity of the free troposphere plays a strong role in the control of deep convection.

On the modeling side, use of the weak temperature gradient approximation (WTG) of Sobel and Bretherton in conjunction with a cumulus ensemble model provides a way to test the interaction between convection and controlling influences in a causally correct fashion. Early results from this technique are largely in agreement with the above observations. Cumulus parameterizations can be tested by exercising them in a context similar to that imposed on the numerical convective model, thus allowing direct comparison between the two in a realistic context.