Rethinking Convective Quasi-Equilibrium
Speaker: David Neelin (UCLA)
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Abstract

Convective quasi-equilibrium (QE) has for several decades stood as a key postulate for parameterization of the impacts of moist convection at small scales upon the large-scale flow.
Observational results aimed at helping to constrain convection schemes suggest some important features, like a coherent free tropospheric temperature, work as a leading approximation, while other aspects are in need of revision. The properties of precipitation as a function of water vapor and temperature conform to those of critical phenomena associated with a continuous phase transition. This is used to infer empirically the temperature-moisture dependence of the critical point at which precipitation increases rapidly. While the system's attraction to the critical point is predicted by QE, several fundamental properties of the transition, including high precipitation variance in the critical region, need to be added to the theory. Long-range correlations imply that this variance does not reduce quickly under spatial averaging; scaling associated with this spatial averaging has potential implications for superparameterization. Long tails of the distribution of water vapor create relatively frequent excursions above criticality with associated strong precipitation events.