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Assessing the validity of simple models for tropical cyclones in high resolution simulations

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Existing theoretical models for tropical cyclones have been instrumental in understanding the mechanisms under which their intensification occurs. The potential intensity (PI) which was first introduced by Emanuel 1986, provides an upper bound for the intensity a tropical cyclone can achieve based on the environmental conditions. However, this model and others naturally assume idealized settings which do not necessarily occur in the real world. Using simulations from the high resolution cloud resolving model SAM in rotating radiative-convective equilibrium settings, we assess the validity of these idealizations in the simulations. We find that some idealizations, such as assuming convection on a moist adiabat in the eyewall, are only partially valid. In order to understand why these deviations from the theory occur, we look at different possible mechanisms missing in simple models, such as upper level processes and entrainment.