A machine learning assisted stochastic cloud population model as a parameterization of cumulus convection

Samson Hagos1, Jingyi Chen1, Katelyn Barber1, Koichi Sakaguchi1, Zhe Feng1, Heng Xiao1, Bob Plant2

A machine learning assisted cloud population model is coupled with the Advanced Research Weather Research and Forecasting (WRF) to represent fluctuations in cloud base mass flux associated with the life cycles of cumulus convection cells. In this model, the size distribution and associated cloud base mass flux of the convective cells are related to their previous state and the change in the convective area via a transition function. The convective area tendency in turn is assumed to depend on cloud base mass flux resolved by the host model (WRF). The transition function is represented by neural network trained by a 1 km grid spacing WRF simulation. The cloud population model continuously predicts the cell size and cloud base mass flux distributions which are then fed to an entraining plume model. It is shown that such approach to parameterization can lead to realistic precipitation statistics and diurnal cycle over various regions as well as MJO related propagation of precipitation.