On the use of Emulators, built from Ensembles of Large Eddy Simulations, to study Clouds and Aerosol-Cloud Interactions

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In this presentation we will discuss efforts to train emulators to mimic the the behavior of stratocumulus cloud systems. We specifically employ Gaussian-process regression, an established machine-learning technique. Our emulators are built using an ensemble dataset of hundreds of simulations of aerosol-cloud interactions (Glassmeier et al. 2019). First we will show that emulators successfully reproduce key cloud field properties such as cloud fraction, cloud albedo, and cloud radiative effect. Second we will show how valuable emulation is for interpreting physical processes, and how it connects to our broad knowledge-base acquired through LES case studies, mixed layer models, and single column models. Third, we will discuss how emulators might be used to enhance our understanding of cloud systems observed at supersites in naturally covarying conditions.