A novel Python based large eddy simulation capability designed to generate training data for machine learning of microphysical process rates.

Kyle Pressel, Colleen Kaul, Jacob Sphund, Jiwen Fan, Mikhail Ovchinnikov, and Po-Lun Ma

A goal of the EAGLES project is to develop better representations of cloud water autoconversion as part of the project’s larger objective of providing improved parameterization of aerosol cloud interaction (ACI). Historically, models have relied on simple curve fits relating cloud water mass and droplet number concentration to autoconverion rate, based on limited numbers of numerical simulations of clouds with explicit representation of cloud microphysical process. One approach that EAGLES has adopted towards improving such process representations is to replace simple curve fits with machine learning approaches, such as deep neural networks (DNNs), that have been trained on data from observationally verified large eddy simulations (LES) for diverse warm cloud types. To enable the generation of diverse LES datasets, EAGLES has developed a new Python based large eddy simulation capability, called PINACLES (**P**redicting **IN**teractions of **A**erosol and **C**louds in **L**arge **E**ddy **S**imulation) that offers dramatically improved throughput over other models like WRF, enhanced extensibility to allow generation of the custom datasets required for ML, and broader capabilities for observational verification.