Parametric sensitivity in ACME-V1 atmosphere model revealed by short Perturbed Parameters Ensemble (PPE) simulations

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Motivation

In one-at-a-time model tuning we often encounter
(1) the tuning of one parameter leads to an offset of the accomplishment from the tuning of another parameter;
(2) the improvement in one target variable leads to degradation of model fidelity in another target variable.

Approach

- 18 perturbed parameters.
- 256 sampling points from the parameter space.
- Latin Hypercube sampling method.
- 12 ensemble members corresponding to 12 months for each sampling point.
- 3-day long simulation and day-3 results analyzed.
- Finished 256x12 ensemble simulations at a rather modest cost and within 5 days of wall clock time.

Impact

- Identified the most influential parameters and quantified the model response to these parameters for a number of important fidelity metrics.
- Provided a more complete picture of the ACME-V1 model behavior and information on the tuning potential of different parameters, thus can help guide the tuning activities.