

# Modeling Workflow for the DOE Atmospheric Radiation Measurement Facility's LES ARM Symbiotic Simulation and Observation (LASSO) Workflow



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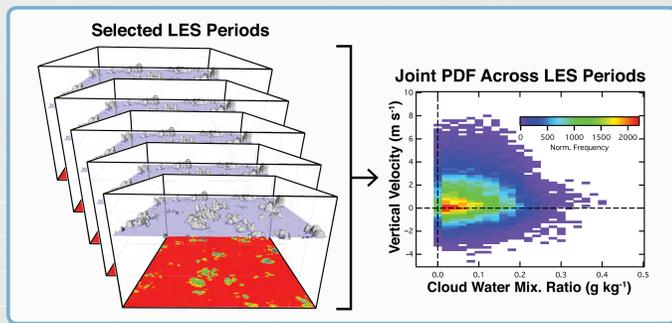
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## What is LASSO?

Over the next two years the DOE Atmospheric Radiation Measurement (ARM) Facility will develop the capability to do ongoing, routine large-eddy simulations (LESs) to compliment ARM's extensive climate-focused observations. This new capability is called the *LES ARM Symbiotic Simulation and Observing (LASSO) workflow*.

- Simulations will initially target shallow convection at the ARM Southern Great Plains megasite in Oklahoma.
- Once LASSO goes online in 2017, ARM will investigate options to expand the LES modeling to include additional cloud types and multiple locations, such as the ARM North Slope of Alaska and East North Atlantic (Azores) sites.
- LASSO is designed to generate an ever expanding library of LES simulations that will add value to ARM's observations. The goal is to expand beyond the typical case-specific mentality used in much of LES modeling.

## How can you use LASSO?



## Process Understanding and Parameterization Development

The library of simulations will enable statistical comparisons of fully consistent fields from the model, including details that cannot be easily measured, e.g., profiles of fluxes. Combining this with ARM's observations will be valuable to understand boundary layer and cloud processes, and it will allow robust testing of climate model parameterizations over many different cases.

The forcing datasets and workflow software will permit users to reproduce the simulations, as well as simulate alternate scenarios, or use their own model to compare with the ARM observations.

## Retrieval Development

Developing retrievals for remote sensing instruments often requires making assumptions whose impacts are not well known a priori. The LASSO library of simulations will permit retrieval developers to test their algorithms using the 3-D LES output as a proxy for reality. Then, they can apply the same algorithm to observations and compare the results to identify potential biases or other issues.

## LASSO Workflow Features

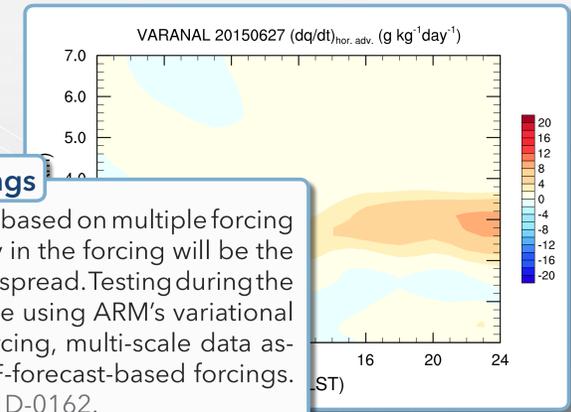


### 1 Enhanced observations

ARM is enhancing 5 boundary facilities to provide remotely sensed profiles of boundary layer temperature and humidity to better constrain the large-scale forcing. Other inputs include surface fluxes, radiosondes, radar-based winds, satellite radiances, and routine surface observations.

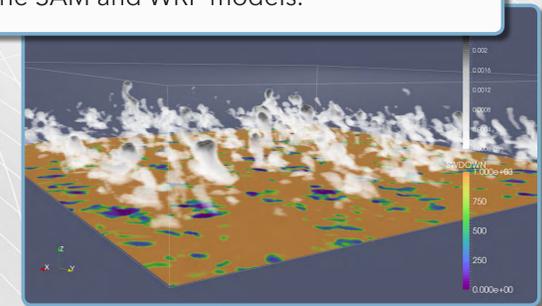
### 2 Ensemble of forcings

Ensembles will be used based on multiple forcing datasets, as uncertainty in the forcing will be the biggest driver of model spread. Testing during the pilot phase will examine using ARM's variational analysis continuous forcing, multi-scale data assimilation, and ECMWF-forecast-based forcings. See Li et al., poster A21D-0162.



### 3 Ensemble of LES simulations

Each simulated day will consist of an ensemble of LES simulations using 2-moment bulk microphysics plus one deterministic simulation using spectral bin microphysics. Testing during the pilot period will examine the SAM and WRF models.

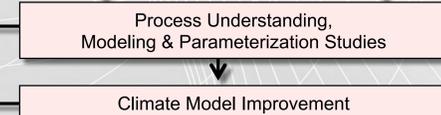
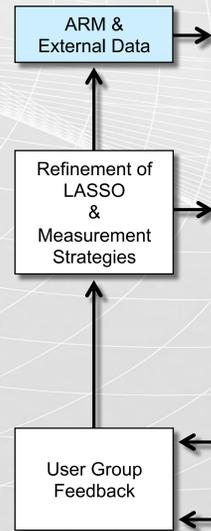
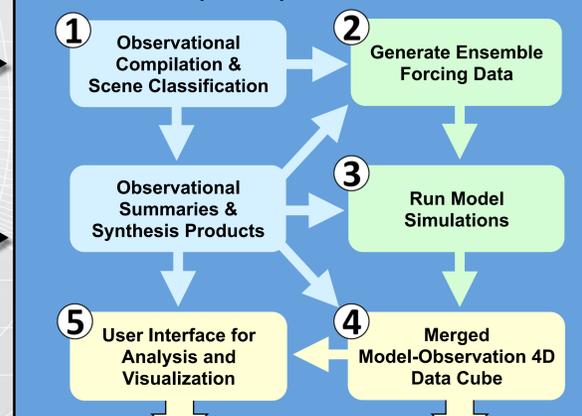


### 5 Analysis tools

Tools will be developed to simplify analysis and visualization. The goal is to have quicklooks and efficient filtering methods via a web interface plus a scripted interface for efficiently interacting with the data from remote locations.



## LES ARM Symbiotic Simulation and Observation (LASSO) Workflow



## LASSO geared toward improving climate models

The overall LASSO goal is to add value to ARM's observations and improve their usefulness for climate and Earth system modelers.

LES modeling will form a bridge between ARM's point measurements and climate model grid scales, which will facilitate improved process understanding, parameterization development, and model evaluation.

We want your feedback! Let us know how we can make LASSO valuable for your research. Contact [William.Gustafson@pnnl.gov](mailto:William.Gustafson@pnnl.gov).

### 4 Data cube for users

Model output and observations will be merged and presented to users via a "data cube." Key metrics and diagnostics will be pre-computed and methods to intercompare simulations and observations will be developed. See Vogelmann et al., poster A21D-0163.



To be included in LASSO project e-mail updates, sign up for the LASSO Information e-mail list at <http://eepurl.com/bCS8s5>