LASSO: Tying LES Modeling and ARM Data Together for Atmospheric Science

A key to creating the next-generation Atmospheric Radiation Measurement (ARM) Climate Research Facility is a pilot project tying together observational data and large-eddy simulation (LES) modeling to support the study of atmospheric processes, improvement of observational retrievals, and parameterizations of clouds, aerosols, and radiation in earth system models. This two-year pilot project, initially focused on continental shallow convection, has released two initial evaluation products and goes operational in 2018.

Since data collection began in 1992, ARM has been a key component of the U.S. Department of Energy’s (DOE) efforts to better understand and predict earth system processes in order to develop sustainable solutions to the nation’s energy and environmental challenges. The ARM Facility is a world leader in providing unprecedented continuous observations of cloud and aerosol properties and their impacts on Earth’s energy balance—data that have proved invaluable for understanding the atmosphere and improving the predictive capabilities of earth system models.

ARM is adding new capabilities to further its mission and provide even more complete data sets for next generation scientists. This pilot project, called LASSO—the LES ARM Symbiotic Simulation and Observation workflow—is one of those new capabilities.

LASSO is an integral part of achieving the goals in ARM’s Decadal Vision to:

- Establish observation-modeling “megasites,” starting with ARM’s Southern Great Plains (SGP) atmospheric observatory in Oklahoma and Kansas
- Enhance ARM measurement excellence to support DOE atmospheric science research
- Produce routine high-resolution model simulations over domains coincident with ARM sites
- Develop data products and software tools that facilitate the use of ARM data
- Strengthen interactions with the atmospheric science and modeling communities.

New Routine Modeling

LASSO enhances ARM observations by using LES modeling to provide context and a self-consistent representation of the atmosphere surrounding the SGP that will connect processes and facilitate improved understanding. The project has already resulted in a library of simulations that can be used to test the accuracy of atmospheric representations and serve as a proxy of the atmosphere to develop remote retrievals.
LASSO Alpha Product Releases

The LASSO pilot project has laid the groundwork to produce routine LES modeling at the SGP observatory, beginning in 2018. The pilot project released two Alpha data products that include data bundles, which combine ARM observations and high-resolution model output, and the Bundle Browser, which is a new web interface to access the data bundles. These releases are a step toward the final version that will become the routinely generated datastream. Initially targeting shallow clouds, the implementation will later expand to other phenomena and ARM locations.

The pilot project released Alpha data products for the 2015 and 2016 summer seasons prior to going into operations for 2017. These new products will evolve and be carried forward as the focus of ARM’s routine high-resolution modeling capability. Combining simulations with detailed observations, the ARM Facility is providing powerful new research capabilities for atmospheric researchers and modelers.

Community Input on LASSO Implementation and Expansion

The LASSO modeling approach is partially inspired by the Koninklijk Nederlands Meteorologisch Instituut (KNMI) Parametrization Testbed over the Cabauw site in the Netherlands. ARM tailored the current LES-observation coupling approach used for LASSO to best address shallow convection at SGP. To ensure that this DOE project meets researcher and modeler needs, community input is sought regarding its value and potential enhancements that would make LASSO more valuable to researchers.

Input is also being sought for LASSO expansion scenarios for implementing routine modeling at locations beyond SGP and for additional cloud regimes. Suggestions and feedback can be sent to lasso@arm.gov.

Additional Information

- LASSO Alpha Releases
  www.arm.gov/science/themes/lasso/releases
- ARM Decadal Vision
- LASSO Bundle Browser
  www.archive.arm.gov/lassobrowser
- LASSO Pilot Recommendation Report
  www.arm.gov/publications/programdocs/doe-sc-arm-17-031.pdf

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To be included in LASSO project email updates, sign up for the LASSO information email list at http://eepurl.com/bCS8s5

LASSO’s Bundle Browser offers scientists a new way to search for the data most relevant to their work.

The ARM Research Facility is funded through the U.S. Department of Energy’s Office of Science. Additional information is available on the ARM website at www.arm.gov.