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

A key project in the next-generation Atmospheric Radiation Measurement (ARM) user facility is 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 project, initially focused on continental shallow convection, has already completed four seasons of shallow convection simulations at ARM’s Southern Great Plains atmospheric observatory.

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. ARM 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 project, called LASSO—the LES ARM Symbiotic Simulation and Observation workflow—is one of those capabilities.

LASSO is an integral part of achieving ARM’s goals to:

• Establish enhanced observation-modeling sites, starting with ARM’s Southern Great Plains (SGP) atmospheric observatory in Oklahoma and Kansas
• Increase 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.

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 resulted in an ever-growing 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-sensing retrievals.
LASSO Product Releases

LASSO is being used to produce routine high-resolution simulations at the SGP observatory. Four seasons of data bundles from 2015 to 2018 of shallow convection have been released as of late 2019, amounting to 78 case days.

The LASSO data product consists of data bundles, which combine ARM observations and high-resolution model output, and the Bundle Browser, which is a web interface to access the data bundles. These data bundles are generated for each day with shallow convection at the SGP.

Expanding LASSO to Deep Convection

With the shallow convection scenario fully established, work has begun to expand LASSO to simulate deep convection. Over the next year, ARM will focus on LES and associated data bundles for cases from the recent Cloud, Aerosol, and Complex Terrain Interactions (CACTI) field campaign in Argentina. This will broaden the library of available simulations to a new meteorological regime and draw particular focus to ARM’s radar-based capabilities.

Community Input on LASSO

To ensure that this DOE project meets researcher and modeler needs, community input is sought regarding LASSO’s value and potential enhancements that would make it more valuable to researchers.

Feedback regarding data needs and model configurations for the new CACTI simulations is of particular interest. Suggestions and feedback can be sent to lasso@arm.gov.

More information about additional expansion possibilities is available in the LASSO Expansion Workshop report. Following the implementation of the CACTI simulations, it is expected the LASSO team will take on the other regimes discussed in the workshop report. ARM and the LASSO team will continue to engage with the community to enable the implementation of these cases, and potentially, other meteorological regimes.

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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

The CACTI field campaign in the Sierras de Córdoba mountain range of north-central Argentina began in October 2018 and ended in April 2019. This region experiences some of the world’s tallest thunderstorms and largest hail.

Additional Information

- LASSO Releases
  www.arm.gov/capabilities/modeling/lasso/releases
- LASSO Bundle Browser
  adc.arm.gov/lassobrowser
- LASSO Expansion Workshop Report
- ARM LASSO News
  bit.ly/ARMLASSO
- ARM Decadal Vision