



Routine Large-Eddy Simulations of Continental Shallow Convection: Simulation Workflow Development and Megasite Observations

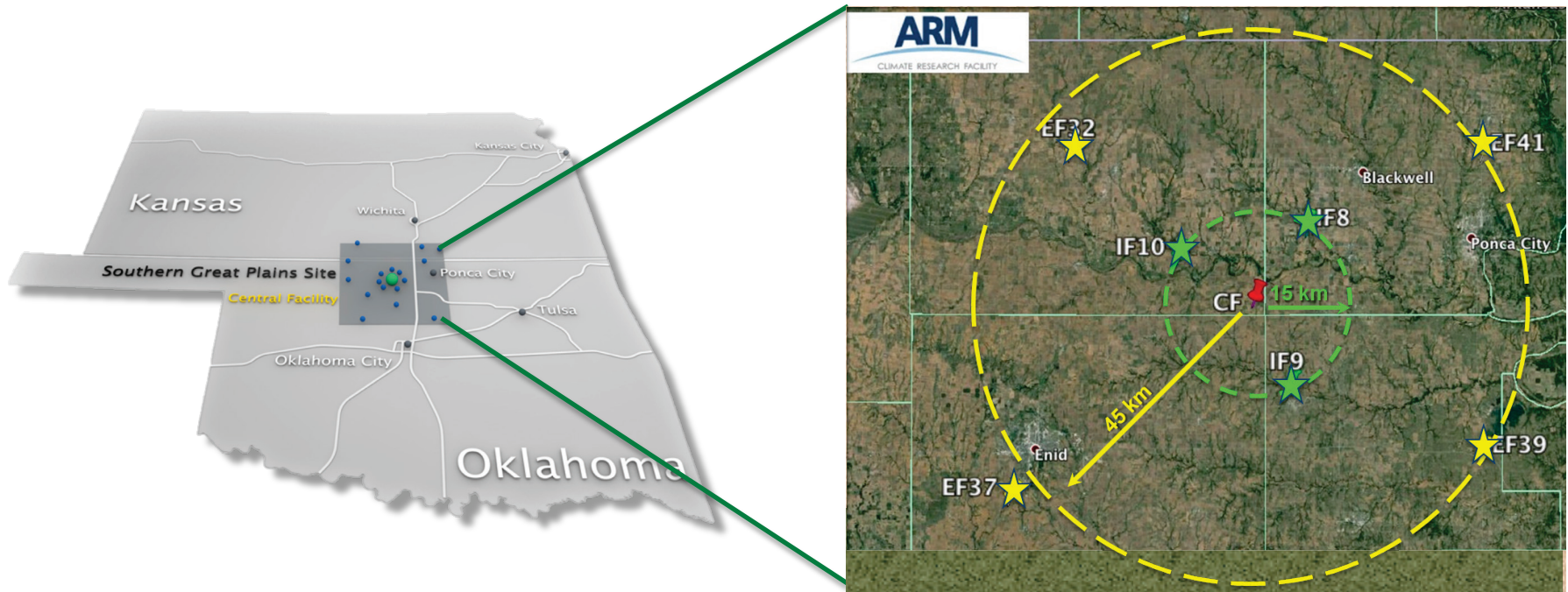
Andrew M. Vogelmann (Co-PI)¹, William I. Gustafson Jr. (PI)², Zhijin Li^{3,4},
Xiaoping Cheng⁵, Satoshi Endo¹, Bhargavi Krishna⁶, Tami Toto¹, Heng Xiao²

¹BNL, ²PNNL, ³UCLA, ⁴JPL, ⁵Nanjing University, ⁶ORNL

Summary

The LES ARM Symbiotic Simulation and Observation (LASSO) Workflow is designed to complement the ARM megasite observations with LES output to support community study of atmospheric processes & improved model parameterizations.

DOE Atmospheric Radiation Measurement (ARM) Facility's Southern Great Plains (SGP) Megasite



- CF: Extensive meteorology, cloud, radiation, aerosol, & surface flux obs
- 15 km: Includes Radar Wind Profilers
- 45 km: Includes Doppler Lidar, Surface fluxes, IR Spectrometer, MWR

LASSO Objectives

- Help bridge the scale gap between DOE ARM observations and models
- Use routine LES to add value to observations
 - Provide a dynamical context for the observations
 - Provide *unobservable* processes & properties
 - Self-consistent representation of the atmosphere
- Generate a simulation library for researchers
 - Enable *statistical* approaches beyond single-cases
 - Provide information needed by modelers to reproduce the LES

What LASSO could do for YOU

■ Observationalists

- Aid development of instrument remote sensing retrievals
- Test implications of instrument scan strategies or flight paths

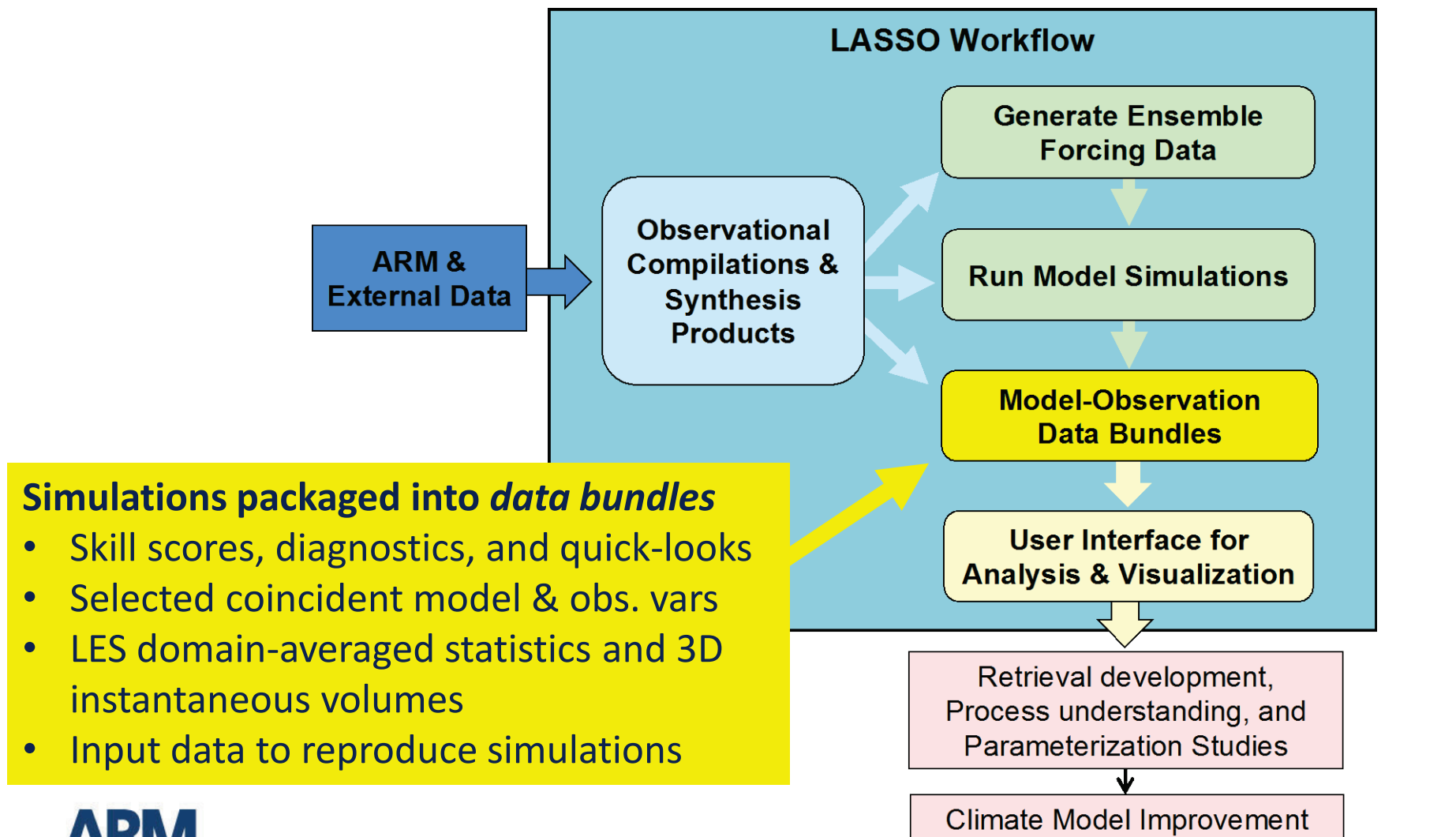
■ Theoreticians

- Get estimates of fluxes & co-variability of values
- Test relationships without having to run the model

■ Modelers

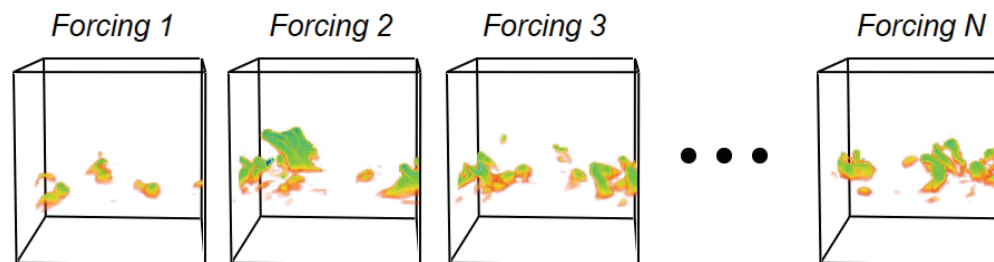
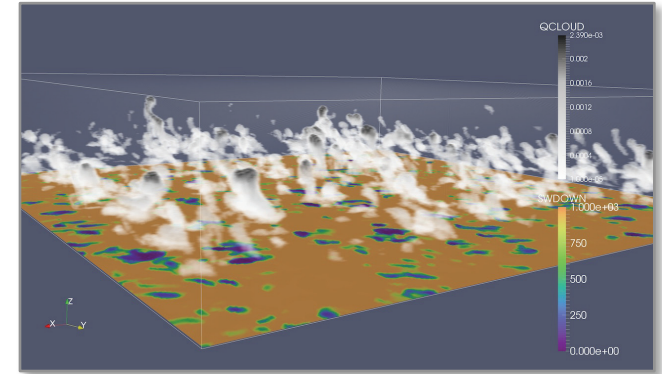
- Know which days have good forcing (atmospheric specifications)
- Have co-registered observations at high-resolution scales
- Have the inputs and outputs to test parameterizations

LASSO Workflow to Support Research



Model Configuration & Approach

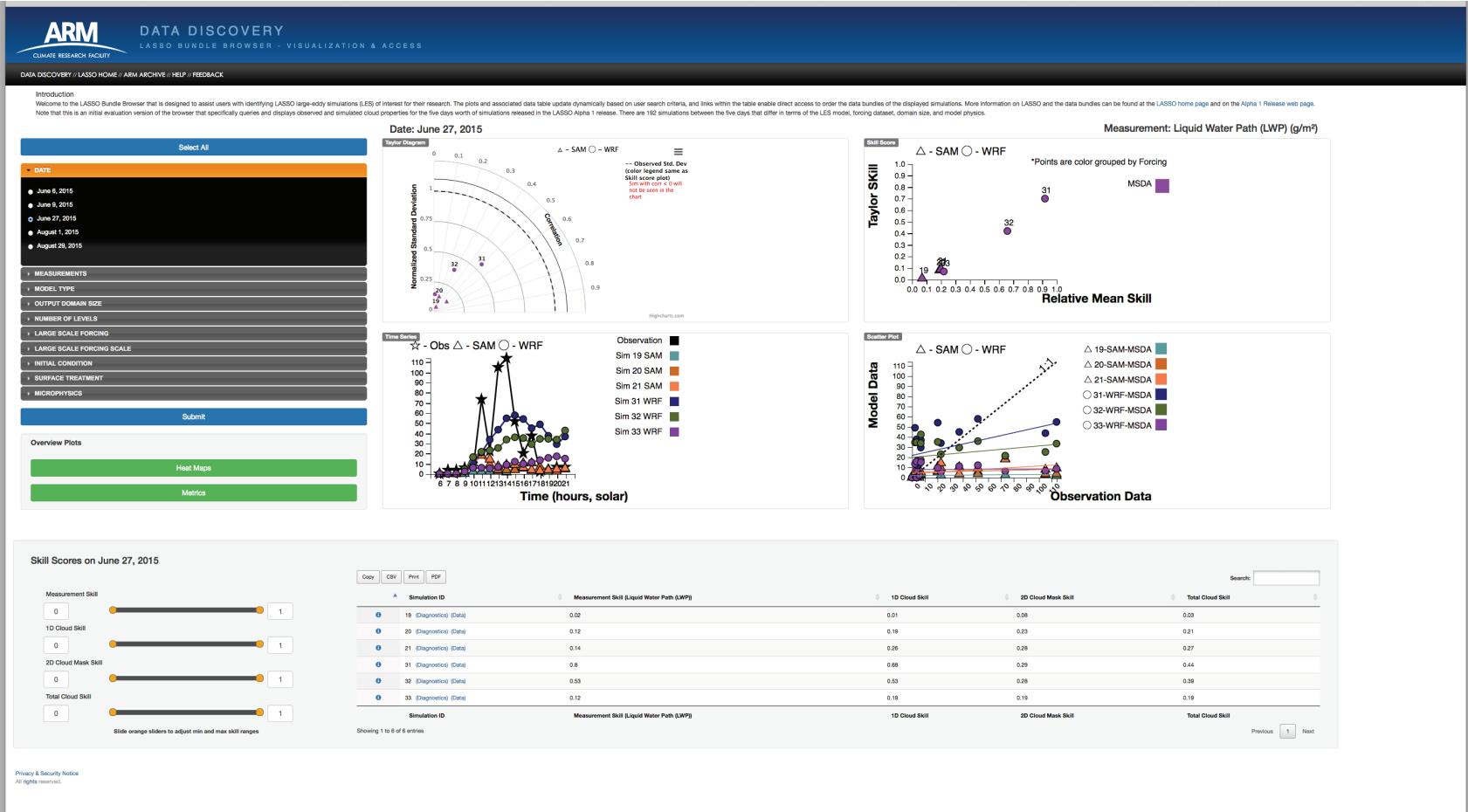
- Evaluating SAM & WRF
- Configuration:
 - Doubly-periodic domains
 - $\Delta x=100$ m, $\Delta z=30+$ m to tropopause
 - Environmental specifications
 - 12Z radiosonde, Surface fluxes from ARM Observations, Large-scale tendencies
- Models run in a hindcast mode using ensemble forcings
 - Forcing uncertainty determines model results to 0th order
 - Routine LES cannot afford to tune forcings as done for case studies
 - The ensemble aims to bound the realizations w/ metrics to evaluate



Ensemble Forcings from 3 Sources

1. ARM constrained variational analysis (300 km scale)
2. ECMWF-analysis-based forcing (75, 150, 300 km)
3. Multi-scale data assimilation (MS-DA) (75, 150, 300 km)
 - WRF-based using Gridpoint Statistical Interpolation (GSI) system
 - Scale separation to combine observations at coarse & fine scales
 - Initially using GSI w/ 3D-Var DA and will test hybrid EnKF DA
 - Can directly incorporate ARM observations
 - ❑ Hybrid Raman Lidar+AERI-retrieved T profiles
 - ❑ Raman Lidar Qv profiles
 - ❑ RWP wind profiles
 - ❑ Surface meteorology network

LASSO Bundle Browser



<http://archive.arm.gov/lassobrowser>

LASSO Data Releases & Contact Information

■ Data Releases

- Alpha 1: 192 simulations from 5 ShCu days in 2015
- Alpha 2: To be released in July (13 ShCu cases from 2016)
- Summer 2017: Soft transition of LASSO to operations

■ Contact information

- **Leads:** Andrew Vogelmann: vogelmann@bnl.gov
Bill Gustafson: William.Gustafson@pnnl.gov
- **LASSO Webpage:** <https://www.arm.gov/capabilities/modeling/lasso>
- **LASSO e-mail list sign up:** <http://eepurl.com/bCS8s5>