Large-Eddy Simulation for the Masses: LASSO's Going into Production

William I. Gustafson Jr.[1], Andrew M. Vogelmann[2], Zhijin Li[3,4],
Xiaoping Cheng[5], Satoshi Endo[2], Jinwon Kim[3], Bhargavi Krishna[6], Tami Toto[2], Heng Xiao[1]

[1]PNNL, [2]BNL, [3]UCLA, [4]JPL, [5]Nanjing University, [6]ORNL
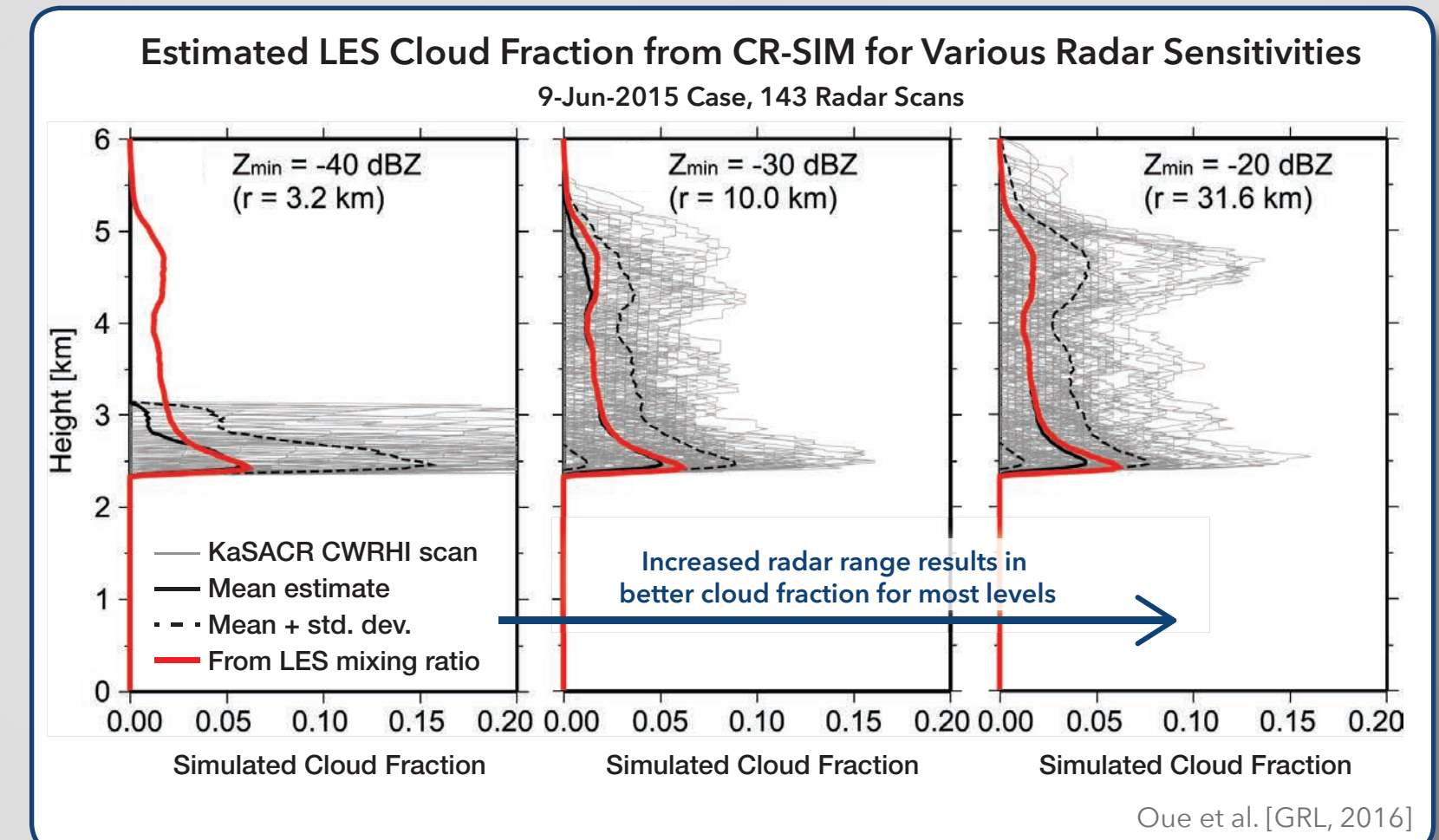
ARM CLIMATE RESEARCH FACILITY

What is LASSO?

The Large-Eddy Simulation (LES) ARM Symbiotic Simulation and Observation (LASSO) Pilot Project develops the capability to generate routine LES simulations of shallow convection over the SGP region. Ongoing LES simulations will be coupled with ARM observations to form a library of data bundles to quicken scientific discovery.
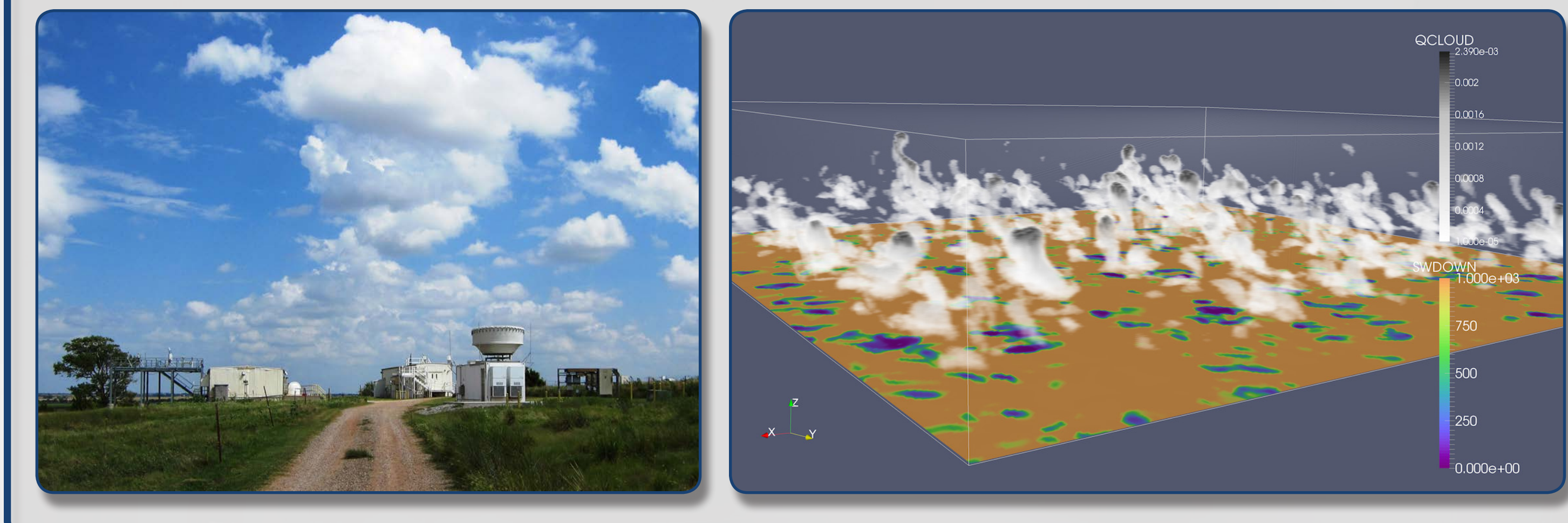
LASSO Benefits Many Research Areas

As an observationalist
» Inform instrument remote sensing retrievals
» Conduct Observation System Simulation Experiments (OSSEs)
» Test implications of scan strategies or flight paths

Estimated LES Cloud Fraction from CR-SIM for Various Radar Sensitivities
9-Jun-2015 Case, 143 Radar Scans
Oue et al. [GRL, 2016]

As a theoretician
» Get estimates of fluxes & co-variability of values
» Test relationships without having to run the model yourself

As a modeler
» Know ahead of time which days have good forcing
» Have co-registered observations at high-resolution scales
» Have inputs and corresponding outputs to test parameterizations

Alpha 1 Relese, doi:10.5439/1256454

Previews the data bundle concept. Provides opportunity for community feedack based on initial conept for forcing products, model configuration, output, and observation-model integration.


LASSO Simulation #10, 27-Jun-2015
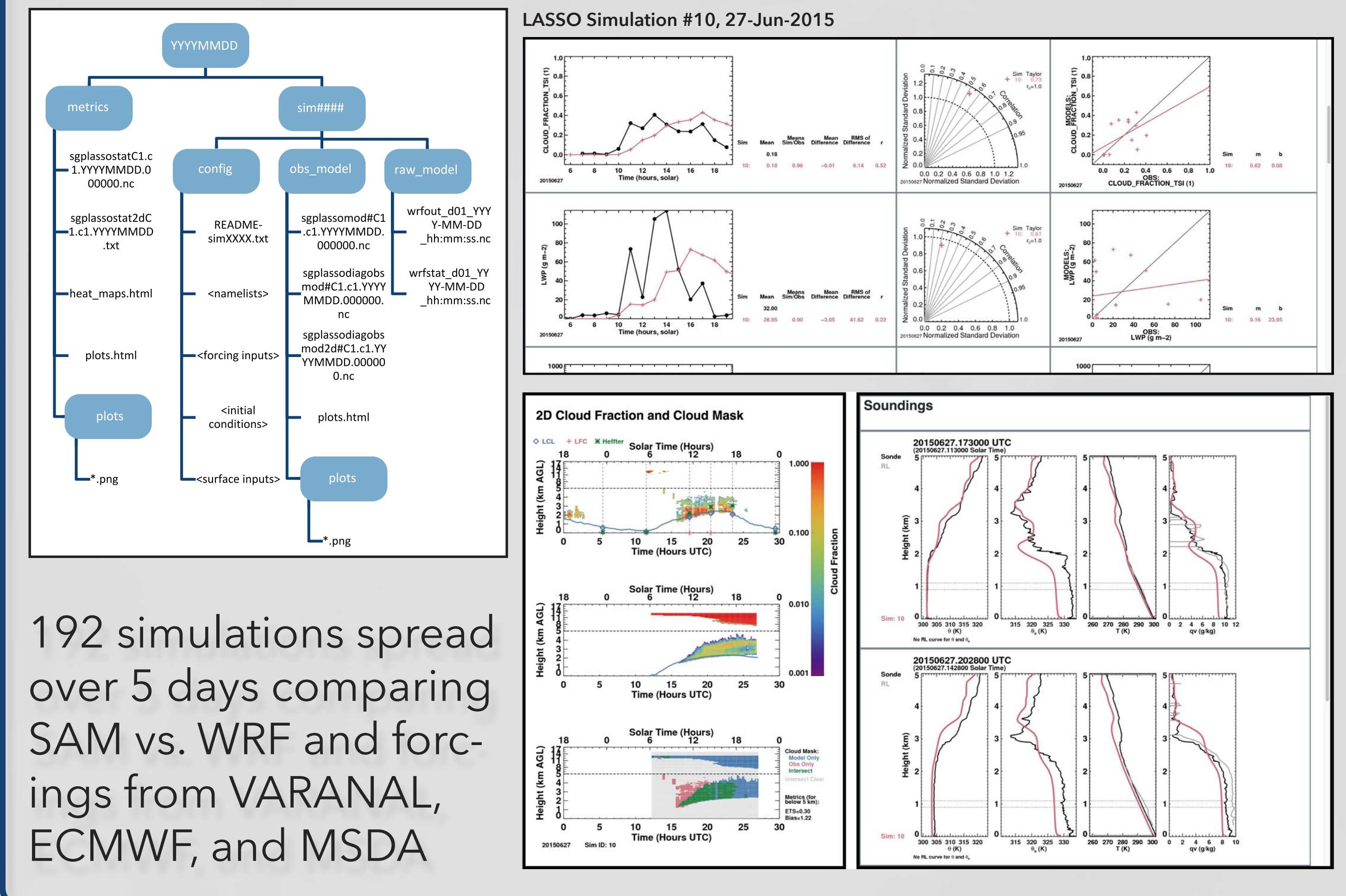
192 simulations spread over 5 days comparing SAM vs. WRF and forcings from VARANAL, ECMWF, and MSDA

Data Bundles Provide Easy Useability

A "data bundle" is constructed for each case date and is discoverable with the Bundle Browser. The bundles contain

BASIC USERS
» Diagnostics and metrics for model evaluation
» ARM observations in a form directly comparable to the LES output
» Domain-wide and time averaged profiles for LES statistics, e.g., meteorological state, cloud fraction, variances

ADVANCED USERS
» Instantaneous LES output fields at regular intervals
» LES initialization and forcing data based on an ensemble of forcing sources

1-D Cloud Metric
LS Forcing
VARANAL
ECMWF
MSDA
None
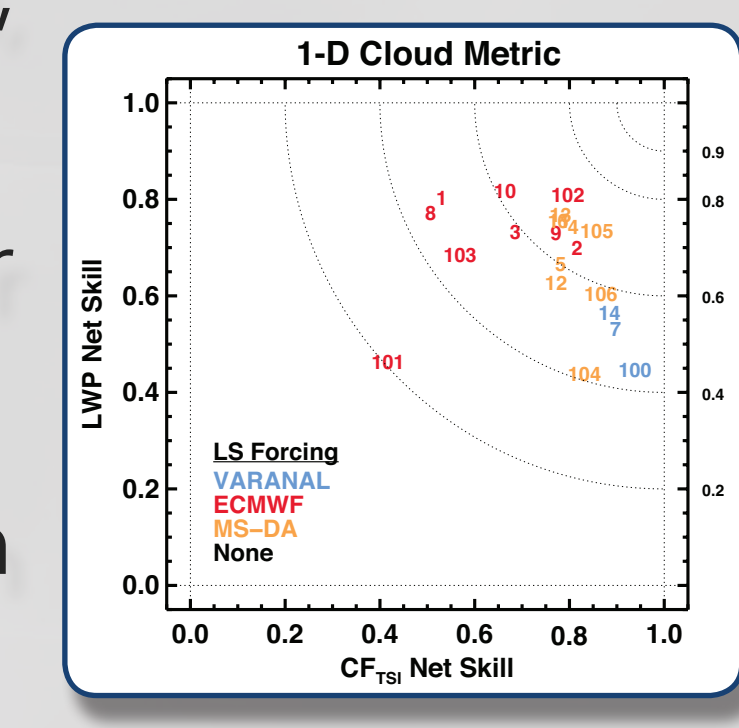
Alpha 2 Release, Coming Soon

Fourteen cases from spring/summer 2016. Will include ARM profiles in the multiscale data assimilation used for deriving LES forcing data. Further enhancement of diagnostics and metrics.

Raman lidar — AERI — Radar wind profiler
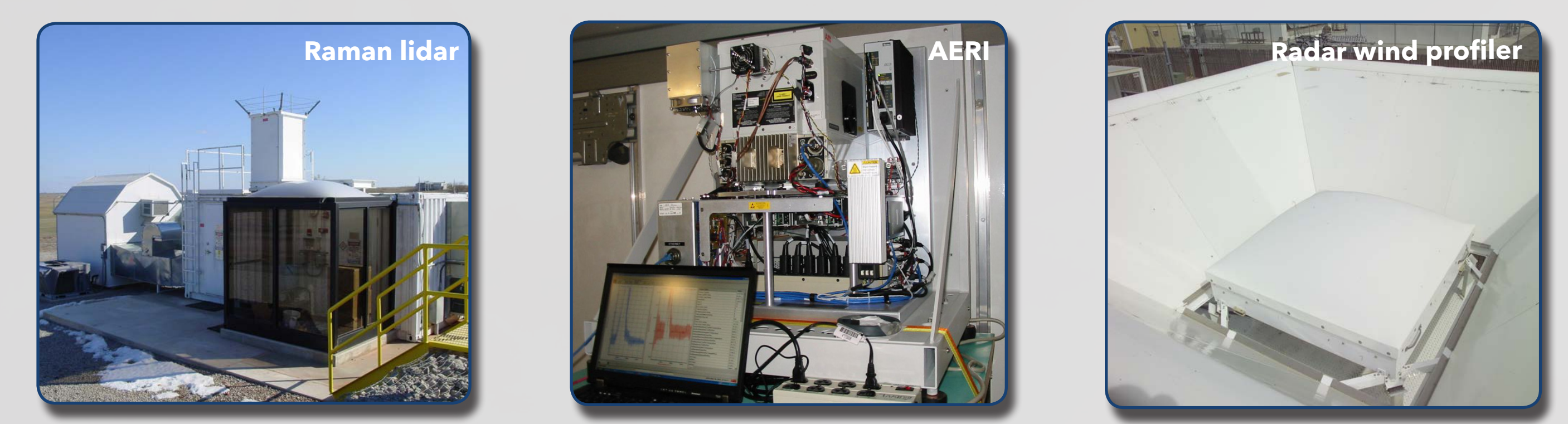
A cases (traditional ShCu): Jun. 10, 11, & 19, Aug. 18

B cases (mixed ShCu): May 18, Jun. 25, Jul. 19, Aug. 30

C cases (difficult days): May 30, Jun. 14 & 20, Jul. 16 & 20, Aug. 19

A: 10-Jun-2016 — B: 18-May-2016 — C: 30-May-2016
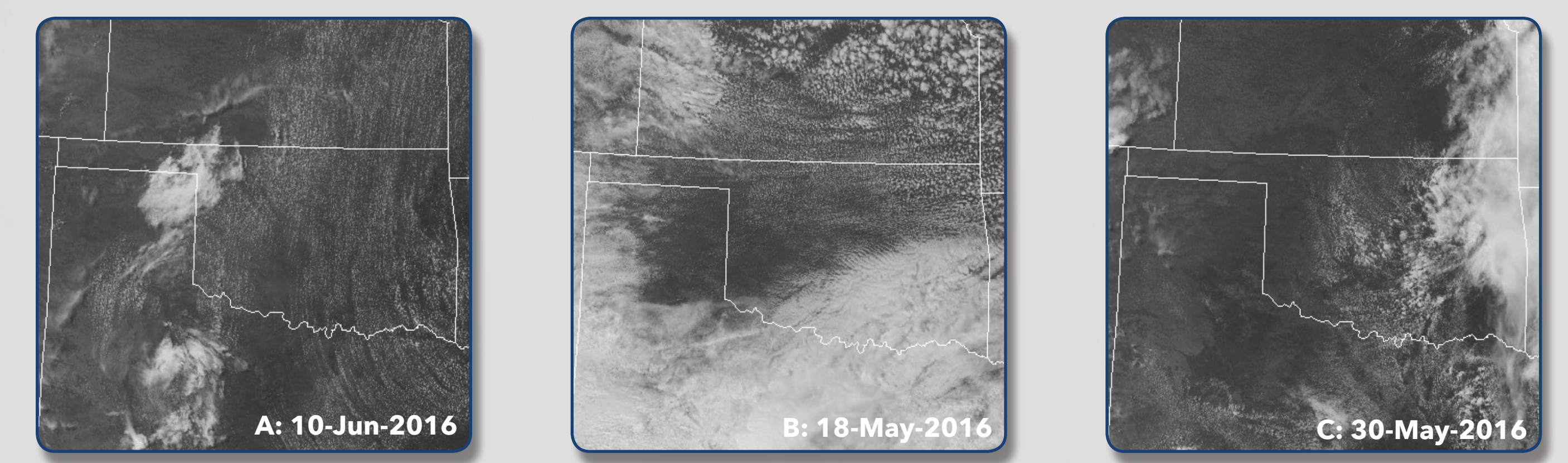
Timeline

April 2015	Started LASSO pilot project
March 2016	Formed Atmospheric Modeling Advisory Group
May 2016	Began collecting data from new boundary facility instruments
July 2016	Released Alpha 1 data bundles
May 2017	Planned release of Alpha 2 data bundles
May 2017	Make recommendations to ARM and transition from pilot phase to routine operations