

The Holistic Interactions of Shallow Clouds, Aerosols, and Land-Ecosystems (HI-SCALE) Campaign: Measurement Strategy and Preliminary Findings



Pacific Northwest
NATIONAL LABORATORY

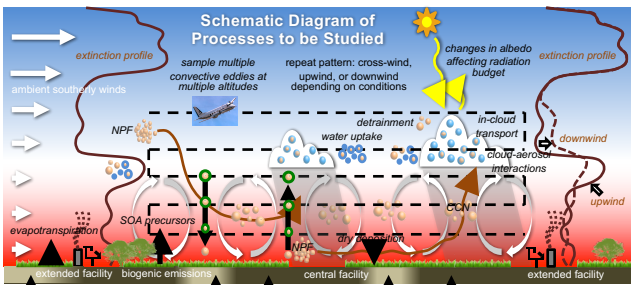
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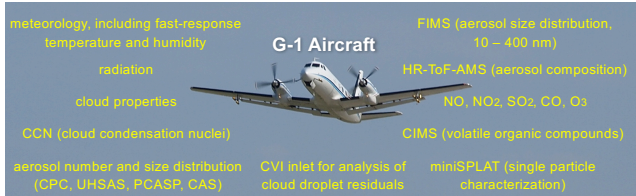
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Campaign Objectives

- 1) Provide a detailed set of measurements needed to obtain a more complete understanding of the **lifecycle of shallow clouds** by coupling cloud macrophysical and microphysical properties to **land surface properties, ecosystems, and aerosols**.
- 2) Conduct two 4-week intensive observation periods: spring (**April 25 - May 20**) and late summer (**August 28 - September 22**) of 2016, to take advantage of different stages of vegetation "greenness" in the vicinity of the ARM Southern Great Plains (SGP) site as well as aerosol properties that vary during the growing season.

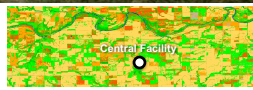
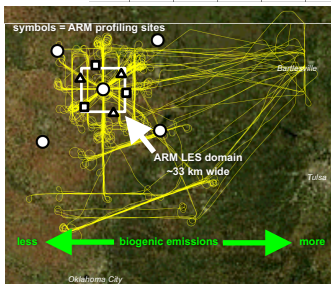


HI-SCALE Measurements



ARM SGP Supersite

To achieve our science objectives, we will couple HI-SCALE data with the extensive routine in situ and remote sensing data from ARM's "supersite" instrumentation configuration. HI-SCALE data will also be used to evaluate routine simulations of shallow clouds by the Large Eddy Simulation (LES) modeling project, called LASSO.



Acknowledgements:

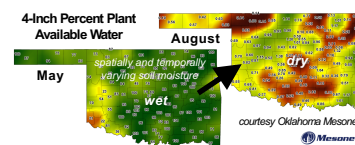
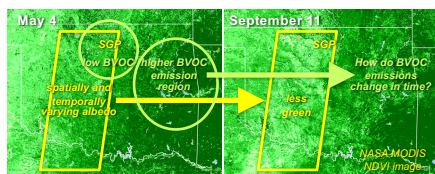
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Motivation

Cumulus convection is an important component in the radiation budget and hydrologic cycle over the southern Great Plains and over many regions of the world, particularly during the summertime growing season when intense

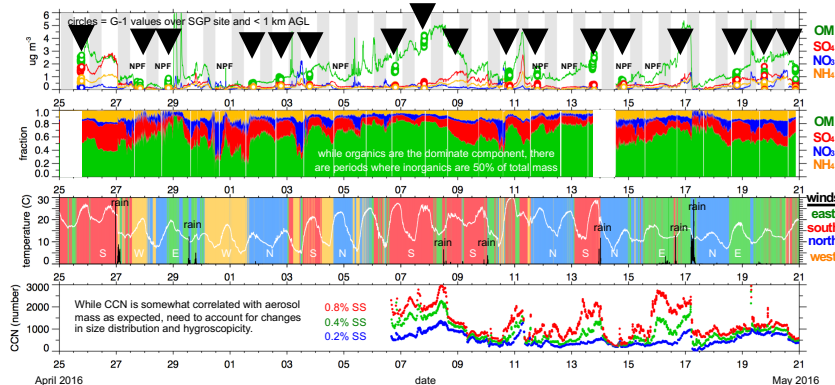
turbulence induced by surface radiation couples the land surface to clouds. Current convective cloud parameterizations contain uncertainties due in part to insufficient coincident data that couples cloud macrophysical and microphysical properties to inhomogeneities in boundary layer and aerosol properties.

Factors Influencing the Surface Energy Budget & BVOCs

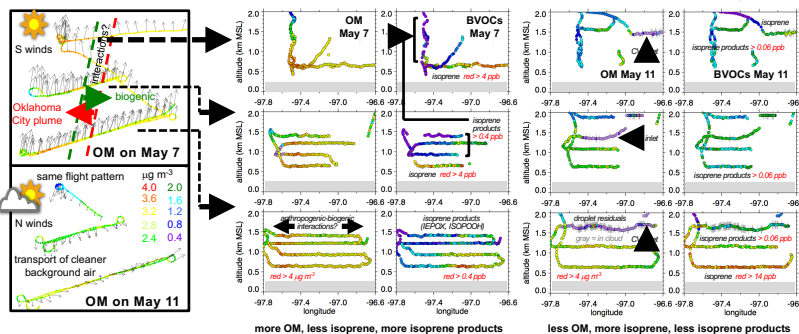


Phase 1: Weather wetter and cooler than normal
Phase 2: Weather drier and warmer than normal

Temporal Variations on Aerosol Properties and CCN



Spatial Variations in OM and BVOCs: A Tale of Two Days



Science Objectives

Some of our science questions include:

- ▶ What controls particle growth from ultrafine to accumulation mode size?
- ▶ How does NPF, SOA formation, and aerosol growth contribute to CCN concentration?
- ▶ What is the relative contribution of various sources of aerosols and their effect on cloud properties over the year?
- ▶ Can LES adequately capture the observed temporal and spatial variability of surface fluxes, boundary layer mixing, aerosol and CCN properties, cloud-aerosol interactions, and cloud properties?
- ▶ How can the aircraft data coupled with LES modeling and routine ARM data be used to develop new parameterizations of sub-grid scale variability associated with boundary layer turbulence and shallow clouds?

For more information on HI-SCALE: jerome.fast@pnl.gov; <http://www.arm.gov/campaigns/aaf2016hiscale>