Hypothesis: Higher resolution will increase Arctic cloud amount

High Resolution Atmospheric General Circulation Models with Variable Resolution and Super-Parameterization
- Global earth system model development is trending toward higher resolutions.
- Certain aspects of the climate are improved with resolution and SP-CAM, but unique biases in cloud liquid and ice content arise when compared with observations.

Evaluating model simulations against satellite retrievals
Using a satellite simulator tool, we find that the Community Atmosphere Model (CAM) and SP-CAM have different biases in liquid cloud amount relative to CALIPSO retrievals (below).

Evaluating Large Eddy Simulations and in situ Tethered Balloon Measurements
Routine high-resolution large eddy simulations (LES) are developed for the ARM sites at the North Slope of Alaska to develop a statistical understanding of the phase of the clouds. We use the System for Atmospheric Modeling (SAM) to explore LES performance of cloud amount at Oliktok Point during field campaigns. A supercooled liquid water content sensor and fiber-optic distributed temperature sensor are flown on a tethered balloon to obtain observations of supercooled liquid for evaluation of LES performance. We found the magnitude of the supercooled liquid water content in the simulations is sensitive to tuning and forcing conditions.

Developments Required
- Comprehensive Arctic Grid
- ACME v2/v3 development plans for comprehensive, coupled Arctic grid (See R. Leung’s Talk)
- Diagnostic Storm Tracking and Detection Algorithm for Unstructured Grids
- Work has started for finding objects in unstructured grids (See CMDV breakouts)

Expected Impact
- Increase understanding of Arctic System
  - Reducing cloud bias will add confidence when evaluating more complex problems (e.g., aerosols)
  - Improve validation and diagnostics in data-poor region
- Object-finders are missing from GCM diagnostic toolkits, which are needed as resolution increases