CMDV–CM4 Activity

CMDV-CM4 Overview

2017 ARM/ASR PI Meeting

March 14, 2017

CMDV–CM4 Activity

Coupling Mechanistically
the
Convective Motions
and
Cloud Macrophysics
in a
Climate Model

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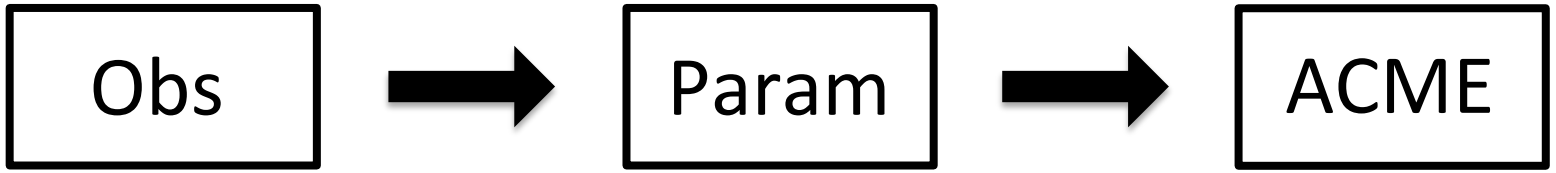
What we are trying to do

CM4 will use new ARM observations of shallow clouds and the lower-tropospheric state to evaluate the current CLUBB representation of shallow clouds in ACME, develop new shallow-cloud schemes, and tune and validate those shallow-cloud schemes in single-column-model (SCM) simulations.



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CMDV-CM^4 Collaborators

• David Romps	Lead PI	LBNL
• Andrew Vogelmann	Co-PI	BNL
• Christopher Bretherton	Co-PI	U Washington
• Charles Jackson	Co-PI	UT Austin
• Michael Jensen	Co-I	BNL
• Pavlos Kollias	Co-I	BNL
• Rusen Oktem	Co-I	LBNL

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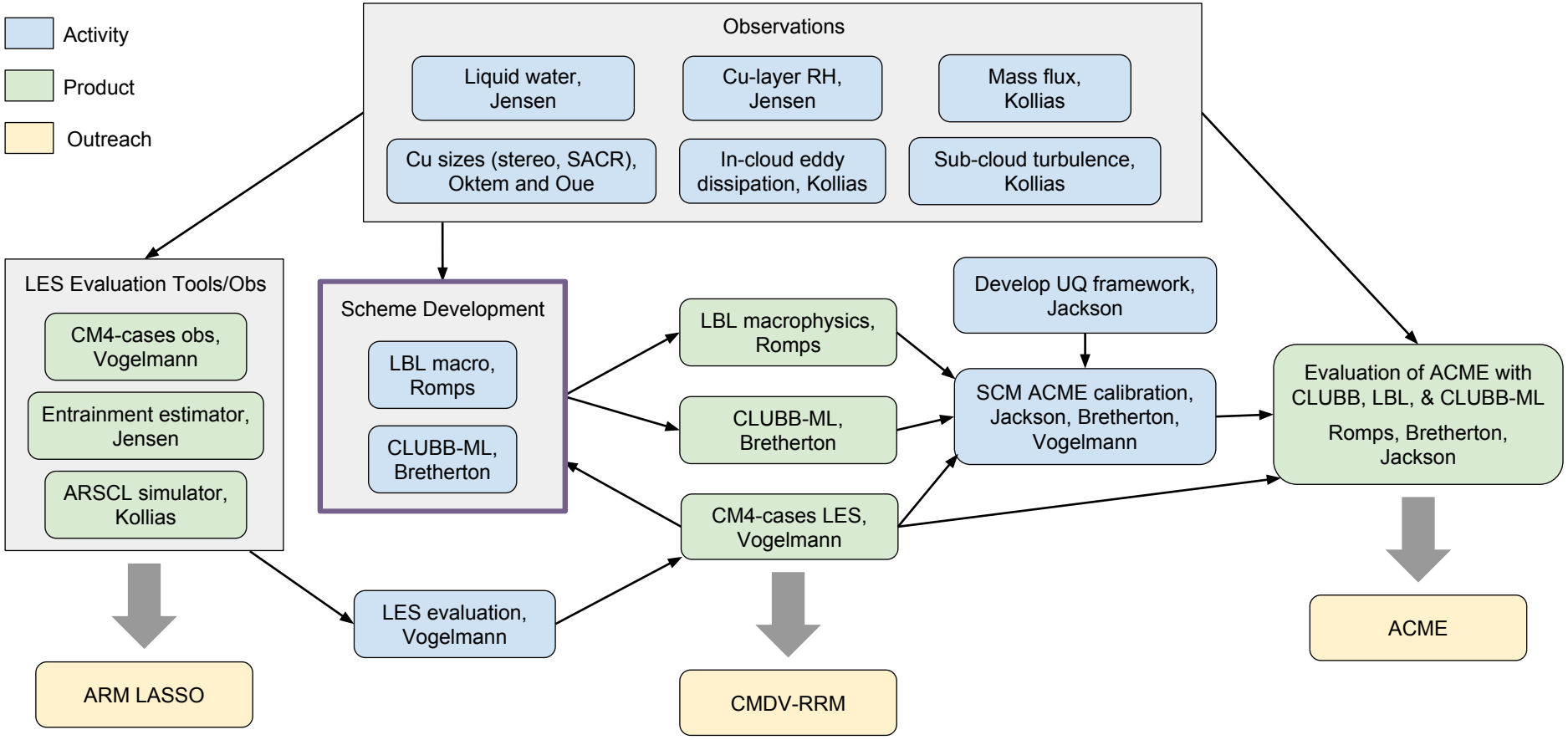

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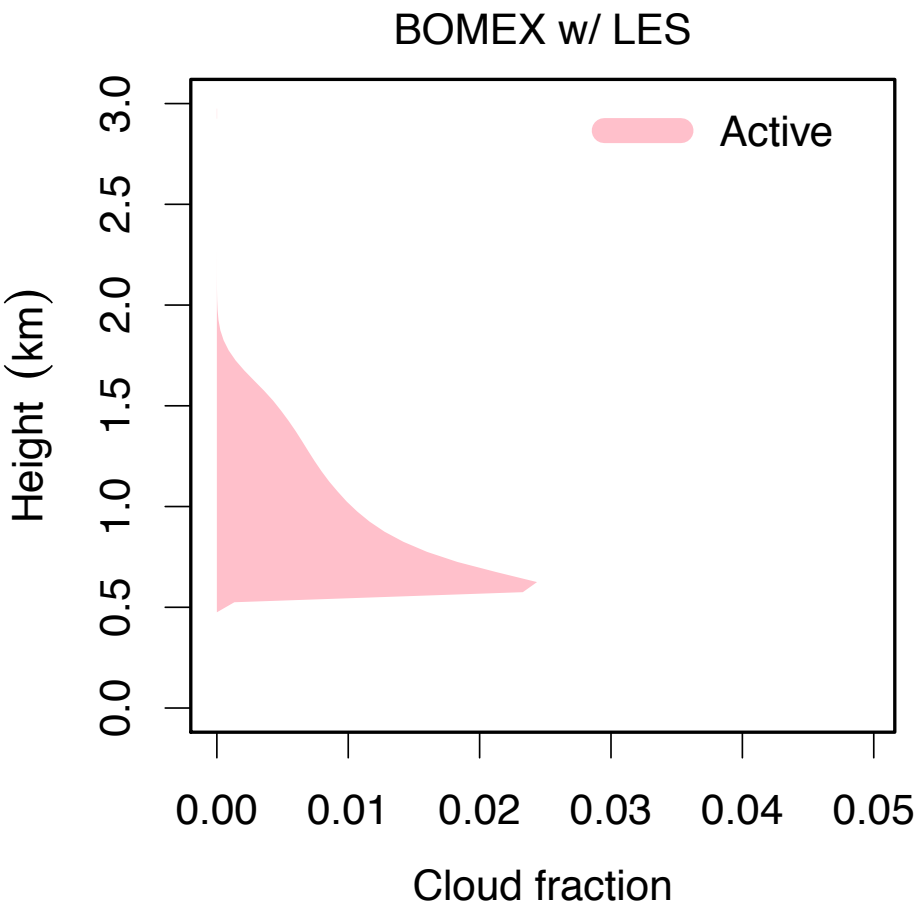
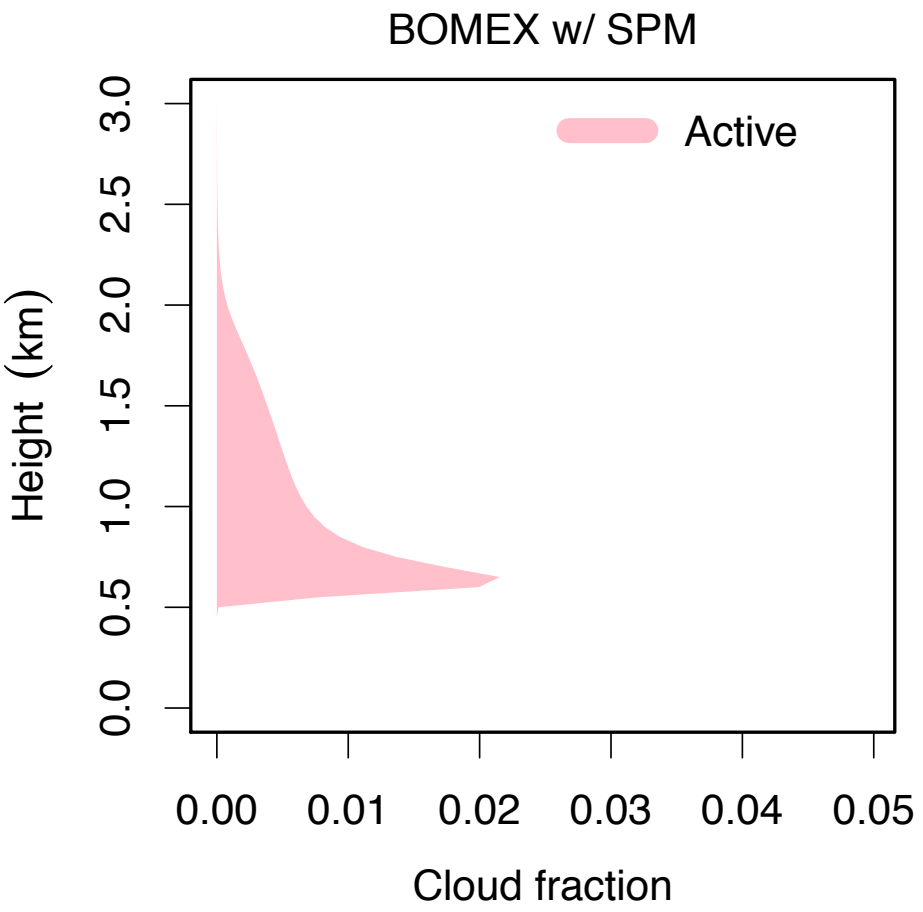
Approach 1: Couple mass flux to cloud cover





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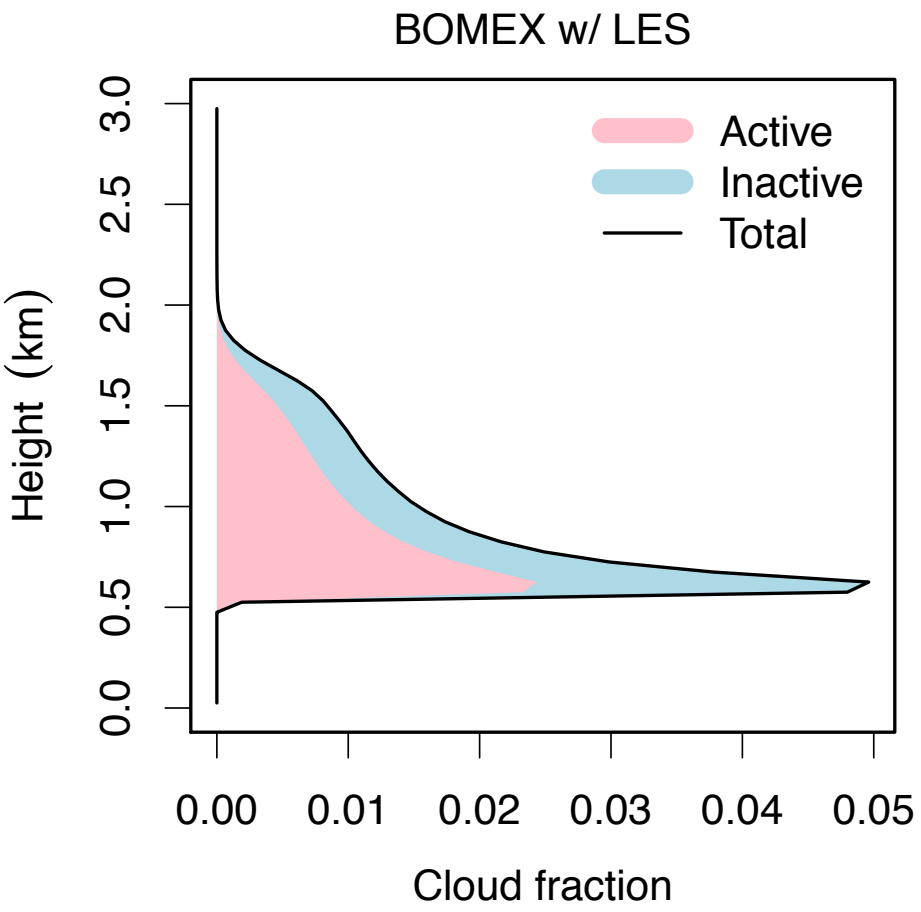

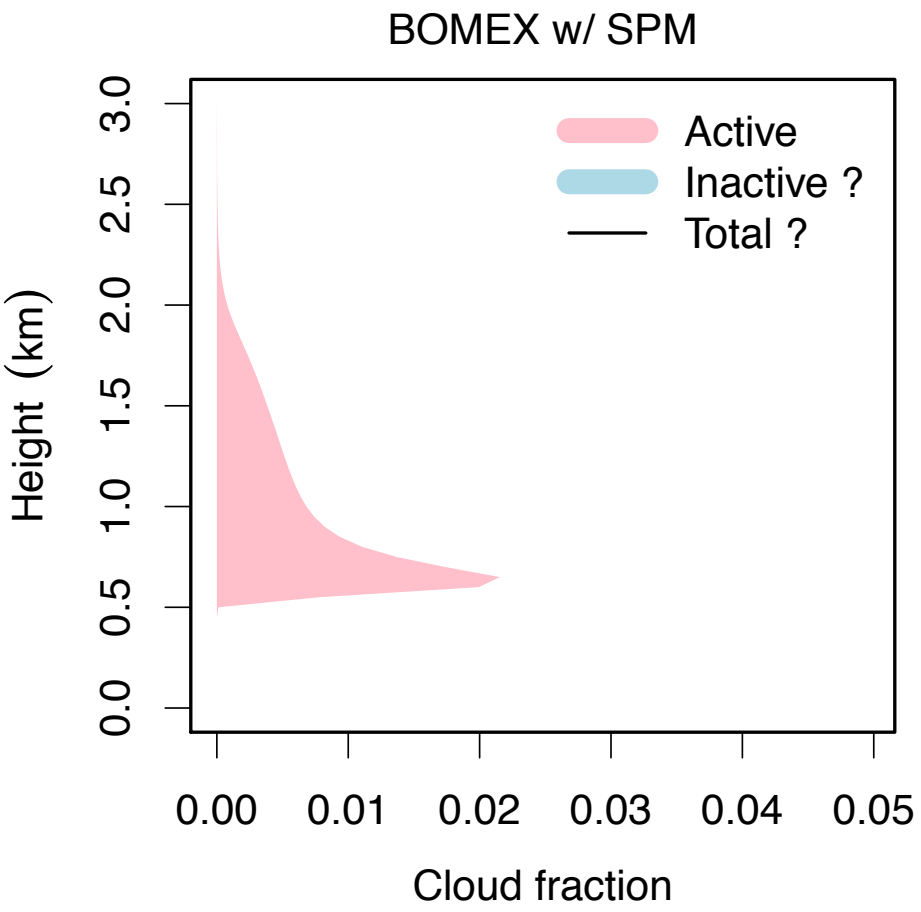

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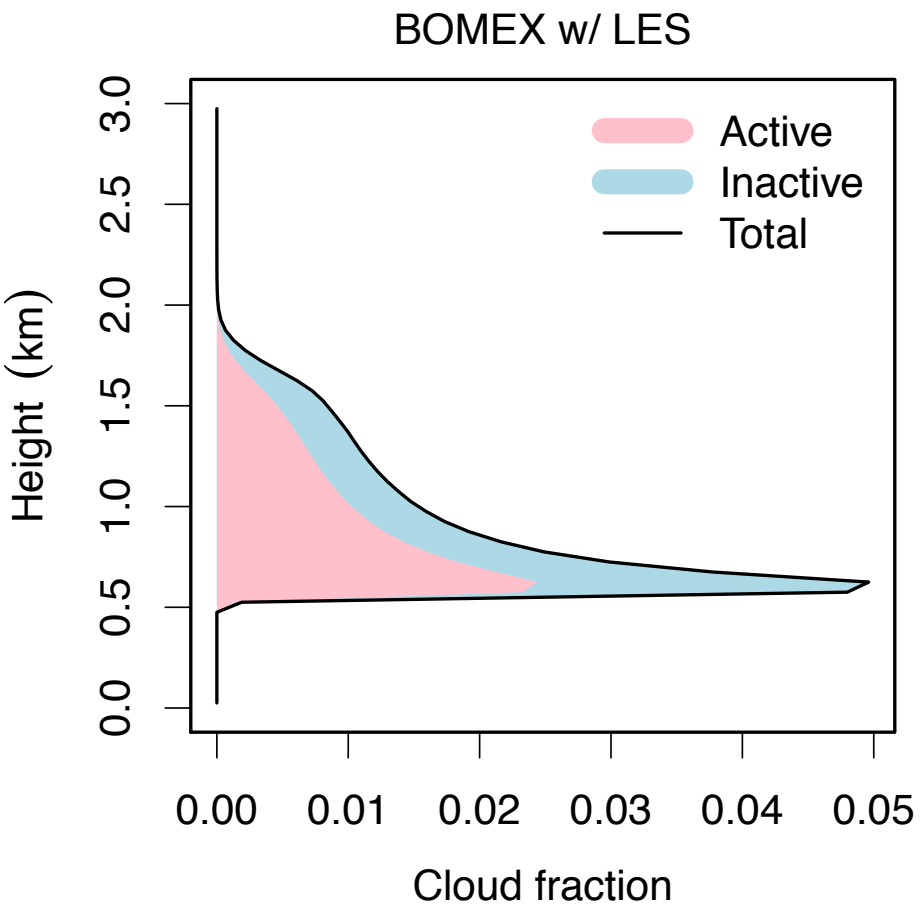

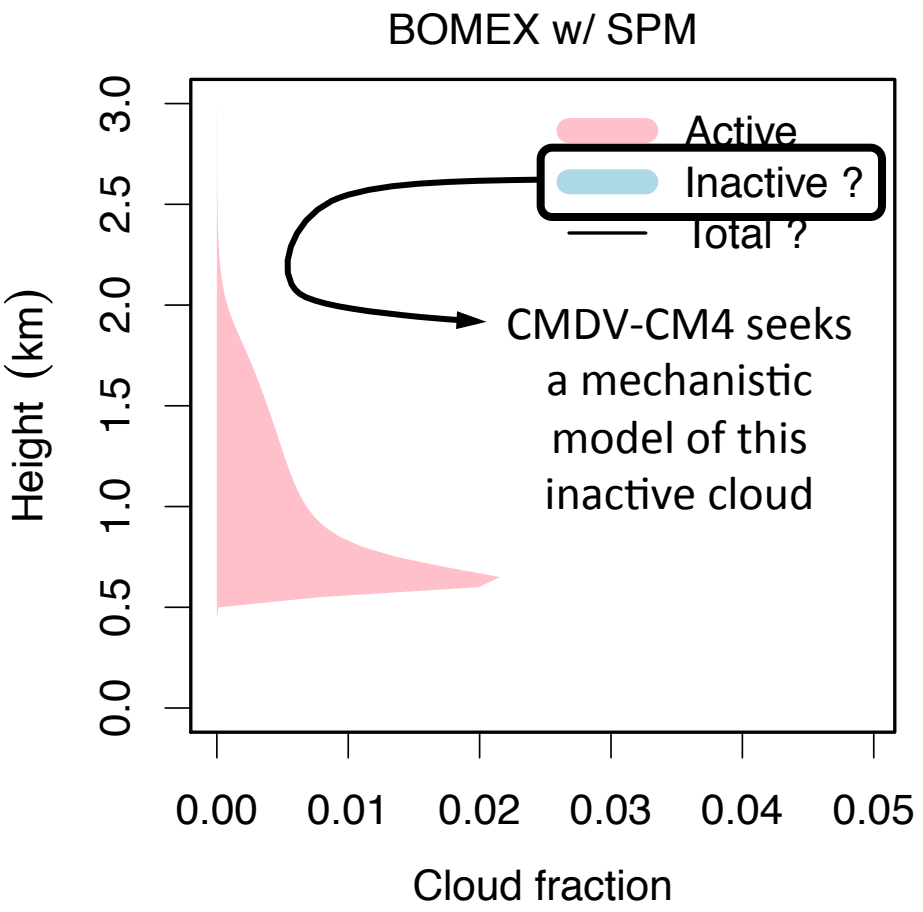

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Approach 2: Replace CLUBB with machine learning

Like CLUBB, prognose the subgrid correlations between temperature, water, and vertical velocity.

Unlike CLUBB, use machine learning to find the appropriate higher-order closure (HOC) rather than assuming a form of the PDF.

It is expected that this will retain the primary benefits of CLUBB, but with higher accuracy.

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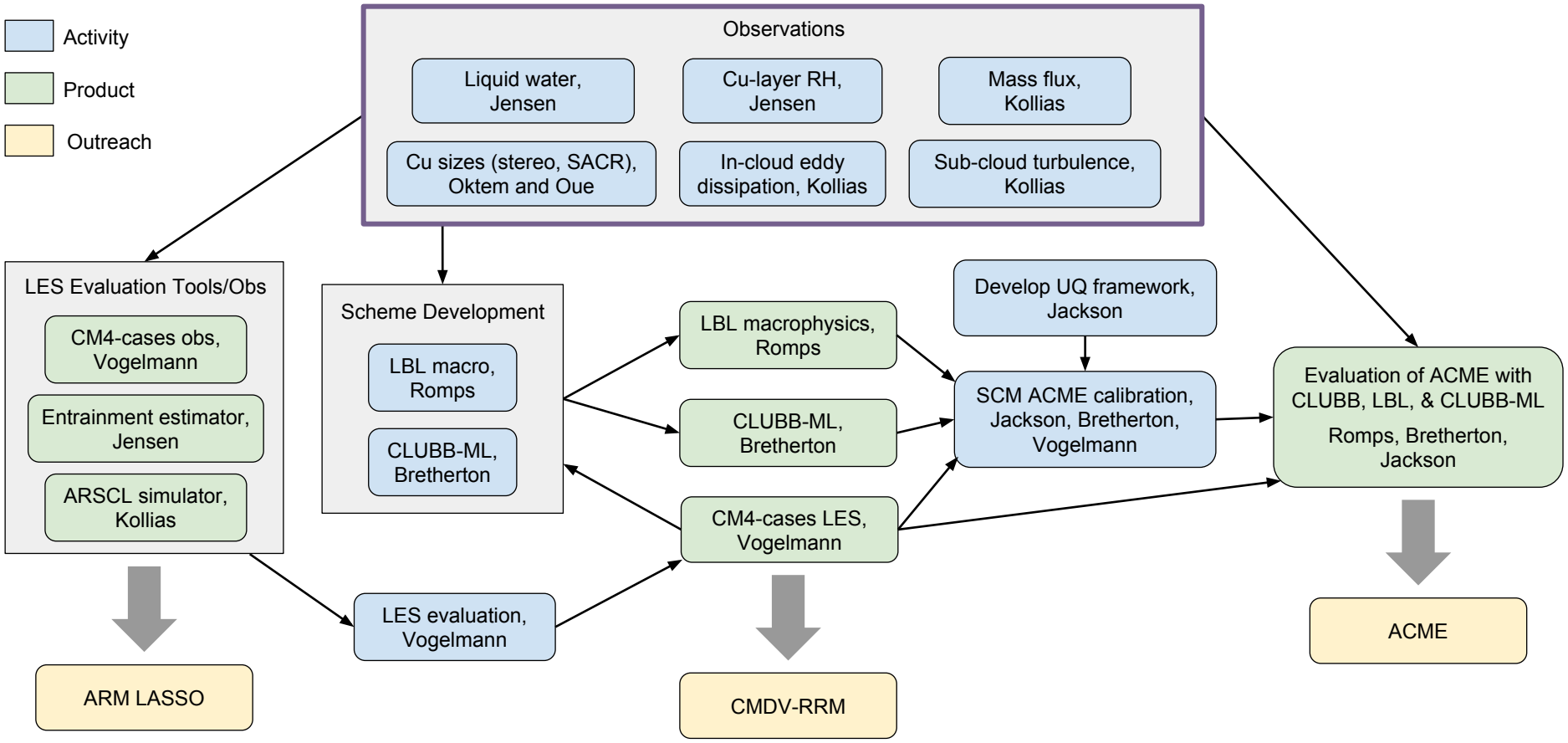

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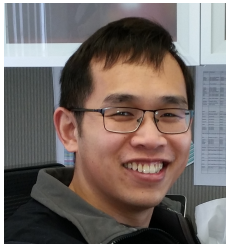
Observational Analysis Plans


Damao Zhang

- Mass Flux
  - Algorithm available for estimates from KAZR-derived updraft velocity
- In-cloud eddy dissipation
  - Algorithm available, Retrieval based on radar Doppler spectrum width
- Cu-layer RH
  - Object-oriented data processing
  - Readying RL and AERI datasets has resolved QC questions
- Sub-cloud turbulence
  - Object-oriented data processing
  - Vertical velocity variance and skewness from Doppler lidar. Recently resolved data issues
- Liquid Water Content
  - Use combined MWR-KAZR technique. Needs AERIoe for EFs
- Cu sizes (SACR)
  - Requires availability of SACR observations (beginning June 2017)

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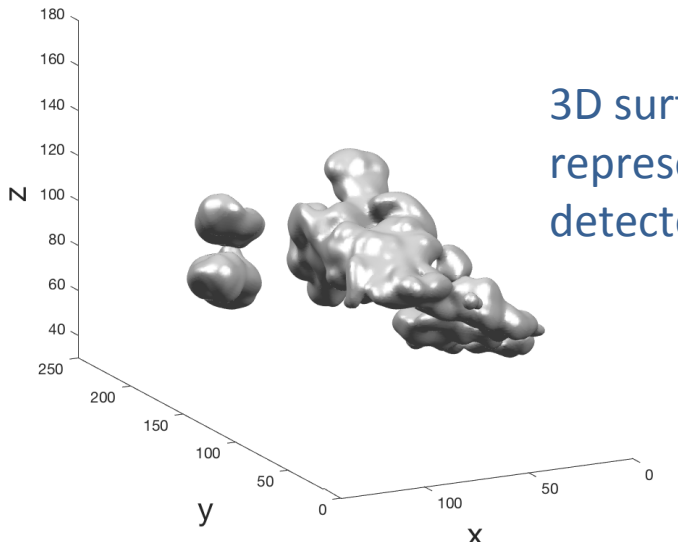
Observation – 3D Modeling via Stereo Photogrammetry

A software algorithm is developed to achieve the following steps from a single stereo view

- Separate the clouds from the background
- Reconstruct 3D positions of the cloud points
- Generate a surface representation for identified cloud masses at 20 m resolution

Shallow Cu at SGP CF, red dots represent locations of reconstructed cloud points



3D surface representation of detected clouds

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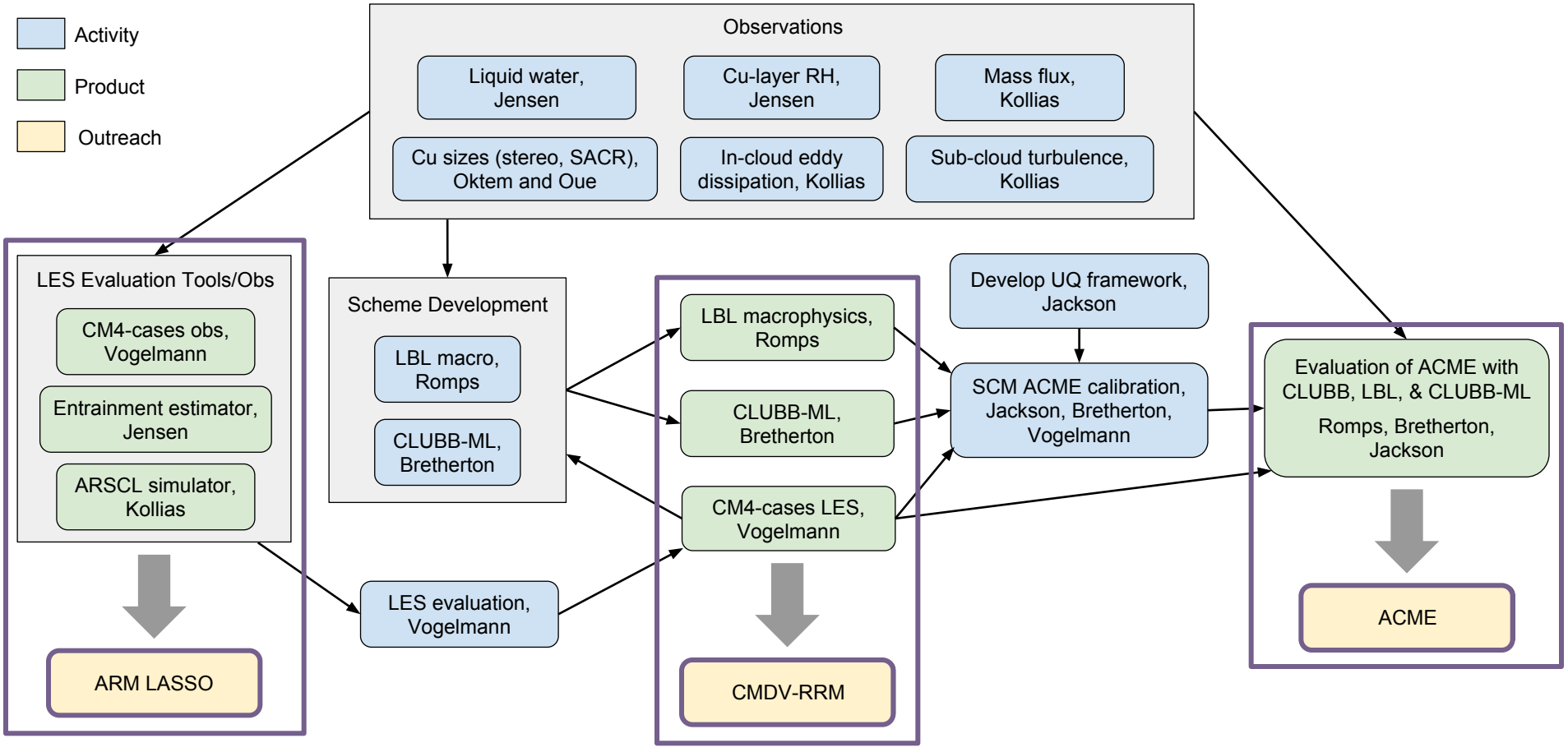

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