Convective Processes Working Group

Co-Chairs

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Joint ARM User Facility and ASR PI Meeting

Thursday, August 10, 2023

Photo courtesy of Ramón Alberto Acuña (SMN).

Mission

The mission of the Convective Processes Working Group is to document from observations and modeling, and thereby develop understanding of, the dynamical, thermodynamical, microphysical, and radiative processes that together determine the evolution of convective cloud systems from formation to dissipation, and to translate this understanding into methods for representing convective cloud processes in numerical weather and climate models.

Sign up for our WG mailing list: https://adc.arm.gov/armuserreg/
You need to sign up for an ARM account if you don't have one yet and then go to "subscriptions"

Photo courtesy of Ramón Alberto Acuña (SMN).

Research Themes

Convective System Transitions

- Shallow to Deep (Liquid to Ice, Entrainment, Cold Pools)
- Mesoscale-Synoptic Organization (MCS Life Cycle, Cold Pools, MJO)

Convective Dynamics

- Observational Retrievals
- Entrainment, Detrainment, and Dilution
- Two-way Interactions with Microphysics and Surrounding Environment

Aerosol-Cloud Interactions

- Liquid and Ice Microphysical Effects
- Cloud Dynamical Effects

Parameterization Evaluation and Improvement

- Convection and Organization
- Microphysics
- Turbulence

Photo courtesy of Ramón Alberto Acuña (SMN).

2022 ARM/ASR PI Meeting Discussion

- A lot of focus on ***updraft size, strength, and entrainment***, which are critical to shallow-to-deep transition, vertical transport, and cumulus parameterizations. There is a lot of progress currently happening in this area.
  - ***Sensitivities to evolving environmental (thermodynamic, kinematic, aerosol) conditions*** are not quantified.
  - A critical need to formulate new, better targeted ***observational strategies***.
  - ***Tropical, oceanic shallow through deep convection*** is an ideal target.
- Some disagreement on how to isolate aerosol effects on deep convection.
  - More discussion on microphysics in general needed.
- A lot of GoAmazon studies are completed – could be worth organizing a study summarizing what has been learned.
- More thought is needed on how to best integrate high-resolution modeling and observations for process level understanding with advances in LES and global km-scale modeling.

Photo courtesy of Ramón Alberto Acuña (SMN).

Recent/Future Field Campaigns

- **Recent Field Campaigns**
  - CACTI (orographic convection in Argentina) Oct 2018 – Apr 2019; adam.varble@pnnl.gov
    - LASSO-CACTI (LES runs of shallow to deep cases); lasso@arm.gov
  - COMBLE (cold air outbreak convection on Norway coast) Dec 2019 – May 2020; geerts@uwyo.edu
  - TRACER (coastal convection near Houston, TX) Oct 2021 – Sep 2022; mjensen@bnl.gov
  - SAIL (orographic convection in Colorado Rockies) Sep 2021 – June 2023; drfeldman@lbl.gov
- **Upcoming Field Campaigns**
  - SEUS (inland convection over the SE US) tentatively begins Nov 2023; seusteam@arm.gov

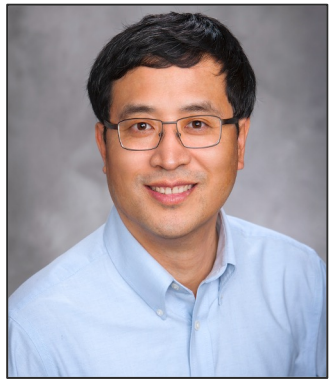
Photo courtesy of Ramón Alberto Acuña (SMN).

Science Product Development Led by a Team of Scientists

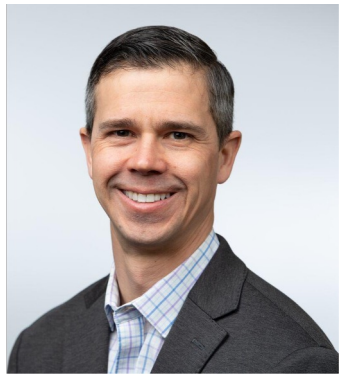
ARM Translator Group

Translators are liaisons between the scientific community and ARM software developers that develop Value-Added Products (VAPs) and open-source tools for the user community.

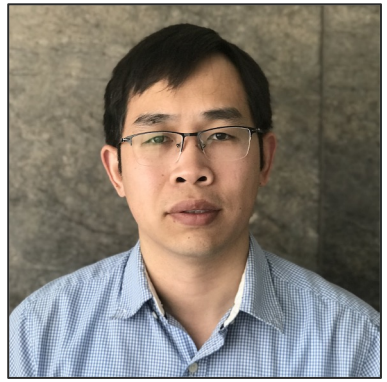
www.arm.gov/connect-with-arm/organization



Shaocheng Xie
Warm Clouds POC
EPCAPE POC



John Shilling
Aerosol POC
TRACER POC



Damao Zhang
High-Latitude POC
SAIL POC

Scott Collis
Convective POC
CAPE-K POC

Scott Giangrande
Lead Translator
AMF3 BNF

Krista Gaustad
Software Development

Ken Kehoe
Data Quality

Agenda

- 9:55-10:07 *Hannah Vagasky, Clark Evans, Becky Adams-Selin*: Potential sources of low-frequency gravity waves observed within MCS stratiform regions

- 10:07-10:19 *Siyu Shan, Dale Allen, Zhanqing Li, Kenneth Pickering*: Machine learning based investigation of the variables affecting summertime lightning over South Great Plains and Southeastern South America

- 10:19-10:31 *Jiwen Fan*: Machine learning analyses of western US fire impacts on hailstorms in the central US

- 10:31-10:43 *Jake Mulholland*: How does vertical wind shear influence hydrometeor characteristics in supercell thunderstorms?

- 10:43-10:55 *Kamal Kant Chandrakar*: Turbulence effects on droplet collision-coalescence: a key to understanding observed rain formation in cumulus clouds

- 10:55-11:07 *Dan Kirshbaum*: On the quantification and mechanisms of cumulus entrainment, detrainment, and dilution

- 11:07-11:19 *Hugh Morrison*: Entrainment and dilution of dry and moist thermals

- 11:19-12:00 Open discussion

Photo courtesy of Ramón Alberto Acuña (SMN).