ARM Translator Products for WBLP

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Translator POC for WBLP: Shaocheng Xie (LLNL), xie2@llnl.gov

U.S. DEPARTMENT OF ENERGY

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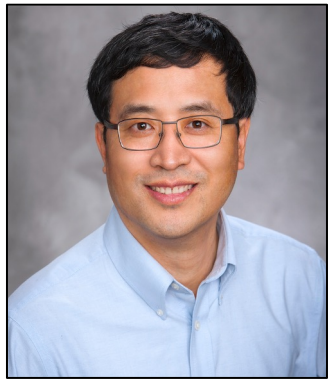
Science Product Development Led by a Team of Scientists

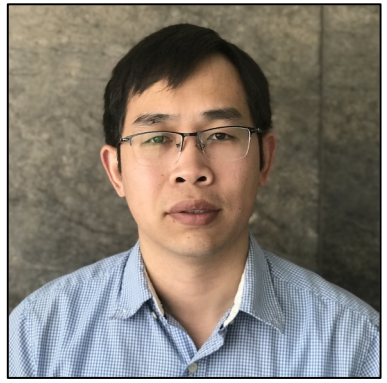
ARM Translator Group

Translators are liaisons between the scientific community and ARM infrastructure staff members, and develop Value-Added Products, or VAPs, from the direct output of ARM instruments or other VAPs.



Shaocheng Xie
Warm Clouds POC
EPCAPE POC

John Shilling
Aerosol POC
TRACER POC



Damao Zhang
High-Latitude POC
SAIL POC

Scott Collis
Convective POC
AWAKEN POC

Scott Giangrande
Lead Translator
COMBLE POC

Krista Gaustad
Software Development

Ken Kehoe
Data Quality

Core ARM Translator VAPs for AMFs

WBLP WG Translator Point of Contact: Shaocheng Xie xie2@llnl.gov

The list includes aerosol & cloud properties, PBLH, Surface Fluxes, as well as the large-scale conditions.

The list could be revised according to feedback from the communities

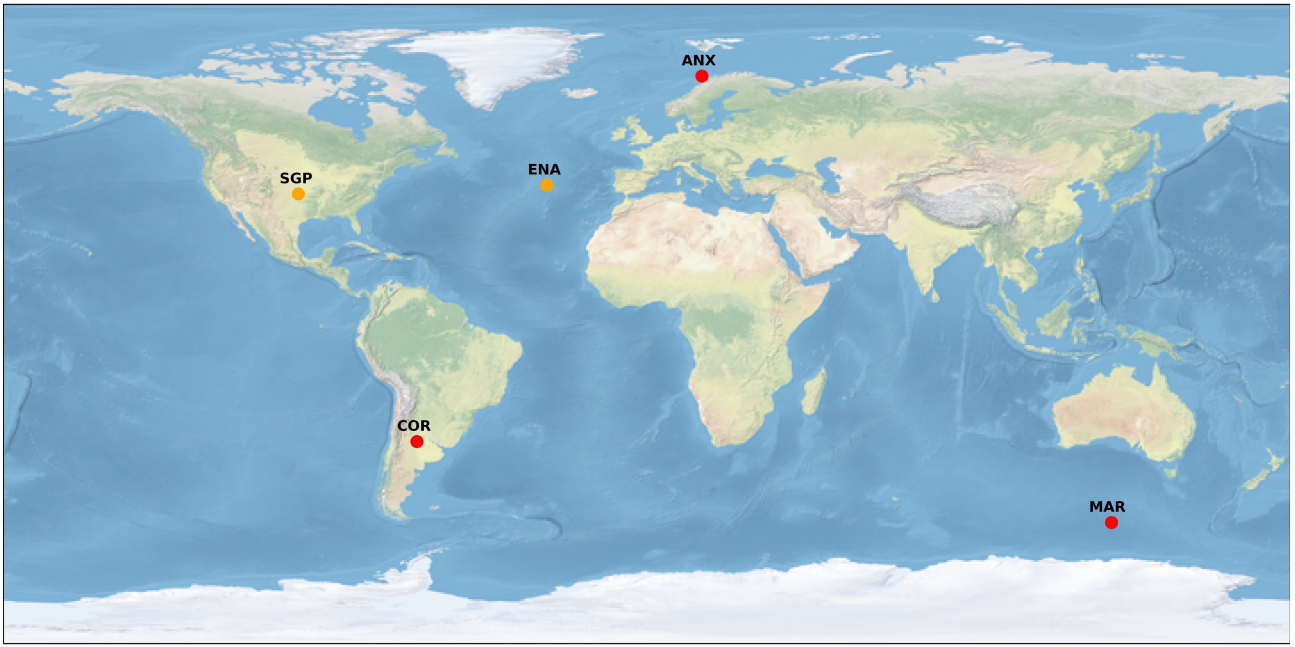
ARM VAP	Translator / Contact	Expected Timetable
AOP/AOD	**Shilling**	**1 week of data collection for AOP, ~1 year for AOD**
AERIoe	Zhang	6 months of end of campaign
ARMBE	**Xie**	**<1 month when required VAPs available**
AERINF	**Zhang**	1 week of data collection
ARSCL	**Giangrande**	**< 1 month of data collection**
INTERPSONDE	**Giangrande**	**< 1 month of data collection**
MWRRET	**Zhang**	**1 week of data collection**
MICROBASE_PLUS	**Giangrande**	**Upon availability of MWRRET**
PBL Height	**Zhang**	**1 week of data collection**
MPLCLDMASK	**Zhang**	**1 week of data collection**
DLPROF	**Zhang**	**1 week of data collection**
QCRAD / RADFLUX	**Zhang**	**1 week of data collection**
QCECOR	Xie	1 month of end of campaign
SPHOT COD	**Giangrande**	**6 months of end of campaign**
LDQUANTS/VDISQUANTS	**Giangrande**	<1 week of data collection
SACRGRID	**Giangrande**	<2 months of data collection
VARANAL	**Xie**	3-6 months of end of campaign

AERIoe and TROPoe

Translator: Damao Zhang, damao.zhang@pnnl.gov

- **AERIoe available at multiple sites:**

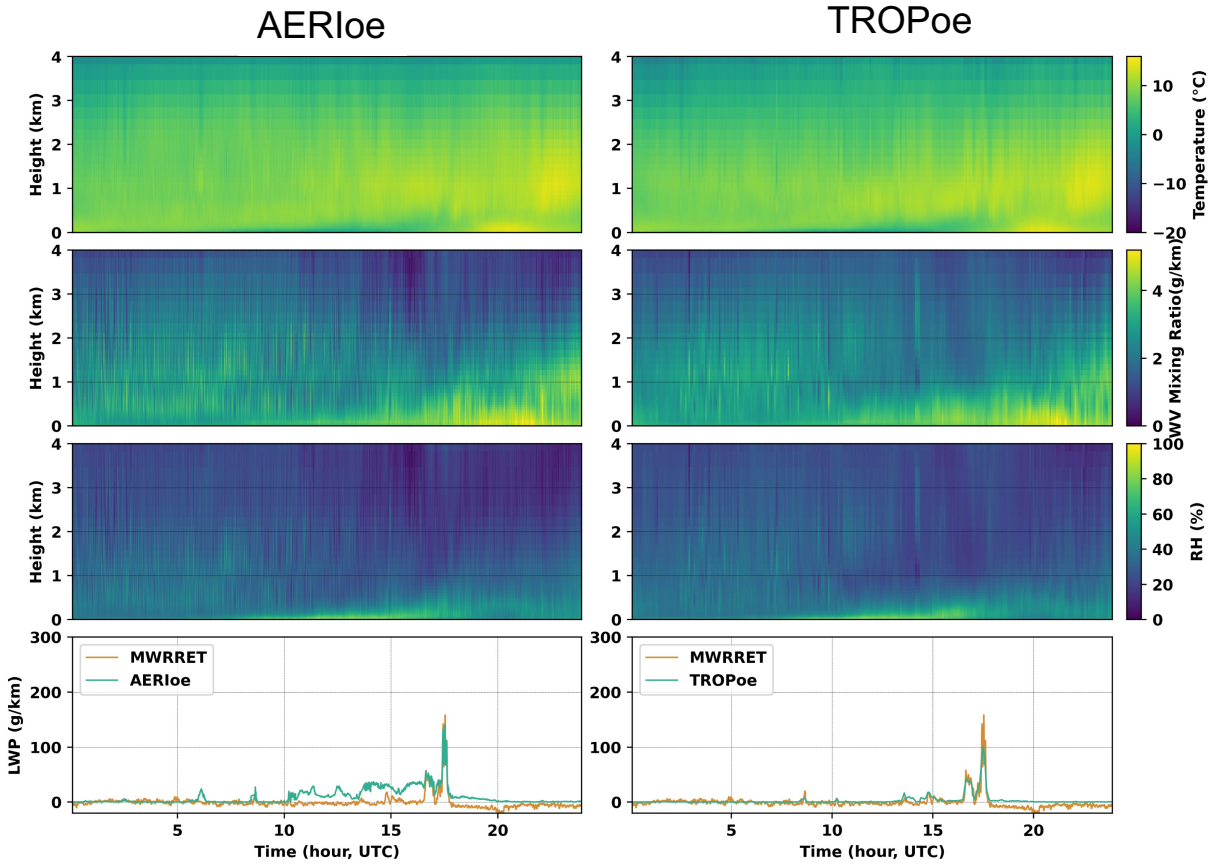
Retrievals of boundary-layer temperature and water vapor mixing ratio profiles, and cloud liquid water path



SGP C1	SGP E32	SGP E37	SGP E39	ACE-ENA
01/2016-06/2023	08/2016-06/2021	08/2016-05/2021	08/2016-07/2022	06/2017-03/2018

- **Upgrading AERIoe to TROPoe**

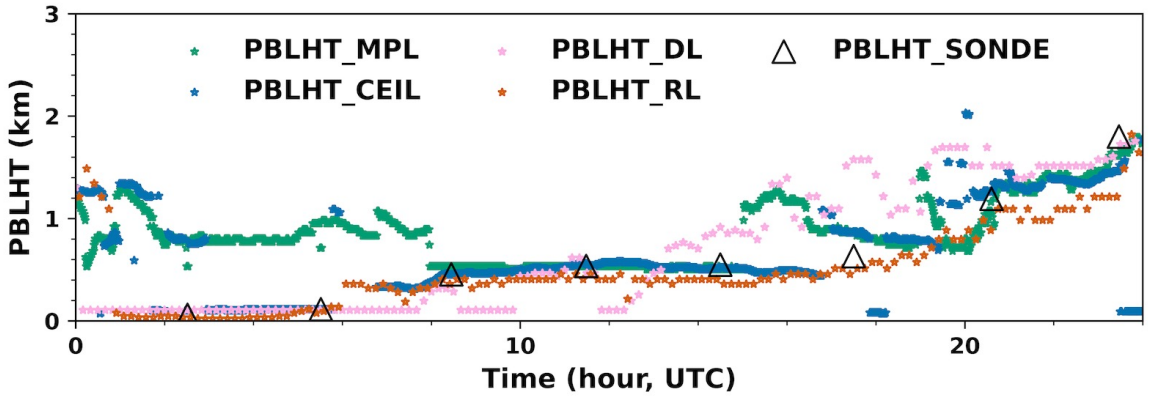
TROPoe: IDL --> Python in a container; easier for maintenance

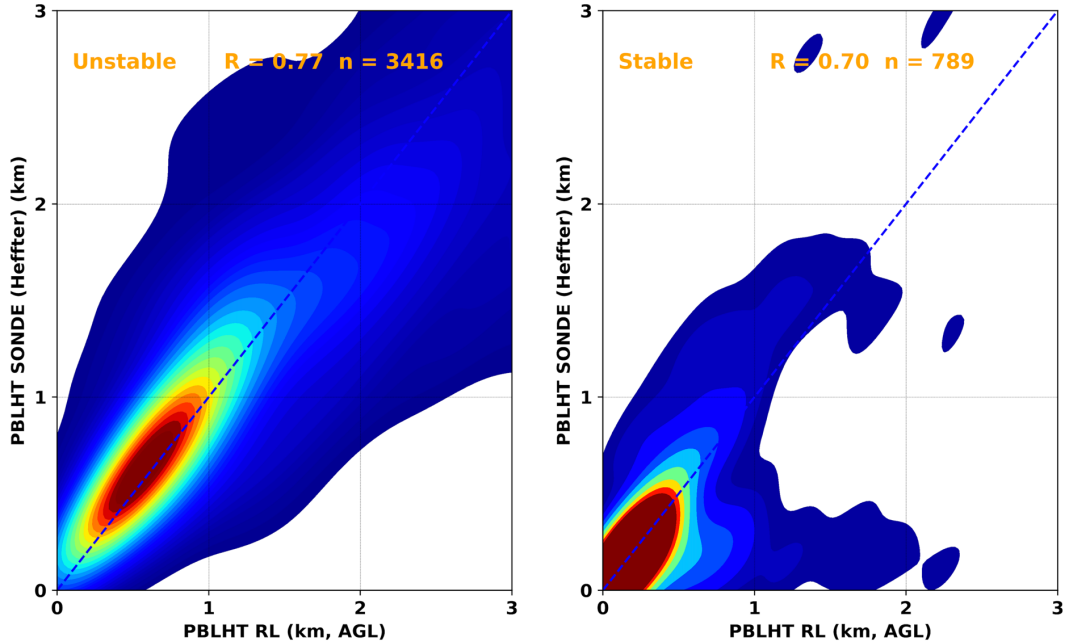


PBLHT-Lidar Data Products

Translator: Damao Zhang, damao.zhang@pnnl.gov

- PBLHT_MPL (aerosol backscatter)
  - Gradient method (Harr wavelet covariance) by Sawyer and Li (2013); available at SGP and COR.
- PBLHT_CEIL (aerosol backscatter)
  - Enhanced gradient method; real-time display; available at most sites.
- PBLHT_DL (dynamics)
  - Vertical wind variance threshold; available at SGP.
- PBLHT_RL (thermodynamics)
  - Heffter method using RLPROF+AERIoe potential temperature profiles.
  - Good performance under both unstable and stable boundary layer conditions.
  - Evaluation data at SGP will be released soon.

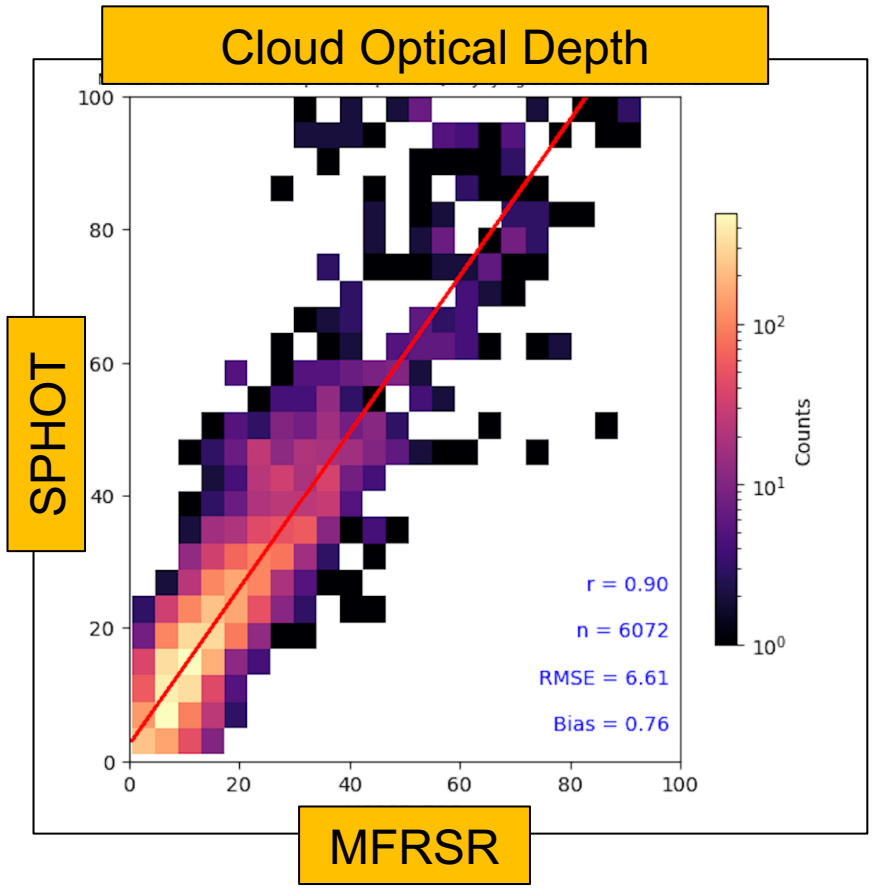




2016-2022 at SGP with RLPROF+AERIoe data

Ongoing ARM Cloud Microphysical Retrieval VAPs

For more VAP information, please contact S. Giangrande: sgrande@bnl.gov



Recent AMFs TRACER, SAIL, EPCAPE Radar VAPs Now Available:

- Active Remote Sensing of Clouds (ARSCL) cloud boundaries, layers.
- Scanning ARM Cloud Radar (SACR) gridded products (SACRGRID).

Retrieval Improvements and New Sites for MICROBASEPLUS:

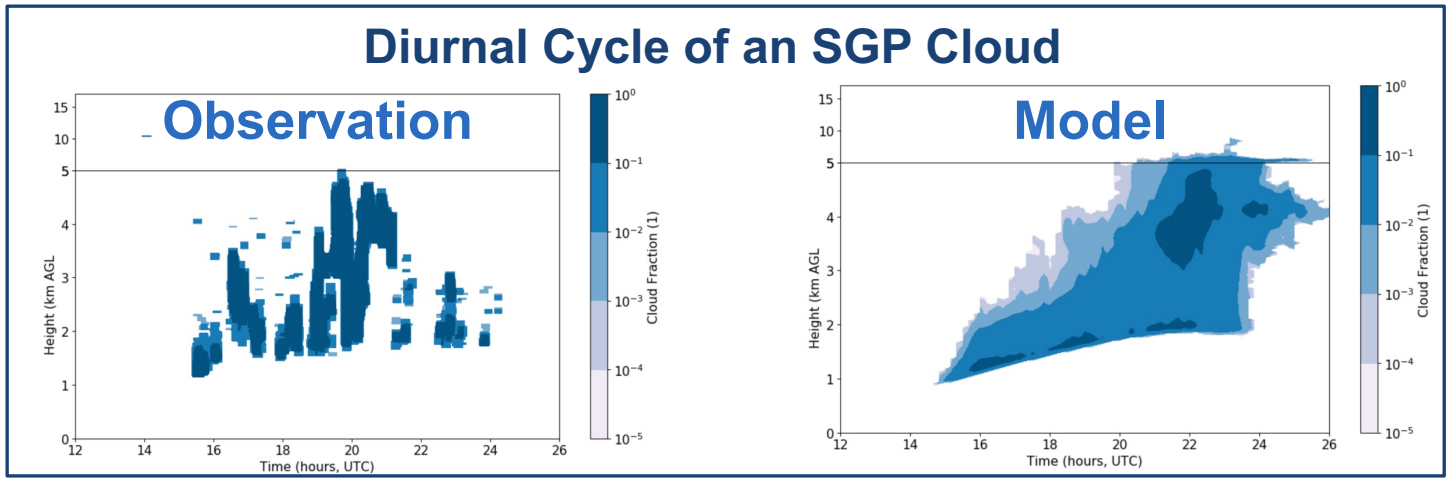
- Liquid Water Content (LWC), Ice Water Content (IWC), and Effective Size (De) retrievals for fixed sites, AMF sites including COMBLE.
- Uncertainty quantification, ACE-ENA *in situ* campaign evaluation.

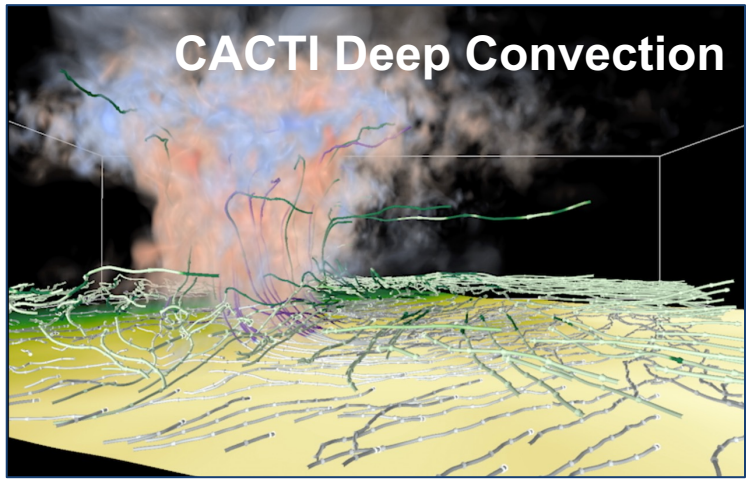
Microphysical Cloud Properties from ARM Sunphotometers:

- Cloud Optical Depth (COD), Cloud droplet effective radius (EFF), and Liquid Water Path (LWP) retrievals.
- Uncertainty quantification & long-term ARM evaluation at ENA, SGP.

LASSO Bundles

For more VAP information, please contact Bill Gustafson: william.gustafson@pnnl.gov





LASSO for Shallow Convection at SGP

- The initial Large-Eddy Simulation (LES) ARM Symbiotic Simulation and Observation (LASSO) projects enables users to compare models with ARM observations collected at the SGP site during shallow cumulus events
- Bundles consist of LES outputs for each event (95 shallow cumulus events observed from 2015-2019 over the SGP site), and the items needed to reproduce the LES results.
- Observations from those shallow cumulus events, and skill scores / diagnostic details identify how the LES behaved.

LASSO-CACTI for Deep Convection

- CACTI simulations now available: 20 days down to dx=2.5 km (33 ensemble members) and 9 days with dx=100 m (avg. 4 memb.)
- Data currently pre-staged on Cumulus cluster while working to archive it. Contact lasso@arm.gov for info on access.

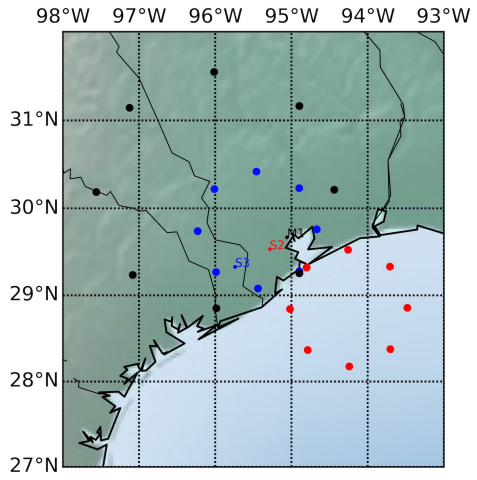
Data Product Highlight: Large-scale Forcing (VARANAL)

TRACER

Research Focus: Convective cloud life cycle; Meteorological controls on convective life cycle; Aerosol-deep convective interactions, etc.

VARANAL settings:

- Time: 201912 – 202005
- Domain: three different fixed domains (land & ocean)
- Resolution: hourly, 25 mb
- v0 (released): ERA5 only
- v1 (completed): ERA5 + mrms precipitation



- Blue dots (default): 75-km radius domain over land
- Black dots: 150-km radius domain over land
- Red dots: 75-km radius domain over ocean

MOSAiC

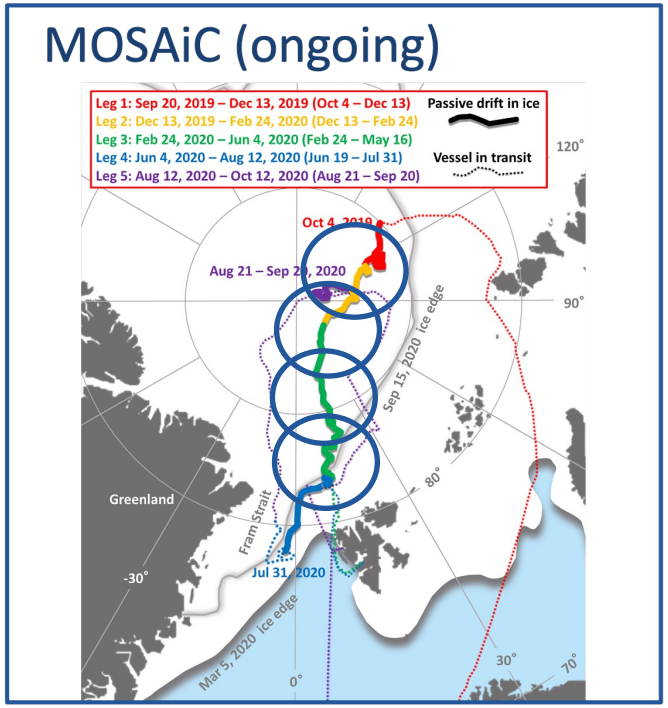
Research Focus: Surface energy budget of sea ice; Clouds, precipitation; Aerosols; Atmospheric boundary layer, etc.

VARANAL settings:

- Time: 201910 – 202010
- Domain: 150-km radius domain following the *Lagrangian* trajectories.
- Resolution: hourly, 25 mb
- v0 (ongoing): ERA5 only

Collaboration:

- Prof. Minghua Zhang at Stony Brook University



Contact: Cheng Tao, LLNL, tao4@llnl.gov

ARM Diagnostics/Tools:
ARM Diagnostics Package for GCMs

Objective: To facilitate the use of ARM ground-based in-situ measurements in climate model evaluation and model inter-comparison.

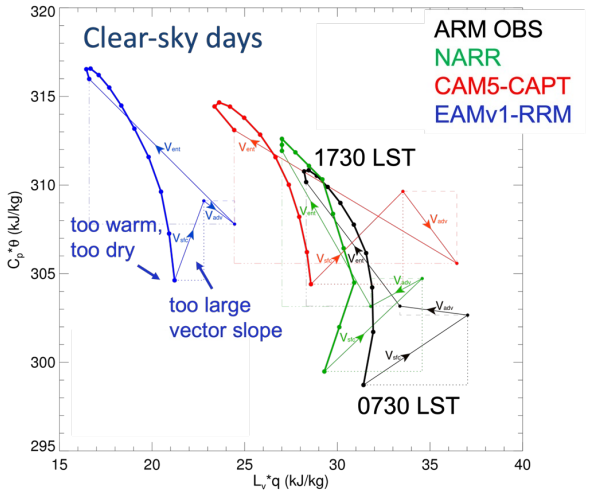
ARM-DIAGS version 4.0 (ongoing):

- Basic diagnostics sets: diurnal evolution of θ, q, PBL height, and the fluxes of heat and moisture.
- Process-oriented diagnostics sets: mixing diagrams, LCL deficits, relationship of evaporative fraction (EF) vs. soil moisture, etc.
- Observational data assembled from: VARANAL, ARMBE, PBLHT, LSSONDE and other VAPs.

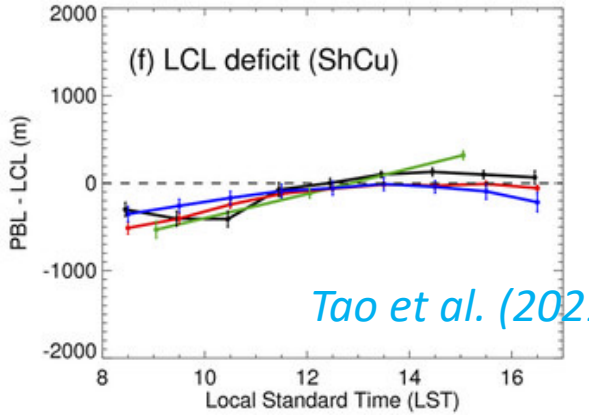
Outreach activities:

- Use ARM-Diags routinely in the **E3SM atmosphere model (EAM)** development.
- Engage ARM-Diags in GFDL and NCAR model development through **NOAA's MDTF project**.

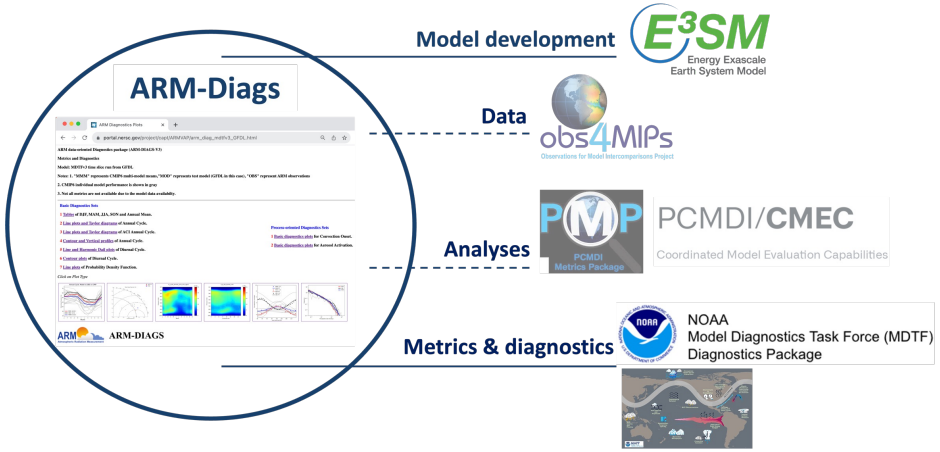
Mixing diagrams



LCL deficits (PBL minus LCL)



Tao et al. (2021)



Contact: Cheng Tao, LLNL, tao4@llnl.gov

Questions?

Let’s know your data needs and we are here to support!

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More on ARM Translators

- **Translators actively engage with the climate community to promote:**
  i. Improved accessibility
  ii. Improved documentation and uncertainty estimates for ARM datasets
  iii. New support for data visualization and analyses
  iv. New modeling diagnostics or forward-instrument operator tools
  v. New model-observational hybrid activities
- **Translators prioritize efforts based on input from the communities including the ARM UEC, AMSG, CPMSG, Triennial Review, ASR WGs, ARM field campaign ST.**
  - Provide more timely AMF VAP production and formalizing of AMF VAP request processes in conjunction with ARM infrastructure leads and active AMF campaign Pis
  - Support for new instrumentation and capabilities (e.g., AOS, scanning radar and lidar)
  - Data quality and uncertainty
  - Improvements to product communication and accessibility

See the updated “ARM translator plan”, which will be available in November 2022