DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof. Reference herein to any social initiative (including but not limited to Diversity, Equity, and Inclusion (DEI); Community Benefits Plans (CBP); Justice 40; etc.) is made by the Author independent of any current requirement by the United States Government and does not constitute or imply endorsement, recommendation, or support by the United States Government or any agency thereof.

U.S. DEPARTMENT OF ENERGY | Office of Science

DOE/SC-ARM-25-032

Optical Particle Measurements during EPCAPE Field Campaign Report

M Petters

December 2025

ARM

DISCLAIMER

DOE/SC-ARM-25-032

Optical Particle Measurements during EPCAPE Field Campaign Report

M Petters, University of California, Riverside

December 2025

How to cite this document:

Petters, M. 2025. Optical Particle Measurements during EPCAPE Field Campaign Report. U.S. Department of Energy, Atmospheric Radiation Measurement User Facility, Richland, Washington. DOE/SC-ARM-25-032.

Work supported by the U.S. Department of Energy,
Office of Science, Office of Biological and Environmental Research

Acronyms and Abbreviations

AMF1	first ARM Mobile Facility
AOS	Aerosol Observing System
APS	aerodynamic particle sizer
ARM	Atmospheric Radiation Measurement
DOE	U.S. Department of Energy
EPCAPE	Eastern Pacific Cloud Aerosol Precipitation Experiment
MAE	mean absolute error
OPC	optical particle counter
SMPS	scanning mobility particle sizer
TRACER	Tracking Aerosol Convection Interaction Experiment

Contents

Figures

1.0 Summary

This campaign requested the deployment of the U.S. Department of Energy (DOE) Atmospheric Radiation Measurement (ARM) User Facility optical particle counter (OPC) at the first ARM Mobile Facility (AMF1) located at the Scripps Pier in La Jolla, California during the Eastern Pacific Cloud Aerosol Precipitation Experiment (EPCAPE). The addition of the OPC was requested for two reasons.

(1) Close the gap between the scanning mobility particle sizer (SMPS) and aerodynamic particle sizer (APS) size distribution from the Aerosol Observing System (AOS) measurements.

(2) Principal investigator Petters has been working with Tracking Aerosol Convection Interaction Experiment (TRACER) data to compute particle fluxes from Doppler lidar (Petters et al. 2024). Briefly, backscatter flux is obtained using the eddy covariance technique using the Doppler vertical velocity and attenuated backscatter. Building upon prior studies, we were able to relate backscatter to particle number concentration by calibrating the lidar retrievals against optical particle counter-measured ground-based aerosol size distribution and radiosonde-interpolated relative humidity at lidar sample height. Performing similar analysis was of interest to EPCAPE to better understand the emissions and vertical transport of large particles into the overlying stratus clouds. However, as stated above, this analysis requires an optical size distribution that covers the 0.3-30-µm-diameter size range.

The OPC was deployed between 2023-04-14 and 2024-02-14. The deployment, data quality analysis, and data archiving was handled by the DOE ARM instrument mentor team without additional involvement by the principal investigator. Data quality was marked as “routine” for the majority of the campaign.

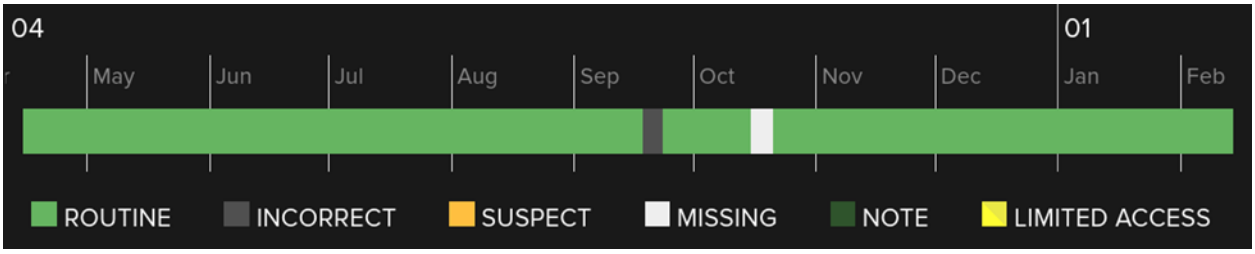

Figure 1. Data timeline and quality for the OPC polled from the ARM Data Discovery tool.

2.0 Results

The data were used to support computation of particle fluxes using a combination of Doppler lidar and OPC data (Pujiastuti et al. 2025). This work includes a comparison of aerosol number concentration calculated at 105 m above the surface based on the Doppler lidar retrieved backscatter signal and the OPC measurement derived number concentration at the surface. The comparison showed a strong correlation ($R^2 = 0.76$) and mean absolute error (MAE) = 1.44 cm^{-3} between the Mie theory calculations and OPC measurements. The main result from Pujiastuti et al. (2025) is the estimated sea-spray production flux for a number of case studies during EPCAPE. These fluxes ranged from 0.20 to 1.53 $cm^{-2}\ s^{-1}$, with wind speeds varying between ~4.5 and ~6 m s^{-1}.

3.0 Publications and References

Petters, MD, T Pujiastuti, A Rasheeda Satheesh, S Kasparoglu, B Sutherland, and N Meskhidze. 2024. "Wind-driven emissions of coarse-mode particles in an urban environment." *Atmospheric Chemistry and Physics* 24(1): 745–762, https://doi.org/10.5194/acp-24-745-2024

Pujiastuti, TT, N Meskhidze, and MD Petters. 2025. "Sea spray aerosol production flux retrieval based on Doppler lidar measurements." *Atmospheric Environment* 360: 121407, https://doi.org/10.1016/j.atmosenv.2025.121407

www.arm.gov

U.S. DEPARTMENT OF
ENERGY

Office of Science