

Title: Workshop on Evaluation of Cloud Probe Processing Software  
Date: July 12-13, 2024 (Precedes International Conference on Clouds and Precipitation)  
Venue: National Institute for Meteorological Sciences (NIMS), 33 Seohobukro, Seogwiposi, Jeju, South Korea  
Sponsor: International Commission on Clouds and Precipitation (ICCP)  
Co-Sponsor: IUGG  
Organizer: Greg McFarquhar (mcfarq@ou.edu)  
Local Sponsor: Joo Wan Cha ([jwcha@korea.kr](mailto:jwcha@korea.kr))

### Scientific objective and scope of the meeting

The motivation for the meeting is to aid in the development, interpretation, evaluation and standardization of software packages that process data obtained by optical array probes. Optical array probes are the most common type of in-situ cloud probe used on aircraft to derive cloud microphysical properties (e.g., size distributions, total number concentrations, extinction and mass content). The derivation of products from such probes involves decompression of packed data that provides information on the timing of particles arriving in a sample volume and the shadowing of diodes in array attached to a fast response electronics. The derivation of products is complicated by many issues such as the need for corrections for out of focus particles, elimination of artifacts generated by shattering of large particles on probe tips, removal of fogged and blocked pixels in the photodiode array, resizing of particles not in the entire field of view, removal of corrupt images and noise, and determination of the probe depth of field and overload period.

Several software packages and processing algorithms have been developed by different groups around the world to generate geophysical parameters from optical array probe data. Previous workshops have been conducted to intercompare products from different algorithms, including the 2014 Data Analysis Workshop in Boston, Massachusetts, the 2016 Workshop on Data Processing, Analysis and Presentation Software in Manchester, United Kingdom, the 2017 Training Workshop on Processing of Cloud Particle Measurements in Oberpfaffenhofen, Germany, and the 2018 Workshop on Evaluation of Cloud Probe Processing Software in Vancouver, Canada. This additional workshop is needed to identify the causes of these discrepancies and to develop a methodology for either standardizing the processing software or for determining benchmark standards which can be used to evaluate different software packages or processing algorithms.

Prior to the workshop, a synthetic dataset will be generated that produces a binary data simulating data generated by OAPs that includes all aspects of OAP performance and operation (optical model, electronic delay, discretization model, particle timing

information, airspeed, array clocking speed, raw data compression and encoding). Particles are randomly placed in the three-dimensional sample volume for a probe with a given number of diodes, arm spacing, diode resolution and diode response characteristics). Although synthetic datasets for testing probe performance have been previously generated, the new synthetic dataset for this workshop will be more realistic in terms of probe response and particle shapes/habits/spacing than previously available. Groups participating in the workshop will generate size distributions and bulk cloud parameters from the synthetic dataset, and plots generating comparisons of the derived parameters will be produced before the meeting so that meeting time can be devoted to discussions of reasons for the differences.

The audience for the meeting will include scientists responsible for the development and implementation of the different software packages, as well as users of the software packages and early career scientists and students who are interested in the use of and analysis of optical array probe data in their studies. We anticipate that a report that discusses the most important processing algorithms and the proper implementation of them applied to cloud measurements, outlining the uncertainties in the processing algorithms will be produced after the workshop. In this way, we will help the cloud physics community move towards the development of community software for processing cloud probe measurements and move towards the establishment of a consensus on the optical way of processing cloud probe measurements.

## Preliminary Agenda

### **Friday July 12**

8:00 to 9:00 Arrival & Light Breakfast

9:00 to 9:15 Introduction and Workshop Goals, Greg McFarquhar

9:15 to 9:30 Synthetic Data Sets Used in Processing,

9:30 to 10:00 Processing Instructions Provided,

10:00 to 10:30 CIP/PIP Processing Comparison,

### **10:30 to 10:45 BREAK**

10:45 to 12:00 CIP/PIP Processing Comparison cont.,

### **12:00 to 13:00 CATERED LUNCH BREAK**

13:00 to 13:45 Time extrapolation methods & how to treat particles crossing boundaries discussion

13:45 to 14:30 2DS/HVPS Comparisons,

14:30 to 15:00 2DS/HVPS Comparison Discussion,

**15:00 to 15:30 BREAK**

15:30 to 16:15 Size Correction Discussions (out of focus and partially imaged particles)

16:15 to 16:45 2DS Processing Developments,

16:45 to 17:45 Holographic Data Processing,

17:45 to 18:00 Group Discussion and Goals for Tomorrow, McFarquhar/Baumgardner

**18:00 to 19:00 BREAK**

19:00 to 21:00 Group Dinner,

**Saturday July 13**

8:00 to 9:00 Arrival & Light Breakfast

9:00 to 9:45 Sample Area Determination, effective width and depth of field calculations discussion

9:45 to 10:30 Artifact Rejection Discussion

**10:30 to 10:45 BREAK**

10:45 to 11:30 Paper on 2D Data Algorithms and Analysis,

11:30 to 12:00 Algorithm Discussions: General

**12:00 to 13:00 CATERED LUNCH BREAK**

13:00 to 14:00 Steering Committee for Cloud Probe Software Evaluation and Standardization: Role, Responsibilities

14:00 to 15:00 Processes for Algorithm Endorsement and Best Practices

**15:00 to 15:30 BREAK**

15:30 to 16:00 Miscellaneous, Wrap-Up and Next Steps