

TITLE: BAMEX\_UIUC\_MICROPHYSICS

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## 1.0 DATA SET OVERVIEW

As part of BAMEX, the NOAA P-3 aircraft made extensive observations of the vertical variability of cloud microphysical properties in stratiform areas behind bow echoes. The NOAA P-3 flew 17 Lagrangian spiral descents through horizontally extensive stratiform areas, flying circles of about 5 km radius in storm relative coordinates so that a constant distance from the leading convective line was maintained. For the first spirals, the P-3 descended at approximately 1 m/s above the melting layer and approximately 5 m/s below the melting layer to match the expected fall speeds of hydrometeors in order to trace the evolution of the same population of particles. To increase the number of spirals and to reduce problems associated with aircraft charging, the descent rate above the melting layer was increased to 5 m/s for spirals flown during the second half of the project.

Time period covered by data: May 2003 to July 2003

Physical location: Coordinates of NOAA P-3 taking data are included in state parameter file

## 2.0 INSTRUMENT DESCRIPTION

The NOAA P-3 was equipped with a two-dimensional cloud probe (2DC), nominally sizing particles between 50 and 1600 micrometers and a two-dimensional precipitation probe (2DP) sizing between 200 and 6400 micrometers. The probes are standard optical array probes produced by Particle Measuring Systems (PMS). For probe operation, a laser beam illuminates an array of photodiode detectors and when a particle falls through the beam, a number of photodiode detectors are occulted. Because the photodiodes are connected to fast response electronics, multiple images are recorded as the particles pass through the field of view, hence giving a two-dimensional picture of the hydrometeor that can be used to derive its size and shape. Raw data are available from other sections on the archive. In order to accommodate users who may not be familiar with data structures and formats of optical array probe data, the UIUC group is making their calculations of hydrometeor size distributions available for others to use.

### 3.0 DATA COLLECTION AND PROCESSING

Although data were continuously collected during all NOAA P-3 flights, only data from the spiral descents/ascents are included in this data file (additional times will be processed if requested from Greg McFarquhar). The data were processed using software designed at NCAR (W. Hall et al.) and modified at Illinois to accommodate the P-3 data structures. Quality control procedures are followed in this routine to remove particles with stuck bits and bad timing words; in addition, all images are visually inspected to remove time periods where image problems not detected by the automatic algorithms occur (e.g., streakers). Although there are no other instruments to compare against these data, the 2DC and 2DP size distributions agree remarkably well in the overlap region of approximately 1200 micrometers.

### 4.0 DATA FORMAT

For each spiral descent in the stratiform cloud layer, two files are included.

IOP##\_hhmm\_hhmm.image

IOP##\_hhmm\_hhmm.spectra

where ## represents the IOP # during which the spiral descent was made, the first hhmm represents the UTC time where the spiral descent began and the second hhmm represents the time where the spiral descent ended.

The \*.image file is a gmeta file generated by NCAR graphics program and can be read with the "idt" program available with that package. In this file, several image strips are included. Each image strip corresponds to one buffer of data recorded by either the 2DC or 2DP (as indicated on top of page). For the indicated time of the buffer, each strip records the photodiodes that are occulted during the measurement of each hydrometeor. Orange images are those rejected by the processing program because of various criteria (i.e., too large, particle interarrival times do not add to total time of record, etc.) and blue images indicate those that are accepted. Information at the top of each bar gives the time of the image, the true air speed, the time elapsed during the record, the measured particle interarrival times the total number of particles accepted and rejected and the estimated concentration.

The \*.spectra file gives an ASCII file of the size distributions computed from the processing routine, where the size distributions are averaged over a 60 second processing period. In order, this file lists the NOAA data file processed, the 2DC bin limits, the number of area ratios for the 2DC, the 2DP bin limits and the number of 2DP area ratios (typically 10, going from 0.0-0.1 to 0.9-1.0). Following this header, the concentrations for each diameter/area ratio bin are given in number of particles per cubic centimeter. For each probe, 10 lines follow the time giving the number concentration for the different bin sizes (starting at smallest area ratio bins, i.e., first line for area ratio 0.0-0.1, second line for 0.1-0.2, and last line for 0.9-1.0).

### 5.0 DATA REMARKS

Other than the June 22, 2003 flight, when the 2DP did not work, both probes worked on all days. Although clear-air updating and stuck bits were occasionally observed on some flights, the probes functioned well.

Because interpretation of data from the 2DC/2DP probes is not straightforward, anyone wishing to use these data is strongly encouraged to talk to Dr. McFarquhar before using these data in a study.