RICO 2D-S C-130 Data Archive READ ME

19 November 2008

2D-S images were accepted or rejected according to rather complex algorithms to eliminate the effects of noisy diodes and the effects of particles shattering on the probe tips. Noisy diodes are primarily identified by comparing the number of slices that are shaded for each diode. Shattering is primarily identified as images that are too closely spaced. However, some image analysis methods are also used for both cases. Contact SPEC Brad Baker (brad@specinc.com) for details regarding those algorithms.

Accepted images are used to estimate size distributions according to a number of different methods, which we call M1, M2, M4, and M6. M1 sizes the images according to the number of slices, i.e. the size in the direction of motion perpendicular to the array, and uses all the accepted images. M2 sizes the images along the array and uses only accepted images that also do not occult an edge diode (i.e. all in). M4 is M2 with the additional step of estimating corrected sizes according to the amount of white and dark (occulted) image areas following Korolev et al. (1998) and Korolev (2007). The corrections are due to diffraction effects of out of focus images, which are the majority of images. M6 addresses the correction another way. M6 used only in-focus images (i.e. the image white area is less than 10% of the total area) and sizes those according to M2 for bins smaller than 265 μm and according to M1 for bins larger than 325 μm. For the three bins between 265 and 325 μm, the average of those two methods is used. Methods M4 and M6 are archived. M4 has the advantage of better sampling statistics while M6 has the advantages of more direct sizing and reaching larger sizes.

The archive files are 1 Hz. The first column is the time mark in seconds since midnight. The second column is the percentage of total images that were accepted for M4 processing, provided to give some indication of how many spurious effects were removed due to noisy diodes and/or shattering. Data corrupted during transfer from the probe to the data acquisition system can cause timing irregularities. A count of timing irregularities encountered during a given second (column 3) is included to indicate when data may be corrupt. This count is usually zero, if the count is high, the user should beware. The 4th column is the concentration found by summing over the M4 PSD. Extinction (column 5) is found by summing over the occulted area of all images accepted for M4 processing. Liquid Water Content (column 6) is found from the M4 accepted images assuming they are spheres of the specified diameter. Columns 7 – 9 provide some information on the sampling statistics of M4. They are the number of M4 accepted images in the following size ranges: < 50, 50 - 250, and > 250 respectively. The next 122 columns are the M4 PSD in 61 size bins as indicated in the header line followed by the M6 PSD in 61 bins as indicated in the header line. The next 3 columns are the M1 in-focus only PSD for the three bins where M1 and M2 were averaged to produce M6. The final 2 columns provide some sampling statistics for M6. They are the number of images accepted for M6 processing in the following two size ranges: < 265 and > 325.

File names follow the format ‘RF##_flightdate_2DS_channel_archivedate.txt’ where ## is the research flight number and channel represents one of the two independent arrays of the 2D-S, which are called H and V (for horizontal and vertical) even though for RICO they are both oriented at 45 degrees.

The H and V processed data usually agree. If they do not agree for some period, beware. Contact SPEC with the time period for advice on which array may be more accurate. SPEC has already removed some data, from the archive files, for poor functioning time periods that were discovered during processing. Poor and non-functioning periods are archived as 9.99E+09.

The program SPEC used to create the archive files (2DSview) is available upon request. It may be used to process data by other methods and at different resolutions and will display the particle images.

References

Korolev, A. V., J. W. Strapp and G. Isaac, 1998: Evaluation of the Accuracy of PMS Optical Array Probes. J. Atmos. Oceanic Technology, **15**, 708-720.

Korolev, A. V., 2007: Reconstruction of the sizes of spherical particles from their shadow images. Part 1: Theoretical considerations. *J. Atmos. Oceanic. Technol.*, **24**, 376–389.