

ARISTO 2016 2DS + BCPD instrument report

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Objectives:

The objectives for the deployment of the 2D-S and the BCPD during ARISTO 2016 were to (1) integrate a set of instruments that are fairly new to the scientific community, (2) evaluate and compare their performance against more mature instruments such as the RAF Fast 2DC and the RAF Cloud Droplet Probe (CDP), and (3) compare the 2D-S with the RAF 3V-CPI in conditions where shattering of cloud hydrometeors on probe surfaces occurs. The 2D-S has been requested for SOCRATES so it is important to integrate this instrument on RAF aircraft. The ideal sampling conditions for these instruments were to perform extended sampling in marine stratocumulus and in mixed phase clouds.

Methodology:

The 2D-S (Stereo) probe is an optical array probe (OAP) that captures two-dimensional images of particles passing through the sample volume where laser beams overlap. The 2D-S measures the size distribution of particles in the diameter range of 10 to 1280 μm which overlaps with the range of the Fast 2DC and the 3V-CPI. The Backscatter Cloud Probe with Polarization Detection (BCPD) measures cloud droplet size distributions in the range 2 to 50 μm , which are then used to derive the total number concentrations and liquid water content (LWC). The BCPD overlaps in range with the CDP, and the BCPD LWC can also be compared with the RAF King LWC sensor.

Outcomes:

ARISTO presented us with excellent opportunities for testing the performance of the 2DS and the BCPD in marine and continental clouds. We were successful in getting data in water only clouds and mixed phase clouds. We were not able to get data in ice only clouds. This couldn't have been accomplished with the C-130 as it does not have a high enough ceiling to sample ice clouds this time of year. The 2D-S and BCPD data are archived on <ftp://data.eol.ucar.edu/pub/incoming/aristo>. These data will be processed and comparisons made with the RAF instruments.

The specific flights that are of value:

- RF03: 6 cloud penetrations in continental cumulus down to a temperature $-6\text{ }^{\circ}\text{C}$
- RF05: 12 cloud penetrations in continental cumulus down to $-8\text{ }^{\circ}\text{C}$
- RF06: 25 mins in marine stratocumulus with variations in aircraft true air speed and 14 cloud penetrations in continental towering cumulus down to $-16\text{ }^{\circ}\text{C}$

In general, ARISTO 2016 was crucial in getting the data that we need in liquid and mixed phase clouds to evaluate the performance of the 2D-S and the BCPD. The 2D-S was a challenging integration but the outcome was successful. The BCPD was fairly easy to integrate. The challenge with the BCPD is to study airflow distortion effects at the sampling area. Initial results indicate that there is no airflow shadowing effect at the sampling area. The 2D-S data are currently being analyzed and compared with RAF probes.