ECLIPSE (2017) Project Manager Report
Judge

I.   Aircraft Payload and Layout

This report is written to provide documentation for data quality and instrumentation issues encountered during the experiment. The goal is to provide sufficient background information to assist data users when analyzing the project data set.

The report covers only the RAF supplied instrumentation on the GV and is organized into the following sections. Section II provides a general overview of the data collected and lists recurring problems, general limitations, and systematic biases in the standard RAF measurements.

Information on the processing algorithms used to produce the final dataset can be found at:
https://www.eol.ucar.edu/content/raf-bulletins

II.   General Data Notes

RAF staff have reviewed the data set for instrumentation problems. When an instrument has been found to be malfunctioning, specific time intervals are noted. In those instances the bad data intervals have been filled in the netCDF data files with the missing data code of -32767. In some cases a system will be out for an entire flight.

1.   Position and Altitude Data
The GPS operated well during ECLIPSE. Terrastar corrections were active on all flights. Data was collected at 20 Hz. The horizontal standard deviation was typically below 0.1 m. Vertical standard deviation was less than 0.2 m except during and following turns, where loss of GPS data quality is expected. These are represented in the GGxxx variables in the dataset.

2.   Three Dimensional Winds
Vertical wind has been optimized by applying calibration to the angle of attack, with the aim to achieve the mean vertical wind of zero. Angle of attack was calibrated using a linear model based on two predictors: the ratio of the vertical differential pressure (on the radome) to the dynamic pressure and the dynamic pressure alone. The model was fit to near-level legs, in clear sky conditions and with minimal roll. WIC is the variable for vertical wind during ECLIPSE. It is unreliable due to unknown issues, hence the variable is removed from the data. The reference horizontal wind variables are WDC and WSC. The GPS-Corrected Wind Vector, North component (VIC) and the GPS-Corrected Wind Vector, East Component (UIC) data look reasonable outside of the blank period (16:05Z-17:00Z).

3.   Pressure

Static pressure (PSF) on the GV is measured using a static port on the fuselage and then corrected (PSFC) using the angle of attack and dynamic pressure. This sensor worked well through the entire project and its measurements are the reference for ECLIPSE (PSX, PSXC). There are two measurements for dynamic pressure: a heated pitot tube on the fuselage (QCF) and the forward hole on the radome (QCR), which is unheated. Both are also corrected using the static pressure and angle of attack (QCFC and QCRC). Water can sometimes get into the radome tubing and cause poor measurements. QCF and QCFC are chosen as the reference raw and corrected dynamic pressures (QCX, QCXC). The corrected measurements from the pitot-static sensor mounted on the nose of the GV (QCTFC and PSTFC) track well with the traditional variables described above but are not used as the reference measurements here; their intent is to reduce the line length and resonance in the lines, which has not been found significant in the project.

4.   Ambient Temperature

Temperature measurements were made using heated sensors from Harco (ATH1 & ATH2). The temperature sensors tracked well throughout the project with the greatest differences of ~0.25C seen during high altitude cruise. The published reference temperature, ATX, is equal to ATH1.

5.   Humidity

Humidity is measured by two thermoelectric dew point sensors. These chilled mirror dew pointers (_DPL, _DPR) typically perform poorly in the flight profiles of the GV as they become very cold at high altitude and subsequently flood with condensation on descent into more humid lower atmosphere and take a long time to evaporate condensation and re-stabilize. There are also non-physical oscillations that occur occasionally in the chilled mirror sensors. DPL performed best and is used as the reference humidity measurement (DPX and EWX).