TITLE: VOCALS NCAR C-130 Cloud Condensation Nuclei Data

AUTHOR(S):

Name: Jeff Snider
Address: University of Wyoming, Dept of Atmospheric Science, Dept. 3038 1000 East University Avenue, Laramie, WY 82071, 307 766 2637
E-mail: jsnider@uwyo.edu

1.0 DATA SET OVERVIEW:

Introduction: VOCALS NCAR C-130 Cloud Condensation Nuclei Data
Time period covered by the data: With exception of RF11, all C-130 flights
Physical location: NCAR C-130
Data source if applicable (e.g., for operational data include agency): Not Applicable
WWW references:
http://www-das.uwyo.edu/~jsnider/snider_jaot_2006.pdf
http://www-das.uwyo.edu/~jsnider/snider_jgr_2003.pdf
http://www-das.uwyo.edu/~jsnider/ackerman_mwr_2009.pdf
http://www-das.uwyo.edu/~jsnider/snider_tellus_2000.pdf

2.0 INSTRUMENT DESCRIPTION:

Brief text:
Cloud condensation nuclei (CCN) are the particles that enable the formation of cloud droplets. Without these particles, many of the properties of clouds (e.g., the height of cloud base and sunlight light reflected by clouds) would be quite different. The University of Wyoming CCN instrument consists of a static thermal-gradient chamber and an optical detection system. An aerosol sample is drawn into the diffusion chamber, the chamber is isolated by closing two valves, the chamber becomes supersaturated with water vapor and the aerosol particles grow by condensation. Aerosol particles with a critical supersaturation less than the chamber supersaturation grow, reaching a size approximately 5 micrometer in less than 20 seconds. Laser light scattered from the cloud droplets is detected by a photocell and the photocell output signal is related to the concentration of nucleated cloud droplets by a calibration. It is common to refer to the process of cloud droplets forming on CCN as “activation.”

Figures (or links), if applicable:
Please see links to WWW references

Table of specifications (i.e., accuracy, precision, frequency, resolution, etc.): These are provided in the WWW references, particularly http://www-das.uwyo.edu/~jsnider/snider_jaot_2006.pdf

3.0 DATA COLLECTION AND PROCESSING:

Description of data collection:
Aerosol samples came into the C-130 via the University of Hawaii solid diffuser inlet. Four CCN data channels were recorded every second (1 Hz sampling) by the C-130 data system: top plate temperature, bottom-to-top plate temperature difference, photocell signal and instrument status. These signals are inputs to a data processing step (C:\jeff\ccn_vocals_5\pro\ ccn_processor_18.pro) and the output of the processing is a NetCDF file whose format is discussed below.

Description of derived parameters and processing techniques used:
CCN concentration is related to the maximum photocell signal via a calibration technique described in http://www-das.uwyo.edu/~jsnider/snider_jaot_2006.pdf

Description of quality control procedures:
CCN measurements associated with rain drop concentration greater than 1 per liter, or cloud droplet concentration greater than 10 per cubic centimeter are flagged as invalid. On 20100413, two additional quality control criteria were applied. The first is designed to eliminate data points associated with light scattering signals exceeding the upper-limit output of the photodetector (+10 V). The second eliminates measurement intervals affected by a sticky CCN sampling valve. Here is a listing of the eliminated time intervals (all times are UTC):

RF01 - None
RF02 - None
RF03 - None
RF04 - None
RF05 - None
RF06 - None
RF07 – 094000 to 095000
RF08 - None
RF09 - None
RF10 – 085000 to 091000; 093500 to 094500
RF11 – No data
RF12 – 172500 to 175300; 183200 to 184700; 191200 to 192400; 194900 and 202100; 204200 to 210000
RF13 – 135500 to 140500
RF14 – 131800 to 133000; 133500 to 143000; 143300 to 152500; 161700 to 162500; 171500 to 183400

Data intercomparisons, if applicable:
Comparison to cloud droplet number concentration, via a model which initializes with measurements of the CCN activation spectrum and vertical velocity.

4.0 DATA FORMAT:

Data file structure and file naming conventions (e.g., column delimited ASCII, NetCDF, GIF, JPEG, etc.):

NetCDF file

Data format and layout (i.e., description of header/data records, sample records):
Variables in the NetCDF file are:
t, time, seconds since start of day
s, CCN supersaturation, %
c, CCN concentration, particles per actual cubic centimeter
Please note: The value of “s” is what we call the "nominal supersaturation." The "actual supersaturation" is proportional to "s" but smaller: s_actual = s * 0.61. The nominal-actual relationship assumes a Koehler theory model. Please contact me about assumptions inherent to Koehler model, for example, if you are relating the CCN measurements to predicted CCN concentrations (from aerosol size spectra) or relating CCN activation spectra to cloud droplet number concentration.

List of parameters with units, sampling intervals, frequency, range:
The largest possible CCN sampling rate is two samples per minute.

Data version number and date:
20090812 and 20100413

Description of flags, codes used in the data, and definitions (i.e., good, questionable, missing, estimated, etc.):
Values in the NetCDF file have been quality assurance checked. The QC check occurs in the data processing step described above.

5.0 DATA REMARKS:

PI's assessment of the data (i.e., disclaimers, instrument problems, quality issues, etc.):
None at this time.

Missing data periods:
There is no CCN data for C-130 Flight RF11

Software compatibility (i.e., list of existing software to view/manipulate the data):
An IDL routine is provided here:

```
pro get_netcdf_ccn
;
nc_ccn_path_filename = 'C:\jeff\ccn_vocals_3\out\ccn1\RF01_CCN104.nc'
print, nc_ccn_path_filename
fid = ncdf_open (nc_ccn_path_filename, /nowrite)
;
cname      = 'c'
cattrib    = 'info'
get_attrib, nc_ccn_path_filename, cname, cattrib, my_return
```

```
print, string(my_return)
vidc = NCDF_VARID(fid, cname)
ncdf_varget, fid, vidc, ac
print, ac
;
sname       = 's'
sattrib     = 'info'
get_attrib, nc_ccn_path_filename, sname, sattrib, my_return
print, string(my_return)
vids = NCDF_VARID(fid, sname)
ncdf_varget, fid, vids, as
print, as
;
tname       = 't'
tattrib     = 'info'
get_attrib, nc_ccn_path_filename, tname, tattrib, my_return
print, string(my_return)
vidt = NCDF_VARID(fid, tname)
ncdf_varget, fid, vidt, at
print, at
;
end
;
;
pro get_attrib, nc_path_filename, my_var_name, my_attrib, my_return
 fptr   = ncdf_open(nc_path_filename, /nowrite)
 result = ncdf_inquire(fptr)
;
 for i = 0, result.nvars - 1 do begin
  result = ncdf_varinq(fptr, i)
  my_string = result.name
  for j = 0, result.natts - 1 do begin
   if strcmp(result.name, my_var_name, 9, /fold_case) then begin
    if strcmp(ncdf_attname(fptr, i, j), my_attrib, 9, /fold_case) then begin
     ncdf_attget, fptr, i, ncdf_attname(fptr, i, j), my_return
    endif
   endif
  endfor
 endfor
;
 ncdf_close, fptr
;
end
```

6.0 REFERENCES:

List of documents cited in this data set description:
Please see links to WWW references