

First version of AMMA Quality Controlled Driftsonde Data Set

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2. Driftsonde Dataset Overview

During AMMA in Africa, total 171 MIST sondes were dropped from eight driftsonde flights (see Fig. 1). There are total 124 good soundings (Fig. 2). The driftsondes were launched from Zinder, Africa and then slowly acrossed the Atlantic. All sondes except three were dropped from above 19.5 km (~60 hPa) (see Fig. 3). **Note that all soundings except seven do not contain any GPS altitude and wind data above 18 km.** D files were first re-generated by Dean Lauritsen from the raw binary sounding files. A series of quality-controlling procedures have been applied to the raw D files (see details in Section 4). The first version of QCed data (called as “QCv1”) is then produced. **Note that the QCv1 data do not contain any calculated pressure values. Only GPS altitude can be used as the vertical coordinate.**

3. Data format

The data are in our sounding ascii D-file format and have vertical resolution of half second. The naming convention for these files is "DRIFTX-yyyymmdd-hhmmss-YYY-QCv1.1", where “X” (1-8) is the flight number, yyyy = year, mm = month, hh = hour of the day GMT, mm = minute of the hour, ss = second of the hour, and “YYY” is the MIST serial number.

The data contain three parts, “header”, “prelaunch data”, “sonde data” and “tail” (see Fig. 4 for details). The header records consist of 5 lines that include the sonde ID, date and time, and also the column headers for the data. Detailed information about each sounding can be found in the “tail” (the last 19 lines). This information includes project name, launch time, sonde ID, pre-launch observations, site location and other information. The “LAU” line is the “launch detect” line, and the “AXX” and “PXX” lines contain the flight-level data and the data collected before dropping, respectively. The “SXX” lines are the sounding data and are the most relevant information to the users. The data records each contain sonde ID, GMT date and time, pressure, temperature, relative humidity, wind speed and direction, vertical velocity, balloon position, and both geopotential, GPS altitude and others (see Fig. 5). Figure 5 describes each column in details. **“RH1” (Column #8) should be used and is compensated using the substrate temperature when $T > -40^{\circ}\text{C}$ and the air temperature when $T \leq -40^{\circ}\text{C}$ since the substrate temperature sensor does not work at $T < -40^{\circ}\text{C}$. “RH0” is measured RH without temperature compensation, and “RH1” is compensated using the air temperature. RH is set to 0.01% if the compensated RH is less than 0%.**

4. Data Quality Control and Highlights

The following QC procedures have been applied to the raw D files:

- 1) **Remove “bad” soundings:** The “bad” soundings include sondes that were never launched (referred as “stuck” sondes, which stuck either inside or outside the Gondola), and soundings without GPS data at all (no GPS altitudes). Total “bad” soundings are 47 out of total 171; 85% of them are “stuck” sondes.
- 2) **Remove “bad” surface data points:** When the sondes hit the surface over land, they sometimes continued to collect data. The visual examination of all temperature data concludes that the temperatures are either missing due to broken temperature sensors, or spuriously too warm or cold. Figure 6 shows one example, where GPS altitudes stay relatively constant and the temperatures are too warm. Based on visual examination of each profile shown in Fig. 6, we identified the last reasonable data point on the ground and removed the data after that point.
- 3) **Remove bad data points in the flight:** Sometimes there are data outliers identified by looking at the profiles, such as bad GPS altitudes at about 300s after the sonde was launched in Fig. 6. These suspicious data points are discarded. **Note that RH profiles are not examined, so may still contain some suspicious data points.**
- 4) **Remove the data during the equilibrium period for soundings with GPS altitude data above 18 km:** After the sondes were launched from the gondola, it took some time (on the order of 20-30s depending on the sensor’s time constant) to reach equilibrium with the ambient environment. The data collected during this period do not represent the reality and should be removed. Figure 7 shows one example. This is not a problem for most of soundings since all soundings except three were dropped above 18 km and thus have no GPS altitude data during the equilibrium period. For soundings with GPS altitude and T/RH data during the equilibrium period, we removed the portion of data representing the equilibrium process.
- 5) **Replace missing temperature data with the substrate temperature data:** DRIFT3-20060902-121318-87.1 has no air temperature data at all for the entire profile (except on the ground). DRIFT8-20060917-000337-342.1 has a constant of -2.85°C air temperatures above ~ 6 km (see Fig. 8). For these two soundings, the substrate temperatures replace the air temperatures since the substrate T sensors were working properly. Note that the substrate T is colder than the air T by less than 1°C because of its slower response.

Note that in spite of these careful QC procedures, the data might still contain some suspicious data points. We strongly recommend the users to make their own judgment on further removing some data points and inform us for any systematic data problems.

All T, RH, and U/V wind profiles for all 124 soundings are shown in Fig. 9 to provide an overview of the data.

All driftsondes in AMMA (171)

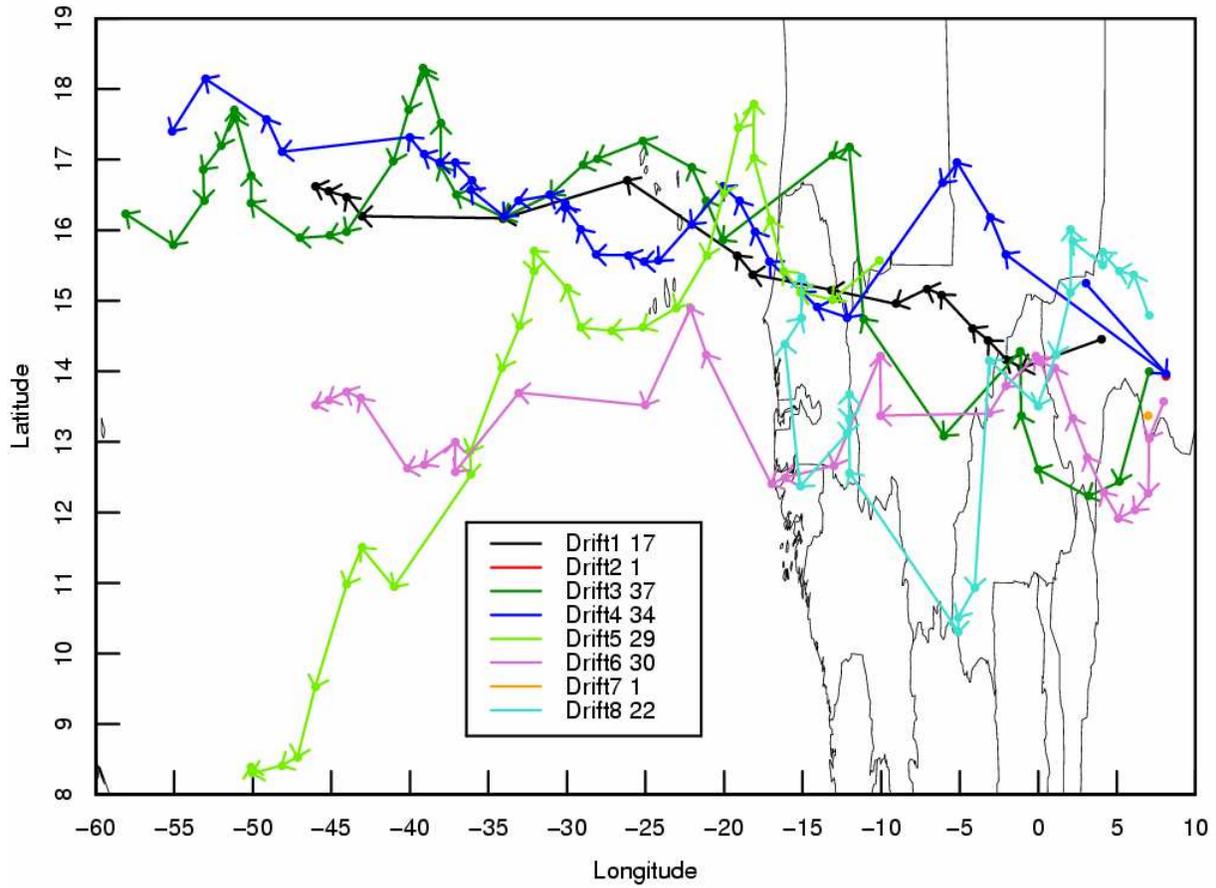


Figure 1. Locations of all MIST sondes from eight flights during AMMA. The arrows represent the drift directions of flights.

All good MIST sondes in AMMA (124)

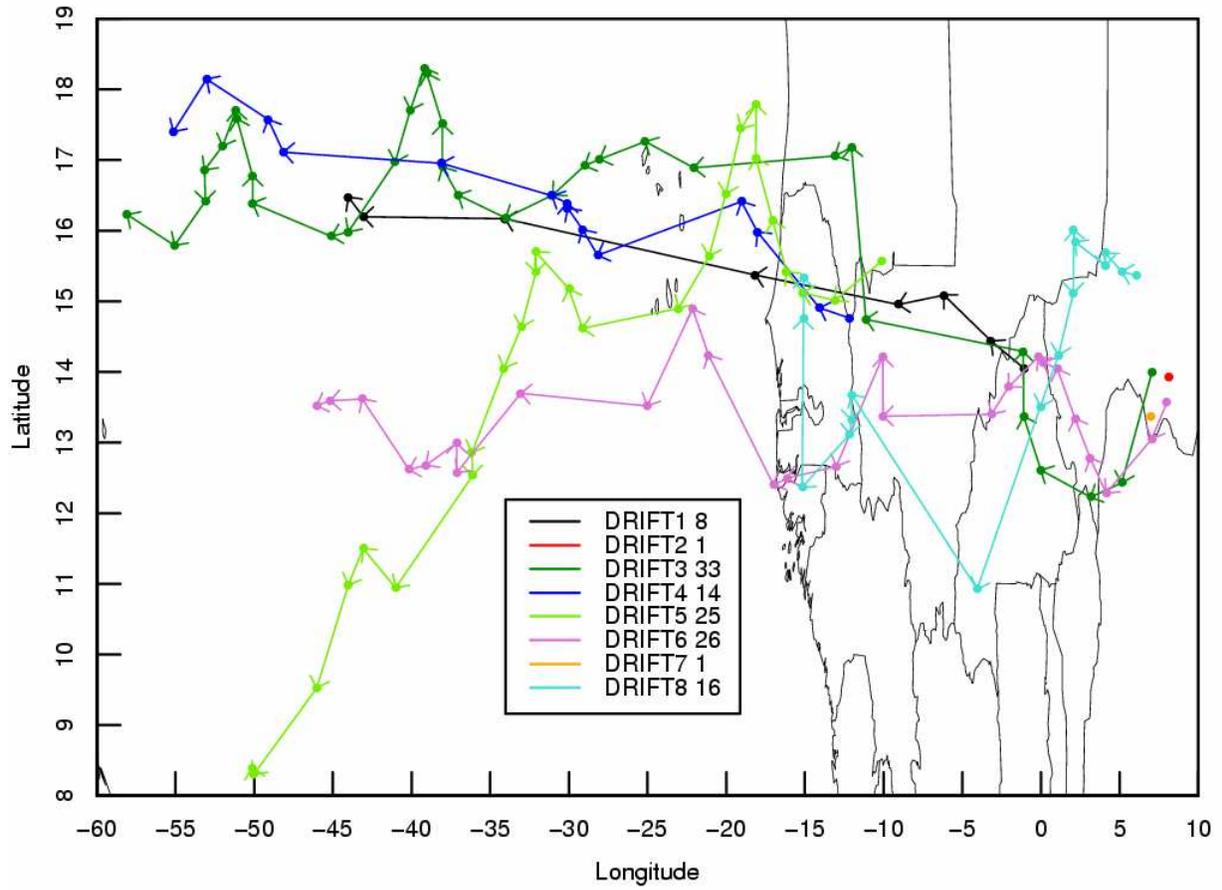


Figure 2. Locations of all good MIST sondes from eight flights during AMMA.

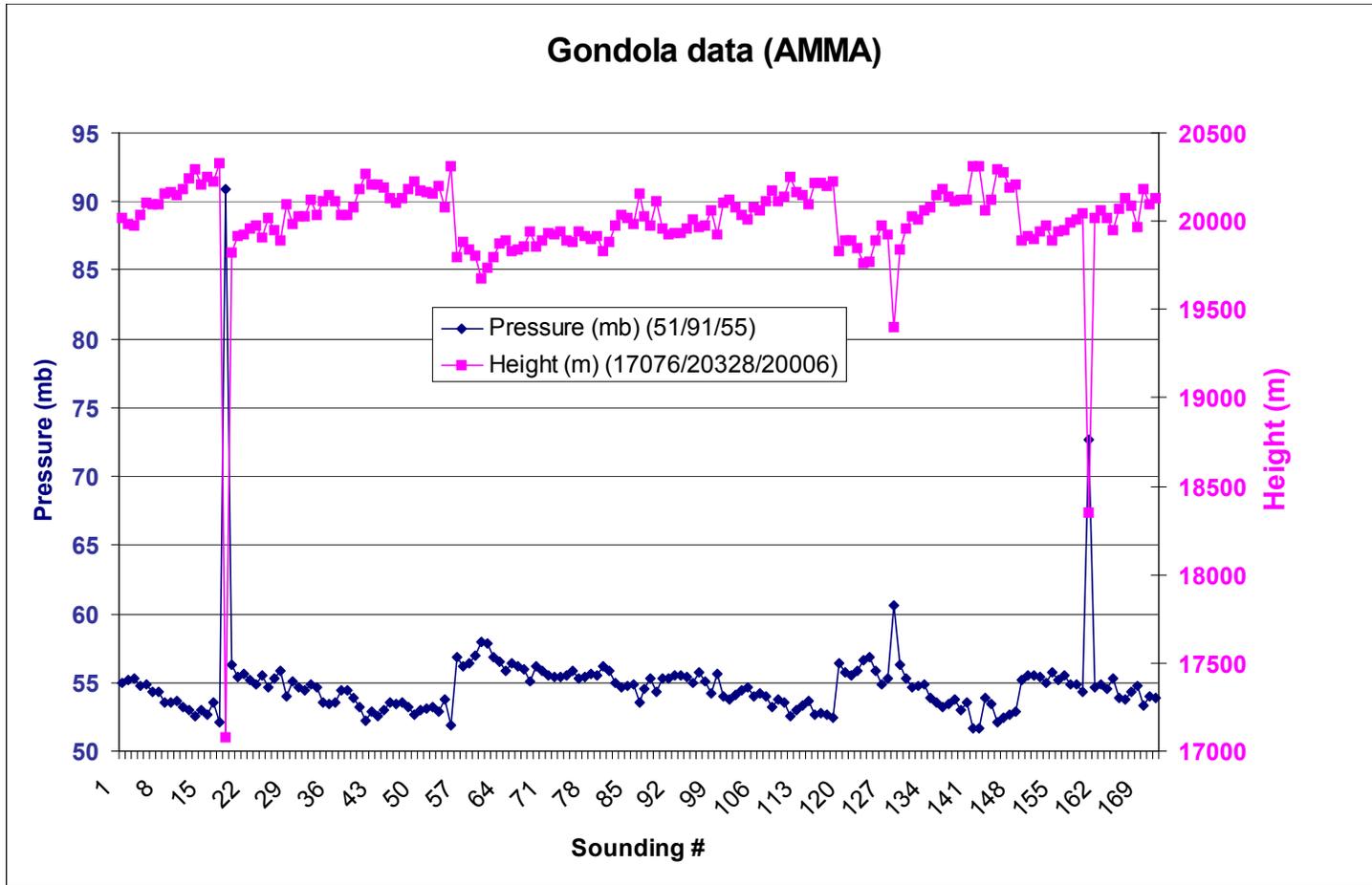


Figure 3. Gondola flight level altitudes (pink) and pressures (blue) for all 171 soundings. Maximum, minimum and median values are given in the legend.

D-file Format

Header (including LAU and AXX lines)

```
AVAPS-T01 STA 000000011 060829 100808.00
AVAPS-T01 COM      UTC      UTC
AVAPS-T01 COM      Sonde   Date   Time   Air   Air   RH1   Wind   Wind   Vert   GPS   GPS   Geopoten GPS   RH0   RH2   GPS Wind   GPS   SHT75   Sonde
AVAPS-T01 COM      ID     yymmdd hhmsss.ss (mb) (degC) (%) (deg) (m/s) (m/s) (deg) (deg) (m) Sat (%) (%) Sat (m/s) (m) (degC) (vdc)
-----
AVAPS-T01 LAU 000000011 060829 100808.00
AVAPS-D01 A11 000000000 060829 100808.00      55.23   5.80 999.00 999.00 999.00 999.00 -1.040370 14.046277      0.00   0 999.00 999.00   0 0.00 19980.40      0.00   0.0
```

Prelaunch data (PXX lines)

```
AVAPS-D01 P00 000000011 060829 100806.50 9999.00 -3.31 0.72 0.00 0.00 0.00 -1.539906 14.046246 99999.00 6 0.98 0.42 6 99.00 99999.00 11.89 0.0
AVAPS-D01 P00 000000011 060829 100807.00 9999.00 -3.21 0.72 0.00 0.00 0.00 -1.539982 14.046250 99999.00 6 0.98 0.42 6 99.00 99999.00 11.89 0.0
AVAPS-D01 P00 000000011 060829 100807.50 9999.00 -3.13 0.72 0.00 0.00 0.00 -1.540059 14.046253 99999.00 6 0.98 0.42 6 99.00 99999.00 11.89 0.0
```

Sonde data (SXX lines)

```
AVAPS-D01 S00 000000011 060829 100808.00 9999.00 -3.05 0.72 0.00 0.00 0.00 -1.540137 14.046259 99999.00 6 0.98 0.42 6 99.00 99999.00 11.94 0.0
AVAPS-D01 S00 000000011 060829 100808.50 9999.00 -2.99 0.72 0.00 0.00 0.00 -1.540211 14.046262 99999.00 6 0.98 0.42 6 99.00 99999.00 11.94 0.0
AVAPS-D01 S00 000000011 060829 100809.00 9999.00 -2.94 0.72 0.00 0.00 0.00 -1.540284 14.046266 99999.00 6 0.98 0.42 6 99.00 99999.00 11.94 0.0
AVAPS-D01 S00 000000011 060829 100809.50 9999.00 -2.90 0.72 0.00 0.00 0.00 -1.540359 14.046269 99999.00 6 0.98 0.42 6 99.00 99999.00 11.98 0.0
AVAPS-D01 S00 000000011 060829 100810.00 9999.00 -2.99 0.72 0.00 0.00 0.00 -1.540435 14.046274 99999.00 6 0.98 0.42 6 99.00 99999.00 11.98 0.0
AVAPS-D01 S00 000000011 060829 100810.50 9999.00 -3.10 0.72 0.00 0.00 0.00 -1.540513 14.046279 99999.00 6 0.98 0.42 6 99.00 99999.00 12.02 0.0
AVAPS-D01 S00 000000011 060829 100811.00 9999.00 -3.26 0.72 0.00 0.00 0.00 -1.540590 14.046284 99999.00 6 0.98 0.42 6 99.00 99999.00 12.02 0.0
AVAPS-D01 S00 000000011 060829 100811.50 9999.00 -3.47 0.72 0.00 0.00 0.00 -1.540662 14.046288 99999.00 6 0.98 0.41 6 99.00 99999.00 12.02 0.0
AVAPS-D01 S00 000000011 060829 100812.00 9999.00 -3.69 0.72 0.00 0.00 0.00 -1.540736 14.046291 99999.00 6 0.98 0.41 6 99.00 99999.00 12.02 0.0
AVAPS-D01 S00 000000011 060829 100812.50 9999.00 -3.77 0.64 0.00 0.00 0.00 -1.540812 14.046295 99999.00 6 0.90 0.33 6 99.00 99999.00 12.06 0.0
AVAPS-D01 S00 000000011 060829 100813.00 9999.00 -3.88 0.64 0.00 0.00 0.00 -1.540885 14.046300 99999.00 6 0.90 0.33 6 99.00 99999.00 12.06 0.0
```

Tail

```
AVAPS-T01 COM Data Type/Data Channel: DRIFTSONDE SOUNDING DATA, Channel 1
AVAPS-T01 COM Project Name/Mission ID: AMMA, DRIFT1
AVAPS-T01 COM Site Type/ID: Mobile, DRIFT1
AVAPS-T01 COM Launch Time (y,m,d,h,m,s): 2006/08/29, 10:08:08.00
AVAPS-T01 COM Sounding Name:
AVAPS-T01 COM Sonde ID/ID#/Type/Sensors: 11, 000000011, NCAR MIST, YSI 41A3P10 (temp); Sensirion SHT75 (rh); Ublox TIM-LF (gps wind)
AVAPS-T01 COM Sonde Frequency: 405.22 MHz
AVAPS-T01 COM Sonde Baseline Errors (p,t,h1,h2): 0.0 mb, 0.0 C, 0.0 %, 0.0 %
AVAPS-T01 COM Sonde Dynamic Errors (p,t,h): 0.0 mb, 0.0 C, 0.0 %
AVAPS-T01 COM Pre-launch Obs Data System/Time: Balloon Gondola, 10:08:08.00
AVAPS-T01 COM Pre-launch Obs (p,t,d,h): 55.2 mb, 5.8 C, 99.0 C, 999.0 %
AVAPS-T01 COM Pre-launch Obs (wd,ws): 999.0 deg, 999.0 m/s
AVAPS-T01 COM Pre-launch Obs (lon,lat,alt): -1.040370 deg, 14.046277 deg, 19980.4 m, ( 1 02.4222'W, 14 02.7766'N)
AVAPS-T01 COM Operator Name/Comments: Dean, This dataset was recomputed from the raw binary sounding file
AVAPS-T01 COM Standard Comments:
AVAPS-T01 VER
AVAPS-T01 FMT
AVAPS-T01 TOF 0.00 Met/Wind Offset: ptu data leads wind data by 0.00 sec
AVAPS-T01 END 000000011 070102 183428.41
```

Figure 4. Example of D-file format

Field No.	Parameter	Units	Missing Value
1	System Type	-----	-----
2	Data Flags*	-----	-----
3	Sonde ID	-----	-----
4	GMT Date	yymmdd	-----
5	GMT Time	hhmmss.ss	-----
6	Pressure	Millibars	99999.0
7	Dry-bulb Temp	Degrees C	99.00
8	Relative Humidity (RH1)	%	999.0
9	Wind Direction	Degrees	999.0
10	Wind Speed	m/s	999.0
11	Vertical Velocity	m/s	99.00
12	Longitude	Degrees	999.000000
13	Latitude	Degrees	99.000000
14	Geopoten Alt	Meters	99999.00
15	GPS Wnd Sat	-----	-----
16	Sonde RH0	%	999.00
17	Sonde RH2	%	999.00
18	GPS Snd Sat	-----	-----
19	Wind Error	m/s	99.0
20	GPS Altitude	Meters	99999.00
21	Substrate temperature	°C	99.00
22	Sonde battery voltage	vdc	99.00

Figure 5. Descriptions of each column in the D-file format.

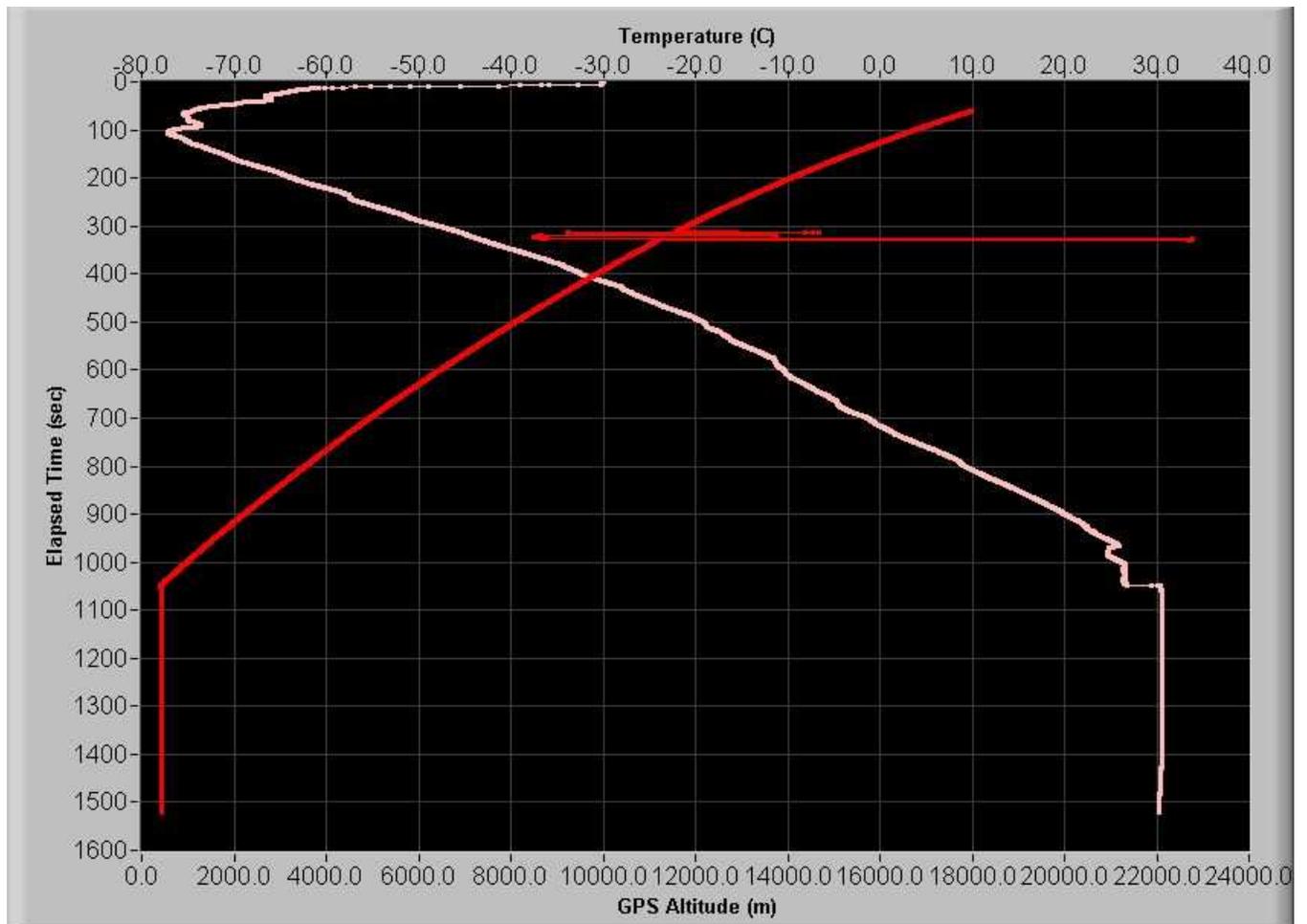


Fig. 6 The temperature (in pink) and GPS altitude (red) profiles as a function of elapsed time (s) for D3-20060901-235205-75-QCv1.1 with “bad” surface data.

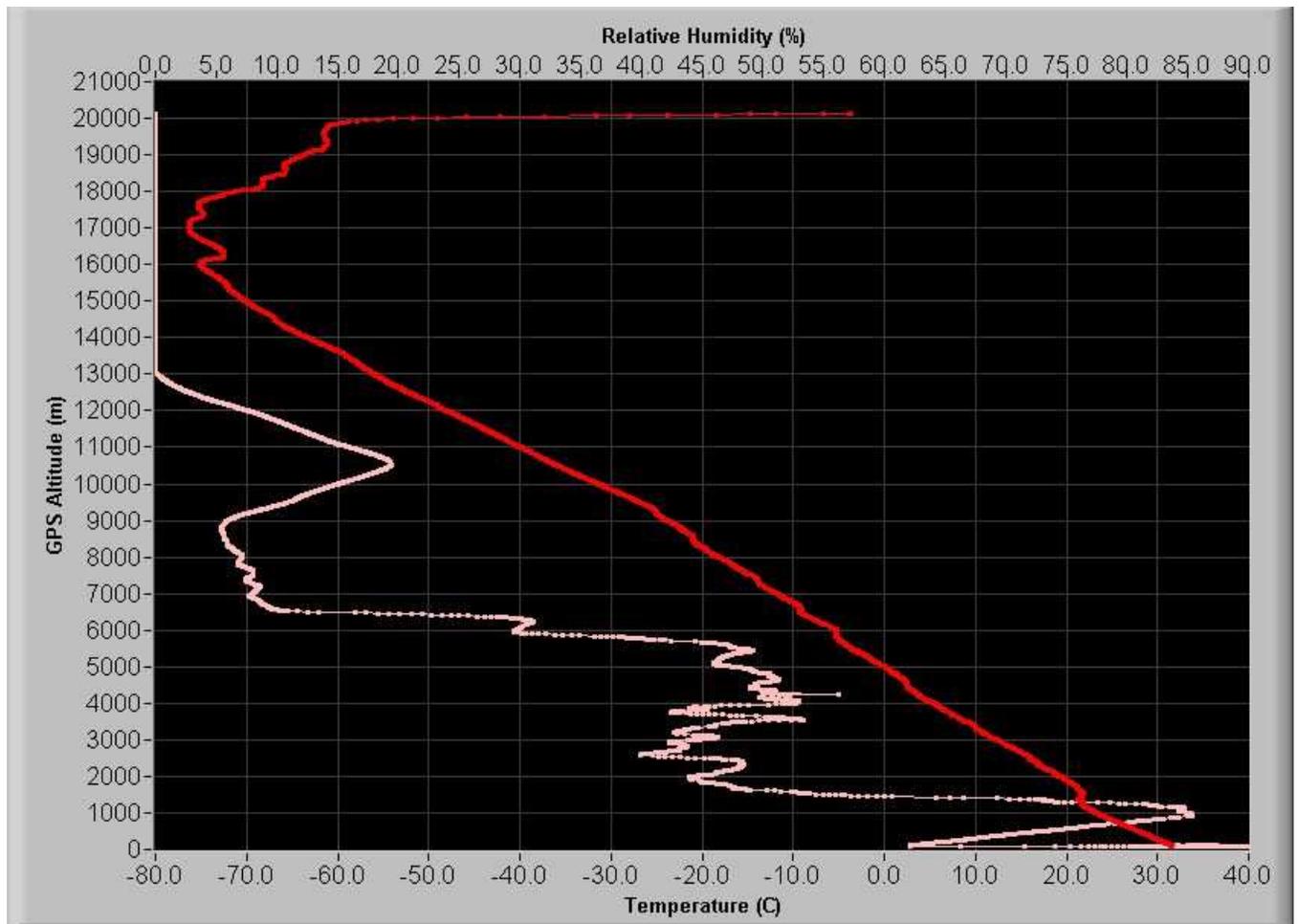


Figure 7. The temperature (red) and RH (pink) profiles as a function of GPS altitudes for D8-200060921-171958-372.1 with GPS altitude data available above 18 km.

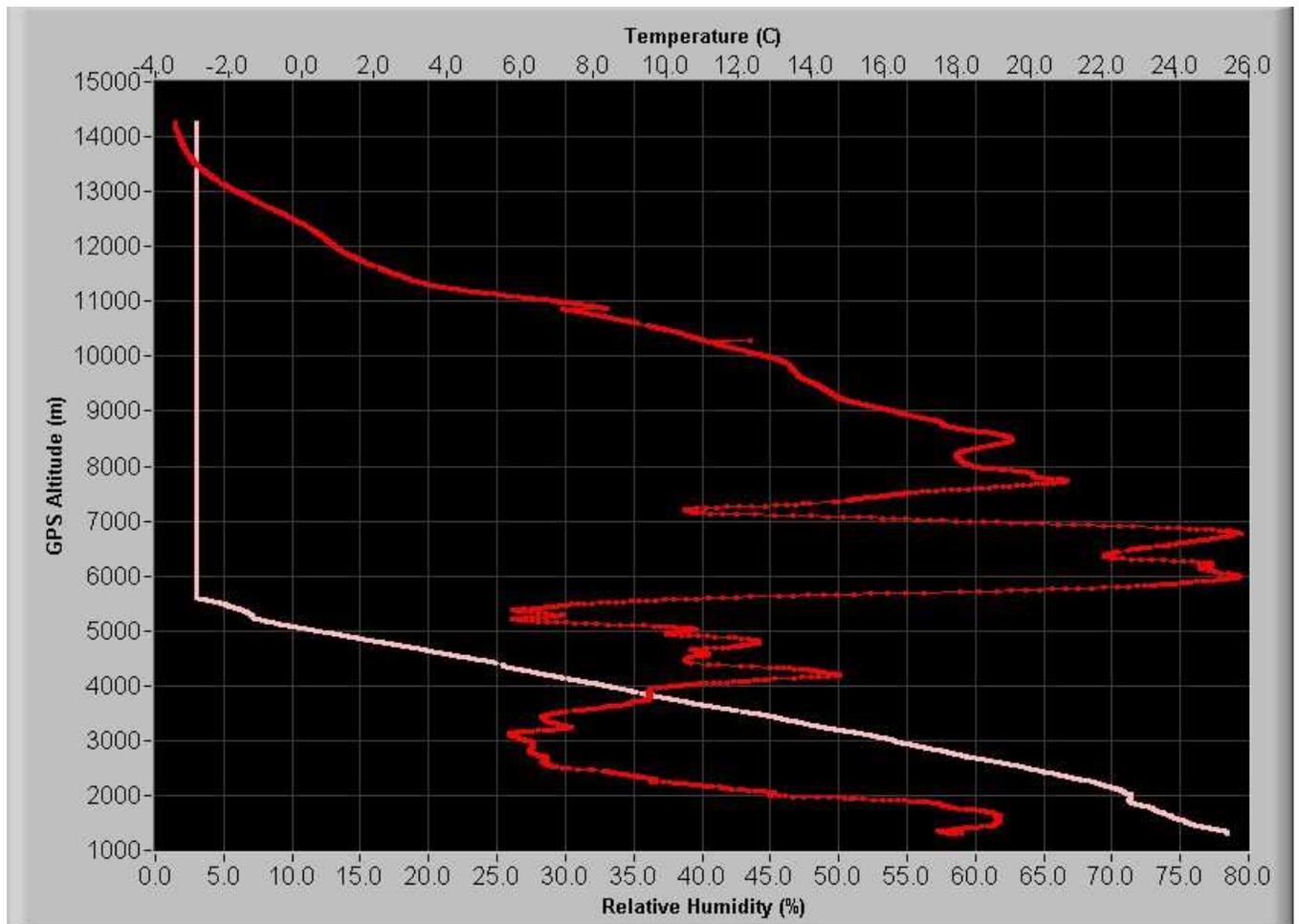
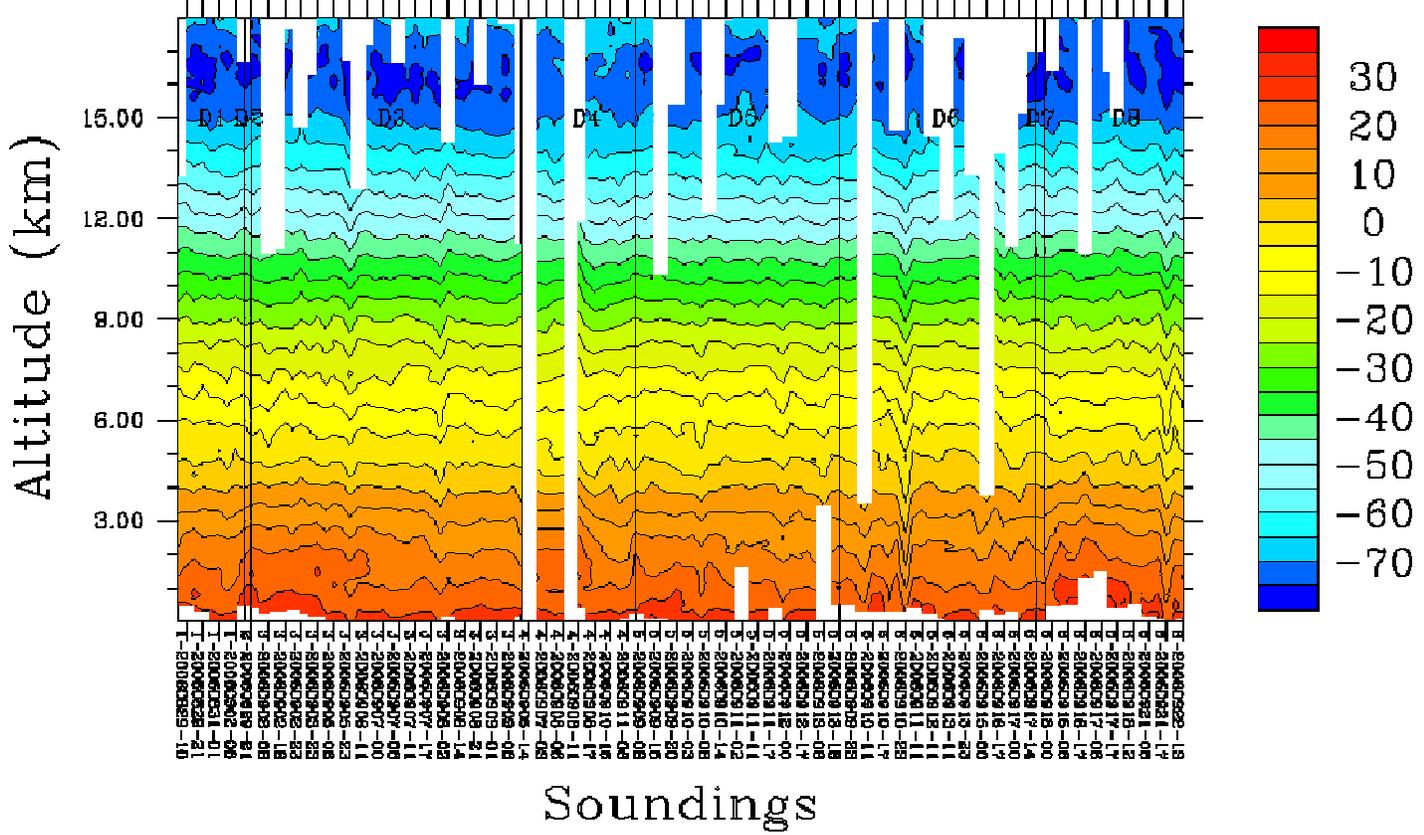
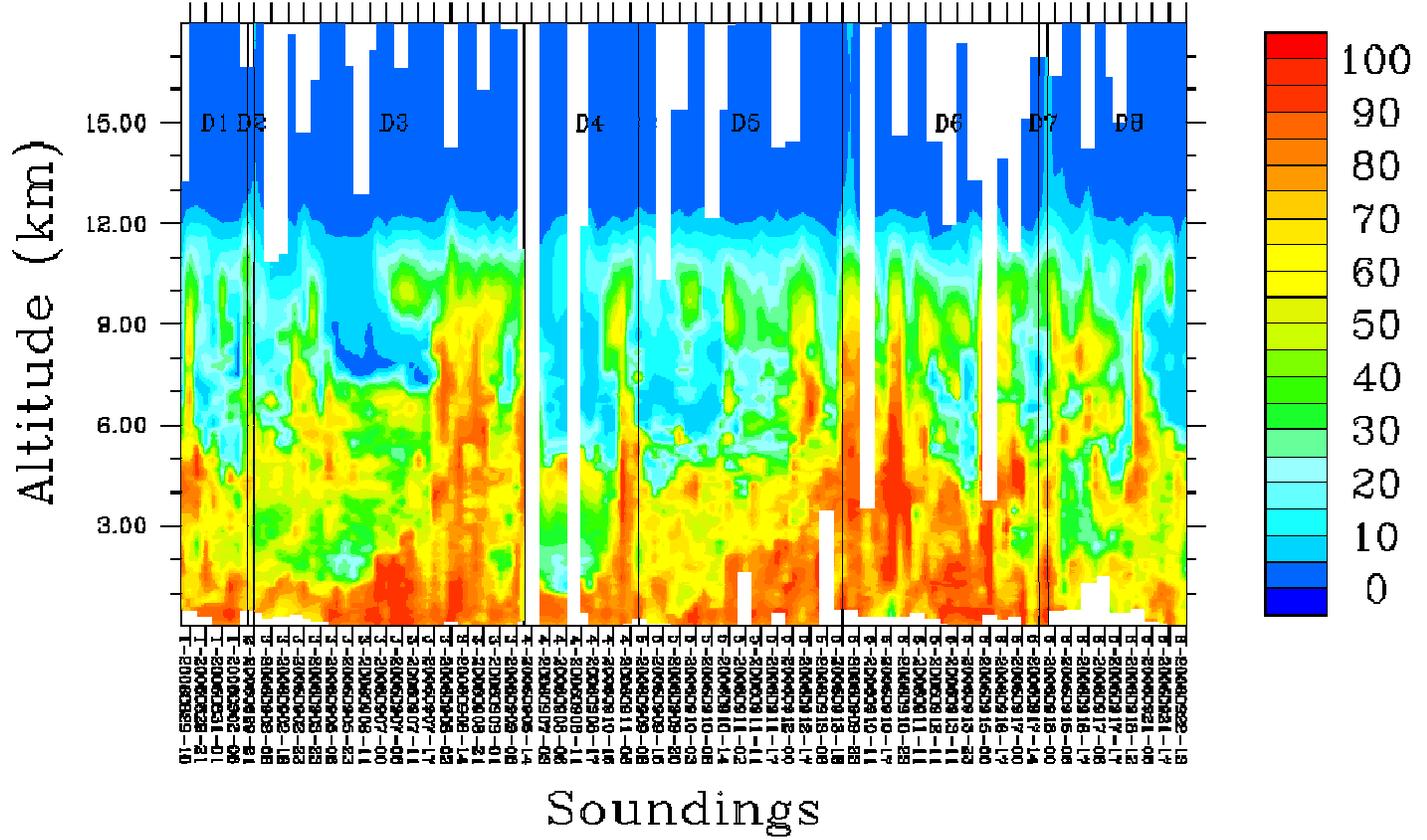


Fig. 8. Temperature (pink) and RH (red) profiles for D8-20060917-000337-342-QCv1.1 with a spurious “-2.85” temperature above ~5.5 km.

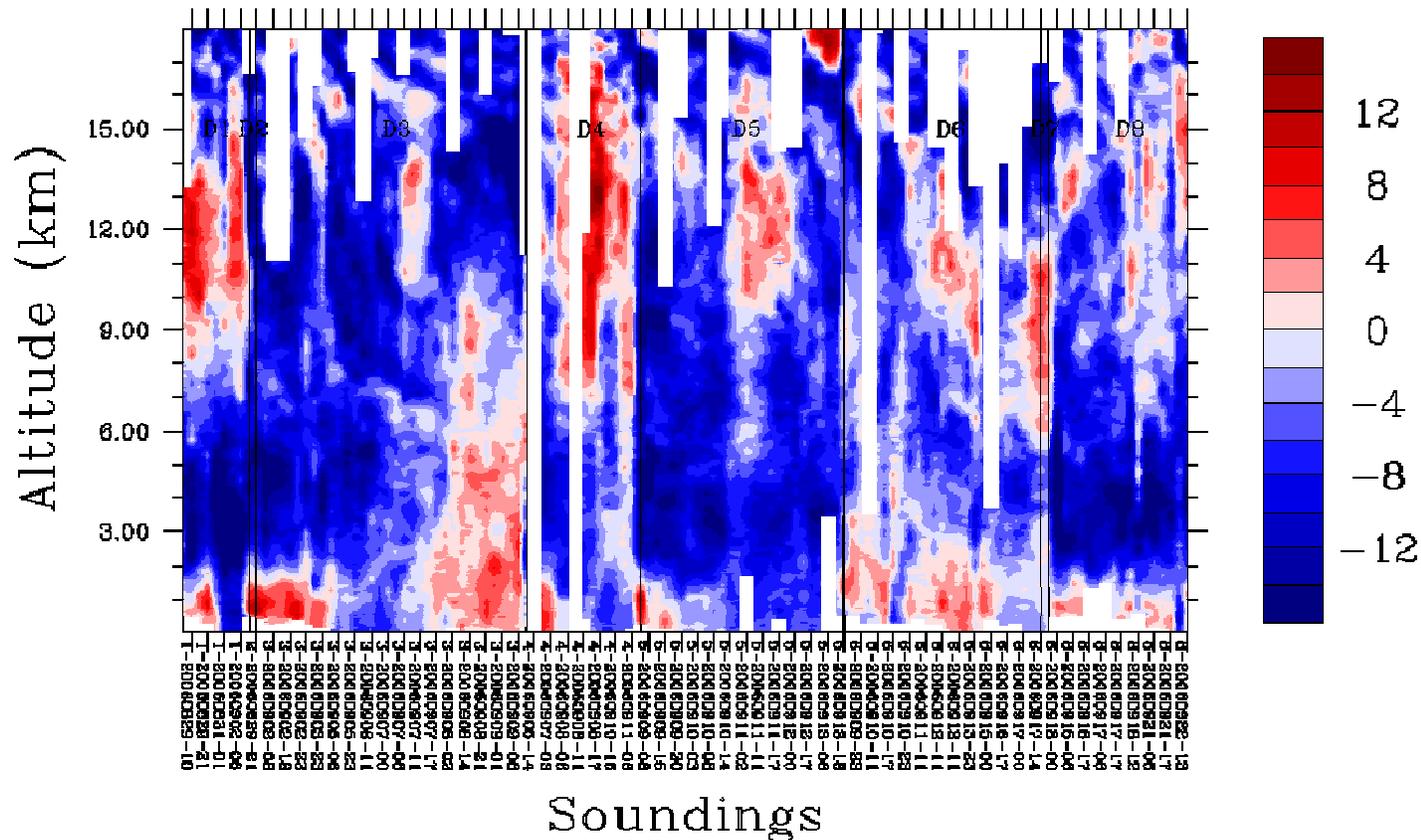
AMMA 2006 T (C)



AMMA 2006 RH (%)



AMMA 2006 U-wind (m/s)



AMMA 2006 V-wind (m/s)

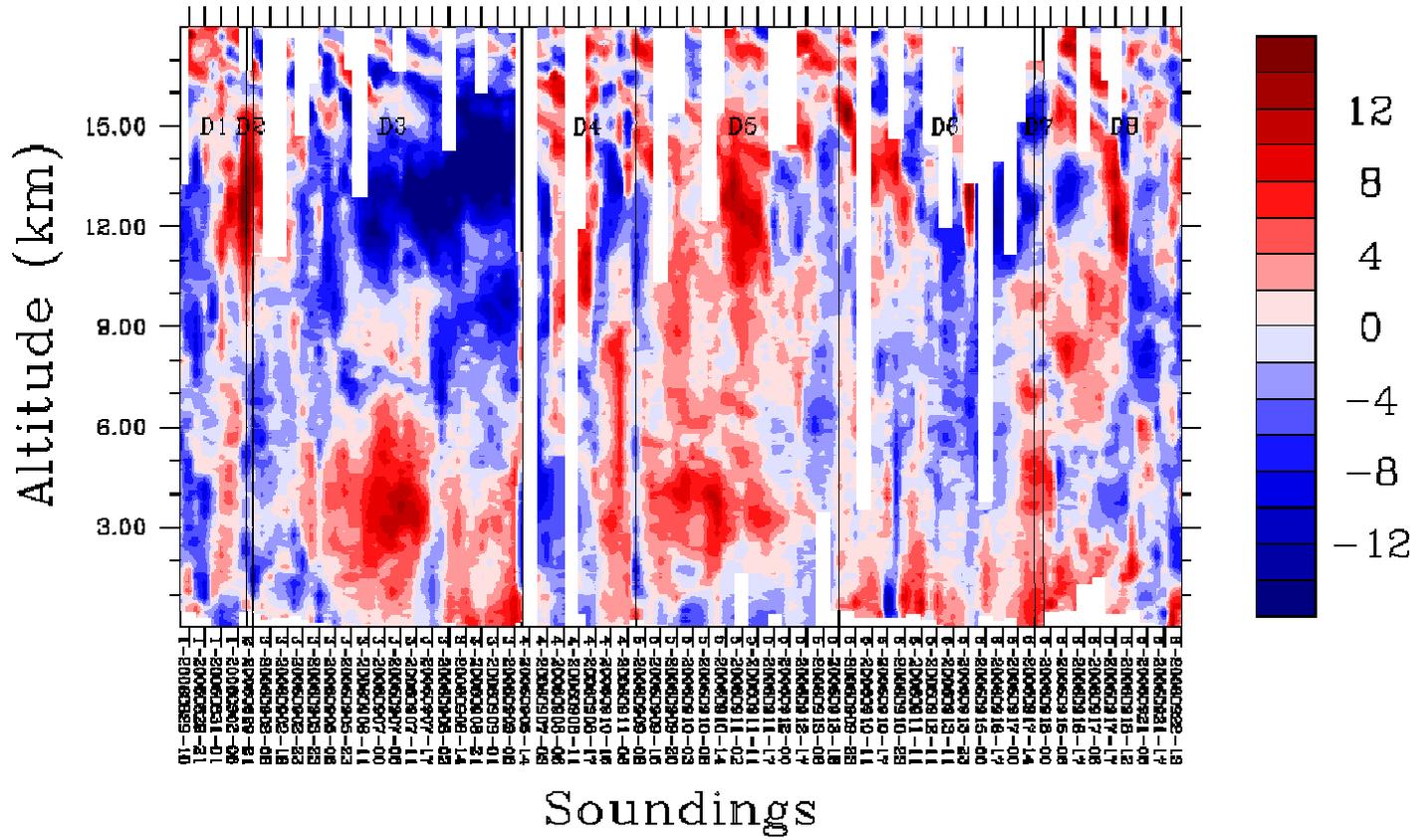


Figure 9. Profiles of T, RH, U-wind and V-wind profiles for all 124 soundings.