DEPARTMENTAL PROCEDURE	**AOC Science Section:** Standard Operating Procedure
PROCEDURE TITLE: GPS Dropwindsonde processing using the ASPEN software system.	**SUBJECT MATTER EXPERT:** Richard Henning
Effective Date:	Number: SCISEC
Revision: N/A	Originator: Richard Henning

Standard Operating Procedure for

1.0 TASK: Standardize AOC procedures for creating WMO TEMPDROP messages and other sounding analysis products using the ASPEN software package.

2.0 Purpose/Background: GPS Dropwindsondes (also called dropsondes or simply referred to as sondes) transmit vertical profiles of temperature, humidity, pressure, geopotential height, wind speed and wind direction via UHF radio to the AVAPS pallet onboard the aircraft from which it was launched. The AVAPS II dropsonde, as well as the AVAPS receiver and data processing system produced by Vaisala Corporation, are standard equipment across most US aircraft reconnaissance platforms: the NOAA AOC WP-3D and G-IV, 53rd WRS WC-130J, NASA DC-8 and NCAR G-V. A smaller AVAPS III sonde (also manufactured by Vaisala) is used by the NASA Global Hawk and ER-2. All dropsonde data collected by these platforms is processed by the onboard AVAPS system which outputs a raw D file (in a standard format) for each drop.

The D file is a tabular text file containing raw collected values for each parameter measured. For many years, Editsonde, a software package developed by HRD, was used on AOC aircraft to ingest the raw D file and generate the Quality Controlled WMO TEMPDROP message which would then be transmitted via SATCOM to users on the ground. ASPEN was a software package developed for the 53rd WRS by NCAR for the same purpose. During the past decade, NCAR developed a unified version of ASPEN that included all the functionality of Editsonde which could be used across all reconnaissance platforms.

3.0 Requirement: Using the ASPEN software package, the operator must be able to take a D file and create a valid WMO TEMPDROP message and be familiar with a variety of other ASPEN output products such as skew T log P plots and high resolution tabular files used by researchers.

4.0 Definitions/Abbreviations:

AAMPS	Airborne Atmospheric Measurement and Profiling System
ASPEN	Atmospheric Sounding Processing Environment
AVAPS	Airborne Vertical Atmospheric Profiling System
DROPSONDE	Shortened name for GPS Dropwindsonde
FD	Flight Director
HRD	Hurricane Research Division (part of AOML in Miami, FL)
LAN	Local Area Network
NCAR	National Center for Atmospheric Research (Boulder, CO)
OFCM	Office of the Federal Coordinator for Meteorological Services / Research
PTH	Pressure, temperature & humidity data (sometimes referred to as “PTU”)
SATCOM	Satellite Communications System
SEB	Science and Engineering Branch of AOC
SONDE	Shortened name for GPS Dropwindsonde
WMM	Weather Message Module
WSR	Pacific Winter Storm project (ie: WSR11 is the Winter Storm 2011 project)
WMO	World Meteorological Organization

5.0 References/Resources: This document as well as the Vaisala AVAPS User’s Manual, NCAR ASPEN User’s Manual and the OFCM Federal Meteorological Handbook #3 describing Rawinsonde and Pibal Observations

6.0 Scope/Responsibility: The AOC Flight Director (FD).

7.0 Procedures: The following provides a step-by-step procedure to process a raw dropsonde D file while flying onboard AOC P-3 or G-IV aircraft and generate a WMO TEMP DROP message for transmission, as well as creating and understanding other output products of ASPEN. A separate instruction policy discusses how to process sondes from a ground station. The primary difference between the two lies in how to obtain the D file from an aircraft flying a mission while on the ground. Once the D file is ingested into ASPEN, the methodology for processing it is the same whether on the ground or on the aircraft.

7.1 Using REMOTE AVAPS to follow the progress of a sonde

Dropsondes are launched by AOC Science and Engineering Branch (SEB) technicians using launch tubes located near the back of the cabin. On the P-3, the dropsonde launch tube is located across from the Main Cabin Door immediately behind Station 5. At this station you will find the receiver for the transmitted UHF signals coming up from the falling sonde. A computer at Station 5 ingests GPS position data 4 times per second. Using changes to position and Doppler effects in the GPS signal, an instantaneous calculation of wind direction and speed is derived every 0.25 seconds. Pressure, temperature and humidity data are transmitted and processed twice every second as the sonde falls, so a line of PTH data (also sometimes called PTU data) is created every 0.5 second. The AVAPS computer compiles the D file from these data sets.

Similarly, the sonde launch tube is in the rear of the cabin in the G-IV directly behind Station R5. The G-IV has two functionally identical AVAPS systems to receive and process the raw dropsonde data signal located at R5 and L5.

It is the job of the AVAPS technician to watch the incoming data and note any readily apparent abnormalities to the FD. Upon sonde splashdown, a loss of data is apparent to the AVAPS Operator. At that point, the technician “kills” the channel in which the data are being received. There are 8 AVAPS channels available to the operator (to allow for multiple sondes in the air transmitting data simultaneously). Once a sonde run is terminated by the operator the AVAPS computer automatically compiles the data into the D file. The FD also has the ability to follow the progress of falling sondes using the Remote AVAPS program loaded at the FD station. The program allows the FD to follow multiple sondes in the air simultaneously using different AVAPS channels.

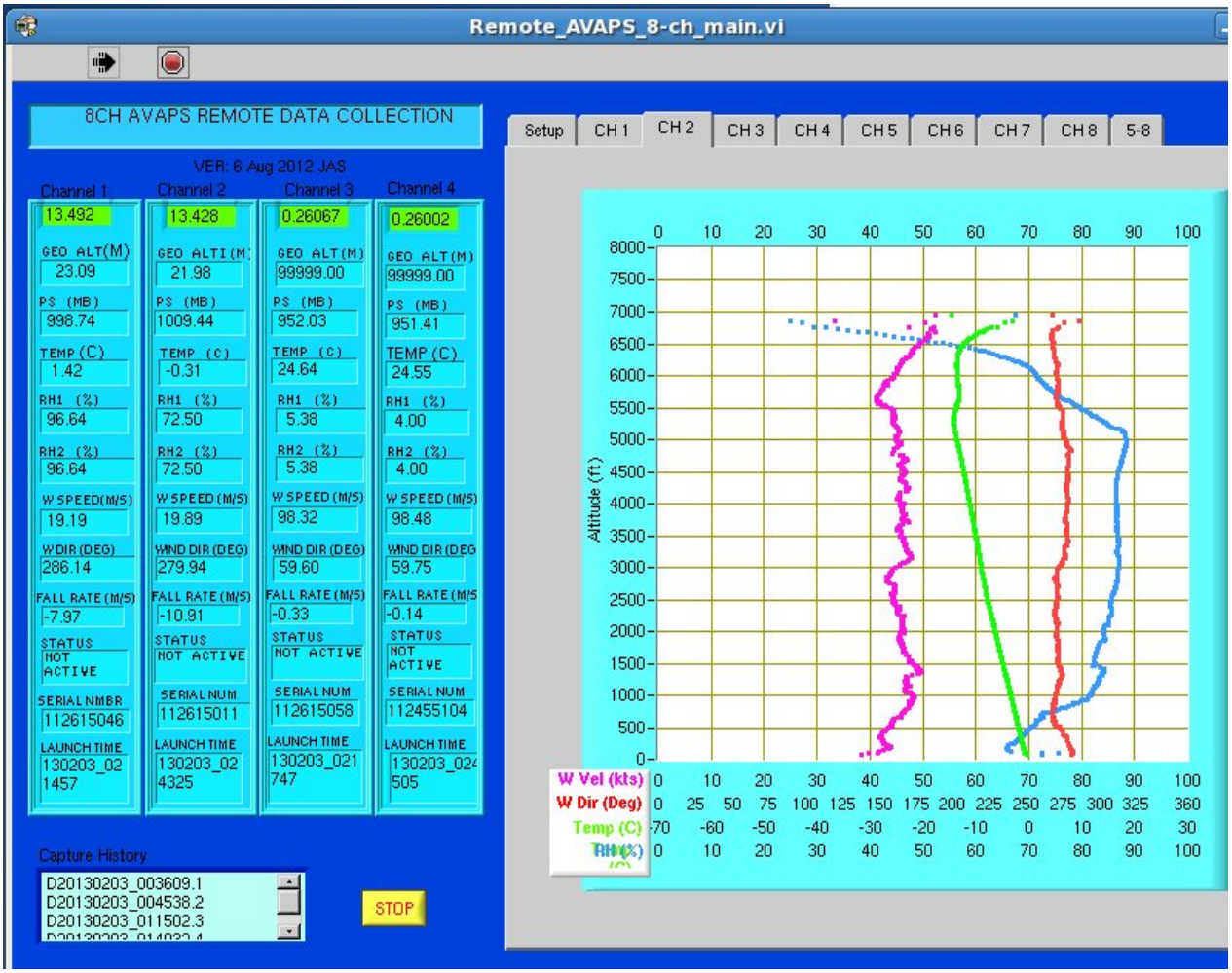

FIGURE 1: Example Remote AVAPS screen depicting a sonde profile on Channel #2

As the sonde is released, traces for wind velocity (magenta), wind direction (red), temperature (green) and relative humidity (blue) are plotted in real time. It takes several seconds after launch for data from the sonde to stabilize (as the sensors adapt from the environment inside the aircraft cabin to the atmosphere outside). During this brief interval these data appear as scattered points of each color corresponding to each data type, then upon stabilization, a coherent line begins to appear. Another interval of separate points may also appear in the last few seconds just prior to splash with some drops.

The traces of plotted data for a particular channel are viewed by selecting that channel using the tabs across the top of the right portion of the screen. On the left, alphanumeric

data for each channel are displayed. To see alphanumeric data for Channels 5 through 8, click on the 5-8 tab at the top on the right side of the display pane.

Many common sonde problems are easily recognized by following the progress of a drop using Remote AVAPS. The most common abnormality is known as a fast fall. This occurs when a parachute fails to open or becomes detached after deployment. The result is a sonde tumbles as it falls much more quickly than designed. A sonde released from the P-3 at common working altitudes between 7,000 and 12,000 feet will typically begin falling at about 10 to 12 meters per second once the parachute is deployed and it stabilizes. Sondes released from the G-IV are typically deployed at much higher altitudes (usually above 40,000 feet). Due to the air density being so low at these heights, even with a proper parachute deployment, the sonde will begin its fall at about 20 meters per second (twice the vertical velocity seen with P-3 drops). By the time the sonde reaches 850 mb it should slow to a little over 10 m/s. The Fall Rate is one parameter constantly updating in the alphanumeric data display.

When there is a parachute failure the sonde will display extreme fluctuations in fall rate as well as fall at rates of up to 35 m/s when dropped from the G-IV (over 20 m/s from the P-3). Fast falls make it impossible to maintain a good signal lock with the GPS satellites. The result is a telltale scattering of points on the Remote AVAPS plot of Wind Speed and Wind Direction from launch to splash (as seen below). The resulting sounding will contain suspect wind and PTH data and should not be used to create a WMO TEMPDROP message. In most cases a fast fall is readily apparent after launch and a backup sonde should be deployed. Sometimes a fast fall chute will eventually inflate and stabilize at a lower altitude. On rare occasions, a good chute will break at some point well into its descent and the sonde will become a fast fall for the remainder of the profile.

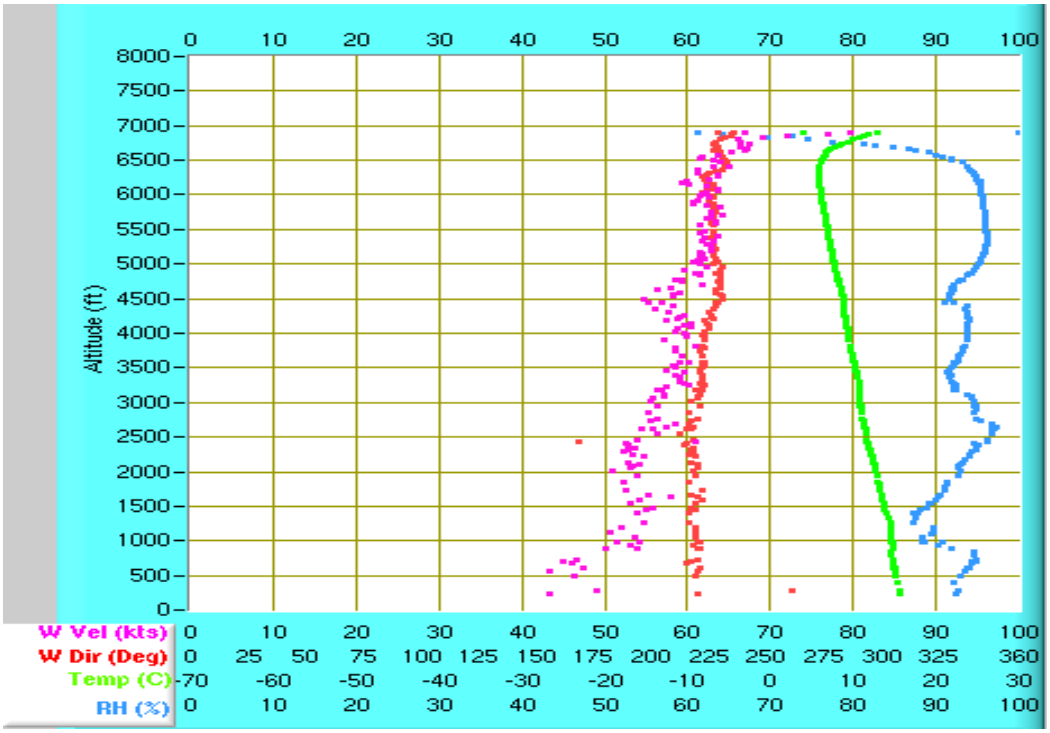

FIGURE 2: Remote AVAPS screen depiction of a Fast Fall. Note the scattering of the data points for wind speed and direction rather than coherent, contiguous lines.

Occasionally, there are faulty parachutes that only partially inflate. While this is usually sufficient to keep the sonde upright and retard the fall rate enough to obtain good PTH data, the wind data will be noisier than usual. An example of a partial sonde failure from the G-IV is shown below. It is up to the discretion of the FD to determine whether or not to use the resulting sounding.

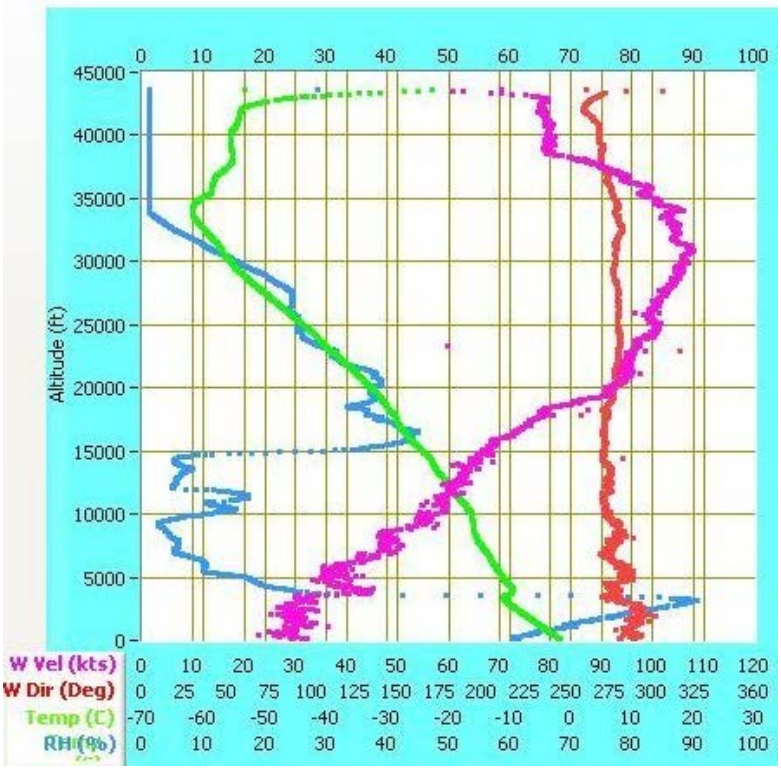

FIGURE 3: Example of a partial parachute failure. The traces of wind speed and direction are “noisier” than normal and momentarily non-contiguous in some levels.

Another common sonde problem easily noticed on Remote AVAPS is an Early Launch Detect (ELD). This will cause the AVAPS system to begin compiling sounding data while the sonde is still in the launch tube inside the aircraft. Remote AVAPS displays this problem as a random scattering of data points corresponding to the cabin altitude of the aircraft (typically about 810 mb for the G-IV). The cabin altitude of the P-3 varies depending on the pressurization level but can be read off the AAMPS Screen 800. Another sign of an ELD using Remote AVAPS is that the alphanumeric data will show a STATUS of ACTIVE (rather than NOT ACTIVE) on the channel being used for an imminent launch. The LAUNCH TIME also will show the time of the erroneous launch detect rather than the time of the actual sonde deployment.

If not detected prior to launch, the D file that results from an ELD can still be used to compile a valid and complete sounding using ASPEN. However, some manual editing of the D file is needed before it can be properly processed by ASPEN. The LAU Line (launch line) of the D file (explained in Section 7.4 on Page 8) must be edited to reflect the actual launch time and latitude / longitude position rather than the inadvertent earlier time and position. Also, all the lines of the D file generated between the inadvertent launch detect and the actual sonde release time need to be deleted from the file before it is processed by ASPEN.

7.2 Obtain D files from the AVAPS computer via the aircraft LAN

The AVAPS computer is networked to the aircraft LAN and data folders on it may be accessed by the FD. Prior to dropping sondes for a mission, the FD should ensure they have located the proper pathway to the folder on the AVAPS computer where D files will collect after each drop.

The FD will locate the D file in the AVAPS computer folder labeled with the flight's mission ID and copy it to a folder that they created on their local hard drive. Many types of files are created on the AVAPS folder for each dropsonde. Most of these are not used by the FD to generate a sounding with ASPEN (however, they are useful to engineers in monitoring proper AVAPS performance and need to be downloaded for archiving at the end of each mission). Only the D file beginning with the full flight ID and ending with the appended letter P is needed for ASPEN. The P designation denotes only a small portion of the data collected while the sonde was in the launch tube awaiting deployment is included in the D file (resulting in a file size roughly half that of the D file not ending with the letter P). In the example below this is file D20130208_143606_P.1. The P.1 denotes that Channel #1 was used for this sonde.

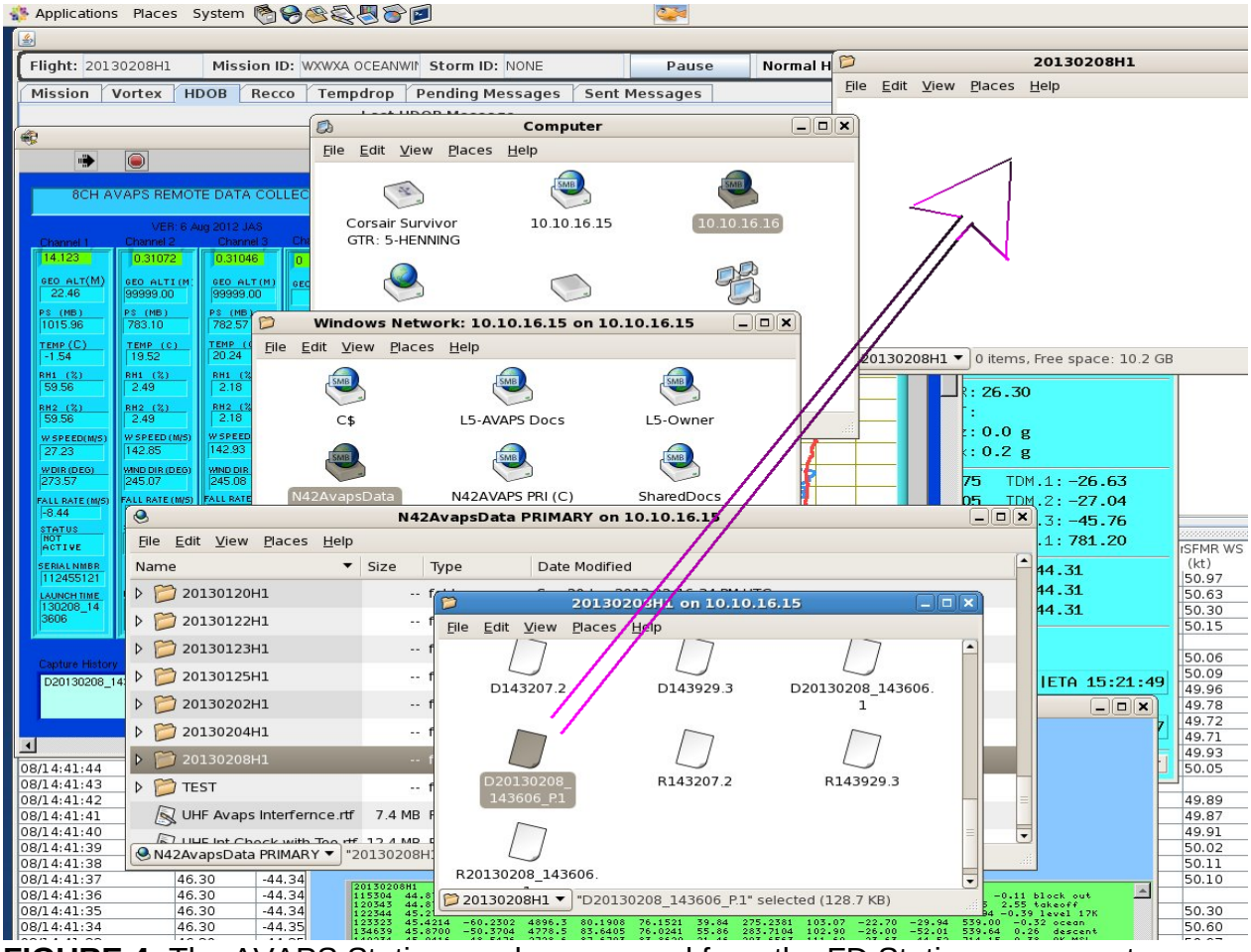

FIGURE 4: The AVAPS Station can be accessed from the FD Station as a remote computer on the aircraft's LAN. In the directory of the AVAPS computer, locate the folder which includes all the files generated each time a sonde is terminated. The only files needed for ASPEN processing are the D files. Copy the D files off their location on the network to a folder you have created on your local hard drive.

7.3 Load the D file into ASPEN

Open the ASPEN executable file (a shortcut is found on the FD computer Desktop). As the program loads, a standard select pane will open to the folder the program has been pointed towards or the last folder used by the program on an earlier flight. Like any file select pane, you can navigate to the proper folder using the “Look in” dropdown menu:

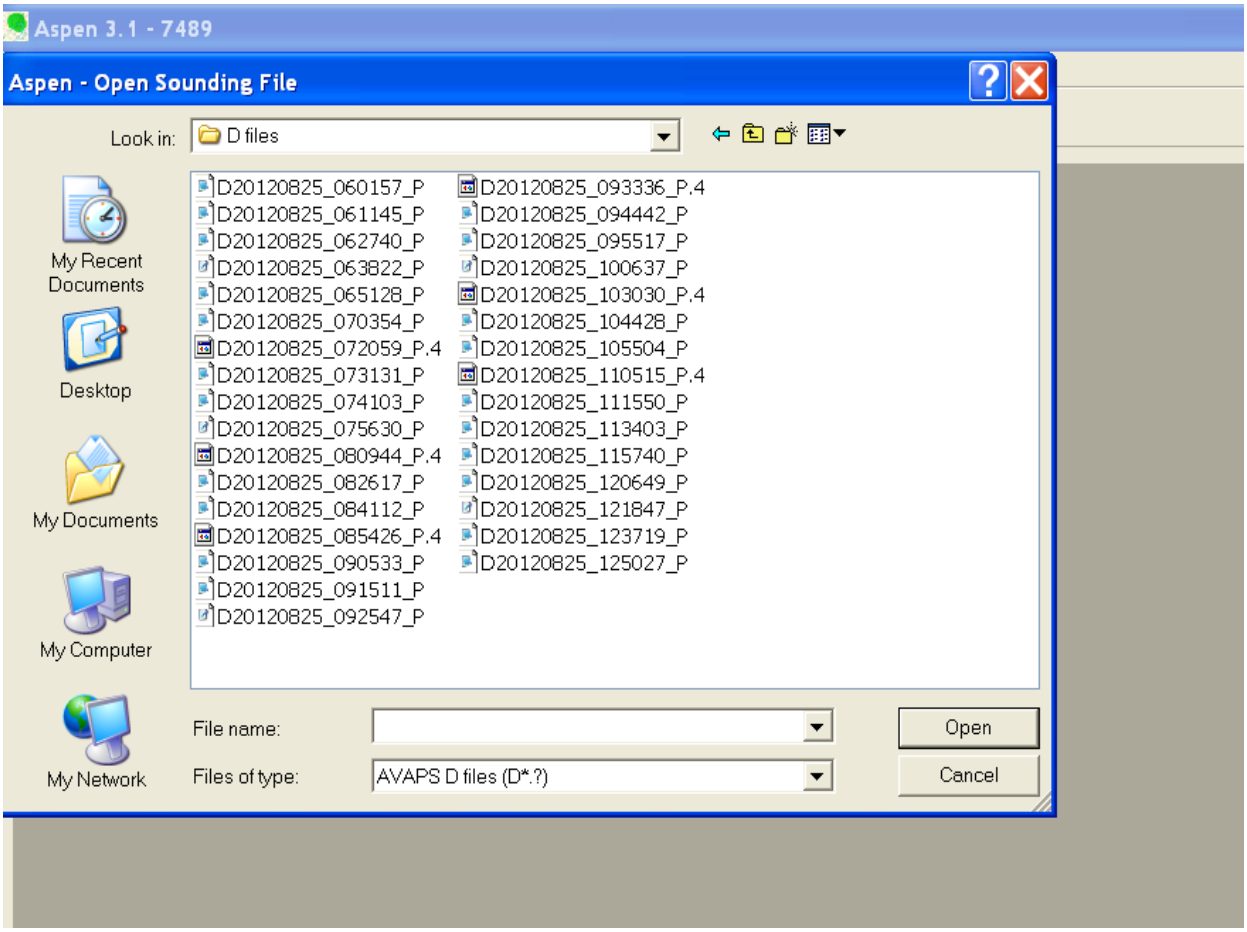

FIGURE 5: When ASPEN is opened a file select pane will appear.

After selecting the D file you plan to process, ASPEN will automatically create a variety of products including a WMO TEMPDROP message within a few seconds. It does so by using algorithms to quality check the sounding data by applying filters to disregard data that do not meet pre-established criteria for validity. HOWEVER, it is vital to stress that the TEMPDROP message is not yet ready to be sent to the AOC customer. Careful human analysis is necessary to ensure ASPEN has worked properly. There are many problematic sondes that contain suspect data. ASPEN catches MOST BUT NOT ALL problems. While it is a tool to help process many sondes on a busy flight, it is not sufficiently advanced to replace a trained meteorologist.

7.4 Understanding the elements comprising a D File

There are many columns of data generated during compilation of a D file by the AVAPS computer. Each column is explained fully in Appendix B. There is a row of data generated each 0.25 seconds. As seen in Figure 6 shown below, not each data type specified in every column is populated at this rate. Only GPS measurements needed for calculation of the winds and fall rate (also called vertical velocity) are measured at this 4 Hz rate. Columns of pressure, temperature and humidity data are populated at a 2 Hz rate (every 0.50 seconds). Therefore many of the rows are partially filled out with 999s denoting no data. After the sonde splashes, there will be lines showing all 999s from when the sonde splashes until the run is terminated by the AVAPS operator.

```
AVAPS-T01 STA 111745195 120825 055625.41
AVAPS-T01 COM             UTC      UTC       Air     Air      Rel   Wind   Wind   Vert      GPS         GPS     Geopoten GPS  Sonde  Sonde GPS Wind    GPS
AVAPS-T01 COM   Sonde     Date     Time     Press    Temp    Humid  Dir    Spd    Veloc  Longitude   Latitude  Altitude Wnd  RH1    RH2   Snd Error Altitude
AVAPS-T01 COM    ID     yymmdd hhmmss.ss    (mb)   (degC)    (%)   (deg)  (m/s)  (m/s)    (deg)       (deg)      (m)   Sat   (%)    (%)   Sat (m/s)    (m)
AVAPS-T01 COM --------- ------ --------- ------- ------ ------ ------ ------ ------ ---------- ---------- -------- --- ------ ------ --- ----- --------
AVAPS-T01 LAU 111745195 120825 060157.25
AVAPS-D01 A00 111745195 120825 060157.00  179.01 -59.11  40.37 222.01  25.95   0.40  -79.508200  27.113400 13070.80   0  40.37  40.37   0  0.00 13109.80
AVAPS-D01 P00 111745195 120825 060147.25  806.18  17.78  11.87 280.08 237.73  -0.10  -79.529817  27.117149 99999.00   9  10.96  11.87   9  0.51 13076.22
AVAPS-D01 P10 111745195 120825 060147.50 9999.00  99.00 999.00 280.12 237.63  -0.08  999.000000  99.000000 99999.00   9 999.00 999.00   9  0.52 99999.00
AVAPS-D01 P00 111745195 120825 060147.75  806.15  17.75  11.89 280.17 237.62  -0.09  -79.528640  27.116961 99999.00   9  10.95  11.89   9  0.52 13076.24
AVAPS-D01 P10 111745195 120825 060148.00 9999.00  99.00 999.00 280.23 237.70  -0.14  999.000000  99.000000 99999.00   9 999.00 999.00   9  0.52 99999.00
AVAPS-D01 P00 111745195 120825 060148.25  806.15  17.76  11.90 280.28 237.68  -0.17  -79.527463  27.116771 99999.00   9  10.97  11.90   9  0.52 13076.24
AVAPS-D01 P10 111745195 120825 060148.50 9999.00  99.00 999.00 280.32 237.68  -0.17  999.000000  99.000000 99999.00   9 999.00 999.00   9  0.52 99999.00
AVAPS-D01 P00 111745195 120825 060148.75  806.18  17.74  11.91 280.36 237.67  -0.13  -79.526287  27.116579 99999.00   9  10.96  11.91   9  0.50 13076.24
AVAPS-D01 P10 111745195 120825 060149.00 9999.00  99.00 999.00 280.45 237.70  -0.26  999.000000  99.000000 99999.00   9 999.00 999.00   9  0.48 99999.00
AVAPS-D01 P00 111745195 120825 060149.25  806.15  17.75  11.88 280.45 237.66  -0.20  -79.525111  27.116386 99999.00   9  10.98  11.88   9  0.48 13076.28
AVAPS-D01 P10 111745195 120825 060149.50 9999.00  99.00 999.00 280.50 237.73  -0.11  999.000000  99.000000 99999.00   9 999.00 999.00   9  0.49 99999.00
AVAPS-D01 P00 111745195 120825 060149.75  806.23  17.76  11.94 280.53 237.66  -0.05  -79.523935  27.116191 99999.00   9  10.98  11.94   9  0.56 13076.28
AVAPS-D01 P10 111745195 120825 060150.00 9999.00  99.00 999.00 280.60 237.61  -0.04  999.000000  99.000000 99999.00   9 999.00 999.00   9  0.50 99999.00
AVAPS-D01 P00 111745195 120825 060150.25  806.26  17.75  11.90 280.67 237.68  -0.06  -79.522760  27.115994 99999.00   9  11.00  11.90   9  0.48 13076.29
AVAPS-D01 P10 111745195 120825 060150.50 9999.00  99.00 999.00 280.70 237.71  -0.04  999.000000  99.000000 99999.00   9 999.00 999.00   9  0.50 99999.00
AVAPS-D01 P00 111745195 120825 060150.75  806.27  17.75  11.87 280.74 237.64  -0.00  -79.521585  27.115795 99999.00   9  10.96  11.87   9  0.50 13076.30
AVAPS-D01 P10 111745195 120825 060151.00 9999.00  99.00 999.00 280.80 237.62   0.01  999.000000  99.000000 99999.00   9 999.00 999.00   9  0.54 99999.00
AVAPS-D01 P00 111745195 120825 060151.25  806.11  17.74  11.88 280.83 237.65   0.14  -79.520410  27.115595 99999.00   9  10.95  11.88   9  0.58 13076.53
AVAPS-D01 P10 111745195 120825 060151.50 9999.00  99.00 999.00 280.87 237.62   0.24  999.000000  99.000000 99999.00   9 999.00 999.00   9  0.54 99999.00
AVAPS-D01 P00 111745195 120825 060151.75  806.04  17.75  11.89 280.93 237.56   0.26  -79.519236  27.115393 99999.00   9  10.97  11.89   9  0.51 13076.71
AVAPS-D01 P10 111745195 120825 060152.00 9999.00  99.00 999.00 281.02 237.65   0.03  999.000000  99.000000 99999.00   9 999.00 999.00   9  0.50 99999.00
AVAPS-D01 P00 111745195 120825 060152.25  806.12  17.74  11.89 281.06 237.68   0.09  -79.518062  27.115189 99999.00   9  10.96  11.89   9  0.49 13076.69
AVAPS-D01 P10 111745195 120825 060152.50 9999.00  99.00 999.00 281.09 237.61   0.12  999.000000  99.000000 99999.00   9 999.00 999.00   9  0.52 99999.00
AVAPS-D01 P00 111745195 120825 060152.75  806.21  17.73  11.89 281.14 237.59   0.17  -79.516889  27.114982 99999.00   9  10.96  11.89   9  0.53 13076.77
AVAPS-D01 P10 111745195 120825 060153.00 9999.00  99.00 999.00 281.17 237.50   0.24  999.000000  99.000000 99999.00   9 999.00 999.00   9  0.53 99999.00
AVAPS-D01 P00 111745195 120825 060153.25  806.14  17.74  11.85 281.23 237.51   0.30  -79.515717  27.114774 99999.00   9  10.93  11.85   9  0.52 13076.88
AVAPS-D01 P10 111745195 120825 060153.50 9999.00  99.00 999.00 281.30 237.56   0.31  999.000000  99.000000 99999.00   9 999.00 999.00   9  0.52 99999.00
AVAPS-D01 P00 111745195 120825 060153.75  806.22  17.74  11.84 281.34 237.43   0.35  -79.514545  27.114563 99999.00   9  10.93  11.84   9  0.52 13076.97
AVAPS-D01 P10 111745195 120825 060154.00 9999.00  99.00 999.00 281.37 237.48   0.42  999.000000  99.000000 99999.00   9 999.00 999.00   9  0.51 99999.00
AVAPS-D01 P00 111745195 120825 060154.25  806.18  17.74  11.80 281.43 237.45   0.50  -79.513373  27.114351 99999.00   9  10.94  11.80   9  0.52 13077.11
AVAPS-D01 P10 111745195 120825 060154.50 9999.00  99.00 999.00 281.47 237.44   0.49  999.000000  99.000000 99999.00   9 999.00 999.00   9  0.50 99999.00
AVAPS-D01 P00 111745195 120825 060154.75  806.14  17.74  11.79 281.52 237.48   0.64  -79.512202  27.114137 99999.00   9  10.92  11.79   9  0.50 13077.42
AVAPS-D01 P10 111745195 120825 060155.00 9999.00  99.00 999.00 281.59 237.42   0.66  999.000000  99.000000 99999.00   9 999.00 999.00   9  0.50 99999.00
```

FIGURE 6: A sample D File. Note the wind speed and direction are 4 Hz data while the PTH data are 2 Hz. Since a line is generated for every 0.25 seconds, half of the lines will contain 99999s for missing PTH data.

The **LAU** line is highlighted below in red. It denotes the Launch Detect time:

```
AVAPS-T01 STA 111745195 120825 055625.41
AVAPS-T01 COM             UTC      UTC       Air     Air      Rel   Wind   Wind   Vert      GPS         GPS
AVAPS-T01 COM   Sonde     Date     Time     Press    Temp    Humid  Dir    Spd    Veloc  Longitude   Latitude
AVAPS-T01 COM    ID     yymmdd hhmmss.ss    (mb)   (degC)    (%)   (deg)  (m/s)  (m/s)    (deg)       (deg)
AVAPS-T01 COM --------- ------ --------- ------- ------ ------ ------ ------ ------ ---------- ----------
AVAPS-T01 LAU 111745195 120825 060157.25
AVAPS-D01 A00 111745195 120825 060157.00  179.01 -59.11  40.37 222.01  25.95   0.40  -79.508200  27.113400
AVAPS-D01 P00 111745195 120825 060147.25  806.18  17.78  11.87 280.08 237.73  -0.10  -79.529817  27.117149
AVAPS-D01 P10 111745195 120825 060147.50 9999.00  99.00 999.00 280.12 237.63  -0.08  999.000000  99.000000
AVAPS-D01 P00 111745195 120825 060147.75  806.15  17.75  11.89 280.17 237.62  -0.09  -79.528640  27.116961
AVAPS-D01 P10 111745195 120825 060148.00 9999.00  99.00 999.00 280.23 237.70  -0.14  999.000000  99.000000
AVAPS-D01 P00 111745195 120825 060148.25  806.15  17.76  11.90 280.28 237.68  -0.17  -79.527463  27.116771
AVAPS-D01 P10 111745195 120825 060148.50 9999.00  99.00 999.00 280.32 237.68  -0.17  999.000000  99.000000
AVAPS-D01 P00 111745195 120825 060148.75  806.18  17.74  11.91 280.36 237.67  -0.13  -79.526287  27.116579
AVAPS-D01 P10 111745195 120825 060149.00 9999.00  99.00 999.00 280.45 237.70  -0.26  999.000000  99.000000
AVAPS-D01 P00 111745195 120825 060149.25  806.15  17.75  11.88 280.45 237.66  -0.20  -79.525111  27.116386
```

FIGURE 7: The LAU line denotes the time when the AVAPS system detects that the sonde has been deployed. It is supposed to be within the first second that the sonde leaves the aircraft.

In this example, the Launch Detect occurred at 06:01:57.25 UTC. AVAPS will then populate the next line with aircraft data from the previous 0.25 seconds (in this case from 06:01:57.00 UTC) as the **A00** line highlighted in Figure 8 below:

AVAPS-T01	STA	111745195	120825	055625.41									
AVAPS-T01	COM		UTC	UTC	Air	Air	Rel	Wind	Wind	Vert	GPS	GPS	
AVAPS-T01	COM	Sonde	Date	Time	Press	Temp	Humid	Dir	Spd	Veloc	Longitude	Latitude	
AVAPS-T01	COM	ID	yymmdd	hhmmss.ss	(mb)	(degC)	(%)	(deg)	(m/s)	(m/s)	(deg)	(deg)	
AVAPS-T01	COM	---	---	---	---	---	---	---	---	---	---	---	
AVAPS-T01	LAU	111745195	120825	060157.25									
AVAPS-D01	**A00**	**111745195**	**120825**	**060157.00**	**179.01**	**-59.11**	**40.37**	**222.01**	**25.95**	**0.40**	**-79.508200**	**27.113400**	
AVAPS-D01	P00	111745195	120825	060147.25	806.18	17.78	11.87	280.08	237.73	-0.10	-79.529817	27.117149	
AVAPS-D01	P10	111745195	120825	060147.50	9999.00	99.00	999.00	280.12	237.63	-0.08	999.000000	99.000000	
AVAPS-D01	P00	111745195	120825	060147.75	806.15	17.75	11.89	280.17	237.62	-0.09	-79.528640	27.116961	
AVAPS-D01	P10	111745195	120825	060148.00	9999.00	99.00	999.00	280.23	237.70	-0.14	999.000000	99.000000	
AVAPS-D01	P00	111745195	120825	060148.25	806.15	17.76	11.90	280.28	237.68	-0.17	-79.527463	27.116771	
AVAPS-D01	P10	111745195	120825	060148.50	9999.00	99.00	999.00	280.32	237.68	-0.17	999.000000	99.000000	
AVAPS-D01	P00	111745195	120825	060148.75	806.18	17.74	11.91	280.36	237.67	-0.13	-79.526287	27.116579	
AVAPS-D01	P10	111745195	120825	060149.00	9999.00	99.00	999.00	280.45	237.70	-0.26	999.000000	99.000000	
AVAPS-D01	P00	111745195	120825	060149.25	806.15	17.75	11.88	280.45	237.66	-0.20	-79.525111	27.116386	
AVAPS-D01	P10	111745195	120825	060149.50	9999.00	99.00	999.00	280.50	237.73	-0.11	999.000000	99.000000	
AVAPS-D01	P00	111745195	120825	060149.75	806.23	17.76	11.94	280.53	237.66	-0.05	-79.523935	27.116191	
AVAPS-D01	P10	111745195	120825	060150.00	9999.00	99.00	999.00	280.60	237.61	-0.04	999.000000	99.000000	
AVAPS-D01	P00	111745195	120825	060150.25	806.26	17.75	11.90	280.67	237.68	-0.06	-79.522760	27.115994	

FIGURE 8: The A00 line is populated with flight level (FL) aircraft data from AAMPS

None of the data parameters shown on the A00 line come from the sonde. They come from the AAMPS data system of the launch aircraft. Below the A00 line are several lines of data from before the launch detect. You will note the Air Pressure column for these rows corresponds with the cabin pressure of the G-IV as the sonde sat in the launch tube.

It takes several seconds for the sonde's sensors to stabilize and begin transmitting valid data. The beginning of a D file is shown in Figure 9 below. Note the rows containing data from 10 seconds prior to Launch Detect at 06:01:57.25 UTC beginning with the line highlighted in red. To save space in the example below, the rows of cabin data from 06:01:48.50 to 06:01:55.75 UTC were omitted. The first line of data from the sonde in the air outside the aircraft is highlighted in magenta.

AVAPS-T01	STA	111745195	120825	055625.41									
AVAPS-T01	COM		UTC	UTC	Air	Air	Rel	Wind	Wind	Vert	GPS	GPS	
AVAPS-T01	COM	Sonde	Date	Time	Press	Temp	Humid	Dir	Spd	Veloc	Longitude	Latitude	
AVAPS-T01	COM	ID	yymmdd	hhmmss.ss	(mb)	(degC)	(%)	(deg)	(m/s)	(m/s)	(deg)	(deg)	
AVAPS-T01	COM	---	---	---	---	---	---	---	---	---	---	---	
AVAPS-T01	LAU	111745195	120825	060157.25									
AVAPS-D01	A00	111745195	120825	060157.00	179.01	-59.11	40.37	222.01	25.95	0.40	-79.508200	27.113400	
AVAPS-D01	**P00**	**111745195**	**120825**	**060147.25**	**806.18**	**17.78**	**11.87**	**280.08**	**237.73**	**-0.10**	**-79.529817**	**27.117149**	
AVAPS-D01	P10	111745195	120825	060147.50	9999.00	99.00	999.00	280.12	237.63	-0.08	999.000000	99.000000	
AVAPS-D01	P00	111745195	120825	060147.75	806.15	17.75	11.89	280.17	237.62	-0.09	-79.528640	27.116961	
AVAPS-D01	P10	111745195	120825	060148.00	9999.00	99.00	999.00	280.23	237.70	-0.14	999.000000	99.000000	
AVAPS-D01	P00	111745195	120825	060148.25	806.15	17.76	11.90	280.28	237.68	-0.17	-79.527463	27.116771	
AVAPS-D01	P10	111745195	120825	060156.00	9999.00	99.00	999.00	281.75	237.33	0.78	999.000000	99.000000	
AVAPS-D01	P00	111745195	120825	060156.25	806.22	17.73	11.81	281.81	237.31	0.72	-79.508691	27.113487	
AVAPS-D01	P10	111745195	120825	060156.50	9999.00	99.00	999.00	281.85	237.29	0.64	999.000000	99.000000	
AVAPS-D01	P01	111745195	120825	060156.75	806.14	17.73	11.79	999.00	999.00	99.00	999.000000	99.000000	
AVAPS-D01	P11	111745195	120825	060157.00	9999.00	99.00	999.00	999.00	999.00	99.00	999.000000	99.000000	
AVAPS-D01	**S00**	**111745195**	**120825**	**060157.25**	**152.04**	**17.72**	**11.60**	**281.96**	**237.38**	**0.64**	**-79.506353**	**27.113046**	
AVAPS-D01	S10	111745195	120825	060157.50	9999.00	99.00	999.00	282.13	237.15	0.72	999.000000	99.000000	
AVAPS-D01	S11	111745195	120825	060157.75	128.01	99.00	999.00	999.00	999.00	99.00	999.000000	99.000000	
AVAPS-D01	S11	111745195	120825	060158.00	9999.00	99.00	999.00	999.00	999.00	99.00	999.000000	99.000000	
AVAPS-D01	S11	111745195	120825	060158.25	9999.00	99.00	999.00	999.00	999.00	99.00	999.000000	99.000000	
AVAPS-D01	S11	111745195	120825	060158.50	9999.00	99.00	999.00	999.00	999.00	99.00	999.000000	99.000000	
AVAPS-D01	S11	111745195	120825	060158.75	9999.00	99.00	999.00	999.00	999.00	99.00	999.000000	99.000000	
AVAPS-D01	**S00**	**111745195**	**120825**	**060159.00**	**180.62**	**-9.01**	**1.00**	**280.73**	**228.59**	**2.49**	**-79.502361**	**27.112279**	
AVAPS-D01	S10	111745195	120825	060159.25	9999.00	99.00	999.00	280.23	228.31	3.08	999.000000	99.000000	
AVAPS-D01	S00	111745195	120825	060159.50	180.93	-12.07	1.00	280.10	228.06	3.46	-79.501231	27.112105	
AVAPS-D01	S10	111745195	120825	060159.75	9999.00	99.00	999.00	279.46	227.37	3.55	999.000000	99.000000	
AVAPS-D01	**S00**	**111745195**	**120825**	**060232.00**	**200.96**	**-54.96**	**6.96**	**209.53**	**28.06**	**-20.67**	**-79.498222**	**27.119444**	

FIGURE 9: The first line of data from the sonde outside the aircraft is highlighted above in magenta (at 06:01:57.25 UTC).

The first two Air Pressure readings of 152.04 mb and 128.01 mb are invalid, as are the temperatures of 17.72 and -9.01 deg C (both far too warm for a sonde launched from the G-IV). The first reliable Air Pressure reading was not made until 06:01:59.00 UTC (from the row highlighted in brown) with 180.62 mb being the first believable static pressure data (given the aircraft data in the A00 line showed an outside atmospheric pressure at launch of 179.01 mb). In Figure 9 on the previous page the lines from 06:02:00.00 to 06:02:31.75 UTC were also omitted to save space. It was not until the row of data at 06:02:32.00 UTC (shown as the row highlighted in blue (34.75 seconds after Launch Detect)) that all the GPS wind and PTH data was stabilized and valid. Note how prior to this time, the sonde was still showing much of the forward velocity of the aircraft for a Wind Speed (227.37 m/s versus the actual wind speed of 28.06 m/s). Note also the Vertical Velocity (aka Fall Rate) of 20.67 m/s finally looks valid in the blue row along with the Air Temp of -54.96 deg C. Many sondes do not take this long for winds to stabilize. Generally, valid winds come in within about 10 seconds. It often does take this long for PTH data from the G-IV to stabilize given the extreme changes pressure, temperature and humidity from inside to outside the aircraft.

7.5 Initial analysis of a sounding in ASPEN

After ASPEN has completed its automated processing of a D file the Main screen shown below will appear. You will see a number of tabs across the top. Each screen in ASPEN has this set of tabs. These allow the user to navigate back and forth through the various screens. The yellow bar shows the date and time of the D file used to generate the sounding. In the case below D20120825 060157 denotes the sonde was launched at 06:01:57 UTC (also called z or zulu time) on August 25, 2012. The P.1 shows the sonde utilized AVAPS Channel 1. The next number…111745195…is the serial number of the sonde launched. The remaining information shows the season and Mission ID of the flight along with the aircraft from which it was deployed.

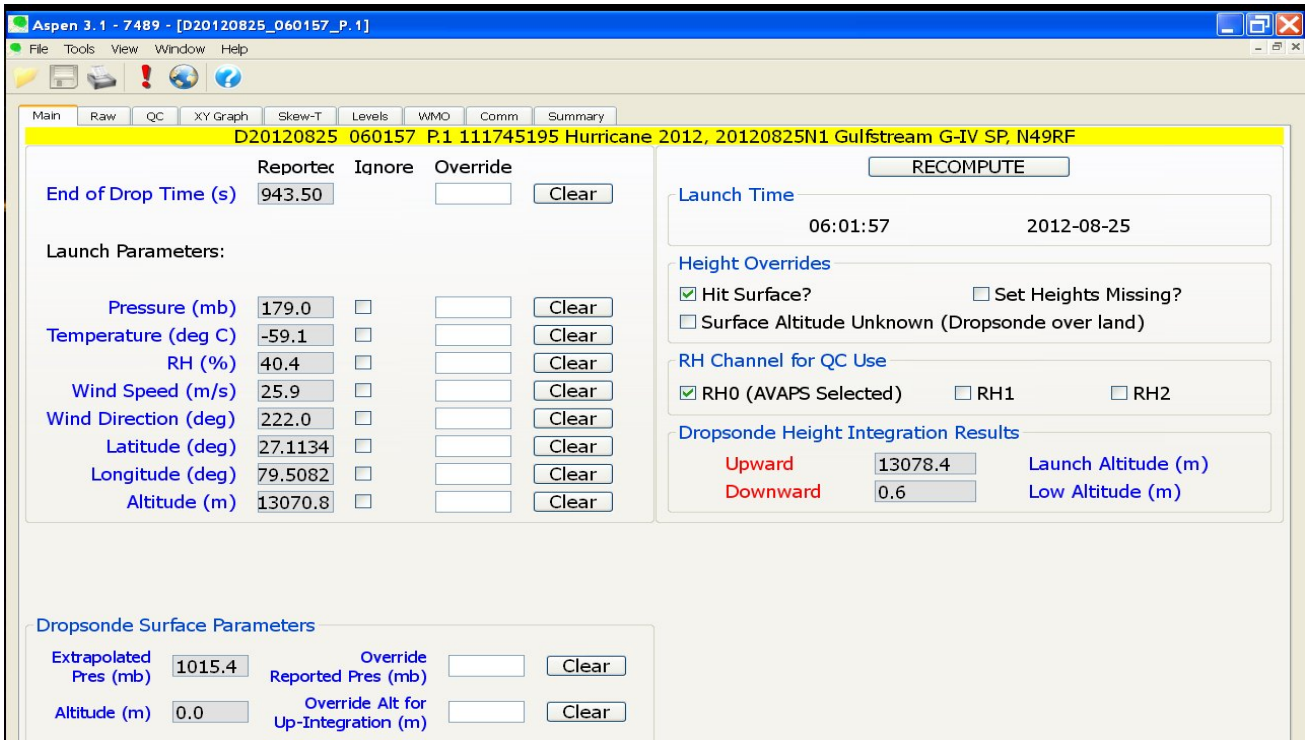

Figure 10: ASPEN Main Screen

The Main Screen shows that by default, ASPEN assumes that the sonde made it all the way to the surface and splashed while still transmitting valid data. On the right side of the pane under Height Overrides note that the Hit Surface box should be checked, reflecting this assumption. ASPEN calculates surface pressure and geopotential heights by integrating from the bottom of the sounding upward. Therefore, it is crucial that the sonde data reaches the surface. If you know before processing a sonde that it terminated data collection at some point above the surface then there is no way to accurately calculate surface pressure or geopotential heights. You must uncheck Hit Surface and check the Set Heights Missing box. Then hit the RECOMPUTE button (any changes made to the Main screen settings require you to hit RECOMPUTE for those changes to be included in further calculations).

Sometimes during the processing of a drop using ASPEN you discover there were problems (such as the sonde data not extending to the surface). A quick way to tell something is wrong is by looking at the Dropsonde Height Integration Results. In Figure 10 on the previous page you see optimal results: The value for downward integration should be very small (in this case only 0.6 meters) and the upward integration should be close to the Altitude shown on the left side under Launch Parameters (in this case 13078.4 meters from the sonde upward integration versus 13070.8 meters from the aircraft data using the A00 Line of the D file).

In Figure 11 below, something is obviously wrong. In the example below, the sonde failed to transmit valid data in the last 3200 meters before splash. Note how large the downward integration is. Also, the upward integration yields a Launch Altitude more than 3000 meters less than the aircraft data Altitude shown under Launch Parameters:

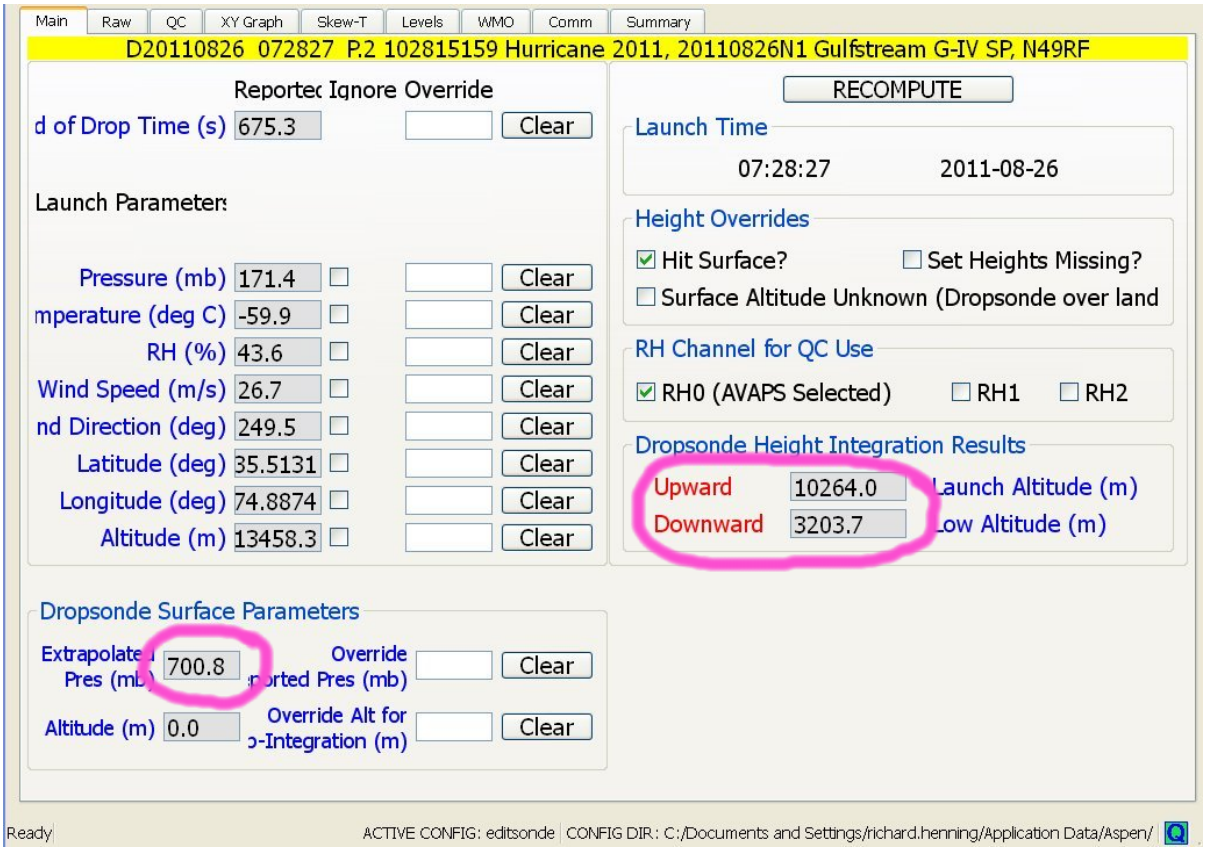

Figure 11: In this example, the sonde failed at approximately 700 millibars.

In this case, the sonde failed just below the 700 mb level. With ASPEN still set to calculate a surface pressure (as dictated by the “Hit Surface” setting being checked) it assumes the last data received was just prior to splash. The resulting Extrapolated Pres (under Dropsonde Surface Parameters on the left side near the bottom) calculation yields a surface pressure of 700.8 mb.

The only way to code a valid TEMPDROP message is to uncheck Hit Surface, check Set Heights Missing and then click the RECOMPUTE button. The resulting Main screen after ASPEN recalculates is shown in Figure 12 below.

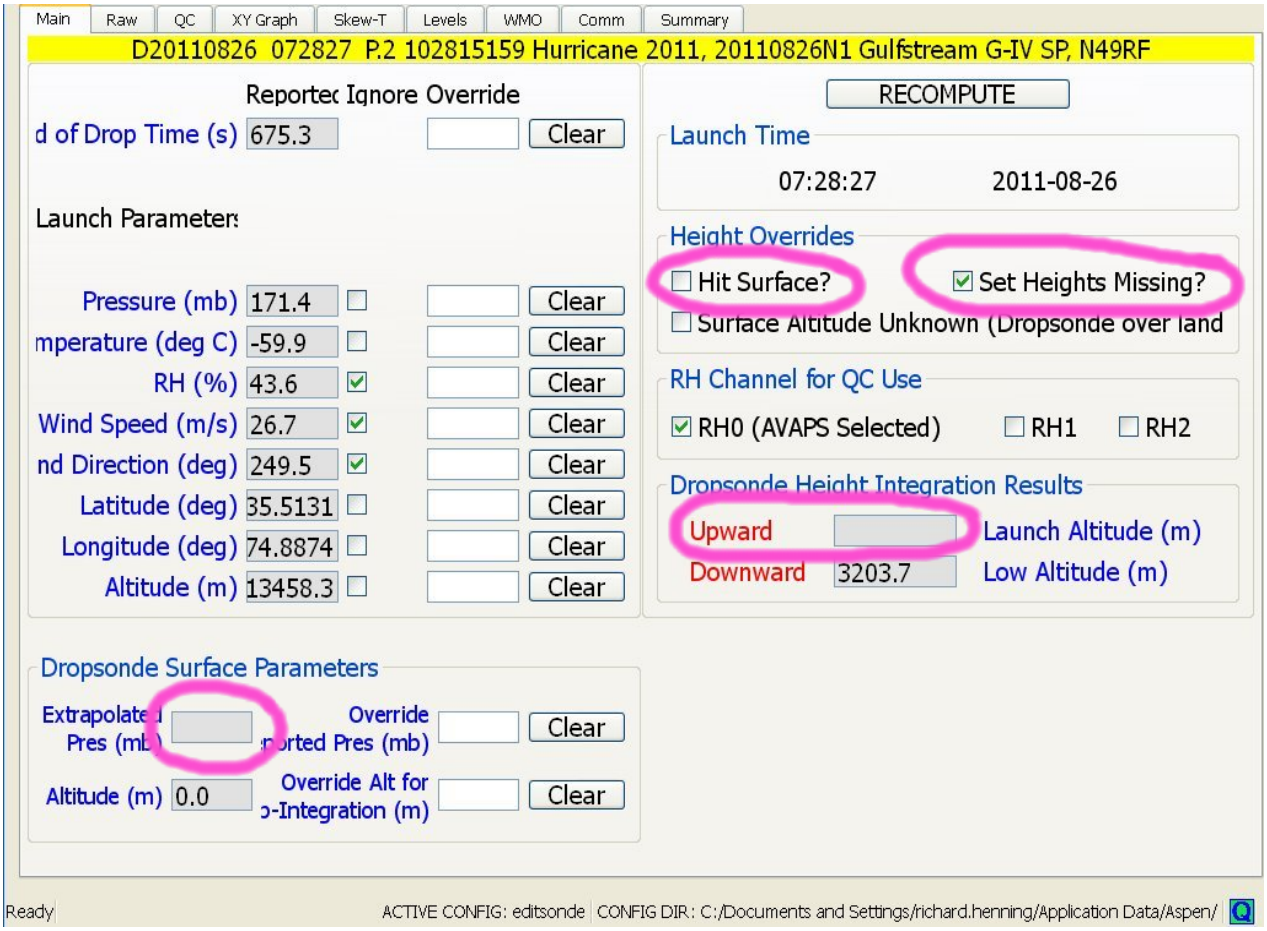

Figure 12: The result of the Hit Surface button (the default) being unchecked and the Set Heights Missing button being checked.

Note in Figure 12 there is no longer any upward integration calculation and no surface pressure. You may not transmit a message with geopotential heights from the top of the sounding to where it failed (ie: 200, 250, 300, 400, 500 and 700 mb levels). With there being no valid bottom of the sounding, since ASPEN integrates geopotential heights from the bottom upward, the only valid components of the TEMPDROP message will be winds, temperature and humidity data at the corresponding pressure levels where these measurements were made (with no heights showing the altitude where these pressure levels exist). While height data is arguably the most important component of an observation ingested by the numerical models, the remaining data in the message will still be of value (and certainly better than a missing ob).

Another useful tool to check for problems is the End of Drop Time window on the left side of the Main tab. Looking back at the first example (Figure 10 at the bottom of Page 10) it took 943.5 seconds (over 15.5 minutes) for the sonde to reach the surface. This is a typical duration for a drop from the G-IV (most are between 850 and 950 seconds). Durations significantly less than this from the G-IV suggests there was a problem. The two most common culprits for a much shorter data transmission interval are either a fast fall or early termination. In the event both the FD and the AVAPS Operator fail to notice the fast fall, ASPEN will usually flag the drop as such (see Figure 13 below):

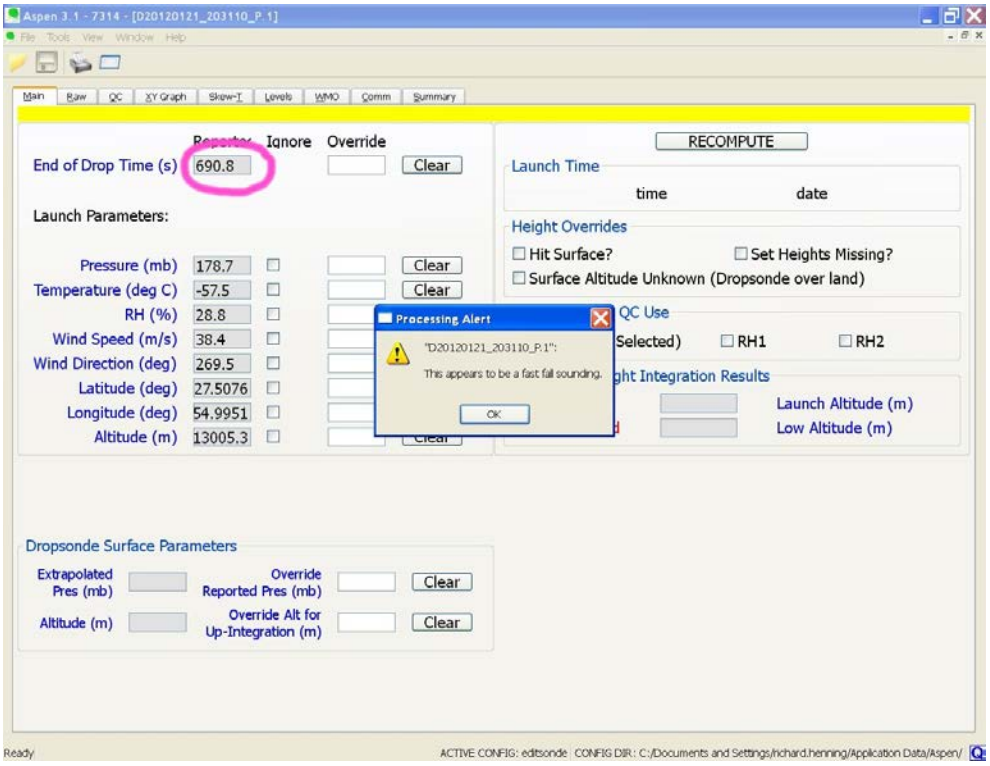

Figure 13: Note the End of Drop Time (in the upper left) is only 690.8 seconds. This is too short of a time from launch to splash at typical G-IV operating altitudes. ASPEN has flagged it as a Fast Fall.

Going back to the first example on Page 10, the drop duration was 943.5 seconds. To ensure there was a clean termination at the surface go to the Raw tab. The top portion of the raw sonde data is shown below (note the aircraft data from the A00 Line of the D file appears as the top line and the first line of sonde data is from the LAU):

Main | Raw | QC | XY Graph | Skew-T | Levels | WMO | Comm | Summary

D20120825_060157_P.1 111745195 Hurricane 2012, 20120825N1 Gulfstream G-IV SP, N49RF

Time (s)	Pres (mb)	Tdry (C)	RH (%)	Spd (m/s)	Dir (deg)	Alt (m)	Dz/Dt (m/s)	Lat (deg)	Lon (deg)	Sats (n)	Attributes
-1.00	F 179.0	F -59.1	F 40.4	F 25.9	F 222.0	13070.8		27.1134	-79.5082		F
0.00	Ae 152.0	Ae 17.7	Ae 11.6	Ae 237.4	Ae 282.0		0.6	27.1130	-79.5064	9	Ae
0.25				Ae 237.2	Ae 282.1		0.7			9	Ae
0.50	Ae 128.0									0	P Ae
0.75										6	
1.00										0	
1.25										0	
1.50										0	
1.75	Ae 180.6	Ae -9.0	Ae 1.0	Ae 228.6	Ae 280.7		2.5	27.1123	-79.5024	6	Ae
2.00				Ae 228.3	Ae 280.2		3.1			5	Ae
2.25	Ae 180.9	Ae -12.1	Ae 1.0	Ae 228.1	Ae 280.1		3.5	27.1121	-79.5012	5	Ae
2.50				Ae 227.4	Ae 279.5		3.5			4	Ae

Figure 14: The beginning of the Raw tab showing the top line is flight level data from the aircraft's AAMPS data system one second prior to the LAU (Launch Detect) line.

Scroll down the Raw screen until you reach the end of the sonde data. In Figure 15 below (from that same dropsondes introduced in Figure 10) you see the last line of data does indeed match the 943.5 seconds shown on the Main screen:

Main | Raw | QC | XY Graph | Skew-T | Levels | WMO | Comm | Summary

D20120825_060157_P.1.1 111745195 Hurricane 2012, 20120825N1 Gulfstream G-IV SP, N49RF

Time (s)	Pres (mb)	Tdry (C)	RH (%)	Spd (m/s)	Dir (deg)	Alt (m)	Dz/Dt (m/s)	Lat (deg)	Lon (deg)	Sats (n)	Attributes
936.50				Bc 5.9	Bc 71.0		-11.0			9	Bc
936.75	1006.7	28.4	76.2	6.4	67.6	51.6	-11.1	27.1559	-79.5256	9	
937.00				6.4	67.1		-11.3			9	
937.25	1007.1	28.4	76.0	6.4	67.4	47.8	-11.2	27.1559	-79.5256	9	
937.50				6.4	67.5		-11.0			8	
937.75	1007.9	28.4	76.2	6.5	67.1	41.3	-11.0	27.1559	-79.5257	8	
938.00				6.5	66.5		-10.9			8	
938.25	1008.4	28.5	76.0	6.4	66.4	37.0	-10.9	27.1559	-79.5257	8	
938.50				6.5	65.2		-10.9			9	
938.75	1009.0	28.6	75.6	6.5	62.6	31.1	-11.2	27.1559	-79.5257	9	
939.00				6.7	65.4		-11.2			9	
939.25	1009.6	28.6	74.5	6.4	64.5	26.2	-11.1	27.1559	-79.5258	8	
939.50				6.7	65.4		-11.0			8	
939.75	1010.4	28.7	74.6	6.7	62.2	19.2	-11.1	27.1559	-79.5258	8	
940.00				6.7	65.2		-11.1			8	
940.25	1010.9	28.7	74.3	6.7	64.1	15.0	-11.1	27.1558	-79.5258	8	
940.50				6.4	64.7		-11.1			9	
940.75	1011.6	28.8	75.0	6.3	68.7	8.1	-10.9	27.1558	-79.5258	9	
941.00				6.6	68.6		-10.9			9	
941.25	1012.0	28.8	74.7	6.4	65.8	4.5	-11.0	27.1558	-79.5259	9	
941.50				6.3	64.6		-10.8			9	
941.75	1012.8	28.9	74.4	6.5	63.8	-2.1	-10.8	27.1558	-79.5259	9	
942.00				6.4	66.3		-10.8			9	
942.25	1013.3	28.9	74.2	Bc 7.0	Bc 67.4	-6.9	-10.8	27.1558	-79.5259	9	Bc
942.50				6.4	64.6		-10.8			9	
942.75	1013.9	29.0	73.9	6.5	65.5	-12.0	-10.8	27.1558	-79.5260	9	
943.00				6.6	66.9		-10.8			9	
943.25	1014.5	29.0	74.3	6.5	65.5	-17.1	-10.7	27.1558	-79.5260	9	
943.50				6.5	64.8		-10.6			9	

Figure 15: The Raw tab showing the final seconds of a normal sonde termination.

This example above has all the attributes of a good sonde termination. It was receiving GPS signal from 9 satellites, with valid wind direction and speed, all the way to splash. The pressure steadily rose with each reading every 0.5 seconds until a raw maximum value of 1014.5 mb was measured just before reaching the surface.

Contrast that with the following case of a very problematic termination:

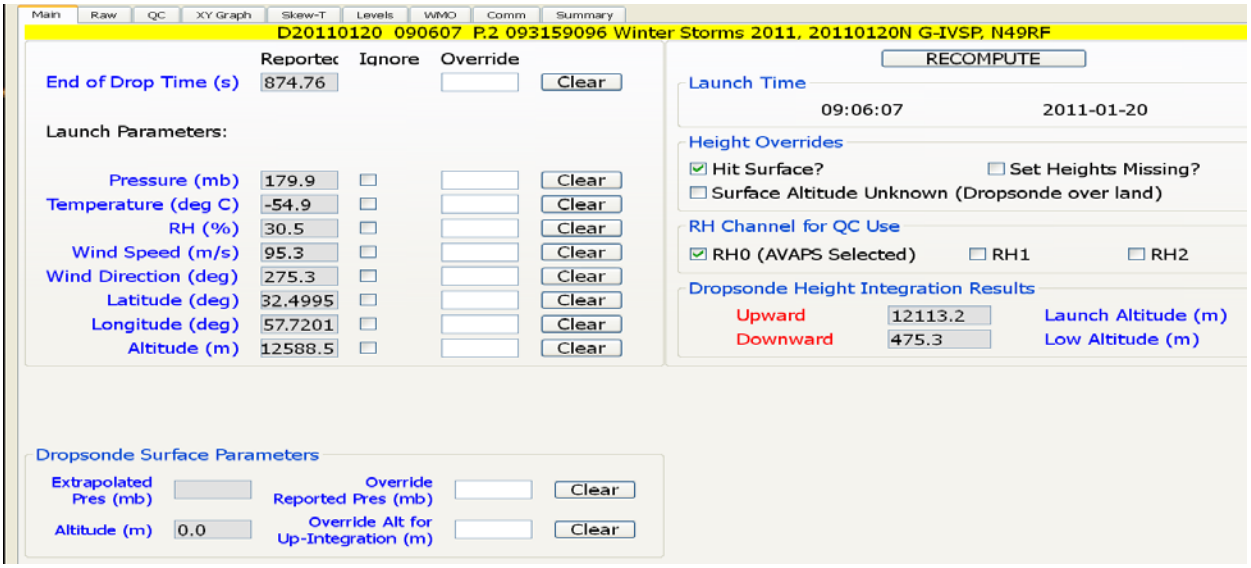

Figure 16: No surface pressure was calculated (in spite of the Hit Surface button being checked). There is nearly 500 meters of Downward Integration and a large difference between the Upward Integration and the Geopotential Altitude calculated by AAMPS

The three things that should be apparent in this example are the large downward integration and the fact that no Extrapolated Pressure was calculated under Dropsonde Surface Parameters. Also there is 475 meters of Downward Integration. Finally, the Upward Integration is also about 475 meters different than the Altitude of the sonde deployment as shown on the left under Launch Parameters (this is the aircraft's Geopotential Altitude as calculated by the aircraft's AAMPS Data System).

When the Raw tab is examined (see Figure 17 below), at the bottom of the data the pressure is nearly constant for the final 14 seconds of data at just under 733 mb (as is the temperature, humidity and altitude).

Main | Raw | QC | XY Graph | Skew-T | Levels | WMO | Comm | Summary

D20110120_090607_P.2 093159096 Winter Storms 2011, 20110120N G-IVSP, N49RF

Time (s)	Pres (mb)	Tdry (C)	RH (%)	Spd (m/s)	Dir (deg)	Alt (m)	Dz/Dt (m/s)	Lat (deg)	Lon (deg)	Sats (n)	Attributes
860.76	P 732.8	P -21.9	P 11.7							0	P
861.26	P 732.7	P -21.9	P 11.3							0	P
861.76	Pc 732.7	-21.9	11.3			2530.1				0	Pc
862.26	Pc 732.8	-21.9	11.3			2529.2				0	Pc
862.76	Pc 732.8	-21.9	11.3			2529.2				0	Pc
863.26	Pc 732.8	-21.9	11.3			2529.6				0	Pc
863.76	Pc 732.7	-21.9	11.3			2529.7				0	Pc
864.26	Pc 732.8	-21.9	11.4			2529.5				0	Pc
864.76	Pc 732.7	-21.9	11.4			2530.0				0	Pc
865.26	P 732.8	P -21.9	P 11.3							0	P
865.76	Pc 732.8	-21.9	11.2			2529.2				0	Pc
866.26	Pc 732.8	-21.9	11.3			2529.6				0	Pc
866.76	P 732.8	P -21.9	P 11.4							0	P
867.26	P 732.7	P -21.9	P 11.4							0	P
867.76	Pc 732.7	-21.9	11.4			2529.8				0	Pc
868.26	Pc 732.7	-21.9	11.4			2529.6				0	Pc
868.76	Pc 732.7	-21.9	11.3			2529.7				0	Pc
869.26	Pc 732.8	-21.9	11.3			2529.2				0	Pc
869.76	P 732.8	P -22.1	P 11.6							0	P
870.26	Pc 732.7	-21.9	11.5			2530.0				0	Pc
870.76										0	
871.26	Pc 732.7	-21.9	11.5			2530.0				0	Pc
871.76	P 732.7	P -21.9	P 11.5							0	P
872.26	P 732.7	P -21.9	P 11.5							0	P
872.76	P 732.7	P -22.1	P 11.4							0	P
873.26	Pc 732.7	-21.9	11.4			2529.8				0	Pc
873.76	Pc 732.8	-21.9	11.4			2529.4				0	Pc
874.26	Pc 732.8	-21.9	11.4			2529.4				0	Pc
874.76	Pc 732.8	-21.9	11.4			2529.3				0	Pc

Figure 17: Abnormal pressure trend: rather than slowly increasing, the pressure becomes "stuck" at around 732.7 mb

Main | Raw | QC | XY Graph | Skew-T | Levels | WMO | Comm | Summary

D20110120_090607_P.2 093159096 Winter Storms 2011, 20110120N G-IVSP, N49RF

Time (s)	Pres (mb)	Tdry (C)	RH (%)	Spd (m/s)	Dir (deg)	Alt (m)	Dz/Dt (m/s)	Lat (deg)	Lon (deg)	Sats (n)	Attributes
795.26	Fc 964.5	9.1	83.4			382.9				0	Fc
795.76	Fc 965.1	9.2	83.4			377.4				0	Fc
796.26	Fc 965.8	9.3	82.9			371.6				0	Fc
796.76	Fc 966.5	9.3	82.8			365.6				0	Fc
797.26	Fc 967.2	9.4	81.9			359.6				0	Fc
797.76										0	
798.26										0	
798.76										0	
799.26										0	
799.76	Fc 970.7	9.7	81.3			329.6				0	Fc
800.26	Fc 971.4	9.7	81.2			324.2				0	Fc
800.76										0	
801.26										0	
801.76										0	
802.26										0	
802.76	P 974.8	P 10.0	P 78.9							0	P
803.26										0	
803.76										0	
804.26	P 977.3	P 9.9								0	P
804.76										0	
805.26										0	
805.76										0	
806.26										0	
806.76										0	
807.26										0	
807.76										0	
808.26										0	
808.76	P 983.0	P 10.5	P 76.5							0	P
809.26										0	

Figure 18: Data became very sporadic just above 800 millibars.

Scrolling back up to 800 seconds in Figure 18 we see that after 797.26 seconds (at 967.2 mb) the PTH data became very sporadic. At this point, we have already lost all GPS data with 0 satellites. Scrolling further down (Figure 19 below) we see the PTH data lose all semblance of validity at around 812 seconds (37.7 mb then 991.4 mb followed by 986.9 mb). At 824.76 seconds is the beginning of the near-constant pressure values of just under 733 mb that lasted until termination.

Main | Raw | QC | XY Graph | Skew-T | Levels | WMO | Comm | Summary

D20110120_090607_P.2 093159096 Winter Storms 2011, 20110120N G-IVSP, N49RF

Time (s)	Pres (mb)	Tdry (C)	RH (%)	Spd (m/s)	Dir (deg)	Alt (m)	Dz/Dt (m/s)	Lat (deg)	Lon (deg)	Sats (n)	Attributes
811.76										0	
812.26	P 37.7									0	P
812.76										0	
813.26										0	
813.76										0	
814.26										0	
814.76	P 991.4	P 11.2	P 73.4							0	P
815.26										0	
815.76										0	
816.26	P 986.9	P 12.1	P 72.7							0	P
816.76										0	
817.26										0	
817.76										0	
818.26										0	
818.76										0	
819.26										0	
819.76										0	
820.26										0	
820.76										0	
821.26										0	
821.76										0	
822.26										0	
822.76										0	
823.26										0	
823.76										0	
824.26										0	
824.76	Fc 732.8	Fc -21.9	11.3			2529.5				0	Fc
825.26	Fc 732.7	Fc -21.9	11.3			2529.6				0	Fc
825.76	Fc 732.7	Fc -21.9	11.4			2529.6				0	Fc

Figure 19: Data either missing or erratic then the pressure hanging at a constant value

This case is a good opportunity to introduce the Skew T tab:

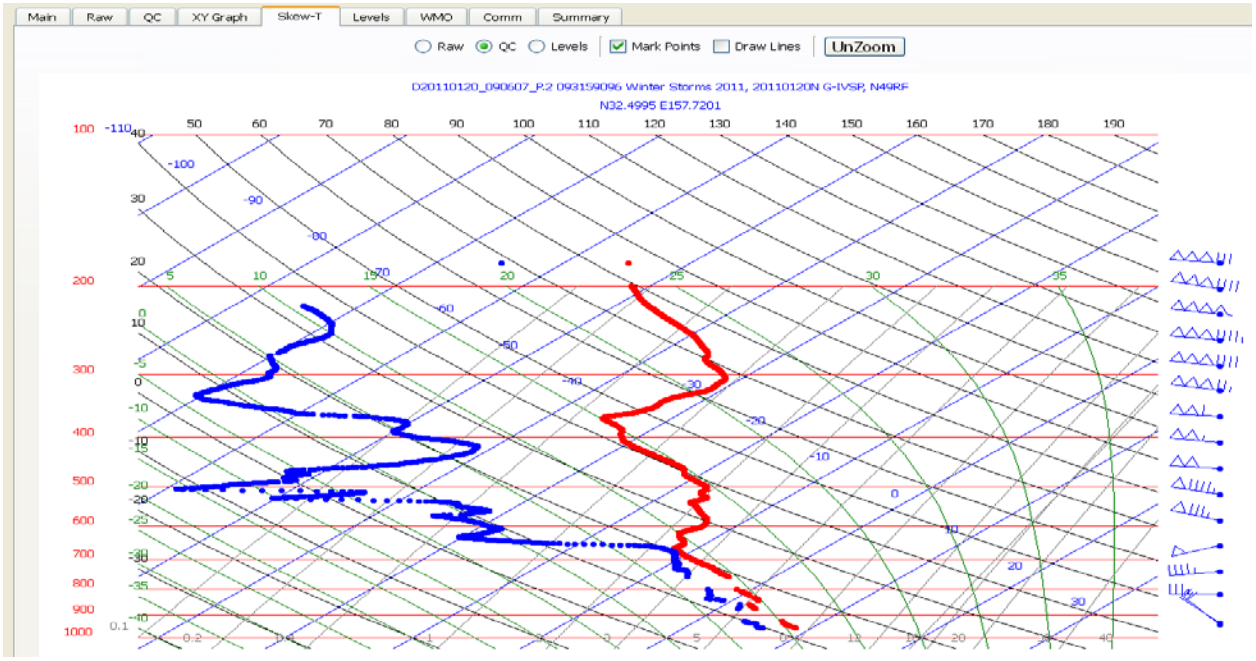

Figure 20: Missing data evident below 700 mb on the Skew T tab

Any portion of the Skew T in ASPEN can be zoomed by clicking and dragging a box:

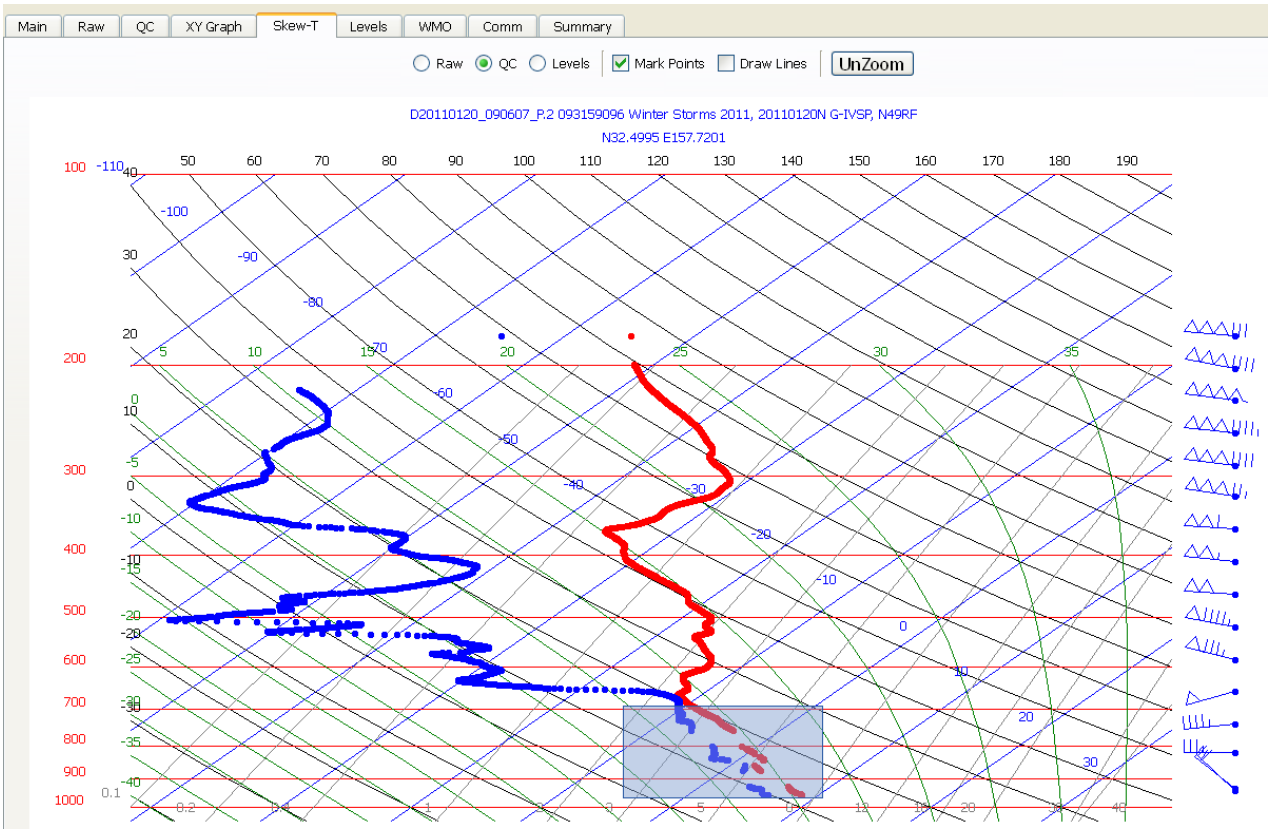

Figure 21: Clicking and dragging will zoom into a portion of the Skew T

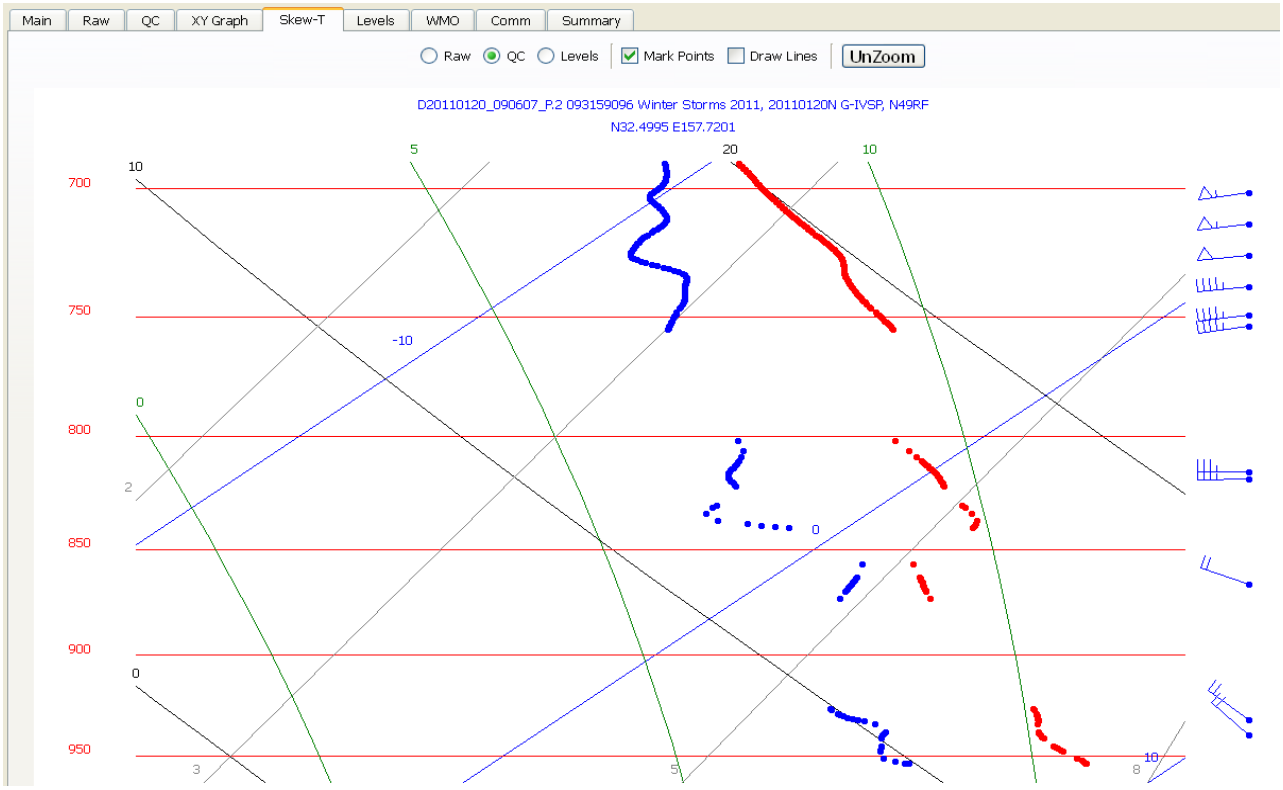

Figure 22: The zoomed in area showing the missing data intervals in greater detail

The bottom of the Skew T clearly shows this sonde has problems. The many large and small gaps that begin just below 750 mb and the lack of any valid data below about 970 millibars illustrate that this sonde cannot be used to calculate geopotential heights.

The Skew T screen in ASPEN is also a valuable tool for the initial screening of the Launch Parameter (aircraft data) section shown on the Main screen. At the high G-IV working altitudes (typically 41,000 through 45,000 feet Pressure Altitude), the aircraft's dew point values are generally unreliable and nearly always read far too warm. In most environments, the G-IV dew point sensors cannot register readings low enough to be accurate (especially in Winter Storm mission settings where flight above the tropopause is in relative humidity regimes of less than 5 percent). Occasionally, in the relatively moist Central Dense Overcast (CDO) of a tropical cyclone, there is good agreement between the aircraft-measured flight level dew point and the first few reliable sonde measurements after stabilization.

Additionally the aircraft temperature sensors can, at times, read too warm by a few degrees. The Skew T screen in ASPEN can assist the FD in determining whether to use or discard the flight level temperature and dew point in finalizing the sounding.

In Figure 23 below, the Skew T from 09:25:47z on 25 Aug 2012 shows an example of where the aircraft's temperature is a reasonable continuation of the trace created by the dropsonde thermistor, suggesting the temp under Launch Parameters should be kept.

Conversely, there is no meteorological evidence to support why there would be a sudden rightward shift in the dew point trace to accommodate the relatively moist aircraft dew point measurement…suggesting that parameter should be discarded.

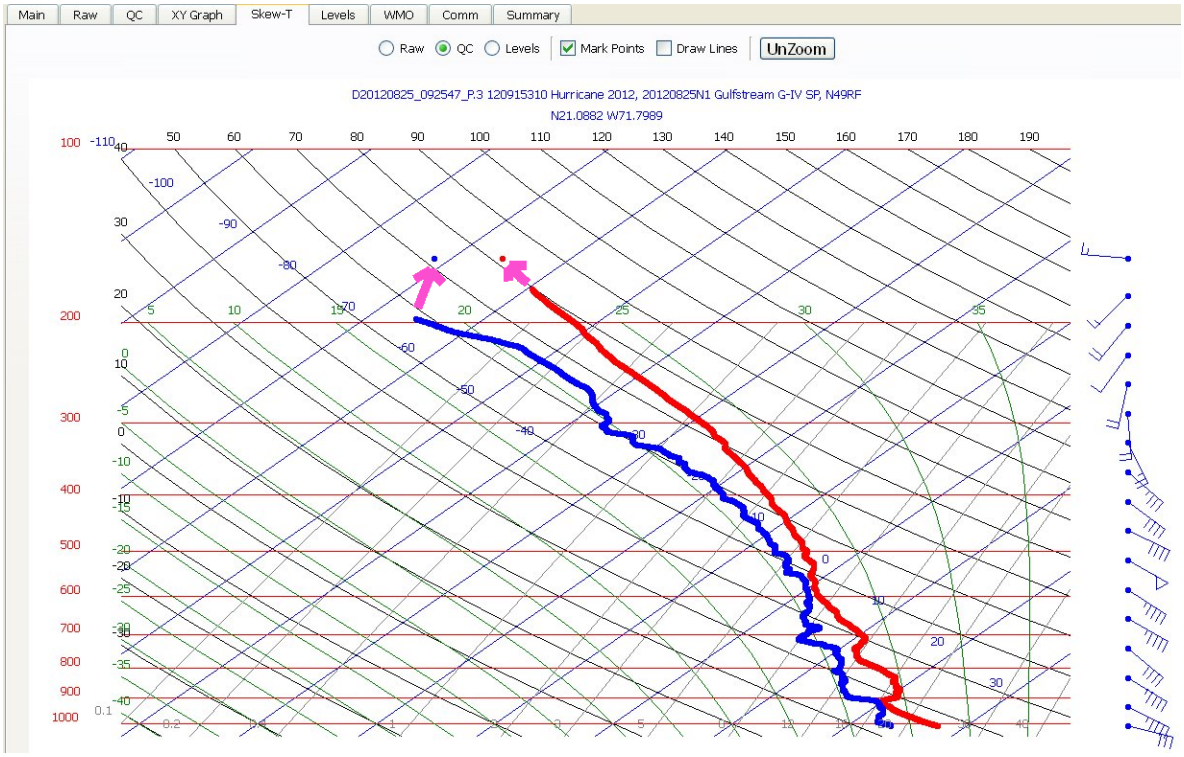

Figure 23: Example where the aircraft's flight level temperature is consistent with the sonde derived trace below it but the aircraft measured dew point is not

Note in Figure 23 on the previous page that the aircraft-derived flight level temperature and dew point are the uppermost red and blue dots well above the rest of the data traces. The gap is normal and due to the long interval needed for the dropsonde's thermistor and hygristor to stabilize before they begin transmitting valid data.

In the example below from 12:40:14z on 12 January 2011, the aircraft temperature is significantly warmer than the first valid sonde temps at the top of the sounding (the Skew T only shows sonde data that has passed through the ASPEN QC filter). Here, there is not enough evidence to be confident in either the aircraft temp or dew point.

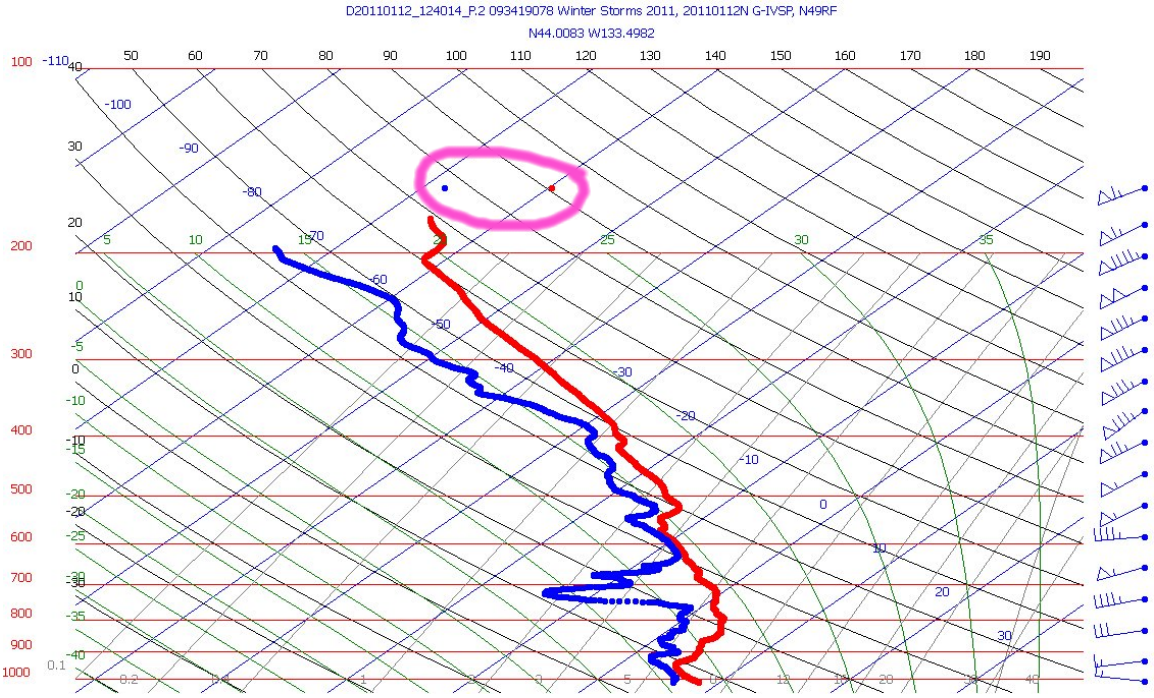

Figure 24: In this example, both flight level temp and dew point are suspect

To discard the aircraft temp and dew point, go to the Main screen and click the IGNORE boxes to the right of Temperature and Relative Humidity under Launch Parameters. Note that these steps generate a flashing exclamation point in the Toolbar as a reminder to always hit RECOMPUTE on the right to recalculate a new sounding:

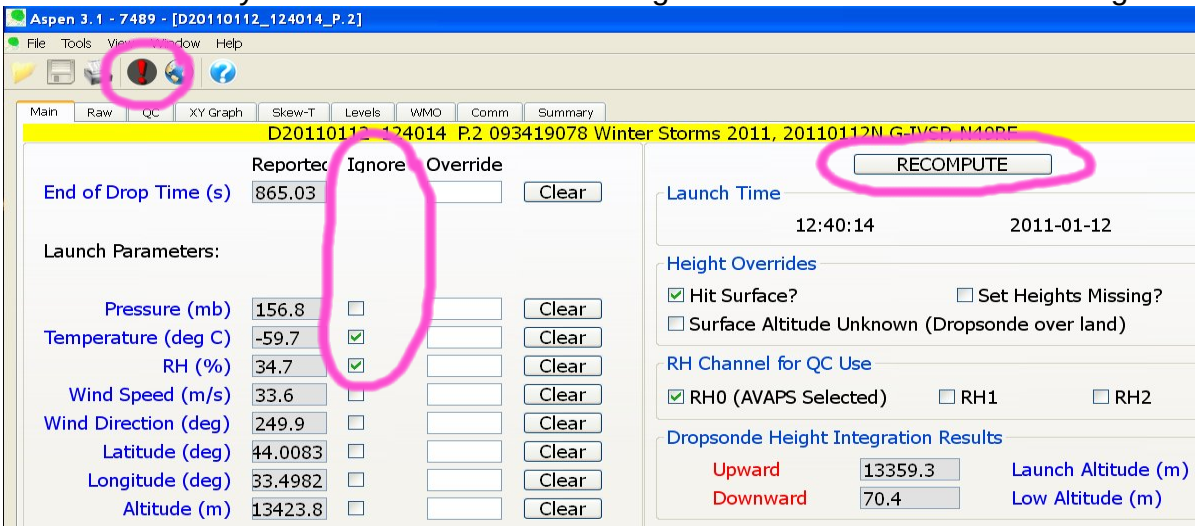

Figure 25: Checking ignore for any of the parameters on the left side generates a flashing exclamation point in the toolbar as a reminder to hit the RECOMPUTE button

After hitting RECOMPUTE the new Skew T will reflect omission of the flight level aircraft temperature and humidity data (see Figure 26 below). Note that the wind data collected from the aircraft is still included (the uppermost wind flag on the right).

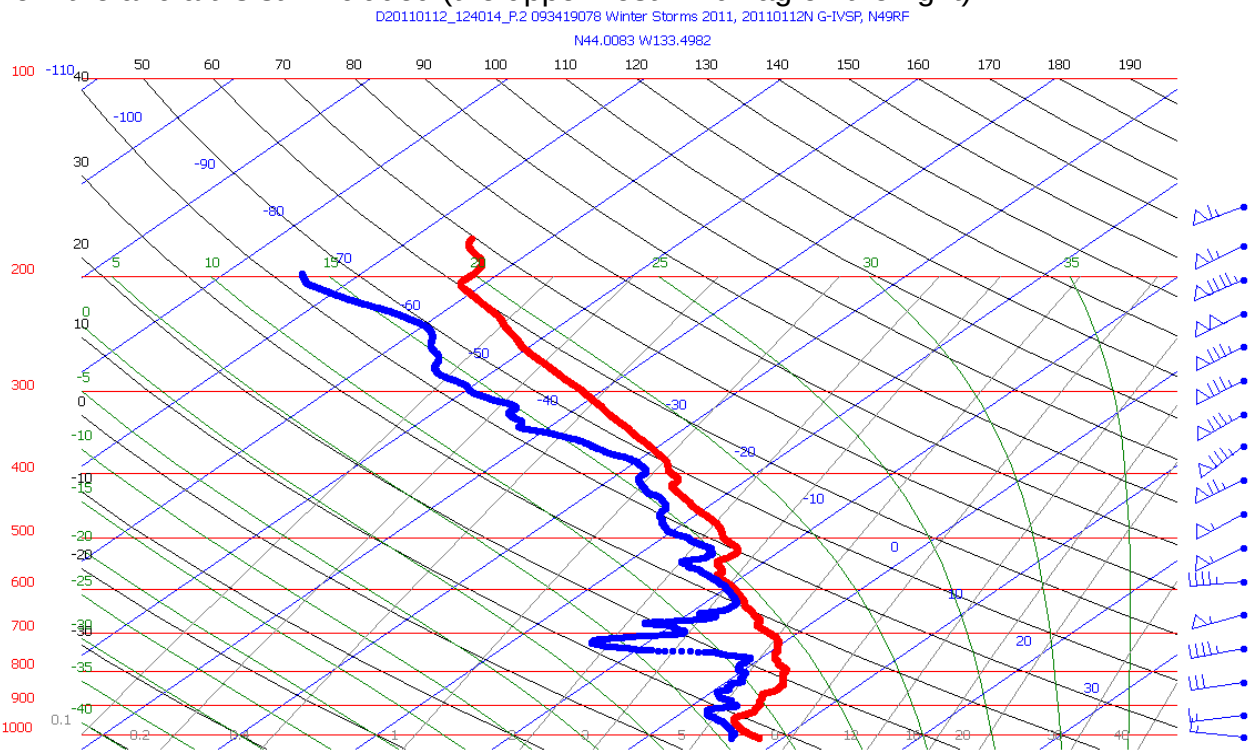

Figure 26: After a new sounding is recomputed the points denoting flight level temperature and dew point (above the traces generated by the sonde) disappear

The decision as to whether to include the aircraft winds is another judgment call on the part of the FD. In recent years, the dependability of flight level (FL) winds on the G-IV has improved dramatically following dedicated wind calibration flights, but the validity of G-IV aircraft measured winds is something that must be checked for each drop. The P-3 aircraft winds can be assumed to be highly accurate unless shown otherwise. Figure 27 below is an example of suspect FL winds on the G-IV:

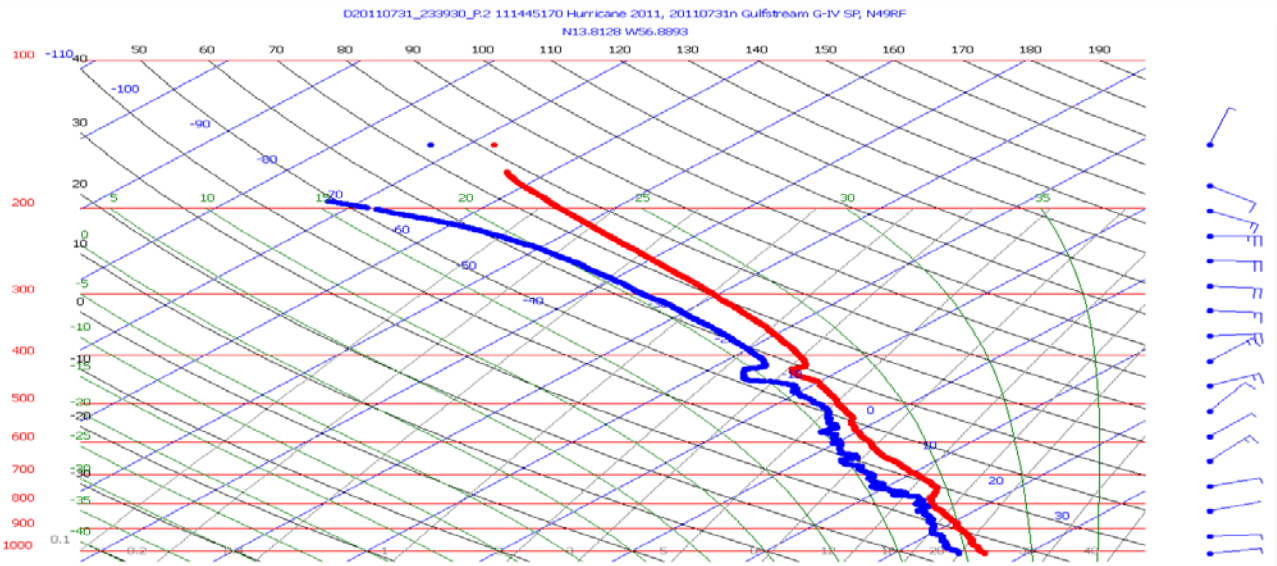

Figure 27: Example showing suspect G-IV aircraft derived flight level winds

The example in Figure 27 of the previous page from 23:39:30z 31 July 2011 shows flight level aircraft derived winds of 020 at 7 knots. The first two winds barbs depicting sonde derived winds show winds from an ESE direction, then a deep layer of easterly winds. While it will be shown shortly that an examination of just the wind barbs on the Skew T is not sufficient to make the determination that aircraft winds are not valid, it does provide evidence that further investigation is necessary.

The next step is to examine the winds in the Raw tab. In Figure 28 below you see the aircraft winds on the top line of 022 degrees at 3.6 meters per second. Then you see three seconds of winds that still reflect the aircraft's forward motion (speeds in excess of 160 m/s). When the winds begin to settle into believable numbers around five seconds after deployment, they are southerly at less than 10 m/s.

Main | Raw | QC | XY Graph | Skew-T | Levels | WMO | Comm | Summary

D20110731_233930_P2 111445170 Hurricane 2011, 20110731n Gulfstream G-IV SP, N49RF

Time (s)	Pres (mb)	Tdry (C)	RH (%)	Spd (m/s)	Dir (deg)	Alt (m)	Dz/Dt (m/s)	Lat (deg)	Lon (deg)	Sats (n)	Attributes
-1.00	F 148.4	F -68.1	F 53.1	F 3.6	F 22.0	14315.1		13.8128	-56.8893		F
0.00	Ae 132.0	Ae 19.1	Ae 1.8	Ae 218.8	Ae 181.5		-0.3	13.8109	-56.8893	12	Ae
0.25				Ae 216.9	Ae 181.5		-0.3			12	Ae
0.50	Ae 145.2	Ae 6.8	Ae 1.0	Ae 213.2	Ae 179.8		-0.2	13.8119	-56.8893	11	Ae
0.75				Ae 211.7	Ae 179.9		-0.1			10	Ae
1.00	Ae 128.4								76.6255	8	P Ae G
1.25										7	
1.50										0	
1.75										0	
2.00										0	
2.25	Ae 149.9	Ae -16.4	Ae 1.0	Ae 174.7	Ae 178.7		-19.7	13.8149	-56.8892	4	Ae
2.50				Ae 165.3	Ae 180.1		-26.0			4	Ae
2.75	Ae 150.1	Ae -19.1	Ae 1.0							0	Ae
3.00										0	
3.25	Ae 150.4	Ae -21.7	Ae 1.0	Ae 53.0	Ae 184.5		-26.8	13.8154	-56.8892	4	Ae
3.50				Ae 38.2	Ae 179.2		-25.5			4	Ae
3.75	Ae 150.6	Ae -24.2	Ae 1.0	Ae 19.6	Ae 169.7	14216.0	-24.3	13.8153	-56.8892	7	Ae
4.00				Ae 14.2	Ae 168.8		-23.1			8	Ae
4.25	Ae 150.9	Ae -26.6	Ae 1.0			14204.0				0	Ae
4.50				Ae 11.5	Ae 182.6		-22.2			9	Ae
4.75	Ae 151.1	Ae -29.0	Ae 1.0	Ae 9.6	Ae 182.6	14192.4	-21.5	13.8144	-56.8893	10	Ae
5.00				Ae 7.2	Ae 180.2		-21.8			7	Ae
5.25	Ae 151.7	Ae -33.8	Ae 1.0	Ae 6.7	Ae 181.1	14166.2	-22.1	13.8137	-56.8893	7	Ae
5.50				Ae 6.0	Ae 182.2		-22.2			8	Ae
5.75										0	
6.00										0	
6.25	Ae 151.9	Ae -36.0	Ae 1.0	Ae 5.4	Ae 181.1	14154.8	-22.1	13.8135	-56.8893	8	Ae
6.50				Ae 4.6	Ae 183.7		-22.3			9	Ae
6.75	Ae 152.2	Ae -38.1	Ae 1.0	Ae 4.6	Ae 180.8	14141.6	-22.4	13.8134	-56.8893	9	Ae

Figure 28: Looking at this example using the Raw tab: Aircraft measured winds of 022 degrees at 3.6 m/s do not correlate well with the first few potentially valid winds at around 5 to 6 seconds that are from a southerly direction.

Looking at the QC tab in Figure 29 below, the first valid sonde winds that make it through the ASPEN QC filter are 10 sec after launch and are SSE at less than 2 m/s:

Main | Raw | QC | XY Graph | Skew-T | Levels | WMO | Comm | Summary

D20110731_233930_P.2 111445170 Hurricane 2011, 20110731n Gulfstream G-IV SP, N49RF

Time (s)	Pres (mb)	Tdry (C)	RH (%)	Spd (m/s)	Dir (deg)	Alt (m)	Dz/dt (m/s)	Lat (deg)	Lon (deg)
9.00									
9.25								13.8133	-56.8893
9.50									
9.75								13.8132	-56.8893
10.00				1.7	168.2				
10.25				1.6	166.5			13.8132	-56.8893
10.50				1.6	164.6				
10.75				1.6	162.4			13.8132	-56.8893
11.00				1.6	160.0				
11.25				1.6	157.4			13.8132	-56.8893
11.50				1.6	154.5				
11.75				1.5	151.5			13.8132	-56.8893

Figure 29: QC tab showing the first quality controlled winds coming in 10 seconds after launch and around 150 degrees different in direction from the aircraft measured winds

While possible, it is unlikely to find winds about 150 degrees apart in direction in the first ten seconds of a sounding. To discard the aircraft winds, click the IGNORE box next to Wind Speed and Wind Direction under Launch Parameters. Remember to always hit the RECOMPUTE button any time after you check or uncheck an IGNORE box.

Figure 30 below, from 13:20:51z 26 August 2012, points out how important it is to not discount the validity of the FL wind based solely on their apparent discontinuity with the first few sonde wind barbs on the Skew T. It is important to understand that when the G-IV reaches the near 150 millibar level it enters the outflow regime of hurricanes where the winds change direction at a few degrees outward from the eyewall, transitioning from clockwise to counterclockwise flow. There are many instances when a sonde will be deployed into the outflow regime then quickly fall into the inflow regime (which may extend up to 200 mb or higher in more intense hurricanes). Below we see aircraft derived 148 mb winds of 260 at 28 knots with southerly and SSE wind barbs denoting the first several sonde derived winds plotted on the Skew T:

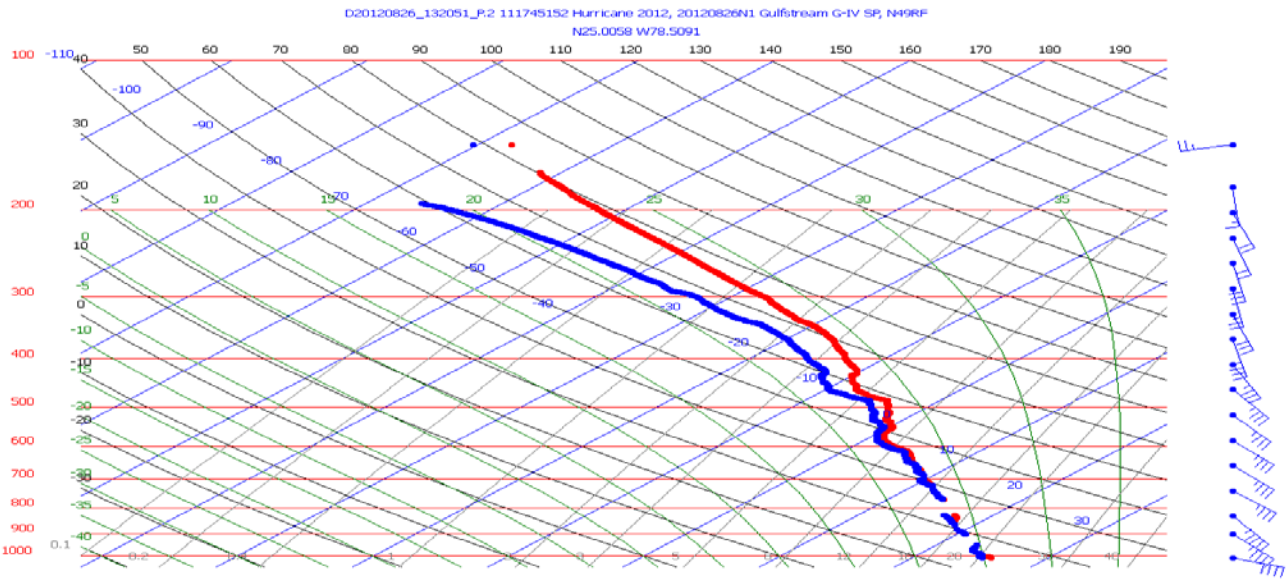

Figure 30: Example of an apparent discontinuity (on first glance looking only at the wind barbs) showing southerly sonde derived winds versus westerly aircraft derived winds

Examining the raw tab of this sounding (Figure 31 below) we see the flight level aircraft derived winds on the top line (260.5 degrees at 14.4 m/s). The forward motion of the aircraft is reflected in the first several seconds of wind data. By 5.50 seconds after launch, the number of satellites being used for position is up to 10 and the wind speed and direction have stabilized into a southwesterly direction between 11-12 m/s.

Main | Raw | QC | XY Graph | Skew-T | Levels | WMO | Comm | Summary

D20120826_132051_P2 111745152 Hurricane 2012, 20120826N1 Gulfstream G-IV SP, N49RF

Time (s)	Pres (mb)	Tdry (C)	RH (%)	Spd (m/s)	Dir (deg)	Alt (m)	Dz/Dt (m/s)	Lat (deg)	Lon (deg)	Sats (n)	Attributes
-1.00	F 147.9	F -67.5	F 68.8	F 14.4	F 260.5	14362.1		25.0058	-78.5091		F
0.00	Ae 154.3	Ae 15.5	Ae 1.0	Ae 217.9	Ae 129.9		0.5	25.0061	-78.5096	10	Ae
0.25				Ae 219.1	Ae 129.9		0.2			10	Ae
0.50	Ae 148.0	Ae 4.8	Ae 1.0	Ae 218.4	Ae 128.9		0.1	25.0067	-78.5104	10	Ae
0.75				Ae 218.2	Ae 128.7		-0.4			10	Ae
1.00	Ae 148.7	Ae -3.2	Ae 1.0	Ae 218.1	Ae 128.8		-0.8	25.0074	-78.5112	10	Ae
1.25				Ae 217.4	Ae 126.6		-2.6			9	Ae
1.50	Ae 149.0	Ae -7.4	Ae 1.0	Ae 216.9	Ae 127.0		-3.3	25.0079	-78.5121	9	Ae
1.75				Ae 216.8	Ae 126.2		-4.7			9	Ae
2.00	Ae 149.2	Ae -10.8	Ae 1.0	Ae 213.7	Ae 125.7		-5.1	25.0085	-78.5129	7	Ae
2.25				Ae 212.2	Ae 125.4		-5.3			6	Ae
2.50	Ae 149.3	Ae -13.5	Ae 1.0	Ae 209.8	Ae 125.1		-5.4	25.0090	-78.5138	6	Ae
2.75				Ae 207.4	Ae 125.0		-5.4			5	Ae
3.00	Ae 149.6	Ae -16.3	Ae 1.0	Ae 205.3	Ae 125.1		-5.3	25.0096	-78.5146	5	Ae
3.25				Ae 202.9	Ae 125.0		-5.3			5	Ae
3.50	Ae 150.2	Ae -19.1	Ae 1.0	Ae 203.3	Ae 124.9	14275.3	-5.2	25.0101	-78.5154	4	Ae
3.75				Ae 102.6	Ae 126.8		12.4			6	Ae
4.00	Ae 150.5	Ae -21.6	Ae 1.0	Ae 63.1	Ae 129.9	14261.9	17.5	25.0098	-78.5149	4	Ae
4.25				Ae 50.3	Ae 131.3		19.4			4	Ae
4.50	Ae 150.8	Ae -24.2	Ae 1.0	Ae 48.0	Ae 134.3	14250.5	21.3	25.0098	-78.5148	4	Ae
4.75				Ae 24.8	Ae 140.7		15.6			6	Ae
5.00	Ae 151.0	Ae -26.9	Ae 1.0	Ae 11.9	Ae 159.0	14239.6	7.1	25.0094	-78.5140	8	Ae
5.25				Ae 8.0	Ae 198.7		-0.9			9	Ae
5.50	Ae 151.3	Ae -29.4	Ae 1.0	Ae 11.2	Ae 222.8	14226.0	-9.3	25.0089	-78.5130	10	Ae
5.75				Ae 11.9	Ae 227.5		-14.6			10	Ae
6.00	Ae 151.6	Ae -32.0	Ae 1.0	Ae 11.9	Ae 228.7	14211.4	-18.1	25.0083	-78.5119	10	Ae
6.25				Ae 11.8	Ae 230.4		-20.3			10	Ae
6.50	Ae 151.8	Ae -34.2	Ae 1.0	Ae 11.5	Ae 233.2	14198.7	-21.2	25.0080	-78.5111	8	Ae
6.75				Ae 11.4	Ae 234.4		-21.8			8	Ae

Figure 31: Raw tab showing aircraft derived winds on the first line (provided by the AAMPS data system) and then around five seconds of invalid sonde winds that reflect the rapid forward motion of the sonde after leaving the launch tube. After five seconds the sonde winds stabilize only about 3 knots and 25 degrees different than FL winds

Examining the QC tab of data that has made it through the ASPEN validity filters we see the first QC'd wind values come in at 10 seconds showing 243.8 degrees at 11.3 m/s. Even though the Skew T did not display these WSW winds as wind barbs, they help to confirm there was not sufficient evidence to discard the aircraft derived flight level winds as invalid.

Main | Raw | QC | XY Graph | Skew-T | Levels | WMO | Comm | Summary

D20120826_132051_P2 111745152 Hurricane 2012, 20120826N1 Gulfstream G-IV SP, N49RF

Time (s)	Pres (mb)	Tdry (C)	RH (%)	Spd (m/s)	Dir (deg)	Alt (m)	Dz/dt (m/s)	Lat (deg)	Lon (deg)
9.50								25.0076	-78.5098
9.75									
10.00				11.3	243.8			25.0076	-78.5097
10.25				11.2	243.6				
10.50				11.1	243.5			25.0076	-78.5097
10.75				11.0	243.4				
11.00				10.9	243.3			25.0077	-78.5096
11.25				10.8	243.2				
11.50				10.7	243.1			25.0077	-78.5095
11.75				10.6	243.1				
12.00				10.5	243.0			25.0077	-78.5095

Figure 32: QC tab showing the first valid winds at 10 sec after launch are only about 15 degrees in direction and 3 knots in speed different than aircraft derived FL winds

7.6 Understanding the WMO TEMPDROP Message

After the initial validity checks performed both manually by the FD and automatically by ASPEN, a WMO TEMPDROP message is created. It is vital to examine the message. before it is transmitted off the aircraft, First, an understanding of the components of a TEMPDROP message is necessary. To view the TEMPDROP message, click on the WMO tab in ASPEN. An example is shown in Figure 33 below. Note that it reads beginning from the bottom of the sounding upward (the opposite of a D file or other ASPEN products that read from the top down).

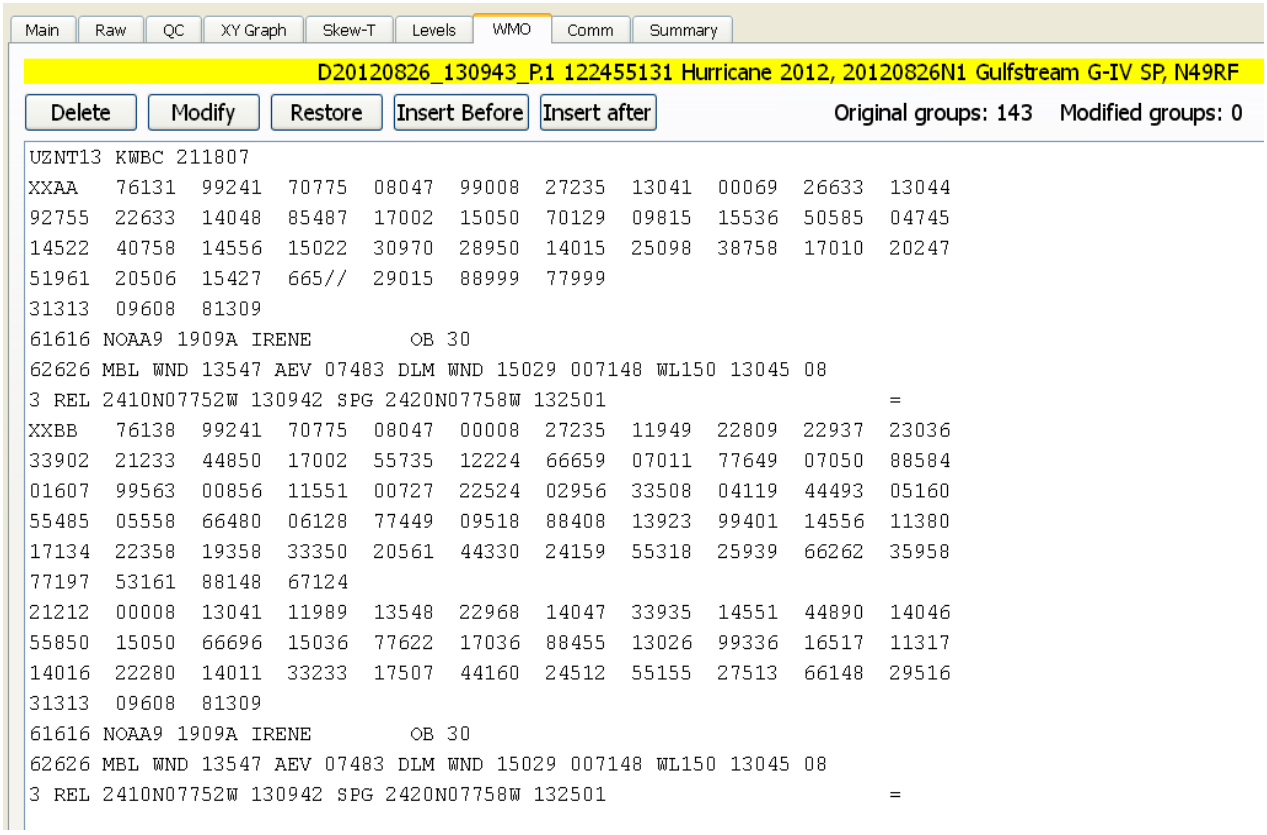

Figure 33: A WMO TEMPDROP message from a G-IV mission into Hurricane Irene

Much of the code is pre-determined. A full tutorial of all the groups is included as Appendix A. The message can be broken down into five sections:

1) Headers
2) The XXAA Section - Mandatory Level Data
3) The XXBB Section - Significant Temperature Levels
4) The 21212 Group - Significant Wind Levels
5) Remarks

Headers – UZNT13 defines this message as a TEMPDROP for the North Atlantic Basin. This is automatically set by the Weather Message Module (WMM). The others most commonly used are:

UZPN13 - Eastern North Pacific
UZPA13 - Western North Pacific (west of the International Date Line)

The next group in the Header is always KWBC for NOAA AOC aircraft. This is also set by the WMM. This distinguishes messages sent by the P-3 and G-IV from those transmitted by the 53rd WRS which commonly uses KNHC. Finally, 211807 indicates that ASPEN processed this sounding and created the TEMPDROP on the 21st day of the month at 1807 UTC.

The first few groups of the XXAA section are non-meteorological bookkeeping and explained in Appendix A. The first meteorological item to check is the sea level pressure which is denoted as a three digit number which follows the 99 identifier. In the example highlighted in Figure 34 below we see the 99 identifier followed by 008. This denotes a sea level pressure of 1008 millibars. ASPEN will round its calculation to the nearest whole millibar. When sea level pressure is 1000 mb or higher the leading 1 is dropped. The next group shows surface temperature and dew point depression. In this case, 27235 denotes a temperature of 27.2C and a dew point depression of 3.5 degrees C. Finally, the surface wind group, 13041, denotes a wind of 130 at 41 knots. The wind direction is graduated in units of five degrees. ASPEN calculates wind direction to the nearest degree but then for the TEMPDROP message it is rounded to the nearest five degree increment. When winds are greater than 100 knots and the wind direction ends in five (such as 135 degrees), the hundreds digit for speed is added to the five for direction. Therefore a wind of 135 at 127 knots would be coded as 13627. A wind of 135 at 208 knots would be coded as 13708.

```
UZNT13 KWBC 211807
XXAA   76131  99241  70775  08047  99008  27235  13041  00069  26633  13044
92755  22633  14048  85487  17002  15050  70129  09815  15536  50585  04745
14522  40758  14556  15022  30970  28950  14015  25098  38758  17010  20247
51961  20506  15427  665//  29015  88999  77999
31313  09608  81309
61616 NOAA9 1909A IRENE        OB 30
```

Figure 34: The XXAA Section of a WMO TEMPDROP message

The next mandatory level in the XXAA section is 1000 millibars. Its groups are highlighted in Figure 35 below. The 1000 mb level is identified by a leading 00 followed by the 1000 mb geopotential height (69 meters in this case). The temperature and dew point depression group, as well as the wind group are coded the same as in the surface data groups. If the surface pressure is less than 1000 mb there will be no temperature, humidity or wind data for the 1000 mb mandatory level. In these cases, the temperature humidity and wind groups are slashed out with /////.

```
UZNT13 KWBC 251647
XXAA   76131  99241  70775  08047  99008  27235  13041  00069  26633  13044
92755  22633  14048  85487  17002  15050  70129  09815  15536  50585  04745
14522  40758  14556  15022  30970  28950  14015  25098  38758  17010  20247
51961  20506  15427  665//  29015  88999  77999
31313  09608  81309
61616 NOAA9 1909A IRENE        OB 30
```

Figure 35: The 1000 millibar Group of the XXAA Section

The next level is 925 mb (identified by the leading 92 in the geopotential height group). Note in Figure 35 above that the geopotential height is coded explicitly as 755 meters. Above 925 mb, each subsequent mandatory level must use some form of shorthand to code geopotential height with only three digits available. For 850 millibars, in the example above the height is 1487 meters with the leading digit being dropped. For 700 millibars above the height is 3129 meters with the leading digit again being dropped. Beginning at 500 mb, the height is shown in decameters (the geopotential height in the example above is 5850 meters with the 400 mb height being 7580 meters).

Beginning at 500 millibars, while ASPEN calculates geopotential heights to the nearest meter, it codes the TEMPDROP message rounded to the nearest decameter. It will be shown in later sections that tools in ASPEN will display heights at these higher levels to one meter resolution but then not code them to the same resolution in the message.

Above 300 millibars (where geopotential heights exceed 10,000 meters) even though the value is still expressed in decameters there are not enough available digits to code heights without dropping the leading digit. Therefore, as in Figure 36 below, while the 300 mb height is simply 970 decameters or 9700 meters, beginning at the 250 mb height (shown as 098) the leading digit of 1 is dropped denoting a height of 1098 decameters or 10,980 meters. The 200 mb height below is 12,470 meters and the 150 mb height is 14,270 meters.

```
UZNT13 KWBC 251647
XXAA   76131  99241  70775  08047  99008  27235  13041  00069  26633  13044
92755  22633  14048  85487  17002  15050  70129  09815  15536  50585  04745
14522  40758  14556  15022  30970  28950  14015  25098  38758  17010  20247
51961  20506  15427  665//  29015  88999  77999
31313  09608  81309
61616 NOAA9 1909A IRENE        OB 30
```

Figure 36: Since the 250 mb Geopotential Height is greater than 10,000 meters, the value of 10,980 meters (1098 decameters) is denoted as 098. The leading digit is also dropped for 200 and 150 millibar heights.

It is useful to have a feel for the general range in which to expect the geopotential heights to fall. Below in Table 1 are the standard heights of each mandatory level in an idealized atmosphere with a surface pressure of 1013.2 mb, a surface temperature of 20C, a standard lapse rate of 6.5 degrees, and a tropopause height of 226 millibars:

1000 mb	111 m
925 mb	762 m
850 mb	1457 m
700 mb	3012 m
500 mb	5574 m
400 mb	7185 m
300 mb	9164 m
250 mb	10363 m
200 mb	11784 m
150 mb	13608 m

Table 1: Standard Geopotential Heights of each mandatory level

It is important to have a good grasp of the synoptic setting in which a mission will be conducted with the resulting effects that can be expected on the geopotential heights. In general, G-IV Winter Storm missions flown above large, cold core baroclinic lows at high latitudes over the Pacific Ocean will result in geopotential heights much lower than those shown in the table above. In contrast, a Hurricane Synoptic Surveillance G-IV mission may sample the Subtropical Ridge over the North Atlantic and find geopotential heights considerably higher. When circumnavigating the core of a hurricane (or flying across the top of the core on a G-IV Tail Doppler Radar CDO mission) surface pressures and geopotential heights in much of the troposphere will be well below standard heights, however, strong warm core barotropic systems display positive geopotential height anomalies in the upper troposphere.

Regarding temperature, when the last digit (tenths of a degree) is even, this denotes above freezing. When it is an odd number, the temperature is negative. In Figure 37 below, the 700 mb temperature is +9.8C while the 500 mb temp is -4.7C.

```
UZNT13 KWBC 251647
XXAA   76131  99241  70775  08047  99008  27235  13041  00069  26633  13044
92755  22633  14048  85487  17002  15050  70129  09815  15536  50585  04745
14522  40758  14556  15022  30970  28950  14015  25098  38758  17010  20247
51961  20506  15427  665//  29015  88999  77999
31313  09608  81309
61616 NOAA9 1909A IRENE        OB 30
```

Figure 37: Positive temperatures are denoted by the third digit of a temperature being even. Negative temperatures end in an odd number. Here the 700 mb temp is +9.8C while the 500 mb temp is -4.7C

Appendix A includes a full description of the coding of dew point depression (DPD). Summarizing some of the most commonly seen values, when the DPD is between 0 and 4.9 degrees C, it is explicitly coded. In Figure 38 below, the last two digits of the highlighted groups for the surface through 500 mb all denote DPDs in this range (3.3 at 1000 and 925 mb, 0.2 at 850 mb, 1.5 at 700 mb and 4.5 degrees at 500 mb).

```
UZNT13 KWBC 251647
XXAA   76131  99241  70775  08047  99008  27235  13041  00069  26633  13044
92755  22633  14048  85487  17002  15050  70129  09815  15536  50585  04745
14522  40758  14556  15022  30970  28950  14015  25098  38758  17010  20247
51961  20506  15427  665//  29015  88999  77999
31313  09608  81309
61616 NOAA9 1909A IRENE        OB 30
```

Figure 38: Dew point depression of 3.5 degrees at the surface, 3.3 at 1000 mb and 925 mb, 0.2 at 850 mb, 1.5 at 700 mb and 4.5 at 500 mb

When the DPD is between 5.0 and 5.4 degrees, it is coded as 50. This is highlighted in Figure 39 below for 300 mb:

```
UZNT13 KWBC 251647
XXAA   76131  99241  70775  08047  99008  27235  13041  00069  26633  13044
92755  22633  14048  85487  17002  15050  70129  09815  15536  50585  04745
14522  40758  14556  15022  30970  28950  14015  25098  38758  17010  20247
51961  20506  15427  665//  29015  88999  77999
31313  09608  81309
61616 NOAA9 1909A IRENE        OB 30
```

Figure 39: Dew point depression at 300 mb of between 5.0 - 5.4 degrees coded as 50

Between 5.5 and 6.0 degrees, DPD is coded as 56 seen in Figure 40 below at 400 mb:

```
UZNT13 KWBC 251647
XXAA   76131  99241  70775  08047  99008  27235  13041  00069  26633  13044
92755  22633  14048  85487  17002  15050  70129  09815  15536  50585  04745
14522  40758  14556  15022  30970  28950  14015  25098  38758  17010  20247
51961  20506  15427  665//  29015  88999  77999
31313  09608  81309
61616 NOAA9 1909A IRENE        OB 30
```

Figure 40: Dew point depression at 400 mb of between 5.5 - 6.0 degrees coded as 56

When the DPD is more than 6.0 degrees, the value is coded only to the nearest whole degree and added to the number 50. In Figure 41 below, in the highlighted group at 250 mb the 58 represents a DPD of 8 degrees while the 61 at 200 mb represents an 11 degree DPD:

```
UZNT13 KWBC 251647
XXAA   76131  99241  70775  08047  99008  27235  13041  00069  26633  13044
92755  22633  14048  85487  17002  15050  70129  09815  15536  50585  04745
14522  40758  14556  15022  30970  28950  14015  25098  38758  17010  20247
51961  20506  15427  665//  29015  88999  77999
31313  09608  81309
61616 NOAA9 1909A IRENE        OB 30
```

Figure 41: Dew point depression at 250 mb of 8 degrees coded as 58 and a DPD of 11 degrees at 200 mb coded as 61

For conditions where the relative humidity is measurable but less than 20%, 80 would be used (implying a DPD of 30 for everything in that range). If the air is too dry to measure humidity, then // is used. If the IGNORE box for RH is checked on the ASPEN Main tab the resulting TEMPDROP message (see Figure 42 on the next page) will show // for DPD at 150 mb (if the flight level is above 150 mb and the first valid dropsonde humidity readings do not begin until the sonde is below 150 mb).

```
UZNT13 KWBC 261347
XXAA   76131  99241  70775  08047  99008  27235  13041  00069  26633  13044
92755  22633  14048  85487  17002  15050  70129  09815  15536  50585  04745
14522  40758  14556  15022  30970  28950  14015  25098  38758  17010  20247
51961  20506  15427  665//  29015  88999  77999
31313  09608  81309
61616 NOAA9 1909A IRENE        OB 30
```

Figure 42: For 150 mb, when the IGNORE box is checked for Humidity (RH%) under Launch Parameters then // will appear in the TEMPDROP message for DPD

When the surface pressure is below 1000 mb, the temperature, humidity and wind groups for the 1000 mb mandatory level are slashed out. In these cases, the 1000 mb geopotential height is a negative value and is coded by adding 500 to the height as shown below in Figure 43 where 535 denotes a geopotential height of -35 meters. This case is from a WSR mission southwest of Alaska near the International Date Line (note the UZPN13 header).

```
UZPN13 KWBC 261443
XXAA   60132  99465  71800  16260  99996  04840  18503  00535  /////  /////
92596  00457  25008  85270  03159  25010  70776  13158  23526  50529  26557
26052  40687  37361  25578  30880  50567  27078  25997  55974  22521  20141
51183  18520  88249  56175  22022  77338  26106  42535
31313  09608  81232
51515  10190  15328
61616 NOAA9 01WSW TRACK71      OB 09
```

Figure 43: An example where the surface pressure is below 1000 mb. In these cases, the 1000 millibar Geopotential Height is a negative value and is denoted in the 1000 mb Group by adding 500 to the value (the 535 here denotes a 1000 mb height of -35 meters). The rest of the Group (temperature, humidity and winds) is slashed out with /////

Looking further at the XXAA Section of this sounding, the tropopause data is shown near the end of the section after the highest mandatory level (which in the example shown below as Figure 44 is 200 mb). The identifier for the tropopause data is 88 and, in this case shown below, is located at 249 mb. The next two groups are the temp, humidity, and wind found at the tropopause in the same format as the mandatory levels (temp -56.1C, DPD 25 deg C, winds 220 at 22 knots).

```
UZPN13 KWBC 261443
XXAA   60132  99465  71800  16260  99996  04840  18503  00535  /////  /////
92596  00457  25008  85270  03159  25010  70776  13158  23526  50529  26557
26052  40687  37361  25578  30880  50567  27078  25997  55974  22521  20141
51183  18520  88249  56175  22022  77338  26106  42535
31313  09608  81232
51515  10190  15328
61616 NOAA9 01WSW TRACK71      OB 09
```

Figure 44: The Tropopause Data Group follows the “88” identifier after the highest mandatory level

The final groups in the XXAA Section come after the tropopause 88 groups and describe with the maximum wind found in the sounding. In the case shown in Figure 44 on the previous page, the maximum wind did not occur at flight level so it is identified by 77 (if the max wind coincides with flight level it is coded as 66). What follows the 77 is the level which the max wind was found…338 mb in the case. The next group is the direction and speed of the max wind (260 at 106 knots). The final group in this set deals with characterization of the wind shear. This group is very complex and not typically QC'd by the FD on a busy mission with many drops to process. An explanation is included in Appendix A.

The XXBB Section describes significant temperature levels where there is an abrupt change in the lapse rate. The obvious example of what will trigger ASPEN to generate a significant level in this section is when it encounters an inversion. However, any change in the lapse rate that meets the criteria established in the ASPEN user settings will trigger creation of a level.

The same book keeping found at the beginning of the XXAA Section also begins the XXBB Section (items such as date / time group, location, octant and Marsden Square of the Earth which are explained in the appendix). The first significant level is always the surface if it was measured. If so, the surface will use the identifier 00…if there was no surface temperature data the first significant level will be identified by 11. Subsequent significant levels are then identified by 22, 33, 44, and so on, followed in the group by the pressure level of that significant temperature departure. The 00 is not repeated as it is reserved for use only for designating the surface (so 99, if it is coded, would be followed by 11). In Figure 45 below there are 18 significant temperature levels beginning with the surface (996 mb) where the following group follows the same temp and humidity coding as in the XXAA Section (temp +4.8C DPD of 4.0 degrees). The next significant level at 917 mb has a temp of -0.01C and a DPD between 5.5 and 6.0 degrees. Then we have additional levels from 895 mb up to 163 mb (temp -50.7C DPD 13 degrees).

XXBB	60138	99465	71800	16260	00996	04840	11917	00156	22895	00563
33850	03159	44809	05161	55739	11356	66664	14764	77653	13182	88637
12187	99581	17773	11511	25357	22404	36761	33375	40959	44261	55372
55241	56376	66213	49183	77185	53369	88163	50763			

Figure 45: The XXBB Section showing 18 significant temperature levels

The 21212 Section is for significant wind levels. In a fashion similar to the XXBB Section, a group is created each time there is a significantly abrupt change in wind speed or direction to meet the thresholds established in the User Settings. There are no bookkeeping groups in the 21212 Section. It begins with the 21212 identifier immediately below the last line of the XXBB Section and uses the same convention beginning with 00 to denote the surface wind then 11 to mark the first significant wind level aloft (if no surface winds are measured the first identifier used is 11). There are 25 groups (seen in Figure 46 at the top of the following page) beginning with a surface (996 mb) wind of 185 at 3 knots. The next significant wind level is 916 mb with winds of 255 at 10 knots. Note that the highest wind in a sounding is always one of the significant wind levels in the 21212 Section (see the level marked with 44 at 338 mb where winds are 260 at 106 knots).

```
21212 00996 18503 11916 25510 22882 26510 33850 25010 44842 26511
55825 26512 66799 23015 77680 22530 88660 22026 99633 27017 11599
28526 22549 26540 33435 25559 44338 26106 55293 27075 66264 27533
77259 27023 88255 24018 99242 21030 11227 22547 22216 23045 33204
19518 44197 18522 55183 19534 66163 20522
```

Figure 46: The 21212 Section showing 25 significant wind levels

Remarks are signified by assigned designations. Many of the remarks used in reconnaissance fall under the category of "nationally developed" codes and thus follow the 62626 group identifier. In Figure 47 below, the first remark following the 62626 identifier is for the last QC'd wind prior to splash. This LST WND remark is not used if the last valid wind is measured within 12 meters of the surface. When the last valid wind is above 12 meters the surface wind is slashed out with ///// in the XXAA and 21212 Sections. In the case below the last valid wind as per the ASPEN filter was 16 meters.

```
UZPA13 KWBC 262041
XXAA  70102 99357 11688 12858 99995 09037 ///// 00538 ///// /////
92603 04230 29034 85285 01107 28036 70808 10958 26550 50530 29162
26578 40687 37962 26122 30881 41995 26621 25005 417// 27145 20155
453// 26639 88348 45374 26119 66172 26650 414//
31313 09608 81009
51515 10190 15346
61616 NOAA9 07WSW TRACK76       OB 16
62626 LST WND 016 MBL WND 28028 AEV 07483 LAST REPORT DLM WND 265
77 994172 WL150 27523 089 REL 3573N16884E 100949 SPG 3576N16922E
 102313 =
XXBB  70108 99357 11688 12858 00995 09037 11850 01107 22826 02712
33815 01956 44804 02158 55711 10357 66660 13564 77539 25975 88522
27362 99508 28763 11438 32776 22386 40162 33356 44772 44342 45576
55300 41995 66290 40599 77261 41798 88217 427// 99172 47964
21212 00995 ///// 11994 27022 22946 29033 33850 28036 44726 27042
55641 25568 66528 25566 77416 26121 88317 26113 99274 27141 11234
26647 22191 26630 33172 26650
31313 09608 81009
51515 10190 15346
61616 NOAA9 07WSW TRACK76       OB 16
62626 LST WND 016 MBL WND 28028 AEV 07483 LAST REPORT DLM WND 265
77 994172 WL150 27523 089 REL 3573N16884E 100949 SPG 3576N16922E
 102313 =
```

Figure 47: The LST WND 016 remark denotes the last valid wind prior to splash at 16 meters. With no valid winds within 10 meters of splash, surface winds are coded as /////. In cases where ASPEN does not code a surface wind, the lowest valid wind measurement can be found as the fist group following the surface in the 21212 Section (in this example, at 994 mb (one millibar above the surface) winds of 270 at 22 knots).

Note that the 62626 remarks group is repeated at the end of the message as is the 61616 group (the line just above it) that includes the Mission ID & observation number. Other remarks dealing with wind are highlighted in Figure 48 on the following page. The Mean Boundary Layer Wind is the mean velocity over the bottom 500 meters of the sounding…in this case…280 at 28 knots. The Deep Layer Mean Wind is calculated through the entire depth of the sounding containing QC'd winds. In this case it was 265 at 77 knots in a layer from 994 mb up through 172 mb (the next six digit group after

DLM WND). Finally the WL150 group is the mean wind velocity of QC'd winds over the lowest 150 meters (275 at 23 knots) with the next group showing the height above the surface of the mid-point of that 150 meter layer (89 meters).

```
UZPA13 KWBC 262041
XXAA  70102 99357 11688 12858 99995 09037 ///// 00538 ///// /////
92603 04230 29034 85285 01107 28036 70808 10958 26550 50530 29162
26578 40687 37962 26122 30881 41995 26621 25005 417// 27145 20155
453// 26639 88348 45374 26119 66172 26650 414//
31313 09608 81009
51515 10190 15346
61616 NOAA9 07WSW TRACK76      OB 16
62626 LST WND 016 MBL WND 28028 AEV 07483 LAST REPORT DLM WND 265
77 994172 WL150 27523 089 REL 3573N16884E 100949 SPG 3576N16922E
 102313 =
XXBB  70108 99357 11688 12858 00995 09037 11850 01107 22826 02712
33815 01956 44804 02158 55711 10357 66660 13564 77539 25975 88522
27362 99508 28763 11438 32776 22386 40162 33356 44772 44342 45576
55300 41995 66290 40599 77261 41798 88217 427// 99172 47964
21212 00995 ///// 11994 27022 22946 29033 33850 28036 44726 27042
55641 25568 66528 25566 77416 26121 88317 26113 99274 27141 11234
26647 22191 26630 33172 26650
31313 09608 81009
51515 10190 15346
61616 NOAA9 07WSW TRACK76      OB 16
62626 LST WND 016 MBL WND 28028 AEV 07483 LAST REPORT DLM WND 265
77 994172 WL150 27523 089 REL 3573N16884E 100949 SPG 3576N16922E
 102313 =
```

Figure 48: Mean Boundary Layer (MBL WND), Deep Layer Mean (DLM WND) and Lowest 150 Meter (WL150) remarks

The items highlighted in Figure 49 below include the sonde release point and time (REL). This position (35.73N 168.84W) is given in decimal format rather than degrees and minutes. The following six digit group is the release time in UTC including seconds (10:09:49z). The splash point (SPG) and time follows the same format. AEV is the release number of the ASPEN software used to create the message. The LAST REPORT message is included to signify that this is the last observation of a mission (not including HDOBs which have their own separate numbering scheme). It is appended to the TEMPDROP by clicking the Last Report box on the COMM Tab. However, the remark needs to be manually edited by the FD before this last message can be transmitted. The procedure for manually editing fields in the TEMPDROP message is included in Section 7.9.

```
61616 NOAA9 07WSW TRACK76      OB 16
62626 LST WND 016 MBL WND 28028 AEV 07483 LAST REPORT DLM WND 265
77 994172 WL150 27523 089 REL 3573N16884E 100949 SPG 3576N16922E
 102313 =
```

Figure 49: Remarks for Release Location and Time (REL), Splash Location and Time (SPG), ASPEN Version (AEV) and the LAST REPORT remark

There are remarks used during P-3 missions that specifically deal with hurricane penetrations. Figure 50 below is an example of a remark denoting the drop was made into the eastern eyewall of Hurricane Earl. The EYEWALL 090 remark signifies an azimuth of 090 out from the center of the storm. Note the 105 knot surface winds:

```
UZNT13 KWBC 021230
XXAA  52127 99302 70745 11604 99952 26200 10105 00938 ///// /////
92253 24600 12634 85996 21800 14635 70669 14800 17127 88999 77999
31313 09608 81209
51515 10167 06564
61616 NOAA2 WX07A EARL10 OB 16
62626 REL 3016N07447W 120917 SPG 3033N07457W 121453 WL150 11112 0
85 DLM WND 15122 951641 MBL WND 12130 EYEWALL 090=
XXBB  52128 99302 70745 11604 00952 26200 11944 25800 22677 13802
33668 13801 44651 12209 55641 11000
21212 00952 10105 11950 10600 22949 11088 33947 11104 44945 11615
55942 11602 66939 11130 77938 11133 88936 11627 99925 12634 11921
12643 22917 12646 33914 12631 44913 12641 55910 13147 66905 13150
77899 13144 88895 13633 99889 13630 11885 13623 22883 13628 33880
14127 44876 14134 55712 16634 66667 18613 77641 18622
31313 09608 81209
51515 10167 06564
61616 NOAA2 WX07A EARL10 OB 16
62626 REL 3016N07447W 120917 SPG 3033N07457W 121453 WL150 11112 0
85 DLM WND 15122 951641 MBL WND 12130 EYEWALL 090=
```

Figure 50: Eyewall penetration azimuth remark

These remarks are generated using dropdown menus (Environment and Azimuth in the 62626 Group) under the COMM tab as seen below in Figure 51.

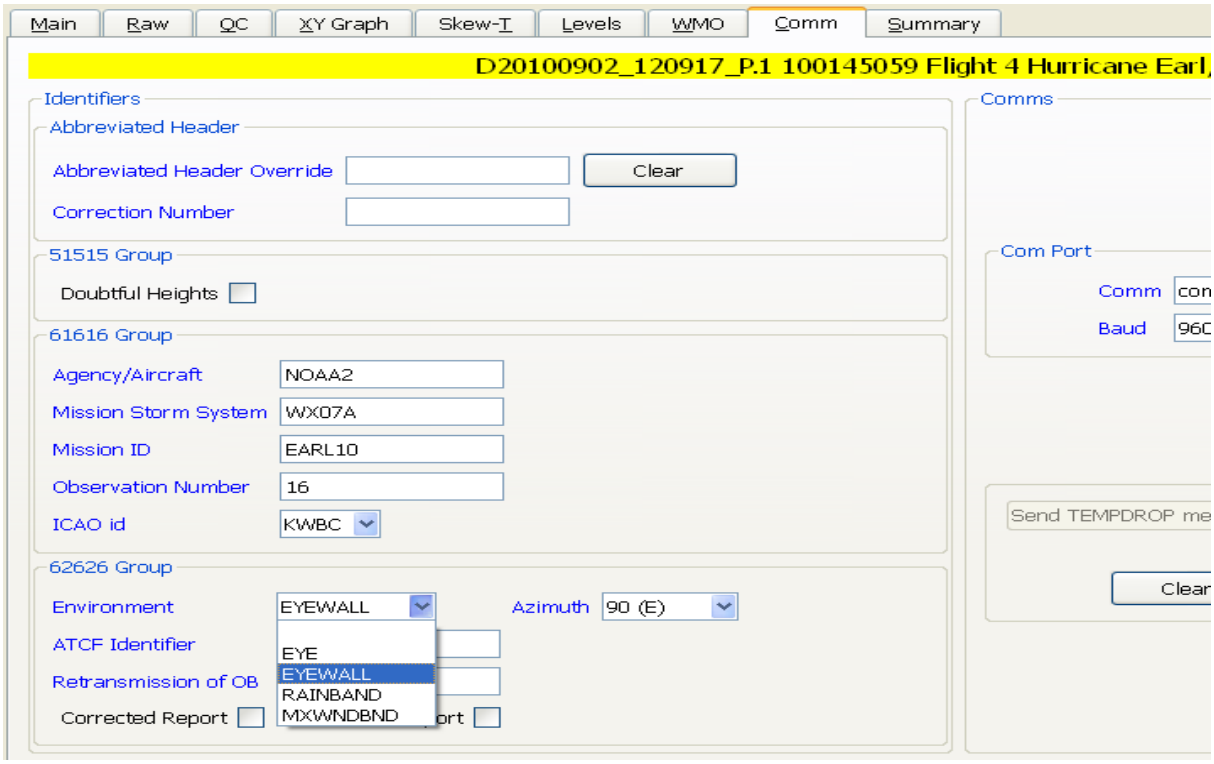

Figure 51: Selection of the hurricane penetration remarks using the COMM tab

7.7 Using XY Graph Tab and Levels Tab

Most parameters measured by the sonde can be plotted on an X-Y graph with either pressure (the default) or time along the vertical axis. A good practice in quality checking all sonde data is to bring up the X-Y plot of Altitude versus Pressure (with pressure along the vertical axis) by selecting the Pres-Alt radio button on the XY Graph Tab:

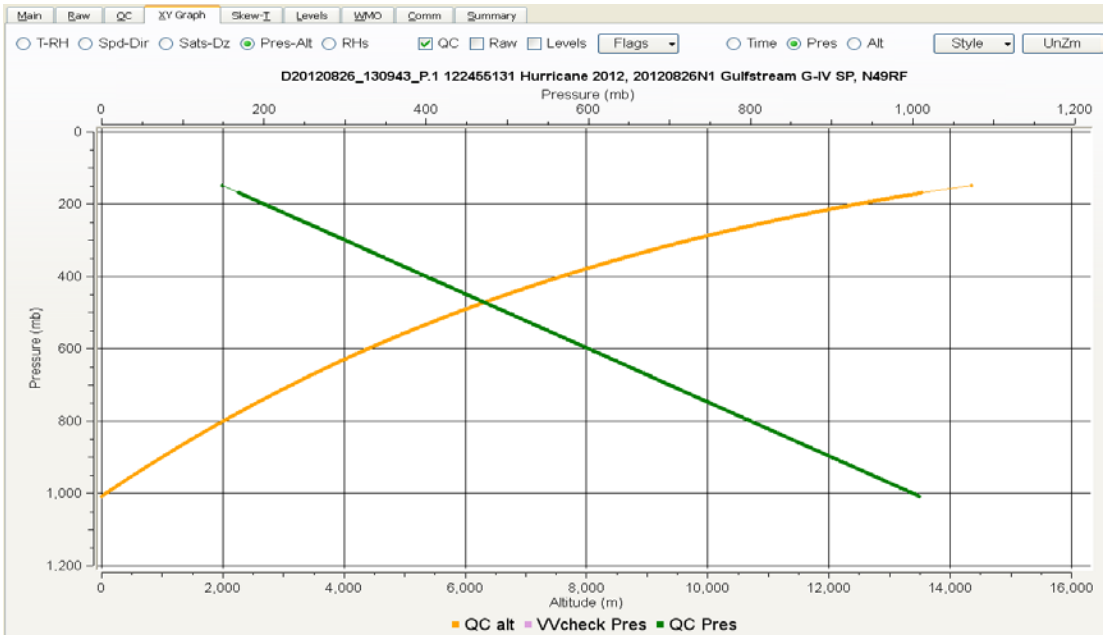

Figure 52: XY Graph tab showing the traces for sonde Altitude vs Pressure

Since there is a predictable logarithmic increase in pressure as a sonde falls this plot should always look almost exactly as in Figure 52 above (forming an X where the green line is just pressure plotted against itself (so a perfectly straight line) with the orange line being a gently sloped convex curve of altitude in meters versus pressure. The FD should then plot time on the vertical axis by selecting the Time radio button:

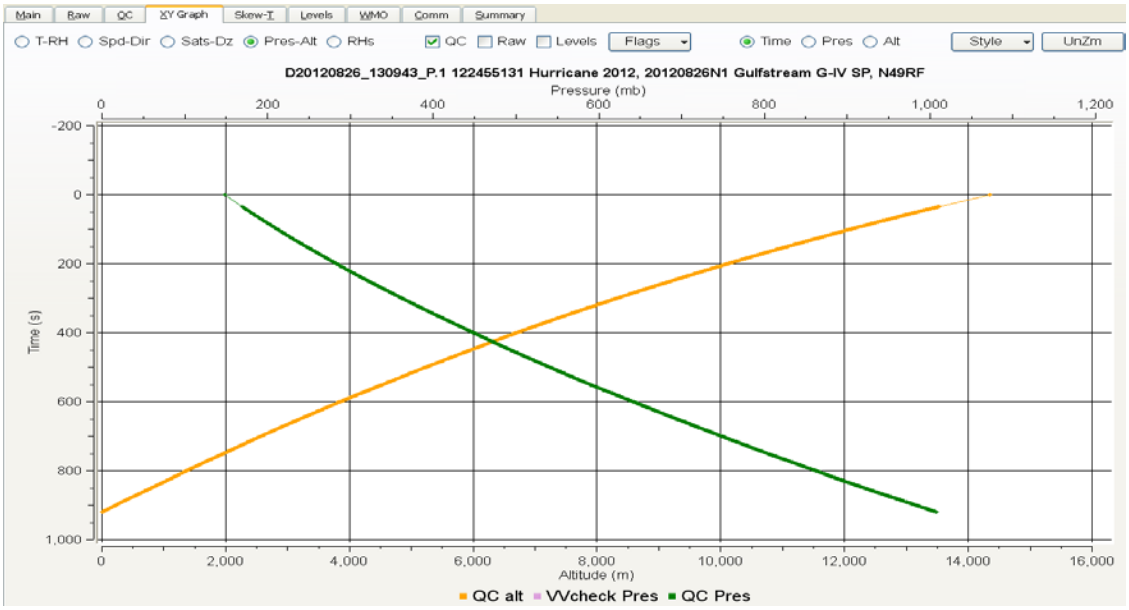

Figure 53: Plot of Time vs Pressure

This will create another “X” shape of a gently sloping concave trace in green of Pressure versus Time crossed by a slightly curved convex trace in orange of Pressure versus Time. There should never be any deviation from this pattern. Any deviation is most often a clear indication of a serious problem in the sounding data. One rare exception is deployment of a P-3 sonde into the eyewall of an intense hurricane where updrafts can exceed the magnitude of the 10-15 m/s fall rate. With “upsondes” the instrument briefly stops falling or even rides the updraft upward for a few seconds. This would disrupt the “X” pattern shown in Figure 53 at the bottom of the previous page.

One of the most useful applications of the X-Y Tab is in confirming a fast fall. As mentioned in Section 7.1, following the progress of the sonde as it is deployed is the responsibility of the AVAPS Operator, however, it is important that the FD also be watching for abnormalities using the Remote AVAPS program (provided other Flight Director duties permit this as there are many instances where your attention may have to be focused elsewhere). If the neither the AVAPS Operator nor the FD are able to notice that a sonde is a fast fall as it is deployed, a backup sonde won’t be available to cover the observation but there are techniques to ensure the resulting WMO TEMPDROP message (populated with bad data) is not transmitted off the aircraft. As mentioned in Section 7.5, ASPEN will normally flag the sounding with an alert pane that pops up on the Main Page as the D file is opened that says “This appears to be a fast fall sounding” or it may say “Unable to dynamically adjust winds. This appears to be a fast fall sounding”. As mentioned in the same earlier section, a sounding duration considerably shorter than the typical 850 to 950 seconds seen in a standard G-IV drop is another clue.

Opening the X-Y Tab of ASPEN and selecting the Sats-Dz radio button will show the fall rate of the sonde in meters per second. You should see a relatively smooth curve that begins (from the G-IV) with a fall rate somewhere between 20-25 m/s at deployment which gradually slows to around 10 m/s at splashdown. In Figure 54 below, we see the wild fluctuations in fall rate (vertical velocity) which characterize a fast fall along with fall rates that begin at around 40 m/s and never get any slower than 15-20 m/s by splashdown. The data from this sounding CANNOT be used to create a TEMPDROP:

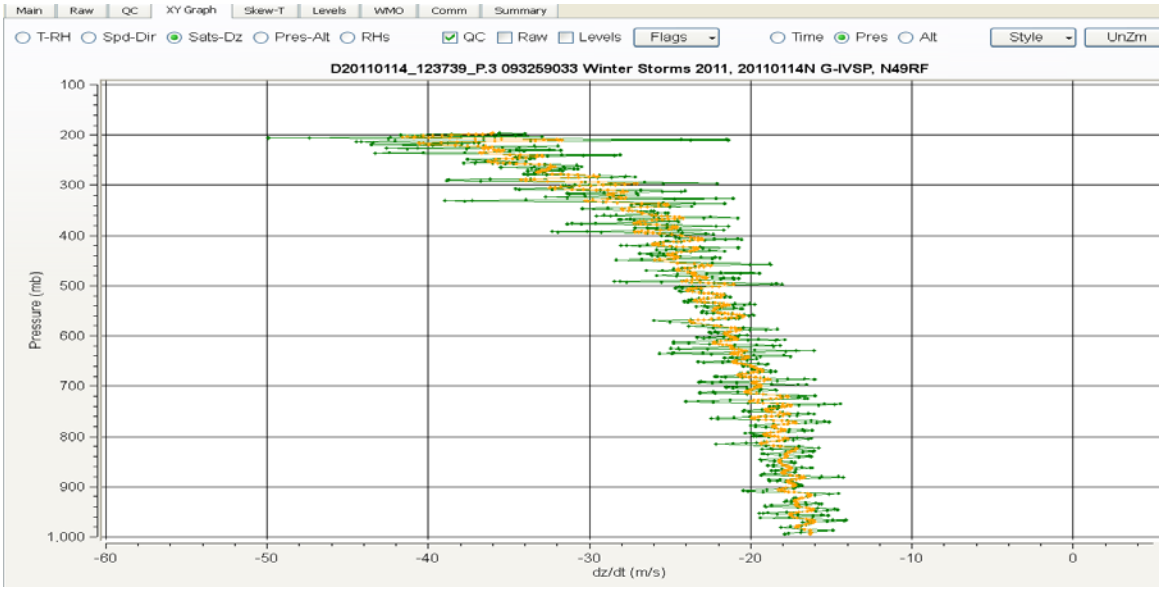

Figure 54: Telltale fluctuations in fall rate (vertical velocity) seen in a fast fall

The X-Y Tab is an excellent means of examining the temperature and humidity profile of a sounding and often better than the Skew T as an indicator of invalid data. The example seen in Figure 55 below is typical of a G-IV Winter Storm mission. This plot includes the flight level temperature and relative humidity. It is clear that both should have been selected to be ignored on the Main Screen. The flight level temperature is the uppermost green point that is connected to the remainder of the temperature trace by an unnatural straight line. The same is true for the RH shown in orange. In this sounding the tropopause is clearly evident at 314 mb. Note that RH in the stratosphere is extremely low (often below 5%) and that the tropopause is often characterized by a sharp discontinuity of both temp and humidity. There is often a discontinuity of either wind speed and/or direction there as well.

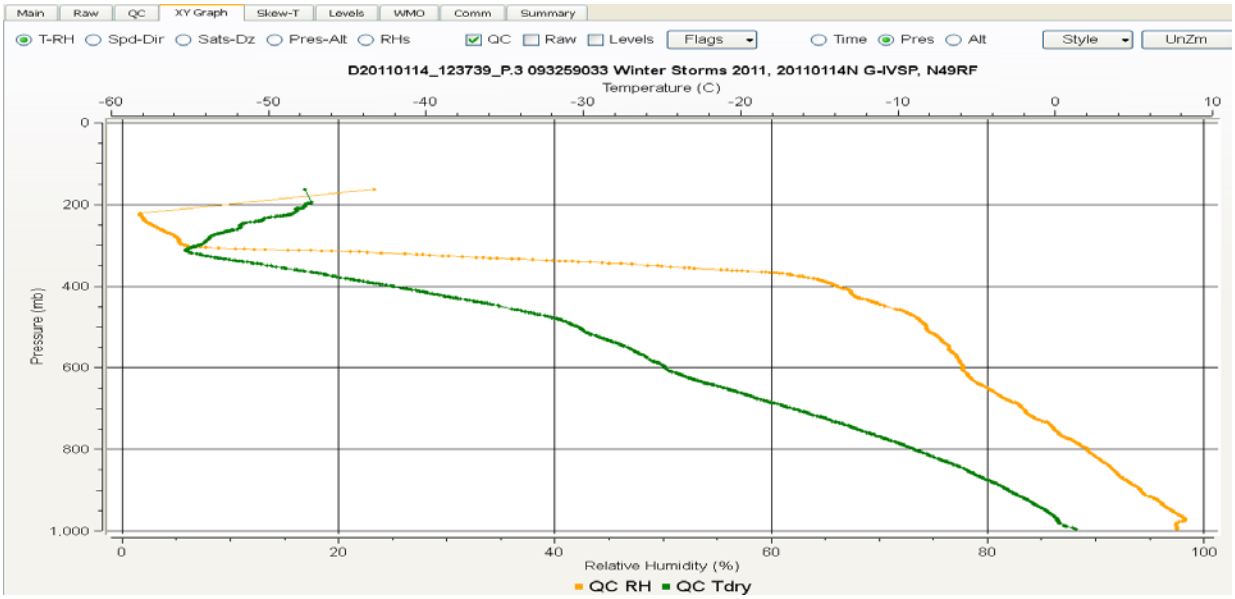

Figure 55: Mean Boundary Layer (MBL WND),

In Figure 56 below from a different Winter Storm mission, with the tropopause near 200 mb there was a pronounced wind max of 133 knots at 192 mb (note that the horizontal scale of the X-Y wind speed plot is in meters per second rather than knots).

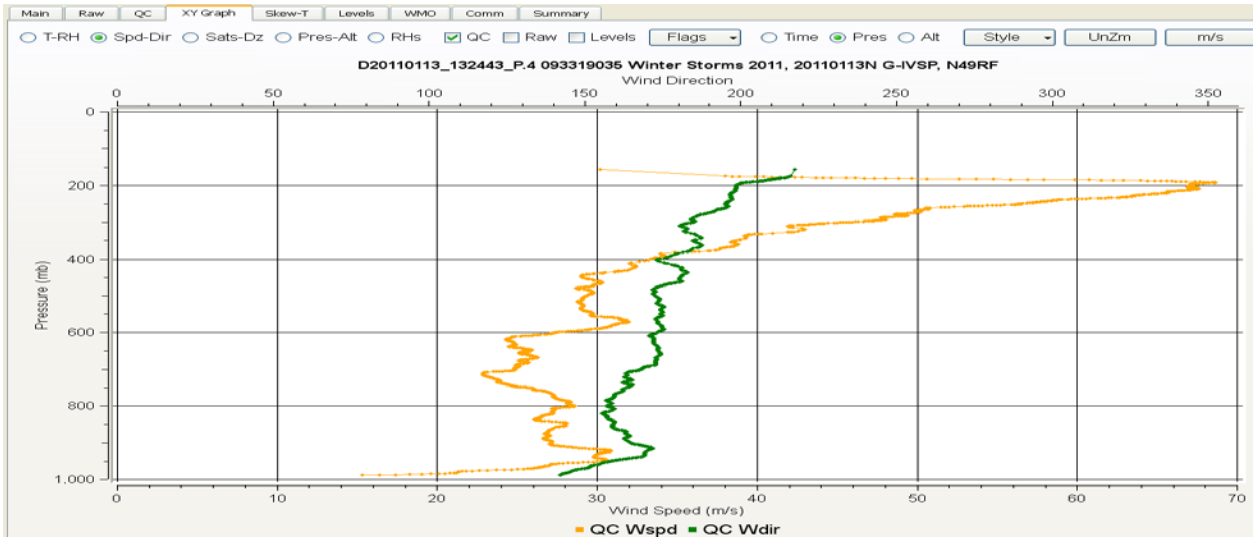

Figure 56: Spike in wind speed (orange) to almost 70 m/s just below the tropopause

In addition to the data being displayed graphically on the XY Graph Tab, each level of data compiled on the TEMPDROP message can also be examined individually using the Levels Tab. Figures 57 and 58 below show the upper portions (sonde deployment at 148 mb through 381.8 mb) and lower portions (578.2 mb to splash) of a sounding:

Main | Raw | QC | XY Graph | Skew-T | Levels | WMO | Comm | Summary

D20120826_125007_P.3 111745153 Hurricane 2012, 20120826N1 Gulfstream G-IV SP,

Click on a level to disable/enable it. Disabled Levels are highlighted in red.

	Type	Time (s)	Pres (mb)	Tdry (C)	RH (%)	Dir (deg)	Spd (m/s)	Alt (m)
0	62626 REL Location	-1.0	148.0					
1	Uppermost Thermodynamic	-1.0	148.0	-66.3				
2	Uppermost Winds	-1.0	148.0			312.7	4.5	
3	Standard	2.5	150.0	-65.8		314.4	6.7	14274
4	GDL Wind Direction	10.0	154.3			315.9	11.4	
5	GDL Wind Speed	31.8	166.9			278.9	13.4	
6	GDL Wind Direction	59.5	183.7			217.4	9.1	
7	Uppermost Thermodynamic	71.3	191.1	-56.0	17.8			
8	Standard	85.3	200.0	-53.2	25.2	245.1	7.3	12477
9	GDL Wind Direction	86.0	200.4			245.5	7.2	
10	GDL Wind Speed	106.8	213.7			238.0	5.1	
11	GDL Wind Direction	114.5	218.7			218.2	5.9	
12	GDL Wind Direction	122.5	223.9			226.2	5.7	
13	GDL Wind Direction	138.8	234.7			193.0	6.6	
14	Standard	160.9	250.0	-39.9	40.9	179.4	6.5	10997
15	GDL Wind Direction	162.3	251.0			178.2	6.6	
16	GDL Wind Direction	170.8	257.0			157.0	6.9	
17	GDL Temperature	192.3	272.3	-34.9	52.9			
18	GDL Wind Speed	214.8	288.7			130.6	8.2	
19	Standard	230.0	300.0	-29.7	62.9	126.2	12.4	9724
20	GDL Wind Direction	240.0	307.6			119.6	14.2	
21	GDL RH	266.3	327.8	-25.9	67.1			
22	GDL Wind Speed	269.5	330.3			131.3	19.3	
23	GDL RH	307.8	360.1	-20.2	27.4			
24	GDL Temperature	334.3	381.8	-16.6	24.7			

Figure 57: Levels Tab showing data from launch down to 381.8 millibars

Main | Raw | QC | XY Graph | Skew-T | Levels | WMO | Comm | Summary

D20120826_125007_P.3 111745153 Hurricane 2012, 20120826N1 Gulfstream G-IV SP,

Click on a level to disable/enable it. Disabled Levels are highlighted in red.

	Type	Time (s)	Pres (mb)	Tdry (C)	RH (%)	Dir (deg)	Spd (m/s)	Alt (m)
33	GDL RH	550.8	578.2	1.5	69.0			
34	GDL Temperature	570.8	597.6	3.4	72.6			
35	GDL Wind Direction	590.8	617.3			118.9	19.5	
36	GDL Temperature	666.3	692.0	8.9	66.5			
37	Standard	674.0	700.0	9.2	69.1	128.9	16.4	3168
38	GDL Temperature	704.8	733.3	9.8	90.0			
39	GDL Wind Direction	712.5	742.2			139.5	21.2	
40	Standard	807.3	850.0	18.2	76.5	135.5	18.9	1532
41	Station Base Pressure	807.3	850.0	18.2	76.5			
42	GDL Wind Speed	807.3	850.0			135.5	18.9	
43	GDL Wind Speed	828.3	874.4			129.6	20.2	
44	GDL Wind Speed	834.3	880.8			128.6	18.6	
45	Standard	874.1	925.0	22.3	81.0	132.6	18.9	801
46	GDL Wind Speed	874.8	925.7			132.3	18.9	
47	GDL Wind Speed	894.3	946.1			129.2	15.8	
48	62626 Mean BL Wind	904.4	957.3			131.9	13.3	500
49	GDL Wind Speed	917.8	971.8			124.3	16.4	
50	GDL Wind Speed	937.8	994.2			142.2	10.3	
51	Standard	942.8	1000.0	25.8	86.2	145.4	11.9	114
52	GDL Wind Speed	943.3	1000.5			145.5	11.9	
53	62626 150m Layer Mean Wind	944.8	1002.2			144.7	11.2	84
54	62626 SPG Location	953.0	1011.8					
55	62626 Deep Layer Mean Wind	953.5	1012.4			132.7	14.8	
56	Surface Winds	953.0	1013.0			150.1	11.1	10
57	Surface Thermodynamic	954.0	1013.0	27.0	86.7			0

Figure 58: Levels Tab showing data from 578.2 millibars down to splash

Note in Figure 57 at the top of the previous page that the first three lines of the Levels tab refer to flight level data gathered by the aircraft at 148 mb. Each blue line represents a mandatory level. The first shown is 150 mb (reached 2.5 seconds after sonde deployment) where the temp was -65.8C, the winds were 314.4 degrees at 6.7 meters per second and the geopotential height was 14274 meters. It is important to understand that all those values are all calculated through interpolation between the flight level data and the first valid (quality checked) values obtained by the sonde after data stabilization several seconds below the 150 mb level. This is necessary to be able to populate models with 150 mb data or any other mandatory level which lies just below the sonde deployment altitude (which is often just above 700 mb when the P-3 is flying at 10,000 feet in a tropical cyclone).

Significant levels (to be coded as groups in the XXBB Section for temperature and in the 21212 Section for winds) are denoted as GDL (Greatest Departure from Linearity). There will always be a GDL line assigned to the first QC'd winds from the sonde (in this case at 10 seconds or 154.3 mb).

In Figure 57, the flight level RH was ignored by the operator (the most common situation in the G-IV). This means there is not a full line of QC'd temp and humidity data from the sonde until the Uppermost Thermodynamic line at 71.3 seconds and 191.1 mb. If the operator had elected to not ignore the flight level humidity, it would be included in the Levels tab (and therefore on the resulting TEMPDROP message). This would create a situation where there would always be a gap in thermodynamic data since it takes time for the sonde PTH data to stabilize. To define that layer, the Levels tab would look like Figure 59 below when FL temp and humidity is retained. Extra lines for Missing RH Top and Missing RH Bottom are added to define this layer:

Main | Raw | QC | XY Graph | Skew-T | Levels | WMO | Comm | Summary

D20120826_125007_P.3 111745153 Hurricane 2012, 20120826N1 Gul

Click on a level to disable/enable it. Disabled Levels are hi

	Type	Time (s)	Pres (mb)	Tdry (C)	RH (%)	Dir (deg)	Spd (m/s)	Alt (m)
0	62626 REL Location	-1.0	148.0					
1	Missing RH Top	-1.0	148.0	-66.3	64.8			
2	Uppermost Thermodynamic	-1.0	148.0	-66.3	64.8			
3	Uppermost Winds	-1.0	148.0			312.7	4.5	
4	Standard	2.5	150.0	-65.8		314.4	6.7	14274
5	GDL Wind Direction	10.0	154.3			315.9	11.4	
6	GDL Wind Speed	31.8	166.9			278.9	13.4	
7	GDL Wind Direction	59.5	183.7			217.4	9.1	
8	Missing RH Bottom	74.8	193.3	-55.3	19.9			
9	GDL RH	74.8	193.3	-55.3	19.9			
10	Standard	85.3	200.0	-53.2	25.2	245.1	7.3	12477
11	GDL Wind Direction	86.0	200.4			245.5	7.2	
12	GDL Wind Speed	106.8	213.7			238.0	5.1	

Figure 59: Levels tab showing a case where IGNORE was not selected for flight level humidity. This would generate a Group in the XXBB Section of the TEMPDROP message for 148 mb that included Dew Point Depression. The layer of "missing" RH shown is from 148 mb until the first valid sonde humidity measurements at 193.3 mb.

An important utility of the Levels tab allows the FD to disable a line by clicking on it. This will automatically remove that level from the resulting TEMPDROP message. When a line is selected to be disabled, it will be highlighted in red. To re-enable a line that has been disabled, simply click on it again. The red highlighting will disappear and the data from that level will again be included in the TEMPDROP message.

In Figure 60 below, if the FD determined that data from 235 to 275 mb was suspect, and should not be included in the TEMPDROP, it could be disabled using the Levels tab. The resulting change to the original message can be seen comparing Figure 61 with Figure 62 (showing resulting delections). These include deletion of the 250 mb standard level as well as deletion of the tropopause group along with deletion of significant levels in the XXBB Section at 257 and 271 mb and at 263 mb in the 21212 Section:

Main | Raw | QC | XY Graph | Skew-T | Levels | WMO | Comm | Summary

D20110116_110410_P.4 093039059 Winter Storms 2011, 20110116N G-IVSP, N49

Click on a level to disable/enable it. Disabled Levels are highlighted in red.

	Type	Time (s)	Pres (mb)	Tdry (C)	RH (%)	Dir (deg)	Spd (m/s)	Alt (m)
0	Extrapolated Altitude	-1.0	150.0					13533
1	62626 REL Location	-1.0	160.6					
2	Uppermost Winds	-1.0	160.6			272.7	81.0	
3	Uppermost Thermodynamic	-1.0	160.6	-54.9				
4	GDL Wind Speed	13.4	168.2			276.5	76.7	
5	Wind Shear Above	50.3	189.9			275.9	88.0	12017
6	Standard	65.5	200.0	-49.0		274.2	84.3	11679
7	Uppermost Thermodynamic	66.4	200.6	-48.9	3.3			
8	Maximim Wind	91.9	218.2			272.7	91.9	11103
9	GDL Wind Speed	91.9	218.2			272.7	91.9	
10	GDL Temperature	111.4	232.4	-46.5	3.6			
11	Standard	134.5	250.0	-48.6	4.5	268.9	69.2	10204
12	Wind Shear Below	135.3	250.6			268.7	68.6	10189
13	GDL RH	143.4	256.8	-49.9	5.9			
14	GDL Wind Speed	151.9	263.5			261.4	57.2	
15	Tropopause	160.4	270.2	-51.9	33.8	257.3	56.0	9697
16	GDL Temperature	161.4	271.0	-51.8	35.3			
17	GDL RH	187.4	292.4	-48.0	65.2			
18	Standard	196.7	300.0	-46.5	69.8	249.8	53.4	9013
19	GDL Temperature	220.9	319.9	-42.4	75.8			

Figure 60: Data from 250 mb through 271 mb being deleted (in red)

```
UZPA13 KWBC 172059
XXAA   66112  99389  11685  12888  99986  13407  /////  00621  /////  /////
92533  10202  19060  85234  06602  20053  70803  02105  22055  50541  17314
24071  40704  30530  25066  30901  46534  25104  25020  48776  27134  20168
491//  27664  88270  51959  25609  77218  27678  44612
31313  09608  81104
51515  10190  15353
61616 NOAA9 06WSW TRACK76       OB 11
62626 LST WND 016 MBL WND 18048 AEV 07483 DLM WND 24068 984161 WL
150 18037 090 REL 3894N16846E 110409 SPG 3905N16880E 111748           =
XXBB   66118  99389  11685  12888  00986  13407  11850  06602  22648  05109
33517  15517  44397  31130  55320  42527  66292  48139  77271  51959  88257
49973  99232  46578  11201  48978  22161  549//
21212  00986  /////  11984  17530  22953  18554  33920  18561  44908  19057
55898  19568  66865  19561  77850  20053  88813  21064  99638  22050  11505
24072  22428  24058  33335  25600  44263  26111  55218  27678  66168  27649
```

Figure 61: Original TEMPDROP message prior to deletions

```
UZPA13 KWBC 172059
XXAA   66112  99389  11685  12888  99986  13407  /////  00621  /////  /////
92533  10202  19060  85234  06602  20053  70803  02105  22055  50541  17314
24071  40704  30530  25066  30901  46534  25104  25///  /////  /////  20168
491//  27664  88999  77218  27678  4//12
31313  09608  81104
51515  10190  15353
61616 NOAA9 06WSW TRACK76      OB 11
62626 LST WND 016 MBL WND 18048 AEV 07483 DLM WND 24068 984161 WL
150 18037 090 REL 3894N16846E 110409 SPG 3905N16880E 111748           =
XXBB   66118  99389  11685  12888  00986  13407  11850  06602  22648  05109
33517  15517  44397  31130  55320  42527  66292  48139  77232  46578  88201
48978  99161  549//
21212  00986  /////  11984  17530  22953  18554  33920  18561  44908  19057
55898  19568  66865  19561  77850  20053  88813  21064  99638  22050  11505
24072  22428  24058  33335  25600  44218  27678  55168  27649  66161  27657
```

Figure 62: Subsequent TEMPDROP after deletions showing the removal of data from the 250 mb Mandatory Level as well as removal of Groups at 257 mb and 271 mb in the XXBB Section, along with removal of a Group at 263 mb of the 21212 Section and removal of the Tropopause Group

7.8 Using the Synoptic Mapping Tool

Data from multiple sondes deployed throughout a mission can be examined in a “plan view” in a manner similar to upper air constant pressure charts (ie: a 500 mb chart). To open the Synoptic Map tool, click on the Globe Icon of the Toolbar. A map of the world will appear as shown in Figure 63 below along with a listing of D files recently processed by ASPEN in the lower right corner. Check the box next to the sounding for it to appear as a station plot.

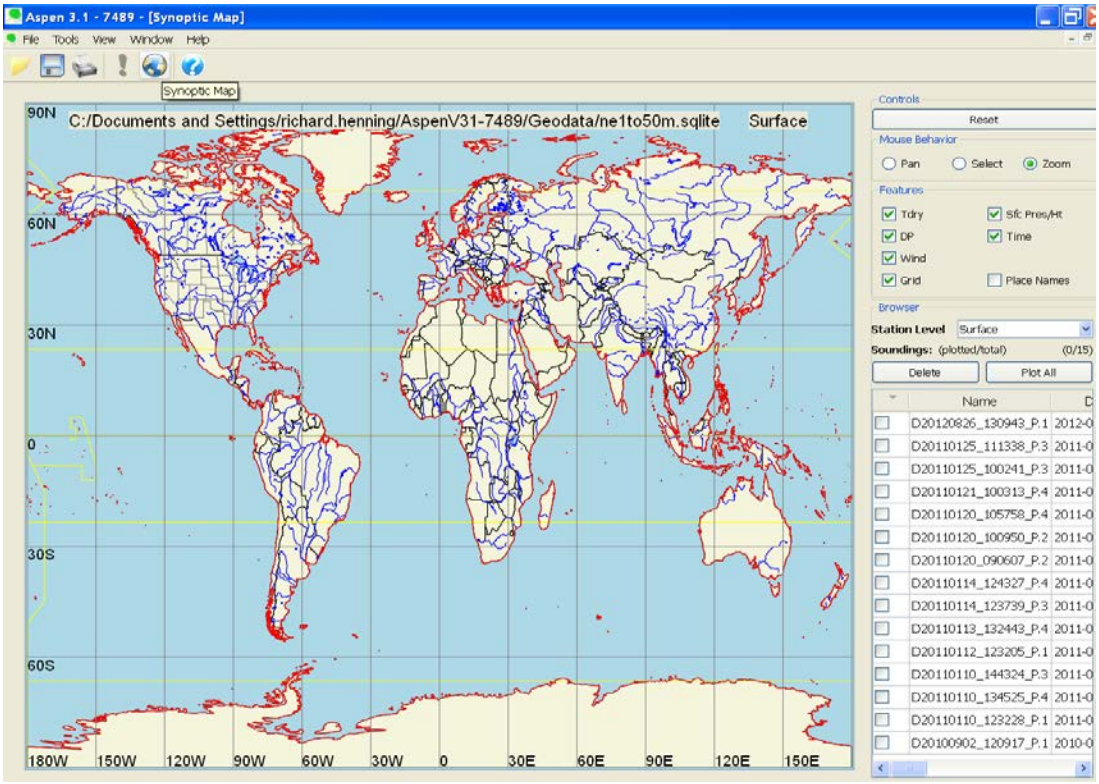

Figure 63: Synoptic Mapping Tool pane as it first appears upon selection

To leave the Synoptic Map screen and return back to the ASPEN Tabs go to File in the upper left corner and use the dropdown menu to return to any of the last several soundings you have processed:

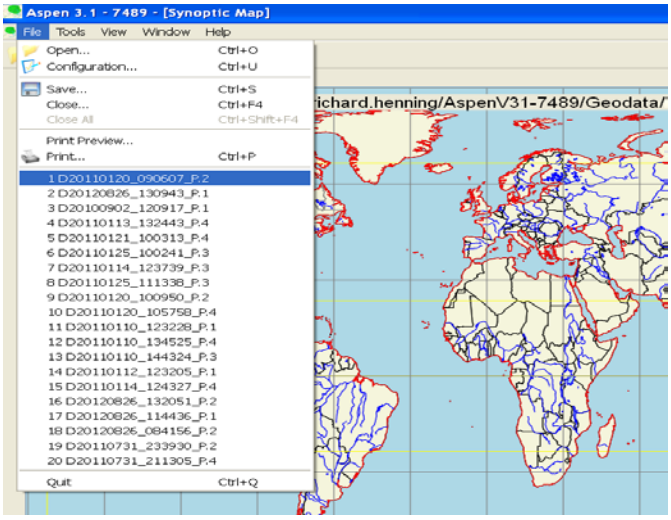

Figure 64: Returning from Synoptic Map function back to ASPEN tabs

To zoom into the region where a mission is being flown, click and drag on the world map (ensuring that the Zoom radio button in the upper right corner under Mouse Behavior is selected):

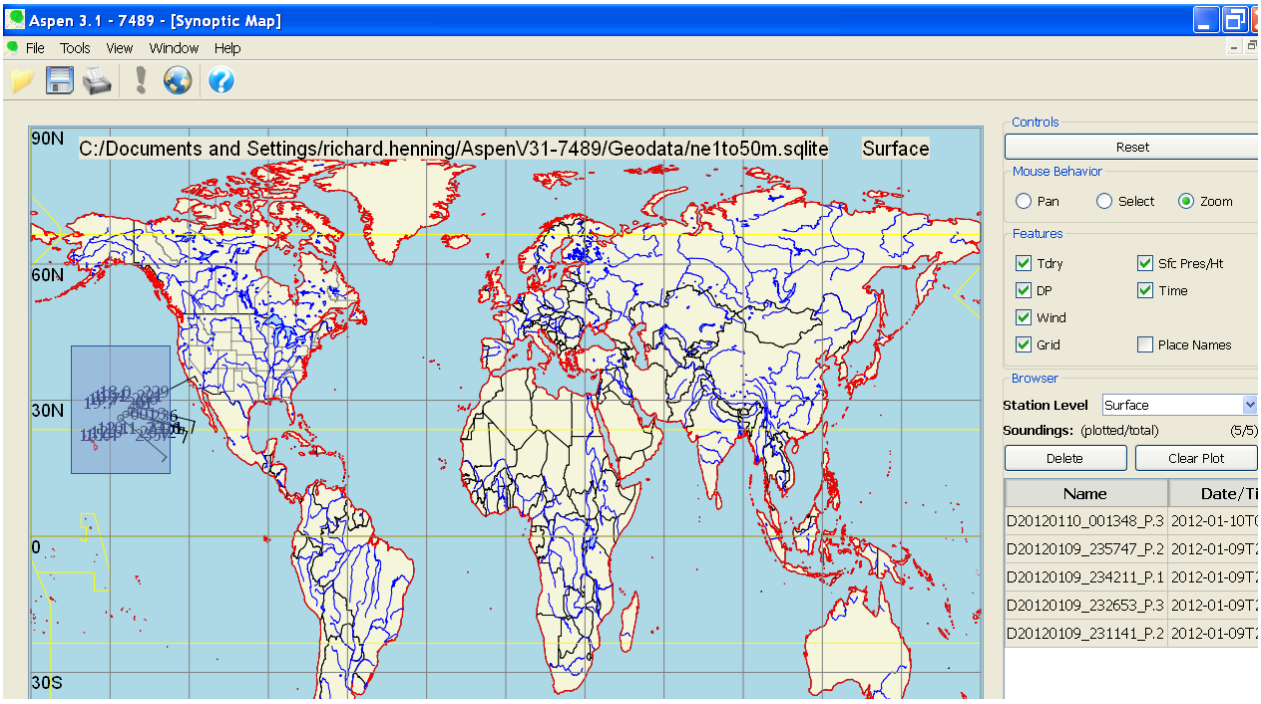

Figure 65: With Zoom selected under Mouse Behavior click and drag to zoom in

Each mandatory level can be selected for display. Figure 66 on the following page shows surface data for a Winter Storm G-IV mission near Hawaii. The observations range from 2311z (surface pressure 1023.6 mb) to 0120z (1017.7 mb). Temperature & dew point are in the standard station model format:

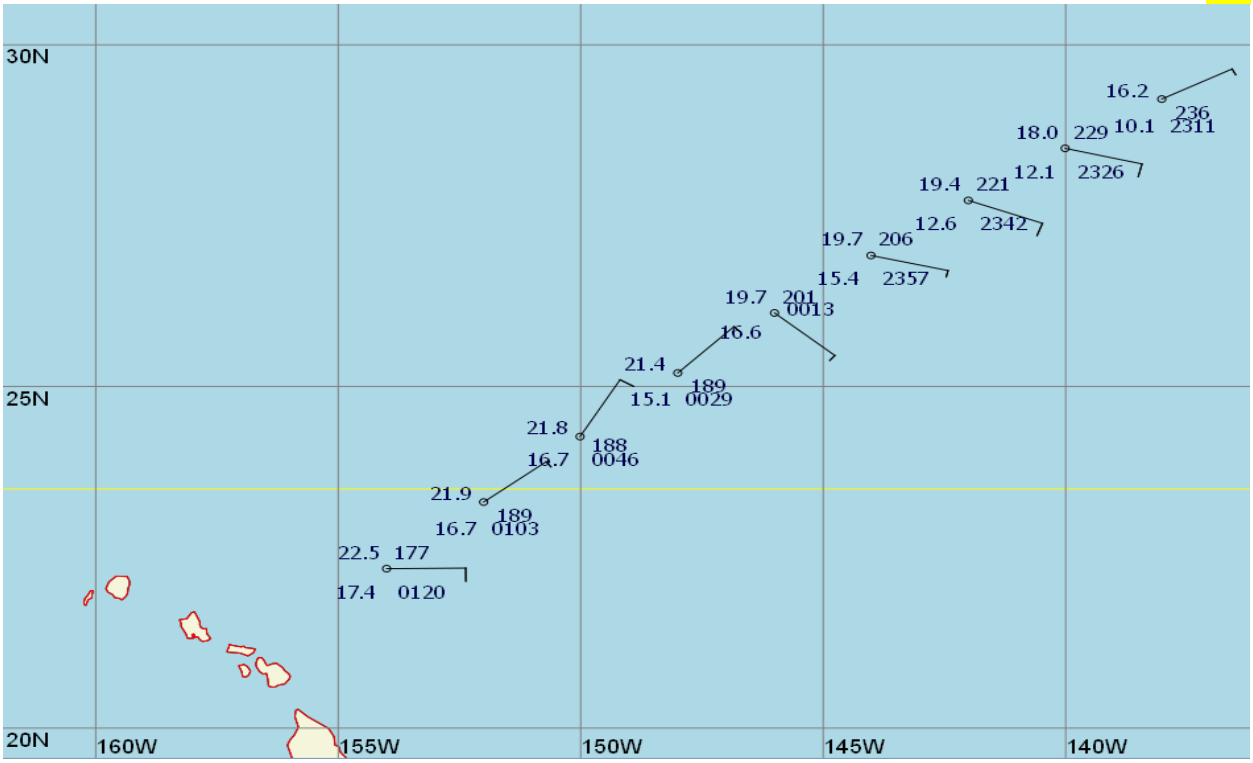

Figure 66: Surface data

Each mandatory upper air level can be selected for display using the Station Level dropdown menu on the right side of the pane. Figure 67 below shows 300 mb data from the same mission. Note how well the location of the 300 mb trough axis is defined (between obs at 2342z and 2357z). As would be expected, the coldest 300 mb temps are found in the trough axis (a minimum of -44.0C) with warmer conditions further away from the axis (temp -33.2C at 0120z). Note there is more than 200 meters of geopotential height gradient across the observations.

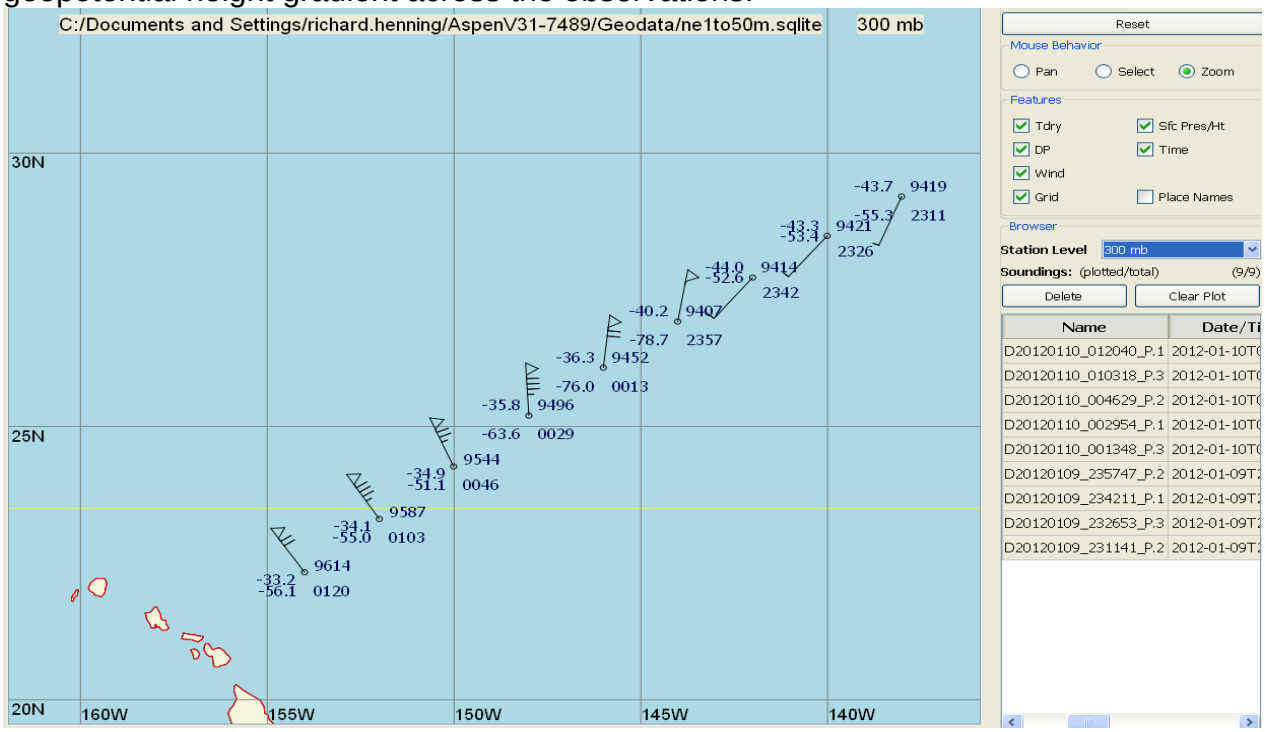

Figure 67: 300 millibar data showing a well defined trough

7.9 Use of the COMM Tab to Generate Remarks and Manually Editing a TEMPDROP

As we have seen, in many cases, the process by which ASPEN compiles a TEMPDROP message can be altered along the way (such as flight level temp and or humidity being ignored). However, when automated ASPEN techniques cannot be employed, sometimes a group may need to be manually edited in the WMO Tab.

In Figure 68 below, the operator manually changes the 150 mb dew point depression from // to 22 degrees. First, select the group (it will become highlighted). Then press the MODIFY button. A “Modify Code Group” dialog box will appear. Type in the change to the dialog box then deselect it using the red X in the upper right corner of the box:

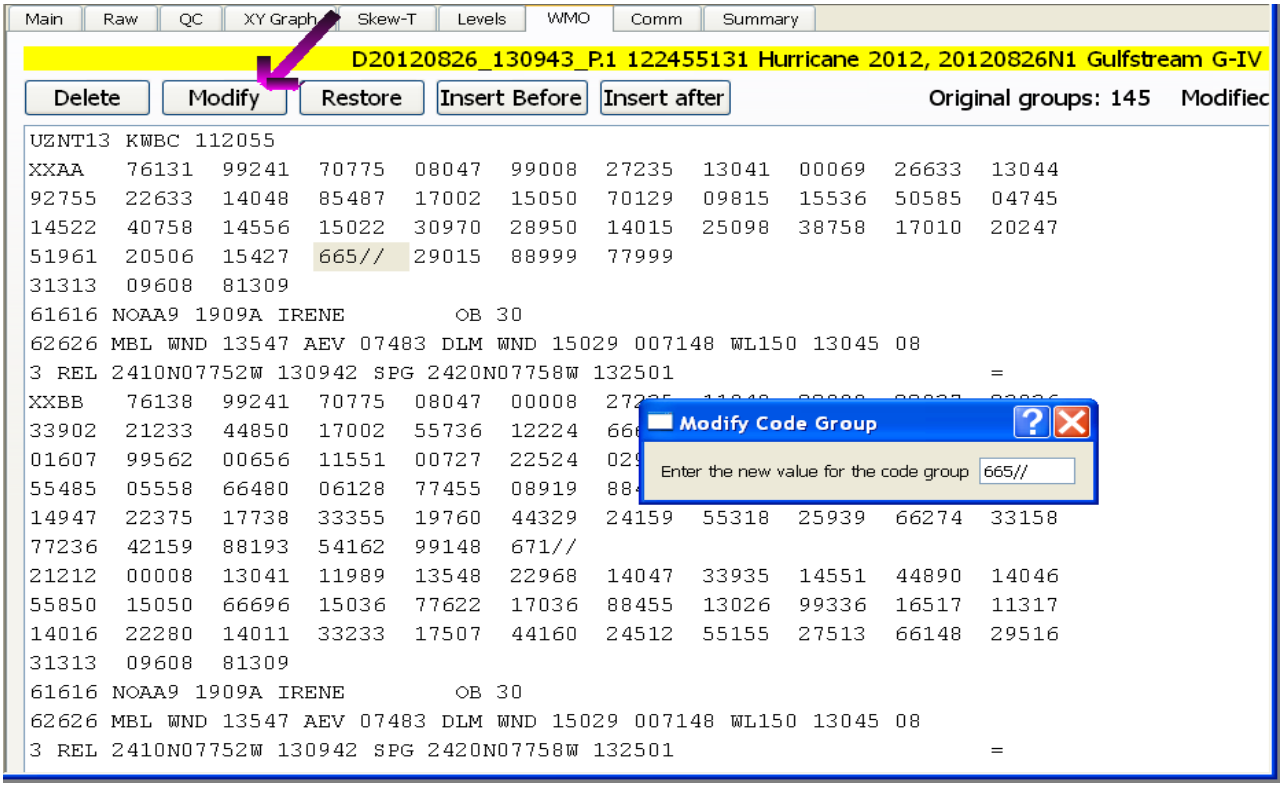

Figure 68: Manually editing humidity data in the 150 mb Group of the XXAA Section

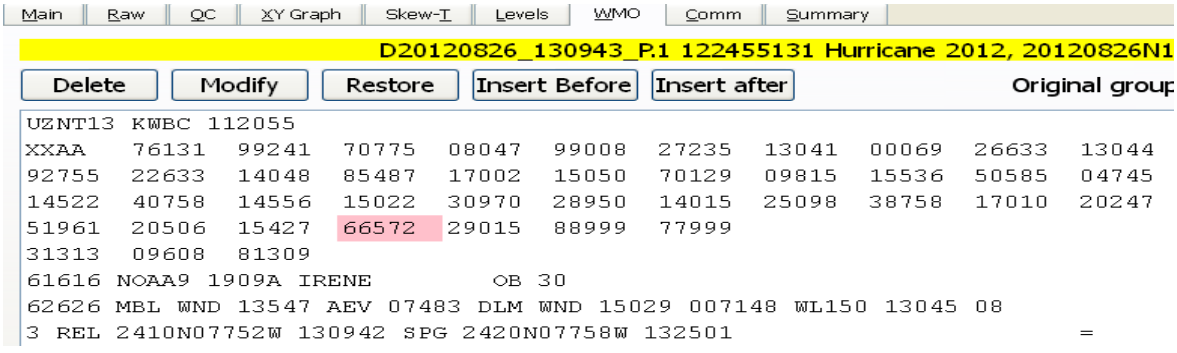

Figure 69: After the change the modified group will become backlit with pink

7.10 Generation of Additional Products using ASPEN

Scientists flying with AOC will often ask for additional ASPEN products useful in additional post flight analysis. One of the products is the NOAA FRD file (commonly referred to as the “Fred” file). It is similar in layout to the D file, with a line of data generated for each 0.25 seconds of a sounding, but the data has first been run through the ASPEN QC filter. The FRD file can be automatically generated and saved each time a D file is processed using the QC Auto Save tab. At the top of the ASPEN application under the Tools dropdown menu select Options. Then under Option go to the QC Auto Save tab. This tab is shown in Figure 70 shown below. Create a folder somewhere on the local FD hard drive to save these additional ASPEN products then point to it under Auto Save Directory using the CHANGE button. Then check the Auto Save Enable box along with the desired products to automatically generate and save each time a D file is processed (checking the boxes under QC Output Formats and SkewT Output Formats):

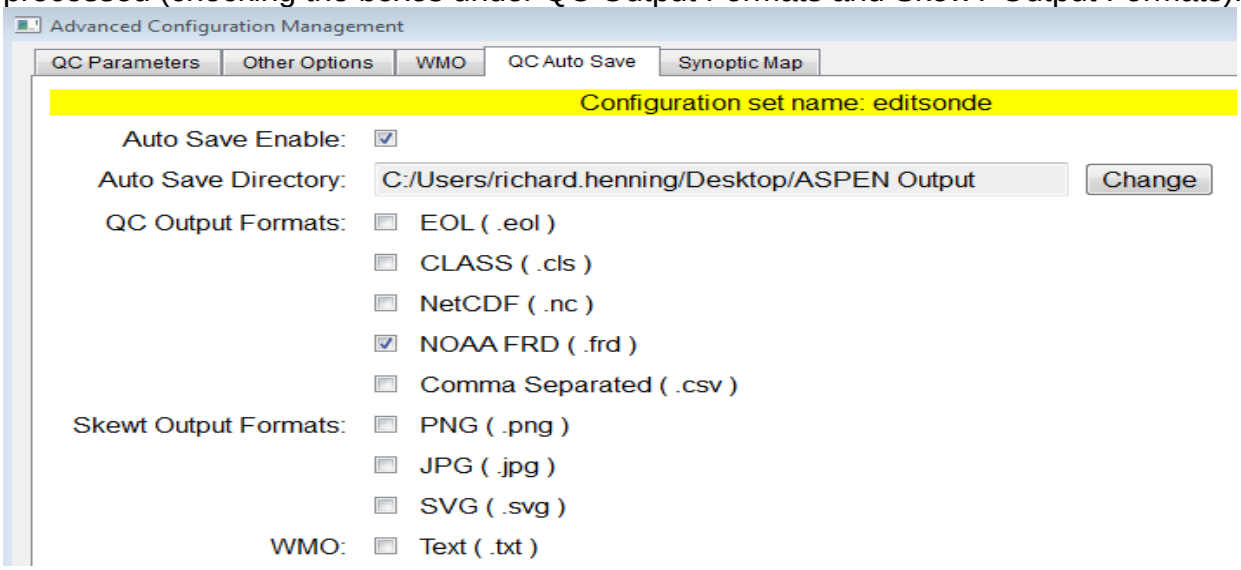

Figure 70: To have FRD and SkewT products automatically generated by ASPEN when a D file is opened select the desired products and check the Auto Save Enable box

The FRD file is useful for researchers in that it provides the high resolution of a D file in a quality controlled format (discarding data collected prior to launch while the sonde is sitting in the tube and the lines of data after splash before it is terminated). ASPEN will code invalid or missing data in a FRD file with -999 to make it easy for researchers to discard it when writing scripts to automatically read them for analysis. The WMO TEMPDROP message in Figure 71 below is from a 2012 mission into Hurricane Isaac. The corresponding FRD file is shown in Figure 72 on the following page:

```
UZNT13 KWBC 281254
XXAA  78128 99274 70876 08177 99988 25805 19570 00606 ///// /////
92581 22605 19077 85318 19814 21064 88999 77999
31313 09608 81225
61616 NOAA2 3009A ISAAC         OB 20
62626 SPL 2747N08757W 1229 MBL WND 19077 AEV 30000 DLM WND 20066
988752 WL150 19072 083 REL 2741N08760W 122550 SPG 2747N08757W 122
905 =
XXBB  78128 99274 70876 08177 00988 25805 11850 19814 22764 17010
33752 14800
21212 00988 19570 11983 19067 22970 18577 33939 19081 44909 19574
55896 20067 66850 21064 77752 22054
31313 09608 81225
61616 NOAA2 3009A ISAAC         OB 20
62626 SPL 2747N08757W 1229 MBL WND 19077 AEV 30000 DLM WND 20066
988752 WL150 19072 083 REL 2741N08760W 122550 SPG 2747N08757W 122
```

Figure 71: The low resolution data shown in a TEMPDROP message.

The TEMPDROP message is designed for ingestion into global models as well as providing key details in shorthand to operational forecasters and therefore is coarse including only mandatory and significant levels of PTH and wind data. In the Hurricane Isaac example, a forecaster would be interested in the 70 knot surface wind as well as the 81 knot significant wind at 939 mb, the MBL Wind of 77 knots and WL150 wind of 72 knots but this message is not of sufficient detail for research purposes. The FRD file from the same sonde shown in Figure 72 below is initially filled with -999 as the wind and PTH data stabilizes through several seconds following deployment:

```
================================================================================
DROPWINDSONDE PROCESSING RECORD                                  Sonde: 111755060
FDR file written by Aspen Version 3.1, 22 Apr 2013 16:46 UTC
Aircraft: NOAA WP-3D, N42RF                 Date: 120828   Time: 122551 UTC
--------------------------------------------------------------------------------
Bias corrections:  PR =   0.0 mb  TE =   0.0 C  RH =   0.0 %  PRB =  0.0 mb
Filters (LPF):     PTH =
Dyn RH correction =
Estimated PR used =
Dyn T correction  =
--------------------------------------------------------------------------------
COMMENT: none, Good Drop
================================================================================

================================================================================
Date: 120828   Lat:  27.41 N   TA:   14.8 C   PS:  751.6 mb   WD:   219 deg
Time: 122551   Lon:  87.60 W   TD:   14.8 C   GA:   2383 m    WS:  28.1 m/s
SID:  111755060                RH:  100.0 %   Navaid:   GP
================================================================================
```

IX	t (s)	P (mb)	T (C)	RH (%)	Z (m)	WD	WS (m/s)	U (m/s)	V (m/s)	NS	WZ (m/s)	ZW (m)	FP	FT	FH	FW	LAT (N)	LON (E)
0001	0.0	-999.0	-999.00	-999.0	-999	-999	-999.00	-999.00	-999.00	10	-999.0	-999	0	0	0	0	27.412	-87.597
0002	0.3	-999.0	-999.00	-999.0	-999	-999	-999.00	-999.00	-999.00	10	-999.0	-999	0	0	0	0	-999.000	-999.000
0003	0.5	-999.0	-999.00	-999.0	-999	-999	-999.00	-999.00	-999.00	10	-999.0	-999	0	0	0	0	27.412	-87.597
0004	0.8	-999.0	-999.00	-999.0	-999	-999	-999.00	-999.00	-999.00	8	-999.0	-999	0	0	0	0	-999.000	-999.000
0005	1.0	-999.0	-999.00	-999.0	-999	-999	-999.00	-999.00	-999.00	9	-999.0	-999	0	0	0	0	27.411	-87.596
0006	1.3	-999.0	-999.00	-999.0	-999	-999	-999.00	-999.00	-999.00	7	-999.0	-999	0	0	0	0	-999.000	-999.000
0007	1.5	-999.0	-999.00	-999.0	-999	-999	-999.00	-999.00	-999.00	6	-999.0	-999	0	0	0	0	27.411	-87.596
0008	1.8	-999.0	-999.00	-999.0	-999	-999	-999.00	-999.00	-999.00	6	-999.0	-999	0	0	0	0	-999.000	-999.000
0009	2.0	-999.0	-999.00	-999.0	-999	-999	-999.00	-999.00	-999.00	5	-999.0	-999	0	0	0	0	27.411	-87.596
0010	2.3	-999.0	-999.00	-999.0	-999	-999	-999.00	-999.00	-999.00	5	-999.0	-999	0	0	0	0	-999.000	-999.000
0011	2.5	-999.0	-999.00	-999.0	-999	-999	-999.00	-999.00	-999.00	6	-999.0	-999	0	0	0	0	27.411	-87.596
0012	2.8	-999.0	-999.00	-999.0	-999	-999	-999.00	-999.00	-999.00	7	-999.0	-999	0	0	0	0	-999.000	-999.000
0013	3.0	-999.0	-999.00	-999.0	-999	-999	-999.00	-999.00	-999.00	7	-999.0	-999	0	0	0	0	27.411	-87.596
0014	3.3	-999.0	-999.00	-999.0	-999	-999	-999.00	-999.00	-999.00	6	-999.0	-999	0	0	0	0	-999.000	-999.000
0015	3.5	-999.0	-999.00	-999.0	-999	-999	-999.00	-999.00	-999.00	6	-999.0	-999	0	0	0	0	27.412	-87.596
0016	3.8	-999.0	-999.00	-999.0	-999	-999	-999.00	-999.00	-999.00	7	-999.0	-999	0	0	0	0	-999.000	-999.000

At 10 seconds (line 0041) valid wind data comes in with QC'd PTH data (all except for humidity) coming in after 13 seconds (beginning with line 0053):

0038	9.3	-999.0	-999.00	-999.0	-999	-999	-999.00	-999.00	-999.00	10	-999.0	-999	0	0	0	0	-999.000	-999.000
0039	9.5	-999.0	-999.00	-999.0	-999	-999	-999.00	-999.00	-999.00	10	-999.0	-999	0	0	0	0	27.413	-87.595
0040	9.8	-999.0	-999.00	-999.0	-999	-999	-999.00	-999.00	-999.00	10	-999.0	-999	0	0	0	0	-999.000	-999.000
0041	10.0	-999.0	-999.00	-999.0	-999	215	29.32	16.64	24.14	10	-999.0	-999	0	0	0	0	27.413	-87.595
0042	10.3	-999.0	-999.00	-999.0	-999	215	29.39	16.65	24.22	10	-999.0	-999	0	0	0	0	-999.000	-999.000
0043	10.5	-999.0	-999.00	-999.0	-999	214	29.45	16.65	24.29	10	-999.0	-999	0	0	0	0	27.414	-87.595
0044	10.8	-999.0	-999.00	-999.0	-999	214	29.52	16.66	24.37	10	-999.0	-999	0	0	0	0	-999.000	-999.000
0045	11.0	-999.0	-999.00	-999.0	-999	214	29.59	16.66	24.45	10	-999.0	-999	0	0	0	0	27.414	-87.595
0046	11.3	-999.0	-999.00	-999.0	-999	214	29.65	16.67	24.53	10	-999.0	-999	0	0	0	0	-999.000	-999.000
0047	11.5	-999.0	-999.00	-999.0	-999	214	29.72	16.67	24.60	10	-999.0	-999	0	0	0	0	27.414	-87.595
0048	11.8	-999.0	-999.00	-999.0	-999	214	29.78	16.67	24.67	10	-999.0	-999	0	0	0	0	-999.000	-999.000
0049	12.0	-999.0	-999.00	-999.0	-999	214	29.83	16.67	24.75	10	-999.0	-999	0	0	0	0	27.414	-87.595
0050	12.3	-999.0	-999.00	-999.0	-999	214	29.89	16.66	24.81	10	-999.0	-999	0	0	0	0	-999.000	-999.000
0051	12.5	-999.0	-999.00	-999.0	-999	214	29.94	16.65	24.88	10	-999.0	-999	0	0	0	0	27.414	-87.594
0052	12.8	-999.0	-999.00	-999.0	-999	214	29.98	16.63	24.94	10	-999.0	-999	0	0	0	0	-999.000	-999.000
0053	13.0	764.4	17.09	-999.0	2232	213	30.18	16.47	25.29	10	-11.8	2232	0	0	0	0	27.414	-87.594
0054	13.3	-999.0	-999.00	-999.0	-999	213	30.20	16.43	25.35	10	-999.0	-999	0	0	0	0	-999.000	-999.000
0055	13.5	764.9	17.09	-999.0	2226	213	30.22	16.37	25.39	10	-12.0	2226	0	0	0	0	27.414	-87.594
0056	13.8	-999.0	-999.00	-999.0	-999	213	30.22	16.32	25.44	10	-999.0	-999	0	0	0	0	-999.000	-999.000
0057	14.0	765.5	17.08	-999.0	2220	213	30.23	16.26	25.49	10	-12.1	2220	0	0	0	0	27.414	-87.594
0058	14.3	-999.0	-999.00	-999.0	-999	212	30.23	16.19	25.53	10	-999.0	-999	0	0	0	0	-999.000	-999.000
0059	14.5	766.0	17.07	-999.0	2214	212	30.23	16.13	25.57	10	-12.3	2214	0	0	0	0	27.415	-87.594
0060	14.8	-999.0	-999.00	-999.0	-999	212	30.23	16.06	25.62	10	-999.0	-999	0	0	0	0	-999.000	-999.000
0061	15.0	766.6	17.06	-999.0	2207	212	30.24	15.99	25.66	10	-12.3	2207	0	0	0	0	27.415	-87.594
0062	15.3	-999.0	-999.00	-999.0	-999	212	30.24	15.92	25.71	10	-999.0	-999	0	0	0	0	-999.000	-999.000
0063	15.5	767.2	17.04	-999.0	2201	212	30.25	15.86	25.76	10	-12.4	2201	0	0	0	0	27.415	-87.594

The sonde splashed at 195.25 seconds (line 0781) with a raw pressure of 988.1 mb and the last QC'd winds a quarter second earlier of 194 degrees at 35.71 m/s:

0766	191.3	-999.0	-999.00	-999.0	-999	190	34.95	6.13	34.41	10	-999.0	-999	0	0	0	0	-999.000	-999.000
0767	191.5	984.4	25.58	97.0	33	190	35.10	6.19	34.55	10	-9.7	33	0	0	0	0	27.466	-87.572
0768	191.8	-999.0	-999.00	-999.0	-999	190	35.31	6.27	34.75	10	-999.0	-999	0	0	0	0	-999.000	-999.000
0769	192.0	985.0	25.62	96.9	28	190	35.55	6.40	34.97	10	-9.5	28	0	0	0	0	27.466	-87.572
0770	192.3	-999.0	-999.00	-999.0	-999	191	35.80	6.57	35.19	9	-999.0	-999	0	0	0	0	-999.000	-999.000
0771	192.5	985.5	25.66	96.8	23	-999	-999.00	-999.00	-999.00	10	-9.3	23	0	0	0	0	27.466	-87.572
0772	192.8	-999.0	-999.00	-999.0	-999	191	36.21	7.12	35.50	10	-999.0	-999	0	0	0	0	-999.000	-999.000
0773	193.0	986.0	25.70	96.8	19	192	36.32	7.49	35.54	10	-9.2	19	0	0	0	0	27.466	-87.572
0774	193.3	-999.0	-999.00	-999.0	-999	193	36.38	7.92	35.51	9	-999.0	-999	0	0	0	0	-999.000	-999.000
0775	193.5	986.5	25.74	96.8	15	193	36.37	8.36	35.40	10	-9.0	15	0	0	0	0	27.466	-87.572
0776	193.8	-999.0	-999.00	-999.0	-999	194	36.29	8.77	35.22	10	-999.0	-999	0	0	0	0	-999.000	-999.000
0777	194.0	986.9	25.77	96.9	11	195	36.16	9.15	34.98	10	-9.0	11	0	0	0	0	27.467	-87.572
0778	194.3	-999.0	-999.00	-999.0	-999	195	35.96	9.48	34.69	10	-999.0	-999	0	0	0	0	-999.000	-999.000
0779	194.5	987.3	25.81	97.1	7	196	35.73	9.77	34.37	10	-8.9	7	0	0	0	0	27.467	-87.572
0780	194.8	-999.0	-999.00	-999.0	-999	194	35.71	8.88	34.59	10	-999.0	-999	0	0	0	0	-999.000	-999.000
0781	195.3	988.1	25.83	97.1	0	-999	-999.00	-999.00	-999.00	-999	-999.0	0	0	0	0	0	-999.000	-999.000

Figure 72: Portions of the FRD file corresponding to the sounding shown in Figure 71

The EOL file is another high resolution QC'd research product that can be auto-generated by ASPEN and is similar in format to the FRD file:

```
Data Type/Direction:                    AVAPS SOUNDING DATA, Channel 7/Descending
File Format/Version:                    EOL Sounding Format/1.1
Project Name/Platform:                  Hurricane Sandy, 20121027H1/NOAA WP-3D, N42RF
Launch Site:
Launch Location (lon,lat,alt):          77 10.84'W -77.180700, 29 11.96'N 29.199400,  3599.30
UTC Launch Time (y,m,d,h,m,s):          2012, 10, 27, 10:18:47
Sonde Id/Sonde Type:                    111925005/
Reference Launch Data Source/Time:      IWGADTS Format (IWG1)/10:18:47
System Operator/Comments:               tmr/fast fall for about 250mb then slowed, Fast Fall
Post Processing Comments:               Aspen Version 3.1; Created on 27 Oct 2012 10:36 UTC; Configuration editsonde
/
  Time    -- UTC --    Press    Temp    Dewpt     RH     Uwind    Vwind    Wspd     Dir      dZ     GeoPoAlt     Lon          Lat        GPSAlt
   sec    hh mm   ss     mb       C       C       %       m/s      m/s      m/s      deg      m/s        m          deg          deg          m
-------- -- -- ----- ------- ------- ------- ------- -------- -------- -------- -------- -------- --------- ------------ ------------ --------
   -1.00 10 18 46.00  640.15    7.85    7.85  100.00   -15.18   -12.50    19.66    50.53  -999.00   3583.73   -77.180700    29.199400  3599.30
    0.01 10 18 47.01 -999.00 -999.00 -999.00 -999.00  -999.00  -999.00  -999.00  -999.00  -999.00   -999.00   -77.181341    29.199923  3538.45
    0.26 10 18 47.26 -999.00 -999.00 -999.00 -999.00  -999.00  -999.00  -999.00  -999.00  -999.00   -999.00  -999.000000 -999.000000  -999.00
    0.51 10 18 47.51 -999.00 -999.00 -999.00 -999.00  -999.00  -999.00  -999.00  -999.00  -999.00   -999.00   -77.180969    29.199531  3539.72
    0.76 10 18 47.76 -999.00 -999.00 -999.00 -999.00  -999.00  -999.00  -999.00  -999.00  -999.00   -999.00  -999.000000 -999.000000  -999.00
    1.01 10 18 48.01 -999.00 -999.00 -999.00 -999.00  -999.00  -999.00  -999.00  -999.00  -999.00   -999.00   -77.180723    29.199242  3542.74
    1.26 10 18 48.26 -999.00 -999.00 -999.00 -999.00  -999.00  -999.00  -999.00  -999.00  -999.00   -999.00  -999.000000 -999.000000  -999.00
    1.51 10 18 48.51 -999.00 -999.00 -999.00 -999.00  -999.00  -999.00  -999.00  -999.00  -999.00   -999.00   -77.180850    29.199228  3540.95
    1.76 10 18 48.76 -999.00 -999.00 -999.00 -999.00  -999.00  -999.00  -999.00  -999.00  -999.00   -999.00  -999.000000 -999.000000  -999.00
    2.01 10 18 49.01 -999.00 -999.00 -999.00 -999.00  -999.00  -999.00  -999.00  -999.00  -999.00   -999.00   -77.180950    29.199184  3536.78


258.01 10 23  5.01  965.26   24.43   23.67   95.45  -13.15  -25.51   28.69   27.27  -12.37    65.54  -77.222064   29.147456    68.25
258.26 10 23  5.26 -999.00 -999.00 -999.00 -999.00  -13.12  -25.30   28.50   27.40 -999.00  -999.00 -999.000000 -999.000000 -999.00
258.51 10 23  5.51  965.93   24.46   23.72   95.57  -13.06  -25.10   28.29   27.50  -12.38    59.41  -77.222133   29.147337    62.15
258.76 10 23  5.76 -999.00 -999.00 -999.00 -999.00  -13.03  -24.90   28.10   27.62 -999.00  -999.00 -999.000000 -999.000000 -999.00
259.01 10 23  6.01  966.60   24.49   23.76   95.63 -999.00 -999.00 -999.00 -999.00  -12.40    53.32  -77.222204   29.147219    56.09
259.26 10 23  6.26 -999.00 -999.00 -999.00 -999.00  -12.89  -24.46   27.65   27.79 -999.00  -999.00 -999.000000 -999.000000 -999.00
259.51 10 23  6.51  967.28   24.53   23.80   95.64  -12.77  -24.22   27.38   27.80  -12.43    47.16  -77.222276   29.147103    49.92
259.76 10 23  6.76 -999.00 -999.00 -999.00 -999.00  -12.58  -23.95   27.05   27.71 -999.00  -999.00 -999.000000 -999.000000 -999.00
260.01 10 23  7.01  967.97   24.56   23.83   95.59  -12.33  -23.67   26.69   27.52  -12.46    40.90  -77.222347   29.146989    43.49
260.26 10 23  7.26 -999.00 -999.00 -999.00 -999.00  -12.01  -23.38   26.28   27.19 -999.00  -999.00 -999.000000 -999.000000 -999.00
260.51 10 23  7.51  968.66   24.60   23.85   95.49  -11.61  -23.08   25.84   26.71  -12.48    34.53  -77.222415   29.146878    37.17
260.76 10 23  7.76 -999.00 -999.00 -999.00 -999.00  -11.17  -22.80   25.39   26.10 -999.00  -999.00 -999.000000 -999.000000 -999.00
261.01 10 23  8.01  969.37   24.64   23.87   95.37 -999.00 -999.00 -999.00 -999.00  -12.49    28.09  -77.222479   29.146771    30.77
261.26 10 23  8.26 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00  -999.00 -999.000000 -999.000000 -999.00
261.51 10 23  8.51  970.07   24.68   23.89   95.24   -9.61  -22.17   24.16   23.44  -12.48    21.72  -77.222539   29.146665    24.36
261.76 10 23  8.76 -999.00 -999.00 -999.00 -999.00   -9.08  -22.09   23.88   22.34 -999.00  -999.00 -999.000000 -999.000000 -999.00
262.01 10 23  9.01  970.75   24.72   23.90   95.10   -8.55  -22.08   23.68   21.18  -12.46    15.59  -77.222593   29.146562    18.18
262.26 10 23  9.26 -999.00 -999.00 -999.00 -999.00   -8.05  -22.11   23.53   20.01 -999.00  -999.00 -999.000000 -999.000000 -999.00
262.51 10 23  9.51  971.40   24.76 -999.00 -999.00   -7.56  -22.14   23.39   18.85  -12.39     9.68  -77.222644   29.146459    11.96
262.76 10 23  9.76 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00  -999.00 -999.000000 -999.000000 -999.00
263.30 10 23 10.30  972.46   24.78   23.93   94.89 -999.00 -999.00 -999.00 -999.00 -999.00     0.00 -999.000000 -999.000000 -999.00
```

Figure 73: Portions of an example EOL file

Similarly, the CLASS or .cls file is another 0.25 resolution QC'd file laid out in tabular form. The principal difference between this format and that of the FRD or EOL files is that the sounding is described from the bottom up (the first line is the splash):

```
Data Type:                      AVAPS SOUNDING DATA, Channel 2
Project ID:                     Hurricane 2012, 20120828H1
Launch Site Type/Site ID:       NOAA WP-3D, N42RF
Launch Location (lon,lat,alt):  87 35.80'W, 27 24.71'N, -87.59670 27.41190 2380
GMT Launch Time (y,m,d,h,m,s):  2012, 08, 28, 12:25:51
Sonde Id:                       111755060
/
System Operator/Comments:       crq,none, Good Drop
Post Processing Comments:       Aspen Version 3.1; Created on 22 Apr 2013 19:37 UTC
/
 Time   Press   Temp   Dewpt   RH     Uwind   Vwind   Wspd   Dir    dZ       Lon       Lat      Rng     Az      Alt     Qp    Qt    Qh    Qu    Qv    Quv
  sec     mb      C       C    %       m/s     m/s     m/s    deg    m/s       deg       deg      km    deg       m     mb     C     %     m/s   m/s   m/s
------ ------ ------ ------- ----- ------- ------- ------- ------ ------ --------- --------- ------- ------- ------- ------ ----- ----- ----- ----- -----
 195.3  988.1  25.8   25.4   97.1   999.0   999.0 999.0  999.0   99.0   999.000   999.000   999.0   999.0     0.0  99.0  99.0  99.0  99.0  99.0  99.0
 194.8 9999.0 999.0  999.0  999.0     8.9    34.6  35.7  194.4   99.0   999.000   999.000   999.0   999.0 99999.0  99.0  99.0  99.0  99.0  99.0  99.0
 194.5  987.3  25.8   25.3   97.1     9.8    34.4  35.7  195.9   -8.9   -87.572    27.467   999.0   999.0     6.8  99.0  99.0  99.0  99.0  99.0  99.0
 194.3 9999.0 999.0  999.0  999.0     9.5    34.7  36.0  195.3   99.0   999.000   999.000   999.0   999.0 99999.0  99.0  99.0  99.0  99.0  99.0  99.0
 194.0  986.9  25.8   25.3   96.9     9.2    35.0  36.2  194.7   -9.0   -87.572    27.467   999.0   999.0    10.6  99.0  99.0  99.0  99.0  99.0  99.0
 193.8 9999.0 999.0  999.0  999.0     8.8    35.2  36.3  194.0   99.0   999.000   999.000   999.0   999.0 99999.0  99.0  99.0  99.0  99.0  99.0  99.0
 193.5  986.5  25.7   25.2   96.8     8.4    35.4  36.4  193.3   -9.0   -87.572    27.466   999.0   999.0    14.7  99.0  99.0  99.0  99.0  99.0  99.0
 193.3 9999.0 999.0  999.0  999.0     7.9    35.5  36.4  192.6   99.0   999.000   999.000   999.0   999.0 99999.0  99.0  99.0  99.0  99.0  99.0  99.0
 193.0  986.0  25.7   25.2   96.8     7.5    35.5  36.3  191.9   -9.2   -87.572    27.466   999.0   999.0    18.9  99.0  99.0  99.0  99.0  99.0  99.0
 192.8 9999.0 999.0  999.0  999.0     7.1    35.5  36.2  191.3   99.0   999.000   999.000   999.0   999.0 99999.0  99.0  99.0  99.0  99.0  99.0  99.0
 192.5  985.5  25.7   25.1   96.8   999.0   999.0 999.0  999.0   -9.3   -87.572    27.466   999.0   999.0    23.4  99.0  99.0  99.0  99.0  99.0  99.0
 192.3 9999.0 999.0  999.0  999.0     6.6    35.2  35.8  190.6   99.0   999.000   999.000   999.0   999.0 99999.0  99.0  99.0  99.0  99.0  99.0  99.0
 192.0  985.0  25.6   25.1   96.9     6.4    35.0  35.6  190.4   -9.5   -87.572    27.466   999.0   999.0    28.2  99.0  99.0  99.0  99.0  99.0  99.0
 191.8 9999.0 999.0  999.0  999.0     6.3    34.7  35.3  190.2   99.0   999.000   999.000   999.0   999.0 99999.0  99.0  99.0  99.0  99.0  99.0  99.0
 191.5  984.4  25.6   25.1   97.0     6.2    34.6  35.1  190.2   -9.7   -87.572    27.466   999.0   999.0    33.2  99.0  99.0  99.0  99.0  99.0  99.0
 191.3 9999.0 999.0  999.0  999.0     6.1    34.4  35.0  190.1   99.0   999.000   999.000   999.0   999.0 99999.0  99.0  99.0  99.0  99.0  99.0  99.0
 191.0  983.8  25.5   25.1   97.2   999.0   999.0 999.0  999.0   -9.9   -87.572    27.466   999.0   999.0    38.2  99.0  99.0  99.0  99.0  99.0  99.0
 190.8 9999.0 999.0  999.0  999.0     6.0    34.3  34.8  190.0   99.0   999.000   999.000   999.0   999.0 99999.0  99.0  99.0  99.0  99.0  99.0  99.0
 190.5  983.3  25.5   25.1   97.4     6.0    34.2  34.8  189.9  -10.0   -87.572    27.466   999.0   999.0    43.3  99.0  99.0  99.0  99.0  99.0  99.0
 190.3 9999.0 999.0  999.0  999.0     6.0    34.2  34.7  189.9   99.0   999.000   999.000   999.0   999.0 99999.0  99.0  99.0  99.0  99.0  99.0  99.0
 190.0  982.7  25.5   25.0   97.5     6.0    34.2  34.8  189.9  -10.2   -87.572    27.465   999.0   999.0    48.5  99.0  99.0  99.0  99.0  99.0  99.0
```

Figure 74: A portion of an example CLASS file

The .csv file is yet another high resolution sounding product that is generated as a Comma Separated file. There are also options on the QC Auto Save tab to generate and save SkewT diagrams in either .png, .jpg or .svg formats.

APPENDIX A – WMO TEMPDROP MESSAGE CODE (see following pages for key)

UZNT13 KNHC 061851
XXAA 56185 99251 70786 08158 99016 26444 18501 00140 26247 07004 92827
22856 10509 85560 17834 07510 70200 09045 07012 50591 05532 07016 88999
77999
61616 AF968 0204A BONNIE OB 04
62626 RAINBAND SPL 2635N08996W LST WND 001 MBL WND 04010
XXBB 56188 99251 70786 08158 00016 26444 11005 25841 2291 26657 33860
18233 44719 10657 55679 07023 66624 03656 77555 01917 88541 02556 99523
11497 05927
21212 00016 18501 11983 07510 22959 10010 33865 09511
44787 06510 55719 08011 66695 06512 77646 08512 88597 07011 99570 03511
11538 08014 22523 08516 33497 07016
31313 09608 81828
51515 10166 02050
61616 AF968 0204A BONNIE OB 04
62626 RAINBAND SPL 2635N08996W LST WND 001 MBL WND 04010

XXAA – Identifier for a temp drop code

Date/Time Group: YYGGI_d

- Identifier: YY – Date Group, Identifier: GG – Time Group, Identifier: I_d - The highest mandatory level for which wind is available

LATTITUDE: 99$L_aL_aL_a$

- Identifier: 99 – Indicator for data on position, Identifier: $L_aL_aL_a$ – Latitude in tenths of degrees

LONGITUDE: $Q_cL_oL_oL_oL_o$

- Identifier: Q_c – The octant of the globe, Identifier: $L_oL_oL_oL_o$ – Longitude in tenths of degrees

MARSDEN SQUARE: MMM$U_{la}U_{lo}$

- Identifier and explain: MMM – Marsden square, Identifier and explain: $U_{la}U_{lo}$ – Units

SEA LEVEL PRESSURE: 99$P_oP_oP_o$ $T_oT_oT_oD_oD_o$ $d_od_of_of_of_o$

- Identifier: 99 – Indicator for data at the surface level follows
- Identifier: $P_oP_oP_o$ –Pressure of specified levels in whole millibar (thousands digit omitted)
- Identifier: $T_oT_oT_o$ – Tens and digits of air temperature (not rounded off) in degrees Celsius, at specified levels beginning with surface
- Identifier: D_oD_o – Dewpoint depression at standard isobaric surfaces beginning with surface level

NOTE

When the depression is 4.9C or less encode the units and tenths digits of the depression. Encode depressions of 5.0 through 5.4C as 50. Encode depressions of 5.5C through 5.9C as 56. Dew point repressions of 6.0 and above are encoded in tens and units with 50 added. Dew point depressions for relative humidities less then 20% are encoded as 80. When air temperature is below –40C report D_aD_a as // Identifier: d_od_o – True direction from which the wind is blowing rounded to nearest 5 degrees. Report hundreds and tens digits. The unit (0 and 5) is added to the hundreds digit of wind.

- Identifier: $f_of_of_o$ – Wind speed in knots. Hundreds digit is sum of hundreds digit of speed and unit digit of direction. Example: 295 degrees at 125 knots is encoded as 29625

STANDARD ISOBARIC SURFACES: $P_1P_1h_1h_1h_1$ $T_1T_1T_1D_1D_1$ $d_1d_1f_1f_1f_1$

- Identifier: P_1P_1 – Pressure of standard isobaric surfaces in units of tens of millibars. (1000mbs = 00, 925mbs – 92, 850mbs = 85, 700mbs = 70, 500mbs = 50, 400mbs = 40, 300mbs = 30, 250mbs = 25)
- Identifier: $h_1h_1h_1$ – Heights of the standard pressure level in geopotential meters or decameters above the surface. Encoded in decameters at and above 500mbs omitting, if necessary, the thousands or tens of thousands digits. Add 500 to hhh for negative 1000mb or 925mb heights. Report 1000mb group as 00/// ///// ///// when pressure is less than 950mbs.

DATA FOR TROPOPAUSE LEVELS: 88$P_nP_nP_n$ $T_nT_nT_nD_nD_n$ $d_nd_nf_nf_nf_n$

- Identifier: 88 – Indicator for Tropopause level follows
- Identifier: $P_nP_nP_n$ – Pressure at the tropopause level reported in whole millibars. Report 88$P_nP_nP_n$ as 88999 when tropopause is not observed
- Identifier: $T_nT_nT_nD_nD_n$ – Same temperature/dew point encoding procedures apply
- Identifier: $d_nd_nf_nf_nf_n$ - Same wind encoding procedures apply

MAXIMUM WIND DATA: 77$P_nP_nP_n$ $d_nd_nf_nf_nf_n$ 4$v_bv_bv_av_a$

- Identifier: 77 – Indicator that data for maximum wind level and for vertical wind shear follow when max wind does not coincide at flight. If maximum wind level coincides with flight level encode 66
- Identifier: $P_nP_nP_n$ – Pressure at maximum wind level in whole millibars
- Identifier: $d_nd_nf_nf_nf_n$ – Same wind encoding procedures apply
- Identifier: 4 – Data for vertical wind shear follow
- Identifier: v_bv_b – Absolute value of vector difference between max wind and wind 3000 feet BELOW the level of max wind, reported to the nearest knot. Use "//" if missing and a 4 is reported. A vector difference of 99 knots or more is reported with the code figure "99".
- Identifier: v_av_a – Absolute value of vector difference between max wind and wind 3000 feet ABOVE the level of max wind, reported to the nearest knot. Use "//" if missing and a 4 is reported. A vector difference of 99 knots or more is reported with the code figure "99".

AIRCRAFT AND MISSION IDENTIFICATION: 61616 AFXXX XXXXX XXXXX OB X KXXX

- Identifier: 61616 – Aircraft and mission identification data follows
- Identifier: AFXXX XXXX XXXXX: Mission ID
- Identifier: OB 04 – The observation number as transmitted from the aircraft.

NATIONALLY DEVELOPED CODES: 62626

- Identifier: 62626 – This is the remarks section. Only the remarks: EYE EYEWALL XXX (eyewall will be followed by the radian to the eye center procured from the ARWO), or RAINBAND, if release was made in a feeder band. The splash location will be recorded automatically by computer. Followed by last wind height in meters and the mean boundary layer wind with degrees to the nearest five-degree and knots.

PART BRAVO (B)

- XXBB – Identifier for a temp drop code
- The following 6 groups same as in PART ALPHA: Date/Time and location and SLP

SIGNIFICANT ISOBARIC LEVELS: $n_on_oP_oP_oP_o$ $T_oT_oT_oD_oD_o$

- Identifier: n_on_o – Number of level starting with surface level. Only surface will be numbered as "00". When a standard level is also selected as significant, repeat the level.
- Identifier: $P_oP_oP_o$ – Pressure at specified levels in whole millibars.
- Identifier: $T_oT_oT_oD_oD_o$ – Same temperature/dew point encoding applies.

SIGNIFICANT WIND LEVELS: 21212 nnPPP ddfff

- Identifier: n_on_o – Number of level starting with surface level. Only surface will be numbered as "00". When a standard level is also selected as significant, repeat the level.
- Identifier: $d_1d_1f_1f_1f_1$ – Same wind encoding procedures apply to all levels

SOUNDING SYSTEM INDICATION, RADIOSONDE/SYSTEM STATUS, LAUNCH TIME: 31313 $s_rr_ar_as_as_a$ 8GGgg

ADDITIONAL DATA GROUPS: 51515 101XX $0P_nP_nP_nP_n$

- Identifier: 51515 – Additional data in regional code follow
- Identifier: 10166 – Geopotential data are doubtful between the following levels $0P_nP_nP_nP_n$.
- Identifier: 10167 – Temperature data are doubtful between the following levels $0P_nP_nP_nP_n$.
- Identifier: 10190 – Extrapolated altitude data follows:

a. When the sounding begins within 25mbs below a standard surface, the height of the surface is reported in the format 10190 $P_nP_nh_nh_nh_n$. The temperature group is not reported

b. When the sounding does not reach surface, but terminates within 25mbs of a standard surface, the height of the standard surface is reported in Part A of the code in standard format and also at the end of Part A and Part B of the code in the format as 10190 $P_nP_nh_nh_nh_n$.

- Identifier: 10191 – Extrapolated surface pressure preceds. Extrapolated surface pressure is only reported when the termination occurs between 850mbs and the surface. Surface pressure is reported in Part A as $99P_oP_oP_o$ ///// and in Part B as $00P_oP_oP_o$ /////. When surface pressure is extrapolated the 10191 group is the last additional data group reported in Part B.

SECOND EXAMPLE:

```
UZNT13 KNHC 032223
XXAA  53223 99397 70727 15292 99012 04636 04516 00098 03829 04016
        A     B     C     D     E     F     G
92728 01649 32008 85404 02918 29021 70940 03188 28044 50554 15174
27068 40719 27361 28594 30921 383// 27147 88999 66298 27147 4////
                                        H           I       J

61616 AF866 WSWSA TRACK04 OB 02
  K           L
62626 MBL WND 03515 AEV 20108 DLM WND 28536 012359 WL150 04516 07
  M         N         O             P                 Q
5 =
XXBB  53228 99397 70727 15292 00012 04636 11978 02224 22970 02660
        R                     S     T
33938 01231 44920 01456 55850 02918 66804 06124 77795 01785 88707
02793 99682 04184 11651 07360 22634 07186 33623 06586 44591 09382
55567 11764 66557 11947 77535 12359 88514 13375 99455 21572 11425
23761 22400 27361 33371 29936 44357 31356 55329 339// 66298 38535

21212 00012 04516 11980 04016 22970 02518 33944 02010 44933 34006
  U     V     W
55922 31509 66901 28507 77889 27010 88850 29021 99770 29028 11723
27042 22693 28044 33536 27073 44496 27068 55445 29083 66385 28598
77298 27147

31313 09608 82209
  X     Y     Z
61616 AF866 WSWSA TRACK04 OB 02
62626 MBL WND 03515 AEV 20108 DLM WND 28536 012359 WL150 04516 07
5 =
```

A: (53) Day of the Month, When wind data are included 50 is added to the day
(22) Actual time of the observation, to the nearest whole hour (GMT)
(3) Indicator used to specify the highest millibar level with wind data
B: (99) Indicator for data on position follow (397) Latitude, in tenths or a degree
C: (7) Quadrant of the globe (0727) Longitude, in tenths of a degree
D: (152) The number of the marsden square for AC position at the time of the Drop
(9) Unit digit for latitude for verification purposes
(2) Unit digit for longitude for verification purposes
E: (99) Indicator for data for surface level follow
(012) Pressure of specified levels in whole millibars thousands digit omitted. Above the surface, Pressure of standard isobaric surfaces is in tens of millibars
F: (04) Tens and units digit of air temp. in degrees C, at previously specified levels
(6) Approximate tenths value of the air temp. Even = Positive, Odd = negative
(36) Dew-point depression in units and tenths. DP dep. of 6C and above are encoded in tens and units with 50 added. DP dep. for RH < 20% are encoded as 80.
G: (04) True dir. from which wnd is blowing rnded to nearest 5 deg. in hundreds & tens
(516) Wind speed in knots. Hundreds digit is sum of hundreds digit of speed and the unit digit of direction. i.e. 295 deg at 125kts encoded as 29625
H: (88) Indicator for data for tropopause level follow
(999) Pressure at the trop. Lvl reported in whole mb followed by T, Td Dep., True Dir. and WS. 88999 indicator that trop. Data have not been observed
I: (66) Indicator that data for max wnd for vert. Wnd shear follow when max wnd occurs At figt level 77 indicates max wnd lvl does not coincide with the flight level
(298) Pressure at max wnd level in whole millibars
(27147) True wind Direction and wind speed in knots
J: (4///) Data for vert wnd shear follow; consult OI 15-25 for shear values, if needed
K: (61616) Indicator preceding a character string containing the wx mission id & ob #
L: (AF866) AC Tail # (WSWSA TRACK04 OB 02) Weather mission/track and drop obs #
M: (62626) Indicator preceding a specific sonde or mission related remarks. Last remark Would be placed here after indicator
N: (MBL WND 03515) The mean wnd in the lowest 150m of the sounding
O: (AEV 20108) The software version being used for the sounding
P: (DLM WND 28536 012359) The avg wnd over the depth of sndg Last grp is pressure layer
Q: (WL150 04516 07) Avg wnd ovr the lowest available 150m of snding (07) is lyr center
R: (8) Indicator for the use of satellite navigation for wind finding
S: (00) # of Level, starting w/sfc, only sfc will be # 'd as 00 (012) Press in whole mb
T: (04636) Temp and Humidity data, read as section one T/Td dep
U: (21212) Data for Significant levels with respect to wind follow
V: (00) # of Level, starting w/sfc, only sfc will be # 'd as 00 (012) Press in whole mb
W: (04516) True wind direction and speed; read the same way as G
X: (31313) Data on sounding system
Y: (096) Should always be encoded as such (08) Tracking techniques: 00 = AC has no wind finding capability and 08 = Automatic Satellite navigation
Z: (8) Indicator for time of OB (2209) Actual time of drop launch in hour and minutes

APPENDIX B – D FILE COMPONENTS

```
AVAPS-T01 STA 111745195 120825 055625.41
AVAPS-T01 COM             UTC      UTC       Air    Air     Rel   Wind   Wind   Vert      GPS        GPS      Geopoten GPS  Sonde  Sonde GPS Wind    GPS
AVAPS-T01 COM   Sonde     Date     Time      Press  Temp    Humid Dir    Spd    Veloc  Longitude  Latitude Altitude Wnd  RH1    RH2   Snd Error Altitude
AVAPS-T01 COM    ID       yymmdd   hhmmss.ss (mb)   (degC)  (%)   (deg)  (m/s)  (m/s)  (deg)      (deg)    (m)      Sat  (%)    (%)   Sat (m/s)   (m)
AVAPS-T01 COM ---------- ------ ---------- ------- ------ ------ ------ ------ ------ ---------- ---------- -------- --- ------ ------ --- ----- --------
AVAPS-T01 LAU 111745195 120825 060157.25
AVAPS-D01 A00 111745195 120825 060157.00  179.01 -59.11  40.37 222.01  25.95   0.40 -79.508200 27.113400 13070.80   0  40.37  40.37   0  0.00 13109.80
AVAPS-D01 P00 111745195 120825 060147.25  806.18  17.78  11.87 280.08 237.73 -0.10 -79.529817 27.117149 99999.00   9  10.96  11.87   9  0.51 13076.22
AVAPS-D01 P10 111745195 120825 060147.50 9999.00  99.00 999.00 280.12 237.63 -0.08 999.000000 99.000000 99999.00   9 999.00 999.00   9  0.52 99999.00
AVAPS-D01 P00 111745195 120825 060147.75  806.15  17.75  11.89 280.17 237.62 -0.09 -79.528640 27.116961 99999.00   9  10.95  11.89   9  0.52 13076.24
AVAPS-D01 P10 111745195 120825 060148.00 9999.00  99.00 999.00 280.23 237.70 -0.14 999.000000 99.000000 99999.00   9 999.00 999.00   9  0.52 99999.00
AVAPS-D01 P00 111745195 120825 060148.25  806.15  17.76  11.90 280.28 237.68 -0.17 -79.527463 27.116771 99999.00   9  10.97  11.90   9  0.52 13076.24
AVAPS-D01 P10 111745195 120825 060148.50 9999.00  99.00 999.00 280.32 237.68 -0.17 999.000000 99.000000 99999.00   9 999.00 999.00   9  0.52 99999.00
AVAPS-D01 P00 111745195 120825 060148.75  806.18  17.74  11.91 280.36 237.67 -0.13 -79.526287 27.116579 99999.00   9  10.96  11.91   9  0.50 13076.24
AVAPS-D01 P10 111745195 120825 060149.00 9999.00  99.00 999.00 280.45 237.70 -0.26 999.000000 99.000000 99999.00   9 999.00 999.00   9  0.48 99999.00
AVAPS-D01 P00 111745195 120825 060149.25  806.15  17.75  11.88 280.45 237.66 -0.20 -79.525111 27.116386 99999.00   9  10.98  11.88   9  0.48 13076.28
AVAPS-D01 P10 111745195 120825 060149.50 9999.00  99.00 999.00 280.50 237.73 -0.11 999.000000 99.000000 99999.00   9 999.00 999.00   9  0.49 99999.00
AVAPS-D01 P00 111745195 120825 060149.75  806.23  17.76  11.94 280.53 237.66 -0.05 -79.523935 27.116191 99999.00   9  10.98  11.94   9  0.56 13076.28
AVAPS-D01 P10 111745195 120825 060150.00 9999.00  99.00 999.00 280.60 237.61 -0.04 999.000000 99.000000 99999.00   9 999.00 999.00   9  0.50 99999.00
AVAPS-D01 P00 111745195 120825 060150.25  806.26  17.75  11.90 280.67 237.68 -0.06 -79.522760 27.115994 99999.00   9  11.00  11.90   9  0.48 13076.29
AVAPS-D01 P10 111745195 120825 060150.50 9999.00  99.00 999.00 280.70 237.71 -0.04 999.000000 99.000000 99999.00   9 999.00 999.00   9  0.50 99999.00
AVAPS-D01 P00 111745195 120825 060150.75  806.27  17.75  11.87 280.74 237.64 -0.00 -79.521585 27.115795 99999.00   9  10.96  11.87   9  0.50 13076.30
AVAPS-D01 P10 111745195 120825 060151.00 9999.00  99.00 999.00 280.80 237.62  0.01 999.000000 99.000000 99999.00   9 999.00 999.00   9  0.54 99999.00
AVAPS-D01 P00 111745195 120825 060151.25  806.11  17.74  11.88 280.83 237.65  0.14 -79.520410 27.115595 99999.00   9  10.95  11.88   9  0.58 13076.53
AVAPS-D01 P10 111745195 120825 060151.50 9999.00  99.00 999.00 280.87 237.62  0.24 999.000000 99.000000 99999.00   9 999.00 999.00   9  0.54 99999.00
AVAPS-D01 P00 111745195 120825 060151.75  806.04  17.75  11.89 280.93 237.56  0.26 -79.519236 27.115393 99999.00   9  10.97  11.89   9  0.51 13076.71
```

Figure B1: First rows of a D File including Launch Detect (LAU), Aircraft Data (A00) and the first few seconds of data recorded while the sonde was still in the launch tube (P00 and P10 rows)

Time on top line (highlighted in yellow as 055625.41 UTC in HHMMSS format with hundredths of seconds following the decimal point) IS NOT the time of the launch detect. It is the time when the AVAPS operator initializes the sonde and begins testing and prepping it for release (usually about 5 minutes prior to launch).

Launch Detect time is shown on the LAU line highlighted in green (in this case 060157.25 UTC). A bright LED light is located on the opposite side of the open inner cylinder from a light sensor on one end of the sonde. The parachute is stuffed between the light and the sensor. Upon deployment, the parachute unfurls into the air stream and leaves the open end of the sonde, allowing the LED light to shine into the sensor and activate the launch detect signal. This LAU time is used as the stamp naming the D File.

The A00 line (highlighted in magenta) is populated with aircraft data from 0.25 seconds prior to the launch detect. The next line (labeled P00 in the second column) is the first of 10 seconds of data from the sonde while it was still in the launch tube inside the aircraft prior to deployment. Note that it is showing the typical cabin pressure (806.18 mb), temperature (17.78C) and RH (11.87%) for the G-IV.

All the rows that are labeled with a P in that 2nd column display sonde data from the cabin. AVAPS is set to display the 10 seconds of sonde data before launch detect (that is why the times jump back 10 seconds for the first row labeled with P. Expect to see the label alternate between P00 and P10. The 1 in the first digit after the P denotes an error flag in the PTH data. This is expected in every other line since PTH data is only populated every 0.5 seconds (so since a line is generated every 0.25 seconds, half of them will be missing PTH data and filled with 999s for those columns). The second digit after the P is an error flag for GPS data. When GPS data for a row is flagged as invalid this will display a 1. In Figure B1, there were no rows with invalid GPS data while the sonde was in the launch tube.

Each dropsonde has a unique Sonde ID (shown in the third column) assigned by the manufacturer.

There are two humidity sensors on each sonde, therefore, there are two columns (#16 and #17) for both values of RH calculated by the AVAPS system (RH1 and RH2).

Geopotential Altitude (column #14) is provided by AAMPS in the A00 line. Afterwards, it is calculated by AVAPS using the hydrostatic equation based on this initial aircraft platform reference and subsequent changes in pressure and virtual temperature as determined by the sonde. This results in a raw estimate of Geopotential Altitude (GA) since the calculation is made from the top down. Later, when the D File is processed by ASPEN, a separate, more accurate integration of GA is performed from the bottom of the sounding upward. There is no calculation for GA in the P lines with the sonde in the launch tube.

Changes in Geopotential Altitude as the sonde falls is used to calculate Vertical Velocity in column #11. The GPS Altitude (the final column on the right) is not used for either GA or Vertical velocity calculations.

The GPS calculation of latitude, longitude, wind direction and wind speed on the A00 line (derived by the aircraft's AAMPS data system) are entirely independent of the corresponding calculation made on subsequent lines of the D File by the sonde and the AVAPS system. Note there are slight differences in each of these parameters between the A00 line and the 10 seconds of data in the P lines awaiting launch. The number of satellites being used for GPS calculations by AVAPS is shown in column #15.

		Sonde ID	UTC Date yymmdd	UTC Time hhmmss.ss	Air Press (mb)	Air Temp (degC)	Rel Humid (%)	Wind Dir (deg)	Wind Spd (m/s)	Vert Veloc (m/s)	GPS Longitude (deg)	GPS Latitude (deg)	Geopoten Altitude (m)	GPS Wnd Sat	Sonde RH1 (%)	Sonde RH2 (%)	GPS Snd Sat	Wind Error (m/s)	GPS Altitude (m)
AVAPS-D01	P00	111745195	120825	060155.25	806.19	17.74	11.83	281.64	237.39	0.63	-79.511031	27.113922	99999.00	9	10.89	11.83	9	0.50	13077.81
AVAPS-D01	P10	111745195	120825	060155.50	9999.00	99.00	999.00	281.65	237.39	0.69	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.49	99999.00
AVAPS-D01	P00	111745195	120825	060155.75	806.07	17.73	11.82	281.70	237.39	0.79	-79.509860	27.113706	99999.00	9	10.90	11.82	9	0.49	13078.21
AVAPS-D01	P10	111745195	120825	060156.00	9999.00	99.00	999.00	281.75	237.33	0.78	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.49	99999.00
AVAPS-D01	P00	111745195	120825	060156.25	806.22	17.73	11.81	281.81	237.31	0.72	-79.508691	27.113487	99999.00	9	10.90	11.81	9	0.47	13078.53
AVAPS-D01	P10	111745195	120825	060156.50	9999.00	99.00	999.00	281.85	237.29	0.64	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.47	99999.00
AVAPS-D01	P01	111745195	120825	060156.75	806.14	17.73	11.79	999.00	999.00	99.00	999.000000	99.000000	99999.00	0	10.89	11.79	0	99.00	99999.00
AVAPS-D01	P11	111745195	120825	060157.00	9999.00	99.00	999.00	999.00	999.00	99.00	999.000000	99.000000	99999.00	0	999.00	999.00	0	99.00	99999.00
AVAPS-D01	S00	111745195	120825	060157.25	152.04	17.72	11.60	281.96	237.38	0.64	-79.506353	27.113046	99999.00	9	9.52	11.60	9	0.63	13079.11
AVAPS-D01	S10	111745195	120825	060157.50	9999.00	99.00	999.00	282.13	237.15	0.72	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.82	99999.00
AVAPS-D01	S11	111745195	120825	060157.75	128.01	99.00	999.00	999.00	999.00	99.00	999.000000	99.000000	99999.00	0	999.00	999.00	0	99.00	99999.00
AVAPS-D01	S11	111745195	120825	060158.00	9999.00	99.00	999.00	999.00	999.00	99.00	999.000000	99.000000	99999.00	6	999.00	999.00	6	99.00	99999.00
AVAPS-D01	S11	111745195	120825	060158.25	9999.00	99.00	999.00	999.00	999.00	99.00	999.000000	99.000000	99999.00	0	999.00	999.00	0	99.00	99999.00
AVAPS-D01	S11	111745195	120825	060158.50	9999.00	99.00	999.00	999.00	999.00	99.00	999.000000	99.000000	99999.00	0	999.00	999.00	0	99.00	99999.00
AVAPS-D01	S11	111745195	120825	060158.75	9999.00	99.00	999.00	999.00	999.00	99.00	999.000000	99.000000	99999.00	0	999.00	999.00	0	99.00	99999.00
AVAPS-D01	S00	111745195	120825	060159.00	180.62	-9.01	1.00	280.73	228.59	2.49	-79.502361	27.112279	99999.00	6	1.00	1.00	6	2.34	13082.16
AVAPS-D01	S10	111745195	120825	060159.25	9999.00	99.00	999.00	280.23	228.31	3.08	999.000000	99.000000	99999.00	5	999.00	999.00	5	2.49	99999.00
AVAPS-D01	S00	111745195	120825	060159.50	180.93	-12.07	1.00	280.10	228.06	3.46	-79.501231	27.112105	99999.00	5	1.00	1.00	5	2.58	13085.00
AVAPS-D01	S10	111745195	120825	060159.75	9999.00	99.00	999.00	279.46	227.37	3.55	999.000000	99.000000	99999.00	4	999.00	999.00	4	2.93	99999.00
AVAPS-D01	S00	111745195	120825	060200.00	181.16	-14.32	1.00	999.00	999.00	99.00	999.000000	99.000000	99999.00	0	1.00	1.00	0	99.00	99999.00
AVAPS-D01	S10	111745195	120825	060200.25	9999.00	99.00	999.00	999.00	999.00	99.00	999.000000	99.000000	99999.00	0	999.00	999.00	0	99.00	99999.00
AVAPS-D01	S00	111745195	120825	060200.50	181.80	-16.27	1.00	999.00	999.00	99.00	999.000000	99.000000	12979.33	0	1.00	1.00	0	99.00	99999.00
AVAPS-D01	S10	111745195	120825	060200.75	9999.00	99.00	999.00	999.00	999.00	99.00	999.000000	99.000000	99999.00	0	999.00	999.00	0	99.00	99999.00
AVAPS-D01	S00	111745195	120825	060201.00	181.98	-18.26	1.00	999.00	999.00	99.00	999.000000	99.000000	12971.81	0	1.00	1.00	0	99.00	99999.00
AVAPS-D01	S10	111745195	120825	060201.25	9999.00	99.00	999.00	999.00	999.00	99.00	999.000000	99.000000	99999.00	0	999.00	999.00	0	99.00	99999.00
AVAPS-D01	S00	111745195	120825	060201.50	182.28	-20.28	1.00	999.00	999.00	99.00	999.000000	99.000000	12959.84	0	1.00	1.00	0	99.00	99999.00
AVAPS-D01	S10	111745195	120825	060201.75	9999.00	99.00	999.00	999.00	999.00	99.00	999.000000	99.000000	99999.00	0	999.00	999.00	0	99.00	99999.00
AVAPS-D01	S00	111745195	120825	060202.00	182.51	-22.33	1.00	999.00	999.00	99.00	999.000000	99.000000	12950.52	0	1.00	1.00	0	99.00	99999.00
AVAPS-D01	S10	111745195	120825	060202.25	9999.00	99.00	999.00	999.00	999.00	99.00	999.000000	99.000000	99999.00	0	999.00	999.00	0	99.00	99999.00
AVAPS-D01	S00	111745195	120825	060202.50	182.85	-24.32	1.00	999.00	999.00	99.00	999.000000	99.000000	12936.85	0	1.00	1.00	0	99.00	99999.00
AVAPS-D01	S10	111745195	120825	060202.75	9999.00	99.00	999.00	999.00	999.00	99.00	999.000000	99.000000	99999.00	0	999.00	999.00	0	99.00	99999.00
AVAPS-D01	S00	111745195	120825	060203.00	183.16	-26.23	1.00	999.00	999.00	99.00	999.000000	99.000000	12924.23	0	1.00	1.00	0	99.00	99999.00
AVAPS-D01	S10	111745195	120825	060203.25	9999.00	99.00	999.00	224.81	27.82	-19.30	999.000000	99.000000	99999.00	7	999.00	999.00	7	1.01	99999.00
AVAPS-D01	S00	111745195	120825	060203.50	183.37	-28.09	1.00	225.25	29.42	-19.77	-79.501912	27.112779	12916.09	8	1.00	1.00	8	0.85	13040.64
AVAPS-D01	S10	111745195	120825	060203.75	9999.00	99.00	999.00	225.64	29.23	-19.99	999.000000	99.000000	99999.00	7	999.00	999.00	7	0.92	99999.00
AVAPS-D01	S00	111745195	120825	060204.00	183.75	-29.90	1.00	225.73	28.94	-21.14	-79.502375	27.113290	12901.18	8	1.00	1.00	8	0.71	13013.68
AVAPS-D01	S10	111745195	120825	060204.25	9999.00	99.00	999.00	224.90	28.17	-21.73	999.000000	99.000000	99999.00	7	999.00	999.00	7	0.59	99999.00

Figure B2: The first line of actual sonde data from outside the aircraft after launch is highlighted in magenta. The label in column #2 switches from P to S.

In Figure B2 above, the transition from sonde data recorded inside the aircraft to outside the aircraft is marked by column #2 switching from P11 to S00. The same convention applies to these S rows with a 1 in the first digit after the S denoting an error flag in PTH data and a 1 in the second digit denoting an error flag in GPS data. After launch detect, at 060157.25 UTC, the sonde pressure is momentarily erratic (reading 152.04 mb initially, and 128.01 mb a half second later). Both of these values are impossible since the aircraft's flight level pressure was 179.01 mb. Within about two seconds of

launch, the first pressures that appear reasonable at first glance (greater than the flight level pressure provided by AAMPS) appear (beginning with 180.62 mb and rising slowly thereafter as the sonde fell). However, after processing the D File with ASPEN, the first valid pressure was not calculated (using upward integration) until 31.25 seconds after launch when the first QC'd temperature was available.

Given that the flight level temperature provided by AAMPS was -59.11C, none of the temperatures shown in Figure B2 after launch are close to being valid. The first outside temperature of -9.01C is obviously far too warm. In the next several seconds the temperature is seen to quickly drop to -29.90C but is still in the process of acclimating to the drastic temperature change from inside to outside the aircraft. The Relative Humidity is also suspect in those first few seconds as it dropped from cabin values of just under 12 percent to a constant value "flat-lined" at 1 percent.

The first Geopotential Altitude calculated by AVAPS from sonde data appears 3.25 seconds after launch. However, this calculation is based on the initial aircraft reference GA followed by calculations that utilized temperatures that were far too warm. Therefore the GA value of 12,979.33 meters is highly suspect.

Not only does it take time for PTH data to stabilize, but the first few seconds of AVAPS calculated sonde winds reflect the forward motion of the G-IV. This is why the first several rows after launch show wind speeds in excess of 200 meters per second. GPS Winds tend to stabilize much more quickly than PTH data so by six seconds after launch a much more reasonable value of 27.82 m/s can be seen. The ASPEN QC filter requires a few seconds of these stabilized values before reporting the first valid wind values. To help ensure this, ASPEN filters out the first 10 seconds of winds after launch in all soundings. Therefore, while the first valid winds may not be reported until after 10 seconds they will never be reported any sooner than that.

	Sonde ID	UTC Date yymmdd	UTC Time hhmmss.ss	Air Press (mb)	Air Temp (degC)	Rel Humid (%)	Wind Dir (deg)	Wind Spd (m/s)	Vert Veloc (m/s)	GPS Longitude (deg)	GPS Latitude (deg)	Geopoten Altitude (m)	GPS Wnd Sat	Sonde RH1 (%)	Sonde RH2 (%)	GPS Wind Snd Sat	GPS Wind Error (m/s)	GPS Altitude (m)
AVAPS-D01	S10	111745195	120825	060224.75	9999.00	99.00	999.00	210.56	28.43	-19.15	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.55	99999.00
AVAPS-D01	S00	111745195	120825	060225.00	196.48	-54.89	3.98	210.69	28.82	-19.22	-79.499206	27.117883	12458.99	9	3.56	3.98	9	0.55	12555.72
AVAPS-D01	S10	111745195	120825	060225.25	9999.00	99.00	999.00	210.07	28.39	-19.39	999.000000	99.000000	99999.00	8	999.00	999.00	8	0.58	99999.00
AVAPS-D01	S00	111745195	120825	060225.50	196.85	-54.95	4.18	209.71	28.64	-19.60	-79.499135	27.117995	12446.94	8	3.78	4.18	8	0.56	12545.79
AVAPS-D01	S10	111745195	120825	060225.75	9999.00	99.00	999.00	209.91	28.77	-19.83	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.57	99999.00
AVAPS-D01	S00	111745195	120825	060226.00	197.13	-54.98	4.35	209.91	28.67	-19.85	-79.499063	27.118107	12437.80	9	3.99	4.35	9	0.55	12535.66
AVAPS-D01	S10	111745195	120825	060226.25	9999.00	99.00	999.00	209.52	28.68	-19.96	999.000000	99.000000	99999.00	8	999.00	999.00	8	0.60	99999.00
AVAPS-D01	S00	111745195	120825	060226.50	197.45	-55.01	4.53	209.58	28.48	-20.13	-79.498993	27.118220	12427.33	8	4.15	4.53	8	0.60	12525.45
AVAPS-D01	S10	111745195	120825	060226.75	9999.00	99.00	999.00	209.59	28.57	-20.34	999.000000	99.000000	99999.00	8	999.00	999.00	8	0.56	99999.00
AVAPS-D01	S00	111745195	120825	060227.00	197.77	-55.04	4.74	209.65	28.55	-20.50	-79.498922	27.118332	12416.90	8	4.33	4.74	8	0.55	12515.17
AVAPS-D01	S10	111745195	120825	060227.25	9999.00	99.00	999.00	209.74	28.55	-20.56	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.57	99999.00
AVAPS-D01	S00	111745195	120825	060227.50	198.10	-55.05	4.92	209.22	28.48	-20.57	-79.498852	27.118444	12406.47	9	4.47	4.92	9	0.57	12504.77
AVAPS-D01	S10	111745195	120825	060227.75	9999.00	99.00	999.00	209.70	28.21	-20.76	999.000000	99.000000	99999.00	8	999.00	999.00	8	0.57	99999.00
AVAPS-D01	S00	111745195	120825	060228.00	198.39	-55.05	5.11	209.50	28.25	-20.81	-79.498783	27.118555	12397.12	9	4.63	5.11	9	0.55	12494.16
AVAPS-D01	S10	111745195	120825	060228.25	9999.00	99.00	999.00	209.48	28.48	-20.65	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.55	99999.00
AVAPS-D01	S00	111745195	120825	060228.50	198.74	-55.05	5.31	209.20	28.15	-20.79	-79.498713	27.118667	12385.63	8	4.79	5.31	8	0.57	12483.79
AVAPS-D01	S10	111745195	120825	060228.75	9999.00	99.00	999.00	209.75	28.23	-20.90	999.000000	99.000000	99999.00	8	999.00	999.00	8	0.56	99999.00
AVAPS-D01	S00	111745195	120825	060229.00	199.04	-55.04	5.51	209.19	28.55	-20.79	-79.498642	27.118778	12376.03	8	4.98	5.51	8	0.54	12473.43
AVAPS-D01	S10	111745195	120825	060229.25	9999.00	99.00	999.00	209.43	28.36	-20.84	999.000000	99.000000	99999.00	8	999.00	999.00	8	0.57	99999.00
AVAPS-D01	S00	111745195	120825	060229.50	199.32	-55.03	5.70	209.34	28.47	-20.68	-79.498572	27.118890	12367.21	9	5.14	5.70	9	0.56	12463.15
AVAPS-D01	S10	111745195	120825	060229.75	9999.00	99.00	999.00	209.29	28.25	-20.79	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.55	99999.00
AVAPS-D01	S00	111745195	120825	060230.00	199.64	-55.02	5.91	209.73	28.03	-20.87	-79.498503	27.119001	12356.82	9	5.33	5.91	9	0.58	12452.81
AVAPS-D01	S10	111745195	120825	060230.25	9999.00	99.00	999.00	209.51	28.05	-20.94	999.000000	99.000000	99999.00	8	999.00	999.00	8	0.56	99999.00
AVAPS-D01	S00	111745195	120825	060230.50	200.01	-55.01	6.18	209.85	28.19	-20.91	-79.498433	27.119111	12345.09	8	5.62	6.18	8	0.55	12442.44
AVAPS-D01	S10	111745195	120825	060230.75	9999.00	99.00	999.00	209.46	28.04	-20.96	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.56	99999.00
AVAPS-D01	S00	111745195	120825	060231.00	200.30	-55.00	6.46	210.01	28.32	-20.94	-79.498363	27.119222	12335.81	9	5.88	6.46	9	0.57	12432.00
AVAPS-D01	S10	111745195	120825	060231.25	9999.00	99.00	999.00	209.81	28.37	-20.91	999.000000	99.000000	99999.00	8	999.00	999.00	8	0.56	99999.00
AVAPS-D01	S00	111745195	120825	060231.50	200.62	-54.99	6.72	209.38	28.06	-20.80	-79.498292	27.119333	12325.43	9	6.10	6.72	9	0.56	12421.68
AVAPS-D01	S10	111745195	120825	060231.75	9999.00	99.00	999.00	209.97	28.29	-20.75	999.000000	99.000000	99999.00	8	999.00	999.00	8	0.56	99999.00
AVAPS-D01	S00	111745195	120825	060232.00	200.96	-54.96	6.96	209.53	28.06	-20.67	-79.498222	27.119444	12314.78	9	6.30	6.96	9	0.56	12411.42
AVAPS-D01	S10	111745195	120825	060232.25	9999.00	99.00	999.00	209.66	27.84	-20.63	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.54	99999.00
AVAPS-D01	S00	111745195	120825	060232.50	201.24	-54.94	7.25	209.41	27.61	-20.60	-79.498153	27.119553	12305.76	8	6.50	7.25	8	0.58	12401.23

Figure B3: D File data from 20 seconds further into the descent of the sonde shows where ASPEN first reported a valid pressure 31.25 seconds after launch. The temperature had stabilized at approximately -55C. The humidity was now no longer "flat-lined" at 1 percent, as it was slowly rising from about 4 percent to 7 percent. In this example, ASPEN would not report a valid humidity until 62.75 seconds, when it reached 25.1 percent.

		Sonde ID	UTC Date yymmdd	UTC Time hhmmss.ss	Air Press (mb)	Air Temp (degC)	Rel Humid (%)	Wind Dir (deg)	Wind Spd (m/s)	Vert Veloc (m/s)	GPS Longitude (deg)	GPS Latitude (deg)	Geopoten Altitude (m)	GPS Wnd Sat	Sonde RH1 (%)	Sonde RH2 (%)	GPS Snd Sat	Wind Error (m/s)	GPS Altitude (m)
AVAPS-D01	S00	111745195	120825	061734.00	1006.73	28.36	76.24	67.60	6.41	-11.10	-79.525602	27.155927	51.60	9	76.05	76.24	9	0.52	80.58
AVAPS-D01	S10	111745195	120825	061734.25	9999.00	99.00	999.00	67.14	6.44	-11.27	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.54	99999.00
AVAPS-D01	S00	111745195	120825	061734.50	1007.15	28.40	75.98	67.41	6.38	-11.17	-79.525632	27.155915	47.80	9	75.73	75.98	9	0.54	74.88
AVAPS-D01	S10	111745195	120825	061734.75	9999.00	99.00	999.00	67.46	6.37	-11.04	999.000000	99.000000	99999.00	8	999.00	999.00	8	0.54	99999.00
AVAPS-D01	S00	111745195	120825	061735.00	1007.89	28.45	76.19	67.14	6.45	-10.96	-79.525662	27.155904	41.26	8	76.00	76.19	8	0.55	69.47
AVAPS-D01	S10	111745195	120825	061735.25	9999.00	99.00	999.00	66.54	6.48	-10.88	999.000000	99.000000	99999.00	8	999.00	999.00	8	0.55	99999.00
AVAPS-D01	S00	111745195	120825	061735.50	1008.37	28.49	76.03	66.41	6.44	-10.95	-79.525693	27.155892	36.99	8	75.93	76.03	8	0.54	64.07
AVAPS-D01	S10	111745195	120825	061735.75	9999.00	99.00	999.00	65.19	6.45	-10.91	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.54	99999.00
AVAPS-D01	S00	111745195	120825	061736.00	1009.04	28.55	75.61	62.64	6.54	-11.16	-79.525722	27.155879	31.07	9	75.49	75.61	9	0.53	58.44
AVAPS-D01	S10	111745195	120825	061736.25	9999.00	99.00	999.00	65.42	6.73	-11.18	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.54	99999.00
AVAPS-D01	S00	111745195	120825	061736.50	1009.59	28.60	74.51	64.48	6.43	-11.07	-79.525753	27.155865	26.21	8	74.29	74.51	8	0.54	52.88
AVAPS-D01	S10	111745195	120825	061736.75	9999.00	99.00	999.00	65.39	6.74	-11.02	999.000000	99.000000	99999.00	8	999.00	999.00	8	0.54	99999.00
AVAPS-D01	S00	111745195	120825	061737.00	1010.38	28.66	74.62	62.23	6.65	-11.10	-79.525784	27.155852	19.19	8	74.43	74.62	8	0.55	47.40
AVAPS-D01	S10	111745195	120825	061737.25	9999.00	99.00	999.00	65.18	6.71	-11.05	999.000000	99.000000	99999.00	8	999.00	999.00	8	0.56	99999.00
AVAPS-D01	S00	111745195	120825	061737.50	1010.86	28.71	74.34	64.08	6.71	-11.07	-79.525814	27.155839	14.96	8	74.15	74.34	8	0.58	41.94
AVAPS-D01	S10	111745195	120825	061737.75	9999.00	99.00	999.00	64.70	6.42	-11.06	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.60	99999.00
AVAPS-D01	S00	111745195	120825	061738.00	1011.64	28.76	75.04	68.69	6.34	-10.91	-79.525845	27.155827	8.07	9	74.80	75.04	9	0.58	36.59
AVAPS-D01	S10	111745195	120825	061738.25	9999.00	99.00	999.00	68.62	6.59	-10.92	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.54	99999.00
AVAPS-D01	S00	111745195	120825	061738.50	1012.05	28.82	74.71	65.84	6.41	-11.03	-79.525875	27.155816	4.49	9	74.39	74.71	9	0.54	31.25
AVAPS-D01	S10	111745195	120825	061738.75	9999.00	99.00	999.00	64.59	6.35	-10.82	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.54	99999.00
AVAPS-D01	S00	111745195	120825	061739.00	1012.80	28.85	74.44	63.77	6.45	-10.81	-79.525905	27.155804	-2.14	9	74.17	74.44	9	0.54	25.98
AVAPS-D01	S10	111745195	120825	061739.25	9999.00	99.00	999.00	66.31	6.40	-10.79	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.54	99999.00
AVAPS-D01	S00	111745195	120825	061739.50	1013.34	28.91	74.15	67.37	7.02	-10.80	-79.525935	27.155793	-6.88	9	73.87	74.15	9	0.58	20.72
AVAPS-D01	S10	111745195	120825	061739.75	9999.00	99.00	999.00	64.61	6.44	-10.81	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.56	99999.00
AVAPS-D01	S00	111745195	120825	061740.00	1013.91	28.96	73.93	65.45	6.53	-10.83	-79.525965	27.155781	-11.96	9	73.79	73.93	9	0.55	15.52
AVAPS-D01	S10	111745195	120825	061740.25	9999.00	99.00	999.00	66.93	6.56	-10.77	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.53	99999.00
AVAPS-D01	S00	111745195	120825	061740.50	1014.49	29.01	74.26	65.53	6.50	-10.66	-79.525995	27.155769	-17.10	9	74.09	74.26	9	0.52	10.22
AVAPS-D01	S10	111745195	120825	061740.75	9999.00	99.00	999.00	64.76	6.53	-10.59	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.52	99999.00
AVAPS-D01	S11	111745195	120825	061741.00	9999.00	99.00	999.00	999.00	999.00	99.00	999.000000	99.000000	99999.00	0	999.00	999.00	0	99.00	99999.00
AVAPS-D01	S11	111745195	120825	061741.25	9999.00	99.00	999.00	999.00	999.00	99.00	999.000000	99.000000	99999.00	0	999.00	999.00	0	99.00	99999.00
AVAPS-D01	S11	111745195	120825	061741.50	9999.00	99.00	999.00	999.00	999.00	99.00	999.000000	99.000000	99999.00	0	999.00	999.00	0	99.00	99999.00
AVAPS-D01	S11	111745195	120825	061741.75	9999.00	99.00	999.00	999.00	999.00	99.00	999.000000	99.000000	99999.00	0	999.00	999.00	0	99.00	99999.00
AVAPS-D01	S11	111745195	120825	061742.00	9999.00	99.00	999.00	999.00	999.00	99.00	999.000000	99.000000	99999.00	0	999.00	999.00	0	99.00	99999.00
AVAPS-D01	S11	111745195	120825	061742.25	9999.00	99.00	999.00	999.00	999.00	99.00	999.000000	99.000000	99999.00	0	999.00	999.00	0	99.00	99999.00
AVAPS-D01	S11	111745195	120825	061742.50	9999.00	99.00	999.00	999.00	999.00	99.00	999.000000	99.000000	99999.00	0	999.00	999.00	0	99.00	99999.00
AVAPS-D01	S11	111745195	120825	061742.75	9999.00	99.00	999.00	999.00	999.00	99.00	999.000000	99.000000	99999.00	0	999.00	999.00	0	99.00	99999.00
AVAPS-D01	S11	111745195	120825	061743.00	9999.00	99.00	999.00	999.00	999.00	99.00	999.000000	99.000000	99999.00	0	999.00	999.00	0	99.00	99999.00

Figure B4: D File for the bottom of a sounding just prior to splashdown. This depicts a textbook sonde termination. An entire line of PTH and GPS data (highlighted in yellow) was reported for time 061740.50 UTC with GPS only at 0.25 seconds prior to splash (highlighted in green). At splashdown there is a total loss of telemetry with 999s in all columns (highlighted in red). There will be several seconds of these rows filling out the bottom of a D File along with remarks shown in Figure B5 below.

```
AVAPS-D01 S11 111745195 120825 061749.25 9999.00  99.00 999.00 999.00 999.00  99.00  999.000000  99.000000 99999.00   0 999.00 999.00   0 99.00 99999.00
AVAPS-D01 S11 111745195 120825 061749.50 9999.00  99.00 999.00 999.00 999.00  99.00  999.000000  99.000000 99999.00   0 999.00 999.00   0 99.00 99999.00
AVAPS-D01 S11 111745195 120825 061749.75 9999.00  99.00 999.00 999.00 999.00  99.00  999.000000  99.000000 99999.00   0 999.00 999.00   0 99.00 99999.00
AVAPS-D01 S11 111745195 120825 061750.00 9999.00  99.00 999.00 999.00 999.00  99.00  999.000000  99.000000 99999.00   0 999.00 999.00   0 99.00 99999.00
AVAPS-D01 S11 111745195 120825 061750.25 9999.00  99.00 999.00 999.00 999.00  99.00  999.000000  99.000000 99999.00   0 999.00 999.00   0 99.00 99999.00
AVAPS-D01 S11 111745195 120825 061750.50 9999.00  99.00 999.00 999.00 999.00  99.00  999.000000  99.000000 99999.00   0 999.00 999.00   0 99.00 99999.00
AVAPS-D01 S11 111745195 120825 061750.75 9999.00  99.00 999.00 999.00 999.00  99.00  999.000000  99.000000 99999.00   0 999.00 999.00   0 99.00 99999.00
AVAPS-T01 COM Data Type/Data Channel:            AVAPS SOUNDING DATA, Channel 1
AVAPS-T01 COM Project Name/Mission ID:           Hurricane 2012, 20120825N1
AVAPS-T01 COM Aircraft Type/ID:                  Gulfstream G-IV SP, N49RF
AVAPS-T01 COM Launch Time (y,m,d,h,m,s):         2012-08-25, 06:01:57
AVAPS-T01 COM Sounding Name:                     Drop 1
AVAPS-T01 COM Sonde ID/Type/Rev/Built/Sensors:   111745195, 1, A5, 2011/07/12 07:45, Vaisala RS904, Ublox TIM-5H
AVAPS-T01 COM Sonde Freq/Batt/Firmware/Shutoff:   405.70 MHz,  8.3 v,     1.02,   32768 sec,
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):       -0.4 mb,    0.0 C,     0.0 %
AVAPS-T01 COM Pre-launch Obs Data System/Time:   IWGADTS Format (IWG1), 06:01:57
AVAPS-T01 COM Pre-launch Obs (p,t,d,h):           179.0 mb,  -59.1 C,   -66.0 C,   40.4 %
AVAPS-T01 COM Pre-launch Obs (wd,ws):             222.0 deg,  25.9 m/s
AVAPS-T01 COM Pre-launch Obs (lon,lat,alt):      -79.508200 deg,  27.113400 deg, 13070.8 m, (079 30.4920'W, 27 06.8040'N)
AVAPS-T01 COM Operator Name/Comments:            JAS, none
AVAPS-T01 COM Standard Comments:                 Good Drop
AVAPS-T01 VER 3.5.0                              SOFTWARE VERSION 3.5.0 - 2012-05-04; ADDS:
AVAPS-T01 FMT NOAA 1.7                           FORMAT VERSION NOAA 1.7 - 2010 APR 17; ADDS: 0.25 SECOND WINDS
AVAPS-T01 TOF  0.00                              Met/Wind Offset: ptu data leads wind data by  0.00 sec
AVAPS-T01 END 111745195 120825 061854.55
```

Figure B5: Following the last lines of post-splashdown 999s there is a section for remarks by the AVAPS Operator.

ADDITIONAL NOTES REGARDING D FILES:

	Sonde ID	UTC Date yymmdd	UTC Time hhmmss.ss	Air Press (mb)	Air Temp (degC)	Rel Humid (%)	Wind Dir (deg)	Wind Spd (m/s)	Vert Veloc (m/s)	GPS Longitude (deg)	GPS Latitude (deg)	Geopoten Altitude (m)	GPS Wnd Sat	Sonde RH1 (%)	Sonde RH2 (%)	GPS Snd Sat	Wind Error (m/s)	GPS Altitude (m)
AVAPS-D01	S00	111745195	120825	061732.50	1004.81	28.19	76.77	73.17	6.81	-10.68	-79.525511	27.155960	68.59	9	76.55	76.77	9	0.48	97.20
AVAPS-D01	S10	111745195	120825	061732.75	9999.00	99.00	999.00	67.10	6.55	-11.01	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.48	99999.00
AVAPS-D01	S00	111745195	120825	061733.00	1005.42	28.24	76.62	69.00	6.62	-10.82	-79.525542	27.155949	63.20	9	76.43	76.62	9	0.49	91.84
AVAPS-D01	S10	111745195	120825	061733.25	9999.00	99.00	999.00	67.39	6.30	-10.79	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.50	99999.00
AVAPS-D01	S00	111745195	120825	061733.50	1006.12	28.30	75.95	67.94	6.56	-10.91	-79.525573	27.155938	56.96	9	75.89	75.95	9	0.52	86.40
AVAPS-D01	S10	111745195	120825	061733.75	9999.00	99.00	999.00	71.02	5.87	-11.00	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.52	99999.00
AVAPS-D01	S00	111745195	120825	061734.00	1006.73	28.36	76.24	67.60	6.41	-11.10	-79.525602	27.155927	51.60	9	76.05	76.24	9	0.52	80.58
AVAPS-D01	S10	111745195	120825	061734.25	9999.00	99.00	999.00	67.14	6.44	-11.27	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.54	99999.00
AVAPS-D01	S00	111745195	120825	061734.50	1007.15	28.40	75.98	67.41	6.38	-11.17	-79.525632	27.155915	47.80	9	75.73	75.98	9	0.54	74.88
AVAPS-D01	S10	111745195	120825	061734.75	9999.00	99.00	999.00	67.46	6.37	-11.04	999.000000	99.000000	99999.00	8	999.00	999.00	8	0.54	99999.00
AVAPS-D01	S00	111745195	120825	061735.00	1007.89	28.45	76.19	67.14	6.45	-10.96	-79.525662	27.155904	41.26	8	76.00	76.19	8	0.55	69.47
AVAPS-D01	S10	111745195	120825	061735.25	9999.00	99.00	999.00	66.54	6.48	-10.88	999.000000	99.000000	99999.00	8	999.00	999.00	8	0.55	99999.00
AVAPS-D01	S00	111745195	120825	061735.50	1008.37	28.49	76.03	66.41	6.44	-10.95	-79.525693	27.155892	36.99	8	75.93	76.03	8	0.54	64.07
AVAPS-D01	S10	111745195	120825	061735.75	9999.00	99.00	999.00	65.19	6.45	-10.91	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.54	99999.00
AVAPS-D01	S00	111745195	120825	061736.00	1009.04	28.55	75.61	62.64	6.54	-11.16	-79.525722	27.155879	31.07	9	75.49	75.61	9	0.53	58.44
AVAPS-D01	S10	111745195	120825	061736.25	9999.00	99.00	999.00	65.42	6.73	-11.18	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.54	99999.00
AVAPS-D01	S00	111745195	120825	061736.50	1009.59	28.60	74.51	64.48	6.43	-11.07	-79.525753	27.155865	26.21	8	74.29	74.51	8	0.54	52.88
AVAPS-D01	S10	111745195	120825	061736.75	9999.00	99.00	999.00	65.39	6.74	-11.02	999.000000	99.000000	99999.00	8	999.00	999.00	8	0.54	99999.00
AVAPS-D01	S00	111745195	120825	061737.00	1010.38	28.66	74.62	62.23	6.65	-11.10	-79.525784	27.155852	19.19	8	74.43	74.62	8	0.55	47.40
AVAPS-D01	S10	111745195	120825	061737.25	9999.00	99.00	999.00	65.18	6.71	-11.05	999.000000	99.000000	99999.00	8	999.00	999.00	8	0.56	99999.00
AVAPS-D01	S00	111745195	120825	061737.50	1010.86	28.71	74.34	64.08	6.71	-11.07	-79.525814	27.155839	14.96	8	74.15	74.34	8	0.58	41.94
AVAPS-D01	S10	111745195	120825	061737.75	9999.00	99.00	999.00	64.70	6.42	-11.06	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.60	99999.00
AVAPS-D01	S00	111745195	120825	061738.00	1011.64	28.76	75.04	68.69	6.34	-10.91	-79.525845	27.155827	8.07	9	74.80	75.04	9	0.58	36.59
AVAPS-D01	S10	111745195	120825	061738.25	9999.00	99.00	999.00	68.62	6.59	-10.92	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.54	99999.00
AVAPS-D01	S00	111745195	120825	061738.50	1012.05	28.82	74.71	65.84	6.41	-11.03	-79.525875	27.155816	4.49	9	74.39	74.71	9	0.54	31.25
AVAPS-D01	S10	111745195	120825	061738.75	9999.00	99.00	999.00	64.59	6.35	-10.82	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.54	99999.00
AVAPS-D01	S00	111745195	120825	061739.00	1012.80	28.85	74.44	63.77	6.45	-10.81	-79.525905	27.155804	-2.14	9	74.17	74.44	9	0.54	25.98
AVAPS-D01	S10	111745195	120825	061739.25	9999.00	99.00	999.00	66.31	6.40	-10.79	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.54	99999.00
AVAPS-D01	S00	111745195	120825	061739.50	1013.34	28.91	74.15	67.37	7.02	-10.80	-79.525935	27.155793	-6.88	9	73.87	74.15	9	0.58	20.72
AVAPS-D01	S10	111745195	120825	061739.75	9999.00	99.00	999.00	64.61	6.44	-10.81	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.56	99999.00
AVAPS-D01	S00	111745195	120825	061740.00	1013.91	28.96	73.93	65.45	6.53	-10.83	-79.525965	27.155781	-11.96	9	73.79	73.93	9	0.55	15.52
AVAPS-D01	S10	111745195	120825	061740.25	9999.00	99.00	999.00	66.93	6.56	-10.77	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.53	99999.00
AVAPS-D01	S00	111745195	120825	061740.50	1014.49	29.01	74.26	65.53	6.50	-10.66	-79.525995	27.155769	-17.10	9	74.09	74.26	9	0.52	10.22
AVAPS-D01	S10	111745195	120825	061740.75	9999.00	99.00	999.00	64.76	6.53	-10.59	999.000000	99.000000	99999.00	9	999.00	999.00	9	0.52	99999.00
AVAPS-D01	S11	111745195	120825	061741.00	9999.00	99.00	999.00	999.00	999.00	99.00	999.000000	99.000000	99999.00	0	999.00	999.00	0	99.00	99999.00
AVAPS-D01	S11	111745195	120825	061741.25	9999.00	99.00	999.00	999.00	999.00	99.00	999.000000	99.000000	99999.00	0	999.00	999.00	0	99.00	99999.00
AVAPS-D01	S11	111745195	120825	061741.50	9999.00	99.00	999.00	999.00	999.00	99.00	999.000000	99.000000	99999.00	0	999.00	999.00	0	99.00	99999.00

Figure B6: There are two humidity sensors on the dropsonde (Sonde RH1 and Sonde RH2 highlighted in yellow in columns 16 and 17). The relative humidity used in column 7 (76.77% from RH2 in this example) and passed on to ASPEN is chosen from one of these two choices automatically by AVAPS. In ASPEN, using the AVAPS choice is is the default setting, but there is a function on the Main tab that allows the ASPEN user to manually choose RH1 or RH2.

The lowest Geopotential Altitude, as calculated by AVAPS using downward integration from the initial AAMPS flight level GA, is shown (-17.10 meters highlighted in magenta). When ASPEN performs its integration from the surface upward, the final quality controlled surface GA is always set to zero.

Column 19 (the second to the last column from left to right) is GPS Wind Error. In this example (highlighted in blue as 0.48 meters per second) the value hovers near a half meter per second. This is the typical +/- variance in the accuracy of GPS Wind Velocity provided there are a large number of satellites available for signal triangulation. The number of satellites used by the AVAPS system and the sonde for these calculations are shown in columns 15 and 18 and also highlighted in blue.

The final column on the right is GPS Altitude as calculated by AVAPS. The final value shown prior to splash (10.22 meters highlighted in green in this example) will be close to zero but will vary unpredictably (sometimes splashing with negative values). This variable is not used for any calculations by ASPEN and should only be considered as a ballpark reference for altitude.