P3 DROPSONDE PROCESSING INSTRUCTIONS (revised June 14, 2022)

**PREFLIGHT**

Familiarize yourself with the flight track and planned dropsonde points.

Attend pre-flight briefing so that you are aware of the science and operational objectives.

Make a note of the most recent storm center location, maximum wind speed and surface pressure (NHC advisories are an easy way to get this info)

**SETTING UP**

Start computer: Username = ? Password=?

Make sure computer clock time is correct

ASPEN version should be 3.4.7 Linux Centos 7

Find out from dropsonde operator or flight director which type of sonde is loaded. The RD41 sondes are what is used operationally on P3 but occasionally mini-sondes and IR sondes will be launched as part of specific experiments. These require a different ASPEN configuration and are usually not processed or transmitted in real time.

Set up your desktop using the multiple window option. You should have XCHAT open and log into

Aircraft (N42(43) and HRD channels. Have Remote AVAPS application open to monitor falling

sondes. Open KARMA in the web browser to follow flight and see MM LF Radar.

Start dropsonde log and get the flight and mission ID’s from the flight director. Be sure to record the takeoff and landing times and complete the checklist. It is a good idea to draw the planned flight track with drop locations on the log or have a copy handy. Keeping a log is important to keep yourself organized, compare sondes and make note of interesting features or QC problems. You can either fill out the log electronically or use the printed version.

Create directories on the desktop for raw Dfiles and ASPEN output files using the format FLIGHTID\_ASPEN\_DATA, FLIGHTID\_RAW\_DATA (note do not simply name the folder with the flight id as that may cause it to get accidentally over-written). It is a good idea to create “sent” subdirectories in each of these folders for housekeeping purposes. You can move your files there after transmitting to avoid clutter. Open AVAPS\_PRIMARY/FlightID folder in the same window as your RAW\_DATA folder to copy over raw D-files.

Delete the old database file soundings.sqlite, if it exists, in users/hrd/AspenV.3.4.7/. This will allow you to make synoptic maps without including data from previous flights.

Click on the ASPEN icon on the desktop to open ASPEN, you will be prompted to “locate sounding Database” click “okay”, another prompt should show up to create soundings.sqlite, click okay again. If ASPEN prompts you for a “geographical database” browse to users/hrd/ ASPENV3.4.7/Geodata and select the file “ne1to50m.sqlite”.

After that, the ASPEN window should open. There may be multiple ASPEN icons, make sure that you are opening ASPEN version is 3.4.7.

**CONFIGURE ASPEN**

a. Once ASPEN is open you will be prompted to open a file. Click “cancel” in the pop-up window.

b. In the main window click file -> configuration (or ASPEN -> preferences or Tools -> Options ,depending on version).

c. Select editsonde on the first line and click “set as active” on the next line. You will not have to “set active” on the windows version of ASPEN. Do not worry about the options to “Delete” or “Create” configuration set, these are mainly for customizing ASPEN for your own research.

d. Click on the Edit button just below “editsonde” to get the QC parameters. Make sure that “Pressure Monotonic Check” box is not checked and that “Disable QC Filter” and “Disable Outlier Check” boxes are checked in the wind column only. The correct options are as shown in figure 1. Notice that the “Number of Satellites Limit” has increased to 6 and the “Wind Error Limits” have changed < 10km.

e. Click the “Processing” tab. “Normal”, “Levels”, “WMO Message”, “Report Observed Position” and “Use Launch Data” boxes should be checked by default. On the bottom right, check “Enabled” under Fixed Data Source and Destination Directory. Click change and browse to your ***FLIGHTID***\_ ASPEN\_DATA directory and click ok. There is a new option to add metadata in this tab, for now set Agency to NOAA Project to Storm or Experiment name, aircraft to P-3, aircraftID to NOAA42(43) and Flight to the flight id ie. 0101A.

f. Go to the “Auto Save” tab and make sure that Auto Save Enable NOAA FRD, NetCDF, WMO BUFR, PNG, WMO Text and Levels and Summary.txt a are all selected. Set the Auto Save Directory by clicking on “Change”, browsing to your ***FLIGHTID***\_ASPEN\_DATA directory and click ok.

g. Go to “WMO” tab, confirm that Message Type is “TEMP” the other values will change automatically when you load the sonde in the WMM application to transmit.

h. Go to the Synoptic Map tab and set the names for your database and maps. Sounding database should be the “soundings.sqlite” file that was created when you opened ASPEN. You may need to browse to set the correct Geographical database. It should be users/hrd/Aspen3.4.7/Geodata/ne1to50m.sqlite.

i. Click on visual and adjust the skew-T Graph Settings. For the P3 flying at approximately 3km, the temperature range should be from 10 to 40 and Pressure from 600 to1050. The values should be; -10 – 40 and 400-1050 at 6km (20,000ft) and 10-40 and 700-1050 at 2km. The pressure and temperature settings should be; -40 to 40 Temp. and 100 to 1050 Press. for the GIV. *Everyone should use the same* *temperature and pressure ranges so the Skew-T diagrams have a uniform look*. Click okay in the “visual” window and okay again in the “configure” window. You can use the Configuration/Visual tab to change the graph dimensions during the flight if flying at different altitudes during flight segments.

Set up your desktop so that you can easily access everything you need in up to 3 windows. A good configuration is to have one window with XCHAT, KARMA and Remote AVAPS, which you can monitor throughout the flight, a second window with RAW\_DATA directory, ASPEN and AVAPS\_PRIMARY and a third window with ASPEN\_DATA and the WMM APP.

Make sure that you are familiar with the flight plan and where the dropsondes are to be launched before the aircraft is in the surveillance pattern.

Before the flight or during the ferry check with the flight director to see whether you will be required

to add the SST’s to combo drops (dropsonde + AXBT). This should not be necessary anymore but check anyway.

If there is time during the ferry ask the flight director if he/she would be willing to go over sending a

corrected message with you since this is not something that you can practice at home.

**PROCESSING**

Listen for the AVAPS operator via the headset. When a sonde is released, note the release time, location, and environment on the drop log. If you miss the launch on the headset you will likely hear the “woosh” sound as the sonde is released. Most of the AVAPS operators will report the launch times on the XCHAT AVAPS channel. This is particularly useful for folks following the flight from home.

Once the sonde has been terminated by the AVAPS operator, the Dfile will appear in the AVAPS\_PRIMARY/***FLIGHTID***/ directory. Drag and drop to your ***FLIGHTID***\_RAW\_DATA directory. If for some reason you cannot access remote AVAPS the data tech will help you reset the connection. If AVAPS primary prompts for a log in user name is “Operator” not “Operator1” password is NOAA2306. If all else fails, you can ftp the raw D-files from the ground from <ftp://seb.noaa.gov/pub/flight/aamps_ingest/avaps/received/>. There will be multiple copies of each sonde. It is best to process the version that does not have “P” in the name. If there is more than 1 file with the same date/time they should be identical (the last number in the file name indicates the AVAPS receiver).

Process sondes in sequential order unless the flight director requests otherwise; the release time is in the file name. Click on file -> open and select the Dfile you want (you can also do this by clicking on the Dfile).

Process the sonde.

If you make any changes to the sonde, you will need to recompute. The re-compute button “!” in the menu bar will flash after you make a change. Click “!” to re-compute and save changes. When you re-compute, ASPEN re-does the quality control and many calculations, so it is important to carefully look at the sounding again. Some data which had previously been removed may be retained after re-computing.

**A) Main Tab:**

In the main window that will open first, make sure that the “Ignore” box is checked for Temperature, RH, Wind Speed and Direction launch parameters. Keep Pressure, Altitude and Lat/Lon. Compare the upwards height calculations with the launch altitude. The downward calculation should be near zero but can be as high at 40-50meters. Look at the “End of Drop Time” for indications of post-splash data or fast fall. Time should be approximately Altitude /10. Look at surface pressure and height to see if it looks reasonable. Unless the sonde stopped transmitting before splashing, make sure that “Hit Surface” is checked. Otherwise check “Set Heights Missing” and uncheck “Hit Surface”. Note, if you uncheck “Hit Surface” ASPEN will ask if you want to save changes when you close the sonde, select no and check to ensure that “Hit Surface” is checked when processing the next drop. Note any pop-up windows indicating late or early launch, fast fall, bad wind or temperature or any other issues as you will need to take special care with these sondes. The most common pop-up will be for “post-splash” data. You will have to click “ok” in the pop-up window to continue processing. If “Late Launch Detect”, compare the start times in the pop-up window with the raw D-file to confirm that the correct start time is chosen. It is a good idea to make not of the times in your log before closing the pop-up window. You will need to override the launch lat/lon for late launch sondes. Use the value from the D-file at the ASPEN diagnosed launch time. For all drops, record the launch lat/lon abd time and surface pressure and wind speed (in knots) in the droplog. The unique sonde ID will show in the top of the window along with other metadata. Include the sonde-ID in your log in the appropriate space.

If anything seems off, or ASPEN indicated a possible, problem go to the XY Graph tab (see below) and look at the data that way before proceeding to steps B and C. Fast Fall soundings can be identified by looking at the vertical velocity plot. The wind speed/direction plot is usually noisy in the case of fast fall. Switching to time or altitude y axis may help to clarify problems.

**B) Raw Tab:**

Click the “Raw” tab to look at raw data. Quality-control attributes are shown in red next to the values; Hovering over the abbreviation in the Attributes column provides more information on a particular attribute. A large percentage of points with flags can be an indication of a malfunctioning instrument or parachute or poor transmission.

Look at the top and bottom of the sonde to make sure that the launch and splash have been reported correctly. Pressure and Temperature should be increasing from top to bottom. Also check for wind dropouts, sometimes the data just before or after needs to be flagged. Post splash data may show up as data gaps or decreasing pressure or temperature or unphysical wind speeds at the bottom of the sounding. Outlier flags are often present in post-splash data. Note the GPS altitude at the bottom of the sonde to help determine the correct end time, it can potentially be negative in wave troughs. Post splash data can be removed by setting the “End of Drop” to the correct frame by right-clicking on the time and selecting “End of Drop”. Remove data by right-clicking on the bad value and selecting “Ignore Attribute”. Multiple frames can be removed using the shift button. You can undo changes by selecting “Clear Ignore Attribute”. Use the “!” to re-compute and save changes. Toggle back and forth between Raw and QC tabs to see where data is kept/removed. It is also possible to unflag data which you determine to have been flagged incorrectly using “Keep Attribute”. The new settings for ASPEN make it unlikely that you would ever need to do this. Potentially near surface winds can just barely exceed error parameters in a major hurricane, so you might try unflagging them to get a surface value written to the TEMPDROP message. Any time you make a change in ASPEN you will need to hit the recompute icon (“!”).

**C) QC Tab:**

All the data which passes quality control and will be transmitted is here. You made need to toggle back and forth between the RAW and QC tabs to check whether data has been QC’d correctly. When you remove individual data points, ASPEN changes values at other locations and may flag/un-flag data which had previously been un-flagged/flagged.

**D) XY Graph Tab:**

Click on the XY Graph tab and look at the data to check for fall speed, temperature and humidity equilibration and questionable or un-physical data. You may notice layers of questionable lat/lon values. These can now be removed in the raw tab. Going between time and pressure vertical coordinates will provide additional information. Transmission of bufr file requires closer scrutiny of the sounding since all levels are included. If you mouse over the location of bad data points you can get the time or pressure associated with it. You can then keep/remove data by going back to the “Raw” tab. When you are finished making changes click on the “!” re-compute button and then look at the data again. If the vertical velocity indicates a fast-fall sounding, note this in your log and do not transmit the WMO or Bufr message.

**E) SKEWT:**

Look at the final skew-t diagram and compare to the RAW and QC data. Click on the “Levels” tab to see the data that will actually be transmitted, this is the easiest way to identify bad data points in the TEMP DROP.

**F) CHECK SYNOPTIC MAPS**It may be useful to compare the sonde you are processing with previous sondes for consistency. Click on the globe icon. You may be prompted to locate the soundings.sqlite file. Click ‘plot all,’ and all of the drops from the flight will be plotted. Use the mouse to zoom into the flight area on the map. Scroll through the levels to look at the plots. You may need to unzoom and re-select the area.

**G) LEVELS:**

Check Levels tab to read what is reported in the WMO message. You can remove an entire level by clicking on the line or remove data by clicking on the value. Be sure that no data above the height of the first good wind or temperature are reported. Note the height of the lowest wind in your log sheet. You can get the wind speed and direction from here but you will need to convert to knots for your logsheet. Surface wind speed in knots, direction and pressure can also be found on the first line of the tempdrop message.

**H) COMM Tab:**

Click on the Comm tab and set the environment, if appropriate. For EYE & EYEWALL SONDES, set the Environment to CENTER , EYEWALL, RAINBAND or MAXWNDBND if it applies. All but “CENTER” require the azimuth to be set. This is the quadrant where the sonde was released. MAXWNDBND generally refers to a sonde targeting either a secondary wind max or maximum wind when no eyewall exists (not a hurricane). Fill in the OB # using the dropsonde sequence. This will be overwritten in the transmitted message but is saved in the archive version. Click the “!” recompute button after the environment and OB # has been set. If this does not over-write the TEMPDROP or causes ASPEN to crash you will need to manually save if using the “save” icon and browsing to your ASPEN\_DATA directory. If you are saving correctly, you will over-write the previous WMO file. *When processing the first drop, fill in the aircraft, flight id and mission and click “yes” to save changes when closing the drop.*

Check the boxes for corrected and/or last report if necessary.  
  
Manually edit the message for SST if there are simultaneous AXBT data. This is done at the end of the 62626 section. For example you would add SST 256 for a temperature of 25.6. Do this after you have set the environment if applicable. Be sure to check the final message and save it in the WMO tab.

If you make any changes to the WMO message use the recompute icon “!” or save manually to write to the final message. If you try to manually save the tempdrop, you must correctly specify your ASPEN\_DATA directory or else the new WMO message will end up in wrong place. ASPEN will prompt you to overwrite the current WMO message if you have done this correctly.

**TRANSMISSION**

Go to the WMM App, click on the TEMPDROP tab and the top and then “load tempdrop text message” tab to right of the window. Select the \*wmo.txt file to transmit. **Before transmitting**, double check that the Environment is set, if applicable, that the significant level data is correct and the SPG and REL times and locations are good. If this is the first drop confirm that the Mission ID is correct in the “61616” comments section (this will save you a lot of grief). Once you have confirmed that the message is ready click “send”.

Check in “messages pending” to get the observation number and write it in the drop log. The message should move from “pending” to “sent” within a minute or so.

Go back to the TEMPDROP tab and click “load bufr” tab and select the corresponding .bfr file and send. It will show up in the pending and sent tabs as “URNT.YYYYMMDD\_hhmmss.bin”. Once you have transmitted a sonde you can move the “D” file to your sent directory. This is not required but it does make it easier to process subsequent drops.

*Making Corrections:* All corrections are made within the WMM App. You will need to find the original message in “Sent Messages” using the observation number that you noted in your log. Go into the “sent messages” tab in WMM App, select the observation you want to correct and check “correct” to open the message for editing. Open the properly processed WMO message in a text editor and manually edit the old one to match. The lines beginning with “62626” should have “CCA” appended after the OB number. When you are absolutely sure that the message is correct click the send button. This is difficult and time consuming so try and avoid by double checking each message before you send it. You could try this in flight without actually re-sending the observation to practice.

**DURING THE FLIGHT**

Send processed data to AOC. *Copy and paste* the files from ASPEN\_DATA directory to the “FRD” directory on the desktop. Do not drag and drop since data could potentially get lost. These data will be ftp’d to the ground.

Keep track of times, launch locations, and surface information in the drop log. The easiest way to get these values is from the MAIN ASPEN window for each sonde. Be sure to include comments such as the location of drop relative to storm center and special features.

Click on the globe icon to make synoptic maps and compare nearby drops. At the end of the flight, you can select “plot all” then zoom in to include all the drops and nearby land then click the save all tab and save to your ASPEN\_DATA directory.

**AFTER THE SCIENCE MISSION IS COMPLETE**

1. Make Synoptic Maps

2) Ensure all processed data has been sent to AOC (Copied to FRD folder).

3) Archive the data: Portable drive are no longer allowed to be connected to the aircraft computers. Tar and zip up the ASPEN\_DATA and RAW\_DATA and drop into the Google drive folder for the flight as a backup.



Figure 1: Remote\_AVAPS window use to monitor and keep track of sondes. Select a channel to see plots, this will help you to identify problems that you may encounter when processing the sonde. The AVAPS operator will call out the channel once the sondes starts transmitting.

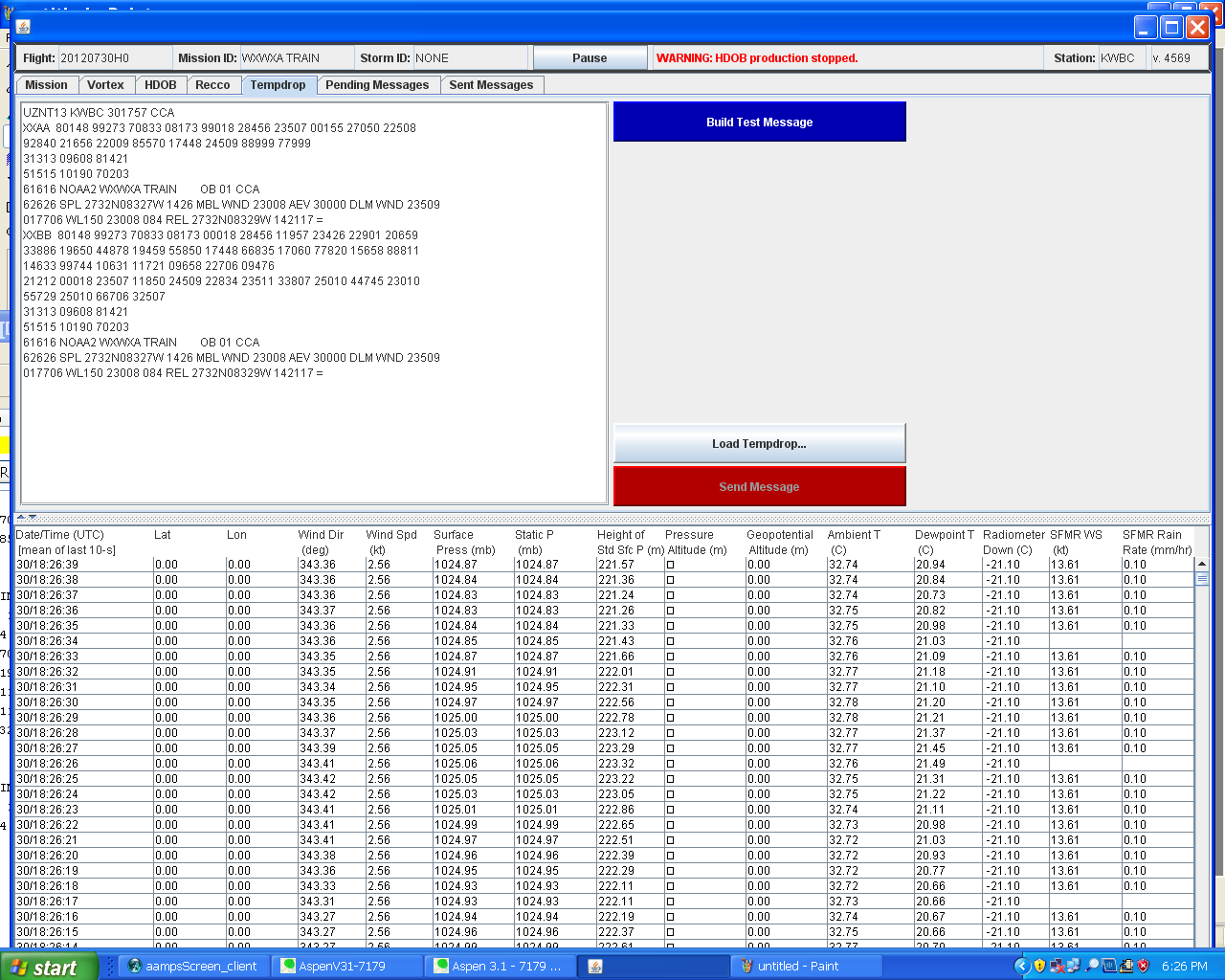


Figure 2: Weather Message Module for transmitting tempdrop message. New version has an additional tab below “Load Tempdrop” for the bufr messages “Load Bufr”

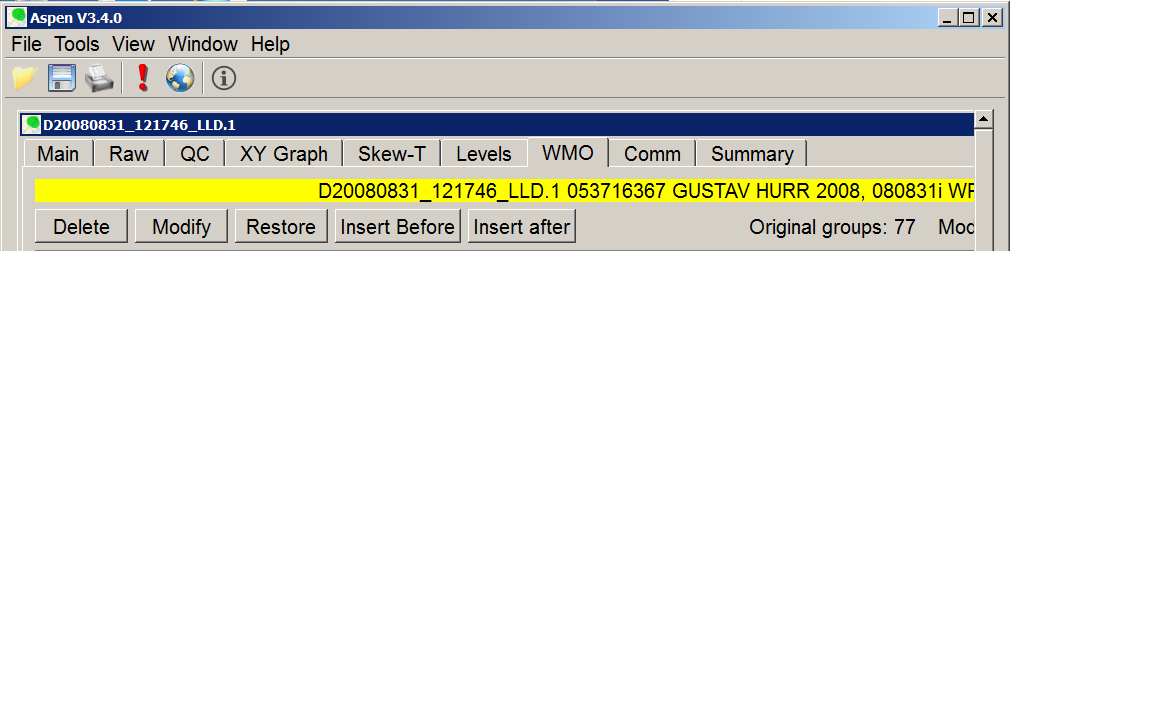
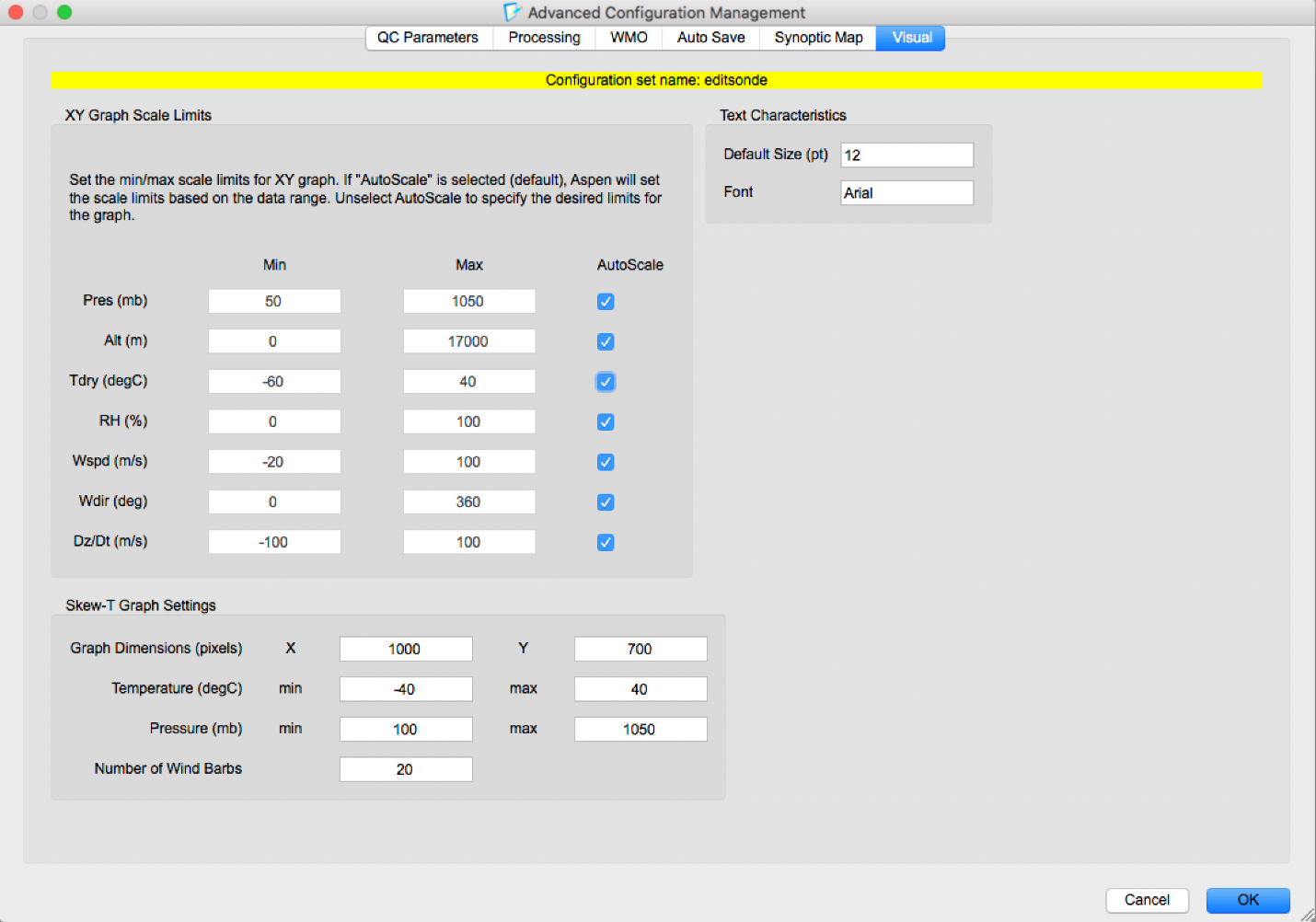


Figure 3: ASPEN buttons …use the leftmost circled icon while in the WMO tab to save the message after adding environment or SST. Middle icon (!) will re-compute after making changes and the globe icon opens the synoptic map interface.

MORE INFO:

CHANGING FONT SIZE – Go to Configuration setup / Visual tab and change to desired size. You will have to close and reopen ASPEN after saving the new configuration for the new font size to be applied.



COMMON SONDE PROBLEMS

FAST FALL –After equilibration, the fall speed should be roughly 10-12 m/s, fast fall sondes can be detected by looking at the vertical wind speed in the xy plots “sats-dz” tab. Note that the terminal velocity increases somewhat at altitude. If a sonde is a fast fall, all the wind data should be removed. Set ignore attribute in QC tab to remove winds and re-compute. Check the Levels tab to ensure that no wind data is getting into the TEMPDROP. In many cases the thermo data is of good quality but if unsure do not transmit fast-falls. Be sure to request a back up sonde at critical locations

SLOW FALL – This is due to a malfunctioning parachute and cannot be handled correctly in ASPEN. Note in your log and do not transmit

PARTIAL FAST FALL – Remove winds in the fast-falling layer and keep the wind data where the sonde is falling normally. Check the xyplots and Levels to make sure that the winds were edited correctly.

SONDE STOPS TRANSMITTING – uncheck “hit surface” and check “set heights missing” in main tab and re-compute. Double check that “hit surface” is checked when processing the next drop. Do not save configuration if prompted.

LATE LAUNCH DETECT – If ASPEN handled this correctly all you need to do is override the launch lat/lon parameters in the “MAIN” tab and re-compute(!). The correct launch location is what is in the D-file at the ASPEN diagnosed launch time..

EARY LAUNCH DETECT – ASPEN is now able to resolve early launch detect. You may need to overwrite the lat/lon with the correct values from the actual launch time. Check the Dfile and the XYPLOTs to see if you need to do this. Also, check the WMO tab to ensure that the proper release time is encoded in the comments section (62626). If ASPEN does not catch an early launch detect, the only way to fix it is to manually edit the sonde to remove the extra data at the top and change the time on the LAU line to the time of the first data line. You will also need to manually correct the aircraft data. This is particularly difficult. There is an example in the training sondes directory of you to edit an early launch detect sonde. It may be best to not transmit an early launch detect if it becomes too difficult to QC. In that case be sure to note in your log.

EXTRA DATA AT END OF SONDE – Change the end of the drop time in the raw tab using right click and “set end of drop” option. Check the MAIN tab, XY graph and TEMPDROP message to make sure that the surface is now encoded correctly. This will occur in about 1/3 of all dropsondes, particularly in the inner core.

LOST TELEMETRY or BAD DATA – Remove bad data by highlighting and selecting “ignore attribute”. This can be time consuming and difficult to get all the bad data, during the flight you may choose to remove the bad data in the levels file to save time. Toggle back and forth from the XY plots to determine what levels to remove. \*\*\*do not transmit the bufr file if only the levels data is corrected, it is best to delete the .frd, .nc and .bfr files in this case. If there are too many bad data points it is best to just note this in your log and not transmit the drop.

SLOW EQUILLABRATION – ASPEN updates should make this a rare occurrence but if the data at the top of the sounding appears un-physical compared with the flight level data you may need to remove additional data points at the top. Removing wind speed/temperature data should also remove wind direction/humidity.

RH WITH NO TEMPERATURE – This should never happen but RH should never be reported if there is not valid temperature data to go with it. Remove all RH data points which do not have temperature reported or where temperature is flagged.

**BOTTOM LINE --------------- DON’T SEND BAD DATA**