

ADEON AZFP Integrated Product Readme File

1.1. Processing of data from remotely deployed echo sounder systems

1.1.1. Converting raw binary files into EchoView formatted .csv files

ADEON is integrating a 4-frequency echo sounder system (38 kHz, 125 kHz, 200 kHz, and 455 kHz) into three of the seven constructed bottom lander platforms. The transducers are mounted at an approximate 15° angle off vertical to eliminate interference from the lander sensors and floatation mounted slightly above the transducers. The AZFP (ASL Environmental Sciences) system is a self-contained instrument designed to measure and record acoustic returns from the water column. The AZFP stores acquired data on a 32 GB Compact FLASH memory card, and downloading of data can occur via 1) an RS-232 interface through a bulkhead connector on the pressure housing or 2) by removing the instrument from its pressure case and using USB card reader to transfer the data from the CF card to a PC. It is recommended that the raw data be downloaded to a PC for ease and speed of further processing.

Initial processing occurs with the AzfpLink software. Detailed instructions on exporting raw AZFP files to .csv files readable by EchoView is provided in the AzfpLink Users Guide (Version 1.0.16) Part V Section 10. In summary, raw files for export are selected under the AzfpLink software Export Tab. For ADEON data, raw data is exported in two formats: 1) A/D (counts) ASL CSV format, and 2) S_v (Backscatter Strength in dB) EchoView CSV format. The ASL CSV format data is used to generate the temperature time series. The EchoView CSV format is generated for direct import into EchoView for further processing. All the individual transducer calibration coefficients (contained in the configuration (.cfg) file for each instrument)(ADEON Calibration and Deployment Good Practice Guide, 2017), which are integrated as part of the instrument firmware and able to be manually specified in the Export Tab, are applied to the raw data during the export process for fully calibrated values of S_v in the EchoView CSV format files. The equations used to relate the AZFP raw data to calibrated measures of S_v is described in Appendix G of the AZFP Operator's Manual (AZFP Operator's Manual GU-100-AZFP-01-R27).

Daily files are exported from the AzfpLink software in .sv.csv format and are referred to as the Level 1 raw data described in the ADEON Data Dictionary in terms of data management. These are daily S_v matrix files as a function of time and depth with the format:

550SN_C1_FREKHZ_YYYYMMDD.sv.csv where SN is instrument serial number, C# is the cycle number in the data collection phase, and FRE is unit frequency. An example file is:
55017_C1_125KHZ_20160426.sv.csv.

1.1.2. Processing EchoView files

Daily files exported from the AzfpLink software are loaded into EchoView software, and compiled to create monthly EchoView (.EV) files for processing. Each monthly .EV file is constructed to include all 4 frequency S_v time series. The .EV files are saved with the designated format:

SITE_YEAR_MON.EV. An example for ADEON data would be VAC_2017_DEC.EV. The initial processing of the .EV files include 1) background removal via techniques outlined in De Robertis & Higginbottom (2007), and 2) a median 3 x 3 filter applied to smooth the data and remove noise interference generated either by our own ship in the region or other passing ships. Both of these steps

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are accomplished within the EchoView software using the Background Noise Removal and Median Filter 3x3 operators, respectively. The parameters of the Background Noise Removal operator applied to the averaging and thresholding of ADEON AZFP data are:

Averaging:

Vertical extent (samples) = 5

Vertical overlap (%) = 0

Thresholds:

Maximum noise (dB) = -125

Minimum SNR: 5

Each monthly .EV file is then also manually scanned to 1) identify “bad data” regions (regions of prolonged interference visible even after the noise removal operators were applied, transducer ringdown, etc) which are marked and excluded from further processing, and 2) designate an appropriate surface line for referencing depth consistently with the fine-scale acoustic survey data. Because of the 15° tilt from vertical of the AZFP transducers on the bottom landers, the true air-sea interface is offset slightly from the surface identification viewed in EchoView. The offset is a function of the transducer beamwidth (38 kHz: 12° ; 125 kHz: 8°; 200 kHz: 8°; 455 kHz: 7°). The true air-sea interface was calculated with the following offsets from the visible surface line on the EchoView display: 38 kHz = 4.5 m, 125 kHz = 3.14 m, 200 kHz = 3.14 m, and 455 kHz = 3.04 m. This processed and conditioned data is then used to export information for classification into designated animal groups.

Conditioned data is exported from the .EV files to .CSV files for classification with Matlab software. Conditioned data is exported in three separate data packages (Table 7) to capture the long term variability at selected temporal and spatial scales. The set-up and execution of export grid averaging in EchoView is described in detail in Appendix A. The naming convention for exported data from EchoView is Site_SerialNumber_Frequency_Year_Month_ExportType.csv (Table 8).

	Depth Averaging	Time Averaging
Full Depth	200-1000 m	24 h
Daily Partition	5 m	24 h
60 min Partition	5 m	60 min
60 min Full Depth	200-1000 m	60 min

Table 7. Selected data export packages from conditioned EchoView data.

Site	VAC, WIL, HAT, etc
SerialNumber	Four digit serial number (i.e. 5041)
Frequency	Three digit frequency (038, 200, 455, 775)
Year	Four digit year
Month	Two digit month
Export Type	FullDepth, Partition, 60minPartition, 60minFullDepth

Table 8. Naming convention key for exported .csv files from EchoView.

For direct, short-term comparison to the focused survey data obtained from vessel mounted echosounder systems, export packages of AZFP data during the period of vessel measurements will reflect higher temporal resolution (shorter averaging windows) over day long durations.