CODAR
OCEAN SENSORS

Template

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SeaSonde Wave WVLM File Format

Wave Model processing produces monthly WVLM files which are text based built upon the **Columnar Table Format (CTF)** which is covered in a separate document which you should be familiar with before reading this document.

With Radial Release 8, all the processed ranges have been filtered down leaving the result without a range; the files will still contain a distance column set with nan and range cell column set with 1.

Identification

The first keyword of the file will typically be **'%CTF: <version>**' describing the version of the CTF file. Before version 1.00, the file will be missing this key; however, it is still readable with this standard. If the CTF version is 2 or greater then the file will not likely be readable by current readers that expect 1.x

Within the first **ten** lines of the file will must be a keyword of:

%FileType: <type> <subtype> <name>

The <type> must be **WVMD** to identify it as wave model data.
The <subtype> identifies when significant changes have been made and latest is **WVM9**. Even if there are other values here, the file will still likely be readable.

File Naming

File name should be use for archiving the data, not as a software determination of whether the file is a valid **WVLM** file, date stamp or contents.

The filenames follow the time-stamped CTF naming convention
WVLM_XXXX_YYYY_MM_DD_HHMM.wls.

'XXXX' is the four character site name.

'YYYY' is the year
'MM' is the two character month from 01 to 12
'DD' is the two character day from 01 to 31

‘HH’ is the two character 24 hour from 00 to 23
‘MM’ is the two character minute from 00 to 59

The wave files will typically have a filename extension of ‘.wls’

Wave files are typically stored on a monthly basis. This means that each wave file will contain up to a month of wave data.

Keywords

%CTF: 1.00
Identifies the file as a Columnar Table Format. The 1.00 version will change in the future if any major changes are needed in reading the format. If the CTF version is 2 or greater then the file will not be readable by current readers that expect 1.x

%FileType: WVMD <subtype> <name>
WVLM Identifies the file as a Wave file. The <subtype> identifies version of this format.

WVM1 is the first wave model single range version.
WVM2 is the second version of single range wave model data, in which the table data was expanded to show full date of each entry.
WVM3 is for first multiple ranges (one range per table) wave model data. Table data is expanded to show range distance and spectra range cells. These have a flaw where the range distance is off by one range cell spacing.
WVM4 is for multiple ranges where the range distances are not offset by one range cell. These have a flaw where the wave direction can be severely off if the coastline is not north/south; The only fix is to reprocess.
WVM5 is for multiple ranges where wave directions are correct.
WVM6 added columns of wave doppler points WDPT and wave method MTHD. These files were only
produced by pre-release software.
WVM7 added columns of wave doppler points WDPT, wave method MTHD and vector flag FLAG and adds much more metadata.
WVM8 added column of max wave height at noise floor PMWH .
WVM9 added columns of number of valid points WHNM and wave height standard deviation WHSD of filtered data.

%UUID: D1D12866-7794-403F-9481-0A840978F8A9
A universally unique identifier for each file. This key is created using Mac OS X call CFUUIDCreate. Each UUID key has a very, very high chance of being unique. This key will change if the file is reprocessed. Search the Internet for more information on UUIDs.

%Manufacturer: CODAR Ocean Sensors. SeaSonde.
Identifies that the file came from SeaSonde. If you create the Wave History file, put your Identity here.

%Site: XXXX “”
Contains the four-character site code followed by optional user friendly site name.

%TimeStamp: 2008 10 13 00 00 00
Identifies the start time in year, month, day, hour, minute, second of the data collected in the file. The time column in seconds is referenced from this time.

%TimeZone: “PDT” –7.000 1
Identifies the timezone used as label, hours from UTC, and non zero if daylight saving time was in effect.

%Origin: 38.3173167 -123.0724667
Is the <latitude> <longitude> of the SeaSonde Site.

%TimeCoverage: 0.250 hours
The time each vector covers is plus & minus half this value from the timestamp.

%AntennaBearing: 180.0
Antenna bearing CW from True North.

%RangeCells: 31
Number of range cells from the processed cross spectra.

%DopplerCells: 512
Number of doppler cells from the processed cross spectra.

%TransmitCenterFreqMHz: 13.475000
Transmitter center frequency from the processed cross spectra.

%TransmitBandwidthKHz: -51.269531
Transmitter bandwidth from the processed cross spectra. Negative value is a down sweep.

%TransmitSweepRateHz: 2.000000
Transmitter sweeprate from the processed cross spectra.

%CoastlineSector: 75.0 215.0 %% Start CW to Stop in Deg NCW
Defined coastline sector that wave processing used from start True clockwise to stop True.

%CurrentVelocityLimit: 150
Maximum allowed current velocity used to determine first order Bragg.

%BraggSmoothingPoints: 3
Doppler cell point smoothing used to determine first order Bragg.

%BraggHasSecondOrder: 1
Setting to tell first order determination to stop upon detection of an expected null between second order.

%WaveBraggNoiseThreshold: 3.0
Noise factor threshold used to determine first order Bragg.

%WaveBraggPeakDropOff: 100.0
Peak dropoff factor used to determine first order Bragg.

%WaveBraggPeakNull: 50.0
Peak null factor used to determine first order Bragg.

%MaximumWavePeriod: 17.0
Maximum allowed wave period to calculate.

%WaveBearingLimits: 90.0 124.0 %% Start CW to Stop in Deg NCW
Sector to limit where waves are allowed to come from.

%WaveUseInnerBragg: 0 %% 0 No, 1 Yes
Was processing using the inner Bragg energy.

%WavesFollowTheWind: 0 %% 0 No, 1 Yes
Was processing told to have waves always follow the wind direction.

%WaveSaturationRatio: 0.8
Setting to determine if second order bragg is saturating into first order.

%WaveHeightLimit: 20.0
Setting to filter out unrealistic wave height results.

%WavePeriodLimit: 10.0
Setting for estimated wave height when at or below cross spectra noise floor

%PatternUUID:
UUID of measured antenna pattern used.

%WaveMergeMethod: 1 %% 0 None, 1 Average, 2 Median, 3 Outlier
Wave filtering method

%WaveReductionMethod: 3 %% 0 None, 1=Temporal, 2=Spatial, 3=Both
Wave filtering reduction method

%WaveMinDopplerPoints: 10
Wave filtering minimum required doppler point in detected second order.

%WaveMinVectors: 1
Wave filtering minimum required source vectors to filter

%WaveMaximumWaveHeight: 1.0
Wave filtering maximum wave height rate of change allowed.

%WaveMaximumWavePeriodChange: 7.00
Wave filtering maximum wave period rate of change allowed.

Columnar Table Data:

If the wave data is multi-range, there will be multiple tables for each range and preceding each table will be %Distance: and %RangeCell: keywords for that table. There is also a table column for distance and range cell, while redundant, this allows you to more easily read the all the tables into a large array and already have the distance in the array.

%Distance: 3.98070 km
Distance to range cell for following table wave results.

%RangeCell: 4
Range cell for following table wave results.

%TableType: WAVL WVM9
<type> must be **WAVL** which indicates table is Wave History
<subtype> is WVM7 to identify the version which contains period, energy, direction info.

%TableColumns: 22
This can be used with the table type and subtype to determine if all the expected columns are in the file,

%TableColumnTypes: TIME MWHT MWPD WAVB WNDB PMWH ACNT DIST RCLL LOND LATD WDPT MTHD FLAG WHNM WHSD TYRS TMON TDAY THRS TMIN TSEC
Use this key to parse the column data to ensure that you are always compatible with future column changes. TableColumnTypes key describes the datum for each column in order. Using this (extremely recommended) will provide compatibility with future unknowns %TableType <subtype>. The %TableColumnTypes: contains a list of four-char-codes describing each column of the table data in order.

The known column codes are:

TIME seconds of the wave info from the date stamp

MWHT wave model height in meters for every one of three waves. 999 if not calculable.

MWPD wave spectra period in seconds. 999 if not calculable.

WAVB wave from direction in degrees. 999 or 1080 if not calculable.

WNDB wind from direction in degrees.

PMWH predicted wave height based solely on cross spectra noise floor. If the actual wave height drops below this level then it cannot be calculated. This value is meant as an indicator when there isn't enough second order to work on when wave heights are too low or interference is too high.

ACNT number of temporal cross spectra by number of spatial ranges that went into averaging the result.

DIST distance from origin in kilometers of the annulus used to calculate the result; this not necessarily an indication of distance from shore. For final filtered output, this value is set to nan because the ranged info has been reduced.

RCLL range cell of result from cross spectra.

LOND longitude placement over water coverage for drawing wave result. Again this doesn't mean that actual wave result from this location. Note that not every WVM9 table has LOND and LATD columns.

LATD latitude placement over water coverage for drawing wave result. Again this

doesn't mean that actual wave result from this location.

WDPT number of doppler points used for wave calculation.

MTHD wave method used for result:
1 when doppler displacement is less than 30% of the Bragg index.Wave period is 1 / doppler displacement and wave height & direction come from fitting the model to the CSS.
2 when doppler displacement is greater than 30% of the Bragg index. Wave period, height & direction from fitting a wave model spectrum to the CSS.
3 same as method 2 except that wave direction follows wind direction due to short period waves.

FLAG vector flag. This is a composite value (think binary)
(0) normal.
(+1) the merged vector result included wave directions at the bearing limits.
(+2) the merged vector sources were all at the wave directions at the bearing limits.
(+4) the merged vector sources contained different wave methods.
(+16) not enough second order doppler points
(+32) wave height too high
(+64) wave height changed too much since previous result.
(+128) wave period changed too much since previous result.
(+256) wave result was marked bad for other yet unknown reasons.
(+512) wave result appears to be saturated where second order to first order power ratio has exceeded set value.

WHNM number of valid temporal and/or spatial source wave vectors used by the filtering tool before reducing to output. **ACNT** column is the maximum possible vectors.

WHSD standard deviation of valid wave heights that filtering tool used to reduced to output.

TYRS year of data point.

TDAY day of the month of the point

THRS hour of the day of the point

TMIN minute of hour of the point

TSEC seconds of the minute of the point

%TableRows: <count>
Tells reader software how much data to expect. Should not be relied upon.

%TableStart: <tablenumber>
<tablenumber> will be missing for the first table.
Before the table data starts two comments are added to help visually identify the data columns.

Then a line for each table entry which start with a ' ' space.

Followed by a line for each Table Row of data. Each line is preceded by a space. Spaces (no tabs) are used between columns.

%TableEnd: <tablenumber>

Marks the end of the table. <tablenumber> will be missing for first table.

After the table(s) the file is followed by processing time and the tools that created the wave file.

Time when the wave file was last updated.

%ProcessedTimeStamp: 23 01 11 14 47 00

All the processing tools and their version number which worked on the data.

%ProcessingTool: "WaveModelFilter" 4.0.4
%ProcessingTool: "SpectraToWavesModel" 11.10.0
%ProcessingTool: "WaveModelForFive" 11.8.0
%ProcessingTool: "WaveModelArchiver" 13.2.1
%ProcessingTool: "AnalyzeSpectra" 12.0.0

Marks the end of the file.

%End:

Example Table:

```
%TableType: WAVL WVM9
%TableColumns: 20
%TableColumnTypes: TIME MWHT MWPD WAVB WNDB PMWH ACNT DIST RCLL WDPT MTHD FLAG WHNM WHSD TYRS TMON TDAY THRS TMIN TSEC
%TableRows: 45
%TableStart:
%%     Time     ----------Wave----------    Wind    WaveNF                                                          Height    Height
%%   FromStart   Height  Period   From      From    Height   Spectra   Distance   Range   Doppler    Wave    Vector   Valid     StdDv    Time
%%   (seconds)     (m)     (s)   (True)    (True)     (m)     count      (km)      cell     bins    Method    Flag    points      (m)    Year Mo Dy  Hr Mn  S
            0      4.50  12.25    57.4      5.9      0.13       42        nan       15       37        2         1         4      0.32    2014 12 01  00 00 00
         1800      3.93  10.76    35.3      2.9      0.13       56        nan       15       37        2         1        29      0.54    2014 12 01  00 30 00
         3600      3.76  10.61    27.4    359.5      0.13       70        nan       15       37        2         1        23      0.32    2014 12 01  01 00 00
         5400      3.84  10.44    20.8    359.4      0.12       70        nan       14       37        2         0        18      0.26    2014 12 01  01 30 00
         7200      3.70  10.30    13.3    354.8      0.12       70        nan       15       37        2         1        33      0.41    2014 12 01  02 00 00
%TableEnd:
```

Revision History

First Print Sep 26, 2016
Revised Jan 29, 2018 added WVM8 and WVM9 additions
Revised Jan 11, 2023 R21 WVM9 additions

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Revision History

Mar 9, 2022 - This is a template. Describe your doc here.

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