WIS "Spectral [WAM]" ASCII data file format

https://wis.erdc.dren.mil

WAM Spectra File Format:

WARNING: The spectral files DO NOT contain the WIS Station Number. They do, however contain the latitude and longitude of the site. Be aware of this while opening up consecutive files that may be from different WIS stations.

The WAM spectra file consists of three header records followed by a 2-D matrix where the columns represent the direction band (excluding column 1) and the rows consist of the frequency bands of the 2D spectrum. A summary of the parameters contained in each header record is provided below.

NOTE: All directions and spectra are in an Oceanographic coordinate system where 0° is a vector heading toward the north, 90° is heading to the east.

Header Record 1:

There is always a '1' in Column 1 that should be disregarded.

Variable 2: DATE [YYYYMMDDHHmmSS] Year, Month, Day, Hour, Minute and Second
Variable 3: LONGITUDE [Degrees East; 0-360°]
Variable 4: LATITUDE [Degrees North; -180° to +180°]
Variable 5: ML, the number of frequency bands
Variable 6: KL, the number of direction bands
Variable 7: f(1), the first frequency band [Hz]. Note $f(n) = 1.1 \cdot f(n-1)$ where n=2,ML
Variable 8: θ(1), the first direction band [°-Oceanographic or 'toward which' where 0° points to the north, 90° points to the east]
Variable 9: Δθ, the directional resolution [°]

Header Record 2:

Variable 1: U10, wind speed at 10m elevation [m/s]
Variable 2: UDIR, wind direction [°-Oceanographic or 'toward which' where 0° points to the north, 90° points to the east]
Variable 3: USTAR, frictional wind velocity [m/s]

Header Record 3 (Equations found below):

Variable 1: HM0, significant wave height [m], or derived from m0
Variable 2: TP, peak spectral wave period [s], $1/f_m$ (frequency band defined by the maximum energy)
Variable 3: TPF, parabolic fit peak spectral wave period [s], weighted average of neighboring energy values on either side of f_m
Variable 4: MPER, mean wave period [s], defined from m_1 and m_0
Variable 5: TM-1, inverse mean wave period [s], defined from m_{-1} and m_0

Variable 6: TM2, second moment mean wave period [s], defined from m_2 and m_0
Variable 7: MDIR, vector mean wave direction [°], defined from the overall 2D spectrum
Variable 8: SPRE, directional spread [°], defined for the MDIR

Directional Wave Spectra:

The matrix defining the directional wave spectra is written where, starting in Column 2, are defined by the discrete direction starting at θ(1) noted above. Column 1 contains the discrete frequency. Each row is defined by each discrete frequency band, ML (number of frequency bands) and KL (number of direction bands) are defined above.

```
DO M=1,ML
   WRITE(IUNIT,FORM2) FR(M),SPEC(1:KL,M)
  END DO

FORM2: = '(1X,F7.4,2X,122F8.3)'
```

Header Wave Parameter Equations

- HM0: Defined as four times the square root of the total energy of the 2-dimensional wave spectra plus the residual energy defined in the parametric region of the spectrum.

$$H_{mo} = 4 * \sqrt{\iint E(f,\theta) df \, d\theta}$$

- TP: Peak Spectral Wave Period: The inverse of the frequency band where the maximum energy resides.

- TPF: Parabolic fit based on the energy level at the discrete frequency and the two bands surrounding the peak. This removes the dependency on the frequency banding. This definition is generally used for evaluation.

- MPER: The First Moment of the Mean Wave Period.

$$T_{M1} = \frac{\int E(f) df}{\int f \cdot E(f) df}$$

- TM-1: The Inverse First Moment of Mean Wave Period.

$$T_{m-1} = \frac{\int f^{-1} \cdot E(f) df}{\int E(f) df}$$

- TM2: Second Moment of Mean Wave Period.

$$T_{M2} = \left[\frac{\int f^2 * E(f) df}{\int E(f) df} \right]^{-1/2}$$

- WAVD: Vector mean wave direction over the entire spectrum

$$\theta_{MEAN} = \arctan\left(X_{COMP}, Y_{COMP}\right)$$

Where:

$$X_{COMP} = \frac{\iint \sin\theta \cdot E(f,\theta)\,df\,d\theta}{\iint E(f,\theta)\,df\,d\theta} \;;\; Y_{COMP} = \frac{\iint \cos\theta \cdot E(f,\theta)\,df\,d\theta}{\iint E(f,\theta)\,df\,d\theta}$$

Note the directional spectra are output in an oceanographic coordinate system

- SPRD: Directional Spread

$$\sigma = \sqrt{2.0 * \left(1 - \sqrt{X_{COMP}^2 + Y_{COMP}^2}\right.}$$

Contact the Wave Information Studies:

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