

NAVO NetCDF information

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 [\[edit\]](#) **The Naval Oceanographic Office
NetCDF Standard v1.1**

[\[edit\]](#) Basics

This standard follows COARDS. For cases in which COARDS does not provide a standard (such as compressing out non-grid points) CF conventions are used.

[\[edit\]](#) References

- ← COARDS convention: [\[1\]](#)
- ← CF convention: [\[2\]](#)
- ← UDUNITS: [\[3\]](#)

[\[edit\]](#) Global Attributes

[NUG] denotes a netcdf User Guide-defined attribute. [COARDS] denotes a COARDS-defined attribute. [CF] denotes a CF-defined attribute.

[\[edit\]](#) Required Global Attributes

Required attributes that do not have a value should be given the value *not applicable*.

← **distribution_statement**

Text. Contains the distribution statement, e.g. "Approved for public release. Distribution unlimited."

← **Conventions** [NUG][COARDS][CF]

Text. Either "NAVO_netcdf_v1.0" or "NAVO_netcdf_v1.1". Note capitalization.

← **institution** [CF]

Text. Institution responsible for creating the file, e.g. "Naval Oceanographic Office"

← **contact**

Text. Contact information for the file, e.g. "NAVO Code N33"

← **history** [NUG][CF]

Text. This is the history of the file, not the data in it. Will typically have the entry for time of creation:

← **created:**

Text: Format of text is YYYY-MM-DD hh:mm:ss plus entries for modifications.

The following four attributes are only required for numerical models:

← **generating_model**

Text. The model and grid used to generate the data, e.g. "SWAFS Americas".

← **operational_status**

Text. Operational status of the generating model. Four legal values: development, opcheck, optest, operational. See definition of operational status values.

← **model_type**

Text.

← **input_data_source**

Text.

[\[edit\]](#) **Optional Global Attributes**

← **comment** [CF]

Text. Comments about the file.

← **message**

Text. A message for application popups. FERRET will display this string when the file is used.

← **references** [CF]

Text. One or more URLs (maybe of this file!) or titles of documents for information about the file format and data.

← **source** [CF]

Text. The source of data in the file.

← **title** [NUG][CF]

Text. A title for the file.

[\[edit\]](#) **Variables**

[\[edit\]](#) **Variable Names**

Variable names are standardized for the convenience of application software and users. The attribute **NAVO_code** can be used to provide an unambiguous numerical identification key.

[\[edit\]](#) **Variable Dimensions**

The ordering of dimensions is significant. For a variable X, the dimension order is X(time dimension, z dimension, y dimension, x dimension). If latitude and longitude are dimensions, longitude will be the x dimension, and latitude the y. If a variable does not vary with a dimension, that dimension is absent, but the remaining ones must preserve the specified order. For example grid water depth as a function of latitude and longitude only would be defined as grid_water_dep(lat, lon).

If only a single value of one dimension is present, that dimension should not be dropped, but set to 1. This is because application software needs that dimension to properly locate the data. For example, water_temp would normally be specified as water_temp(time, depth, lat, lon). If only a single depth is stored, water_temp should not be changed to water_temp(time, lat, lon). It should remain as 4-D, but depth will have a length of one, which will be used to store the depth of the surface.

[\[edit\]](#) **Variable Attributes**

[\[edit\]](#) **Required Variable Attributes**

← **long_name** [COARDS][CF]

Text. A descriptive name for the variable. Allowed values are given in Appendix 2.

← **units** [COARDS][CF]

Text. Preferred units are in Appendix 2. All units should be compliant with the udunits package if possible.

← **positive** [COARDS][CF]

Text. Can have the values "up" or "down". Use when there is a chance of ambiguity. For scalars, "up" means that the value increases as one moves away from the center of the Earth. See Appendix 2 for cases where needed. Do not store if not needed.

[\[edit\]](#) **Optional Variable Attributes**

← **NAVO_code**

Integer. A unique numeric code which allows unambiguous determination of what the physical nature of the data stored in the variable. Values can be found in Appendix 2.

← **_FillValue** [COARDS][CF]

Has the type of the variable. Data variables only. A variable value which denotes that valid data is not present. (For example, water temperature below the bottom.) Suggested values in Appendix 2.

If a float or double variable is packed into a short (to save space), **_FillValue** should be set to the value that the float or double **_FillValue** given in Appendix 2 would take after the packing operation is performed on it. For example, `water_temp` as float will have a **_FillValue** of `-10.f`, but after packing with `add_offset` of `20.f` and `scale_factor` of `0.001f`, it should have a **_FillValue** of `-30000s`. Failure to do this can cause the fill value to fall into the range of valid data. Currently ferret (and probably some other software) fails to recognize that an `NF_FILL_SHORT` should be unpacked to `NF_FILL_FLOAT`. Ferret

scripts should be written to recognize the packed fill and set the unpacked value to the "undefined" value.

Variables that do not use packing in a netcdf files can use `NF_FILL_FLOAT` (or whatever type).

← **add_offset** and **scale_factor** [COARDS][CF]

Have the type of the variable before packing. Data variables only. Used to pack data that would normally be stored as a float (32bits) or double (64bits) into a shorter word, such as short (16bit integer), to save space. The transformation is:

$$\text{original data} = \text{add_offset} + \text{scale_factor} * \text{packed data}$$

Values should be chosen taking care that: (1) Neither valid data, nor the `_FillValue`, will be transformed outside the range of numbers which can be represented in the packed type. (2) Meaningful precision is not lost. See the description of `_FillValue` for considerations on handling that attribute.

← **coordinates** [CF]

Text. Data variables only. If an alternate axis coordinate system is used, this attribute will contain the name of the variable containing the axis value. The main use will be to associate a model run tau value with the time axis.

← **sampling**

Text. Coordinate variables only. If a dataset is subsetting from the original, this attribute will specify the axis indexes that have been used. There are two forms: A comma-separated list of values. A dash specifies a range. For example, "1,3,4-6,9", specifies the index values 1,3,4,5,6,and 9. A start, end, and increment separated by semicolons. For example, "1;9;2", specifies the index values 1,3,5,7,and 9.

[\[edit\]](#) **Mixing values at set Z levels with values at the bottom**

Frequently, NetCDF files are made containing a mixture of Z levels and the values of the parameter at the bottom. For instance, one might have a file containing temperature at 0 meters, 10 meters, 100 meters, and the bottom. Because this occurs frequently and mixes sigma and Z-level coordinate systems, the following solution has been devised.

For a parameter such as salinity, there will be two salinity variables. The first will contain the Z levels and be given the normal name of the variable. The second will contain the bottom level, will not contain a level dimension, and will be given the name of the variable appended with *_bottom*.

Version 1.0 files did not separate these variable, but included a depth in the depth dimension variable with a value of -999 to indicate a bottom level. This has been changed in version 1.1.

[\[edit\]](#) Appendix 1

The required (for models) global attribute **operational_status** can have one of the following values:

← *operational*

Only files with this attribute value can be considered an official product of NAVOCEANO. Even so, there may be cautions on their use.

← *optest* and *opcheck*

Data with these attribute are being tested before being declared operational.

← *development*

The data is the result of development or testing.

[\[edit\]](#) Appendix 2

[\[edit\]](#) Coordinate Variables

Coordinate Variables

NAVO_code	Variable Name	long_name	type	x/y	z	time	units	positive
1	lat	Latitude	double	Y	N	N	degrees_north	
2	lon	Longitude	double	Y	N	N	degrees_east	

3	gridx	Grid X	double	Y	N	N	meter foot nautical_mile nmi	
4	gridy	Grid Y	double	Y	N	N	meter foot nautical_mile nmi	
5	depth	Depth	double	N	Y	N	foot	down
6	water_pressure	Water Pressure	double	N	Y	N	kilopascal atm bar decibar	
7	air_pressure	Air Pressure	double	N	Y	N	kilopascal hectopascal atm millibar mm_Hg inch_Hg	
8	sigma	Sigma	double	N	Y	N	sigma_level	down up
9	layer	Layer	short	N	Y	N	count	down up
10	grid_point	Grid Point	integer	Y	N	N	count	
11	land_point	Land Point	integer	Y	N	N	count	
12	water_point	Water Point	integer	Y	N	N	count	
13	time	Valid Time	double	N	N	Y	{hours day second} since YYYY-MM-DD HH:MM:SS.xxx	

[\[edit\]](#) Dependent Variables

Coordinate Variables

NAVO_code	Variable Name	long_name	type	x/y	z	time	units	positive
14	water_surf_temp	Water Surface Temperature	float short	Y	N	Y	degC degF K	
15	water_temp	Water Temperature	float short	Y	Y	Y	degC degF K	
16	salinity	Salinity	float short	Y	Y	Y	psu	
17	water_u	Eastward Water Velocity	float short	Y	Y	Y	meter/second foot/second knot	
18	water_v	Northward Water Velocity	float short	Y	Y	Y	meter/second foot/second knot	
19	water_w	Vertical Water Velocity	float short	Y	Y	Y	meter/second foot/second	up down
20	water_grid_u	Grid U Water Velocity	float short	Y	Y	Y	meter/second foot/second knot	
21	water_grid_v	Grid V Water	float	Y	Y	Y	meter/second	

		Velocity	short				foot/second knot	
22	water_grid_w	Grid W Water Velocity	float short	Y	Y	Y	meter/second foot/second	up down
23	water_pres	Pressure	float short	Y	Y	Y	pascal kilopascal bar decibar atm	
24	air_u	Eastward Air Velocity	float short	Y	Y	Y	meter/second foot/second knot	
25	air_v	Northward Air Velocity	float short	Y	Y	Y	meter/second foot/second knot	
26	air_w	Vertical Air Velocity	float short	Y	Y	Y	meter/second foot/second	
27	air_gridu	Grid U Air Velocity	float short	Y	Y	Y	meter/second foot/second knot	
28	air_gridv	Grid V Air Velocity	float short	Y	Y	Y	meter/second foot/second knot	
29	air_gridw	Grid W Air Velocity	float short	Y	Y	Y	meter/second foot/second	
30	layer_thickness	Layer Thickness	float short	Y	Y	Y	meter foot	
31	mix_lay	Mixed Layer Thickness	float short	Y	N	Y	meter foot	
32	surf_el	Water Surface Elevation	float short	Y	N	Y	meter foot	up
33	sound_speed	Sound Speed	float short	Y	Y	Y	meter/second foot/second	
34	shal_sndch_dep	Shallow Sound Channel Axis Depth	float short	Y	N	Y	meter foot	down up
35	deep_sndch_dep	Deep Sound Channel Axis Depth	float short	Y	N	Y	meter foot	down up
36	snd_crit_dep	Acoustic Critical Depth	float short	Y	N	Y	meter foot	down up
37	snd_exc_dep	Acoustic Depth Excess	float short	Y	N	Y	meter foot	
38	sonic_lay_dep	Sonic Layer Depth	float short	Y	N	Y	meter foot	down up
39	mixed_lay_dep	Mixed Layer Depth	float short	Y	N	Y	meter foot	down up

40	bt_rms_err	Bathythermograph RMS Error	float short	Y	Y	Y	degC degF K	
41	sig_wav_ht	Significant Wave Height	float short	Y	N	Y	meter foot	
42	sig_wav_dir	Significant Wave Direction	float short	Y	N	Y	angular_degree	
43	sig_wav_per	Significant Wave Period	float short	Y	N	Y	second	
44	sea_wav_ht	Sea Wave Height	float short	Y	N	Y	meter foot	
45	sea_wav_dir	Sea Wave Direction	float short	Y	N	Y	angular_degree	
46	sea_wav_per	Sea Wave Period	float short	Y	N	Y	second	
47	swell_ht	Swell Height	float short	Y	N	Y	meter foot	
48	swell_dir	Swell Direction	float short	Y	N	Y	angular_degree	
49	swell_per	Swell Period	float short	Y	N	Y	second	
50	cutoff_frequency	Cutoff Frequency	float short	Y	N	Y	Hz	
57	surf_wnd_stress	Surface Wind Stress Magnitude	float short	Y	N	Y	newton/meter2 pascal	
58	surf_wnd_stress_e	Eastward Surface Wind Stress	float short	Y	N	Y	newton/meter2 pascal	
59	surf_wnd_stress_n	Northward Surface Wind Stress	float short	Y	N	Y	newton/meter2 pascal	
60	surf_wnd_stress_gri dx	Grid X Surface Wind Stress	float short	Y	N	Y	newton/meter2 pascal	
61	surf_wnd_stress_gri dy	Grid Y Surface Wind Stress	float short	Y	N	Y	newton/meter2 pascal	
62	surf_atm_pres	Surface Atmospheric Pressure	float short	Y	N	Y	kilopascal pascal hectopascal newton/meter2 millibar	
200	water_err	Error Water Velocity	float	Y	Y	Y	meter/second foot/second centimeter/second knot	
201	adcp_echo	Returned Echo Intensity	float	Y	Y	Y	count	

202	adcp_pcmt_good	Average Percent Good	float	Y	Y	Y	percent	
203	botdep	Bottom Depth	float short	Y	N	N	meter foot fathom	up down
204	water_temp_stdev	Water Temperature St. Dev	float short	Y	Y	Y	degC degF K	
205	salinity_stdev	Salinity St. Dev.	float short	Y	Y	Y	psu	
206	lati	Time Dependent Latitude	double	N	N	Y	degrees_north	
207	loni	Time Dependent Longitude	double	N	N	Y	degrees_east	
208	ship_speed	Ship Speed	double	N	N	Y	knot	

[\[edit\]](#) Grid Description Variables

Coordinate Variables

NAVO_code	Variable Name	long_name	type	x/y	z	time	units	positive
50	grid_water_dep	Grid Water Depth	float	Y	N	N	meter foot	down up
51	land_mask	Land Mask	byte	Y	N	N	count	
52	grid_lon	Grid Longitude	double	Y	N	N	degrees_east	
53	grid_lat	Grid Latitude	double	Y	N	N	degrees_north	
54	grid_orient	Grid Orientation	float	Y	N	N	angular_degree	
55	point_dep	Depth At Point	float	Y	Y	N	meter foot	

[\[edit\]](#) Alternate Coordinate Variables

Coordinate Variables

NAVO_code	Variable Name	long_name	type	x/y	z	time	units	positive
56	tau	Tau	float	N	N	Y	hour second	

[\[edit\]](#) Appendix 3 Sample NetCDF Header Files

[\[edit\]](#) Appendix 3.1 A Sigma Coordinate Circulation Model

```
netcdf swafs_gom_200222600 {
  dimensions:
    lat = 214 ;
```

```

lon = 215 ;
sigma = 46 ;
time = UNLIMITED ; // (24 currently)
variables:
  double lat(lat) ;
    lat:long_name = "Latitude" ;
    lat:units = "degrees_north" ;
    lat:NAVO_code = 1 ;
    lat:sampling = "527;740;1" ;
  double lon(lon) ;
    lon:long_name = "Longitude" ;
    lon:units = "degrees_east" ;
    lon:NAVO_code = 2 ;
    lon:sampling = "695;909;1" ;
  double sigma(sigma) ;
    sigma:long_name = "Sigma" ;
    sigma:units = "sigma_level" ;
    sigma:NAVO_code = 8 ;
    sigma:positive = "down" ;
  double time(time) ;
    time:long_name = "Valid Time" ;
    time:units = "hour since 2000-01-01 00:00:00" ;
    time:time_origin = "2000-01-01 00:00:00" ;
    time:NAVO_code = 13 ;
  float grid_water_dep(lat, lon) ;
    grid_water_dep:long_name = "Grid Water Depth" ;
    grid_water_dep:units = "meters" ;
    grid_water_dep:NAVO_code = 50 ;
    grid_water_dep:_FillValue = -10.f ;
  short water_temp(time, sigma, lat, lon) ;
    water_temp:long_name = "Water Temperature" ;
    water_temp:units = "degC" ;
    water_temp:NAVO_code = 15 ;
    water_temp:_FillValue = -30000s ;
    water_temp:scale_factor = 0.001f ;
    water_temp:add_offset = 20.f ;
  short salinity(time, sigma, lat, lon) ;
    salinity:long_name = "Salinity" ;
    salinity:units = "psu" ;
    salinity:NAVO_code = 16 ;
    salinity:_FillValue = -30000s ;
    salinity:scale_factor = 0.001f ;
    salinity:add_offset = 20.f ;
  short water_u(time, sigma, lat, lon) ;
    water_u:long_name = "Eastward Water Velocity" ;
    water_u:units = "meters/second" ;
    water_u:NAVO_code = 17 ;

```

```

        water_u:_FillValue = -10000s ;
        water_u:scale_factor = 0.01f ;
        water_u:add_offset = 0.f ;
    short water_v(time, sigma, lat, lon) ;
        water_v:long_name = "Northward Water Velocity" ;
        water_v:units = "meters/second" ;
        water_v:NAVO_code = 18 ;
        water_v:_FillValue = -10000s ;
        water_v:scale_factor = 0.01f ;
        water_v:add_offset = 0.f ;
    short surf_el(time, lat, lon) ;
        surf_el:long_name = "Water Surface Elevation" ;
        surf_el:positive = "up" ;
        surf_el:units = "meters" ;
        surf_el:NAVO_code = 32 ;
        surf_el:_FillValue = -30000s ;
        surf_el:scale_factor = 0.001f ;
        surf_el:add_offset = 0.f ;

// global attributes:
        :distribution_statement = "Approved for public release.
Distribution unlimited." ;
        :institution = "Naval Oceanographic Office" ;
        :contact = "NAVO, N33" ;
        :history = "created: 2002-08-15 08:10:30" ;
        :generating_model = "SWAFS Americas" ;
        :operational_status = "development" ;
        :model_type = "x-equal lon,y-equal lat,z-sigma" ;
        :input_data_source = "FNMOC NOGAPS" ;
        :Conventions = "NAVO_netcdf_v1.1" ;
        :reference = "http://www.navo.navy.mil/" ;
        :comment = "---" ;
}

```

[\[edit\]](#) Appendix 3.2 A Depth Profile

```

netcdf sample_profile {
dimensions:
    lat = 1 ;
    lon = 1 ;
    depth = 100 ;
    time = 1 ;
}

```

```

variables:
    double lat(lat) ;
        lat:long_name = "Latitude" ;
        lat:units = "degrees_north" ;
        lat:NAVO_code = 1 ;
    double lon(lon) ;
        lon:long_name = "Longitude" ;
        lon:units = "degrees_east" ;
        lon:NAVO_code = 2 ;
    double depth(depth) ;
        depth:long_name = "Depth" ;
        depth:units = "meters" ;
        depth:NAVO_code = 5 ;
    double time(time) ;
        time:long_name = "Valid Time" ;
        time:units = "hour since 2000-01-01 00:00:00" ;
        time:time_origin = "2000-01-01 00:00:00" ;
        time:NAVO_code = 13 ;
    float water_temp(time, depth, lat, lon) ;
        water_temp:long_name = "Water Temperature" ;
        water_temp:units = "degC" ;
        water_temp:NAVO_code = 15 ;
        water_temp:_FillValue = -10.f ;
    float salinity(time, depth, lat, lon) ;
        salinity:long_name = "Salinity" ;
        salinity:units = "psu" ;
        salinity:NAVO_code = 16 ;
        salinity:_FillValue = -10.f ;

// global attributes:
        :distribution_statement = "Approved for public release.
Distribution unlimited." ;
        :institution = "Naval Oceanographic Office" ;
        :contact = "NAVO, N33" ;
        :history = "created: 2002-08-25 00:00:00" ;
        :Conventions = "NAVO_netcdf_v1.1" ;
        :reference = "http://www.navo.navy.mil/" ;

```

[\[edit\]](#) **Appendix 3.3 A Temperature Measuring Drifter**

```

netcdf temperature_drifter {
dimensions:
    time = UNLIMITED ;
variables:

```

```

double lati(time) ;
    lati:long_name = "Time Dependent Latitude" ;
    lati:units = "degrees_north" ;
    lati:NAVO_code = 206 ;
double longi(time) ;
    longi:long_name = "Time Dependent Longitude" ;
    longi:units = "degrees_east" ;
    longi:NAVO_code = 207 ;
double time(time) ;
    time:long_name = "Valid Time" ;
    time:units = "hour since 2000-01-01 00:00:00" ;
    time:time_origin = "2000-01-01 00:00:00" ;
    time:NAVO_code = 13 ;
float water_temp(time) ;
    water_temp:long_name = "Water Temperature" ;
    water_temp:units = "degC" ;
    water_temp:NAVO_code = 15 ;
    water_temp:_FillValue = -10.f ;

// global attributes:
    :distribution_statement = "Approved for public release.
Distribution unlimited." ;
    :institution = "Naval Oceanographic Office" ;
    :contact = "NAVO, N33" ;
    :history = "created: 2002-09-25 00:00:00" ;
    :Conventions = "NAVO_netcdf_v1.1" ;
    :reference = "http://www.navo.navy.mil/" ;
    :comment = "An example of drifter data." ;
    :source = "Acme drifter Model X, SN#10001" ;
}

```

[\[edit\]](#) Appendix 3.4 A NetCDF file mixing Z levels and the bottom level

```

netcdf swafs_ion_aden_2005111500 {
dimensions:
    lon = 137 ;
    lat = 106 ;
    depth = 9 ;
    time = UNLIMITED ; // (49 currently)
variables:
    double depth(depth) ;
        depth:units = "meters" ;

```

```

        depth:long_name = "Depth" ;
        depth:NAVO_code = 5 ;
        depth:positive = "down" ;
short tau(time) ;
    tau:units = "hours since 2005-11-15 00:00:00" ;
    tau:time_origin = "2005-11-15 00:00:00" ;
    tau:long_name = "Tau" ;
    tau:NAVO_code = 56 ;
double time(time) ;
    time:long_name = "Valid Time" ;
    time:units = "hour since 2000-01-01 00:00:00" ;
    time:time_origin = "2000-01-01 00:00:00" ;
    time:NAVO_code = 13 ;
double lon(lon) ;
    lon:long_name = "Longitude" ;
    lon:units = "degrees_east" ;
    lon:NAVO_code = 2 ;
double lat(lat) ;
    lat:long_name = "Latitude" ;
    lat:units = "degrees_north" ;
    lat:NAVO_code = 1 ;
short water_v_bottom(time, lat, lon) ;
    water_v_bottom:long_name = "Northward Water Velocity" ;
    water_v_bottom:units = "meters/second" ;
    water_v_bottom:NAVO_code = 18 ;
    water_v_bottom:_FillValue = -10000s ;
    water_v_bottom:missing_value = -10000s ;
    water_v_bottom:scale_factor = 0.01f ;
    water_v_bottom:add_offset = 0.f ;
short water_v(time, depth, lat, lon) ;
    water_v:long_name = "Northward Water Velocity" ;
    water_v:units = "meters/second" ;
    water_v:NAVO_code = 18 ;
    water_v:_FillValue = -10000s ;
    water_v:missing_value = -10000s ;
    water_v:scale_factor = 0.01f ;
    water_v:add_offset = 0.f ;
short water_u_bottom(time, lat, lon) ;
    water_u_bottom:long_name = "Eastward Water Velocity" ;
    water_u_bottom:units = "meters/second" ;
    water_u_bottom:NAVO_code = 17 ;
    water_u_bottom:_FillValue = -10000s ;
    water_u_bottom:missing_value = -10000s ;
    water_u_bottom:scale_factor = 0.01f ;
    water_u_bottom:add_offset = 0.f ;
short water_u(time, depth, lat, lon) ;
    water_u:long_name = "Eastward Water Velocity" ;

```



```

        water_u:units = "meters/second" ;
        water_u:NAVO_code = 17 ;
        water_u:_FillValue = -10000s ;
        water_u:missing_value = -10000s ;
        water_u:scale_factor = 0.01f ;
        water_u:add_offset = 0.f ;
short water_temp_bottom(time, lat, lon) ;
    water_temp_bottom:long_name = "Water Temperature" ;
    water_temp_bottom:units = "degC" ;
    water_temp_bottom:NAVO_code = 15 ;
    water_temp_bottom:_FillValue = -30000s ;
    water_temp_bottom:missing_value = -30000s ;
    water_temp_bottom:scale_factor = 0.001f ;
    water_temp_bottom:add_offset = 20.f ;
short water_temp(time, depth, lat, lon) ;
    water_temp:long_name = "Water Temperature" ;
    water_temp:units = "degC" ;
    water_temp:NAVO_code = 15 ;
    water_temp:_FillValue = -30000s ;
    water_temp:missing_value = -30000s ;
    water_temp:scale_factor = 0.001f ;
    water_temp:add_offset = 20.f ;
short salinity_bottom(time, lat, lon) ;
    salinity_bottom:long_name = "Salinity" ;
    salinity_bottom:units = "parts per thousand" ;
    salinity_bottom:NAVO_code = 16 ;
    salinity_bottom:_FillValue = -30000s ;
    salinity_bottom:missing_value = -30000s ;
    salinity_bottom:scale_factor = 0.001f ;
    salinity_bottom:add_offset = 20.f ;
short salinity(time, depth, lat, lon) ;
    salinity:long_name = "Salinity" ;
    salinity:units = "parts per thousand" ;
    salinity:NAVO_code = 16 ;
    salinity:_FillValue = -30000s ;
    salinity:missing_value = -30000s ;
    salinity:scale_factor = 0.001f ;
    salinity:add_offset = 20.f ;
float botdep(lat, lon) ;
    botdep:long_name = "Bottom Depth" ;
    botdep:positive = "down" ;
    botdep:units = "meters" ;
    botdep:NAVO_code = 203 ;
    botdep:fill_value = 1.f ;
short surf_el(time, lat, lon) ;
    surf_el:long_name = "Water Surface Elevation" ;
    surf_el:units = "meters" ;

```

```

        surf_el:NAVO_code = 32 ;
        surf_el:positive = "up" ;
        surf_el:_FillValue = -30000s ;
        surf_el:missing_value = -30000s ;
        surf_el:scale_factor = 0.001f ;
        surf_el:add_offset = 0.f ;

// global attributes:
        :classification_level = "UNCLASSIFIED" ;
        :distribution_statement = "Approved for public release.
Distribution unlimited." ;
        :downgrade_date = "not applicable" ;
        :classification_authority = "not applicable" ;
        :institution = "Naval Oceanographic Office" ;
        :contact = "NAVO, N34" ;
        :model_type = "x-equal lon,y-equal lat,z-levels" ;
        :input_data_source = "FNMOC NOGAPS/COAMPS winds blend" ;
        :Conventions = "NAVO_netcdf_v1.1" ;
        :references = "http://www.navo.navy.mil/" ;
        :operational_status = "operational" ;
        :message = "UNCLASSIFIED" ;
        :history = "created: Tue Nov 15 10:16:47 2005\n",
"" ;

```

[\[edit\]](#) Appendix 4 Changes From Previous Versions

- ← Changed the NAVO_code attribute to be optional. It is still recommended.
- ← Added some variables
- ← Added some units to some variable
- ← Added the option to have positive be down or up for some depth-related variables.
- ← Changed the procedure for mixing Z levels and the bottom level in the same file. Instead of a -999 depth indicating bottom, the bottom level parameters are separated out in a different variable with a *_bottom* appended to the standard variable name.