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NCEI NETCDF TEMPLATE REVIEW FOR ELECTRONIC TAG DATA SUPPORT

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1 Overview

NOAA/NCEI (formerly the National Oceanographic Data Center, NODC) has produced a series of netCDF(.nc) spatial feature class templates and recommendations for the packaging of *in situ* oceanographic data with associated geospatial metadata within self-describing data files consistent with earth science data interoperability standards. The .nc templates cover the full range of discrete sampling geometry types typical of oceanographic data as defined by the CF1.6 data standard, including point, profile, trajectory, time series and gridded data types. The templates also leverage both CF (Climate Forecast) and ACDD (Attribute Conventions for Data Discovery) metadata standards. The NCEI .nc templates are not a standard in and of themselves but rather a set of best practices and an implementation of these existing standards for the oceanographic context. The templates, accompanying CDL files, and examples are very well documented, with all resources available online. Launched initially in 2014 after a period of public comment, the current version is v2.0. It serves an invaluable resource that the PO.DAAC has leveraged in support of archival/distribution of NASA oceanographic field campaigns such as SPURS, OMG and also now the ACCESS-15 Oceanographic *In situ* data Interoperability Project (OIIP).

OIIP is a technology development project that seeks to extend available (higher TRL) technologies, including the NCEI .nc templates, to address key interoperability and data challenges associated with oceanographic *in situ* datasets, focusing on marine animal electronic tagging data as a representative (but also more challenging) use case. This report summarizes the findings of an evaluation of applicable templates (trajectory in particular) in supporting the range of (non-acoustic) electronic tagging datasets from archival and popup-archival satellite (PSAT) tags from several manufacturers that are the focus of OIIP. The intent was to improve understanding within the OIIP team of the limits of the .nc templates as regards eTag data. The objective of this review was also to identify any gaps currently and suggest possible areas of improvement or template extension that could guide OIIP technical work. These could also serve as potential recommendations to NCEI and the IOOS-Animal Tracking Network (ATN) program in future.

2 Methods

The approach involved a review and categorization of the range of data output files for a representative range of eTag types from several instrument manufacturers. This was based on a compilation of such sample datasets with associated documentation by OIIP on the project wiki as summarized in table 1 below.

Table 1. Representative range of sample electronic tag dataset types **(**See also https://github.com/tagbase/tagbase/wiki/ArticlePrepareImport for different file formats)

Manufacturer	Type	Model	Processing Tool Version	Format	File	Data/Header Complexity	Notes	Provider	Species/TagID
Wildlife Computers	Popup/ Transmitting	MiniPAT	DAP 3.0 Build 434 (Desktop version)	.csv	Popup_WildlifeComputers.7z	High; try this second to last	Spreadsheet header	LPRC	Sailfish/ 113674
								LPRC	Sailfish/ 142389
Microwave Telemetry	Popup/ Transmitting	X-tag	Manufacturer processed in-house	.xls	Popup_MicrowaveTelemetry.7z	High; try this last		LPRC	Sailfish/ 117259
Wildlife Computers	Implanted/ Archival	Mk-9	Instrument Helper	.csv	Archival_WildlifeComputers.7z	Simple / Medium	Very detailed time series	IATTC	Bigeye tuna/ 0390075
			DAP 3.0 Build 434 (Desktop version)	.csv			Spreadsheet header Very detailed time series	IATTC	Bigeye tuna/ 0590051
			Likely Instrument Helper	.csv			Detailed time series	ATN	Albacore tuna/ 1204043
Lotek	Implanted/ Archival		Viewer 2000	.csv	Archival_LotekWireless.7z	Simple; try first	Very detailed time series	IATTC	Yellowfin tuna/ A0525
							Very detailed time series	IATTC	Yellowfin tuna/ C0066

Similarly, a general review of the NCEI .nc templates, documentation, and CDL at https://www.nodc.noaa.gov/data/formats/netcdf/v2.0/ was undertaken, followed by further close examination of the "trajectory profile – incomplete multidimensional array representation" template which was deemed to most closely model eTag archival datasets (see Appendix). Any identified issues in the ability of this trajectory profile template to support the range of sample tag datasets, whether relating to metadata, data or structural aspects were capture and are summarized in this document further below. Some specific areas of focus for potential future enhancements included: encoding of "rich" community/domain specific metadata, representation of geolocational uncertainty, and support for summarized electronic tagging datasets (bin-frequency and PDT).

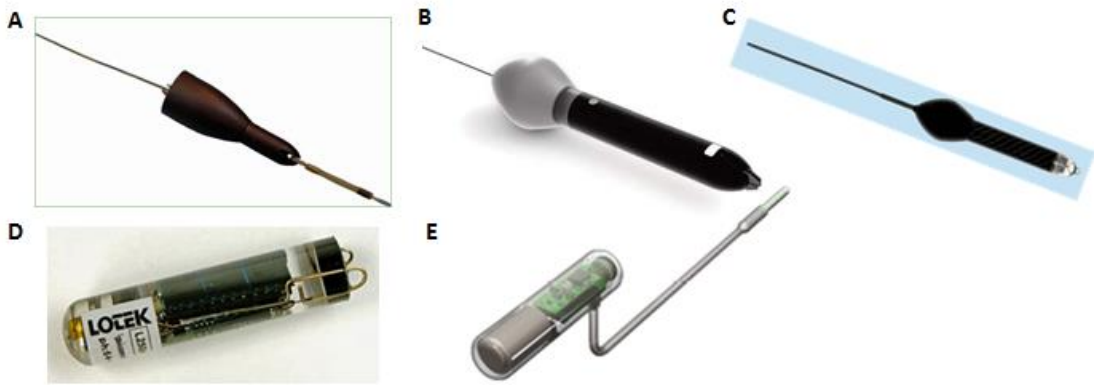
3 eTag Data Files

Types

Non-acoustic, electronic archival tagging data of relevance that are the focus of the OIIP project are comprised of two basic types:

- Continuous time series of sensor observations from implanted archival tags that are retrieved upon recapture of the tagged animal (figure 1 D-E) or from physically retrieved PSAT tags (figure 1A-C) that have popped off the animal.
- Summary data transmitted to satellite from retrieved Pop-up Satellite Archival (PSAT) upon release from the animal.

Figure 1. Electronic tag types illustrated. Popup Satellite Archival (PSAT) tags (A-C) and implantable Archival tags (D-E). A. LOTEK PSAT, B. Wildlife Computers PAT, D. LOTEK LAT2500, E. Wildlife Computers MK9



Representative ASCII/CSV outputs from archival and summarized pop-up (PSAT) data files from several manufacturers are presented in Appendix A below. Figures 2-5 show the typical contents and organization of electronic tag data files of different type, including metadata elements and columnar data.

- Excerpts of outputs from LOTEK, Wildlife Computers (WC), and Microwave Telemetry (MT) archival tag data files are shown in figures 2-4 respectively. Note that the upper part of each figure shows the structure of the archival sensor data whereas the lower portion of the figures illustrates associated light-based geolocation output from archival tags. Linkage of these horizontal position and vertical profile series is based on time stamp. However, it is important to note that the number of Lat/Lon positional estimates are likely to be considerably less than available profile time series observational sensor data given the comparatively low frequency of available positional fixes.

Typical extracts of summarized data outputs transmitted to satellite from PSAT tags that have successfully popped off the animal are illustrated in figures 5 and 6 of Appendix A. Summary eTag data outputs take a variety of forms and are packaged in several CSV data product files by type. In the case, for example, of Wildlife computers CSV output data products include:
Argos.csv. Behavior.csv, Corrupt.csv, DivePDT.csv, DDN.csv, FastlocGPS.csv, HaulOut.csv, Histos.csv, Lightloc.csv, Locations.csv, X-Locations.csv, MixLayer.csv, PDTs.csv, Series.csv, SeriesRange.csv, SST.csv, Status.csv, STP.csv, Summary.csv, RTC.csv, Labels.csv, All.csv, GPE3.csv,DailyData.csv

Descriptions of these files and their contents is available from http://wildlifecomputers.com/wp-content/uploads/manuals/Spreadsheet-File-Descriptions.pdf. But of these, only a subset contain the core science data of interest; several of the other data files contain either ancillary information or alternate representations of the core data, with considerable overlap evident between products. The two products comprising the summarized science data of principal interest are:

- Time-At-Temperature and Time-At-Depth data: summarized bin-frequency temperature and depth distribution data for pre-programmed time intervals and bin classes (typically, 12-14 bin classes) from the source Histos.csv – figure 5
- Profile of Depth and Temperature (PDT): summarized Pressure/Depth/Temperature min/max range values for pre-programmed time intervals from the source *PDTs.csv* – figure 6

Locations:

- Although not shown, daily light based geolocation positional estimates are available with both the aforementioned types of summarized output and resemble those in figure 3 for archival positional estimate outputs from the source *LightLoc.csv* and *Locations.csv* with geocorrected positions from the *GP3.csv* data file. Linkage of horizontal position and summarized vertical profile series is based on matching time stamp, although again there are likely to be differences in data frequency between point geolocation and time interval summary observations as in the case of full archival series.
- Other positional data provided include known Argos-based positions at the time of deployment and post pop-off are summarized in *Argos.csv*. Linkage between geophysical values in both detailed time series or summarized forms and positional data is via available matching date/time field values

Metadata

The availability of metadata describing aspects of the instrumentation, subject animal and nature of the tag deployment undertaken is critical to the valid interpretation of numerical data in eTag data files themselves. The kinds of attributes of relevance to tagging applications are described in the OIIP technical report entitled "*OIIP_Deliverable1.2_TagMetadata_20170207.docx* ". However, inspection of archival and summarized eTag data outputs (Appendix A, figures 2-5) reveals characteristic paucity of global file level metadata of any kind, including processing version and time information. Furthermore, there is limited variable level metadata associated with the columnar data; column headers are named inconsistently and may or may not contain unit information cited according to CF-standards conventions. Figure 3 also illustrates a more subtle issue in this regard: the use of negative values to represent Depth, which by definition is a positive quantity for measurements taken subsurface. All of this necessitates reliance on external documentation, and renders these products poor both from an interoperability and long-term archival/usability standpoint.

Data Organization & Representation

The data in both archival and summarized eTag files are organized in tabular columnar format, each column representing a given variable (eg. date/time, latitude/longitude, temperature, pressure, light level) and values in each row representing recorded values (either individual scalar measurement values or aggregate summary quantities) at a given point in time for the entire observational deployment period.

Time is the fundamental unit of record organization and also linkage across data product types (eg. sensor and positional data files), although as mentioned above, it must be appreciated that time resolutions for different data and product types may differ. For example, positional information availably typically with daily frequency needs to be reconciled or matched against more continuous environmental sensor data (minute scale frequency) or variable interval summarized data values.

Column variables may differ in number and position depending on the data product, manufacturer or even processing version.

PDT and Bin Frequency summarized data both span several columns, each column representing the pre-programed time period interval in the case of PDT or depth/temperature bin interval in the case of Bin Frequency representations. Metadata explicitly defining these interval extents appear absent from the data files themselves, complicating interpretation of the data without recourse to external documentation.

As expected of ASCII-based data files, no type-based constraints are applied to cell values, which can range from integer to double precision values, date/time stamps varying in form, to character strings. Figure 4 presents a curious case in which the numeric *Delta(Val)* column contains also contains cells with non-numeric "X" value entries, whose meaning is not apparent simply from inspection of the data files themselves.

4 NCEI .nc Templates

Applicability to Marine Electronic Tagging Datasets

The NCEI oceanographic feature class templates serve as a useful implementation of existing CF and ACDD data standards for the representation of discrete geometry spatial data types. Electronic tagging data document the movement of marine species both horizontally and vertically through the water column together with measured properties of the local environment in a manner analogous to other trajectory profile datasets, such as glider datasets, based on non-biological sampling platforms. Of the eight available NCEI templates, the applicable template for continuous archival and retrieved PSAT data series is, therefore, the trajectory profile type. Data resulting from satellite positioning tag deployments (eg. SPOT) would be best accommodated by the simpler trajectory template since only surface positions along the animal's migratory track are recorded. In the case where double tagging experiments are conducted (deployment involving SPOT tag in conjunction with PSAT archival tag) then potentially the trajectory-profile template could be implemented for both (but note the caveat below regarding multiple trajectory series in single data files).

Metadata

Global metadata attributes comprising the trajectory profile template specification are listed and defined in Appendix B and towards the bottom of table 2 (after the block of variable declarations). Importantly, this set of global metadata attributes is common across all NCEI .nc template types and is based on CF1.6 and ACDD 1.3 standards. This includes recommendations on the disposition of individual attributes as either required, recommended or optional elements. Template attributes are also fully consistent with interoperability standards specifications for geospatial data at the variable level as well.

It is important to recognize, however, that these standards, and by extension the NCEI templates, principally have a geospatial metadata emphasis with limited support for important, ancillary metadata of other kinds. In the case of electronic tagging but also numerous other oceanographic application, archival and valid interpretation of the observational data requires that domain/community specific attributes also be maintained in a standard manner within self-describing data files additional to the set of complementary geospatial attributes. Standards for the representation/packaging of information rich, domain specific metadata do not currently exist, and it is important that a framework for handling be developed in order to avoid *ad hoc* approaches by data producers. Such an initial specification proposal in the context of electronic tagging data has been developed by the OIIP project and is described in the OIIP technical report "*OIIP_Deliverable1.2_TagMetadata_20170207.docx* ". In future and assuming buy-in by the relevant standards authorities and stakeholders, this framework could become the basis for extension of the template CDLs for systematic accommodation of ancillary non-geospatial metadata attributes for earth science data applications more generally.

An observation regarding global attribute metadata specifications applicable to the NCEI templates more broadly: several of these templates provide support for multiple sets of observations associated with

"feature" instances. In the case of the trajectory profile templates, indexing of data arrays by a trajectory ID that is related to a defined trajectory variable is an example of how multiple trajectories are supported by the templates. Some care, however, is advised when using a single file to store data for multiple trajectories because some global attributes may only apply to discrete features or collections that are closely comparable. Packaging trajectory-profile information from multiple tag deployments of different make/model and species would pose a potential problem for entries to the Instrument and Platform global attributes (ie. which trajectory is associated with which tag deployment). The inclusion of more comprehensive metadata documenting aspects of tag deployments more completely, as for example is advocated in the OIIP tag metadata specification, will effectively insure that in practice only a single tag dataset or trajectory will be possible per data file.

Data Organization & Representation

Of the available trajectory-profile template types proposed by NCEI, it is the "incomplete" multidimensional array version of this template more specifically that applies best to electronic tagging data. This is because this implementation does not necessitate a set/uniform depth interval specification, which is a requirement of the alternative "orthogonal" form. The CDL specification of this incomplete trajectory profile template is given in Appendix B, table 2. While the CF standard prescribes the alternative contiguous ragged array and indexed ragged array representations to pack data more compactly, the current NCEI v2.0 templates (including trajectory profile) are based on the less space efficient but simpler to understand multidimensional array representation.

Unlike archival data series which are appropriately modelled by the trajectory profile template, summarized pop-up satellite archival (PSAT) data pose a challenge to NCEI template application. The reason is that neither the NCEI trajectory profile specification nor the underlying CF standards currently provide support for bin-frequency or interval value range (PDT) type summary data. Although beyond the scope of this particular document, future work by the OIIP project may suggest a possible schema for representations of such summarized data within netCDF files as an extension of existing standards and template specifications.

5 Conclusions

A review of the NCEI templates relative to a representative range of electronic tagging data types and manufacturers has indicated the following:

- The trajectory-profile “incomplete multidimensional array” template is generally well suited for use with data from archival tags. A ragged array version of this template would, however, provide for more efficient storage. This may be important for longer deployments and potentially more voluminous data series from future generation tag sensors. SPOT tag datasets, that in and of themselves are not depth resolved, are best accommodated by the simpler trajectory template type. Support for data from double tag deployments is feasible since multiple trajectories are accommodated by the NCEI template types.

- Currently, the CF standard and NCEI templates provide no support for packaging of the kinds of summary data (eg. bin-frequency, PDT) that may be the only end product from pop-up satellite tag deployments (PSAT). Development of standards accommodating such core classes of summary data representation would be of general value, and is something that OIIP will investigate in future.

- While NCEI templates share a common set of global and variable level metadata consistent with geospatial metadata standards such as CF and ACDD, there are currently limited if any guidelines for supporting the range of domain specific attributes. Such information rich metadata are necessary to properly document eTag deployments and interpret stored data from both a data stewardship and interoperability perspective. Given its importance to other earth science data applications as well, OIIP is working on developing such a metadata framework and draft specification that could in future be generally applicable.

- Some discretion is necessary when packaging multiple series within single data files because of potential constraints by certain global attributes that effectively are series specific. Once ancillary eTag specific attributes are introduced, applicability of multiple trajectories or feature instances will likely no longer be feasible for current template architectures since these metadata will be feature specific.

Appendix A

Representative illustrations of archival and summarized popup (PSAT) data files from a range of models and manufacturers showing the typical contents and organization of associated electronic tag metadata and data.

Archival Data Formats

Figure 2. LOTEK Archival Tag Data Files. [Top] Geophysical sensor, depth and time stamp columnar data . [Bottom] Light based geolocation data with mission day and associated daily summary geophysical data. Linkage between detailed archival geophysical values (light, internal body temperature, ambient water temperature, light level) at depth time series is via mission day fields.

Block Number	Mission Day	Second of Day	Depth - dBar	Light at Depth	Light at Surface	Light Too Dim	Int Temp deg C	Ext Temp deg C	Timestamp
0	0	82500	1	345	374.15	0	24.57	23.39	10/4/2002 22:55
0	0	82560	4	348	379.28	0	25.38	25.28	10/4/2002 22:56
0	0	82620	3	348	378.57	0	25.63	25.39	10/4/2002 22:57
0	0	82680	3	348	378.57	0	25.77	25.12	10/4/2002 22:58
0	0	82740	3	349	379.57	0	25.79	24.85	10/4/2002 22:59
0	0	82800	3	348	378.57	0	25.79	24.58	10/4/2002 23:00
0	0	82860	2	348	377.86	0	25.72	24.33	10/4/2002 23:01
0	0	82920	2	351	380.86	0	25.68	24.13	10/4/2002 23:02
0	0	82980	3	355	385.57	0	25.57	23.86	10/4/2002 23:03
0	0	83040	3	355	385.57	0	25.5	23.64	10/4/2002 23:04
0	0	83100	3	355	385.57	0	25.38	23.5	10/4/2002 23:05
0	0	83160	3	351	381.57	0	25.27	23.37	10/4/2002 23:06
0	0	83220	3	353	383.57	0	25.18	23.35	10/4/2002 23:07

Sunrise UT	Sunset UT	Longitude	Latitude (-	Noon Ligh	Night Ligh	SST Media	Depth For	Opacity - a	Opacity - l	Max Temp	Max Depth	Min Depth	Low Lim M	Time Serie	Mission D	Clock Adju	Battery Vo	Activity M	Condition	T S Pointer
16:05	0:00			393	0	25.28	4	0	0	25.39	4	-1	-1	1	0	0	3.231	40	255	0
0:00	23:41			0	0	94.18	4055	45.01	45.01	23.39	2	-1	-1	1	1	0	3.18	0	255	66
0:00	0:00			0	0	94.18	4055	45.01	45.01	23.21	3	-1	-1	1	2	0	3.178	0	255	1506
0:00	0:00			0	0	94.18	4055	45.01	45.01	23.73	2	-1	-1	0	3	0	3.178	40	255	-1
0:00	0:00			0	0	94.18	4055	45.01	45.01	26.44	3	-1	-1	1	4	0	3.2	40	255	4386
0:00	0:00			0	0	94.18	4055	45.01	45.01	28.92	3	-1	-1	0	5	0	3.13	40	255	-1
0:00	0:00			0	0	94.18	4055	45.01	45.01	20.95	1	-2	-2	1	6	0	3.129	0	255	7266
0:00	0:00			0	0	94.18	4055	45.01	45.01	22.35	2	-2	-2	0	7	0	3.151	0	255	-1
0:00	0:00			0	0	94.18	4055	45.01	45.01	24.56	2	-1	-1	1	8	0	3.169	0	255	10146
13:27	0:00			474	0	24.64	4	35.16	35.16	24.82	61	-1	-1	0	9	0	3.171	15	250	-1
13:19	1:18	-113.1	21.6	462	0	24	6	43.57	43.57	25.12	67	1	32	1	10	0	3.162	15	250	13026
13:21	1:17	-113.3	23	458	0	23.53	6	45.01	45.01	24.62	72	1	26	0	11	0	3.156	17	255	-1
13:22	1:16	-113.3	23.4	457	0	24.26	5	46.55	12.94	24.91	98	0	29	1	12	0	3.156	17	237	15906
13:21	1:19	-113.6	20.2	454	0	23.86	5	39.57	27.4	24.85	288	0	25	0	13	0	3.158	18	236	-1
13:25	1:15	-113.7	24.4	458	0	23.62	5	35.46	29.47	24.87	99	0	25	1	14	0	3.159	17	241	18786
13:22	1:12	-113	23.7	462	0	24.08	5	32.9	25.05	25.57	183	0	24	0	15	0	3.168	17	241	-1
13:23	1:12	-113.2	23.4	469	0	24.62	4	30.12	50.57	25.41	246	-1	14	1	16	0	3.135	18	233	21666
13:29	1:13	-114.1	25.5	445	0	23.06	5	51.52	22.08	24.06	108	0	28	0	17	0	3.133	17	242	-1
13:28	1:12	-113.9	24.8	446	0	23.91	4	50.88	30.01	23.95	117	-1	0	1	18	0	3.146	16	249	24546
13:26	1:09	-113.3	24.8	454	0	23.46	5	42.45	28.15	23.75	178	0	1	0	19	0	3.125	19	244	-1
13:29	1:09	-113.7	25.5	454	0	22.53	4	37.58	28.25	23.39	168	-1	38	1	20	0	3.138	18	245	27426

Figure 3. Wildlife Computers Archival Tag Data Files. [Top] Geophysical sensor data (light, internal body temperature, ambient water temperature, light level), depth and time stamp columnar data . [Bottom] Light based geolocation data with mission day and associated daily summary geophysical data. Linkage between detailed archival geophysical values at depth time series is via date/time fields.

	A	B	C	D	E
1	; SN 03900175				
2	; MK9 HW 1.3 SW 1.7.				
3	; Records 0 to 302422 of 789318				
4	Date	Depth	Recorder Temp	Stalk Temp	Light Level
5	38435.68	-1	24.3	23.05	137
6	38435.68	-1	25.15	22.35	126
7	38435.68	-1.5	24.9	21.7	126
8	38435.68	-1.5	24.45	21.45	125
9	38435.68	-0.5	24.1	22.05	140
10	38435.68	-0.5	23.95	22.5	142
11	38435.69	-1	23.85	22.75	141
12	38435.69	-0.5	23.7	22.75	141
13	38435.69	-0.5	23.65	22.7	140
14	38435.69	-0.5	23.55	22.65	141
15	38435.69	0	23.5	22.55	140
16	38435.69	0	23.45	22.5	140
17	38435.69	0	23.4	22.6	139
18	38435.69	0	23.35	22.65	138
19	38435.69	-0.5	23.35	22.55	142
20	38435.69	0	23.3	22.55	140

	A	B	C	D
1	datetimestamp	mptlat	mptlon	generic
2	4/14/2005	-1.94	-95.18	
3	4/15/2005	-2.13782	-95.122	
4	4/16/2005	-2.38613	-95.187	
5	4/17/2005	-2.63765	-95.268	
6	4/18/2005	-3.01094	-95.277	
7	4/19/2005	-3.34918	-95.239	
8	4/20/2005	-3.60097	-95.178	
9	4/21/2005	-3.64518	-95.282	
10	4/22/2005	-3.70406	-95.475	
11	4/23/2005	-3.62236	-95.244	
12	4/24/2005	-3.48975	-95.331	
13	4/25/2005	-3.36898	-95.08	
14	4/26/2005	-3.26997	-95.306	
15	4/27/2005	-3.36607	-95.393	
16	4/28/2005	-3.66048	-95.401	

Figure 4. Microwave Telemetry Archival Tag Data Files. [Top/Middle] Geophysical sensor time series at depth data (ambient temperature, pressure, light). Lower and higher frequency data sampling records in the Archival and Real-time blocks respectively. [Bottom] Light based geolocation positional estimates at time. Linkage between detailed geophysical values and positional data is via available matching date/time field values.

Archival Data					
Date/Time	Temp(val)	Temp(C)	Delta(val)	Δ Lim +Temp	Δ Lim -Temp
4/14/13 16:00	189	26.92	0		
4/14/13 16:15	206	30.09	0		
4/14/13 16:30	214	31.65	0		
4/14/13 16:45	191	27.28	0		
4/14/13 17:00	189	26.92	0		
4/14/13 17:15	189	26.92	-17		
4/14/13 17:30	189	26.92	-25		
4/14/13 17:45	189	26.92	-2		
4/14/13 18:00	189	26.92	X		
4/14/13 18:15	189	26.92	X		
4/14/13 18:30	188	26.73	X		
4/14/13 18:45	189	26.92	X		
4/14/13 19:00	188	26.73	-1		
4/14/13 19:15	188	26.73	-1		
4/14/13 19:30	188	26.73	0		

Real-Time Data		
Date/Time	Temp(val)	Temp(C)
4/28/13 15:22	179	25.13
4/28/13 19:32	181	25.48
4/28/13 23:54	179	25.13
4/29/13 02:32	179	25.13
4/29/13 02:40	179	25.13
4/29/13 04:07	179	25.13
4/29/13 06:34	179	25.13
4/29/13 08:01	179	25.13
4/29/13 09:45	179	25.13
4/29/13 10:25	179	25.13
4/29/13 10:33	179	25.13
4/29/13 14:54	179	25.13
4/29/13 15:17	179	25.13
4/29/13 19:19	183	25.84
4/29/13 19:35	183	25.84

	Archival Data						
2	Date/Time	Press(val)	Gain	Depth(m)	Delta(val)	Δ Lim Dives	Δ Lim Ascents
3	4/14/13 16:00	131	1	-6.1	0		
4	4/14/13 16:15	122	1	0.0	0		
5	4/14/13 16:30	122	1	0.0	0		
6	4/14/13 16:45	134	1	-8.1	0		
7	4/14/13 17:00	131	1	-6.1	0		
8	4/14/13 17:15	135	1	-8.7	13		
9	4/14/13 17:30	130	1	-5.4	8		
10	4/14/13 17:45	129	1	-4.7	-5		
11	4/14/13 18:00	129	1	-4.7	X		
12	4/14/13 18:15	127	1	-3.4	X		
13	4/14/13 18:30	128	1	-4.0	X		
14	4/14/13 18:45	127	1	-3.4	X		
15	4/14/13 19:00	136	1	-9.4	7		
16	4/14/13 19:15	126	1	-2.7	-1		
17	4/14/13 19:30	125	1	-2.0	-3		
18	4/14/13 19:45	128	1	-4.0	1		

Real-Time Data		
Date/Time	Press(val)	Depth(m)
4/28/13 15:22	61	0.0
4/28/13 19:32	61	0.0
4/28/13 23:54	61	0.0
4/29/13 02:32	61	0.0
4/29/13 02:40	61	0.0
4/29/13 04:07	61	0.0
4/29/13 06:34	61	0.0
4/29/13 08:01	61	0.0
4/29/13 09:45	61	0.0
4/29/13 10:25	61	0.0
4/29/13 10:33	61	0.0
4/29/13 14:54	61	0.0
4/29/13 15:17	61	0.0
4/29/13 19:19	61	0.0
4/29/13 19:35	61	0.0
4/29/13 23:34	61	0.0

1	pointid	dataname	year	month	day	mptlon	mptlat	varlon	vxy	vyx	varlat	taglon	taglat	tagsst	mptsst	kfsst
2	1	fit	2013	4	14	273.4	21.38	0	0	0	0	273.4	21.38		26.6453	
3	2	fit	2013	4	15	273.486	21.435	0.055602	0.010473	0.010473	0.097179	272.9351	9.537354	26.79775	26.6713	
4	3	fit	2013	4	16	273.739	21.5776	0.065383	0.021683	0.021683	0.153646	273.3701	20.59814	26.80042	26.7477	
5	4	fit	2013	4	17	274.135	21.7501	0.069197	0.027922	0.027922	0.182923	273.8067	21.97876	27.06307	26.8631	
6	5	fit	2013	4	18	274.495	22.0153	0.073384	0.029027	0.029027	0.192448	273.87	21.85181	27.21028	26.9328	
7	6	fit	2013	4	19	274.93	22.415	0.07659	0.026923	0.026923	0.186319	274.5601	23.9624	27.22683	26.959	
8	7	fit	2013	4	20	275.351	22.9126	0.080825	0.022871	0.022871	0.162781	275.2519	23.37524	27.12098	26.8764	
9	8	fit	2013	4	21	275.701	23.4816	0.085494	0.018517	0.018517	0.11929	275.6957	21.10596	26.90876	27.1186	
10	9	fit	2013	4	22	276.259	23.8208	0.089535	0.008558	0.008558	0.070987	277.6413	16.09131	26.8081	26.8921	
11	10	fit	2013	4	23	276.012	24.1417	0.090435	-0.00142	-0.00142	0.045068	276.089	24.17664	26.67905	26.6597	
12	11	fit	2013	4	24	275.722	24.5581	0.090847	-0.0044	-0.0044	0.039798	275.7887	25.16846	26.21709	26.3583	
13	12	fit	2013	4	25	275.374	24.7552	0.08983	-0.00783	-0.00783	0.036167	275.2405	24.65271	26.21133	26.2359	
14	13	fit	2013	4	26	275.105	24.9402	0.086052	-0.01016	-0.01016	0.036662	274.6945	26.96167	26.13914	26.1177	
15	14	fit	2013	4	27	275.099	25.111	0.070385	-0.00843	-0.00843	0.035633	275.1506	26.45386	25.98231	25.9783	

Figure 5. Wildlife Computers PSAT Bin-Frequency Summary Data. Summarized bin-frequency temperature and depth distribution data for pre-programmed time intervals and bin classes (12-14). Daily light-based geolocation positional estimates are not shown here (equivalent to those in figure 2). Linkage between detailed geophysical values and positional data is via available matching date/time field values.

DeployID	Ptt	DepthSen	Source	Instr	HistType	Date	Time Offs	Count	BadTherm	LocationQ	Latitude	Longitude	NumBins	Sum	Bin1	Bin2	Bin3	Bin4	Bin5	Bin6	Bin7	Bin8	Bin9	Bin10	Bin11
113674	113674		Transmiss	MiniPAT	TATLIMITS										8	12	14	16	18	20	22	26	26	28	30
113674	113674		Transmiss	MiniPAT	TAT	1/25/2012 16:00	0	1					11	100	0	0	0	0	0	0	0	100	0	0	0
113674	113674		Transmiss	MiniPAT	TAT	1/26/2012 0:00	0	1					11	100	0	0	0	0	0	0	0	1	0	99	0
113674	113674		Transmiss	MiniPAT	TAT	1/26/2012 6:00	0	1					11	100	0	0	0	0	0	0	0	0	0	100	0
113674	113674		Transmiss	MiniPAT	TAT	1/26/2012 12:00	0	1					11	100	0	0	0	0	0	0	0	50.5	0	49.5	0
113674	113674		Transmiss	MiniPAT	TAT	1/26/2012 18:00	0	1					11	100	0	0	0	0	0	0	0	1	0	99	0
113674	113674		Transmiss	MiniPAT	TAT	1/27/2012 0:00	0	2					11	100	0	0	0	0	0	0	0	14.1	0	85.9	0
113674	113674		Transmiss	MiniPAT	TAT	1/27/2012 6:00	0	1					11	100	0	0	0	0	0	0	0	88.9	0	11.1	0
113674	113674		Transmiss	MiniPAT	TAT	1/27/2012 12:00	0	1					11	100	0	0	0	0	0	0	0	18.2	0	81.8	0
113674	113674		Transmiss	MiniPAT	TAT	1/28/2012 6:00	0	1					11	100	0	0	0	0	0	0	0	97	0	3	0
113674	113674		Transmiss	MiniPAT	TAT	1/28/2012 12:00	0	1					11	100	0	0	0	0	0	0	0	41.4	0	58.6	0
113674	113674		Transmiss	MiniPAT	TAT	1/28/2012 18:00	0	1					11	100	0	0	0	0	0	0	0	6.1	0	93.9	0
113674	113674		Transmiss	MiniPAT	TAT	1/29/2012 18:00	0	1					11	100	0	0	0	0	0	0	0	0	0	100	0
113674	113674		Transmiss	MiniPAT	TAT	1/30/2012 6:00	0	1					11	100	0	0	0	0	0	0	0	48.5	0	51.5	0
113674	113674		Transmiss	MiniPAT	TAT	1/30/2012 18:00	0	1					11	100	0	0	0	0	0	0	0	0	0	100	0
113674	113674		Transmiss	MiniPAT	TAT	1/31/2012 0:00	0	1					11	100	0	0	0	0	0	0	0	0	0	100	0
113674	113674		Transmiss	MiniPAT	TAT	1/31/2012 6:00	0	1					11	100	0	0	0	0	0	0	0	0	0	100	0
113674	113674		Transmiss	MiniPAT	TAT	1/31/2012 12:00	0	1					11	100	0	0	0	0	0	0	0	7.1	0	92.9	0
113674	113674		Transmiss	MiniPAT	TAT	2/1/2012 6:00	0	1					11	100	0	0	0	0	0	0	0	0	0	100	0
113674	113674		Transmiss	MiniPAT	TAT	2/4/2012 0:00	0	1					11	100	0	0	0	0	0	0	0	58.6	0	41.4	0
113674	113674		Transmiss	MiniPAT	TAT	2/4/2012 6:00	1	3					11	100	0	0	0	0	0	0	0	96	0	4	0
113674	113674		Transmiss	MiniPAT	TAT	2/4/2012 12:00	1	2					11	100	0	0	0	0	0	0	0	49.5	0	50.5	0
113674	113674		Transmiss	MiniPAT	TAT	2/4/2012 18:00	1	1					11	100	0	0	0	0	0	0	0	8.1	0	91.9	0
113674	113674		Transmiss	MiniPAT	TAT	2/6/2012 6:00	1	1					11	100	0	0	0	0	0	0	0	100	0	0	0
113674	113674		Transmiss	MiniPAT	TAT	2/6/2012 12:00	1	1					11	100	0	0	0	0	0	0	0	90.9	0	9.1	0

Figure 6. Wildlife Computers PSAT Summary PDT Data. Summarized Pressure/Depth/Temperature (PDT - Profile of Depth and Temperature) min/max range values for pre-programmed time intervals. Daily light based geolocation positional estimates are not shown here (equivalent to those in figure 2). Linkage between detailed geophysical values and positional data is via available matching date/time field values.

DeployID	Ptt	DepthSen	Source	Instr	Date	Time Offs	Count	LocationQ	Latitude	Longitude	BadTherm	NumBins	Partial	Depth1	MinTemp	MaxTemp	%Ox1	Discont1	Depth2	MinTemp	MaxTemp	%Ox2	Discont2	Depth3	MinTemp	MaxTemp
113674	113674		Transmiss	MiniPAT	########	0	1					3		0	26	26.4			8	26	26.4			24	26	26.4
113674	113674		Transmiss	MiniPAT	########	0	1					3		0	26.2	26.4			8	26	26.4			32	26	26.4
113674	113674		Transmiss	MiniPAT	########	0	1					3		0	26	26.4			8	26.2	26.4			32	26.2	26.4
113674	113674		Transmiss	MiniPAT	########	0	1					3		0	25.8	26.2			8	25.8	26.2			24	25.8	26.2
113674	113674		Transmiss	MiniPAT	########	0	1					3		0	26.2	26.4			8	26.2	26.4			24	26	26.4
113674	113674		Transmiss	MiniPAT	########	0	1					3		0	26	26.4			8	26	26.4			24	26	26.4
113674	113674		Transmiss	MiniPAT	########	0	1					3		0	25.8	26.2			8	25.8	26			24	25.8	26
113674	113674		Transmiss	MiniPAT	########	0	1					3		0	26	26.2			8	26	26.2			24	25.8	26
113674	113674		Transmiss	MiniPAT	########	0	1					3		0	25.8	26			8	25.8	26			24	25.6	25.8
113674	113674		Transmiss	MiniPAT	########	0	1					3		0	25.8	26			8	25.6	26			32	25.2	25.2
113674	113674		Transmiss	MiniPAT	########	0	1					3		0	26	26.4			8	26	26.4			32	25.6	25.8
113674	113674		Transmiss	MiniPAT	########	0	1					3		0	25.6	26.4			8	25.6	26.4			24	25.6	26.2
113674	113674		Transmiss	MiniPAT	########	0	1					3		0	26.2	26.6			8	26.2	26.6			24	26.2	26.4
113674	113674		Transmiss	MiniPAT	########	0	1					3		0	26.2	26.4			8	26.2	26.4			24	25.8	26.4
113674	113674		Transmiss	MiniPAT	########	0	1					3		0	26	26.4			8	26	26.4			24	25.2	26.2
113674	113674		Transmiss	MiniPAT	########	0	1					3		0	26	26.4			8	26	26.4			24	25.6	26.4
113674	113674		Transmiss	MiniPAT	########	0	1					3		0	26.2	26.4			8	26.2	26.4			24	26.2	26.4
113674	113674		Transmiss	MiniPAT	########	0	1					3		0	26.2	26.4			8	26.2	26.4			24	26.2	26.4
113674	113674		Transmiss	MiniPAT	########	0	1					3		0	26	26.4			8	26	26.4			24	26	26.4
113674	113674		Transmiss	MiniPAT	########	0	1					3		0	26	26.4			8	26	26.4			32	26.4	26.4
113674	113674		Transmiss	MiniPAT	########	0	1					3		0	25.8	26.4			8	25.8	26.4			24	25.8	26.4
113674	113674		Transmiss	MiniPAT	########	0	1					3		0	26.2	26.4			8	26.2	26.4			24	26.2	26.4

Appendix B

NCEI Trajectory Profile Template CDL

Table 2. CDL for the NCEI trajectory profile template using the "Incomplete" multidimensional array representation. This representation is used when the variables of a dataset contain different coordinate values along an axis, useful in cases where profiles with different vertical resolution or levels are to be stored in the same netCDF file. This is the most applicable to eTag archival datasets that are essentially of type trajectory profile, although ragged-array representations would likely most efficiently store archival tag data. CDL templates of this form are not currently available from NCEI, making the TracjectoryProfile_Incomplete the best available match at this time.

netcdf NCEI_TrajectoryProfile_Incomplete {

dimensions:

obs = <dim1> ;

trajectory = <dim2> ;

nzMax = <dim3> ;

variables:

int trajectory(trajectory); //..... RECOMMENDED - If using the attribute below: cf_role. Data type can be whatever is appropriate for the unique feature type.

trajectory:long_name = "Unique identifier for each feature instance"; //..... RECOMMENDED

trajectory:cf_role = "trajectory_id"; //..... RECOMMENDED

double time(trajectory, obs) ;//..... Depending on the precision used for the variable, the data type could be int or double instead of float.

time:long_name = "" ; //..... RECOMMENDED - Provide a descriptive, long name for this variable.

time:standard_name = "time" ; //..... REQUIRED - Do not change

time:units = "seconds since 1970-01-01 00:00:00 0:00" ; //... REQUIRED - Use approved CF convention with approved UDUNITS.

time:calendar = "julian" ; //..... REQUIRED - IF the calendar is not default calendar, which is "gregorian".

time:axis = "T" ; //..... REQUIRED - Do not change.

time:_FillValue = 0.0f;//..... REQUIRED if there could be missing values in the data.

time:ancillary_variables = "" ; //..... RECOMMENDED - List other variables providing information about this variable.

time:comment = "" ; //..... RECOMMENDED - Add useful, additional information here.

float lat(trajectory, obs) ;//..... Depending on the precision used for the variable, the data type could be int or double instead of float.

lat:long_name = "" ; //..... RECOMMENDED - Provide a descriptive, long name for this variable.

lat:standard_name = "latitude" ; //..... REQUIRED - Do not change.

lat:units = "degrees_north" ; //..... REQUIRED - CF recommends degrees_north, but at least must use UDUNITS.

lat:axis = "Y" ; //..... REQUIRED - Do not change.

lat:valid_min = 0.0f ; //..... RECOMMENDED - Replace with correct value.

lat:valid_max = 0.0f ; //..... RECOMMENDED - Replace with correct value.

lat:_FillValue = 0.0f;//..... REQUIRED if there could be missing values in the data.

lat:ancillary_variables = "" ; //..... RECOMMENDED - List other variables providing information about this variable.

lat:comment = "" ; //..... RECOMMENDED - Add useful, additional information here.

float lon(trajectory, obs) ; //..... Depending on the precision used for the variable, the data type could be int or double instead of float.

lon:long_name = "" ; //..... RECOMMENDED

lon:standard_name = "longitude" ; //..... REQUIRED - This is fixed, do not change.

lon:units = "degrees_east" ; //..... REQUIRED - CF recommends degrees_east, but at least use UDUNITS.

lon:axis = "X" ; //..... REQUIRED - Do not change.

lon:valid_min = 0.0f ; //..... RECOMMENDED - Replace this with correct value.

lon:valid_max = 0.0f ; //..... RECOMMENDED - Replace this with correct value.

lon:_FillValue = 0.0f;//..... REQUIRED if there could be missing values in the data.

lon:ancillary_variables = "" ; //..... RECOMMENDED - List other variables providing information about this variable.

lon:comment = "" ; //..... RECOMMENDED - Add useful, additional information here.

float z(trajectory, obs, nzMax) ;//..... Depending on the precision used for the variable, the data type could be int or double instead of float. Also the variable "z" could be substituted with a more descriptive name like "depth", "altitude", "pressure", etc.

z:long_name = "" ; //..... RECOMMENDED - Provide a descriptive, long name for this variable.

z:standard_name = "" ; //..... REQUIRED - Usually "depth" or "altitude" is used.

z:units = "" ; //..... REQUIRED - Use UDUNITS.

z:axis = "Z" ; //..... REQUIRED - Do not change.

z:positive = "" ; //..... REQUIRED - Use "up" or "down".

z:valid_min = 0.0f ; //..... RECOMMENDED - Replace with correct value.

z:valid_max = 0.0f ; //..... RECOMMENDED - Replace with correct value.

z:ancillary_variables = "" ; //..... RECOMMENDED - List other variables providing information about this variable.

z:comment = "" ; //..... RECOMMENDED - Add useful, additional information here.

float geophysical_variable_1(trajectory, obs, nzMax) ;//..... This is an example of how each and every geophysical variable in the file should be represented. Replace the name of the variable("geophysical_variable_1") with a suitable name. Replace "float" by data type which is appropriate for the variable.

geophysical_variable_1:long_name = "" ; //..... RECOMMENDED - Provide a descriptive, long name for this variable.

geophysical_variable_1:standard_name = "" ; //..... REQUIRED - If using a CF standard name and a suitable name exists in the CF standard name table.

geophysical_variable_1:ncei_name = "" ; //..... RECOMMENDED - From the ncei variables vocabulary, if standard_name does not exist.

geophysical_variable_1:units = "" ; //..... REQUIRED - Use UDUNITS compatible units.

geophysical_variable_1:scale_factor = 0.0f ; //..... REQUIRED if the data uses a scale_factor other than 1.The data type should be the data type of the variable.

geophysical_variable_1:add_offset = 0.0f ; // ..... REQUIRED if the data uses an add_offset other than 0. The data type should be the data type of the variable.

geophysical_variable_1:_FillValue = 0.0f ; //..... REQUIRED if there could be undefined values in the data.

geophysical_variable_1:missing_value = 0.0f ; //..... RECOMMENDED if there could be missing values in the data. Not necessary if there is only one value which is the same as _FillValue.

geophysical_variable_1:valid_min = 0.0f ; //..... RECOMMENDED - Replace with correct value.

geophysical_variable_1:valid_max = 0.0f ; //..... RECOMMENDED - Replace with correct value.

geophysical_variable_1:coordinates = "time lat lon z" ; //... REQUIRED - Include the auxiliary coordinate variables and optionally coordinate variables in the list. The order itself does not matter. Also, note that whenever any auxiliary coordinate variable contains a missing value, all other coordinate, auxiliary coordinate and data values corresponding to that element should also contain missing values.

geophysical_variable_1:coverage_content_type = "" ; // .... RECOMMENDED - An ISO 19115-1 code to indicate the source of the data (image, thematicClassification, physicalMeasurement, auxiliaryInformation, qualityInformation, referenceInformation, modelResult, or coordinate). (ACDD)

geophysical_variable_1:grid_mapping = "crs" ; //..... RECOMMENDED - It is highly recommended that the data provider put the data in a well known geographic coordinate system and provide the details of the coordinate system.

geophysical_variable_1:source = "" ; //..... RECOMMENDED - The method of production of the original data

geophysical_variable_1:references = "" ; //..... RECOMMENDED - Published or web-based references that describe the data or methods used to produce it.

geophysical_variable_1: cell_methods = "" ; // ..... RECOMMENDED - Use the coordinate variables to define the cell values (ex., "time: point lon: point lat: point z: point").

geophysical_variable_1:ancillary_variables = "instrument_parameter_variable platform_variable boolean_flag_variable enumerated_flag_variable" ; //..... RECOMMENDED - Identify the variable name(s) of the flag(s) and other ancillary variables relevant to this variable. Use a space-separated list.

geophysical_variable_1:platform = "platform_variable" ; //... RECOMMENDED - Refers to name of variable containing information on the platform from which this variable was collected.

geophysical_variable_1:instrument = "instrument_variable";//..RECOMMENDED - Refers to name of variable containing information on the instrument from which this variable was collected.

geophysical_variable_1:comment = "" ; //..... RECOMMENDED - Add useful, additional information here.

byte boolean_flag_variable(trajectory, obs, nzMax); //..... A boolean flag variable, in which each bit of the flag can be a 1 or 0.

boolean_flag_variable:standard_name= "" ; //..... RECOMMENDED - This attribute should include the standard name of the variable which this flag contributes plus the modifier: "status_flag" (for example, "sea_water_temperature status_flag"). See CF standard name modifiers.

boolean_flag_variable:long_name = "" ; //..... RECOMMENDED - Provide a descriptive, long name for this variable.

boolean_flag_variable:flag_masks = ; //..... REQUIRED - Provide a comma-separated list describing the binary condition of the flags.

boolean_flag_variable:flag_meanings = "" ; //..... REQUIRED - Provide a comma-separated list of flag values that map to the flag_masks.

boolean_flag_variable:references = "" ; //..... RECOMMENDED - Published or web-based references that describe the data or methods used to produce it.

boolean_flag_variable:comment = "" ; //..... RECOMMENDED - Add useful, additional information here.

int enumerated_flag_variable(trajectory, obs, nzMax); //..... An enumerated flag variable, in which numeric values refer to defined, exclusive conditions.

enumerated_flag_variable:standard_name= "" ; //..... RECOMMENDED - This attribute should include the standard name of the variable which this flag contributes plus the modifier: "status_flag" (for example, "sea_water_temperature status_flag"). See CF standard name modifiers.

enumerated_flag_variable:long_name = "" ; //..... RECOMMENDED - Provide a descriptive, long name for this variable.

enumerated_flag_variable:flag_values = "" ; //..... REQUIRED - Provide a comma-separated list of flag values that map to the flag_meanings.

enumerated_flag_variable:flag_meanings = "" ; //..... REQUIRED - Provide a space-separated list of meanings corresponding to each of the flag_values

enumerated_flag_variable:references = "" ; //..... RECOMMENDED - Published or web-based references that describe the data or methods used to produce it.

enumerated_flag_variable:comment = "" ; //..... RECOMMENDED - Add useful, additional information here.

int platform_variable; //..... RECOMMENDED - a container variable storing information about the platform. If more than one, can expand each attribute into a variable. For example, platform_call_sign and platform_ncei_code. See instrument_parameter_variable for an example.

platform_variable:long_name = "" ; //..... RECOMMENDED - Provide a descriptive, long name for this variable.

platform_variable:comment = "" ; //..... RECOMMENDED - Add useful, additional information here.

platform_variable:call_sign = "" ; //..... RECOMMENDED - This attribute identifies the call sign of the platform.

platform_variable:ncei_code = ""; //..... RECOMMENDED - This attribute identifies the NCEI code of the platform. Look at http://www.nodc.noaa.gov/cgi-bin/OAS/prd/platform to find if NCEI codes are available.

platform_variable:wmo_code = "";//..... RECOMMENDED - This attribute identifies the wmo code of the platform. Information on getting WMO codes is available at http://www.wmo.int/pages/prog/amp/mmop/wmo-number-rules.html

platform_variable:imo_code = "";//..... RECOMMENDED - This attribute identifies the International Maritime Organization (IMO) number assigned by Lloyd's register.

int instrument_parameter_variable(trajectory); //..... RECOMMENDED - an instrument variable storing information about a parameter of the instrument used in the measurement, the dimensions don't have to be specified if the same instrument is used for all the measurements.

instrument_parameter_variable:long_name = "" ; //..... RECOMMENDED - Provide a descriptive, long name for this variable.

instrument_parameter_variable:comment = "" ; //..... RECOMMENDED - Add useful, additional information here.

double crs; //..... RECOMMENDED - A container variable storing information about the grid_mapping. All the attributes within a grid_mapping variable are described in http://cfconventions.org/Data/cf-conventions/cf-conventions-1.6/build/cf-conventions.html#grid-mappings-and-projections. For all the measurements based on WSG84, the default coordinate system used for GPS measurements, the values shown here should be used.

crs:grid_mapping_name = "latitude_longitude"; //..... RECOMMENDED

crs:epsg_code = "EPSG:4326" ; //..... RECOMMENDED - European Petroleum Survey Group code for the grid mapping name.

crs:semi_major_axis = 6378137.0d ; //..... RECOMMENDED

crs:inverse_flattening = 298.257223563d ; //..... RECOMMENDED

// global attributes:

:ncei_template_version = "NCEI_NetCDF_TrajectoryProfile_Incomplete_Template_v2.0" ; //..... REQUIRED (NCEI)

:featureType = "trajectoryProfile" ; //..... REQUIRED - CF attribute for identifying the featureType. (CF)

:title = "" ; //..... HIGHLY RECOMMENDED - Provide a useful title for the data in the file. (ACDD)

:summary = "" ; //..... HIGHLY RECOMMENDED - Provide a useful summary or abstract for the data in the file. (ACDD)

:keywords = "" ; //..... HIGHLY RECOMMENDED - A comma separated list of keywords coming from the keywords_vocabulary. (ACDD)

:Conventions = "CF-1.6, ACDD-1.3" ; //..... HIGHLY RECOMMENDED - A comma separated list of the conventions being followed. Always try to use latest version. (CF/ACDD)

:id = "" ; //..... RECOMMENDED - Should be a human readable unique identifier for data set. (ACDD)

:naming_authority = "" ; //..... RECOMMENDED - Backward URL of institution (for example, gov.noaa.ncei). (ACDD)

:history = "" ; //..... RECOMMENDED - Provides an audit trail for modifications to the original data. (ACDD)

:source = "" ; //..... RECOMMENDED - The method of production of the original data. (CF)

:processing_level = "" ; //..... RECOMMENDED - Provide a description of the processing or quality control level of the data. (ACDD)

:comment = "" ; //..... RECOMMENDED - Provide useful additional information here. (CF)

:acknowledgment = "" ; //..... RECOMMENDED - A place to acknowledge various types of support for the project that produced this data. (ACDD)

:license = "" ; //..... RECOMMENDED - Describe the restrictions to data access and distribution. (ACDD)

:standard_name_vocabulary = "CF Standard Name Table vNN" ; //..... RECOMMENDED - If using CF standard name attribute for variables. Replace NN with the CF standard name table number (CF)

:date_created = "" ; //..... RECOMMENDED - Creation date of this version of the data(netCDF). Use ISO 8601:2004 for date and time. (ACDD)

:creator_name = "" ; //..... RECOMMENDED - The name of the person (or other creator type specified by the creator_type attribute) principally responsible for creating this data. (ACDD)

:creator_email = "" ; //..... RECOMMENDED - The email address of the person (or other creator type specified by the creator_type attribute) principally responsible for creating this data. (ACDD)

:creator_url = "" ; //..... RECOMMENDED - The URL of the person (or other creator type specified by the creator_type attribute) principally responsible for creating this data. (ACDD)

:institution = "" ; //..... RECOMMENDED -The name of the institution principally responsible for originating this data.. An institution attribute can be used for each variable if variables come from more than one institution. (CF/ACDD)

:project = "" ; //..... RECOMMENDED - The name of the project(s) principally responsible for originating this data. Multiple projects can be separated by commas. (ACDD)

:publisher_name = "" ; //..... RECOMMENDED - The name of the person (or other entity specified by the publisher_type attribute) responsible for publishing the data file or product to users, with its current metadata and format. (ACDD)

:publisher_email = "" ; //..... RECOMMENDED - The email address of the person (or other entity specified by the publisher_type attribute) responsible for publishing the data file or product to users, with its current metadata and format. (ACDD)

:publisher_url = "" ; //..... RECOMMENDED - The URL of the person (or other entity specified by the publisher_type attribute) responsible for publishing the data file or product to users, with its current metadata and format. (ACDD)

:geospatial_bounds = "" ; //.....RECOMMENDED - Describes the data's 2D or 3D geospatial extent in OGC's Well-Known Text (WKT) Geometry format. (ACDD)

:geospatial_bounds_crs = "" ; //.....RECOMMENDED - The coordinate reference system (CRS) of the point coordinates in the geospatial_bounds attribute. (ACDD)

:geospatial_bounds_vertical_crs = "" ; //.....RECOMMENDED - The vertical coordinate reference system (CRS) for the Z axis of the point coordinates in the geospatial_bounds attribute. (ACDD)

:geospatial_lat_min = 0.0d ; //..... RECOMMENDED - Describes a simple lower latitude limit. (ACDD)

:geospatial_lat_max = 0.0d ; //..... RECOMMENDED - Describes a simple upper latitude limit. (ACDD)

:geospatial_lon_min = 0.0d ; //..... RECOMMENDED - Describes a simple lower longitude limit. (ACDD)

:geospatial_lon_max = 0.0d ; //..... RECOMMENDED - Describes a simple upper longitude limit. (ACDD)

:geospatial_vertical_min = 0.0d ; //..... RECOMMENDED - Describes the numerically smaller vertical limit. (ACDD)

:geospatial_vertical_max = 0.0d ; //..... RECOMMENDED - Describes the numerically larger vertical limit. (ACDD)

:geospatial_vertical_positive = "" ; //..... RECOMMENDED - Use "up" or "down". (ACDD)

:time_coverage_start = "" ; //..... RECOMMENDED - Describes the time of the first data point in the data set. Use ISO 8601:2004 for date and time. (ACDD)

:time_coverage_end = "" ; //..... RECOMMENDED - Describes the time of the last data point in the data set. Use ISO 8601:2004 for date and time.(ACDD)

:time_coverage_duration = "" ; //..... RECOMMENDED - Describes the duration of the data set. Use ISO 8601:2004 for date and time. (ACDD)

:time_coverage_resolution = "" ; //..... RECOMMENDED - Describes the targeted time period between each value in the data set. Use ISO 8601:2004 for date and time. (ACDD)

:uuid = "" ; //..... RECOMMENDED - Machine readable unique identifier for each file. A new uuid is created whenever the file is changed. (NCEI)

:sea_name = "" ; //..... RECOMMENDED - The names of the sea in which the data were collected. Use NCEI sea names table. (NCEI)

:creator_type = "" ; //..... SUGGESTED - Specifies type of creator with one of the following: 'person', 'group', 'institution', or 'position'. (ACDD)

:creator_institution = "" ; //..... SUGGESTED - The institution of the creator; should uniquely identify the creator's institution. (ACDD)

:publisher_type = "" ; //..... SUGGESTED - Specifies type of publisher with one of the following: 'person', 'group', 'institution', or 'position'. (ACDD)

:publisher_institution = "" ; //..... SUGGESTED - The institution that presented the data file or equivalent product to users; should uniquely identify the institution. (ACDD)

:program = "" ; //..... SUGGESTED - The overarching program(s) of which the dataset is a part. (ACDD)

:contributor_name = "" ; //..... SUGGESTED - The name of any individuals, projects, or institutions that contributed to the creation of this data. (ACDD)

:contributor_role = "" ; //..... SUGGESTED - The role of any individuals, projects, or institutions that contributed to the creation of this data. (ACDD)

:geospatial_lat_units = "degrees_north" ; //..... SUGGESTED - Units for the latitude axis described in "geospatial_lat_min" and "geospatial_lat_max" attributes. Use UDUNITS compatible units. (ACDD)

:geospatial_lon_units = "degrees_east"; //..... SUGGESTED - Units for the longitude axis described in "geospatial_lon_min" and "geospatial_lon_max" attributes. Use UDUNITS compatible units. (ACDD)

:geospatial_vertical_units = "" ; //..... SUGGESTED - Units for the vertical axis described in "geospatial_vertical_min" and "geospatial_vertical_max" attributes. The default is EPSG:4979. (ACDD)

:date_modified = "" ; //..... SUGGESTED - The date on which the data was last modified. Note that this applies just to the data, not the metadata. Use ISO 8601:2004 for date and time. (ACDD)

:date_issued = "" ; //..... SUGGESTED - The date on which this data (including all modifications) was formally issued (i.e., made available to a wider audience). Note that these apply just to the data, not the metadata. Use ISO 8601:2004 for date and time. (ACDD)

:date_metadata_modified = "" ; //..... SUGGESTED - The date on which the metadata was last modified. Use ISO 8601:2004 for date and time. (ACDD)

:product_version = "" ; //..... SUGGESTED - Version identifier of the data file or product as assigned by the data creator. (ACDD)

:keywords_vocabulary = "" ; //..... SUGGESTED - Identifies the controlled keyword vocabulary used to specify the values within the attribute "keywords". Example: 'GCMD:GCMD Keywords' ACDD)

:platform = "" ; //..... SUGGESTED - Name of the platform(s) that supported the sensor data used to create this data set or product. Platforms can be of any type, including satellite, ship, station, aircraft or other. (ACDD)

:platform_vocabulary = "" ; //..... SUGGESTED - Controlled vocabulary for the names used in the "platform" attribute. Example: ‘NASA/GCMD Platform Keywords Version 8.1’ (ACDD)

:instrument = "" ; //..... SUGGESTED - Name of the contributing instrument(s) or sensor(s) used to create this data set or product. (ACDD)

:instrument_vocabulary = "" ; //..... SUGGESTED - Controlled vocabulary for the names used in the "instrument" attribute. Example: ‘NASA/GCMD Instrument Keywords Version 8.1’ (ACDD)

:cdm_data_type = "Trajectory" ; //..... SUGGESTED - The data type, as derived from Unidata's Common Data Model Scientific Data types and understood by THREDDS. (ACDD)

:metadata_link = "" ; //..... SUGGESTED - A URL that gives the location of more complete metadata. A persistent URL is recommended for this attribute. (ACDD)

:references = "" ; //.....SUGGESTED - Published or web-based references that describe the data or methods used to produce it. Recommend URIs (such as a URL or DOI) for papers or other references. (CF)

}