

Standard Operating Procedure (SOP) 19: Data Dictionary version 3

Glacier Bay National Park and Preserve Oceanographic Monitoring Protocol

Change History

Previous Version #	Revision Date	Revised By	Changes	Justification	New Version #
2	February 2020	B. Johnson	Split out from monolithic protocol appendix J as a separate SOP document, with minor corrections.	Central Office guidance mandated separate SOPs be extracted from monolithic protocols.	3
1	September 2014	B. Johnson	Minor corrections.	Revised monolithic protocol OC-2014.1	2
-		B. Johnson	Initial version	For original protocol	1

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Note: this had originally been published as Appendix J within the monolithic protocol document OC-2014.1. Based on IMD Central Office guidance, it has since been extracted as an SOP where it may be more readily maintained. While not referenced in the original narrative as SOP 19, it is referenced under that name in most SOPs.

Detailed Deliverable Definitions

Deliverables are the data and information products that are validated, certified, archived, and disseminated through the Southeast Alaska Network. Scientific deliverables are typically built by the Project Leader and submitted to the Data Manager. A few technical deliverables, which are typically built using automated applications, are generated by the Data Manager. Regardless of the source, every deliverable is formally validated by the Data Manager and certified by the originator before it is made available to SEAN's customers.

In order to carry out these processes, it is necessary to define in full detail the content, nature, and domain of each deliverable. Complete definitions also support subsequent interpretation of the products by removing ambiguity.

SOP 19 defines every deliverable supported by the SEAN oceanographic program. It follows policies set in the SEAN Data Management Plan (Johnson and Moynahan 2008, SOP 302: Data Management Considerations in Protocol Development). Using that method, the top level description of a deliverable is explained using a single form named either A, B, C, or D. The specific form used for a particular deliverable depends on the nature of the deliverable's contents. Deliverables of a tabular type are further defined with a form X, where the structure of the table is described. Each individual attribute (i.e., column, field) of a table is then defined in detail using a form Y. Using this set of six forms, all data and information involved in the SEAN oceanographic program (and other SEAN programs) are consistently, precisely, and fully defined.

Each deliverable is also documented with a data flow diagram. These diagrams explain exactly where underlying data come from, what processes are applied to them, where they are stored, and who is responsible for performing each task used to create and update them.

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Purpose of Deliverable

CTD sensors are periodically calibrated. The unit as a whole is generally calibrated annually, although special circumstances may cause individual sensors to be recalibrated and reported *ad hoc*. Calibration results in a report for each sensor that provides numeric factors used to adjust actual field readings to a standardized level. A full CTD calibration typically results in the vendor providing a CON or XMLCON computer file covering multiple sensors. When ad hoc calibration of just one particular sensor is performed, results are typically provided on paper. These paper factors must then be added to the latest CON or XMLCON file using proprietary software. The ultimate deliverable, a calibration file, is used by subsequent processes to normalize field data. Providing this deliverable allows customers to generate processed CNV data from raw readings, replicate our program results, and investigate new methods of processing raw CTD data.

A new calibration file must be created after the result of any sensor recalibration is reported to the Project Leader. Note there are different process steps for handling a file provided for the CTD than there are for handling a paper report on an individual sensor.

Validation cannot be performed until the corresponding OC_G calibration certificate images have been certified.

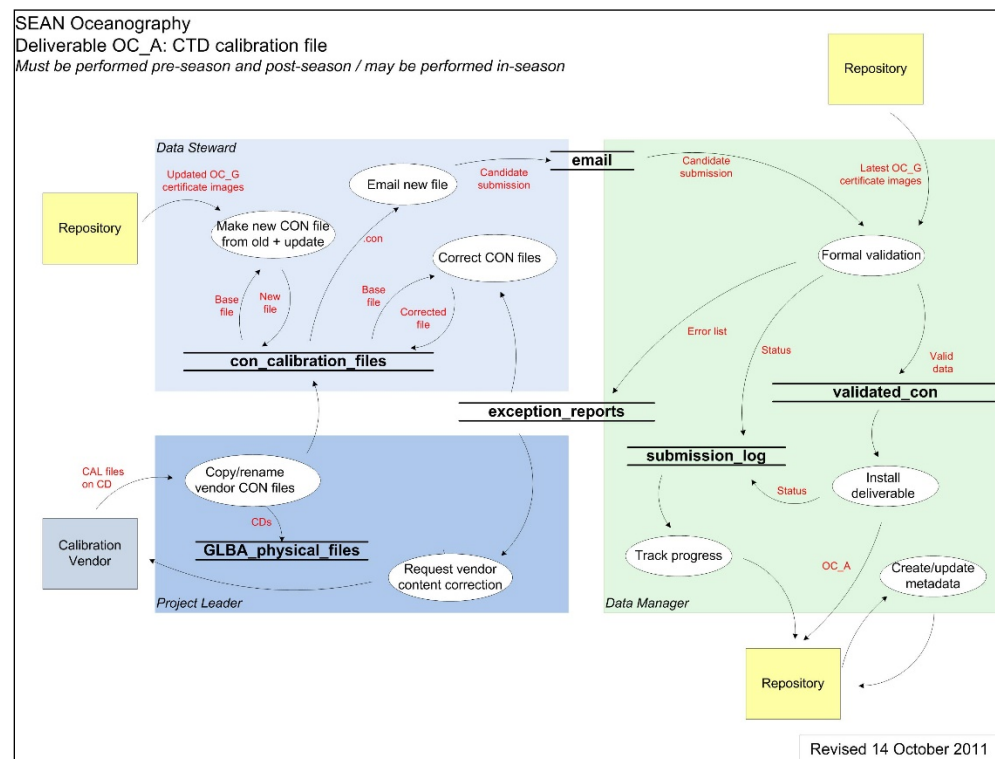


Figure 1. Data flow required to generate deliverable OC A: CON files.

Deliverable Definition Forms

Form C: Nontabular Data Deliverable

<i>Vital Sign:</i> OC Oceanography	<i>Deliverable ID:</i> OC_A	<i>Deliverable Title:</i> CON calibration files
<i>File format:</i> CON or XMLCON	<i>Associated software and version:</i> SBEDatProc.exe 7.22	<i>Revision Date / protocol version:</i> 02-07-2014 / OC-2014.1
<i>Expected frequency:</i> one per CTD per year	<i>Likely dissemination partners:</i> None: served by SEAN	<i>Submission unit:</i> CTD#+Year+Month
<i>What purpose does this deliverable serve?</i> Documents the calibration parameters for all sensors on the CTD. Needed to convert raw HEX data into binned engineering-unit CNV data (using the SBEDatProc program).		
<i>Summary of content:</i> This file uses a proprietary format. Each type of sensor requires different kinds of calibration parameters. The file contains a section for each sensor, as identified by sensor serial number. Within each section are the particular parameters appropriate to that sensor. There is also a general CTD configuration section that defines such items as the number of channels installed. The internal file format named using extension CON was employed by SEAN through 2013. The XMLCON format was used beginning in 2014. There is basically no difference in functionality between the two. For simplicity, the protocol uses the term CON to refer to either file type. The file is named using the convention C_YYMM.CON (or C_YYMM.XMLCON) where C is the single-digit CTD identifier, YY are the last two digits of the highest calendar year in the file in which any sensor was calibrated, and MM are the two-digit month of the most recent sensor calibration in the file.		
<i>Mandatory validation criteria:</i> 1. Must be able to be opened, updated, and resaved using the Config function of SBEDatProc.exe 7.22 or later. 2. Values must match those in corresponding OC_G images from the same time period.		
<i>Optional validation criteria:</i> None		
<i>Deliverable ID of any other SEAN data products required to create this product:</i> OC_G CTD calibration certificate images		
<i>Description and source of any outside data required to create this product:</i> Periodic calibration is performed by Sea-Bird Electronics, typically at the end of each season. They supply a new CON/XMLCON file after each service event. Some sensors may be revised during the season. In this case, PDF documentation is provided to permit the Data Steward to locally produce an updated CON/XMLCON file.		

Purpose of Deliverable

Frequency Produced

Data in HEX format are produced for every cast, as delineated by the cycling of the CTD's on/off switch. The data are unloaded into hex files at the end of each cruise day. Hex files are accumulated during the season. OC_B is created at the end of each season by packaging all component hex files into a single deliverable.

Prerequisites

Production of this deliverable is dependent on capturing the daily CTD data stream into intermediate files throughout the season. The final deliverable is created postseason from the saved in-season data files.

Data Flow

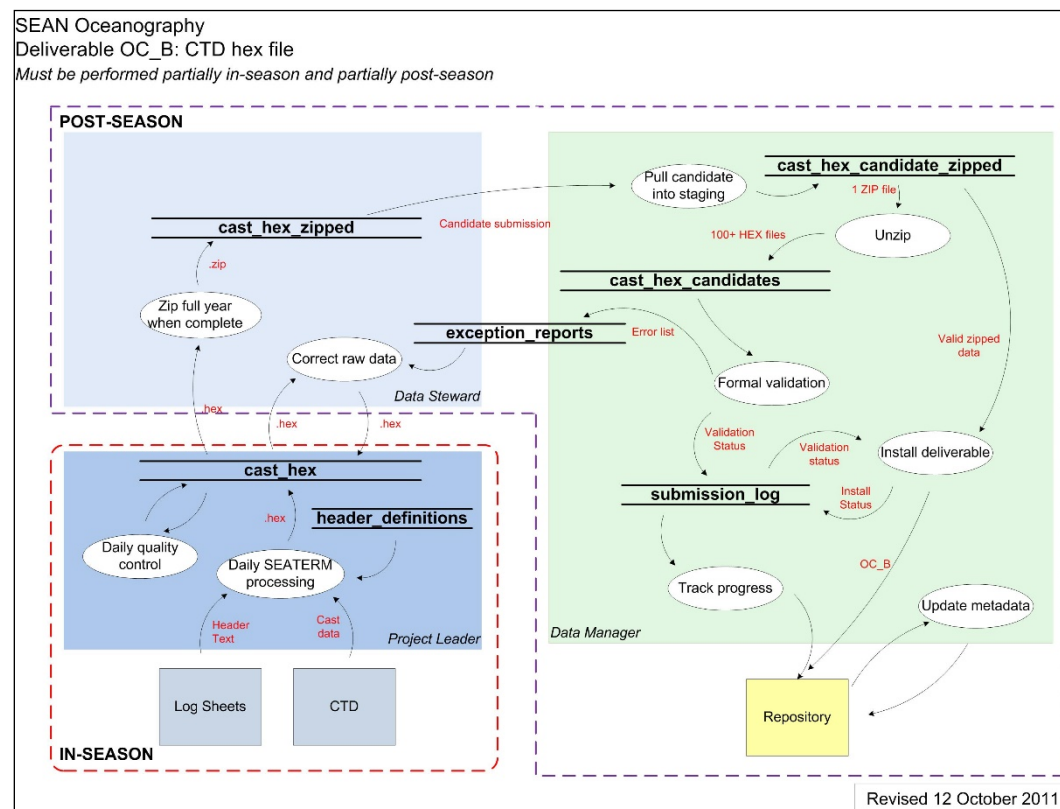


Figure 2. Data flow required to generate deliverable OC_B: HEX files.

Deliverable Definition Forms

Form D: Tabular Data Deliverable

<i>Vital Sign:</i> OC Oceanography	<i>Deliverable ID:</i> OC_B	<i>Deliverable Title:</i> Raw HEX files
<i>File format:</i> ZIP	<i>Associated software and version:</i> PKUNZIP, WINRAR, etc.	<i>Revision Date / protocol version:</i> 01-15-2014 / OC-2014.1
<i>Expected frequency:</i> 1 zip holding about 120 hex files/year	<i>Likely dissemination partners:</i> None – served by SEAN	<i>Submission unit:</i> YEAR
<i>What purpose does this deliverable serve?</i> Provides raw CTD “hex” data to inform customer analyses.		
<i>Identifiers of relations that compose the tabular deliverable (“relations” are tables or files that provide information that may be represented in a grid format. Each relation listed must be fully defined in its own accompanying Form X):</i> HEX_YYYY.ZIP is a .ZIP archive of individual cast files named “YYMM_C_DDDD_cc.HEX”, where YY is year of cast, MM is month of cast, C is local CTD number, DDDD is dump number, and cc is cast number. Leading zeroes are used to make every filename exactly 18 characters.		
<i>Deliverable ID of any other SEAN data products required to create this product:</i> None		
<i>Description and source of any outside data required to create this product:</i> Individual cast data from CTD downloads. Field log sheets recording cast particulars. SeaTerm program configuration file containing the header prompt definitions explained in Appendix G must be available.		

Form X: Relation Definition

<i>Vital Sign:</i> OC Oceanography	<i>Relation identifier:</i> YYMM_C_DDDD_cc.HEX	<i>Used by deliverable ID:</i> OC_B
<i>Revision date / protocol version:</i> 04-08-2009 / OC-2014.1	<i>Type of relation:</i> ☐ Database table ☒ Data file	<i>Estimated rows:</i> 1,200
<i>Primary key for this relation:</i> None		
<i>Purpose:</i> Oceanographic cast raw “hex” data downloaded from CTD.		
<i>Identifiers of attributes defined over this relation (“attributes” are columns of the grid. Each attribute must be defined in an accompanying Form Y):</i> LINE		
<i>Mandatory validation criteria involving multiple attributes:</i> None		
<i>Optional validation criteria involving multiple attributes:</i> None		

Form Y: Attribute Definition

Vital Sign: OC Oceanography	Attribute identifier: LINE	Used by deliverable ID: OC_B
Revision Date / Protocol Version: 04-08-2009 / OC-2014.1	Default report heading: None	Relation (from Form X): YYMM_C_DDDD_cc.HEX
Purpose: One proprietary data line from the CTD device during a cast.		
Data type:	varchar()	
Maximum length:	200	
Required:	no	
Measurement units:	n/a	
Format:	Character string	
Foreign key to (relation+attribute):	n/a	
Case:	Upper only	
Mandatory validation rules for this attribute (in order of application):	1. Null LINE is always valid. 2. LINE having first character of "*" is always valid. 3. LINE having first characters of "<E" is always valid. 4. LINE, other than those beginning with "*" or "<E", must be composed of characters from the set {A–Z} + {0–9}. Lower case is not permitted. 5. Every LINE in the file, other than those beginning with "*" or "<E", must be exactly the same number of characters long. For example, all must be 24 characters in a particular file. 6. Within the relation as a whole, each of the following strings must be present in at least one LINE beginning with "*": "Vessel:", "CTD#:", "Dump#:", "Observer:", "Cast#:", "Station:", "Latitude:", "Longitude:", "Date GMT:", "Time GMT:", "Fathometer depth:", "Cast target depth:". 7. The values for CTD#, Dump#, and Cast# must correspond to those used to construct the filename	
Optional validation rules for this attribute:	Count the number of lines following the delimiter line "*END*". This should match the number of samples determined by parsing the line beginning "* cast" and locating starting and ending record number.	

3 OC_C: Processed CNV Files

Purpose of Deliverable

The CNV files show the recorded parameters for each cast in a manner useful for analysis. Each processed CNV is derived from a HEX file, but differs in three ways. First, the CNV data shows one row for every meter of depth; while HEX data typically show multiple rows for every meter, because HEX readings are taken at periodic times instead of periodic depths. Second, CNV values have been normalized using the calibration factors. Third, CNV values are in terms of engineering units instead of voltage or frequency levels.

Frequency Produced

OC_C is created at the end of each season by generating a CNV file for each HEX file and then packaging all CNV files into a single deliverable.

Prerequisites

Production of this deliverable is dependent on having certified OC_A and OC_B products for the season.

Data Flow

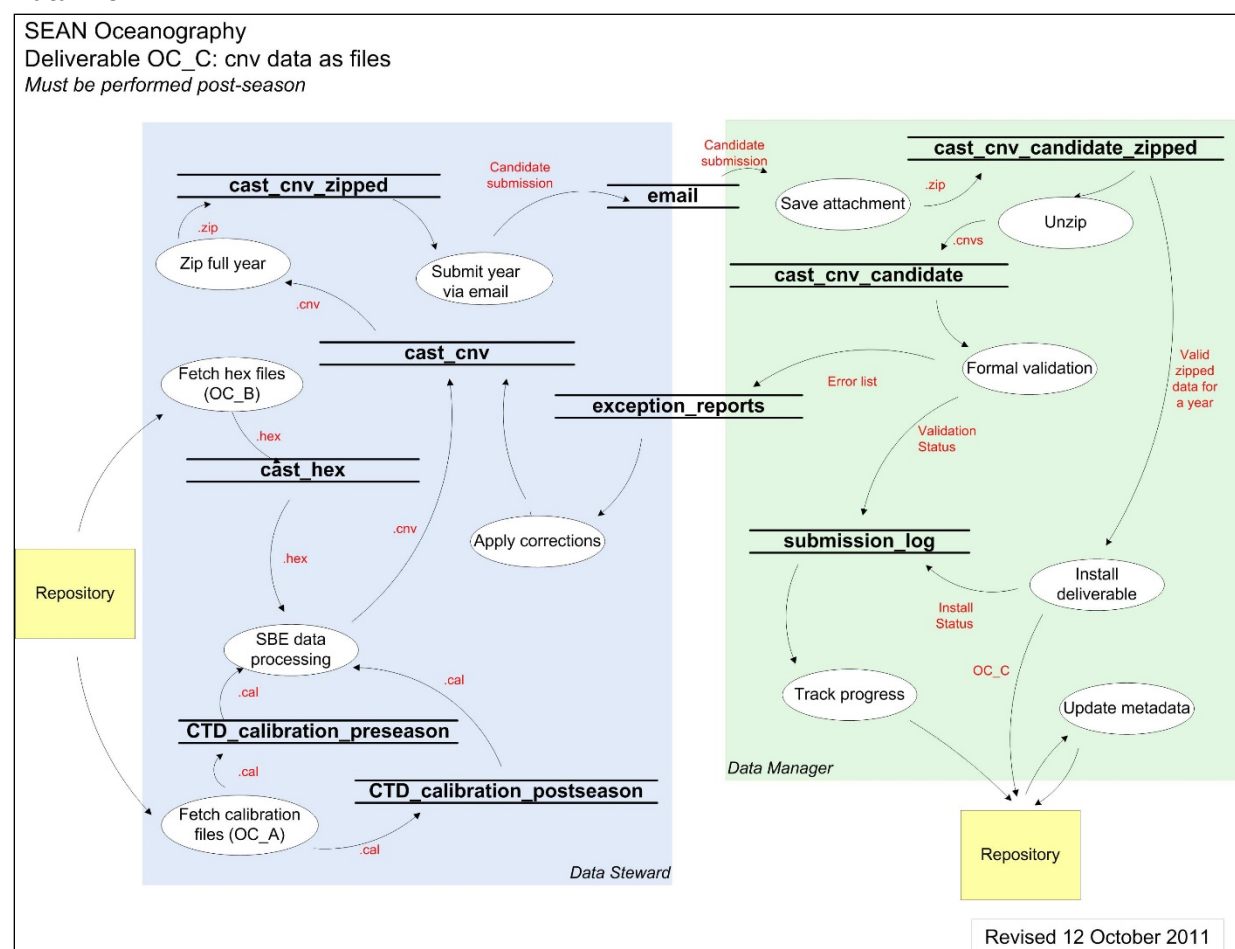


Figure 3. Data flow required to generate deliverable OC_C: CNV files.

Deliverable Definition Forms

Form D: Tabular Data Deliverable

<i>Vital Sign:</i> OC Oceanography	<i>Deliverable ID:</i> OC_C	<i>Deliverable Title:</i> Processed CNV files
<i>File format:</i> ZIP	<i>Associated software and version:</i> PKUNZIP, WINRAR, etc.	<i>Revision Date / protocol version:</i> 04-09-2009 / OC-2014.1
<i>Expected frequency:</i> one ZIP holding about 120 HEX files/year	<i>Likely dissemination partners:</i> None: served by SEAN	<i>Submission unit:</i> YEAR
<i>What purpose does this deliverable serve?</i> Provides binned, calibrated CNV data for customer analyses.		
<i>Identifiers of relations that compose the tabular deliverable ("relations" are tables or files that provide information that may be represented in a grid format. Each relation listed must be fully defined in its own accompanying Form X):</i> CNV_YYYY.ZIP is a zip archive of individual cast files named "YYMM_C_DDDD_cc.CNV", where YY is year of cast, MM is month of cast, C is local ctd number, DDDD is dump number, and cc is cast number. Leading zeroes are used to make every filename exactly 18 characters. The CNV files are considered a relation for purposes of data management.		
<i>Deliverable ID of any other SEAN data products required to create this product:</i> 1. OC_B HEX files for the year of interest. 2. The most recent OC_A CON file whose latest individual sensor calibrations fall before the earliest cast represented in the OC_B files. That is, say, if OC_B covers 1/15/2006 through 9/22/2006 then the OC_A CON file to use must have no individual sensor calibration date exceeding 1/15/2006. The OC_A naming convention usually allows ascertaining the correct file to use at a glance.		
<i>Description and source of any outside data required to create this product:</i> None		

Form X: Relation Definition

<i>Vital Sign:</i> OC Oceanography	<i>Relation identifier:</i> YYMM_C_DDDD_cc.cnv	<i>Used by deliverable ID:</i> OC_C												
<i>Revision date / protocol version:</i> 04-09-2009 / OC-2014.1	<i>Type of relation:</i> ☐ Database table ☒ Data file	<i>Estimated rows:</i> 180												
<i>Primary key for this relation:</i> None														
<i>Purpose:</i> Oceanographic cast CNV data for customer analysis. The file consists of a preamble defining parameters involved in the cast such as station and dump number. This is followed by a second preamble that documents the processing performed to create this cast data. The final section is a grid of attributes with each row representing a meter in the downcast.														
<i>Identifiers of attributes defined over this relation ("attributes" are columns of the grid. Each attribute must be defined in an accompanying Form Y):</i> <table border="1"> <tr> <td>PRESSURE</td> <td>FLUORESCENCE</td> </tr> <tr> <td>DEPTH</td> <td>OBS</td> </tr> <tr> <td>TEMPERATURE</td> <td>OXYGEN</td> </tr> <tr> <td>CONDUCTIVITY</td> <td>PAR</td> </tr> <tr> <td>SALINITY</td> <td>SBE_DATA_FLAG</td> </tr> <tr> <td>SIGMA_T</td> <td></td> </tr> </table>			PRESSURE	FLUORESCENCE	DEPTH	OBS	TEMPERATURE	OXYGEN	CONDUCTIVITY	PAR	SALINITY	SBE_DATA_FLAG	SIGMA_T	
PRESSURE	FLUORESCENCE													
DEPTH	OBS													
TEMPERATURE	OXYGEN													
CONDUCTIVITY	PAR													
SALINITY	SBE_DATA_FLAG													
SIGMA_T														
<i>Mandatory validation criteria involving multiple attributes:</i> - Any record whose first character is either "*" or "#" is preamble data that is always valid, no validation of individual attributes applies to such rows. - Within the relation as a whole, each of the following strings must be present in at least one row beginning with the "*" character: "Vessel:", "CTD#:", "Dump#:", "Observer:", "Cast#:", "Station:", "Latitude:", "Longitude:", "Date GMT:", "Time GMT:", "Fathometer depth:", "Cast target depth:"														
<i>Optional validation criteria involving multiple attributes:</i> None														

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> PRESSURE	<i>Used by Deliverable ID:</i> OC_C
<i>Revision date / protocol version:</i> 04-09-2009 / OC-2014.1	<i>Default Report Heading:</i> Pressure (dbar)	<i>Relation (from Form X):</i> yymm_C_dddd_cc.cnv
<i>Purpose:</i> Pressure in decibars.		
<i>Data type:</i>		real
<i>Maximum length</i>		8
<i>Required:</i>		yes
<i>Measurement units:</i>		decibars
<i>Format:</i>		9999.9999
<i>Foreign key to (relation+attribute):</i>		n/a
<i>Case:</i>		n/a
<i>Mandatory validation rules for this attribute (in order of application):</i>		1. Must be a real number. 2. Must be between -0.002 and 9999.9999
<i>Optional validation rules for this attribute:</i>		1. Should be between 1 and 800

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> DEPTH	<i>Used by Deliverable ID:</i> OC_C
<i>Revision date / protocol version:</i> 04-09-2009 / OC-2014.1	<i>Default Report Heading:</i> Depth (m)	<i>Relation (from Form X):</i> YYMM_C_DDDD_cc.cnv
<i>Purpose:</i> Depth in meters.		
<i>Data type:</i>		integer
<i>Maximum length</i>		4
<i>Required:</i>		yes
<i>Measurement units:</i>		meters
<i>Format:</i>		9999
<i>Foreign key to (relation+attribute):</i>		n/a
<i>Case:</i>		n/a
<i>Mandatory validation rules for this attribute (in order of application):</i>		1. Must be an integer. 2. Must be between 0 and 9999. 3. Must be unique within a file.
<i>Optional validation rules for this attribute:</i>		1. Should be between 0 and 800.

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> TEMPERATURE	<i>Used by Deliverable ID:</i> OC_C
<i>Revision date / protocol version:</i> 04-09-2009 / OC-2014.1	<i>Default Report Heading:</i> Temperature (C)	<i>Relation (from Form X):</i> YYMM_C_DDDD_cc.cnv
<i>Purpose:</i> Temperature in Celsius.		
<i>Data type:</i>	real	
<i>Maximum length</i>	6	
<i>Required:</i>	no	
<i>Measurement units:</i>	degrees C	
<i>Format:</i>	99.9999	
<i>Foreign key to (relation+attribute):</i>	n/a	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	1. Must be a real number. 2. Must be between -5.0 and 20.0. 3. Special allowed case of SBE error flag value: -9.990e-29.	
<i>Optional validation rules for this attribute:</i>	1. Should be between 0.0 and 20.0	

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> CONDUCTIVITY	<i>Used by Deliverable ID:</i> OC_C
<i>Revision date / protocol version:</i> 04-09-2009 / OC-2014.1	<i>Default Report Heading:</i> Conductivity (S/m)	<i>Relation (from Form X):</i> YYMM_C_DDDD_cc.cnv
<i>Purpose:</i> Conductivity in Siemens per meter.		
<i>Data type:</i>	real	
<i>Maximum length</i>	8	
<i>Required:</i>	no	
<i>Measurement units:</i>	Siemens/meter	
<i>Format:</i>	9.999999	
<i>Foreign key to (relation+attribute):</i>	n/a	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	1. Must be a real number. 2. Must be between 0.0 and 10.0. 3. Special allowed case of SBE error flag value: -9.990e-29.	
<i>Optional validation rules for this attribute:</i>	1. Should be between 0.0 and 5.0.	

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> SALINITY	<i>Used by Deliverable ID:</i> OC_C
<i>Revision date / protocol version:</i> 04-09-2009 / OC-2014.1	<i>Default Report Heading:</i> Salinity (PSU)	<i>Relation (from Form X):</i> YYMM_C_DDDD_cc.cnv
<i>Purpose:</i> Salinity in practical salinity units.		
<i>Data type:</i>	real	
<i>Maximum length</i>	6	
<i>Required:</i>	no	
<i>Measurement units:</i>	PSU	
<i>Format:</i>	99.999	
<i>Foreign key to (relation+attribute):</i>	n/a	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	1. Must be a real number. 2. Must be between 0.0 and 40.0. 3. Special allowed case of SBE error flag value: -9.990e-29.	
<i>Optional validation rules for this attribute:</i>	1. Should be between 0.0 and 34.0.	

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> SIGMA_T	<i>Used by Deliverable ID:</i> OC_C
<i>Revision date / protocol version:</i> 04-09-2009 / OC-2014.1	<i>Default Report Heading:</i> Density (kg/m ³)	<i>Relation (from Form X):</i> YYMM_C_DDDD_cc.cnv
<i>Purpose:</i> Density differential in kg/m ³ .		
<i>Data type:</i>	real	
<i>Maximum length</i>	7	
<i>Required:</i>	no	
<i>Measurement units:</i>	kg/m ³	
<i>Format:</i>	99.999	
<i>Foreign key to (relation+attribute):</i>	n/a	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	1. Must be a real number. 2. Must be between 0.0 and 30.0. 3. Special allowed case of SBE error flag value: -9.990e-29.	
<i>Optional validation rules for this attribute:</i>	1. Should be between 15.0 and 27.0.	

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> FLUORESCENCE	<i>Used by Deliverable ID:</i> OC_C
<i>Revision date / protocol version:</i> 04-09-2009 / OC-2014.1	<i>Default Report Heading:</i> Fluorescence (mg/m**3)	<i>Relation (from Form X):</i> YYMM_C_DDDD_cc.cnv
<i>Purpose:</i> Fluorescence.		
<i>Data type:</i>	real	
<i>Maximum length</i>	6	
<i>Required:</i>	no	
<i>Measurement units:</i>	mg/m ³	
<i>Format:</i>	99.999	
<i>Foreign key to (relation+attribute):</i>	n/a	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	1. Must be a real number. 2. Must be between 0.0 and 99.999. 3. Special allowed case of SBE error flag value: -9.990e-29.	
<i>Optional validation rules for this attribute:</i>	1. Should be between 0.0 and 70.0.	

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> OBS	<i>Used by Deliverable ID:</i> OC_C
<i>Revision date / protocol version:</i> 04-09-2009 / OC-2014.1	<i>Default Report Heading:</i> Backscatterance (in NTU)	<i>Relation (from Form X):</i> YYMM_C_DDDD_cc.cnv
<i>Purpose:</i> Turbidity detected by OBS backscatter sensor.		
<i>Data type:</i>	real	
<i>Maximum length</i>	7	
<i>Required:</i>	no	
<i>Measurement units:</i>	NTU	
<i>Format:</i>	999.999	
<i>Foreign key to (relation+attribute):</i>	n/a	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	1. Must be a real number. 2. Must be between 0.0 and 800.0. 3. Special allowed case of SBE error flag value: -9.990e-29.	
<i>Optional validation rules for this attribute:</i>	1. Should be between 0.0 and 500.0.	

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> OXYGEN	<i>Used by Deliverable ID:</i> OC_C
<i>Revision date / protocol version:</i> 04-09-2009 / OC-2014.1	<i>Default Report Heading:</i> Dissolved Oxygen (ml/l)	<i>Relation (from Form X):</i> YYMM_C_DDDD_cc.cnv
<i>Purpose:</i> Dissolved oxygen content.		
<i>Data type:</i>	real	
<i>Maximum length</i>	6	
<i>Required:</i>	no	
<i>Measurement units:</i>	ml/l	
<i>Format:</i>	99.999	
<i>Foreign key to (relation+attribute):</i>	n/a	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	1. Must be a real number. 2. Must be between 0.0 and 20.0. 3. Special allowed case of SBE error flag value: -9.990e-29.	
<i>Optional validation rules for this attribute:</i>	1. Should be between 2.0 and 14.0.	

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> PAR	<i>Used by Deliverable ID:</i> OC_C
<i>Revision date / protocol version:</i> 04-09-2009 / OC-2014.1	<i>Default Report Heading:</i> PAR (uE/m ² * sec)	<i>Relation (from Form X):</i> YYMM_C_DDDD_cc.cnv
<i>Purpose:</i> Photosynthetically active radiation.		
<i>Data type:</i>	real	
<i>Maximum length</i>	8	
<i>Required:</i>	no	
<i>Measurement units:</i>	μmol photons/m ² /sec	
<i>Format:</i>	9999.999	
<i>Foreign key to (relation+attribute):</i>	n/a	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	1. Must be a real number. 2. Must be between 0.0 and 3000.0. 3. Special allowed case of SBE error flag value: -9.990e-29.	
<i>Optional validation rules for this attribute:</i>	1. Should be between 0.0 and 1600.0.	

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> SBE_DATA_FLAG	<i>Used by Deliverable ID:</i> OC_C
<i>Revision date / protocol version:</i> 01-15-2014 / OC-2014.1	<i>Default Report Heading:</i> DP Quality	<i>Relation (from Form X):</i> YYMM_C_DDDD_cc.cnv
<i>Purpose:</i> Indicates bins with suspect data due to pressure slowdown or reversal as drop progresses. Set appropriately by SBE data processing “loopedit” function. A nonzero value indicates an invalid data row, which will not be loaded into the OC_D database. This may also be set manually in order to disqualify a particular row judged to contain unusable data. Note this refers to a column in the file and not the similarly referred to value “-9.990e-29” used to nullify certain individual parameter values in individual cells of a row.		
<i>Data type:</i>	real	
<i>Maximum length</i>	9	
<i>Required:</i>	no	
<i>Measurement units:</i>	n/a	
<i>Format:</i>	n/a	
<i>Foreign key to (relation+attribute):</i>	n/a	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	none	
<i>Optional validation rules for this attribute:</i>	none	

4 OC_D: Cumulative Database

Purpose of Deliverable

Working with large groups of OC_C processed CNV files can be cumbersome and difficult. An oceanography database is maintained that contains all the CNV values for all surveys done in the program. These rows may differ slightly from OC_C data in having data quality information, outlier corrections, etc. Through the web, the database may be queried to produce a single file on the customer's workstation containing final data, filtered to meet the customer's exact area of interest. Deliverable OC_D is an incremental update used to revise the cumulative database.

Frequency Produced

OC_D is generated at the end of each season directly after certification of OC_C processed CNV files. It is created from OC_C's intermediate validation files.

Prerequisites

Production of this deliverable is dependent on having a certified OC_C product for the year.

Data Flow

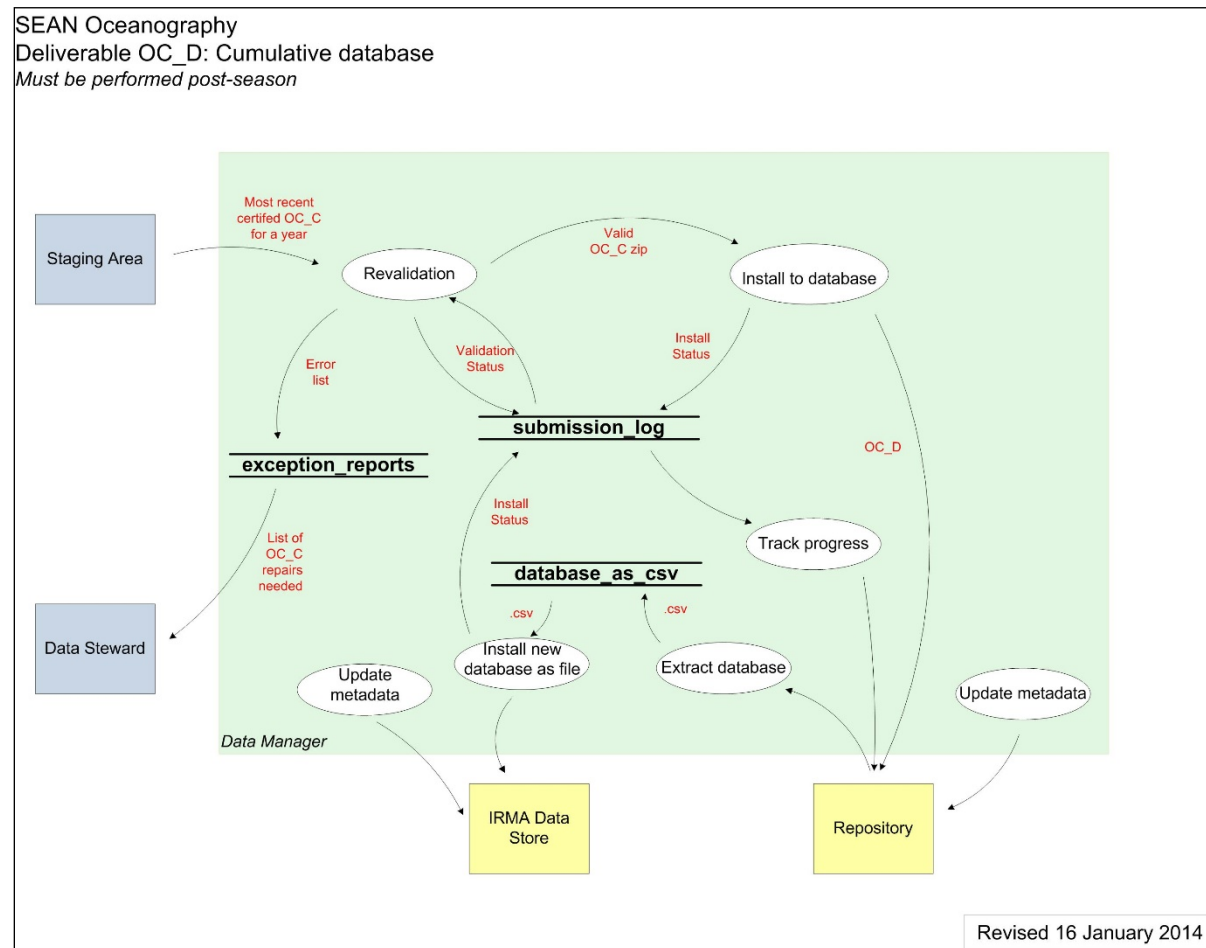


Figure 4. Data flow required to generate deliverable OC_D: cumulative database.

Deliverable Definition Forms

Form D: Tabular Data Deliverable

<i>Vital Sign:</i> OC Oceanography	<i>Deliverable ID:</i> OC_D	<i>Deliverable Title:</i> Cumulative database
<i>File Format:</i> n/a	<i>Associated software and version:</i> n/a	<i>Revision Date / protocol version:</i> 01-15-2014 / OC-2014.1
<i>Expected Frequency:</i> one submission/year	<i>Likely Dissemination Partners:</i> None: served by SEAN	<i>Submission Unit:</i> YEAR
<i>What purpose does this deliverable serve?</i> Provides binned, calibrated CNV data filtered by parameters directly to customer workstations. This is basically all years of deliverable OC_C recast in a database structure. Individual sensor data in the source CNV file that have negative values (typically due to faulty sensor or SBE data error flag) are treated as NULL in the database.		
<i>Identifiers of relations that compose the tabular deliverable ("relations" are tables or files that provide information that may be represented in a grid format. Each relation listed must be fully defined in its own accompanying Form X):</i> tbl_oc_cast		
<i>Deliverable ID of any other SEAN data products required to create this product:</i> OC_C		
<i>Description and source of any outside data required to create this product:</i> None		

Form X: Relation Definition

<i>Vital Sign:</i> OC Oceanography	<i>Relation Identifier:</i> tbl_oc_cast	<i>Used by Deliverable ID:</i> OC_D																																
<i>Revision date / protocol version:</i> 01-15-2014 / OC-2014.1	<i>Type of Relation:</i> Database Table	<i>Estimated Rows:</i> 370,000+																																
<i>Natural key for this relation:</i> ctd + dump + cast + depth																																		
<i>Purpose:</i> Oceanographic calibrated cast data binned to 1 m levels and expressed in engineering units, to serve as a basis for customer analysis. The table is totally denormalized to facilitate web downloading and direct use by Excel and MS Access.																																		
<i>Identifiers of attributes defined over this relation (“attributes” are columns of the grid. Each attribute must be defined in an accompanying Form Y):</i> <table border="1"> <tr><td>CTD</td><td>CONDUCTIVITY</td></tr> <tr><td>DUMP</td><td>SALINITY</td></tr> <tr><td>OBSERVER</td><td>SIGMA_T</td></tr> <tr><td>CAST</td><td>FLUORESCENCE</td></tr> <tr><td>VESSEL</td><td>OBS</td></tr> <tr><td>STATION</td><td>OXYGEN</td></tr> <tr><td>LATITUDE</td><td>PAR</td></tr> <tr><td>LONGITUDE</td><td>SBE_DATA_FLAG</td></tr> <tr><td>DATE_GMT</td><td>COMMENTS</td></tr> <tr><td>TIME_GMT</td><td>DATA_QUALITY</td></tr> <tr><td>FATHOMETER_DEPTH</td><td>QUALITY_COMMENT</td></tr> <tr><td>TARGET_DEPTH</td><td>TIME_STAMP</td></tr> <tr><td>PRESSURE</td><td>PROTOCOL_ID</td></tr> <tr><td>DEPTH</td><td>USERID</td></tr> <tr><td>TEMPERATURE</td><td>SUBMISSION_NUMBER</td></tr> <tr><td></td><td>CRUISE_YEAR</td></tr> </table>			CTD	CONDUCTIVITY	DUMP	SALINITY	OBSERVER	SIGMA_T	CAST	FLUORESCENCE	VESSEL	OBS	STATION	OXYGEN	LATITUDE	PAR	LONGITUDE	SBE_DATA_FLAG	DATE_GMT	COMMENTS	TIME_GMT	DATA_QUALITY	FATHOMETER_DEPTH	QUALITY_COMMENT	TARGET_DEPTH	TIME_STAMP	PRESSURE	PROTOCOL_ID	DEPTH	USERID	TEMPERATURE	SUBMISSION_NUMBER		CRUISE_YEAR
CTD	CONDUCTIVITY																																	
DUMP	SALINITY																																	
OBSERVER	SIGMA_T																																	
CAST	FLUORESCENCE																																	
VESSEL	OBS																																	
STATION	OXYGEN																																	
LATITUDE	PAR																																	
LONGITUDE	SBE_DATA_FLAG																																	
DATE_GMT	COMMENTS																																	
TIME_GMT	DATA_QUALITY																																	
FATHOMETER_DEPTH	QUALITY_COMMENT																																	
TARGET_DEPTH	TIME_STAMP																																	
PRESSURE	PROTOCOL_ID																																	
DEPTH	USERID																																	
TEMPERATURE	SUBMISSION_NUMBER																																	
	CRUISE_YEAR																																	
<i>Mandatory validation criteria involving multiple attributes:</i> None																																		
<i>Optional validation criteria involving multiple attributes:</i> None																																		

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> CTD	<i>Used by Deliverable ID:</i> OC_D
<i>Revision date / protocol version:</i> 01-15-2014 / OC-2014.1	<i>Default Report Heading:</i> CTD #	<i>Relation (from Form X):</i> tbl_oc_cast
<i>Purpose:</i> Local identification number of the CTD device, as designated in Appendix F.		
<i>Data type:</i>		Varchar(1)
<i>Maximum length</i>		1
<i>Required:</i>		yes
<i>Measurement units:</i>		n/a
<i>Format:</i>		9
<i>Foreign key to (relation+attribute):</i>		n/a
<i>Case:</i>		n/a
<i>Mandatory validation rules for this attribute (in order of application):</i>		1. Must be between 1 and 9.
<i>Optional validation rules for this attribute:</i>		None

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> DUMP	<i>Used by Deliverable ID:</i> OC_D
<i>Revision date / protocol version:</i> 04-10-2009 / OC-2014.1	<i>Default Report Heading:</i> DUMP#	<i>Relation (from Form X):</i> tbl_oc_cast
<i>Purpose:</i> The sequential number that is incremented each time any CTD memory is cleared. It tracks distinct uses of the CTD to gather a set of consecutive casts.		
<i>Data type:</i>		Varchar(4)
<i>Maximum length</i>		4
<i>Required:</i>		yes
<i>Measurement units:</i>		n/a
<i>Format:</i>		0000
<i>Foreign key to (relation+attribute):</i>		n/a
<i>Case:</i>		n/a
<i>Mandatory validation rules for this attribute (in order of application):</i>		1. Must represent a whole number, zero filled.
<i>Optional validation rules for this attribute:</i>		None

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> OBSERVER	<i>Used by Deliverable ID:</i> OC_D
<i>Revision date / protocol version:</i> 04-10-2009 / OC-2014.1	<i>Default Report Heading:</i> Observer	<i>Relation (from Form X):</i> tbl_oc_cast
<i>Purpose:</i> The last names of those making the cast.		
<i>Data type:</i>	Varchar(50)	
<i>Maximum length</i>	50	
<i>Required:</i>	no	
<i>Measurement units:</i>	n/a	
<i>Format:</i>	n/a	
<i>Foreign key to (relation+attribute):</i>	n/a	
<i>Case:</i>	any	
<i>Mandatory validation rules for this attribute (in order of application):</i>	None	
<i>Optional validation rules for this attribute:</i>	None	

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> CAST	<i>Used by Deliverable ID:</i> OC_D
<i>Revision date / protocol version:</i> 04-10-2009 / OC-2014.1	<i>Default Report Heading:</i> Cast#	<i>Relation (from Form X):</i> tbl_oc_cast
<i>Purpose:</i> Sequential cast number within a particular dump. Casts are integers beginning with zero. They are generated by the CTDs themselves. Because of memory limits in existing equipment, it is rare CAST will ever exceed 15. Cast is part of the primary key, making its representation critical. If its value is below 10, it must be stored only as two digits, employing a leading zero if needed.		
<i>Data type:</i>	Varchar(2)	
<i>Maximum length:</i>	2	
<i>Required:</i>	yes	
<i>Measurement units:</i>	n/a	
<i>Format:</i>	00	
<i>Foreign key to (relation+attribute):</i>	n/a	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	1. Must represent an integer between 0 and 99.	
<i>Optional validation rules for this attribute:</i>	1. Should be between 0 and 15.	

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> VESSEL	<i>Used by Deliverable ID:</i> OC_D
<i>Revision date / protocol version:</i> 04-10-2009 / OC-2014.1	<i>Default Report Heading:</i> Vessel	<i>Relation (from Form X):</i> tbl_oc_cast
<i>Purpose:</i> Name of the vessel used to conduct the survey.		
<i>Data type:</i>		Varchar(24)
<i>Maximum length:</i>		24
<i>Required:</i>		no
<i>Measurement units:</i>		n/a
<i>Format:</i>		n/a
<i>Foreign key to (relation+attribute):</i>		n/a
<i>Case:</i>		Proper
<i>Mandatory validation rules for this attribute (in order of application):</i>		None
<i>Optional validation rules for this attribute:</i>		None

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> STATION	<i>Used by Deliverable ID:</i> OC_D
<i>Revision date / protocol version:</i> 04-10-2009 / OC-2014.1	<i>Default Report Heading:</i> Station	<i>Relation (from Form X):</i> tbl_oc_cast
<i>Purpose:</i> Identification number for a unique sampling location. Over time station numbers may be retired. The numbers are never recycled. Stations are always exactly two digits in length, using a leading zero if needed to meet that constraint.		
<i>Data type:</i>		Varchar(2)
<i>Maximum length:</i>		2
<i>Required:</i>		yes
<i>Measurement units:</i>		n/a
<i>Format:</i>		00
<i>Foreign key to (relation+attribute):</i>		n/a
<i>Case:</i>		n/a
<i>Mandatory validation rules for this attribute (in order of application):</i>		1. Must represent a zero-filled integer between 00 and 24.
<i>Optional validation rules for this attribute:</i>		None

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> LATITUDE	<i>Used by Deliverable ID:</i> OC_D
<i>Revision date / protocol version:</i> 01-15-2014 / OC-2014.1	<i>Default Report Heading:</i> Latitude	<i>Relation (from Form X):</i> tbl_oc_cast
<i>Purpose:</i> Decimal latitude in WGS84 datum.		
<i>Data type:</i>		real
<i>Maximum length:</i>		8
<i>Required:</i>		no
<i>Measurement units:</i>		degrees
<i>Format:</i>		99.99999
<i>Foreign key to (relation+attribute):</i>		n/a
<i>Case:</i>		n/a
<i>Mandatory validation rules for this attribute (in order of application):</i>		1. Must be a real number. 2. Must be between 58.0 and 61.0.
<i>Optional validation rules for this attribute:</i>		1. Should be within 0.05 degrees of identified station.

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> LONGITUDE	<i>Used by Deliverable ID:</i> OC_D
<i>Revision date / protocol version:</i> 01-15-2014 / OC-2014.1	<i>Default Report Heading:</i> Longitude	<i>Relation (from Form X):</i> tbl_oc_cast
<i>Purpose:</i> Decimal longitude using the WGS84 datum.		
<i>Data type:</i>		real
<i>Maximum length:</i>		10
<i>Required:</i>		no
<i>Measurement units:</i>		n/a
<i>Format:</i>		-999.99999
<i>Foreign key to (relation+attribute):</i>		n/a
<i>Case:</i>		n/a
<i>Mandatory validation rules for this attribute (in order of application):</i>		1. Must be a real number. 2. Must be between -135.0 and -142.0.
<i>Optional validation rules for this attribute:</i>		1. Should be within 0.05 degrees of identified station.

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> DATE_GMT	<i>Used by Deliverable ID:</i> OC_D
<i>Revision date / protocol version:</i> 04-10-2009 / OC-2014.1	<i>Default Report Heading:</i> Date	<i>Relation (from Form X):</i> tbl_oc_cast
<i>Purpose:</i> Date the cast was taken; in the GMT time zone.		
<i>Data type:</i>	date	
<i>Maximum length:</i>	n/a	
<i>Required:</i>	no	
<i>Measurement units:</i>	n/a	
<i>Format:</i>	n/a	
<i>Foreign key to (relation+attribute):</i>	n/a	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	1. Must be a valid date. 2. Must not be a date beyond the current one at moment of validation. 3. Must not be a date before 1992.	
<i>Optional validation rules for this attribute:</i>	None	

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> TIME_GMT	<i>Used by Deliverable ID:</i> OC_D
<i>Revision Date/Protocol Version:</i> 04-10-2009 / OC-2014.1	<i>Default Report Heading:</i> Time	<i>Relation (from Form X):</i> tbl_oc_cast
<i>Purpose:</i> Time cast was initiated, in Greenwich Mean Time.		
<i>Data type:</i>	time	
<i>Maximum length:</i>	n/a	
<i>Required:</i>	no	
<i>Measurement units:</i>	n/a	
<i>Format:</i>	n/a	
<i>Foreign key to (relation+attribute):</i>	n/a	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	1. Must resolve to a valid time.	
<i>Optional validation rules for this attribute:</i>	None	

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> FATHOMETER_DEPTH	<i>Used by Deliverable ID:</i> OC_D
<i>Revision Date/Protocol Version:</i> 04-10-2009 / OC-2014.1	<i>Default Report Heading:</i> Bottom (m)	<i>Relation (from Form X):</i> tbl_oc_cast
<i>Purpose:</i> Depth to the sea floor for this station in meters, expressed as a positive integer.		
<i>Data type:</i>	integer	
<i>Maximum length:</i>	4	
<i>Required:</i>	no	
<i>Measurement units:</i>	meters	
<i>Format:</i>	9999	
<i>Foreign key to (relation+attribute):</i>	n/a	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	1. Must be an integer between 0 and 9999.	
<i>Optional validation rules for this attribute:</i>	None	

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> PRESSURE	<i>Used by Deliverable ID:</i> OC_D
<i>Revision Date/Protocol Version:</i> 04-09-2009 / OC-2014.1	<i>Default Report Heading:</i> Pressure (dbar)	<i>Relation (from Form X):</i> tbl_oc_cast
<i>Purpose:</i> Pressure in decibars.		
<i>Data type:</i>	real	
<i>Maximum length:</i>	8	
<i>Required:</i>	no	
<i>Measurement units:</i>	decibars	
<i>Format:</i>	9999.999	
<i>Foreign key to (relation+attribute):</i>	n/a	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	1. Must be a real number. 2. Must be between 1 and 9999.999.	
<i>Optional validation rules for this attribute:</i>	1. Should be between 1 and 800.	

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> DEPTH	<i>Used by Deliverable ID:</i> OC_D
<i>Revision Date/Protocol Version:</i> 05-12-2010 / OC-2014.1	<i>Default Report Heading:</i> Depth (m)	<i>Relation (from Form X):</i> tbl_oc_cast
<i>Purpose:</i> Depth of this bin in meters, expressed as a positive integer. The first bin is labeled as meter zero. NOTE: sampling mechanics sometimes prevent the first meter (or more) from being recorded. In such cases the missing surface bins are imputed by replicating the readings of the first valid bin up through bin 0 (provided there is a valid bin within 4 m of the surface). A comment explaining this is included on every imputed row. If no valid bin is present for a cast within the first 4 m, no rows are generated and the missing bins in OC_C remain missing in OC_D.		
<i>Data type:</i>		integer
<i>Maximum length:</i>		4
<i>Required:</i>		yes
<i>Measurement units:</i>		meters
<i>Format:</i>		9999
<i>Foreign key to (relation+attribute):</i>		n/a
<i>Case:</i>		n/a
<i>Mandatory validation rules for this attribute (in order of application):</i>		1. Must be an integer. 2. Must be between 0 and 9999.
<i>Optional validation rules for this attribute:</i>		1. Should be less than 800.

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> TEMPERATURE	<i>Used by Deliverable ID:</i> OC_D
<i>Revision Date/Protocol Version:</i> 04-09-2009 / OC-2014.1	<i>Default Report Heading:</i> Temperature (C)	<i>Relation (from Form X):</i> tbl_oc_cast
<i>Purpose:</i> Water temperature in degrees Celsius [ITS-90]		
<i>Data type:</i>		Real
<i>Maximum length:</i>		6
<i>Required:</i>		no
<i>Measurement units:</i>		degrees C
<i>Format:</i>		99.999
<i>Foreign key to (relation+attribute):</i>		n/a
<i>Case:</i>		n/a
<i>Mandatory validation rules for this attribute (in order of application):</i>		1. Must be a real number. 2. Must be between -5.0 and 20.0.
<i>Optional validation rules for this attribute:</i>		1. Should be between 0.0 and 20.0.

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> CONDUCTIVITY	<i>Used by Deliverable ID:</i> OC_D
<i>Revision Date/Protocol Version:</i> 04-09-2009 / OC-2014.1	<i>Default Report Heading:</i> Conductivity (S/m)	<i>Relation (from Form X):</i> tbl_oc_cast
<i>Purpose:</i> Conductivity in Siemens per meter.		
<i>Data type:</i>	real	
<i>Maximum length</i>	8	
<i>Required:</i>	no	
<i>Measurement units:</i>	Siemens/meter	
<i>Format:</i>	9.999999	
<i>Foreign key to (relation+attribute):</i>	n/a	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	1. Must be a real number. 2. Must be between 0.0 and 10.0.	
<i>Optional validation rules for this attribute:</i>	1. Should be between 0.0 and 5.0.	

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> SALINITY	<i>Used by Deliverable ID:</i> OC_D
<i>Revision Date/Protocol Version:</i> 04-09-2009 / OC-2014.1	<i>Default Report Heading:</i> Salinity (PSU)	<i>Relation (from Form X):</i> tbl_oc_cast
<i>Purpose:</i> Salinity in practical salinity units.		
<i>Data type:</i>	real	
<i>Maximum length:</i>	6	
<i>Required:</i>	no	
<i>Measurement units:</i>	PSU	
<i>Format:</i>	99.999	
<i>Foreign key to (relation+attribute):</i>	n/a	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	1. Must be a real number. 2. Must be between 0.0 and 40.0.	
<i>Optional validation rules for this attribute:</i>	1. Should be between 0.0 and 34.0.	

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> SIGMA_T	<i>Used by Deliverable ID:</i> OC_D
<i>Revision Date/Protocol Version:</i> 04-09-2009 / OC-2014.1	<i>Default Report Heading:</i> Density (kg/m ³)	<i>Relation (from Form X):</i> tbl_oc_cast
<i>Purpose:</i> Density differential in kg/m ³ .		
<i>Data type:</i>	real	
<i>Maximum length:</i>	7	
<i>Required:</i>	no	
<i>Measurement units:</i>	kg/m ³	
<i>Format:</i>	nn.nnn	
<i>Foreign key to (relation+attribute):</i>	n/a	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	1. Must be a real number. 2. Must be between 0.0 and 30.0	
<i>Optional validation rules for this attribute:</i>	1. Should be between 15.0 and 27.0.	

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> FLUORESCENCE	<i>Used by Deliverable ID:</i> OC_D
<i>Revision Date/Protocol Version:</i> 01-15-2014 / OC-2014.1	<i>Default Report Heading:</i> Fluorescence (mg/m ³)	<i>Relation (from Form X):</i> tbl_oc_cast
<i>Purpose:</i> Fluorescence, proxy for chlorophyll-a.		
<i>Data type:</i>	real	
<i>Maximum length:</i>	6	
<i>Required:</i>	no	
<i>Measurement units:</i>	mg/m ³	
<i>Format:</i>	99.999	
<i>Foreign key to (relation+attribute):</i>	n/a	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	1. Must be a real number. 2. Must be less than 100.0.	
<i>Optional validation rules for this attribute:</i>	1. Should be between 0.0 and 70.0.	

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> OBS	<i>Used by Deliverable ID:</i> OC_D
<i>Revision Date/Protocol Version:</i> 04-09-2009 / OC-2014.1	<i>Default Report Heading:</i> Backscatterance (NTU)	<i>Relation (from Form X):</i> tbl_oc_cast
<i>Purpose:</i> Turbidity detected by OBS backscatter sensor.		
<i>Data type:</i>	real	
<i>Maximum length:</i>	7	
<i>Required:</i>	no	
<i>Measurement units:</i>	NTU	
<i>Format:</i>	999.999	
<i>Foreign key to (relation+attribute):</i>	n/a	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	1. Must be a real number. 2. Must be between 0.0 and 800.0.	
<i>Optional validation rules for this attribute:</i>	1. Should be between 0.0 and 500.0.	

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> OXYGEN	<i>Used by Deliverable ID:</i> OC_D
<i>Revision Date/Protocol Version:</i> 01-15-2014 / OC-2014.1	<i>Default Report Heading:</i> Dissolved Oxygen (ml/l)	<i>Relation (from Form X):</i> tbl_oc_cast
<i>Purpose:</i> Dissolved oxygen content. Negative values may appear when CTD is used without the DO sensor securely connected.		
<i>Data type:</i>	real	
<i>Maximum length:</i>	6	
<i>Required:</i>	no	
<i>Measurement units:</i>	ml/l	
<i>Format:</i>	nn.nnn	
<i>Foreign key to (relation+attribute):</i>	n/a	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	1. Must be a real number. 2. Must not exceed 20.0.	
<i>Optional validation rules for this attribute:</i>	1. Should be between 2.0 and 14.0.	

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> PAR	<i>Used by Deliverable ID:</i> OC_D
<i>Revision Date/Protocol Version:</i> 04-09-2009 / OC-2014.1	<i>Default Report Heading:</i> PAR (uE/m ² * sec)	<i>Relation (from Form X):</i> tbl_oc_cast
<i>Purpose:</i> Photosynthetically active radiation.		
<i>Data type:</i>	real	
<i>Maximum length:</i>	8	
<i>Required:</i>	no	
<i>Measurement units:</i>	μEinstein/m ² ·sec	
<i>Format:</i>	nnnn.nnn	
<i>Foreign key to (relation+attribute):</i>	n/a	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	1. Must be a real number. 2. Must be between 0.0 and 3000.0.	
<i>Optional validation rules for this attribute:</i>	1. Should be between 0.0 and 1600.0.	

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> SBE_DATA_FLAG	<i>Used by Deliverable ID:</i> OC_D
<i>Revision Date/Protocol Version:</i> 01-15-2014 / OC-2014.1	<i>Default Report Heading:</i> DP Error Flag	<i>Relation (from Form X):</i> tbl_oc_cast
<i>Purpose:</i> Indicates bins with suspect data due to pressure slowdown or reversal as the cast progresses. A nonzero value indicates suspect data, which is excluded from the database. In practice, this column is always 0 since input with other values is always rejected as the database is updated. It is kept here to maintain consistency with OC_C attributes.		
<i>Data type:</i>	real	
<i>Maximum length:</i>	9	
<i>Required:</i>	no	
<i>Measurement units:</i>	n/a	
<i>Format:</i>	n/a	
<i>Foreign key to (relation+attribute):</i>	n/a	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	None	
<i>Optional validation rules for this attribute:</i>	None	

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> COMMENTS	<i>Used by Deliverable ID:</i> OC_D
<i>Revision Date/Protocol Version:</i> 04-10-2009 / OC-2014.1	<i>Default Report Heading:</i> Comments	<i>Relation (from Form X):</i> tbl_oc_cast
<i>Purpose:</i> Recorded comments regarding circumstances of this particular cast.		
<i>Data type:</i>	Varchar(512)	
<i>Maximum length:</i>	512	
<i>Required:</i>	no	
<i>Measurement units:</i>	n/a	
<i>Format:</i>	n/a	
<i>Foreign key to (relation+attribute):</i>	n/a	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	None	
<i>Optional validation rules for this attribute:</i>	None	

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> DATA_QUALITY	<i>Used by Deliverable ID:</i> OC_D
<i>Revision Date/Protocol Version:</i> 01-15-2014 / OC-2014.1	<i>Default Report Heading:</i> Data Quality	<i>Relation (from Form X):</i> tbl_oc_cast
<i>Purpose:</i> Indicator of the quality of the observation, for determining whether to include it in analyses. The Ocean Data View coding system is observed. This is not recorded in the database during OC_D loading. Instead, it is entered upon subsequent certification of deliverable OC_M: Data Quality. 0 = good, 1 = unknown, 4 = questionable, 8 = bad. The DATA_QUALITY_COMMENT explains why a row is flagged 4 or 8. (See the OC_M entry for detailed explanation of quality codes.)		
<i>Data type:</i>	Varchar(1)	
<i>Maximum length:</i>	1	
<i>Required:</i>	no	
<i>Measurement units:</i>	n/a	
<i>Format:</i>	n/a	
<i>Foreign key to (relation+attribute):</i>	tbl_data_quality	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	1. If present, must match 0, 1, 4, or 8.	
<i>Optional validation rules for this attribute:</i>	None	

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> DATA_QUALITY_COMMENT	<i>Used by Deliverable ID:</i> OC_D
<i>Revision Date/Protocol Version:</i> 01-15-2014 / OC-2014.1	<i>Default Report Heading:</i> Quality Comment	<i>Relation (from Form X):</i> tbl_oc_cast
<i>Purpose:</i> Explanation of why data quality was not considered “good.” The source for this attribute is the certified OC_M spreadsheet product for the particular year.		
<i>Data type:</i>	Varchar(512)	
<i>Maximum length:</i>	512	
<i>Required:</i>	no	
<i>Measurement units:</i>	n/a	
<i>Format:</i>	n/a	
<i>Foreign key to (relation+attribute):</i>	n/a	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	None	
<i>Optional validation rules for this attribute:</i>	None	

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> TIME_STAMP	<i>Used by Deliverable ID:</i> OC_D
<i>Revision Date/Protocol Version:</i> 01-15-2014 / OC-2014.1	<i>Default Report Heading:</i> Last Updated	<i>Relation (from Form X):</i> tbl_oc_cast
<i>Purpose:</i> The date and time this row was most recently inserted or updated in the table. It is used for auditing purposes.		
<i>Data type:</i>	date and time	
<i>Maximum length:</i>	n/a	
<i>Required:</i>	yes	
<i>Measurement units:</i>	n/a	
<i>Format:</i>	n/a	
<i>Foreign key to (relation+attribute):</i>	n/a	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	not validated; generated automatically	
<i>Optional validation rules for this attribute:</i>	None	

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> PROTOCOL_ID	<i>Used by Deliverable ID:</i> OC_D
<i>Revision Date/Protocol Version:</i> 01-15-2014 / OC-2014.1	<i>Default Report Heading:</i> Protocol	<i>Relation (from Form X):</i> tbl_oc_cast
<i>Purpose:</i> The formal version of the protocol under which this row was created in the database.		
<i>Data type:</i>	Varchar(10)	
<i>Maximum length:</i>	10	
<i>Required:</i>	yes	
<i>Measurement units:</i>	n/a	
<i>Format:</i>	n/a	
<i>Foreign key to (relation+attribute):</i>	SEAN.tbl_protocol.protocol	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	1. Must match a protocol value in database table tbl_protocol.	
<i>Optional validation rules for this attribute:</i>	None	

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> USERID	<i>Used by Deliverable ID:</i> OC_D
<i>Revision Date/Protocol Version:</i> 01-15-2014 / OC-2014.1	<i>Default Report Heading:</i> Updated by	<i>Relation (from Form X):</i> tbl_oc_cast
<i>Purpose:</i> The login name used to authorize the process that created/updated this row in the cumulative database. It is restricted to those userids stored in the database table called tbl_submitter. It is used for auditing purposes.		
<i>Data type:</i>	Varchar(20)	
<i>Maximum length:</i>	20	
<i>Required:</i>	yes	
<i>Measurement units:</i>	n/a	
<i>Format:</i>	n/a	
<i>Foreign key to (relation+attribute):</i>	SEAN.tbl_submitter.submitter_userid	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	1. Must match a submitter_userid in tbl_submitter.	
<i>Optional validation rules for this attribute:</i>	None	

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> SUBMISSION_NUMBER	<i>Used by Deliverable ID:</i> OC_D
<i>Revision Date/Protocol Version:</i> 04-10-2009 / OC-2014.1	<i>Default Report Heading:</i> Submission#	<i>Relation (from Form X):</i> tbl_oc_cast
<i>Purpose:</i> The submission number used to transmit to the network the files from which this particular row came. It is used for several data management purposes, including auditing.		
<i>Data type:</i>	int	
<i>Maximum length:</i>	n/a	
<i>Required:</i>	yes	
<i>Measurement units:</i>	n/a	
<i>Format:</i>	n/a	
<i>Foreign key to (relation+attribute):</i>	SEAN.tbl_submission_log.submission_number	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	1. Must match a submission_number in tbl_submission_number.	
<i>Optional validation rules for this attribute:</i>	None	

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> CRUISE_YEAR	<i>Used by Deliverable ID:</i> OC_D
<i>Revision Date/Protocol Version:</i> 12-30-2009 / OC-2014.1	<i>Default Report Heading:</i> Cruise Year	<i>Relation (from Form X):</i> tbl_oc_cast
<i>Purpose:</i> Cruises are aggregated by year defined as the period December through November. For example, casts made in December 2008 and those from April 2009 are all in cruise year 2009. Casts made in October 2008 are in cruise year 2008. Cruise year is derived from DATE_GMT.		
<i>Data type:</i>	Varchar(4)	
<i>Maximum length:</i>	4	
<i>Required:</i>	yes	
<i>Measurement units:</i>	n/a	
<i>Format:</i>	0000	
<i>Foreign key to (relation+attribute):</i>	n/a	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	1. Must represent an integer between 1993 and the current year.	
<i>Optional validation rules for this attribute:</i>	None	

5 OC_F: NODC Repository Submission

Purpose of Deliverable

Copies of final certified detailed data are delivered to the National Oceanographic Data Center (NODC) for further dissemination. This repository is accessed by the worldwide research community to obtain detailed data. Its archive also serves as backup in case SEAN experiences a disaster.

Frequency Produced

This is generally created once per field season. In the event incorrect data ever appear in the NODC system, OC_F may be resubmitted to make it correct.

Prerequisites

Production of this deliverable is built using the certified OC_D database for a particular year, once the certified OC_M quality assessment has been applied to it.

Data Flow

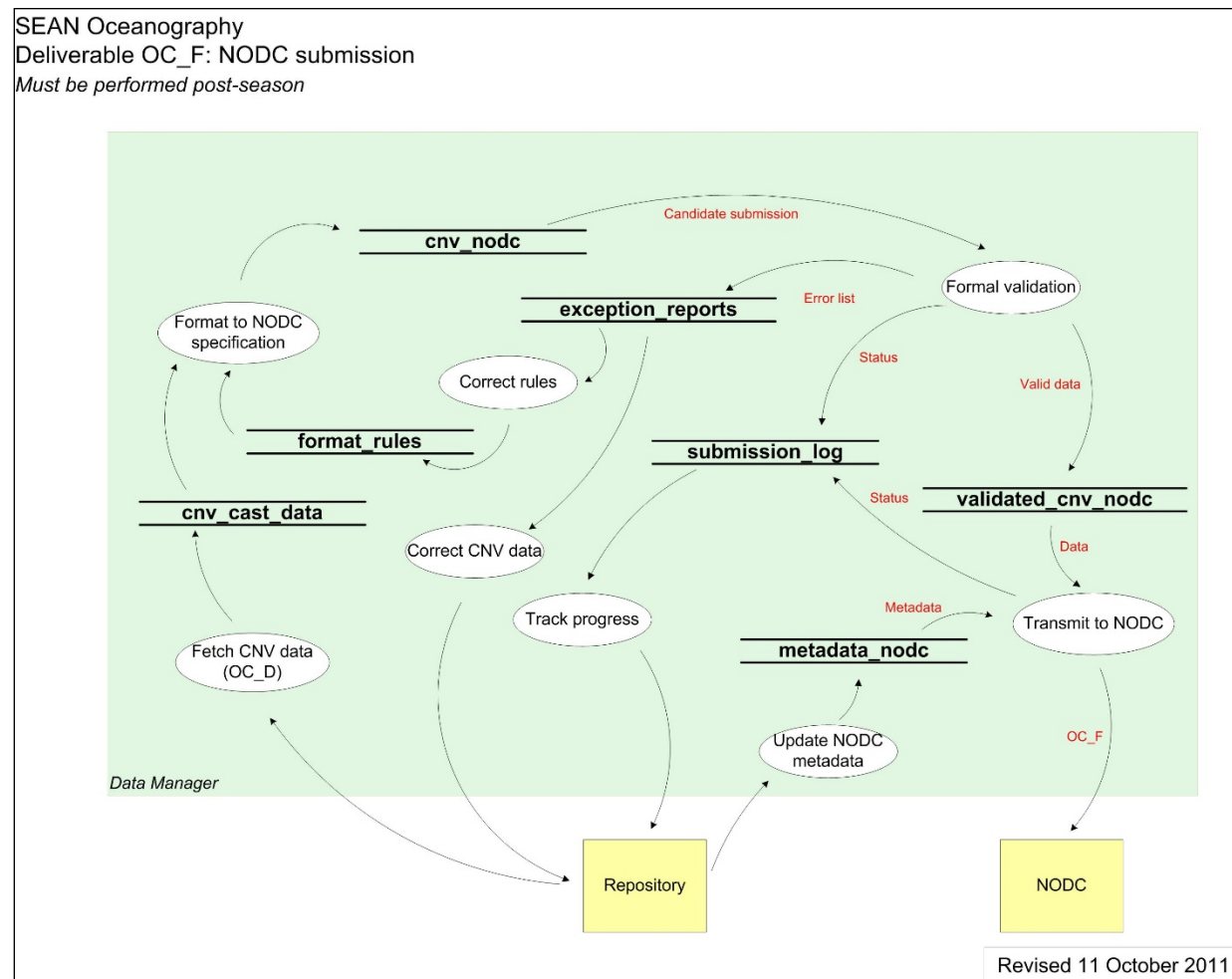


Figure 5. Data flow required to generate deliverable OC_F: NODC submission.

Deliverable Definition Forms

Form D: Tabular Data Deliverable

<i>Vital Sign:</i> OC Oceanography	<i>Deliverable ID:</i> OC_F	<i>Deliverable Title:</i> NODC submission
<i>File format:</i> CSV for data XML for metadata	<i>Associated Software and Version:</i> Custom for data Metavist 5.0 for metadata	<i>Revision Date/Protocol Version:</i> 01-15-2014 / OC-2014.1
<i>Expected frequency:</i> Once per year	<i>Likely dissemination partners:</i> NODC/NOAA	<i>Submission unit:</i> Cumulative all years in every submission
<i>What purpose does this deliverable serve?</i> Populates secondary repository.		
<i>Identifiers of relations that compose the tabular deliverable ("Relations" are tables or files that provide information which may be represented in a grid format. Each relation listed must be fully defined in its own accompanying Form X.):</i> NODC_YYYY.CSV where YYYY is the most recent four-digit year represented is used to contain the detailed observations. Other files, particularly metadata documentation, may be included, depending on what NODC and SEAN mutually agree upon for each annual submission. NODC will accept almost any submission form as long as it is adequately documented.		
<i>Deliverable ID of any other SEAN data products required to create this product:</i> OC_D, OC_M		
<i>Description and source of any outside data required to create this product:</i> None		

Form X: Relation Definition

<i>Vital Sign:</i> OC Oceanography	<i>Relation Identifier:</i> NODC_YYYY.CSV	<i>Used by Deliverable ID:</i> OC_F
<i>Revision Date/Protocol Version:</i> 05-04-2009 / OC-2014.1	<i>Type of Relation:</i> Windows file	<i>Estimated Rows:</i> 370,000+
<i>Primary key for this relation:</i> None		
<i>Purpose:</i> Oceanographic calibrated cast data binned to 1 m buckets, expressed in engineering units and provided as a comma-separated value file.		
<i>Identifiers of attributes defined over this relation (“attributes” are columns of the grid. Each attribute must be defined in an accompanying Form Y):</i>		
CTD	TEMPERATURE	
DUMP	CONDUCTIVITY	
CAST	SALINITY	
VESSEL	SIGMA_T	
STATION	FLUORESCENCE	
LATITUDE	OBS	
LONGITUDE	OXYGEN	
DATE_GMT	PAR	
TIME_GMT	SBE_DATA_FLAG	
FATHOMETER_DEPTH	COMMENTS	
PRESSURE	DATA_QUALITY	
DEPTH	PROTOCOL_ID	
	CRUISE_YEAR	
<i>Mandatory validation criteria involving multiple attributes:</i> None		
<i>Optional validation criteria involving multiple attributes:</i> None		

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i>	<i>Used by Deliverable ID:</i> OC_F
<i>Revision Date/Protocol Version:</i> 01-15-2014 / OC-2014.1	<i>Default Report Heading:</i>	<i>Relation (from Form X):</i> NODC_YYYY.CSV
<i>Purpose:</i> All attributes used for OC_F are copies of those with the same name from OC_D. Refer to the definition of deliverable OC_D for details.		
<i>Data type:</i>		
<i>Maximum length:</i>		
<i>Required:</i>		
<i>Measurement units:</i>		
<i>Format:</i>		
<i>Foreign key to (relation+attribute):</i>		
<i>Case:</i>		
<i>Mandatory validation rules for this attribute (in order of application):</i>		
<i>Optional validation rules for this attribute:</i>		

6 OC_G: Calibration Certificate Images

Purpose of Deliverable

CTD sensors are periodically calibrated. The whole unit is generally calibrated annually, though special circumstances may cause individual sensors to be recalibrated and reported *ad hoc*. When a unit is returned to the Project Leader from calibration, it is accompanied by certificates specifying the latest calibration parameter values and attesting to their accuracy. Researchers need to find these in order to verify accurate calibration figures have been properly applied to other oceanographic data products.

Frequency Produced

Whenever the result of any sensor recalibration is reported to the Project Leader. Certificates may be provided as paper forms, which must be scanned into PDFs. They may also be supplied as PDF files on CD, which may be used directly.

Prerequisites

None.

Data Flow

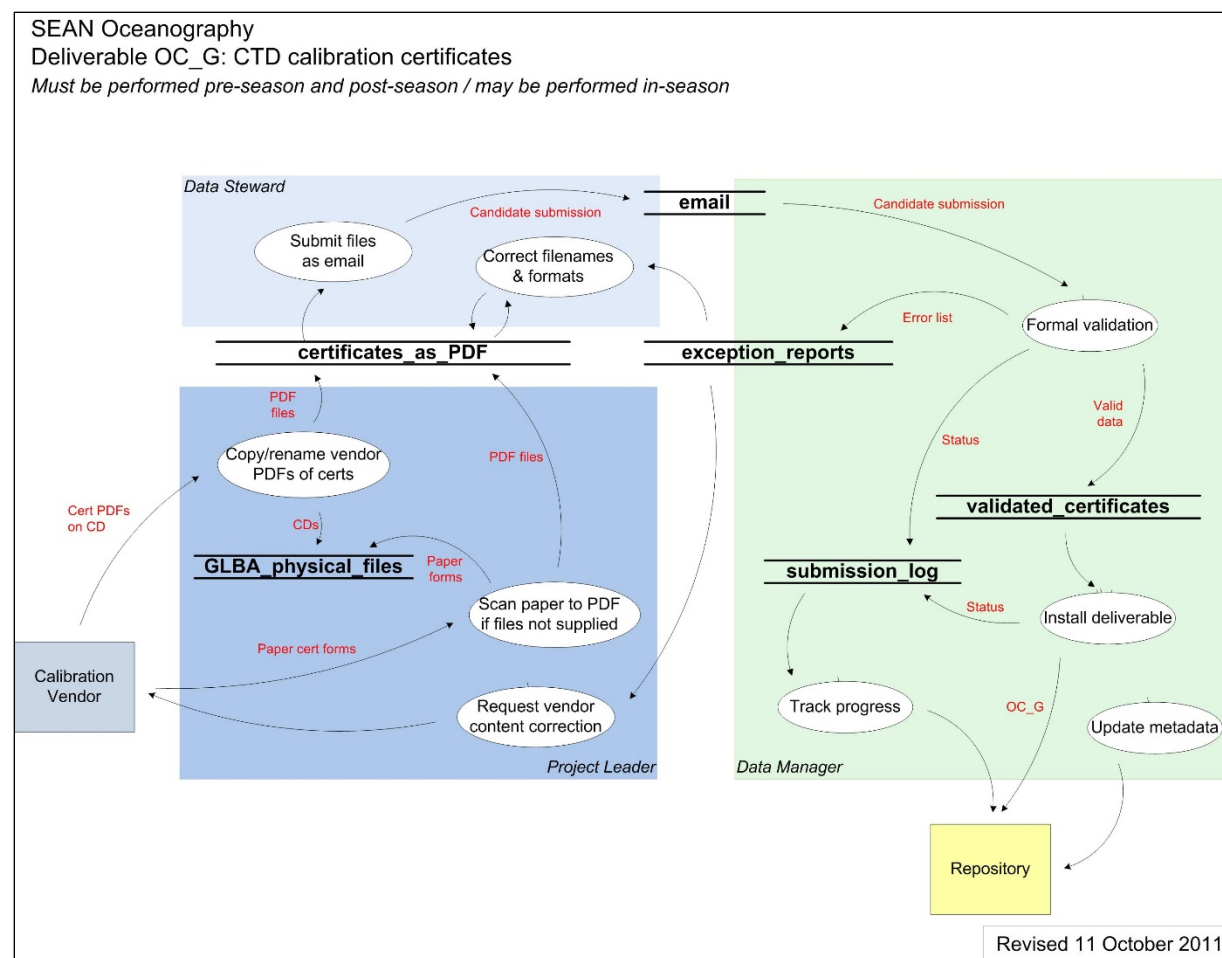


Figure 6. Data flow required to generate deliverable OC_G: calibration certificate images.

Deliverable Definition Forms

Form C: Nontabular Data Deliverable

<i>Vital Sign:</i> OC Oceanography	<i>Deliverable ID:</i> OC_G	<i>Deliverable Title:</i> Calibration certificate images
<i>File Format:</i> PDF	<i>Associated Software and Version:</i> Adobe Acrobat 11 pro	<i>Revision Date/Protocol Version:</i> 01-15-2014 / OC-2014.1
<i>Expected Frequency:</i> five per CTD per year	<i>Likely Dissemination Partners:</i> None: served by SEAN	<i>Submission Unit:</i> CTD# + Sensor s/n + Year + Month
<i>What purpose does this deliverable serve?</i> Documents the calibration parameters for all sensors on the CTD. Needed to validate revisions to OC_A calibration CON files.		
<i>Summary of content:</i> Scanned images of calibration certificates saved as PDFs. Certificates are provided by CTD and sensor vendors after periodic recalibration and after obtaining new sensors.		
<i>Mandatory validation criteria:</i> 1. Must successfully open using Adobe Reader 11.0 or greater. 2. Filename must conform to submission unit pattern described in detailed steps in SOP 2. 3. Image must be free from artifacts that obscure valuable content.		
<i>Optional validation criteria:</i> None		
<i>Deliverable ID of any other SEAN data products required to create this product:</i> None		
<i>Description and source of any outside data required to create this product:</i> Paper and/or PDF calibration certificates from manufacturers.		

7 OC_H: Field Log Sheet Images

Purpose of Deliverable

These are scanned images of the original sampling log sheets used to record the header information for each cast of a cruise. They are made available to allow discovery and correction of erroneous header information in OC_B hex files. Notes on the images may also be viewed to explain exceptional data encountered in other products derived from OC_B. They are also required to produce OC_M quality assessment. Both front and back of each form are recorded, unless completely blank.

Frequency Produced

These should be created annually, typically after completion of the field season.

Prerequisites

Availability of the complete set of log sheets for the survey year.

Data Flow

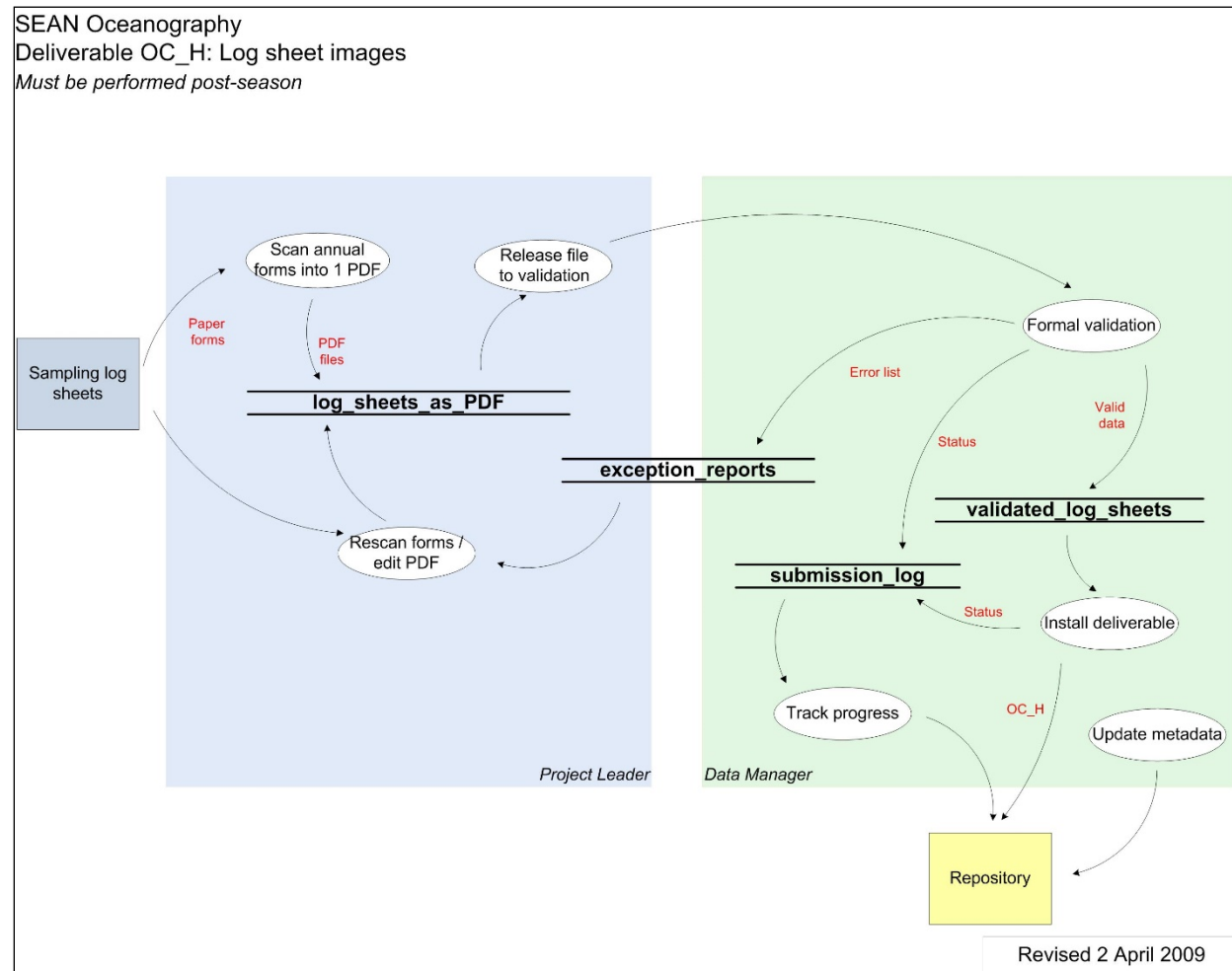


Figure 7. Data flow required to generate deliverable OC_H: field log sheet images.

Deliverable Definition Forms

Form C: Nontabular Data Deliverable

<i>Vital Sign:</i> OC Oceanography	<i>Deliverable ID:</i> OC_H	<i>Deliverable Title:</i> Log sheet images
<i>File Format:</i> PDF	<i>Associated Software and Version:</i> Adobe Acrobat 11	<i>Revision Date/Protocol Version:</i> 01-15-2014 / OC-2014.1
<i>Expected Frequency:</i> 20 per year	<i>Likely Dissemination Partners:</i> None: served by SEAN	<i>Submission Unit:</i> Year
<i>What purpose does this deliverable serve?</i> Source documents may be used for researching data errors and individual exceptions.		
<i>Summary of content:</i> Scanned images of field log sheets.		
<i>Mandatory validation criteria:</i> 1. Must successfully open using Adobe Reader 11.0 or greater. 2. Filename must conform to submission unit pattern described in detailed steps. 3. Image must be free from artifacts that obscure valuable content.		
<i>Optional validation criteria:</i> 1. Should not have cast number gaps. 2. Should all be oriented properly.		
<i>Deliverable ID of any other SEAN data products required to create this product</i> None		
<i>Description and source of any outside data required to create this product:</i> Paper log sheets from field crews.		

8 OC_I: Protocol

Purpose of Deliverable

The protocol document defines in detail the technical methodology employed in the SEAN oceanography program.

Frequency Produced

Created as needed, using the processes in SOP 18.

Prerequisites

Protocol deliverables are always created from the most recent DOCX form of the latest OC_I protocol document.

Data Flow

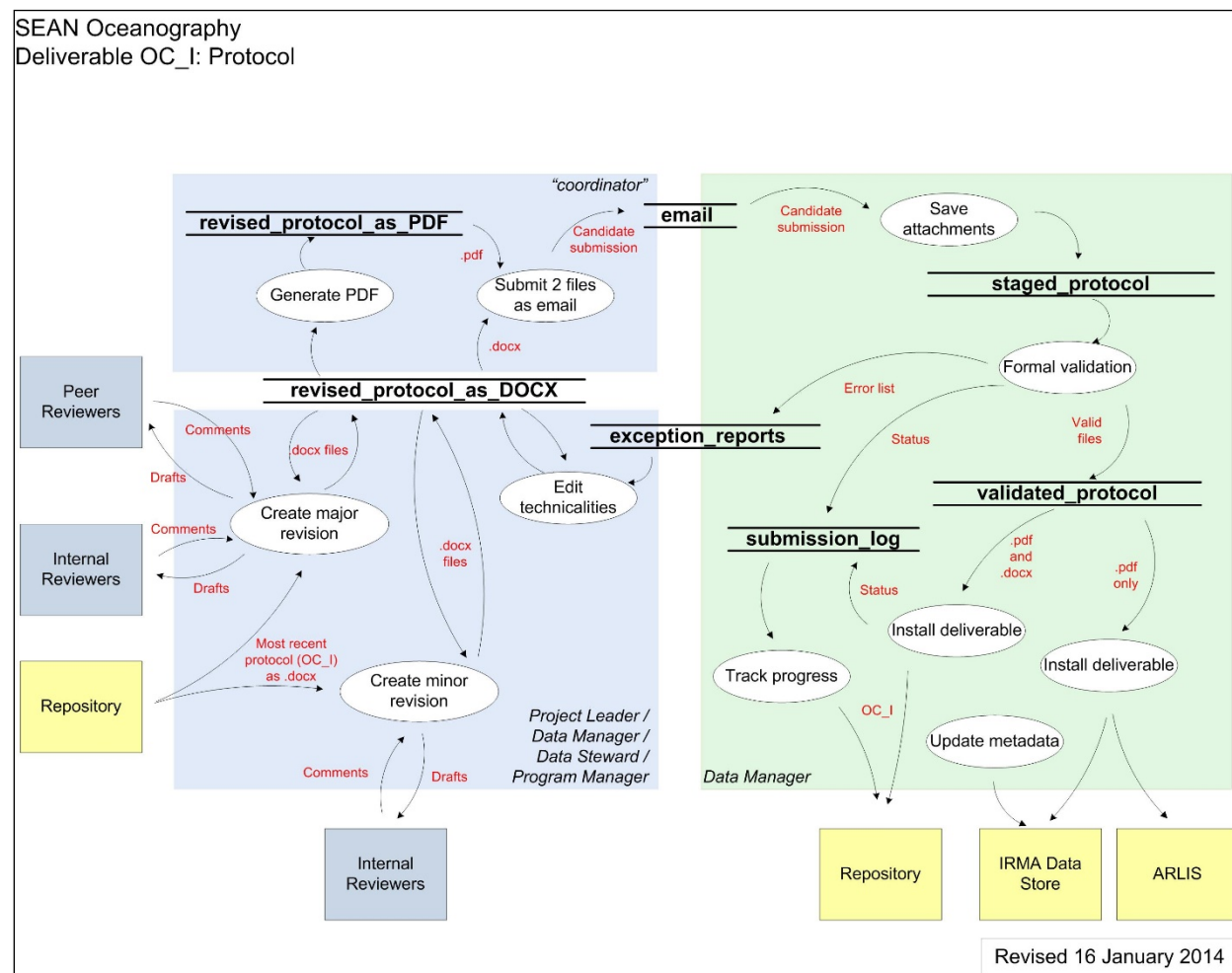


Figure 8. Data flow required to generate deliverable OC_I: protocol.

Deliverable Definition Forms

Form A: Nontabular Information Deliverable

<i>Vital Sign:</i> OC Oceanography	<i>Deliverable ID:</i> OC_I	<i>Deliverable Title:</i> Protocol
<i>File Format:</i> DOCX and PDF	<i>Associated Software and Version:</i> Word 2010 + Adobe Acrobat 11	<i>Revision Date/Protocol Version:</i> 01-15-2014 / OC-2014.1
<i>Expected Frequency:</i> as needed	<i>Likely Dissemination Partners:</i> None: served by SEAN	<i>Submission Unit:</i> Single unit to supplant the existing OC_I.
<i>What purpose does this deliverable serve?</i> Defines the technical methodology employed in the SEAN physical oceanography monitoring program.		
<i>Summary of content:</i> Narrative, detailed appendices, standard operating procedures (SOPs) for conducting program. A PDF copy is kept for dissemination purposes. A DOCX copy is kept as the basis for the next version update.		
<i>Mandatory validation criteria:</i> 1. PDF must successfully open using Adobe Reader 11.0 or greater. 2. DOCX must successfully open using Microsoft Office 365. 3. Must consistently reference a correct protocol version ID, as defined in SEAN Data Management Plan (Johnson and Moynahan 2008, SOP 602: Version Control).		
<i>Optional validation criteria:</i> None		
<i>Deliverable ID of any other SEAN data products required to create this product</i> Prior OC_I.		
<i>Description and source of any outside data required to create this product:</i> No specific sources can be named in advance. Editors will have to draw on a number of areas of technical expertise and guidance to complete this deliverable.		

9 OC_J: Data Availability Matrix

Purpose of Deliverable

Researchers need to be informed of the availability of specific data by month and year. Specific data collected varies depending on factors such as the type of detectors installed at the time, weather conditions, and field circumstances. The availability depicted here is derived from the presence of entries existing in the OC_D cumulative database. If the data management procedures are strictly observed, then the matrix will inherently reflect availability of OC_D's precursors: OC_A, OC_B, OC_C, and OC_G.

Frequency Produced

This must always be performed directly after completing a deliverable OC_D cumulative database, which is normally done annually. The actual deliverable disseminated for OC_J is a PDF file.

However, an Excel spreadsheet is also part of this deliverable, though not served on the website. The spreadsheet serves as the source for the PDF and the basis for the next update.

Prerequisites

OC_D cumulative database.

Data Flow

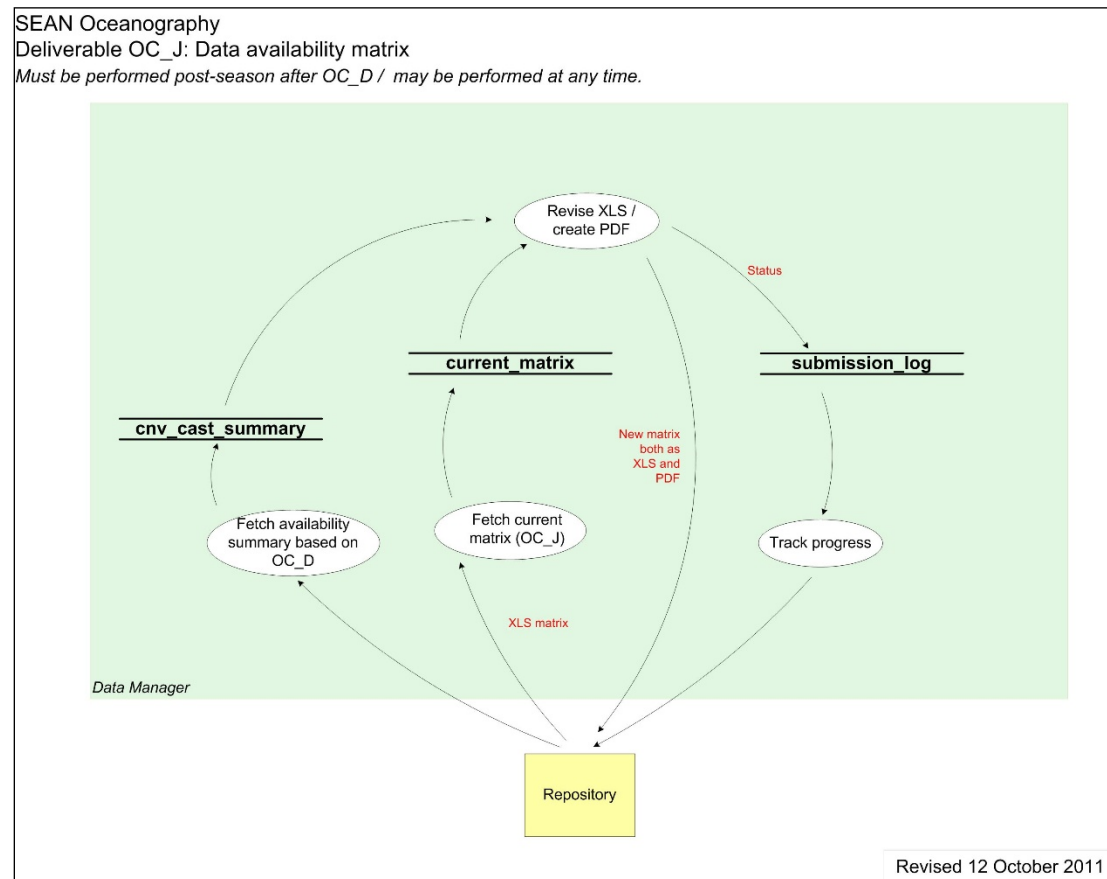


Figure 9. Data flow required to generate deliverable OC_J: data availability matrix.

Deliverable Definition Forms

Form A: Nontabular Information Deliverable

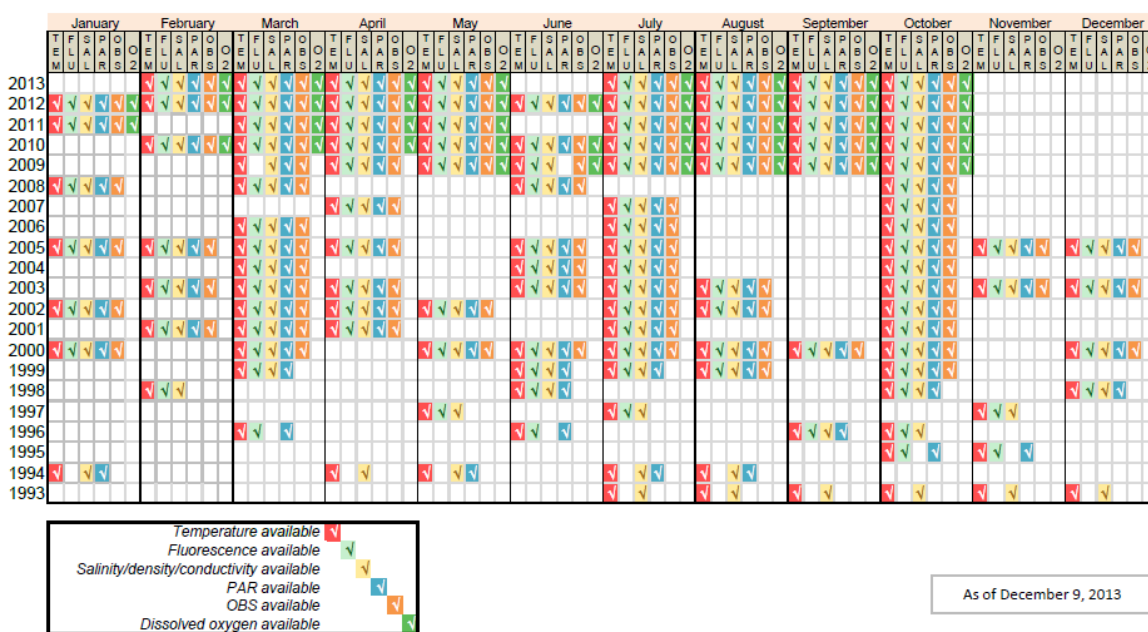
<i>Vital Sign:</i> OC Oceanography	<i>Deliverable ID:</i> OC_J	<i>Deliverable Title:</i> Data availability matrix
<i>File Format:</i> .XLSX and .PDF	<i>Associated Software and Version:</i> Excel 2010 and Adobe Acrobat 11	<i>Revision Date/Protocol Version:</i> 01-15-2013 / OC-2014.1
<i>Expected Frequency:</i> one per year	<i>Likely Dissemination Partners</i> None: served by SEAN	<i>Submission Unit:</i> None: is always the current state

What purpose does this deliverable serve?

Explains to customers the availability of time and type entries existing in deliverable OC_D and its precursors. Time granularity is year/month. Type granularity refers to the kind of physical parameter measured: temperature, PAR, etc.

Summary of content:

A PDF rendering of an Excel spreadsheet similar in form and content to the following:

*Mandatory validation criteria:*

1. Spreadsheet must be able to be opened with full functionality using Microsoft Excel 2010 or more recent version.
2. PDF must be able to be opened and properly rendered under Adobe Reader 11.0 or more recent version.

Optional validation criteria:

None

Deliverable ID of any other SEAN data products prerequisite to this product:

OC_D cumulative database.

Description and source of any outside data required to create this product:

None

10 OC_K: Annual Report

Purpose of Deliverable

This is a report that summarizes the operations and outcomes of a season. Content includes station coverage, tables and plots illustrating current conditions, operation exceptions, and notification of any changes to the protocol. The content is appropriate for its target audience of park management as well as the public.

Frequency Produced

These are typically created annually, after completion of each field season.

Prerequisites

Certified database deliverable OC_D for the season. Certified data quality evaluation OC_M for the season. The OC_M data quality evaluation is typically not available until after the CTD returns from annual factory calibration with new calibration factors.

Data Flow

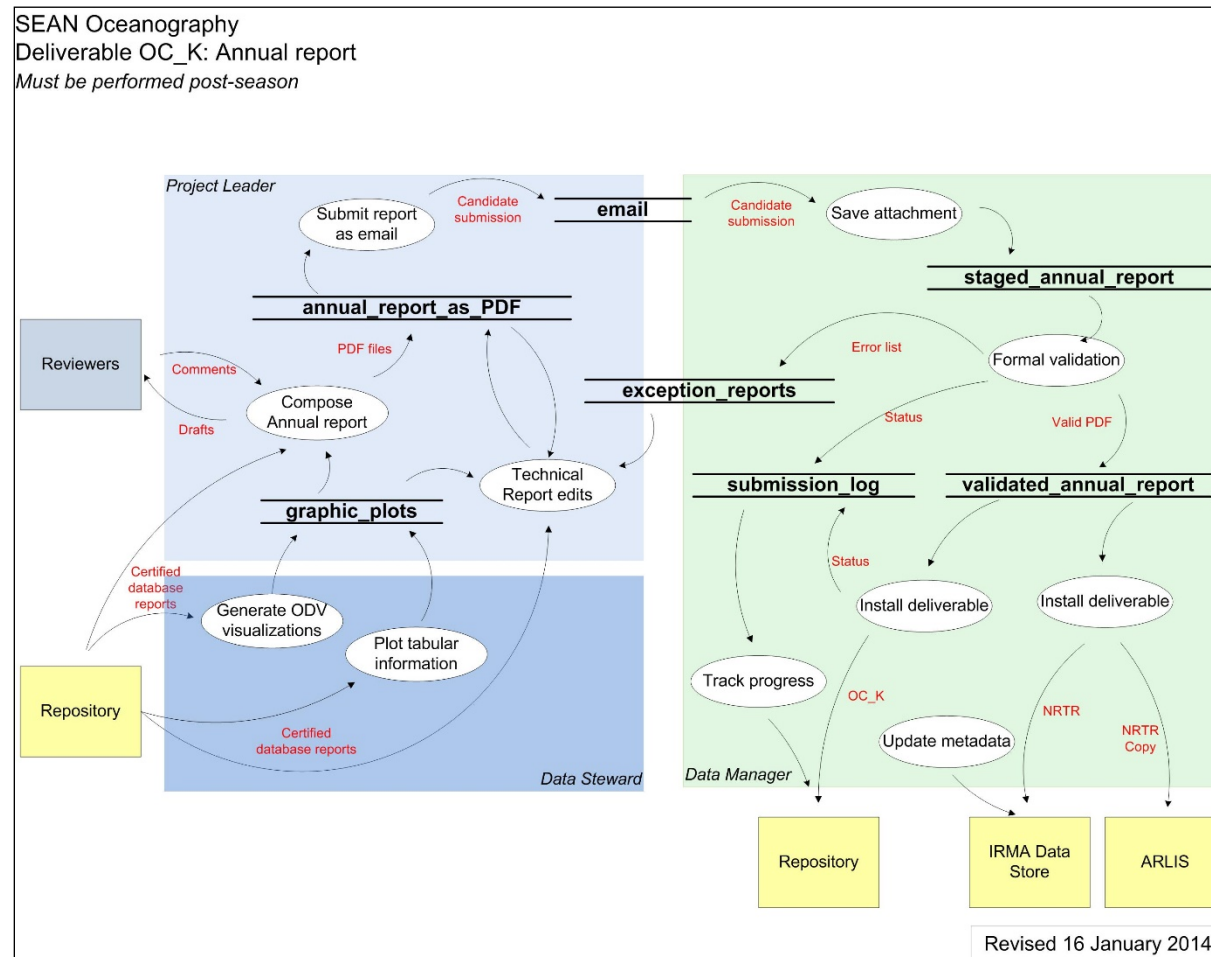


Figure 10. Data flow required to generate deliverable OC_K: annual report.

Deliverable Definition Forms

Form A: Nontabular Information Deliverable

<i>Vital Sign:</i> OC Oceanography	<i>Deliverable ID:</i> OC_K	<i>Deliverable Title:</i> Annual report
<i>File Format:</i> PDF	<i>Associated Software and Version:</i> Adobe Acrobat 11	<i>Revision Date/Protocol Version:</i> 01-15-2014 / OC-2014.1
<i>Expected Frequency:</i> one per year	<i>Likely Dissemination Partners:</i> None: served by SEAN	<i>Submission Unit:</i> Year
<i>What purpose does this deliverable serve?</i> Summarizes the operations and outcomes of a season to inform managers, the public, and the scientific community.		
<i>Summary of content:</i> Synopsis of operations, temporal and spatial coverage for this season, representative data tables, representative vertical profile plots, representative data visualizations, discussion summarizing observations.		
<i>Mandatory validation criteria:</i> Must successfully open using Adobe Reader 11.0 or greater.		
<i>Optional validation criteria:</i> None		
<i>Deliverable ID of any other SEAN data products required to create this product:</i> OC_D CNV database rows. OC_M data quality evaluation.		
<i>Description and source of any outside data required to create this product:</i> None		

11 OC_L: Five-Year Report

Purpose of Deliverable

This report discusses trends that are evident from the historic data series. It does not cover operations, which is done in the annual report. The content is appropriate for an audience of management and the public as well as scientists.

Frequency Produced

These are created every five years, typically sometime after completion of the OC_K annual report for the most recent season.

Prerequisites

Certified database deliverable OC_D cumulative database for all seasons in the scope. Certified data quality report OC_M for all seasons in the scope.

Data Flow

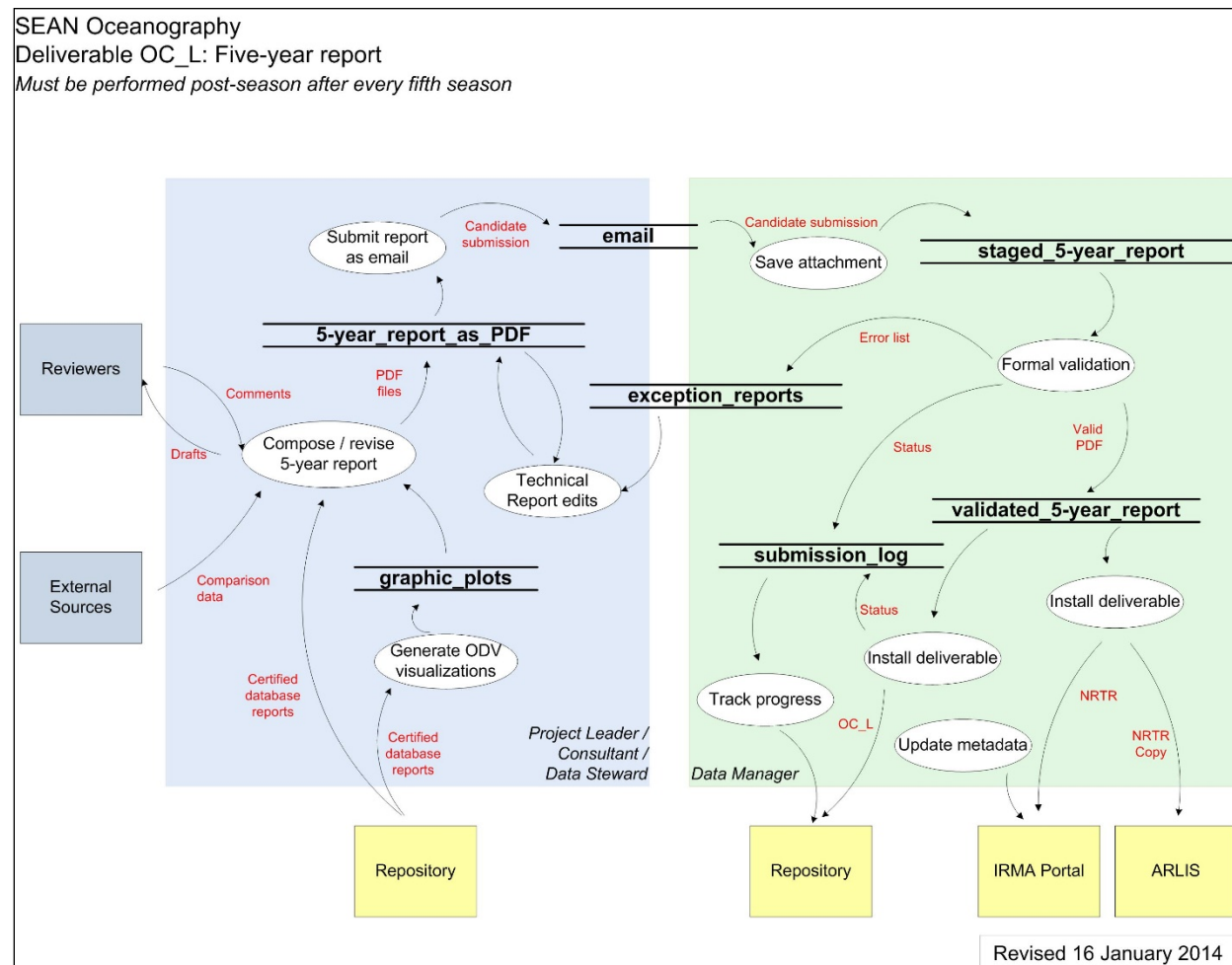


Figure 11. Data flow required to generate deliverable OC_L: five-year report.

Deliverable Definition Forms

Form A: Nontabular Information Deliverable

<i>Vital Sign:</i> OC Oceanography	<i>Deliverable ID:</i> OC_L	<i>Deliverable Title:</i> Five-year report
<i>File Format:</i> PDF	<i>Associated Software and Version:</i> Adobe Acrobat 11	<i>Revision Date/Protocol Version:</i> 01-15-2014 / OC-2014.1
<i>Expected Frequency:</i> Once every five years	<i>Likely Dissemination Partners:</i> None: served by SEAN	<i>Submission Unit:</i> At least the most recent five-year contiguous set of survey years
<i>What purpose does this deliverable serve?</i> Analysis of physical oceanographic trends for each station is provided to inform customers and facilitate decision-making. Time series analysis for evaluating cyclic phenomena is also presented.		
<i>Summary of content:</i> Introduction, methods, results, and discussion.		
<i>Mandatory validation criteria:</i> 1. Must successfully open using Adobe Reader 11.0 or greater.		
<i>Optional validation criteria:</i> None		
<i>Deliverable ID of any other SEAN data products required to create this product</i> OC_D CNV database rows and OC_M data quality evaluation for the years covered must be certified and applied before this report may be composed.		
<i>Description and source of any outside data required to create this product:</i> Oceanographic time series useful for comparison include GAK1, Line P, and Ocean Station PAPA, Canadian "lighthouse, and National Data Buoy Center moorings and coastal stations. Cross correlation analysis uses climate data from NCDC and NDBC, streamflow from USGS, and large-scale climate system indices such as those available from http://jisao.washington.edu and http://www.cgd.ucar.edu/cas/catalog/climind .		

12 OC_M: Data Quality Evaluation

Purpose of Deliverable

This form identifies the quality of data taken during each cast of the season. Once certified, the values in OC_M are applied to columns in the OC_D cumulative database.

Frequency Produced

OC_M is generally submitted and certified once per year. In particular, it must follow any certification of an OC_D database update.

Prerequisites

Certified database deliverable OC_D cumulative database, original *and* postseason calibration reports OC_G, field log sheets OC_H, and quality-assurance plots generated for both HEX and CNV files by Project Leader (not a deliverable).

Data Flow

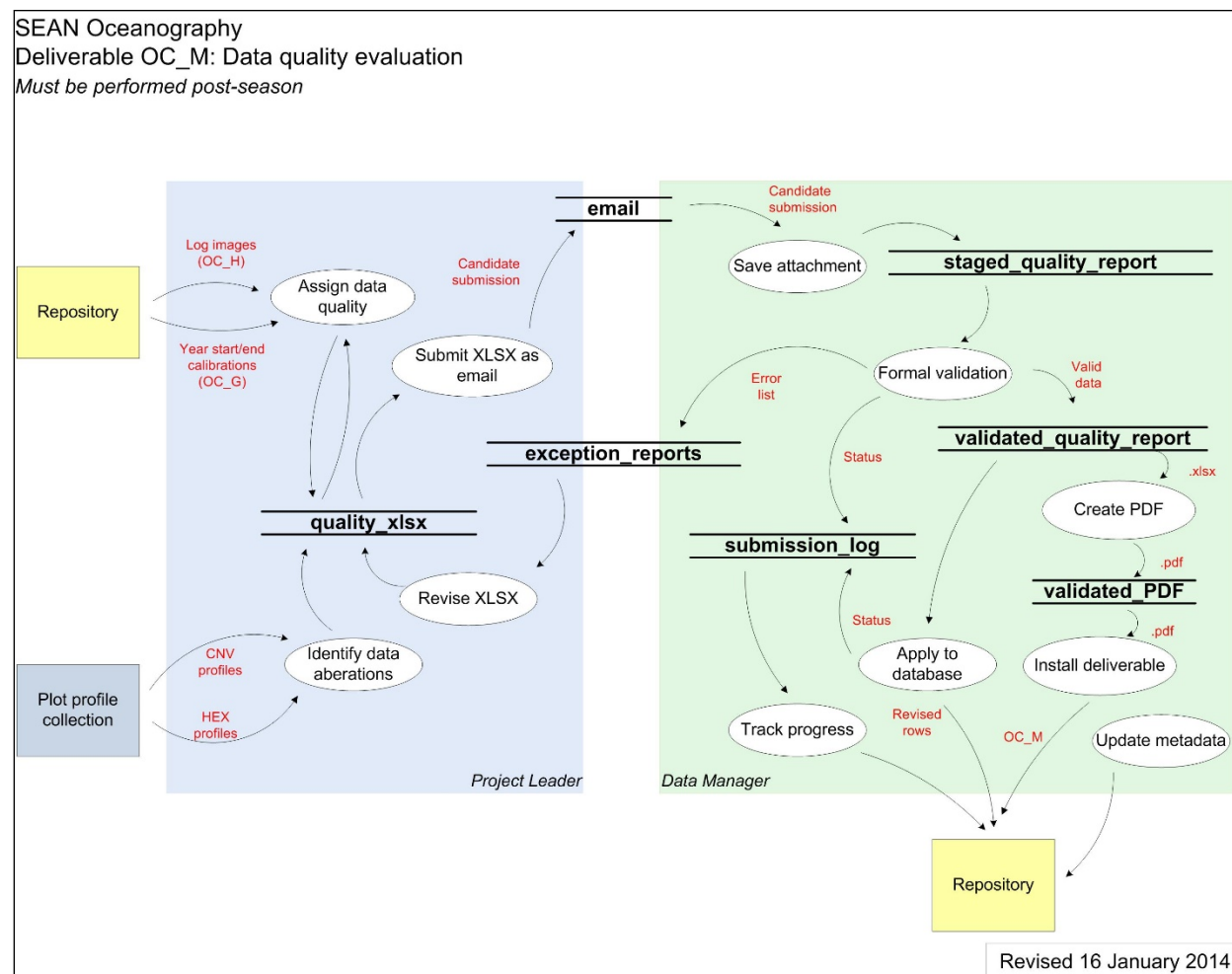


Figure 12. Data flow required to generate deliverable OC_M: data quality evaluation.

Deliverable Definition Forms

Form D: Tabular Data Deliverable

<i>Vital Sign:</i> OC Oceanography	<i>Deliverable ID:</i> OC_M	<i>Deliverable Title:</i> Data quality report
<i>File Format:</i> XLSX workbook covering a cruise year: one tab per dump number.	<i>Associated Software and Version:</i> Excel 2010	<i>Revision Date/Protocol Version:</i> 01-15-2014/OC-2014.1
<i>Expected Frequency:</i> one file per year	<i>Likely Dissemination Partners:</i> None: served by SEAN	<i>Submission Unit:</i> Cruise year
<i>What purpose does this deliverable serve?</i> Provides data quality column values for cumulative database. When applied to the database, attribute values for the cast coming from instruments marked defective/absent are made null.		
<i>Identifiers of relations that compose the tabular deliverable ("relations" are tables or files that provide information which may be represented in a grid format. Each relation listed must be fully defined in its own accompanying Form X):</i> Quality_YYYY.XLSX!DDDD, where YYYY is the cruise year and DDDD is the dump number.		
<i>Deliverable ID of any other SEAN data products required to create this product:</i> OC_D, OC_G, OC_H		
<i>Description and source of any outside data required to create this product:</i> None		

Form X: Relation Definition

<i>Vital Sign:</i> OC Oceanography	<i>Relation Identifier:</i> Quality_YYYY.XLSX! DDDD	<i>Used by Deliverable ID:</i> OC_M
<i>Revision Date/Protocol Version:</i> 01-15-2014 / OC-2014.1	<i>Type of Relation:</i> File	<i>Estimated Rows:</i> 20 tabs by 25 rows
<i>Natural key for this relation:</i> ctd + dump		
<i>Purpose:</i> Roster of casts made during a dump cycle of a particular CTD, with data quality exceptions identified.		
<i>Identifiers of attributes defined over this relation ("attributes" are columns of the grid. Each attribute must be defined in an accompanying Form Y):</i>		
CTD		
DUMP		
CAST		
QUALITY_CODE		
DATA_QUALITY_COMMENT		
COND_BAD		
TEMP_BAD		
FLUO_BAD		
OBS_BAD		
PAR_BAD		
O2_BAD		
<i>Mandatory validation criteria involving multiple attributes:</i> None		
<i>Optional validation criteria involving multiple attributes:</i> 1. If DATA_QUALITY_COMMENT is not null, then QUALITY_CODE should not be null.		

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> CTD	<i>Used by Deliverable ID:</i> OC_M
<i>Revision Date/Protocol Version:</i> 01-15-2014 / OC-2014.1	<i>Default Report Heading:</i> CTD #	<i>Relation (from Form X):</i> Quality_YYYY.XLSX! DDDD
<i>Purpose:</i> Local identification number of the CTD device (defined in Appendix F).		
<i>Data type:</i>		Varchar(10)
<i>Maximum length:</i>		1
<i>Required:</i>		yes
<i>Measurement units:</i>		n/a
<i>Format:</i>		9
<i>Foreign key to (relation+attribute):</i>		n/a
<i>Case:</i>		n/a
<i>Mandatory validation rules for this attribute (in order of application):</i>		1. Must be between 1 and 9.
<i>Optional validation rules for this attribute:</i>		1. Should be between 1 and 6.

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute identifier:</i> DUMP	<i>Used by deliverable ID:</i> OC_M
<i>Revision Date/Protocol Version:</i> 01-15-2014/ OC-2014.1	<i>Default report heading:</i> Dump#	<i>Relation (from Form X):</i> Quality_YYYY.XLSX! DDDD
<i>Purpose:</i> The sequential dump number covered by this data.		
<i>Data type:</i>		Varchar(4)
<i>Maximum length:</i>		4
<i>Required:</i>		yes
<i>Measurement units:</i>		n/a
<i>Format:</i>		0009
<i>Foreign key to (relation+attribute):</i>		n/a
<i>Case:</i>		n/a
<i>Mandatory validation rules for this attribute (in order of application):</i>		1. Must represent an integer between 1 and 9999.
<i>Optional validation rules for this attribute:</i>		none

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> CAST	<i>Used by Deliverable ID:</i> OC_M
<i>Revision Date/Protocol Version:</i> 01-15-2014 / OC-2014.1	<i>Default Report Heading:</i> CAST#	<i>Relation (from Form X):</i> Quality_YYYY.XLSX! DDDD
<i>Purpose:</i> Sequential cast number within a particular dump. Casts are integers beginning with zero or one, depending on CTD software level. They are generated by the CTDs themselves.		
<i>Data type:</i>	Varchar(2)	
<i>Maximum length:</i>	2	
<i>Required:</i>	yes	
<i>Measurement units:</i>	n/a	
<i>Format:</i>	00	
<i>Foreign key to (relation+attribute):</i>	n/a	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	1. Must represent an integer between 0 and 99.	
<i>Optional validation rules for this attribute:</i>	None	

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> QUALITY_CODE	<i>Used by Deliverable ID:</i> OC_M										
<i>Revision Date/Protocol Version:</i> 01-15-2014 / OC-2014.1	<i>Default Report Heading:</i> Quality	<i>Relation (from Form X):</i> Quality_YYYY.XLSX! DDDD										
<i>Purpose:</i> The numeric quality code used to flag individual casts. Codes used are those defined natively by Ocean Data View software. They are interpreted for this protocol as follows: <table border="1"> <tr> <td>0: good</td> <td>No exceptional circumstances were encountered; everything fell within the constraints of the protocol.</td> </tr> <tr> <td>1: unknown</td> <td>It is not possible to ascertain whether there were any exceptions. This typically occurs when the field log information was lost before an assessment could be made.</td> </tr> <tr> <td>4: questionable</td> <td>The user is alerted one or more exceptions were encountered; embedded comments should be reviewed to determine the usefulness of these data for specific purposes. Typical issues include: 1. One or two sensors providing erroneous readings 2. Short casts 3. Significant gaps in vertical profile 4. Data reconstructed from upcasts 5. Imprecise location due to failed GPS, sea ice barriers, drifting during cast, etc. 6. CTD hitting sea floor 7. Imputed values 8. Manually set bad-flags on certain readings</td> </tr> <tr> <td>8: bad</td> <td>Damaged to the point of not being useful: CTD not switched on, catastrophic equipment failure, three or more sensors giving erroneous readings, unknown location, CTD memory overrun, etc. Bad casts typically result in no data, so there may be no rows to tag in the OC_D database.</td> </tr> <tr> <td><null></td> <td>Until a positive action is made to assign quality, these database items have no value.</td> </tr> </table>			0: good	No exceptional circumstances were encountered; everything fell within the constraints of the protocol.	1: unknown	It is not possible to ascertain whether there were any exceptions. This typically occurs when the field log information was lost before an assessment could be made.	4: questionable	The user is alerted one or more exceptions were encountered; embedded comments should be reviewed to determine the usefulness of these data for specific purposes. Typical issues include: 1. One or two sensors providing erroneous readings 2. Short casts 3. Significant gaps in vertical profile 4. Data reconstructed from upcasts 5. Imprecise location due to failed GPS, sea ice barriers, drifting during cast, etc. 6. CTD hitting sea floor 7. Imputed values 8. Manually set bad-flags on certain readings	8: bad	Damaged to the point of not being useful: CTD not switched on, catastrophic equipment failure, three or more sensors giving erroneous readings, unknown location, CTD memory overrun, etc. Bad casts typically result in no data, so there may be no rows to tag in the OC_D database.	<null>	Until a positive action is made to assign quality, these database items have no value.
0: good	No exceptional circumstances were encountered; everything fell within the constraints of the protocol.											
1: unknown	It is not possible to ascertain whether there were any exceptions. This typically occurs when the field log information was lost before an assessment could be made.											
4: questionable	The user is alerted one or more exceptions were encountered; embedded comments should be reviewed to determine the usefulness of these data for specific purposes. Typical issues include: 1. One or two sensors providing erroneous readings 2. Short casts 3. Significant gaps in vertical profile 4. Data reconstructed from upcasts 5. Imprecise location due to failed GPS, sea ice barriers, drifting during cast, etc. 6. CTD hitting sea floor 7. Imputed values 8. Manually set bad-flags on certain readings											
8: bad	Damaged to the point of not being useful: CTD not switched on, catastrophic equipment failure, three or more sensors giving erroneous readings, unknown location, CTD memory overrun, etc. Bad casts typically result in no data, so there may be no rows to tag in the OC_D database.											
<null>	Until a positive action is made to assign quality, these database items have no value.											
<i>Data type:</i>		Varchar(1)										
<i>Maximum length:</i>		1										
<i>Required:</i>		no										
<i>Measurement units:</i>		n/a										
<i>Format:</i>		9										
<i>Foreign key to (relation+attribute):</i>		n/a										
<i>Case:</i>		n/a										
<i>Mandatory validation rules for this attribute (in order of application):</i>		1. Must be one of {0, 1, 4, 8}.										
<i>Optional validation rules for this attribute:</i>		none										

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> DATA_QUALITY_COMMENT	<i>Used by Deliverable ID:</i> OC_M
<i>Revision Date/Protocol Version:</i> 01-15-2014 / OC-2014.1	<i>Default Report Heading:</i> Quality Comment	<i>Relation (from Form X):</i> Quality_YYYY.XLSX! DDDD
<i>Purpose:</i> A brief explanation of why the quality was assigned. If COMMENT is entered, then QUALITY_CODE must not be null.		
<i>Data type:</i>		Varchar(512)
<i>Maximum length:</i>		512
<i>Required:</i>		no
<i>Measurement units:</i>		n/a
<i>Format:</i>		n/a
<i>Foreign key to (relation+attribute):</i>		n/a
<i>Case:</i>		n/a
<i>Mandatory validation rules for this attribute (in order of application):</i>		None
<i>Optional validation rules for this attribute:</i>		None

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> COND_BAD	<i>Used by Deliverable ID:</i> OC_M
<i>Revision Date/Protocol Version:</i> 01-15-2014 / OC-2014.1	<i>Default Report Heading:</i> Bad Conductivity	<i>Relation (from Form X):</i> Quality_YYYY.XLSX! DDDD
<i>Purpose:</i> Set to true if the conductivity instrument has been removed from the CTD or has been judged to be giving invalid readings during this cast.		
<i>Data type:</i>		Boolean
<i>Maximum length:</i>		1
<i>Required:</i>		no
<i>Measurement units:</i>		n/a
<i>Format:</i>		n/a
<i>Foreign key to (relation+attribute):</i>		n/a
<i>Case:</i>		n/a
<i>Mandatory validation rules for this attribute (in order of application):</i>		None
<i>Optional validation rules for this attribute:</i>		None

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> TEMP_BAD	<i>Used by Deliverable ID:</i> OC_M
<i>Revision Date/Protocol Version:</i> 01-15-2014 / OC-2014.1	<i>Default Report Heading:</i> Bad Temperature	<i>Relation (from Form X):</i> Quality_YYYY.XLSX! DDDD
<i>Purpose:</i> Set to true if the temperature instrument has been removed from the CTD or has been judged to be giving invalid readings during this cast.		
<i>Data type:</i>	Boolean	
<i>Maximum length:</i>	1	
<i>Required:</i>	no	
<i>Measurement units:</i>	n/a	
<i>Format:</i>	n/a	
<i>Foreign key to (relation+attribute):</i>	n/a	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	None	
<i>Optional validation rules for this attribute:</i>	None	

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> FLUO_BAD	<i>Used by Deliverable ID:</i> OC_M
<i>Revision Date/Protocol Version:</i> 01-15-2014 / OC-2014.11	<i>Default Report Heading:</i> Bad Fluorescence	<i>Relation (from Form X):</i> Quality_YYYY.XLSX! DDDD
<i>Purpose:</i> Set to true if the fluorometer has been removed from the CTD or has been judged to be giving invalid readings during this cast.		
<i>Data type:</i>	Boolean	
<i>Maximum length:</i>	1	
<i>Required:</i>	no	
<i>Measurement units:</i>	n/a	
<i>Format:</i>	n/a	
<i>Foreign key to (relation+attribute):</i>	n/a	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	None	
<i>Optional validation rules for this attribute:</i>	None	

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> OBS_BAD	<i>Used by Deliverable ID:</i> OC_M
<i>Revision Date/Protocol Version:</i> 01-15-2014 / OC-2014.1	<i>Default Report Heading:</i> Bad OBS	<i>Relation (from Form X):</i> Quality_YYYY.XLSX! DDDD
<i>Purpose:</i> Set to true if the nepholometer has been removed from the CTD or has been judged to be giving invalid readings during this cast.		
<i>Data type:</i>		Boolean
<i>Maximum length:</i>		1
<i>Required:</i>		no
<i>Measurement units:</i>		n/a
<i>Format:</i>		n/a
<i>Foreign key to (relation+attribute):</i>		n/a
<i>Case:</i>		n/a
<i>Mandatory validation rules for this attribute (in order of application):</i>		None
<i>Optional validation rules for this attribute:</i>		None

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> PAR_BAD	<i>Used by Deliverable ID:</i> OC_M
<i>Revision Date/Protocol Version:</i> 01-15-2014 / OC-2014.1	<i>Default Report Heading:</i> Bad PAR	<i>Relation (from Form X):</i> Quality_YYYY.XLSX! DDDD
<i>Purpose:</i> Set to true if the pyrometer has been removed from the CTD or has been judged to be giving invalid readings during this cast.		
<i>Data type:</i>		Boolean
<i>Maximum length:</i>		1
<i>Required:</i>		no
<i>Measurement units:</i>		n/a
<i>Format:</i>		n/a
<i>Foreign key to (relation+attribute):</i>		n/a
<i>Case:</i>		n/a
<i>Mandatory validation rules for this attribute (in order of application):</i>		None
<i>Optional validation rules for this attribute:</i>		None

Form Y: Attribute Definition

<i>Vital Sign:</i> OC Oceanography	<i>Attribute Identifier:</i> O2_BAD	<i>Used by Deliverable ID:</i> OC_M
<i>Revision Date/Protocol Version:</i> 01-15-2014 / OC-2014.1	<i>Default Report Heading:</i> Bad O2	<i>Relation (from Form X):</i> Quality_YYYY.XLSX! DDDD
<i>Purpose:</i> Set to true if the oxygen concentration sensor has been removed from the CTD or has been judged to be giving invalid readings during this cast.		
<i>Data type:</i>	Boolean	
<i>Maximum length:</i>	1	
<i>Required:</i>	no	
<i>Measurement units:</i>	n/a	
<i>Format:</i>	n/a	
<i>Foreign key to (relation+attribute):</i>	n/a	
<i>Case:</i>	n/a	
<i>Mandatory validation rules for this attribute (in order of application):</i>	None	
<i>Optional validation rules for this attribute:</i>	None	