

Coast Survey Development Laboratory

Office of Coast Survey

National Ocean Service

National Oceanic and Atmospheric Administration

Recent Progress on the S-111 Product Specification and Data

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S-111 Product Specification for Surface Current Vectors: Data Formats and Portrayal Rules

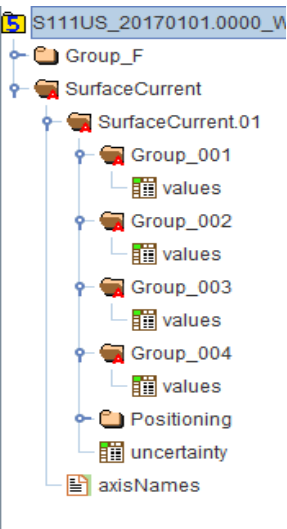
2. Structures

- Fixed station time series
- Regularly gridded
- Irregularly gridded
- Moving stations (drifters)

1. Oceanographic Data: Current Speed and Direction

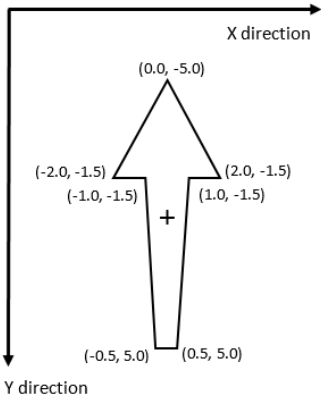
- Real-time Observations
- Historical Observations
- Model-based Forecasts
- Astronomic Predictions
- Analysis Products
- Coastal Radar Imagery

3. Reformat data into HDF5 file

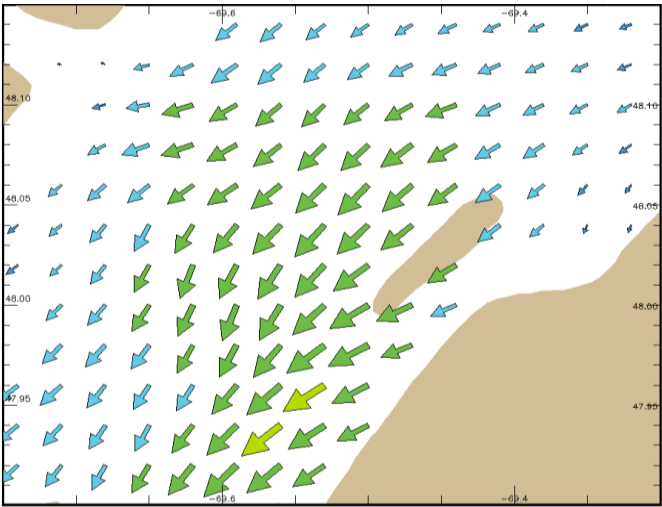


(Portrayal)

4. Current symbol



6. Sample shipboard display



5. Speed-based colour categories

Speed Band	Min Speed (kn)	Speed Band Width (kn)	Colour	RGB Colour Scale Intensity			Displayed Colour
				Red	Green	Blue	
1	0.0	0.5	purple	118	82	226	
2	0.5	0.5	dark blue	72	152	211	
3	1.0	1.0	light blue	97	203	229	
4	2.0	1.0	dark green	109	188	69	
5	3.0	2.0	light green	180	220	0	
6	5.0	2.0	yellow-green	205	193	0	
7	7.0	3.0	orange	248	167	24	
8	10.0	3.0	pink	247	162	157	
9	13.0	86.0	red	255	30	30	

Progress in S-111: Overview

1. Progress since TWCWG3 in April 2018

HDF5 Format Changes through October 2018 (Extensive)

Test Strategy Meeting (Sept, in Busan)

2. Distribution of Edition 1.0.0 by IHO in December 2018

Proposed Changes to the PS Review Process

Made minor edits to Ed. 1.0.0

3. Review of Member State's Test Files

Specification of a Regular Grid

Spelling of variable names, and order are **very important**

4. Works In Progress

DQ Issues and Uncertainty Estimates

Exchange Datasets

Issues from the Test Strategy Group Meeting

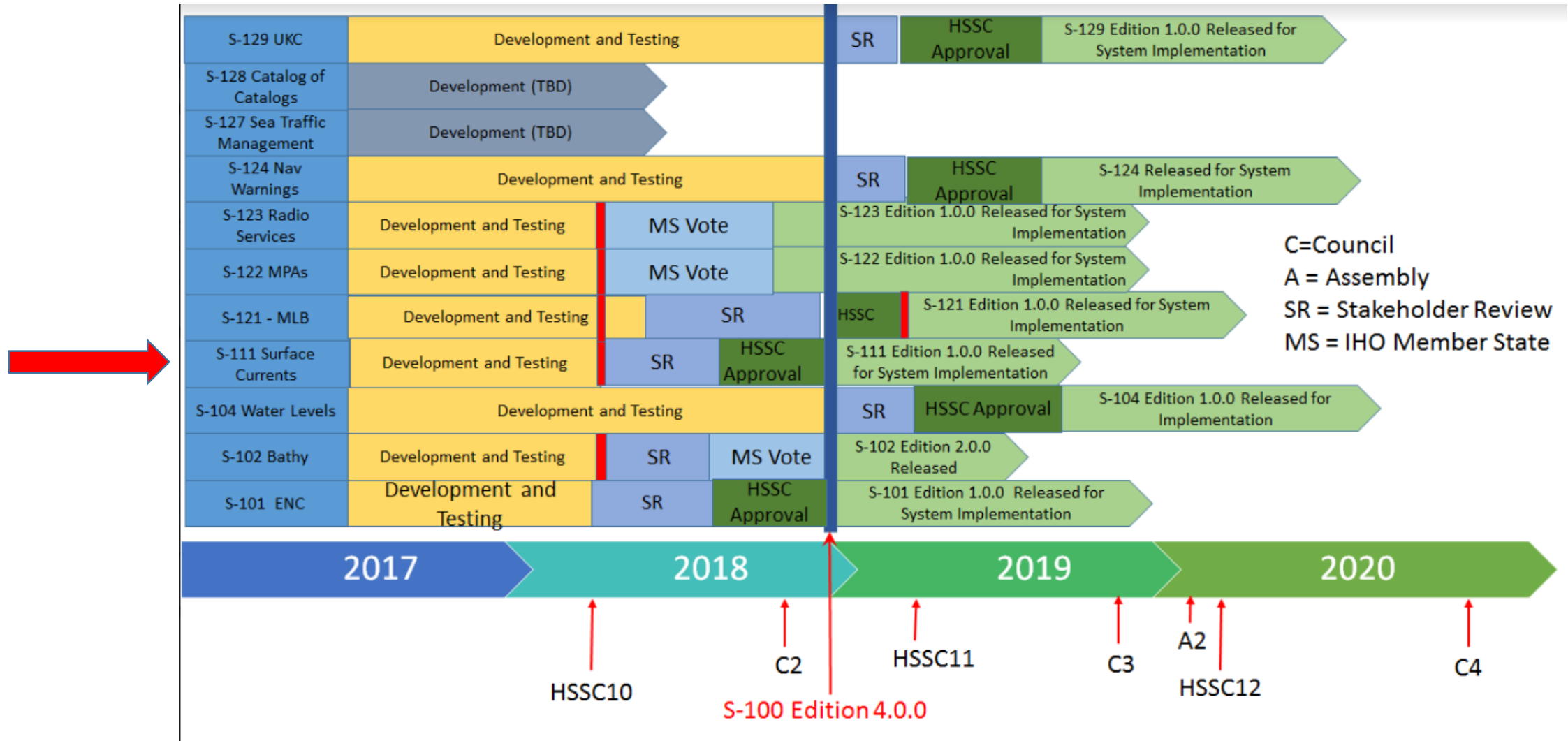
Sept. 18-20, 2018, Busan ROK

- S-111 is in good shape
- Reference to paper: 'The information carrying capacity of flow visualizations'
 - Point data for arrows requires less memory than for streamlines
- Developers need to provide QA/QC and uncertainty data
 - For S-111 Uncertainty for 5 variables: horizontal position, vertical position, time, speed, direction
 - QA/QC: see S-111, Annex D
- Suggestions (from S-102) for chunking in HDF5
 - http://davis.lbl.gov/Manuals/HDF5-1.8.7/Advanced/Chunking/Chunking_Tutorial_EOS13_2009.pdf
- Data compression (ZIP) and encryption are described in S-100 Part 15
 - Files are compressed with ZIP, possibly using the DEFLATE option
 - Encrypt after ZIP compression with an Advanced Encryption Standard (AES) method

Test Strategy Group – Continued

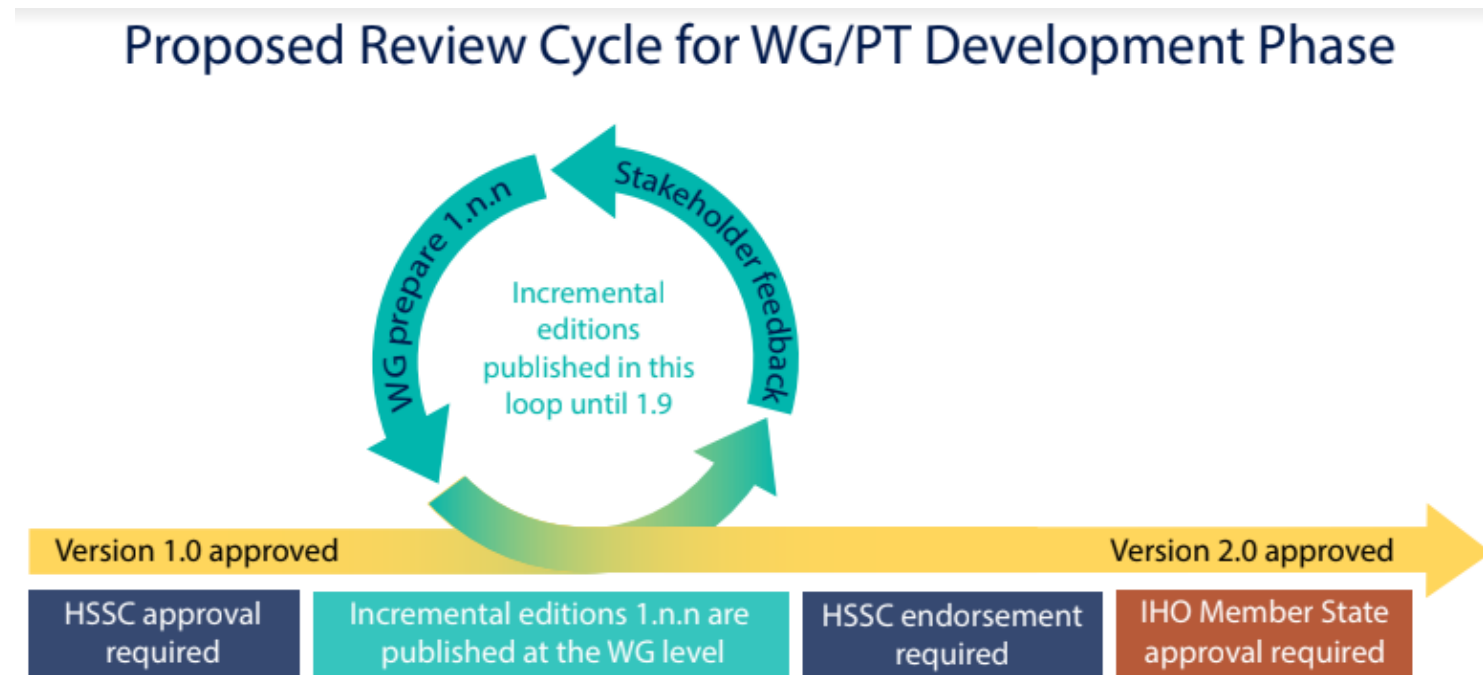
- PS should have use cases for Alerts and Indications (S-126)
 - Requires a new feature type
 - Keyed to spatial (i.e., geographic region) and time (high water, flood/ebb) elements
 - Needed data: current speeds, tidal amplitude
 - Instructions to be added to Portrayal Catalog
- How to implement Marine Resource Names (MRN)
 - Form for publications (URN=Uniform Resource Name):
`urn:mrn:iho:pub:<pub type>:<pub name/number>:<ed_number>:<correction>:<clarification>:<optional information>`
 - Sample:** `urn:mrn:iho:pub:spec:S111:1:0:0`
- Should there be a standard value for ‘missing value’ or ‘unknown value’?
 - In S-111, for uncertainty use -1.0
 - For missing value, user specified ‘fill’ value
 - S-102 uses 1,000,000.0 for missing or unknown value
- Dataset naming convention (S-97, Part A)
 - XXXCCCCnnnnnnnnnnnnnnnnnnnnnnnnn
 - XXX = ‘111’, CCCC = producer code, ‘nn.’ = user-defined characters.
- Uncertainty for entire dataset, or for each value (e.g., bathymetry)?

Status of S-100 Level Product Specs.

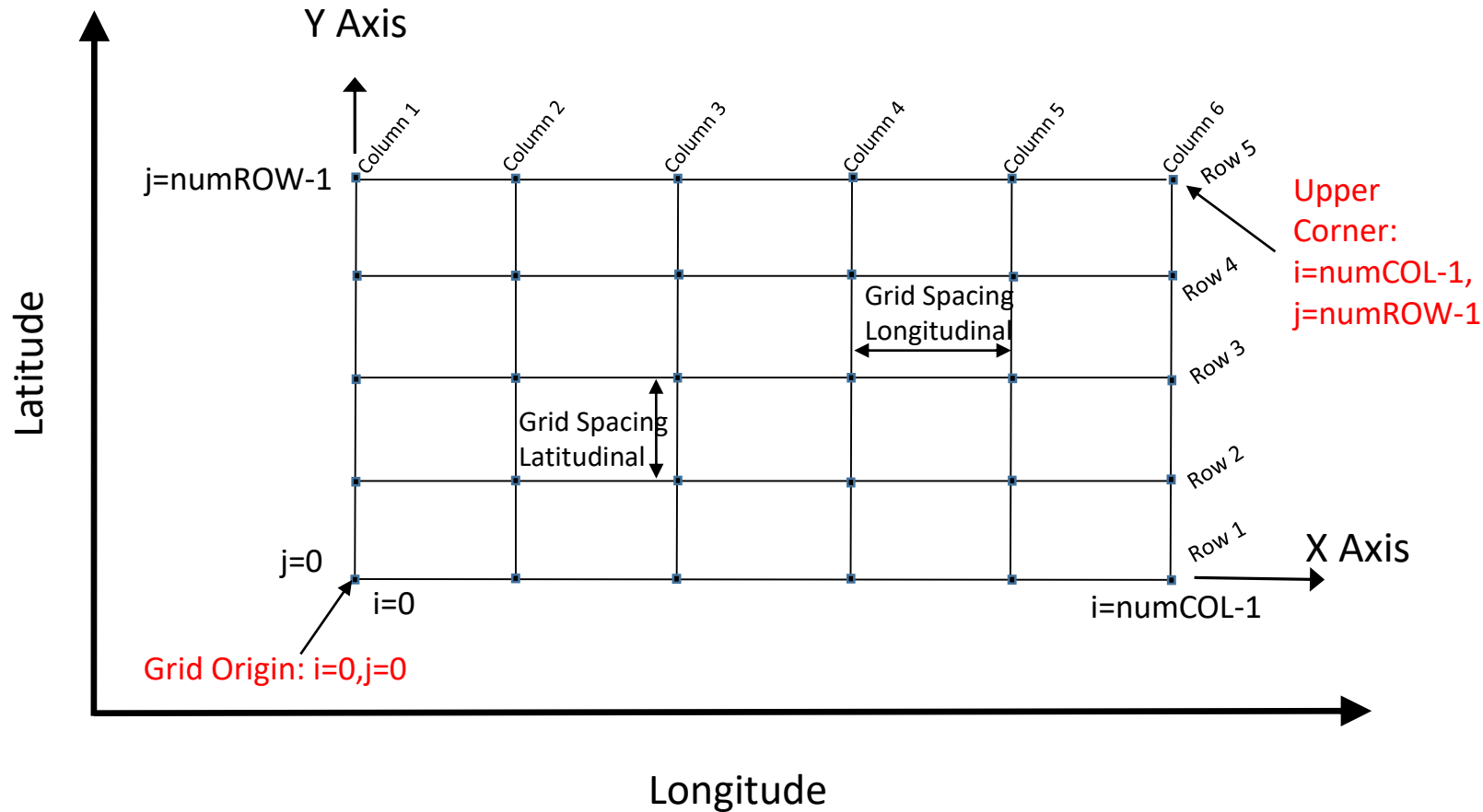


Proposed New Review Process

- Versions 1.n.n (revision, clarification) to be reviewed and published at the WG level
- New Editions (2.0.0, 3.0.0, etc.) require HSSC and MS endorsement
- S-111 Ed. 1.0.1 in draft form (see meeting documents)
- After meeting, S-111 Ed. 1.0.1 to be reviewed in TWCWG



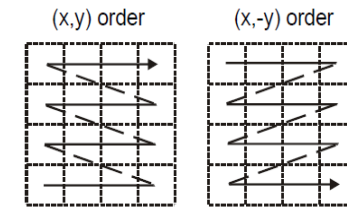
HDF5 Issues: Regular Grid Specification



FEATURES:

- X axis is parallel to longitudinal direction (?)
- Arrow will be plotted at the nodes (intersections)
- Write/Read the data:
sequencingRule.type='linear'

Linear Scan Traversal Order in 2 dimensions



- Write/Read the data:
startSequence = '0,0'
sequencingRule.scanDirection = 'longitude,latitude'

Or to display right side up in HDFView

startSequence = '0,numROW-1'
sequencingRule.scanDirection = 'longitude,-latitude'

Updates to the S-111 Product Specification: Draft S-111 Ed 1.0.1

- Dataset 'SurfaceCurrent' in Group_F:

Data in columns 'upper' and 'closure' now reversed

	code	name	uom.name	fillValue	dataType	lower	upper	closure
0	surfaceCurrentSpeed	Surface current speed	knots	-9999.0	H5T_FLOAT	0.0		geSemiInterval
1	surfaceCurrentDirection	Surface current direction	arc-degrees	-9999.0	H5T_FLOAT	0.0	360	geLInterval

Revised values

- Annex F, Sec. F.2: Added text to clarify variable order and name
For this coding format, the speed and direction are stored in the one-dimensional compound array 'values'. In each element of the array, the first variable is 'surfaceCurrentSpeed' and the second is 'surfaceCurrentDirection'. The spelling and order of variable names is important.
- Other minor spelling and spacing changes. These constitute 'clarifications'

Uncertainty Estimates

Uncertainty Parameters In S-111:

GENERAL: S-100

- *horizontalPositionUncertainty*
- *verticalUncertainty*
- *timeUncertainty*

SURFACE CURRENTS: S-111

- *surfaceCurrentSpeedUncertainty*
- *surfaceCurrentDirectionUncertainty*

Definition of Uncertainty:

- DQWG to review PS S-111 in the coming year
- DQWG chair recommends, in highest to least order:
 - half length of the interval, defined by an upper and a lower limit, in which the true value lies with probability 95 %,
 - half length of the interval, defined by an upper and a lower limit, in which the true value lies with probability nn (e.g., nn = 50 %, 68.3 %, 90 % 99 %),
 - twice the standard deviation (SD), or
 - twice the RMSE (my addition to list)
- It seems that S-111 must include definition of method used. Possibly in Table 12.2 (Feature metadata) or Table 12.3 (Instance metadata), or
- Or, all agree on one definition

The Future: Data Quality Measures

S-100 Part 4c – Metadata – Data Quality, Appendix 4c-C
'Hydrographic Quality Metadata Attribute Definitions'

Existing Text:

DQ_GriddedDataPositionalAccuracy

Closeness of gridded data position values to values accepted as true

DQ_AccuracyOfATimeMeasurement

Correctness of the temporal references of an item
(reporting of error in the time measurement)

DQ_QuantativeAttributeAccuracy

Accuracy of a quantitative attribute

DQ_AbsoluteExternalPositionalAccuracy

DQ_CompletenessCommission

DQ_CompletenessOmission

DQ_ConceptualConsistency

DQ_DomainConsistency

DQ_FormatConsistency

DQ_NonQuantativeAttributeAccuracy

Etc.

Next Steps For Surface Currents

- Continue developing & consulting on HDF5 file formats
- Clarify S-111 interpretation of specifications as needed
- Respond to requests arising from implementation by test bed creators and OEMs
- Review S-111 Ed. 1.0.1
- Develop XML Exchange Datasets
- Continue uncertainty estimations
 - Revise definition of uncertainty
 - Add uncertainty method to HDF5 attributes
 - Review by TWCWG
- Develop software for data quality measures