

S-412

A Weather Overlay Product Specification

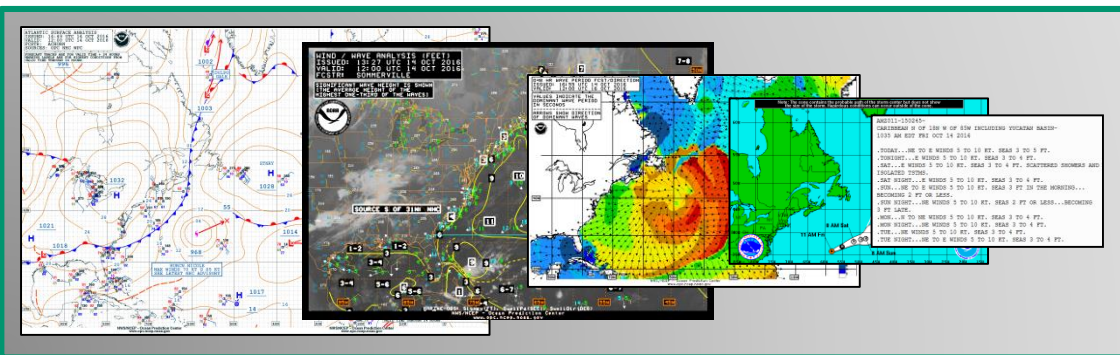
Greg Seroka

Physical Scientist

NOAA/National Ocean Service/Office of Coast Survey, USA

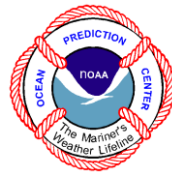
LT Joseph Phillips, NOAA Commissioned Corps, et al. at the
NOAA/National Weather Service/Ocean Prediction Center, USA

IHO TWCWG3 / Viña del Mar, Chile / April 2018





S-412 Weather Overlay: Needed Components



Main

- Specifies what is needed to build a complete product
 - Feature Types
 - Geometry
 - Data formats and file size
 - Metadata
 - Coordinate reference systems

Feature Catalogue

- Features
- Attributes
- Enumerants
- Bindings
- Point, Curve or Surface

Portrayal Catalogue

- Symbols, Line Styles and Area Fills
- Rule for how the feature attribute combination must be portrayed

Data Classification and Encoding Guide (DCEG)

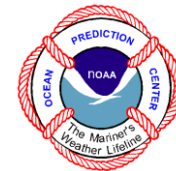
- Contains the guidance for how the data should be encoded by the data producer
- Useful as a template for building the feature catalogue

Exchange Format

- Data format that is used for data exchange
- Exchange Catalogue



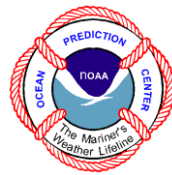
S-412 Weather Overlay: Feature Catalogue Status



- **2012:** WMO/IOC Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM) officially designated US/NOAA as project lead.
- **2013:** Initial Development of Encoding Guides
- **2017:** Merged features and attributes into IHO Registry
- **2017:** Feature Catalogue version 0.0.1 completed
- **January 2018:** Updated Encoding Guides and Application Schema
- **Currently:** Reviewing and updating Encoding Guides and Application Schema
- **Future:**
 - Harmonization where possible with other Product Specifications
 - Merge features/attributes into IHO Registry
 - Feature Catalogue version 0.0.2



S-412 Weather Overlay: Feature Catalogue Challenges



Traditional marine weather products vs digital services.

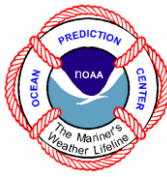
- Shifting paradigm to a hazard focus service model that incorporates traditional services.

WMO Publications are not always best for this product specification:

- Designed for observations and non-digital marine services
 - Definitions don't always exist (ie WMO 558 does not define freezing spray/ice accretion warning criteria) so individual forecasting agencies define them differently.
 - Allowable encodings differ between WMO and IHO (ie WMO 306 uses Code figure "0" – IHO allowable encodings start at 1).
 - Observation criteria conflicts with conservative forecasting (ie WMO 8 4.2.12.5 and WMO 306 Code Tables: if height is in two categories (ie 2-4 m and 4-6 m) then the height is included in the lower category).



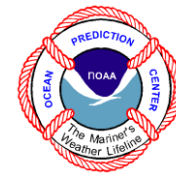
S-412 Weather Overlay: The new data model



- WeatherSystem abstract feature includes sub-features for what causes hazards for mariners (fronts, squalls, thunderstorms, tropical cyclones, etc.)
- WeatherHazard abstract feature includes sub-features for the hazards that are going to cause mariners problems (wind, precipitation, freezing spray, waves, etc.)
- WeatherMessage abstract feature includes sub-features for messages that highlight particular conditions (i.e. warnings, watches, advisories or discussions)



S-412 Weather Overlay: Next Steps for the Feature Catalogue



Simplifying the S-412 data model:

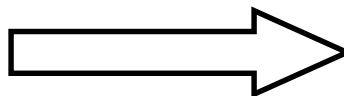
«ComplexAttributeType» gustDirection
+azimuthDegreesOfWindDirection[1..1] : integer +windDirectionCompassPoint[0..1] : cardinalDirection +windAveragePeriod[1..1] : integer

«ComplexAttributeType» windWaveDirection
+azimuthDegreesOfWaveDirection[1..1] : integer +waveDirectionCompassPoint[0..1] : cardinalDirection

«ComplexAttributeType» primarySwellWaveDirection
+azimuthDegreesOfWaveDirection[1..1] : integer +waveDirectionCompassPoint[0..1] : cardinalDirection

«ComplexAttributeType» secondarySwellWaveDirection
+azimuthDegreesOfWaveDirection[1..1] : integer +waveDirectionCompassPoint[0..1] : cardinalDirection

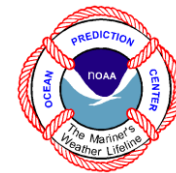
«ComplexAttributeType» windDirection
+azimuthDegreesOfWindDirection[1..1] : integer +windDirectionCompassPoint[0..1] : cardinalDirection +windAveragePeriod[1..1] : integer



«ComplexAttributeType» directionFrom
+azimuthDegrees[1] : integer +cardinalDirection[0..1] : cardinalDirection



S-412 Weather Overlay: Next Steps for the Feature Catalogue



Additional Upcoming Changes:

- Simplify data model – generic attributes, utilize inheritance more
- Remove all upper level information from S-412
- Improve warning services – use text attributes and reduce data duplication
 - Harmonize with S-124 Navigational Warnings where possible
- Clarifying data types for features (vector data vs gridded data)

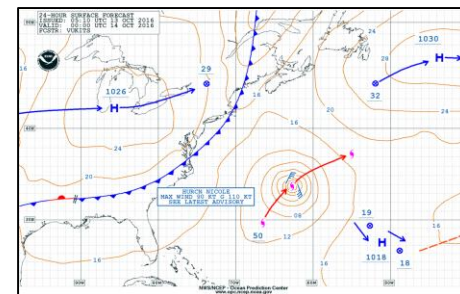
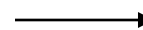
Vector (GML):

~25 features

All WeatherSystem sub-features

All WeatherMessage sub-features

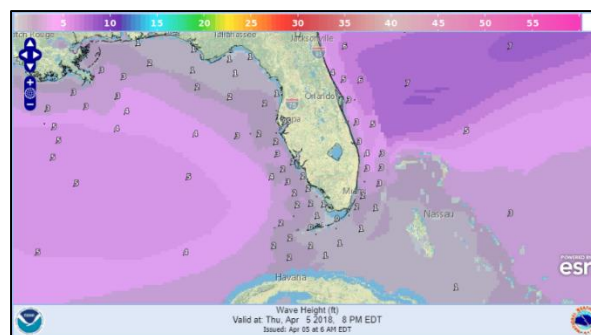
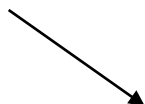
Observation



Grid (HDF5):

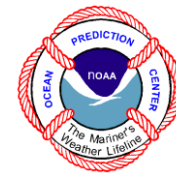
~30 features

All WeatherHazard sub-features (winds, waves, freezing spray)





S-412 Weather Overlay: Portrayal Catalogue Status



To date:

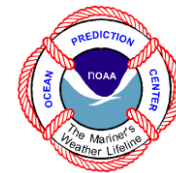
- 48 Point and Line concept symbols defined
 - Symbol encoding underway with KHOA assistance
- 44 Surface concept symbols currently under review

Future Focus:

- Review all symbols for concurrence with data model
- Develop additional symbols with day/night/dusk palettes
- Consider color scales for gridded data features
- Encode symbols
- Merge symbols and rules into IHO Registry
- Develop Portrayal Catalogue version 0.0.1
- Continue and expand testing (KHOA and SPAWAR S-100 Viewers)
 - Goal: Develop and meet testing standards (interoperability)
 - Goal: Symbol sizing rules needed at multiple scales
 - Goal: Defining scaling restrictions for S-412 Features



S-412 Weather Overlay: Portrayal Challenges



While good for guidance, WMO publications are difficult to use for this product specification

- Legacy forecasting products are mainly text products.
- WMO 558 represent hand drawn symbols.
- WMO 485 defined symbols do not always represent products and services used.
- Symbol definitions do not exist for many of these features.

	Cold front at the surface
	Warm front at the surface
	Occluded front at the surface
	Quasi-stationary front at the surface
	Convergence line
	Inter-tropical convergence zone (ITCZ)
6	Centre of tropical cyclonic circulation (maximum winds 34–63 knots)
9	Centre of tropical cyclonic circulation (maximum winds of 64 knots or more)
	Fog

(b) Additional symbols:

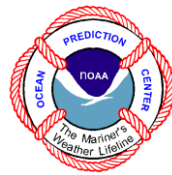
	Ice accretion
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Term	Symbol
1. Cold front at the surface	↑
2. Cold front above the surface	↑
3. Cold front frontogenesis	↑
4. Cold front frontolysis	↑
5. Warm front at the surface	↑
6. Warm front above the surface	↑
7. Warm front frontogenesis	↑
8. Warm front frontolysis	↑
9. Occluded front at the surface	↑
10. Occluded front above the surface	↑
11. Quasi-stationary front at the surface	
12. Quasi-stationary front above the surface	
13. Quasi-stationary front frontogenesis	
14. Quasi-stationary front frontolysis	
15. Instability line	
16. Shear line	
17. Convergence line	
18. Intertropical convergence zone	

Monochromatic	Polychromatic
↑	↑
↑	↑
↑	↑
↑	↑
↑	↑
↑	↑
↑	↑
↑	↑
↑	↑
↑	↑



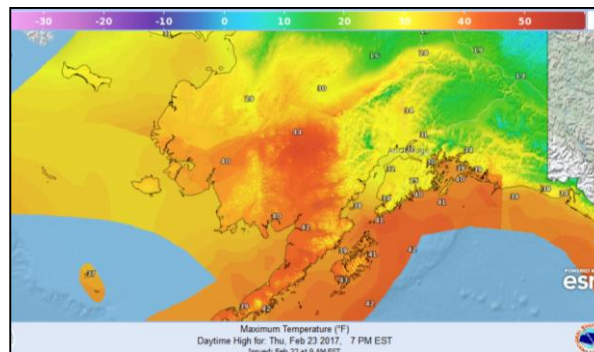
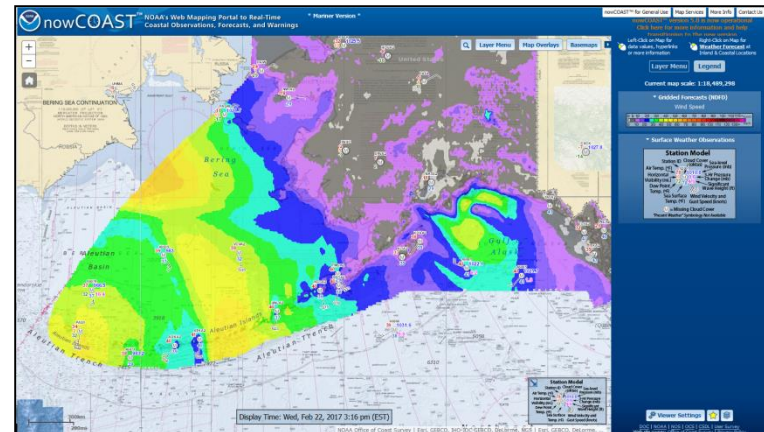
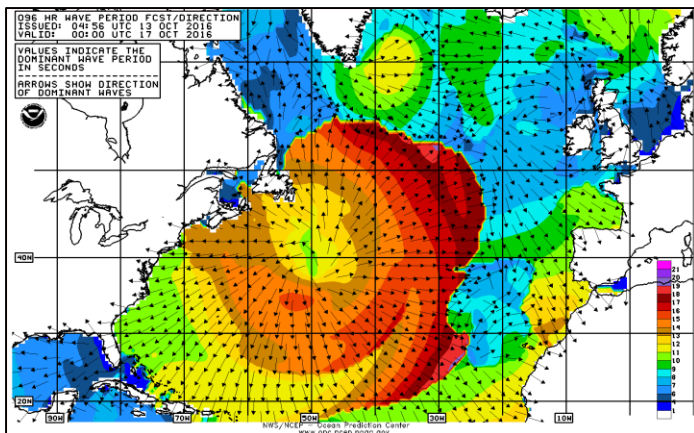
S-412 Weather Overlay: Portrayal Challenges

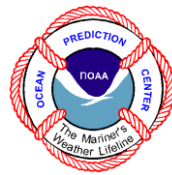


S-412 is considering colour ramps for portraying gridded features.

- Colour ramps, scales, and gradients are commonly used by weather forecasting agencies for web-based services.

Future Gridded Data Focus: point and click for temp/pressure/wind station time series



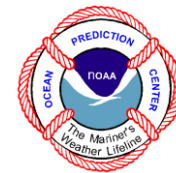


Projected S-412 Milestones

2019	Main	<ul style="list-style-type: none">• Specifies what is needed to build a complete product• Feature Types• Geometry• Data formats and file size• Metadata
2018	Feature Catalogue Version 0.0.2	<ul style="list-style-type: none">• Features• Attributes• Enumerants• Bindings• Point, Curve or Surface
2019	Portrayal Catalogue Version 0.0.1	<ul style="list-style-type: none">• Symbols, Line Styles and Area Fills• Rule for how the feature attribute combination must be portrayed
2018	Data Classification and Encoding Guide Version 0.0.2	<ul style="list-style-type: none">• Contains the guidance for how the data should be encoded by the data producer• Useful as a template for building the feature catalogue
2019/2020	Exchange Format Version 0.0.1	<ul style="list-style-type: none">• Data format that is used for data exchange• HDF5 and GML• Exchange Catalogue



S-412 Weather Overlay: Data Encoder Development

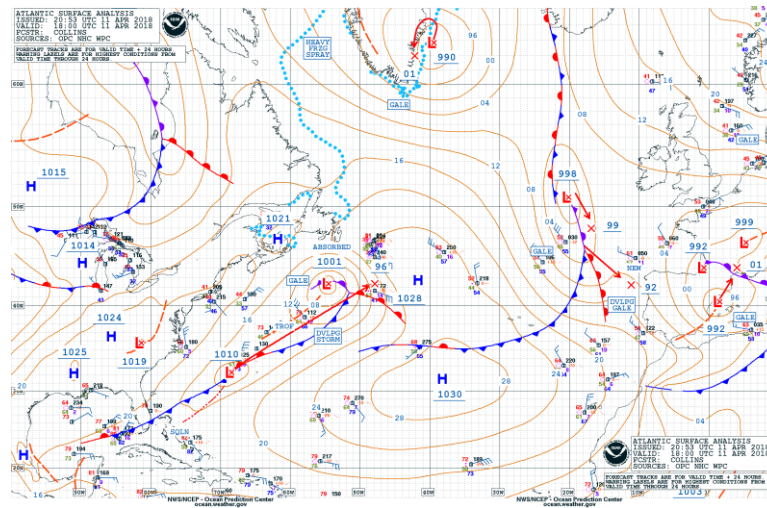


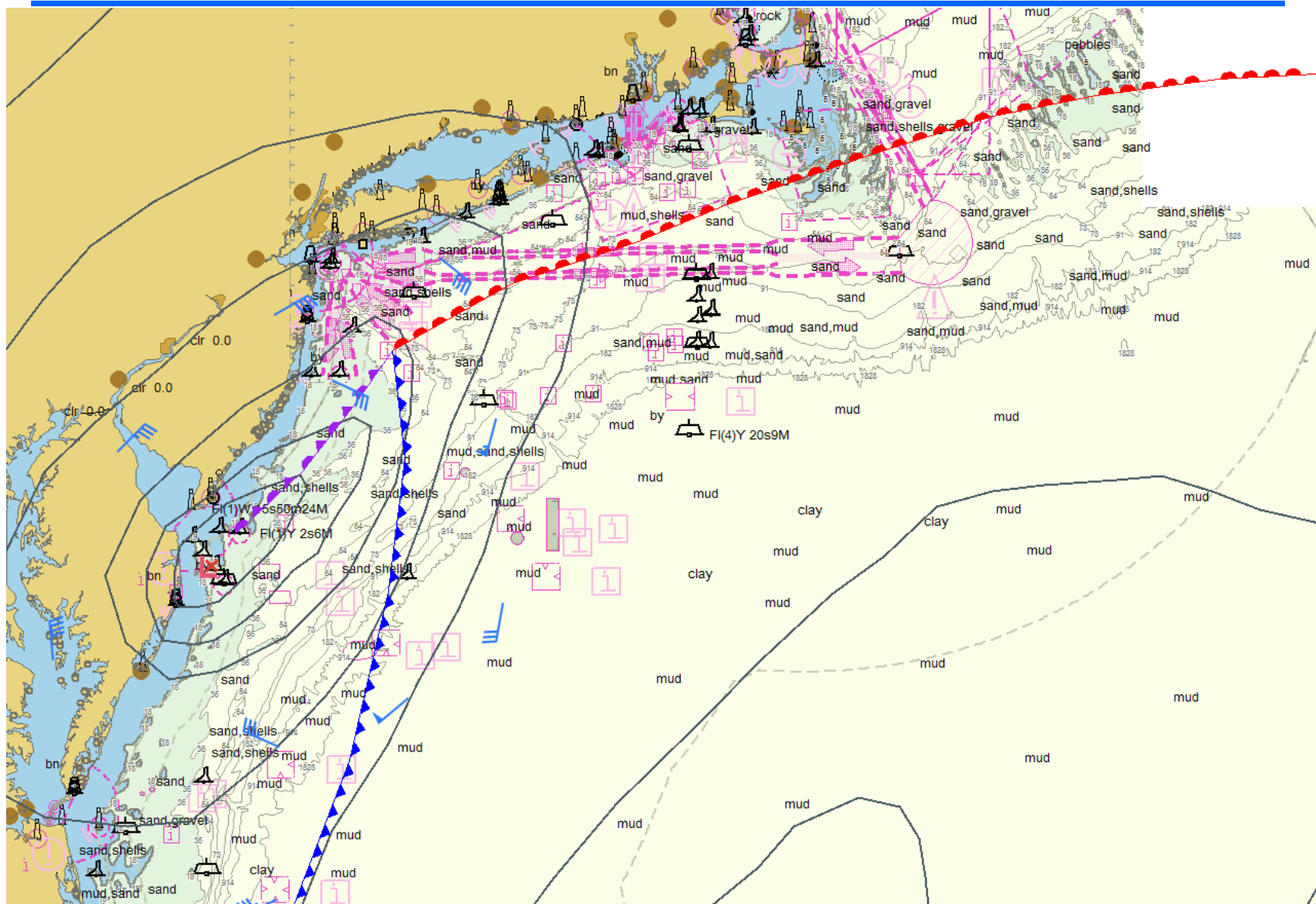
Goal:

Convert NOAA Ocean Prediction Center products into S-100/S-412 compliant datasets

Non-Gridded (Vector)

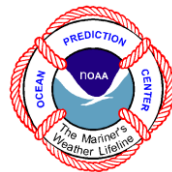
- Advanced Weather Interactive Processing System (AWIPS) Vector Graphics File (VGF)→XML→S-100/S-412 GML
- Python: xml2gml.py, incorporates xmllint validation against GML schema (S412.xsd, s100gmlbase.xsd, S100_gmlProfile.xsd, S100_gmlProfileLevels.xsd)
- *In progress*: update Python scripts to newest S-412 version and validate GMLs against new feature catalogue and S-100 and S-412 GML Schemas







S-412 Weather Overlay: Vector Test Images





S-412 Weather Overlay: Data Encoder Development

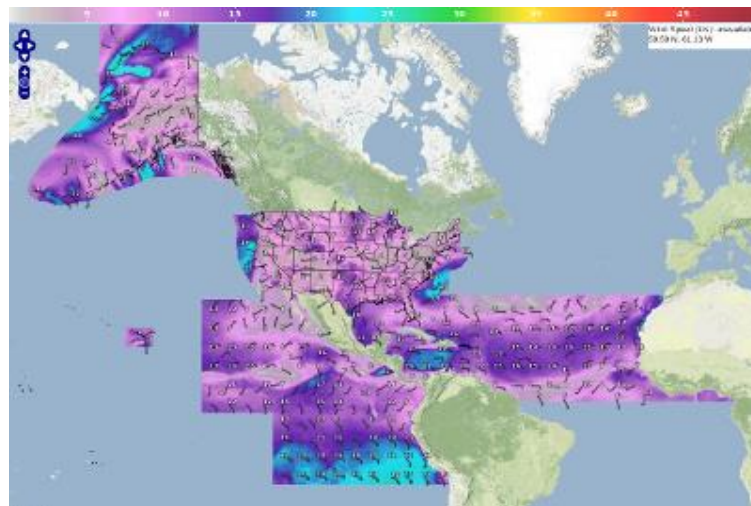


Goal:

Convert NOAA Ocean Prediction Center products into S-100/S-412 compliant datasets

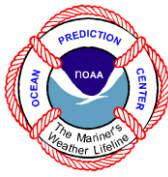
Gridded

- National Digital Forecast Database (NDFD) WMO Gridded Binary 2 (GRIB2)→ S-100/S-412 HDF5
- Python: grib2hdf.py, includes pygrib bug fixes (reading GRIB2 attributes)
- Currently wave height, wind speed & direction, wind gust, warning/watch/advisory
- *In progress*: update Python scripts according to new HDF5 in S-100 Edition 4.0.0





S-412 Weather Overlay: Considerations

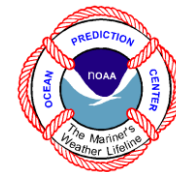


The S-412 product specification is on track to have version 1.0.0 completed in the next 2-3 years.

- Interoperability levels 0-2 will be considered for version 1.0.0.
- Future editions to focus on encryption, full validation, full test datasets, more complete interoperability, etc.
- Project timeline may change due to project management turnover.
- Maritime industry feedback mechanism should be considered.



S-412 Weather Overlay



Questions?

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