

IOOS Vocabulary Management and Development

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IOOS Regional Data Management
Workshop
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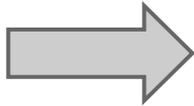
Vocabularies

SECOORA Effort



INTEGRATED OCEAN OBSERVING SYSTEM

IOOS Vocabulary and Ontology Strategy for Observed Properties

- 
- - What has been done ("SECOORA Effort")
 - SECOORA funded effort
 - IOOS Program Office and RAs (GCOOS, NANOOS, and SECOORA)
 - What did we learn
 - What still needs to be done?
 - short-term
 - long term

Work Completed

- IOOS Parameter Vocabulary v2.0 registered on MMI ORR
<http://mmisw.org/ont/ioos/parameter>
- One-to-one parameter mapping between IOOS Parameter Vocabulary and CF Standard Names
- Term lists based on Table 3-3 IOOS Blueprint registered on MMI ORR
http://mmisw.org/ont/ioos/core_variable
http://mmisw.org/ont/ioos/societal_area
- Mapped hierarchies between IOOS Societal Benefit Areas, Core Variables, and IOOS Parameter Vocabulary
- Demonstrated semantics through small set of SPARQL queries
<http://www.unc.edu/~haines/orriooos.html>
- Write-up published in Proceedings of MTS Hampton Roads, Oceans 2012

IOOS Parameter Vocabulary v2.0

mmisw.org/orr/#http://mmisw.org/ont/ioos/parameter

Marine Metadata Interoperability
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Ontology: <http://mmisw.org/ont/ioos/parameter> View as: [RDF/XML](#) [N3](#) Versions

IOOS Parameter Vocabulary v2.0 - <http://mmisw.org/ont/ioos/parameter> (version 20120620T041425)

► Metadata details

▼ Contents

Vocabulary contents:

② Class name: Parameter

②	Term	Definition	Reference	Units
1	absorption	As waves propagate through a medium, the signal strength attenuates by absorption and scattering within the medium.	AMS Glossary of Meterology, Second Edition, 2000, Cambridge, Massachusetts. http://amsglossary.allenpress.com/glossary	
2	absorption_coefficient	The measure of extinction of a wavelength of light due to absorption as it traverses through the medium in which the incident radiant energy is taken up by the substance. Attenuation of light in seawater is caused by absorption and scattering of the radiation of the volume.	AMS Glossary of Meterology, Second Edition, 2000, Cambridge, Massachusetts. http://amsglossary.allenpress.com/glossary	1/(m*sr)
3	acidity	pH is defined as the negative decimal logarithm of the activity of the hydrogen ion in solution and is a measure of acidity.		
4	air_density	Mass of air per unit volume.		kg m-3
5	air_pressure	Pressure exerted by overlying air		hPa
6	air_temperature	Temperature of air in situ.		celcius
7	albedo	Fraction of downward radiation that is reflected or scattered		
8	altitude	Z-coordinate of observation in vertical distance above reference. Up is positive. (sea surface geoid ellipsoid MSL MLLW AGL)		meter
9	ammonia	Concentration of ammonia (NH3) in a water sample.		ug L-1 as N
10	ammonium	Concentration of ammonium (NH4+) in a water sample.		ug L-1 as N

AMS Glossary of Meterology, Second Edition, 2000



CF Standard Name Table v19

mmisw.org/orr/#http://mmisw.org/ont/cf/parameter

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Ontology: <http://mmisw.org/ont/cf/parameter> View as: [RDF/XML](#) [N3](#) [Versions](#)

Climate and Forecast (CF) standard names parameter vocabulary - <http://mmisw.org/ont/cf/parameter> (version 20120323T163922)

► Metadata details

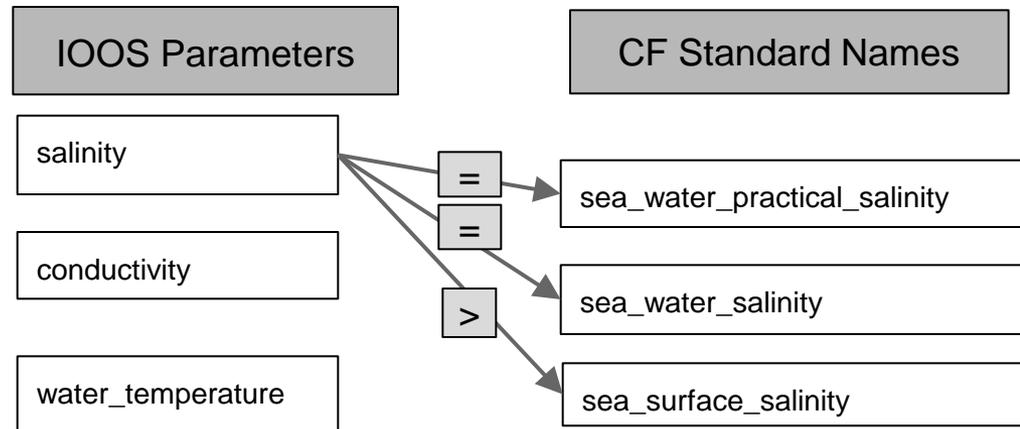
▼ Contents

Synopsis of ontology contents:

- Classes (1)
- Properties (1)
- ▼ Individuals (2188)

Name	canonical_units	type	definition	narrow
age_of_sea_ice	year	Standard_Name	"Age of sea ice" means the length of time elapsed since the ice formed.	
age_of_stratospheric_air	s	Standard_Name	"Age of stratospheric air" means an estimate of the time since a parcel of stratospheric air was last in contact with the troposphere.	
age_of_surface_snow	day	Standard_Name	"Age of surface snow" means the length of time elapsed since the snow accumulated on the earth's surface. The surface called "surface" means the lower boundary of the atmosphere.	
air_density	kg m-3	Standard_Name		
air_potential_temperature	K	Standard_Name	Potential temperature is the temperature a parcel of air or sea water would have if moved adiabatically to sea level pressure.	
air_pressure	Pa	Standard_Name		

1-to-1 Mapping



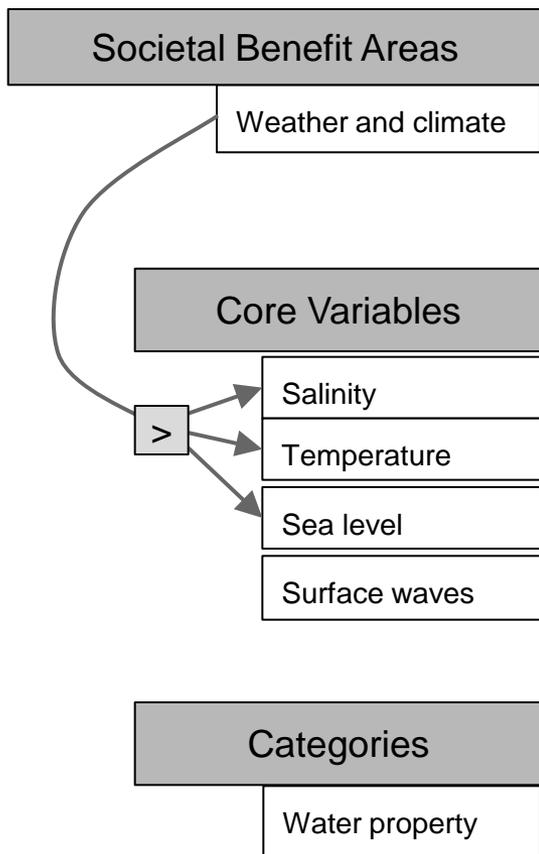
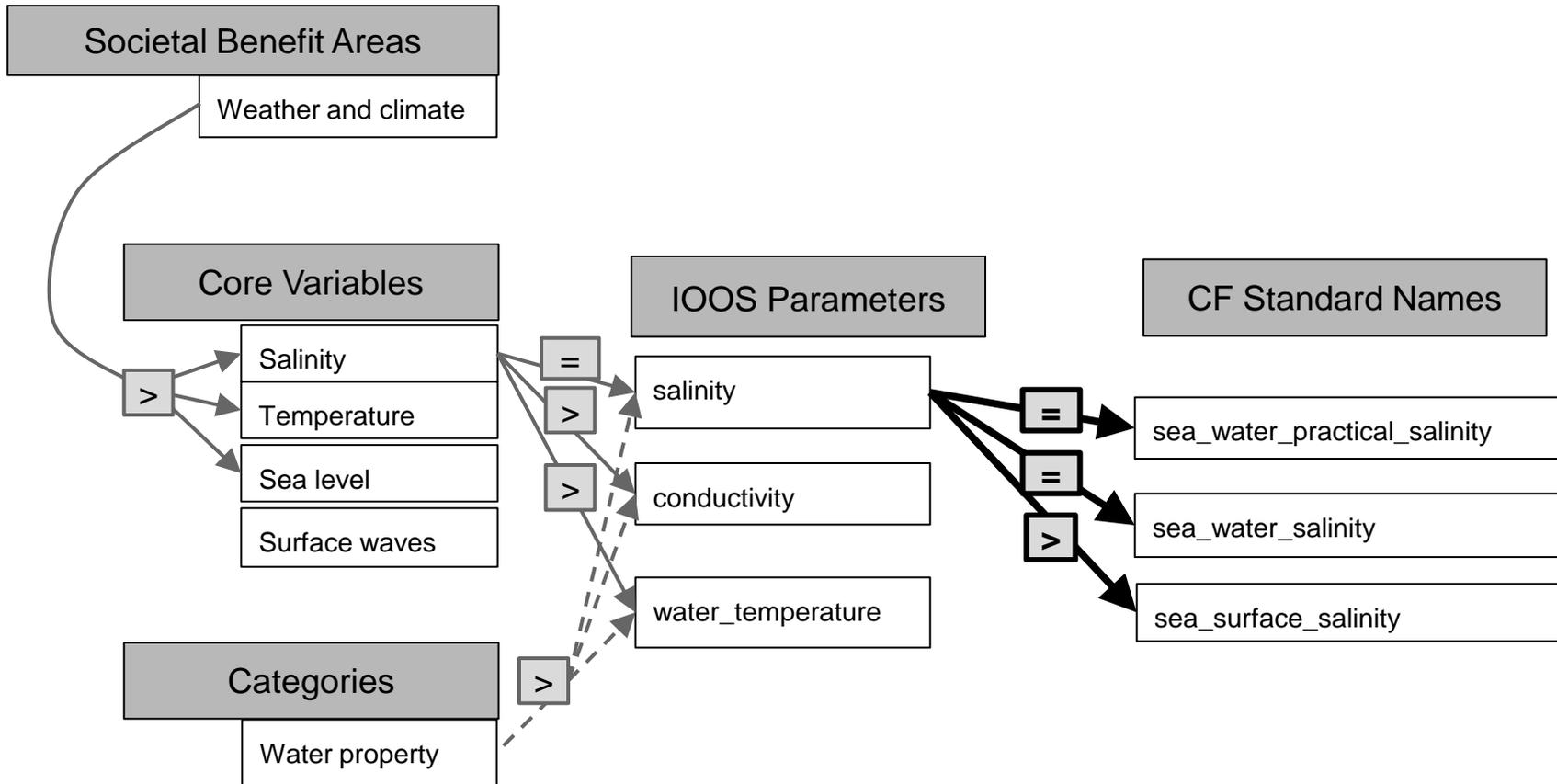


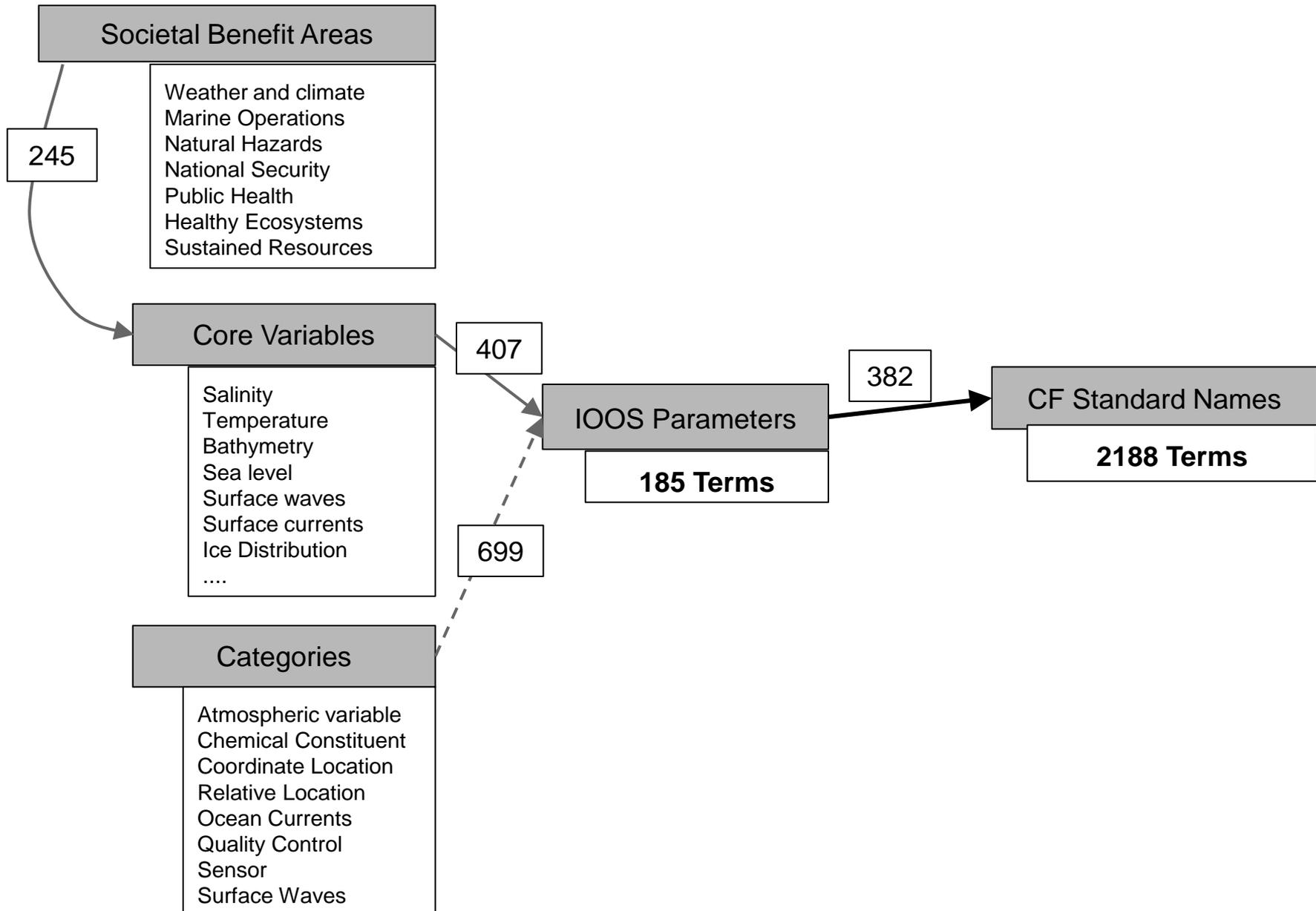
Table 3-3. Relationship of Core Variables to Societal Benefit Areas

Core variable	Weather and climate	Marine operations	Natural hazards	National security	Public health	Healthy ecosystems	Sustained resources
Salinity	X	X	X	X	X	X	X
Temperature	X	X		X	X	X	X
Bathymetry	X	X	X	X	X	X	X
Sea level	X	X	X	X		X	X
Surface waves	X	X	X	X	X	X	X
Surface currents	X	X	X	X	X	X	X
Ice distribution	X	X	X	X			
Contaminants				X	X	X	X
Dissolved nutrients					X	X	X
Fish species						X	X
Fish abundance						X	X
Zooplankton species					X	X	X
Optical properties				X	X	X	X
Heat flux	X					X	X
Ocean color	X	X			X	X	X
Bottom character	X	X				X	X
Pathogens				X	X	X	X
Dissolved oxygen						X	X
Phytoplankton species	X	X		X	X	X	X
Zooplankton abundance						X	X
Wind speed and direction (new)							
Stream flow (new)	X		X			X	X
Total suspended matter (new)							
Colored dissolved organic matter (new)							
Partial pressure of carbon dioxide (pCO ₂) (new)					X	X	X
Acidity (pH) (new)					X	X	X

Note: Highlighted cells indicate priority variables.

Hierarchical Mapping





Term Discovery

- [Semantic Demonstration with SPARQL Queries](#)

<http://www.unc.edu/~haines/orriooos.html>

- help data providers find appropriate label to associate to their data
- reduce ambiguity in names that are similar between vocabs
- give users context of data and discover other terms



Your SPARQL query

```
PREFIX iooos: <http://mmisw.org/ont/ooos/parameter/>
SELECT ?parameter ?definition ?unit ?property ?value
WHERE {?parameter a iooos:Parameter .
       ?parameter ?property ?value .
       ?parameter iooos:Term ?term .
       ?parameter iooos:Definition ?definition .
       ?parameter iooos:Units ?unit .
       FILTER (regex(str(?property), "(exactMatch|closeMatch)", "i") && regex(str(?value), "cf", "i") )
}
ORDER BY ?parameter|
```

Inference: Note: query processing may take significantly longer if inference is enabled.

Submit

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B

The ultimate goal is linked data
which is provided by naming the parameter and providing a URI

- CF Standard Name assigned to "standard_name" attribute in netCDF

```
float atemp(time);
    atemp: long_name = "Air temperature";
    atemp: standard_name = "air_temperature";
    atemp: units = "degrees Celsius";
```

- OGC "swe:ObservableProperty" or "swe:Quantity" tags

```
<swe:ObservableProperty
definition="http://mmisw.org/ont/ioos/parameter/conductivity"/>
```

and their resource mappings to other defined concepts and other terms represented in RDF

IOOS Vocabulary and Ontology Strategy for Observed Properties

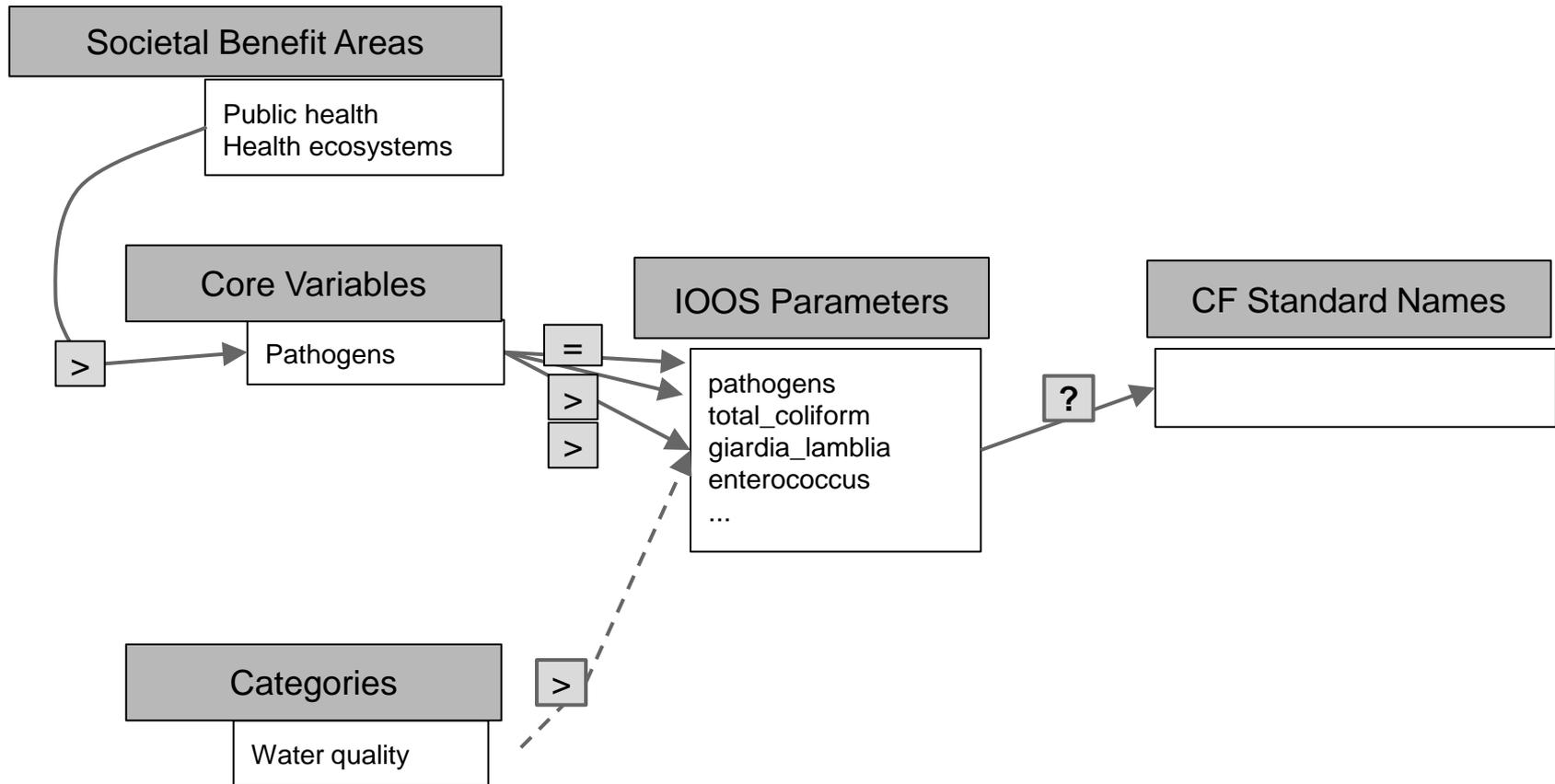
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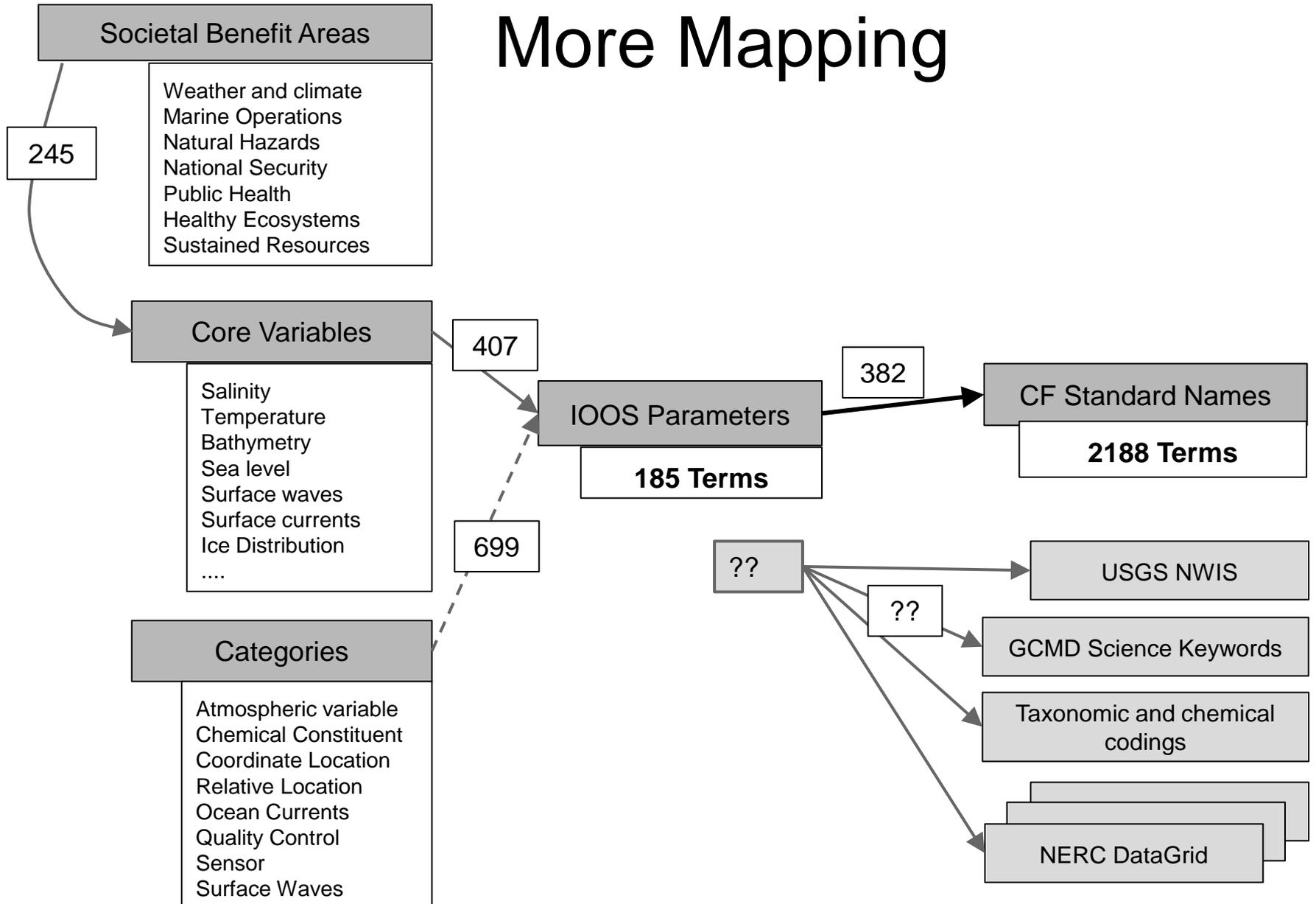
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Category	Summary of Mapping terms from IOOS to CF
Atmospheric	Done -- strong overlap
Coordinate	Done -- strong overlap
Relative Location	Done -- IOOS has more terms, CF only a few
Currents	Done -- strong overlap
Quality Control	Done -- no CF terms
Sensor	Done -- IOOS has more terms, CF only a few
Water Property	Done -- strong overlap
Water Quality	Done -- IOOS has more terms, CF only a few
Waves	Done -- Strong overlap except CF has many terms for peak and mean period but not for peak and mean direction from spectral density and no wave shape terms
Chemical	Not finished mapping -- CF has many atmospheric chemistry terms that did not get mapped
Optical Property	Not mapped yet, CF has good collection, so does IOOS
Water Level	Not mapped yet

Need More Mapping

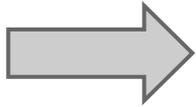


More Mapping



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Short-term, what's next?

(What should Sara work on with remaining 7 days on SECOORA contract?)

Vocabulary contents

- Do the CF and IOOS Parameter Vocabs support the current requirements of the SOS Ref Implementation work? What is missing or incorrect in the disciplines covered so far (e.g. atmos, water prop, water quality, location, currents, waves -- excluding biological and chemical properties)?

Mapping

- What about vector composites? Do you need mapping within an ontology that relates the eastward_wind and northward_wind isComponentOf winds? Or is this handled in the SOS xml template?
(side note: The CF community is presently hashing through how to implement vector quantities in CF-netCDF and that will introduce a whole slew of vector terms in CF standard Name table)
- Should CF terms (all 2188 of them) be mapped to any hierarchy? – either IOOS Core Variables or Categories or some new set of categories
- Map IOOS to GCMD? Or other vocab.

Queries

- Are there other interesting SPARQL queries that should be presented
- Build better user interface to SPARQL queries such as pull down menu or free text search box
- Tweaks to the XML style-sheet for readability of returned output

Other documentation

- ??



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Long term, what's next?

... to be continued

Vocabulary contents

- Periodic content review process and governance
- What types of new terms can be added and how and who manages the vocab
- Work with other controlled vocabulary efforts to efficiently

Mapping

- Identify other controlled vocabs for fish species and abundance and chemical substances
- Identify core set of vocabs that mappings will be maintained
- Periodic review of mappings
- Community Mappings -- the more the better

Queries

- Data discovery from data -- "Linked Data" -- Dereference URI in data back to ontology and search for other similar data in THREDDS catalog

Other documentation

- Guidance documentation for data providers -- choosing data names through ORR? or thru API built around SPARQL??



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Conclusion

Importance of building controlled vocabularies, mapping and developing ontology strategy

- Provide consistency in labeling ocean variables in standard data services
- Reduce ambiguity inherent in human language when same concept given two different names
- Promote discovery of terms and concepts in multiple domains and disciplines

Chemical / Water Quality

Terms, Vocabularies, Ontologies

1. Conventional chemical oceanography and chemical water quality terms already in CF Standard Names or IOOS Parameters (eg: nitrate, oxygen)
2. IOOS WQ project (Rob Ragsdale, 2010-2012?)
3. Ocean Acidification (OA) pilot collaboration:
OA Program, NODC OADSS, IOOS, NANOOS, MMI, OOI(?), SECOORA(?), ...

WHY?

- **Common OA vocabulary terms for integrated discovery**
http://mmisw.org/ont/ioos/core_variable/acidity

- Driven by real world needs
- Within what v
- Very well rec
- Modest & ac
- Builds on MM
- scales interna

	property	value
http://mmisw.org/	http://mmisw.org/ont/ioos/parameter/acidity	
http://mmisw.org/	property	value
http://www.w3.org/	http://mmisw.org/ont/ioos/parameter/Definition	pH is defined as the negative decimal logarithm of the activity of the hydrogen ion in solution and is a measure of acidity.
http://www.w3.org/	http://mmisw.org/ont/ioos/parameter/Term	acidity
http://www.w3.org/	http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://mmisw.org/ont/ioos/parameter/Parameter
http://www.w3.org/	http://www.w3.org/2000/01/rdf-schema#label	acidity
	http://www.w3.org/2004/02	

HOW?

- Identify OA "T" terms
 HCO_3 , CO_3 , ...
- Use The Force
- Find OA terms
- Find OA terms not already c



Terms, Vocabularies, Ontologies; Other Prospects?

4. NERRS-SWMPP Parameters: Work with NERRS-CDMO to upload into MMI, map to IOOS vocabularies. Have mentioned it to CDMO.
5. Farther out: BCO-DMO, CUAHSI, EPA, USGS, etc.

eg: US Water
CDC NEMI

category	term	description
Meteorological	ATemp	average a
Meteorological	RH	average re
Meteorological	BP	average b
Meteorological	WSpd	average w
Meteorological	MaxWSpd	max wind
Meteorological	MaxWSpdT	time of m
Meteorological	Wdir	average w
Meteorological	SDWDir	wind direc
Meteorological	TotPAR	total phot
Meteorological	TotPrcp	total preci
Meteorological	CumPrcp	cumulativ
Meteorological	TotSoRad	total solar
Water Quality	Temp	water tem
Water Quality	SpCond	specific c
Water Quality	Sal	salinity
Water Quality	DO_pct	dissolved
Water Quality	DO_mgl	dissolved
Water Quality	Depth	sonde depth
Water Quality	cDepth	depth from a non-ve
Water Quality	Level	sonde depth as refe
Water Quality	cLevel	level from a non-ver
Water Quality	pH	pH
Water Quality	Turb	turbidity
Water Quality	ChlFluor	chlorophyll fluorescence
Nutrient and Pigment	PO4F	orthophosphate

Water Quality Portal

WQP Home
Download
How to u
User Guide
Web Ser
FAQs
Upload D
National
Coverage
About th
What is
Contribu
organiz
Contact

```

<Codes>
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<Code value="Information" providers="NWIS"/>
<Code value="Inorganics_Major_Metals" providers="NWIS"/>

```



MEMO BETA
Methods for Environmental Measurements and Observations

nobody Logout

Home Combined Search Sensor Search Analyte

Home NEMI Home ACT Home EPA Home USGS Home Contact

Sensor Details

63 pH/Conductivity /Temperature /Temperature YSI

Accuracy: +/-0.5% FS of reading +0.001 mS/cm; +/-2% or +/-0.1 ppt;

NEMI Method	Analyte	Accuracy	Precision	DL
NFM 6.3.3.A-SW	Specific conductivity	NA	NA	10 uS/cm
NFM 6.4.3.A-SW	pH	NA	NA	.01 pH
NFM 6.1.3.B	Temperature	NA	NA	-5 degrees Centigrade

NEMI Method Description

BIO/ECO VOCABULARY

Existing Vocabulary for Bio/Eco

<http://rs.gbif.org/vocabulary/>

IOOS BDP Terminology & Exchange Standards

<http://www.ioos.gov/dmac/biology/welcome.html>

IOOS BDP Terminology & Exchange Standards

<https://marinemetadata.oceanobservatories.org/references/darwincore>



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Proposed IOOS Vocabulary Term Identification

Process ID: B.2.4.5.1-1: Find a "name" in an approved vocabulary

Draft Version 1.0

3/14/12

