National Oceanography Centre

British Oceanographic Data Centre

Mappings in the marine domain: Use cases, practices, standards and governance

Alexandra Kokkinaki & Gwen Moncoiffé

What is the NVS?

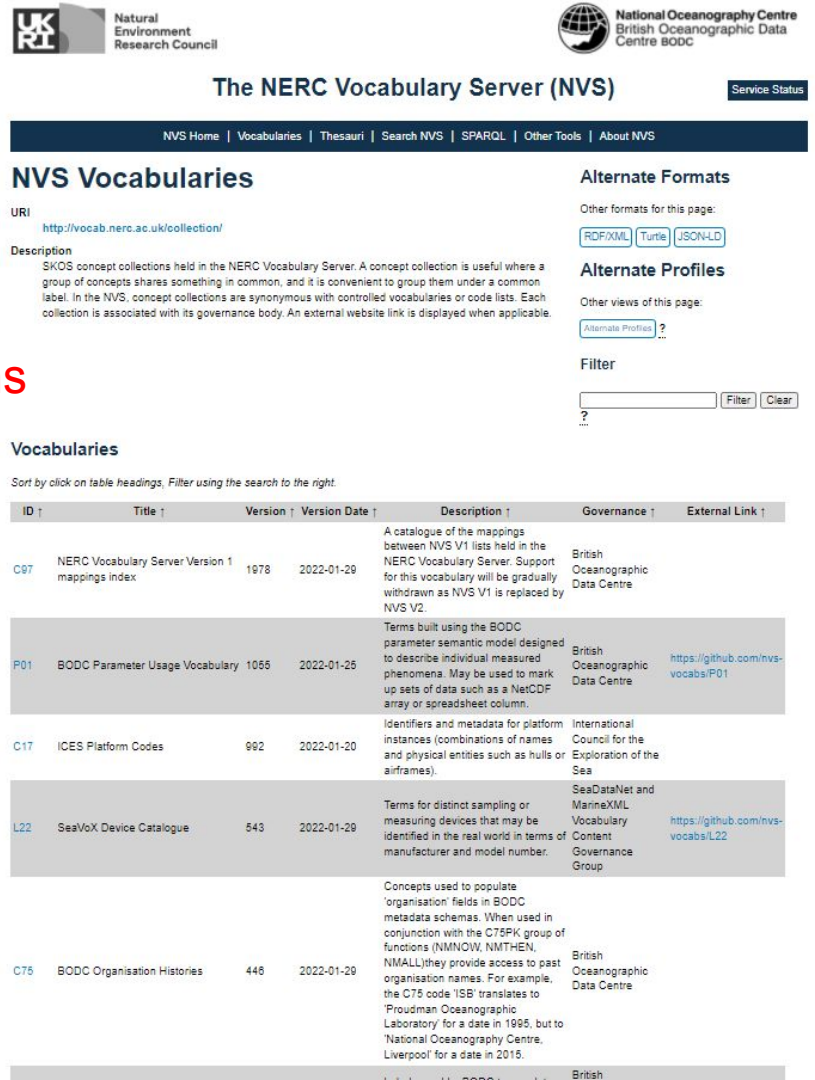
A **semantic repository** for **standardised hierarchical terminologies** used for the management of data in the **marine and related domains**

It stores and serves **vocabularies** including **terms and relationships** between terms in a **human and machine-readable** format.

Collections

Concepts

Mappings



Governance

- Community
- Vocabulary Management Group
- Collaborative tools (github)

Publication

- Linked Data REST API
- SPARQL endpoint
- SOAP service
- Human Interface
  - VocPrez

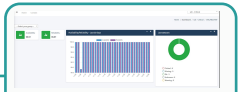
Standards

- RDF
  - XML
  - Json-LD
  - Turtle
- SPARQL
- SKOS pav, Dublin Core, OWL
- LinkedOpen Data
  - Unique URIs for vocabularies, terms and mappings

Tools

- NVS search
- NVS Editor
- SDN facet search
- SDN vocabulary search

Monitoring



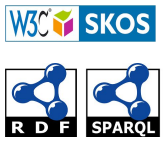
- SeaDataNet Argo
- BODC-Internal NVS Dashboard

Ten simple rules for making a vocabulary FAIR

- https://doi.org/10.1371/journal.pcbi.1009041

https://vocab.nerc.ac.uk/

How do you express the mappings (relationships, and if/which vocabularies, and how to decide this)



SKOS Core

- skos:broader
- skos:narrower
- skos:related

OWL

- owl:sameAs

iadopt

- iop:hasProperty
- iop:hasMatrix
- Iop:hasObjectOfInterest
- iop:hasApplicableMatrix
- iop:has ApplicableObjectOfInterest
- iop:hasApplicableProperty

PUV: Parameter Usage Vocabulary

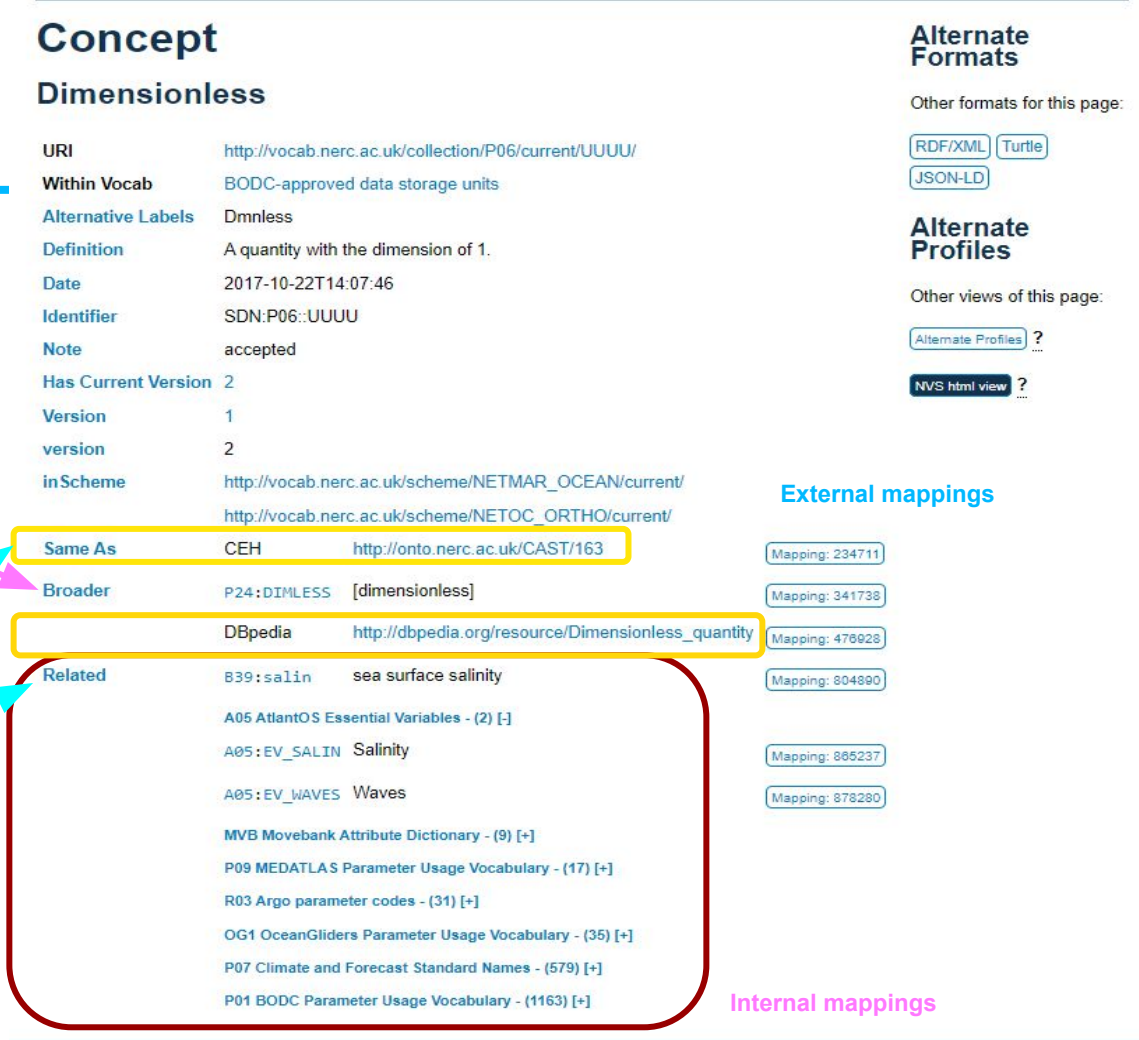
- <https://w3id.org/env/puv#chemicalObject>
- <https://w3id.org/env/puv#matrix>
- <https://w3id.org/env/puv#property>
- <https://w3id.org/env/puv#statistic>

QUDT

- <https://qudt.org/2.1/schema/qudt#hasQuantityKind>

Types of Mappings

- Internal Mappings
- External Mappings
- Hierarchical (Semantic)
  - skos:broader
  - skos:narrower
  - inverse
- Associative
  - owl:sameAs
  - skos:related
- More expressive / smart
  - qudt, i-adopt , puv



Concept

Concentration of oxygen {O2 CAS 7782-44-7} per unit volume of the water body [dissolved plus reactive particulate phase] by in-situ Beckmann probe

High granularity

URI	http://vocab.nerc.ac.uk/collection/P01/current/DOXYPR01/
Within Vocab	BODC Parameter Usage Vocabulary
Alternative Labels	WC_dissO2_Beck
Definition	This is the preferred term for this definition. Alternative term DOXYPR02 is included to cover cases where there are two sensors of the same type contributing to the data set and referential integrity considerations prevent a usage of a single code.
Date	2017-10-10T12:35:16
Identifier	SDN:P01::DOXYPR01
Note	accepted
Has Current Version	4
Version	1 , 2 , 3
version	4

Broader	S06:S0600045	Concentration	
	P01:DOXYZZXX	Concentration of oxygen {O2 CAS 7782-44-7} per unit volume of the water body [dissolved plus reactive particulate phase]	
	C67:DOXY	dissolved oxygen	Mapping: 1758415
	P02:DOXY	Dissolved oxygen parameters in the water column	Mapping: 361217
	S27:CS002779	oxygen	Mapping: 826413
	S26:MAT00633	water body [dissolved plus reactive particulate phase]	Mapping: 826411
	P35:EPC00002	Water body dissolved oxygen concentration	Mapping: 523353
Related	S04:S04211	in-situ Beckmann probe	Mapping: 826407
	P06:UPOX	Micromoles per litre	Mapping: 361219
	S02:S053	per unit volume of the	Mapping: 826405

L22 SeaVoX Device Catalogue - (5) [+]

Low granularity

Alternate Formats

Other formats for this page:

RDF/XML | Turtle | JSON-LD

Alternate Profiles

Other views of this page:

Alternate Profiles ?

NVS html view ?

I-ADOPT html view ?

iop Properties

hasMatrix	S21:S21S027	water body
hasObjectOfInterest	S27:CS002779	oxygen
hasProperty	S06:S0600045	Concentration

National Oceanography Centre

Mappings are part ot the concept definition


```
<http://vocab.nerc.ac.uk/collection/P01/current/CPHLPR01/>
        rdf:type                skos:Concept ;
        dce:identifier          "SDN:P01::CPHLPR01" ;
        dc:date                 "2015-07-29 12:34:02.0" ;
        dc:identifier           "SDN:P01::CPHLPR01" ;
        pav:authoredOn          "2015-07-29 12:34:02.0" ;
        pav:hasCurrentVersion   <http://vocab.nerc.ac.uk/collection/P01/current/CPHLPR01/4/> ;
        pav:hasVersion          <http://vocab.nerc.ac.uk/collection/P01/current/CPHLPR01/2/> , <http://vocab.nerc.ac.uk/collection/P01/current/CPHLPR01/3/> ,
        pav:version             "4" ;
        void:inDataset          <http://vocab.nerc.ac.uk/.well-known/void> ;
        owl:deprecated          "false" ;
        owl:sameAs              <http://vocab.nerc.ac.uk/collection/R03/current/CHLA/> ;
        owl:versionInfo         "4" ;
        skos:altLabel           "chl-a_water_ISfluor" , "chl-a_water_ISfluor"@en ;
        skos:broader            <http://vocab.nerc.ac.uk/collection/S27/current/CS002896/> , <http://vocab.nerc.ac.uk/collection/P02/current/CPWC/> , <http://vocab.nerc.ac.uk/collection/P35/c
<http://vocab.nerc.ac.uk/collection/P07/current/CF14N7/> , <http://vocab.nerc.ac.uk/collection/A05/current/EV_CHLA/> , <http://vocab.nerc.ac.uk/collection/OG1/current/CHLA/> , <http://vocab.
<http://vocab.nerc.ac.uk/collection/C67/current/PIGX/> , <http://vocab.nerc.ac.uk/collection/S26/current/MAT01053/> , <http://vocab.nerc.ac.uk/collection/S06/current/S0600045/> ;
        skos:definition         "In-situ fluorometer with either manufacturer, laboratory or sample calibration applied."@en ;
        skos:inScheme           <http://vocab.nerc.ac.uk/scheme/NETMAR_OCEAN/current/> , <http://vocab.nerc.ac.uk/scheme/NETOC_PARAM/current/> ;
        skos:notation           "SDN:P01::CPHLPR01" ;
        skos:note               "accepted"@en ;
        skos:prefLabel          "Concentration of chlorophyll-a {chl-a CAS 479-61-8} per unit volume of the water body [particulate >unknown phase] by in-situ chlorophyll fluorometer"@en ;
        skos:related            <http://vocab.nerc.ac.uk/collection/L22/current/TOOL0119/> , <http://vocab.nerc.ac.uk/collection/L22/current/TOOL0145/> , <http://vocab.nerc.ac.uk/collection/S
<http://vocab.nerc.ac.uk/collection/S02/current/S053/> , <http://vocab.nerc.ac.uk/collection/L22/current/TOOL0118/> , <http://vocab.nerc.ac.uk/collection/L22/current/TOOL0187/> , <http://voc
<http://vocab.nerc.ac.uk/collection/L22/current/TOOL0075/> , <http://vocab.nerc.ac.uk/collection/P06/current/UMMC/> , <http://vocab.nerc.ac.uk/collection/L22/current/TOOL0002/> .
```

subject relationship object When Who URL Status

Mappings between **L22 (SeaVoX Device Catalogue)** and **L05 (SeaDataNet device categories)**

L22 Identifier ↑	L22 Preferred label ↑	Relationship ↑	L05 Identifier ↑	L05 Preferred label ↑	Date created ↑	Creator ↑	Mapping URL ↑	Status ↑
SDN:L22::TOOL0576	Rockland Scientific Vertical Microstructure Profiler VMP 500	broader	SDN:L05::384	ADVs and turbulence probes	2012-12-18 03:12:41	Jenny Andrew	476904	valid
SDN:L22::TOOL0639	Rockland Scientific Vertical Microstructure Profiler (VMP) 5500	broader	SDN:L05::384	ADVs and turbulence probes	2013-09-25 10:09:04	Jenny Andrew	484850	valid
SDN:L22::TOOL0642	Rockland Scientific SPM-38 velocity shear probe	broader	SDN:L05::384	ADVs and turbulence probes	2013-09-25 10:09:04	Jenny Andrew	484846	valid
SDN:L22::TOOL0643	Rockland Scientific Geo-electro magnetic current meter (GEMCM)	broader	SDN:L05::384	ADVs and turbulence probes	2013-09-25 10:09:04	Jenny Andrew	484845	valid
SDN:L22::TOOL0438	Meerestechnik Elektronik or MICSOS microstructure profiler	broader	SDN:L05::384	ADVs and turbulence probes	2012-05-22 08:05:21	Margaret Wallace	192572	valid
SDN:L22::TOOL0439	Sea and Sun Technology and ISW Wassermesstechnik microstructure profiler	broader	SDN:L05::384	ADVs and turbulence probes	2012-05-22 08:05:21	Margaret Wallace	192573	valid
SDN:L22::TOOL0453	Sea and Sun Technology Microstructure Profiler MSS 90	broader	SDN:L05::384	ADVs and turbulence probes	2012-05-22 08:05:21	Margaret Wallace	346128	valid
SDN:L22::TOOL1646	AML Oceanographic AML-1 RT sonde	broader	SDN:L05::384	ADVs and turbulence probes	2021-03-01 02:03:06	Roseanna Wright	1622798	valid
SDN:L22::TOOL1718	RBR Maestro3 Multiparameter logger system	broader	SDN:L05::384	ADVs and turbulence probes	2021-07-27 11:07:42	Roseanna Wright	1699299	valid
SDN:L22::TOOL0092	SonTek ADVOcean/Hydra acoustic doppler velocimeter	broader	SDN:L05::384	ADVs and turbulence probes	2012-05-22 08:05:21	Roy Lowry	180976	valid
SDN:L22::TOOL0406	Droplet Measurement Technologies Passive Cavity Aerosol Spectrometer Probe (PCASP) 100	broader	SDN:L05::386	Aerosol physical characterisers	2012-05-22 08:05:21	Margaret Wallace	190030	valid
SDN:L22::TOOL0419	TSI 3800 Aerosol Time-of-Flight Mass Spectrometer	broader	SDN:L05::386	Aerosol physical characterisers	2012-05-22 08:05:21	Margaret Wallace	191421	valid

National Oceanography Centre

Unique mapping URI

- https://vocab.nerc.ac.uk/mapping/I/1608282/
- https://vocab.nerc.ac.uk/mapping/E/234711/

National Oceanography Centre

NERC Environmental Data Service

National Oceanography Centre British Oceanographic Data Centre

The NERC Vocabulary

NVS Home | Vocabularies | Thesauri | Search NVS | S

Mapping

An RDF mapping statement

URI	http://vocab.nerc.ac.uk/mapping/I/1608282/
Subject	http://vocab.nerc.ac.uk/collection/P01/current/CPHLPR01/
Predicate	sameAs
Object	http://vocab.nerc.ac.uk/collection/R03/current/CHLA/
Modified	2020-07-10 05:07:41
Status	Valid
Submitter	Mr Thierry Carval

SSSOM vocabulary

```
@prefix dc1: <http://purl.org/dc/elements/1.1/> .
@prefix org: <http://www.w3.org/ns/org#> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix reg: <http://purl.org/linked-data/registry#> .
@prefix sssom: <https://w3id.org/sssom/schema/> .

<http://vocab.nerc.ac.uk/mapping/I/1608282/> a rdf:Statement,
        sssom:Mapping ;
    dc1:modified "2020-07-10 05:07:41" ;
    reg:status reg:statusValid ;
    reg:submitter [ a "http://www.w3.org/ns/prov#Agent",
                "http://xmlns.com/foaf/0.1/Person" ;
            reg:name "Thierry Carval" ;
            reg:title "Mr" ;
            org:memberOf "http://vocab.nerc.ac.uk/collection/C75/current/" ] ;
    sssom:mapping_justification <http://w3id.org/semapv/vocab/ManualMappingCuration/> ;
    sssom:object_id <http://vocab.nerc.ac.uk/collection/R03/current/CHLA/> ;
    sssom:predicate_id <http://www.w3.org/2002/07/owl#sameAs/> ;
    sssom:subject_id <http://vocab.nerc.ac.uk/collection/P01/current/CPHLPR01/> .
```

ORCID

NVS Home | Vocabularies | Thesauri | Search NVS | SPARQL | Other Tools | About NVS

How do you decide something needs to be mapped

National Oceanography Centre

- Facilitate discovery of concepts and data
- Semantic modelling of complex concepts
- Interoperability (i-adopt, external vocabularies)
- Manage hierarchies and associations
- Use case requirements

What considerations do you make?

National Oceanography Centre

- Some of our mappings are **mandatory** in order to not leave **orphans** in hierarchies
  - *a P01 (high granularity) must be mapped to a P02 (low granularity) and only one P02*
- Some are part of our **workflows** for content creation to support **interoperability**
  - e.g. mappings to external registers of biological and chemical entities like e.g. ChEBI, WoRMS
- Some are more **opportunistic** (ad-hoc mappings when an easy equivalence with partner resources is found)
  - e.g. mapping of our biological sub-components or chemical entities to ICES
- Systematic vs opportunistic mainly driven by use cases and **funding** (or lack of) for alignment work

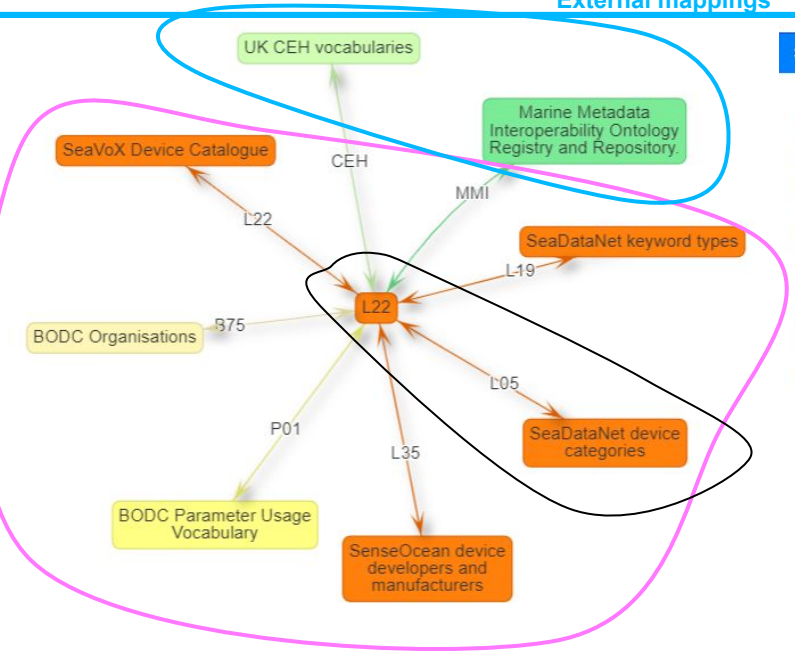
Curation, maintenance, governance

National Oceanography Centre

- Mappings are stored and audited in a relational DB and are maintained using
  - constraints, triggers, procedures
- Mappings can be withdrawn or deprecated if invalid or redundant
- Why a mapping becomes invalid?
  - A concept from a term from an external vocabulary that no longer exists
  - Erroneous
- Users can create/edit/deprecate mappings to their own vocabularies via the Vocab Editor
- Users can suggest/request mappings via github repo: https://github.com/nvs-vocabs

Example: L22-SeaVoX Device Catalogue

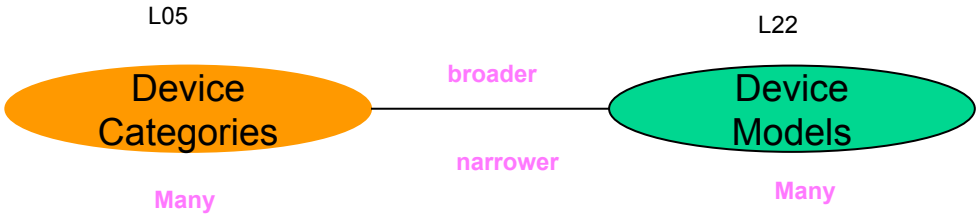
External mappings



Internal mappings

Summary table | Graph

Domain URL ↑	Vocab ↑	Title ↑	Number of mappings to L22 ↑	View mapping
http://vocab.nerc.ac.uk/	B75	BODC Organisations	1797	
http://vocab.nerc.ac.uk/	L05	SeaDataNet device categories	3055	
http://vocab.nerc.ac.uk/	L19	SeaDataNet keyword types	1435	
http://vocab.nerc.ac.uk/	L22	SeaVoX Device Catalogue	44	
http://vocab.nerc.ac.uk/	L35	SenseOcean device developers and manufacturers	820	
http://vocab.nerc.ac.uk/	P01	BODC Parameter Usage Vocabulary	311	
http://onto.nerc.ac.uk/	CEH	UK CEH vocabularies	1	
http://mmisw.org/	MMI	Marine Metadata Interoperability Ontology Registry and Repository.	11	

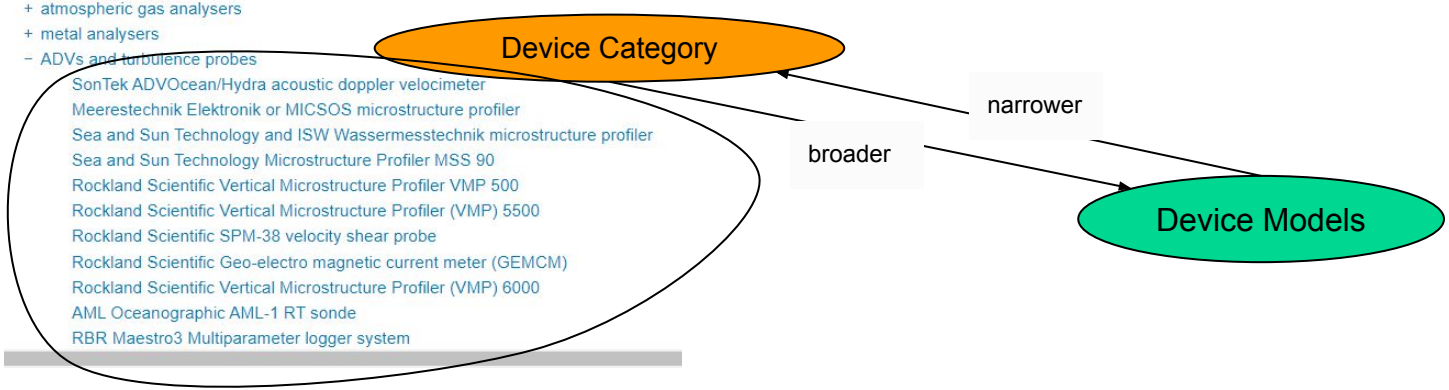


Hierarchy

NVS Search: https://vocab.nerc.ac.uk/search_nvs/

- plummets
- piezometers
- penetrometers
- 250 Hz top-bandwidth single-channel seismic reflection systems
- 1000 Hz top-bandwidth single-channel seismic reflection systems
- 1000 Hz top-bandwidth multi-channel seismic reflection systems
- 2000 Hz top-bandwidth multi-channel seismic reflection systems
- >2000 Hz top-bandwidth multi-channel seismic reflection systems
+ >2000 Hz top-bandwidth sub-bottom penetrator and mud profiler systems
+ seismometers
+ hydrophones
- geothermometers
- 60 Hz top-bandwidth single-channel seismic reflection systems
+ 2000 Hz top-bandwidth single-channel seismic reflection systems
+ >2000 Hz top-bandwidth single-channel seismic reflection systems
- 60 Hz top-bandwidth multi-channel seismic reflection systems
- 250 Hz top-bandwidth multi-channel seismic reflection systems
- sediment surface markers
- water level markers
- sediment profile imagers
+ altimeters
+ submarine cables
+ precipitation gauges
+ atmospheric gas analysers
+ metal analysers
− ADVs and turbulence probes
  - SonTek ADVOcean/Hydra acoustic doppler velocimeter
  - Meerestechnik Elektronik or MICSOS microstructure profiler
  - Sea and Sun Technology and ISW Wassermesstechnik microstructure profiler
  - Sea and Sun Technology Microstructure Profiler MSS 90
  - Rockland Scientific Vertical Microstructure Profiler VMP 500
  - Rockland Scientific Vertical Microstructure Profiler (VMP) 5500
  - Rockland Scientific SPM-38 velocity shear probe
  - Rockland Scientific Geo-electro magnetic current meter (GEMCM)
  - Rockland Scientific Vertical Microstructure Profiler (VMP) 6000
  - AML Oceanographic AML-1 RT sonde
  - RBR Maestro3 Multiparameter logger system

Hierarchy and many:many



P02: SeaDataNet Parameter Discovery Vocabulary

P01: BODC Parameter Usage Vocabulary

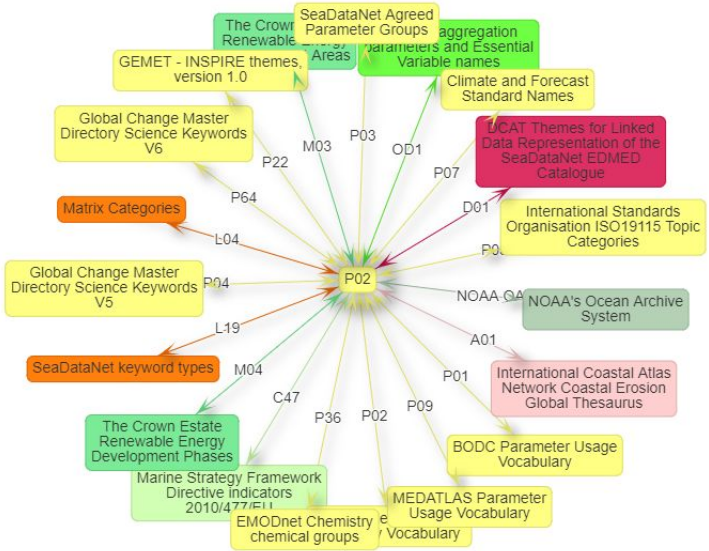
National Oceanography Centre

Low granularity

High granularity

p02	Conceptid	Pref label
⊖	ASAM	Acoustic backscatter in the water column

p01	Conceptid	Pref label
	ACBSA075	Acoustic backscatter (absolute) in the water body by 75kHz broadband acoustic doppler current profiler (ADCP)
	ACBSA150	Acoustic backscatter (absolute) in the water body by 150kHz broadband acoustic doppler current profiler (ADCP) and calibration using protocols of Deines (1999)
	ACBSA300	Acoustic backscatter (absolute) in the water body by 300kHz broadband acoustic doppler current profiler (ADCP) and calibration using protocols of Deines (1999)
	ACBSA600	Acoustic backscatter (absolute) in the water body by 600kHz broadband acoustic doppler current profiler (ADCP) and calibration using protocols of Deines (1999)
	ACBSADCP	Acoustic backscatter (absolute) in the water body by acoustic doppler current profiler (ADCP) and calibration using protocols of Deines (1999)
	ASAMACMX	Signal return amplitude from the water body by in-situ acoustic current meter
	ASAMAP00	Signal return amplitude from the water body by moored acoustic doppler current profiler (ADCP) beam 1
	ASAMAP01	Signal return amplitude from the water body by moored acoustic doppler current profiler (ADCP)
	ASAMAP02	Signal return amplitude from the water body by moored acoustic doppler current profiler (ADCP) beam 2
	ASAMAP03	Signal return amplitude from the water body by moored acoustic doppler current profiler (ADCP) beam 3
	ASAMAP04	Signal return amplitude from the water body by moored acoustic doppler current profiler (ADCP) beam



Concept

Concentration of oxygen {O2 CAS 7782-44-7} per unit volume of the water body [dissolved plus reactive particulate phase] by in-situ Beckmann probe

URI	http://vocab.nerc.ac.uk/collection/P01/current/DOXYPR01/
Within Vocab	BODC Parameter Usage Vocabulary
Alternative Labels	WC_dissO2_Beck
Definition	This is the preferred term for this definition. Alternative term DOXYPR02 is included to cover cases where there are two sensors of the same type contributing to the data set and referential integrity considerations prevent a usage of a single code.
Date	2017-10-10T12:35:16
Identifier	SDN:P01::DOXYPR01
Note	accepted
Has Current Version	4
Version	1 , 2 , 3
version	4

Broader	S06:S0600045	Concentration	Mapping: 826409
	P01:DOXYZZXX	Concentration of oxygen {O2 CAS 7782-44-7} per unit volume of the water body [dissolved plus reactive particulate phase]	Mapping: 1532052
	C67:DOXY	dissolved oxygen	Mapping: 1758415
	P02:DOXY	Dissolved oxygen parameters in the water column	Mapping: 361217
	S27:CS002779	oxygen	Mapping: 826413
	S26:MAT00633	water body [dissolved plus reactive particulate phase]	Mapping: 826411
	P35:EPC00002	Water body dissolved oxygen concentration	Mapping: 523353
Related	S04:S04211	in-situ Beckmann probe	Mapping: 826407
	P06:UPOX	Micromoles per litre	Mapping: 361219
	S02:S053	per unit volume of the	Mapping: 826405

L22 SeaVoX Device Catalogue - (5) [+]

Alternate Formats

Other formats for this page:

RDF/XML | Turtle | JSON-LD

Alternate Profiles

Other views of this page:

Alternate Profiles ?

NVS html view ?

I-ADOPT html view ?

More qualified relationships
Standardisation

National Oceanography Centre

National Oceanography Centre

British Oceanographic Data Centre

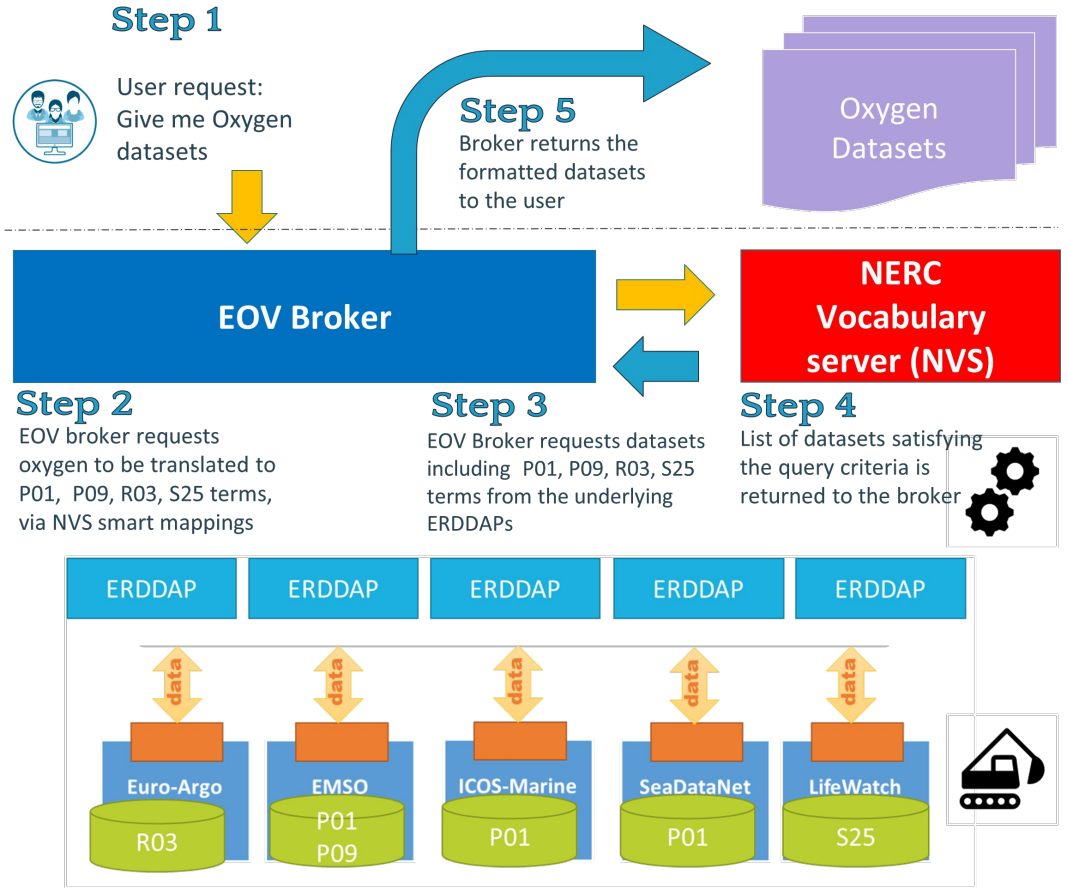
Use Cases

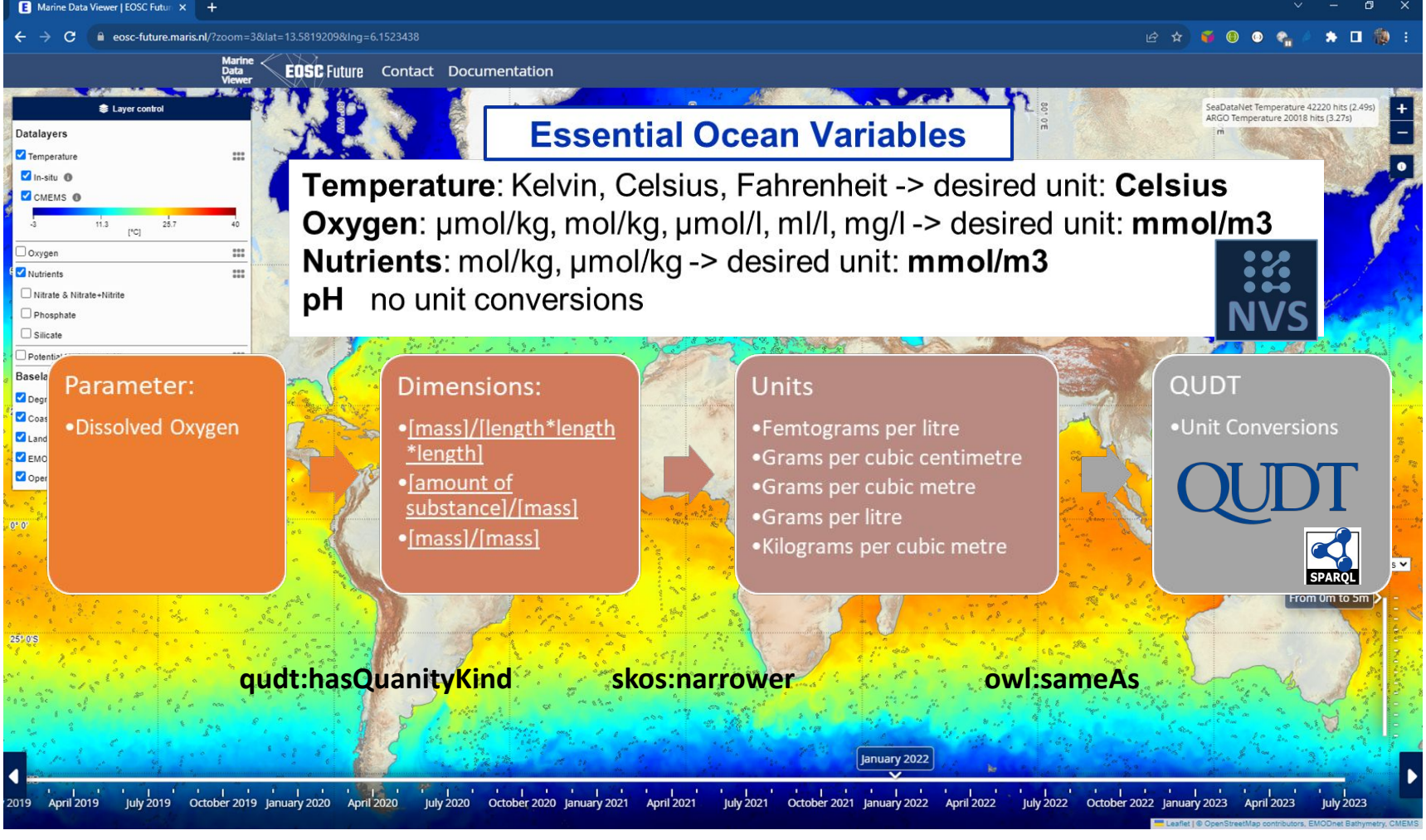
The EOV demonstrator - parameter harmonisation

i-adopt

Smart mappings

Find all the datasets that observe what is defined to be EOV oxygen




Marine Data Viewer | EOSC Futur
eosc-future.maris.nl/?zoom=3&lat=13.5819209&lng=6.1523438
Marine Data Viewer
EOSC Future
Contact
Documentation
Layer control
Datalayers
Temperature
In-situ
CMEMS
Oxygen
Nutrients
Nitrate & Nitrate+Nitrite
Phosphate
Silicate
Essential Ocean Variables
Temperature: Kelvin, Celsius, Fahrenheit -> desired unit: Celsius
Oxygen: µmol/kg, mol/kg, µmol/l, ml/l, mg/l -> desired unit: mmol/m3
Nutrients: mol/kg, µmol/kg -> desired unit: mmol/m3
pH no unit conversions
NVS
Parameter:
•Dissolved Oxygen
Dimensions:
•[mass]/[length*length*length]
•[amount of substance]/[mass]
•[mass]/[mass]
Units
•Femtograms per litre
•Grams per cubic centimetre
•Grams per cubic metre
•Grams per litre
•Kilograms per cubic metre
QUDT
•Unit Conversions
QUDT
SPARQL
qudt:hasQuanityKind
skos:narrower
owl:sameAs
January 2022
2019
April 2019
July 2019
October 2019
January 2020
April 2020
July 2020
October 2020
January 2021
April 2021
July 2021
October 2021
January 2022
April 2022
July 2022
October 2022
January 2023
April 2023
July 2023

P24 Identifier ↑	P24 Preferred label ↑
SDN:P24::MOLPVOL	[amount of substance]/[length*length*le
SDN:P24::MOLPVOL	[amount of substance]/[length*length*le
SDN:P24::MOLPVOL	[amount of substance]/[length*length*le
SDN:P24::MOLPVOL	[amount of substance]/[length*length*le
SDN:P24::MOLPVOL	[amount of substance]/[length*length*le
SDN:P24::MOLPVOL	[amount of substance]/[length*length*le
SDN:P24::MOLPVOL	[amount of substance]/[length*length*le
SDN:P24::MOLPVOL	[amount of substance]/[length*length*le
SDN:P24::MOLPVOL	[amount of substance]/[length*length*le
SDN:P24::MOLPVOL	[amount of substance]/[length*length*le
SDN:P24::MOLPVOL	[amount of substance]/[length*length*le

Relationship ↑ P06 Identifier ↑ P06 Preferred label ↑ Date created ↑ Creator ↑ Mapping URL ↑ Status ↑

```
 {

<http://vocab.nerc.ac.uk/collection/P24/current/MSPVOL/> skos:narrower ?P06.
  ?P06 skos:prefLabel ?prefLabel .
  ?P06 owl:sameAs ?unit .
  ?P06 skos:notation ?P06notation .
 SERVICE <http://qudt.org/fuseki/qudt/query> {
 BIND ("To convert" AS ?toConvert) .
BIND ("into" AS ?into) .
BIND ("multiply by" AS ?multiplyBy) .
?unit rdfs:label ?label .
?unit qudt:conversionMultiplier ?cm1 .
?unit qudt:hasQuantityKind/qudt:hasDimensionVector ?qkdv .
?otherUnit qudt:hasQuantityKind/qudt:hasDimensionVector ?qkdv .
?otherUnit a qudt:Unit .
FILTER regex (str(?otherUnit), "http://qudt.org/vocab/unit/MicroGM-PER-L") .
# FILTER  ((?otherUnit)!=?unit) .
  ?otherUnit qudt:conversionMultiplier ?cm2 .
   #?otherUnit rdfs:label ?otherUnitLabel .
```

Table | Response | 50 results in 22.394 seconds | Simple view | Ellipse | Filter query results | Page size: 50

	toConvert	label	P06notation	into	otherUnitLabel	multiplyBy	multiplier
1	To convert	"Mole per Cubic Metr…	SDN:P06::MLM3	into	"Millimoles per cub…	multiply by	"1000.0"^^<http://www.w3.org/2…
2	To convert	"Micromoles per litre"…	SDN:P06::UPOX	into	"Millimoles per cub…	multiply by	"1.0"^^<http://www.w3.org/2001/…
3	To convert	"millimoles per litre"@en	SDN:P06::MMPL	into	"Millimoles per cub…	multiply by	"1000.0"^^<http://www.w3.org/2…
4	To convert	"Mole Per Litre"@en	SDN:P06::MPLT	into	"Millimoles per cub…	multiply by	"1000000.0"^^<http://www.w3.or…
5	To convert	"Picomoles per litre"@en	SDN:P06::UPML	into	"Millimoles per cub…	multiply by	"0.000001"^^<http://www.w3.org…
6	To convert	"Picomoles per cubic …	SDN:P06::UPMA	into	"Millimoles per cub…	multiply by	"0.000000001"^^<http://www.w3…
7	To convert	"Femtomoles per litre…	SDN:P06::UPFM	into	"Millimoles per cub…	multiply by	"0.000000001"^^<http://www.w3…
8	To convert	"Millimoles per cubic …	SDN:P06::MMCM	into	"Millimoles per cub…	multiply by	"1.0"^^<http://www.w3.org/2001/…
9	To convert	"Mol per Kilogram"@en	SDN:P06::MLKG	into	Millimoles per cubi…	multiply by	"1025000.0"^^<http://www.w3.or…
10	To convert	"Micromoles per kilog…	SDN:P06::KGUM	into	Millimoles per cubi…	multiply by	"1.025"^^<http://www.w3.org/20…
11	To convert	"Nanomoles per kilog…	SDN:P06::KGNM	into	Millimoles per cubi…	multiply by	"0.001025"^^<http://www.w3.org…
12	To convert	"Picomoles per kilogr…	SDN:P06::KGPM	into	Millimoles per cubi…	multiply by	"0.000001025"^^<http://www.w3…
13	To convert	"Femtomoles per kilo…	SDN:P06::FMKG	into	Millimoles per cubi…	multiply by	"0.000000001025"^^<http://www…
14	To convert	"Millimole Per Kilogra…	SDN:P06::MMKG	into	Millimoles per cubi…	multiply by	"1025.0"^^<http://www.w3.org/2…
15	To convert	"Kilogramm je Kubik…	SDN:P06::UKMC	into	Millimoles per cubi…	multiply by	"31251.17191894696051101 91…

rc.ac.uk/mapping/E/391021/?_profile=nvs&_mediatype=te
nts/1.1/> .
#> .
2/22-rdf-syntax-ns#> .
ata/registry#> .
/schema/> .
021/> a rdf:Statement,
 ;
rg/ns/prov#Agent",
/0.1/Person" ;
ffe" ;
.nerc.ac.uk/collection/C75/current/BOD/"] ;
//w3id.org/semapv/vocab/ManualMappingCuration/> ;
ocab/unit/MOL-PER-M3/> ;
org/2002/07/owl#sameAs/> ;
c.ac.uk/collection/P06/current/MLM3/> .

Date created	Creator	Mapping URL	Status
023-09-05 1:09:41	Gwenaelle Moncoiffe	396285	valid
023-09-05 1:09:41	Gwenaelle Moncoiffe	396313	valid
023-09-05 1:09:41	Gwenaelle Moncoiffe	391028	valid
023-09-05 1:09:41	Gwenaelle Moncoiffe	391035	valid
023-09-05 1:09:41	Gwenaelle Moncoiffe	396320	valid
023-09-05 1:09:41	Gwenaelle Moncoiffe	391042	valid
023-09-05 1:09:41	Gwenaelle Moncoiffe	396278	valid
023-09-05 1:09:41	Gwenaelle Moncoiffe	397636	valid
023-09-05 1:09:41	Gwenaelle Moncoiffe	396180	valid
023-09-05 1:09:41	Gwenaelle Moncoiffe	396173	valid
023-09-05 1:09:41	Gwenaelle Moncoiffe	396201	valid