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Collaborative Project of the 7th Framework Programme



## Work Package 5
## Data management and interoperability portal

# D5.1: Formats for metadata description and storage and procedure for validation of Citclops data sets

**Version 1.1**

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www.Citclops.eu

## Document Information

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| **Abstract (for dissemination)** | This deliverable provides documentation of the metadata required for data collected in the project. These data will be collected using sensor systems, including smartphone applications, later on in the project. By defining the metadata format early on in the project the sensor systems and applications can immediately take this requirement into account, which will ease the handling, validation and Quality Control later on. For definition of the Citclops metadata format the SeaDataNet ISO19115 CDI metadata profile is taken as basis. Citclops data and metadata will be stored in a project's data-server during the project, together with relevant long-term and remote-sensing datasets. In this way all data needed for initial validation will be available in an easy way. Before the end of the Citclops project, the data will be handed to national data centers and to GEOSS for long-term storage and further quality control. The metadata format based on CDI format will streamline this. The plan / initial ideas for validation of Citclops data are also described in this document. |
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# 1 Introduction

This document is the first deliverable of Citclops Work Package 5 “Data management and interoperability portal” which has the following objectives:

1. To define, develop and implement a data management system for archiving all collected Citclops data, including metadata, interoperable with the SeaDataNet/ EMODNet infrastructure to support two-way exchange.
2. To define, develop and provide tools for validating the gathered Citclops data, using remote sensing data and also long-term environmental datasets as available through SeaDataNet and EMODNet.
3. To define, develop and implement a Citclops portal service for discovery, access and visualisation of the Citclops data.
4. To extend the service by development and implementation of an application for giving access by mobile platforms, such as smart phones and tablets.

This deliverable formulates the basic conditions and approach to achieve objectives 1 and 2: **Creating a metadata format for Citclops specific data** following SeaDataNet requirements, defining an **approach for storage of data** for the short-term (project phase) and longer term (after project end), plus **defining plans for validation** of the gathered data.

Citclops data will consist of data collected using smartphone applications (with/without extensions), and data collected by new low-cost sensors. By defining the metadata format early on in the project the applications and sensors systems can immediately take the requirements into account, which will ease the handling, validation and Quality Control later on.

Section 2 describes the data management system for Citclops data including the foreseen flow of data from source to user.

Section 3 documents the metadata required for the data collected in the project. For definition of the Citclops metadata format the SeaDataNet ISO19115 CDI metadata profile is taken as basis.

Section 4 defines the storage plan for data. Citclops data and metadata will be stored for the short-term (during project phase) in a project data-server, ready to be used and validated with relevant long-term and remote sensing datasets. At the same time the metadata will make the data interoperable for long term storage in “traditional” data centres.

Section 5 describes the validation plan: how Citclops data can be validated in the best possible way, making it a valuable contribution to traditional research data.

# 2 Citclops data management system

## 2.1 Citclops data

Citclops data is mostly marine data on seawater colour, transparency and fluorescence, collected by low-cost sensors, in some cases integrated into smart phones, so the “crowd” (= the less trained public) can participate in making observations. The purpose and challenge is to involve the crowd as alternative source of research data. However, the data may be of mixed quality so data quality control in an early stage is critical. Contextual information (metadata and data) is important in order to be able to consider the quality of and validate observations. This validation will

be done using long-term time series and other data sources (e.g., remote-sensing data) for comparison (see also chapter 5).

## 2.2 Data management plan

The dataflow from collection (source) to user can be described using as basis the one used in SeaDataNet and EMODNet. The basic dataflow is presented in figure 1.

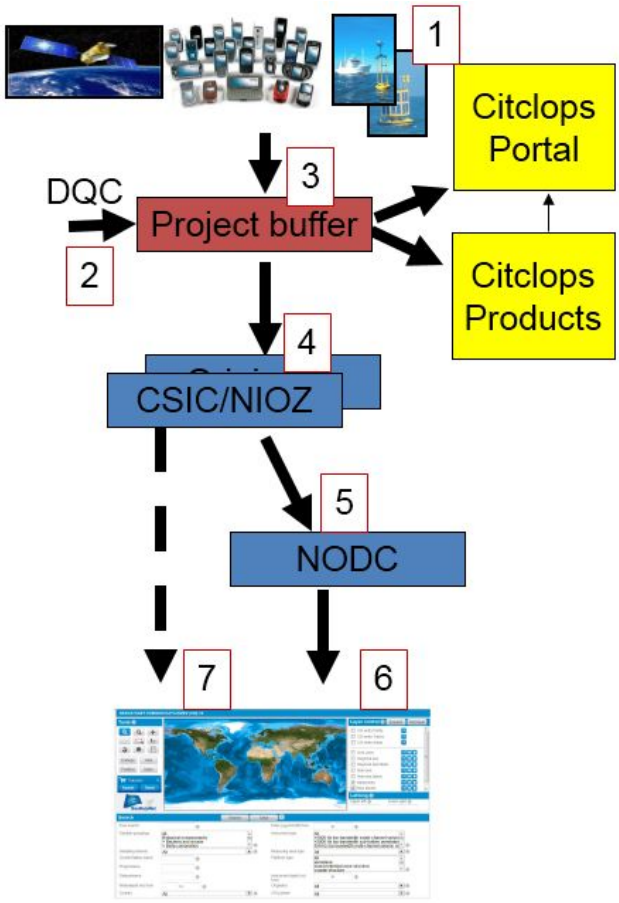


*Figure 1: Dataflow of Citclops data*

Citclops's dataflow is as follows:

1. *Data collection*. Raw data collection via app or low-cost sensor, immediately requesting relevant metadata (more than time/place only; if necessary, partly manually), making use of standard vocabularies already.
2. *Data quality control*. Incoming data is checked for quality (validation is carried out in part comparing to other sources: remote sensing and traditional marine data).
3. *Initial storage of data for immediate use in project*. Data is stored in a partner's data server, accessed via the project's website (see chapter 4). Specific Citclops data products are created.
4. Long-term storage at "originator". Validated datasets are safeguarded (copied) for future use at the center that originally collects the citizens' observations. This could be at local partners in the project - CSIC and NIOZ – that are strongly linked to SeaDataNet, EMODNet and GEOSS. (Expandable setup towards other countries).

5. *Distribution towards wider usage*. Distribution via national data centres (e.g., NODC NL / IEO SP) towards the European infrastructure of EMODNet / *SeaDataNet* (SDN), with interoperability via the CDI system. It is important to have the data and metadata in correct formats to minimise additional costs for conversion and quality control.
6. *Discovery and access*. Data discovery is available via the SeaDataNet/EMODNet portal and Web search engines. Access is via the SeaDataNet/EMODnet portal, the project's website and mobile applications. Datasets should be available in a data transport format as accepted by EMODNet/SDN, therefore it is important to adapt as early as possible.
7. *Download from data centre in standard format*. Users can download the data from the EMODNet/SDN or GEOSS portals in a standard format.

Following these 7 steps Citclops works to setup a system that is expandable to any country, sustainable and immediately linked to other communities.

Initial focus for Citclops will be data collection in a proper data and metadata format, and then building up a project data buffer for work during the project. Citclops will follow existing metadata and data standards, with focus on data management practices from SeaDataNet:

- CDI (Common Data Index) metadata profile approach and format
- Data Quality Control of crowdsourced data is a key Citclops action: Validation to remote sensing data, and long-term archived data
- CDI discovery and data access service
- Use of SeaDataNet Common Vocabularies to describe parameters, instruments etc.

The above methods and standards have been developed and are in use for marine data collected in a traditional way. Citclops partners MARIS and CSIC will propose standardisation bodies (SeaDataNet, SeaVoX [https://www.bodc.ac.uk/data/codes_and_formats/seavox/]) to adapt existing formats and vocabularies to include specific metadata for the description of data coming from participatory science initiatives.

By complying with these standards (and adapting the standards) a broad usage of data retrieved in a participatory way by citizens may be expected. Data will not only be used immediately in the project but also will flow, via national data centres, SeaDataNet/EMODNet and their interoperability to GEOSS, to a wider user community.

# 3 Metadata profile for Citclops data

## 3.1 Background

As explained in chapter 2, Citclops data are retrieved by using smart-phone applications with or without extensions, and by new low-cost sensors. In order to ensure that these data are on a quality level that allows their use as additional research data, validation and data quality control are key issues. Sufficient metadata information is very important to conduct the validation. Furthermore, metadata include information on spatial-temporal dimensions of measurements and this information allows the "crowd" to track their acquired data on a map. Also, they can compare own to other data and thereby increase an interest in own data quality. By defining the required metadata early on in the project the developed applications can immediately

take the requirements into account, which will ease the handling, validation and Quality Control later on. In the next section the Citclops metadata profile is presented.

## 3.2 Citclops's metadata profile

The aim is to start with a slim set of metadata that can be expanded during the project when the need occurs. Therefore for the definition of the Citclops's metadata format the **mandatory fields** of SeaDataNet ISO 19115 content model [http://www.seadatanet.org/Standards-Software/Metadata-formats] (CDI metadata profile) are taken as basis.

Data are submitted to marine data centres for the purpose of long term viability and future access. This requires the data set to be accompanied by key information (metadata). The metadata are based on the SeaDataNet protocols and give information on:

- **Where** the data were collected: location and depth/height
- **When** the data were collected (date and time in UTC or clearly specified local time)
- **How** the data were collected (e.g. instrument types, measurement specifications such as angle in which camera was held to acquire an image)
- **How** you refer to the data (e.g. station name, location)
- **Who** collected the data, including name, type of user (professional, citizen, etc.) or ID, or institution
- **What** has been done to the data (e.g. details of processing and calibrations applied, algorithms used to compute derived parameters)
- **Watch points** for users of the data (e.g. problems encountered and comments on data quality)

The CDI metadata profile makes use of *NERC Vocabulary Server version 2.0* (NVS2.0) [http://www.seadatanet.org/Standards-Software/Common-Vocabularies] [http://www.bodc.ac.uk/products/web_services/vocab/#documentation] [http://vocab.nerc.ac.uk/] to describe parameters, parameters classes, instrument classes, and organisations in a controlled manner. Motivation for this is already explained in Chapter 2: SeaDataNet is the leading community for European standards for (traditional) marine data and also uses NVS2.0. Citclops partners MARIS and CSIC will together communicate with SeaDataNet to adapt existing formats and vocabularies to include specific metadata for the description of data coming from participatory science initiatives.

The Citclops basic metadata profile is explained and formalised in Appendix A where a differentiation has been made between the mandatory metadata for marine data, and an extension specifically dedicated to the Citclops data types.

Regarding these specific data types:

Based on the NASA, ESA and Secchi Dip-in protocols for scientific data [http://www.secchidipin.org/data/assets/DipIn%202010%20Paper%20Questionnaire.pdf] it is recommended to extend the metadata with information about the following environmental conditions that might influence the optical signal from the water that is recorded with a smart phone's camera:

- **Circumstance information**. The position of the camera above water, the sky conditions (clouds), the conditions of the water surface (waves, rain) and reflection from the bottom or white reflecting surface of a Secchi Disk.

- **Viewing Angle**. At the surface of the water the radiation that comes from the sun (yellow), sky (blue) or clouds (white-grey) is always partially reflected. The Fresnel reflection is relatively small at angles below 40 degrees with Zenith, but rapidly increases at higher angles. If we look to the horizon the air-water interface acts as a perfect mirror and reflects almost all radiation.
- **Azimuth Angle**. If sunlight is reflected at small waves at the surface it can easily exceed the optical signal from the water itself. This can best be avoided if the observation is made at an angle of 135 degrees with the position of the sun projected at the horizon.
- **Illumination conditions.** These conditions have impact on the perceived colour above water and the fluorescence behaviour of algae. Metadata on cloud fraction[1], precipitation, surface conditions (waves, wind), local shadow conditions (sunny side of the boat) or highly reflecting surfaces in the water (bottom or Secchi disk) are helpful.

Citizens will not make their observations in optimised conditions as e.g. stated for the Azimuth angle. Therefore the conditions during their observation should either be provided (automatically!) by the application in the metadata, or otherwise should be retrieved as additional data (afterwards) for validation of the observation.

*Appendix A* lists the current set of metadata fields preferred during the collection of Citclops data. For each field it is listed:

- if it is mandatory;
- if it is automatically collected from the app, or manually collected via a form;
- a definition of the content;
- a relation to a controlled vocabulary if appropriate for this field.

# 4 Approach for data (and metadata) storage

In the following, the general approach for storage of data and metadata is provided. Detailed plans will take shape later in the project in functional and technical specifications of the data management system (D5.2 and D5.3).

The basic data flow is presented in figure 1. This diagram indicates that metadata and data storage is foreseen in two stages:

- Initial storage for project use. This is “short term” storage, essential for direct use in the project of new Citclops data, as well as a buffer for external data-access required for data quality control and validation. Data products will be created using this buffer of data.
- Long-term storage at data centres. Validated data will be stored at national data centres connected to international discovery systems to enable broad use of Citclops data as additional data type for research and other purposes. Therefore, the compliance with standard metadata formats need to be ensured, and the inclusion of unnecessary additional fields in the metadata fraction should be avoided.

[1] Cloud fraction is the percentage of each pixel in satellite imagery or each grid-box in a weather model that is covered with clouds. A cloud fraction of one means the pixel is completely covered with clouds, while a cloud fraction of zero represents a totally cloud free pixel.

## 4.1 Short-term data storage

Citclops data will be collected via smart phones and low-cost sensors with sufficient metadata for data quality control and validation. Citclops' data will in a first stage need to be easily available to all project partners for their work, and in a second stage will be made available via the Citclops portal in open access "style" to the general public.

The best option for short term storage is a data server, which can be setup easily, is available to all partners, and can be extended as required as more data flow into the project.

In a similar manner the buffer of externally collected data for validation and modelling can also be placed in the data server. This buffer will only be used by project partners, preventing licensing problems if distributed onwards. However, users will be able to retrieve these data directly from the distribution centres.

Citclops partners BDIGITAL and MARIS, responsible for data management within the project and the project portal, will search a suitable provider and setup the data server for project usage.

## 4.2 Long-term data storage

In order to qualify Citclops data as official additional data source for marine research it is essential that the validated datasets are stored and made available for the long term. Citclops will ensure the new data will flow to GEOSS-connected data-centres that will store the data after validation and will make them available for discovery and download via European infrastructures SeaDataNet and EMODNet.

As described in chapter 3 the metadata of Citclops data are already adopting international principles (standard requirements and use of common vocabularies). In this way the effort needed at the data centres will be kept to a minimum and data can flow with low additional costs into the normal data management systems of the centres.

# 5 Procedure for Citclops data quality control

The *data quality control* (DQC) procedures adopted in the Citclops project are an extension to the procedures that were developed for SeaDataNet (2010). The extension deals with DQC of measurements that are based on optical measurements of water quality: water colour, fluorescence and turbidity. The preparations and conditions for performing optical observations in and above water can be adopted from for ground truthing protocols for satellite based ocean colour observations as developed by NASA (Mueller et al., 2003) and ESA (Tilstone et al., 2004).

In the Citclops project data are collected by many different sensors (including smart phones) and by a large group of observers in the public that will (likely) have limited interest in the measurement conditions. This imposes strong requirements towards ensuring quality and overall coherence of the integrated data set.

DQC has the objective to ensure the consistency within a collection of data and to ensure that the quality and errors of the data are apparent to the user. In Citclops the "user" is defined as the operator of the sensor system or smart phone (public), or the water-quality manager (policymaker). From figure 2 it can be seen (red circles) that two DQC procedures will be developed: one partially embedded near--real-time automated feedback to the public, and one separate offline assessment of the quality in a post-

processing where the data are integrated with other spatial data and satellite information.

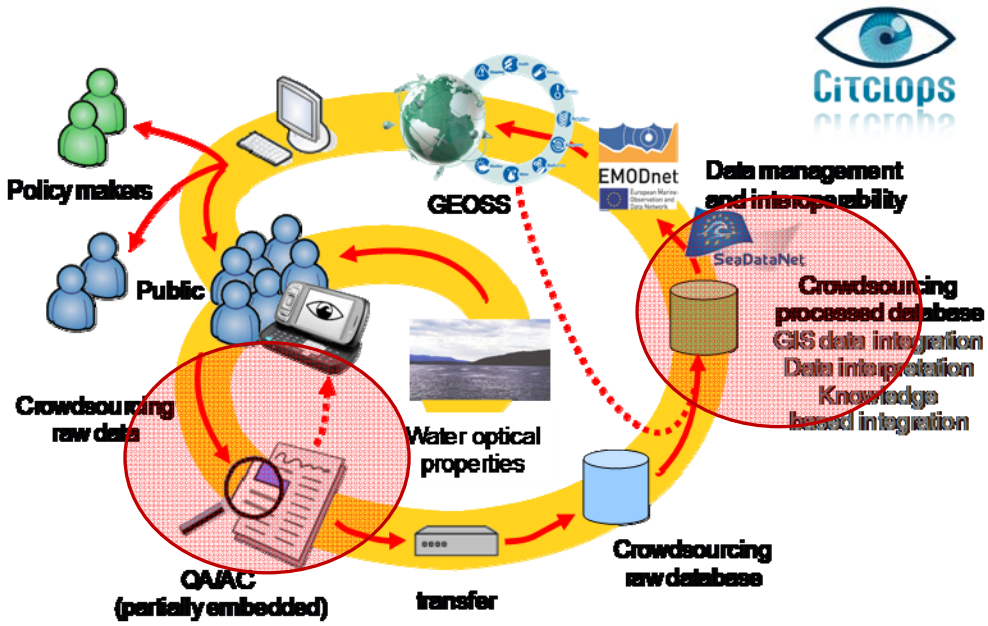


*Figure 2: Dataflow for Citclops data, from source to public and policy makers*

In SeaDataNet, and similar in Citclops, DQC is achieved by establishing and maintaining accurate metadata directories and data access services, as well as common standards for vocabularies, metadata formats, data formats, quality control methods and quality flags. The data format and metadata should allow a variety of automatic tests for a scientific quality control, checking for unexpected anomalies in the time series. DQC extends beyond these procedures mentioned to include the documentation of the data sets. DQC is also related to the availability of good-quality data in real-time. If data can be flagged for errors by automatic software, then faults can be rapidly attended to and fixed.

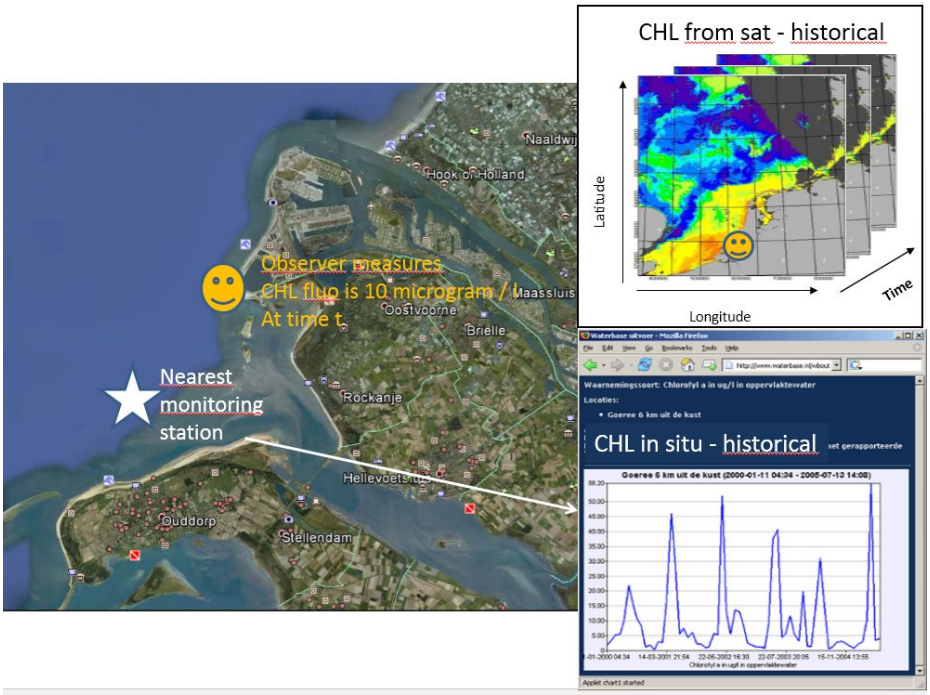


*Figure 3: Intercomparison of data of observer to historical values and remote sensing*

In the data interpretation and validation phase the collected data are compared to the results of satellite observations and existing knowledge of the waters, be it in the form of maps or results of long-term sampling at fixed stations. The metadata that are defined in this document allow for this comparison. In figure 3 below this inter-comparison of data is shown; see also Eleveld et al. (2007) for a proof of concept.

# List of abbreviations and acronyms

CDI - Common Data Index: Metadata index for data files used in SeaDataNet

Citclops - Citizens' observatory for coast and ocean optical monitoring

EMODnet - European marine observation and data network

ESA - European Space Agency

FU - Forel-Ule (scale for ocean colour)

INSPIRE - Infrastructure for spatial information in the Europe community

NASA - National Aeronautics and Space Administration

NetCDF - Network Common Data Format

ODV - Ocean Data View software and related standard file format

OGC - Open Geospatial Consortium

QA- Quality Assessment

QC - Quality Control

SeaDataNet - Pan-European infrastructure for ocean & marine data management

# References


- Eleveld, M. A., Wagtendonk, A. J., Pasterkamp, R. and de Reus, N. O. (2007) 'WATeRS: an open Web Map Service with near-real time MODIS Level-2 standard chlorophyll products of the North Sea', International Journal of
- Remote Sensing, 28:16, 3693 – 3699.
- Mueller, J. L., Fargion, G. S., & McClain, C. R. (2003). Biogeochemical and bio-optical measurements and data analysis. Ocean Optics Protocols for Satellite Ocean Colour Sensor Validation. Washington, USA: National Aeronautical and Space Administration [Revision 5, Volume V].
- SeaDataNet (2010): Data quality control procedures. Version 2.0,
- 14 May 2010. See Website: www.seadatanet.org. Last access May 2013.
- Secchi Dip-In (2013): http://www.secchidipin.org/data/assets/DipIn%202010%20Paper%20Questionnaire.pdf
- Tilstone, G. H., Moore, G. F., Sorensen, K., Doerffer, R., Röttgers, R., Ruddick, K. G., et al. (2004). Regional validation of MERIS chlorophyll products in North Sea coastal waters: REVAMP protocols. ENVISAT validation workshop European Space Agency. Frascatti, Italy: European Space Agency
- http://envisat.esa.int/workshops/mavt_2003/MAVT-2003_802_REVAMPprotocols3.pdf

# Appendix A metadata format

**Format Version 1.0**

<Available via enclosed XLS document>

**Citclops metadata format for specific citclops data (e.g. images - FU selection collected via app, data from low cost sensors). For other data, use standards as already present.**

Proposed fields based on CDI format

*Version 1 - P. Thijsse (MARIS) in cooperation with a.o. J. Busch, O. Zielinski (UNIOL), H. van der Woerd / M. Eleveld (VU), M. Wernand (NIOZ) and others*

| Fieldname | Definition | database filed type | Multiplicity | reference code list | Examples of codes | Automatic in app / via Form |
|---|---|---|---|---|---|---|
| Dataset_name | Short name of observation (e.g. ocean colour via citclops app) | text | 1 | | | A |
| Observation_ID | Unique id of measurement/observation (primary key) | text | 1 | | | A |
| Date_time | Date and time of measurement in ISO8601 notation: YYYY-MM-DDThh:mm:ss. Local time | date_time | 1 | | | A |
| Measuring_area_type | Geographical type, possible values: Point/Track/Area | text | 1 | | | A |
| Location_lat_long | Latitude/Longitude - decimal degrees, Mercator projection (for tracks/areas GML object with string of coordinate pairs).<br>From time and position we can calculate the SZA. Make sure that we have sufficient spatial resolution (1 meter?), because this information is needed to the very local scale where (beach, harbour etc). | decimal | 1-n | | | A |
| Datum_coordinate_system | Datum of the coordinate system. Default/Fixed = WGS84 (use SDN code list L101) | text | 1 | L101 | 4326: WGS84 (2D) | A |
| Parameters_measured | Via code used from vocabulary P02 - BODC Parameter Discovery Vocabulary (New codes might be needed.) (units will be part of the datafile!) | text | 1-n | P02 | Existing codes do not fit. Need of new and dedicated code for crowdsource FU measurements. R410 (code closest to it) is clearly for satellite observations that can be used in WP8, but because we use other devices and do not measure the spectral radiation but the colour (chromaticy coordinate) a new parameter is recommended.<br>Also at least include CDOM absorption.. | A |
| Abstract | Short description of measurement. Default inserted by application. Specific details for measurement (other than strictly necessary for Data Quality check), such as aperture, exposure time etc. should be included in the abstract.** | text | 1 | | | A |
| Platform_type | Type of platform - Code from L061 - Platform type on which the sensor is mounted/carried | text | 1 | L06 | 71: Human | A |
| device_type | Sensor/device/Instrument category - Code from L05 - Device categories | text | 1 | L05 | Existing codes will not fit. Need of new and dedicated code for mobile devices | A |
| device_name | Specific name / brand of the device/instrument or sensor/device id (free text) | text | 0-1 | | | A |
| Station name | Name of measurement location = Field for name or id of observer.<br>Although there might be problems with privacy, it might be interesting for specific groups to be coupled to instruments and observations. For example the Scuba club might check easily on the results of members and small communities could be proud to see the selection of 'their' effort to monitor the waters. | text | 1 | | | A |
| PI | For scientific data or for Citclops crowd the user name, mobile phone ID (privacy important!) | text | 1 | | | A |

| | | | | | | |
|---|---|---|---|---|---|---|
| Station_start_ date_time | Derived from first measurement date/time in case multiple observations/images are taken. ISO8601 notation: YYYY-MM-DDThh:mm:ss (converted to UTC) | date_time | 1 | | | |
| Station_end_ date_time | Derived from first measurement date/time in case multiple observations/images are taken. ISO8601 notation: YYYY-MM-DDThh:mm:ss (converted to UTC) | date_time | 0-1 | | | |
| Language | Language of metadata in file (default = en) | text | 1 | | | A |
| Data_format | SDN data transport format via code from L241. | text | 1 | L241 | For images: code = PNG or TIFF currently allowed (is this sufficient for Citclops purpose?) or NetCDF or even ODV | A |
| Data_Format_Version | Version number of data format | text | 1 | | | A |
| Data_file | Link to datafile via filename. File can be of various type, either image, point measurement, or timeseries or other. | text | 1 | | | A |
| viewing_angle | Specific for camera image: Angle towards the ground in which image has been taken (derived by app!). This is the angle in the vertical (up down) direction that is most important. For example, all traditional holiday pictures of a setting sun (angle 90 degrees, at the horizon) are useless. | decimal | 0-1 (optional for other types) | | TBD: Could also be taken up as part of abstract but more complex to use automatically by applications | A |
| azimuth_angle | A second angle is the azimuth angle, the horizontal angle between observation and the position of the sun.This is less important. Might be asked in the app (is your camera not pointing to the sun?) | decimal | 0-1 | | TBD: Could also be taken up as part of abstract but more complex to use automatically by applications | A |
| Remark | Field for remark about e.g. data quality in free text | text | 0-1 (optional) | | | A |
| **** Additional Data Quality indicators present in Abstract field (specific per datatype, probably collected additionally via form or even later as data for validation):** | | | | | | |
| Cloud Fraction | E.g. button with three options like to indicate no clouds, some clouds and fully clouded | text | 0-1 (optional) | | | F |
| Rain | Does it rain: yes or no | boolean | 0-1 (optional) | | | F |
| Wind and Waves | Entry for the wind in Bft. | decimal | 0-1 (optional) | | | F |
| Surface only or the use of a Secchi Disk | Classical FU is made with a Secchi Disk. When only taking a surface image, it is important to know this distinction. | text | 0-1 (optional) | | | A |
| Bottom | Depth can become important if the water is clear enough to see the bottom. Then the colour cannot only be attributed to the water alone. A simple flag might be appropriate: do you see the bottom? Yes/no In the postprocessing the position and a simple bathymetry map could be used to check this flag. | boolean | 0-1 (optional) | | | F |
| Secchi Disk type | In case we really encourage the use of a SD, we should investigate the SD properties like the forms of the Secchhi Dip In project. Maybe we should ask for the closest resemblance (drop down menu, like size class (10, 20 or 30 cm), black and white or just white. | text | 0-1 (optional) | | | A/F |
| Shadow | Do you measure in the shadow of your ship or platform, yes/no (like encouraged in the standard FU protocols) | boolean | 0-1 (optional) | | | F |
| Height | Hight of the sensor/device above ground level. Standard set at plus 1 to 2 meters (above water), but maybe people use instruments in the water to combine with turbidity and fluorescnce measurements ? | decimal | 0-1 (optional) | | | A |