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Marine technology — Ocean observation systems — Design criteria of ocean hydro-meteorological observation systems reuse and interaction

Technologie maritime — Systèmes d'observation des océans — Critères de conception de la réutilisation et de l'interaction des systèmes d'observation hydrométéorologique des océans

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Foreword

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This document was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 13, *Marine technology*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Ocean hydro-meteorological observation is an important means for human cognition and research on the ocean. It plays an important role in the study of ocean science, protection of the ocean environment, early warning of ocean disasters, and development of ocean resources. Observation activities are coordinated by ocean hydro-meteorological observation systems at observing sites. The observation system is responsible for receiving, storing, displaying, processing and analyzing ocean hydro-meteorological data, providing software support for accurate and efficient observation activities.

The lack of design standards for ocean hydro-meteorological observation systems leads to different system structures, poor interface versatility, and diverse data types, which seriously affects the reusability and interactivity of the system, and brings a series of comprehensive problems, mainly in the following aspects: the system function coverage is imperfect and cannot meet all observation requirements; the interconnection between systems is difficult, which hinders the analysis and application of large-scale ocean data; the system development efficiency is low, the upgrade cost is high, and the ocean observation cost increases.

This document provides an overall framework for ocean hydro-meteorological observation systems. It standardizes the functional composition of such systems, their structure type of the data, their data transmission format and protocol, and their input and output interfaces. As such, this document contributes to improving the development and operation efficiency of these systems, and to meeting diverse needs. It also improves the application analysis and integrated management capabilities of ocean big data.

Marine technology — Ocean observation systems — Design criteria of ocean hydro-meteorological observation systems reuse and interaction

1 Scope

This document specifies the overall framework of ocean hydro-meteorological observation systems, including the system function composition, the data structure type and data transmission format and protocol, as well as the input and output interface. These systems support automatic measurement of e.g. buoy, submersible and shore station instruments, with output interfaces, and provide observations on e.g. water temperature, salinity, depth, current, ocean wave, temperature, pressure, humidity, wind, visibility and precipitation. They have the ability to receive, store, display, process, and analyze data. This document is intended for both developers of ocean observation systems and ocean observers.

2 Normative references

There are no normative references in this document.

3 Terms and definitions, and abbreviated terms

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1 Terms and definitions

3.1.1
interface
function used to implement data reception or transmission

3.1.2
standardized interface
interface (3.1.1) for the uniform specification of names, functions, *parameters* (3.1.5) and return values

3.1.3
instrument
device with a sensory environmental characteristic parameter function for implementing ocean hydro-meteorological observation activities

3.1.4
precision
closeness of agreement between indications or measured quantity values obtained by replicate measurements on the same or similar objects under specified conditions

[SOURCE: ISO/IEC Guide 99:2007, 2.15, modified - Preferred term "measurement precision" deleted; Notes 1 to 4 to entry deleted.]

3.1.5
parameter
ocean hydro-meteorological observation elements measured by an observation *instrument* (3.1.3)

3.1.6
ocean hydro-meteorological complex virtual instrument
ocean hydro-meteorological observation system software element consisting of standardized input and output *interfaces* (3.1.1) and function module

3.2 Abbreviated terms

CTD	conductivity, temperature and depth
URL	Uniform Resource Locator
XML	Extensible Markup Language
OHM-CVI	ocean hydro-meteorological observation complex virtual instrument
MQ	message queue
REST	representational state transfer
API	application programming interface

4 System architecture, workflow and types of interfaces

4.1 Architecture

4.1.1 General

The document combines the requirements of ocean hydro-meteorological observations, and adopts the ocean hydro-meteorological complex virtual instrument (OHM-CVI) as the system design reference model to standardize the overall structure. It specifies standardized data, input and output interfaces and a data exchange format. The input interface is responsible for receiving the collected data of the ocean observation instrument. The output interface provides MQ and REST data sharing modes for different data sharing scenarios to realize the interaction of ocean observation data. A function module is also specified, that includes data display, statistical analysis, and comprehensive query functions to meet the storage, display, processing and analysis requirements for ocean hydro-meteorological observation. The detailed description of the OHM-CVI components is given in 4.1.2 and 4.1.3.

Figure 1 shows the system architecture model, with the standardized interfaces marked in blue.

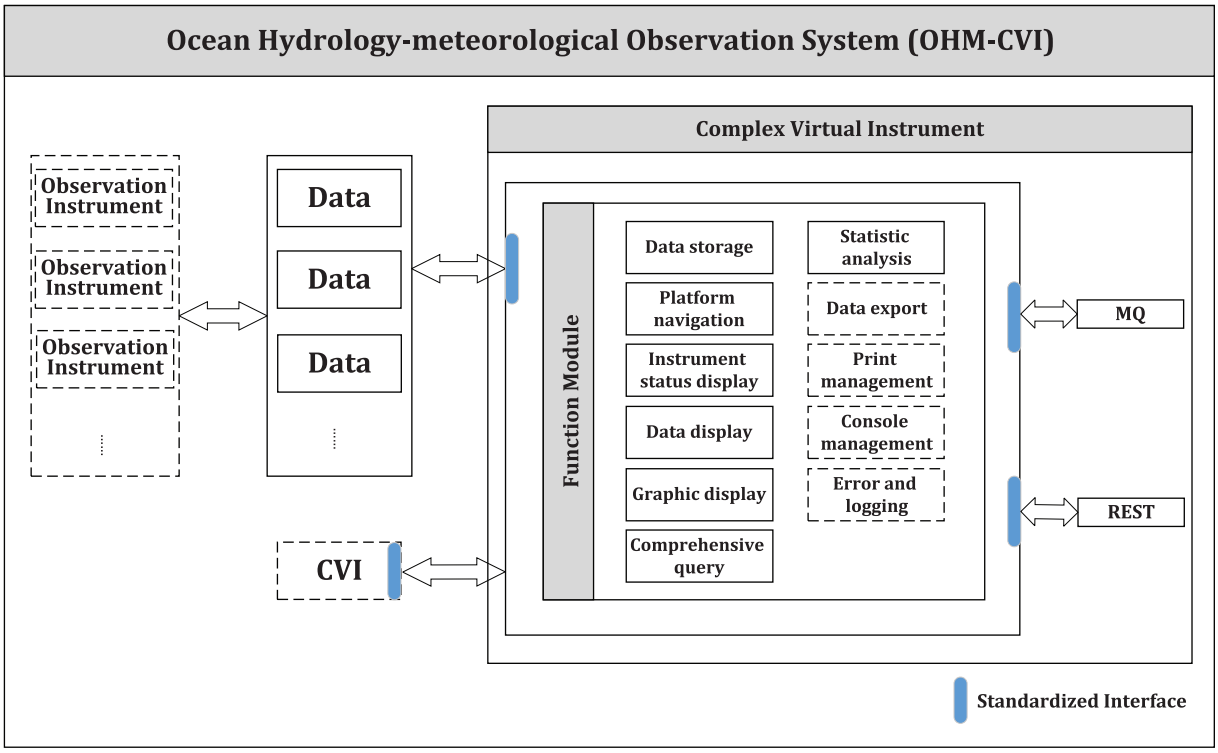

Figure 1 — System framework model

Interaction between a upper application and a OHM-CVI, as well as between several OHM-CVIs, is implemented through a registration centre. The registration centre is responsible for the centralized management of OHM-CVI information, and provides the OHM-CVI registration interface and directory retrieval interface. The OHM-CVI completes registration through the registration interface. The upper application or OHM-CVI obtains the registered OHM-CVI list through the directory retrieval interface, and realizes the data interoperation through the standardized data output interface of OHM-CVI. The OHM-CVI registration and access process is shown in Figure 2. Detailed information is given in 4.1.4.

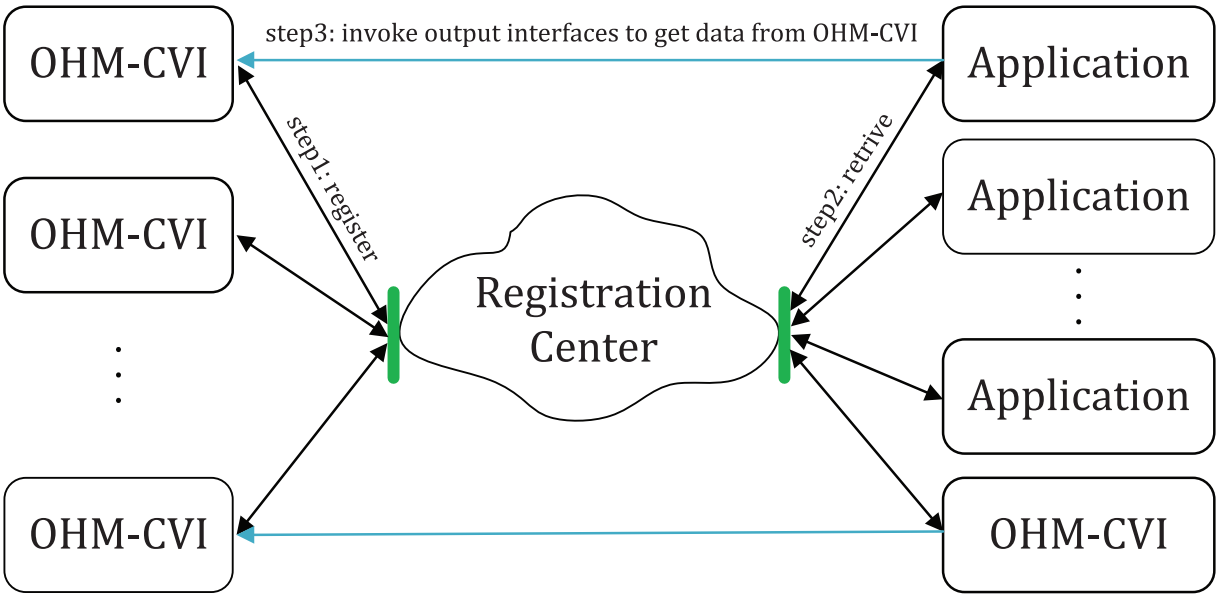

Figure 2 — OHM-CVI registration and access process

4.1.2 Function module

The function module is a module that analyses and displays the source data acquired by OHM-CVI, and provides a standardized interface through MQ and REST. This document lists the data presentation forms commonly used by data display and calculation analysis modules based on observation parameters. Users can increase or decrease data presentation forms according to their requirements and observation parameters. This module shall have the following functions.

1. Data storage: to store the received hydro-meteorological parameter data (see 6.1).
2. Platform navigation: with a horizontal map as the background, to achieve navigation to each platform, (see 6.2).
3. Instrument status display: to show the operation status of each instrument in a visual way (see 6.3).
4. Data display: to display the various parameter data in real time in the form of a list (see 6.4).
5. Graphic display: for real-time display of the various parameter data in a suitable way (see 6.5).
6. Comprehensive query: to query the data under certain conditions, and to display the query results in an appropriate way (see 6.6).
7. Statistic analysis: for the mathematical analysis and display of hydro-meteorological parameter data (see 6.7).
8. Data export: to export data or charts (see 6.8).
9. Print management: to print data or charts (see 6.9).
10. Console management, page closure, minimization or maximization of the software and function module switching operations (see 6.10).
11. Error and logging, warning and logging of errors during software operation (see 6.11).

4.1.3 Standardized interface

The standardized interface standardizes data transformation format. It shall consist of the following.

1. Source data input interface: to transfer source data to OHM-CVI, in a specified format (see 7.2.1.1).
2. Instrument status input interface: to transfer instrument status to OHM-CVI, in a specified format (see 7.2.1.2).
3. Data output interface: for the OHM-CVI to provide standardized observation data interfaces (see 7.3.1).
4. Instrument status output interface: for the OHM-CVI to provide standardized instrument status interfaces (see 7.3.2).

4.1.4 Registration centre

4.1.4.1 General

The registration centre shall contain a registration interface and a query interface.

4.1.4.2 OHM-CVI registration interface

The OHM-CVI registration interface shall be as follows.

1. Name: registrationOHM-CVI.
2. Function: OHM-CVI register.

3. Request parameters: The request parameters are shown in Figure 3, which include URL, UserName, Password, and OHM-CVI description information, where username and password are optional. More details of request parameters are shown in Table 1.

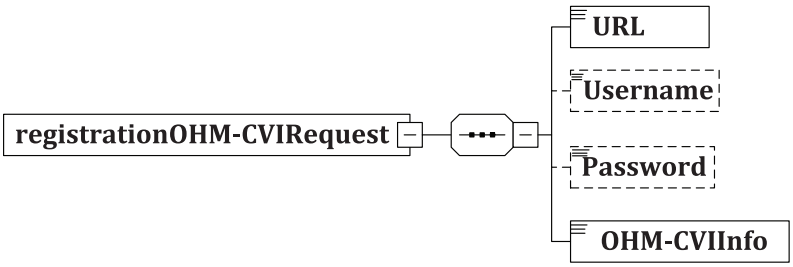

Figure 3 — registrationOHM-CVI request

Table 1 — registrationOHM-CVI request parameters

Name	Type	Description	Use
URL	xs:string	Address of the registration centre	Required
Username	xs:string	User name of registration request information	Optional
Password	xs:string	Password of registration request information	Optional
OHM-CVIInfo	OHM-CVIInfo	Registered OHM-CVI information (see 5.1)	Required

4. Response: Registration successful returns the registration code, and registration failed returns 0. Response result is shown in Figure 4 and details in Table 2.

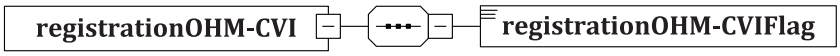

Figure 4 — registrationOHM-CVI response

Table 2 — registrationOHM-CVI response result

Name	Type	Description	Use
registrationOHM-CVIFlag	xs:string	Registration successful returns the registration code, and registration fails returns 0.	Required

5. Exception: Return an exception report message, as specified in Clause 8.

6. Example: The registration information is described in 5.1.

4.1.4.3 OHM-CVI query interface

The OHM-CVI query interface shall be as follows.

1. Name: getOHM-CVI.

2. Function: Query attributes, instrument and parameter information of OHM-CVI through the registration centre.

3. Request parameter: The request parameters are shown in Figure 5, which include URL, UserName, Password, and OHM-CVI name, where username and password are optional. More details of request parameters are shown in Table 3.