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# Ocean Data Standards

## Volume 2

### Recommendation to Adopt ISO 8601:2004 as the Standard for the Representation of Date and Time in Oceanographic Data Exchange

**UNESCO**



**OCEAN DATA  
STANDARDS**



# **Ocean Data Standards**

## **Volume 2**

### **Recommendation to Adopt ISO 8601:2004 as the Standard for the Representation of Date and Time in Oceanographic Data Exchange**

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## 1. BACKGROUND

The value of standards for the management and exchange of data has always been acknowledged. In the oceanography and marine meteorology domain, there have been many efforts to develop common standards and data frameworks for processing data and information but these have never been widely adopted by the community.

IODE (International Oceanographic Data and Information Exchange) and JCOMM (Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology) recognized that, although there were mechanisms to facilitate coordinated ocean data exchange, these had not resulted in the degree of agreement on a wide range of matters that were needed in order to allow the easy exchange and interoperability of collected data. In 2008, the joint IODE/JCOMM Forum on Oceanographic Data Management and Exchange Standards established the Ocean Data Standards Pilot Project (*Intergovernmental Oceanographic Data and Information Exchange. 2010*).

One of the objectives of this Project is to initiate discussions on a limited set of topics for which it is felt that broad agreement is possible and to achieve broad agreement and commitment to adopt key standards related to ocean data management and exchange to facilitate exchange between data centres and contributing programmes. A second objective is to establish an internationally recognized process for submitting proposed standards and their acceptance by the ocean community.

The recommended standards that are produced by this process are intended primarily for the use of the oceanographic and marine meteorological community. After recommendation, their use will be widely encouraged within IOC and WMO.

ISO 8601 was the standard recommended for the representation of date and time at the IODE/JCOMM Forum on Oceanographic Data Management and Exchange Standards. The recommendation has been evaluated and approved in accordance with the IODE/JCOMM Standards Process.

## 2. DATE AND TIME FOR DATA EXCHANGE

The representation of date and time is an important element for the management and exchange of oceanographic data. A standardized, unambiguous way of representing date and time is essential to ensure exchanged data is correctly interpreted. A standard notation helps to avoid confusion in international data exchange caused by different national formats.

## 3. INTERNATIONAL STANDARD ISO 8601:2004

ISO 8601:2004 *Data elements and interchange formats — Information interchange — Representation of dates and times* is an international standard covering the exchange of date and time-related data and is published by the International Organization for Standardization (*International Organization for Standardization. 2004*). The purpose of this standard is to provide an unambiguous and well-defined method of representing dates and times, so as to avoid misinterpretation of numeric representations of dates and times,

particularly when data is transferred between countries with different conventions for writing numeric dates and times.

The ISO 8601 standard is used to represent dates in the Gregorian calendar, times in the 24-hour timekeeping system, time intervals and recurring time intervals. It includes (*International Organization for Standardization. 2010*):

- calendar dates expressed in terms of calendar year, calendar month and calendar day of the month;
- ordinal dates expressed in terms of calendar year and calendar day of the year;
- week dates expressed in terms of calendar year, calendar week number and calendar day of the week;
- local time based upon the 24-hour timekeeping system;
- Coordinated Universal Time of day;
- local time and the difference from Coordinated Universal Time;
- combination of date and time of day;
- time intervals;
- recurring time intervals.

The ISO 8601 standard uses the Gregorian calendar, and fixes a reference calendar date to the Gregorian calendar of 1875-05-20 as the date the *Convention du Mètre*. However, ISO calendar dates before the Convention are still compatible with the Gregorian calendar all the way back to the official introduction of the Gregorian calendar on 1582-10-15. Earlier dates, in the proleptic Gregorian calendar, may be used by mutual agreement of the partners exchanging information (*Wikipedia contributors, 2010*). The International Standard ISO 19108 (*Geographic information — Temporal schema*) can be used to define other calendars or calendar eras.

## 4. DATE AND TIME REPRESENTATION

The International standard states that date and time can be represented in one of two formats: (i) a basic format that has a minimal number of characters and (ii) an extended format that adds separator characters to enhance human readability. The separators used are the hyphen [-] for a date and the colon [:] for a time designation. Separators can be omitted in internal data formats or to describe file names, for example, a file name that corresponds to a date and time could be referred to as MOD021KM.20100516.0930.nc

### 4.1 Date

The basic date notation is

**YYYYMMDD**

where YYYY is the year, MM is the month of the year between 01 (January) and 12 (December), and DD is the day of the month between 01 and 31. For example, the fourth day of February in the year 2005 is written in the basic notation as

**20050204**



Apart from the basic date format, ISO 8601 also specifies an extended date format where a hyphen [-] is used to separate the elements “year”, “month’ and “day”, for example as in

**2005-02-04**

If only the month and year or only the year is of interest, this is represented as

**2005-02 or 2005**

A week date and an ordinal date can also be represented using the ISO 8601 standard.

## 4.2 Time

The ISO 8601 standard is based on the 24-hour timekeeping system where:

- hour is represented by two digits from [00] to [24]. The representation of the hour by [24] is only allowed to indicate the end of a calendar day.
- minute is represented by two digits from [00] to [59]
- second is represented by two digits from [00] to [60]. The representation of second by [60] is used to indicate a positive leap second or an instance within that second

The basic notation for the time of day is

**hhmmss**

where hh is the number of complete hours that have passed since midnight, mm is the number of complete minutes that have passed since the start of the hour, and ss is the number of complete seconds since the start of the minute. For example, the time 27 minutes and 46 seconds past 15 hours is represented as

**152746**

The extended time format includes a colon [:] to separate the elements “hour”, “minute’ and “second”, for example

**15:27:46**

The precision can be reduced by omitting the seconds or both the seconds and minutes as in

**1527 or 15**

It is also possible to add a decimal fraction of hour, minute or second. If a decimal fraction is included then the lower order time element is omitted. The International Standard specifies the decimal sign can be either a comma [,] or full stop [.]. However, as CSV (comma-separated values) is used as a common data exchange format, **it is recommended to use the full stop sign separator**, for example

**152746.5 or 1527.8**

To represent time expressed as Universal Time Coordinated (UTC) the capital letter **Z** is appended to the time. **It is recommended that all exchange of oceanographic and marine meteorological data and metadata use only UTC** as in

**152746Z or 1527Z**

### 4.3 Combined Date and Time

Date and time represents a specified time of a specified day. The basic notation for combined date and time is

**YYYYMMDDThhmmss**

where the capital letter **T** is used to separate the date and time components. For example 27 minutes and 46 seconds past 15 hours on the fourth day of February in the year 2005 is written in basic notation as

**20050204T152746**

Combined date and time can also be used to represent UTC, for example

**20050204T152746Z**

Combined date and time representations are also used in conjunction with time intervals.

### 4.4 Time Interval

A time interval is the intervening time between two time points. The ISO 8601 standard states that a time interval can be expressed in one of the following ways:

- by a start and an end;
- by a duration and context information;
- by a start and a duration;
- by a duration and an end.

A solidus or forward slash [/] is used to separate the two time interval components and the designator [P] precedes an expression of time duration.

Duration is a component of time intervals and defines the amount of intervening time in a time interval. Duration can be represented by a combination of components with designators. The number of years is followed by the designator [Y], the number of months by [M], the number of weeks by [W], and the number of days by [D]. The part including time components is preceded by the designator [T]; the number of hours is followed by [H], the number of minutes by [M] and the number of seconds by [S].

A time interval using a start date of 27 minutes and 46 seconds past 15 hours on the fourth day of February in the year 2005 and an end date of 30 minutes past 9 hours on the 25<sup>th</sup> day of March 2005 local time is written in basic notation as

**20050204T152746/20050325T0930**

A time interval can also be abbreviated, for example, a time interval within the 12<sup>th</sup> day of May 2009 from 15 minutes past 14 hours to 16 hours is represented as

**20090512T1415/1600**

A time interval from the 12<sup>th</sup> day of May to the 15<sup>th</sup> day of May 2009 is represented as

**20090512/15**

Further examples of date and time representations are listed in [Annex I](#).

## 5. DEFINITIONS

The following terms are defined by the International Electrotechnical Commission (IEC) in the International Electrotechnical Vocabulary IEC 60050 (*International Electrotechnical Commission. 2010*).

### *time interval*

part of the time axis limited by two instants

### *duration*

non-negative quantity attributed to a time interval, the value of which is equal to the difference between the time points of the final instant and the initial instant of the time interval, when the time points are quantitative marks

### *date*

time point representing a calendar day on a time scale consisting of an origin and a succession of calendar days.

### *calendar date*

date representing a particular calendar day by its calendar year, its calendar month and its ordinal number within its calendar month

### *ordinal date*

date representing a particular calendar day by its calendar year and its ordinal number within its calendar year

### *week date*

date representing a particular calendar day by the calendar year to which its calendar week belongs, the ordinal number of its calendar week within that calendar year and its ordinal number within its calendar week

### *Coordinated Universal Time - UTC*

time scale which forms the basis of a coordinated radio dissemination of standard frequencies and time signals; it corresponds exactly in rate with international atomic time, but differs from it by an integral number of seconds

### *local time*

locally applicable time of day such as standard time of day, or a non-UTC based time of day

### *calendar day*

time interval starting at midnight and ending at the next midnight, the latter being also the starting instant of the next calendar day

## 6. SCOPE OF THIS RECOMMENDATION

This recommendation seeks to standardize the representation of date and time for the exchange of oceanographic and marine meteorological data and metadata. The use of the ISO 8601:2004 can facilitate this standardization and was recommended by the IODE/JCOMM Forum on Oceanographic Data Management and Exchange Standards. Integrating the ISO 8601:2004 standard into oceanographic data and associated items of metadata will facilitate interoperability and comparability among data systems and domains. It is intended for all local, national, and international bodies, programs and projects that exchange oceanographic and marine meteorological data. It applies to all instances where a date and time needs to be identified within oceanographic and meteorological data or accompanying metadata. The main benefit for the oceanographic and marine meteorology communities in using ISO 8601:2004 is to standardize the representation of date and time across the IOC and JCOMM communities by implementing a widely used and internationally accepted standard.

All National Oceanographic Data Centres (NODC) are encouraged to adopt this recommendation within existing oceanographic data collection and management projects. Although it is not a requirement that the standard be used to represent date and time in internal databases, many NODCs have already implemented the ISO standard to describe their data while other NODCs have agreed to adopt and integrate the standard in their databases and products. Data collection projects are also encouraged to adopt this standard. If an ongoing project has difficulties to implement the standard, depending on the stage of project development, the National Oceanographic Data Centres with responsibility for long-term management of the data may be able to provide assistance.

The main benefit for the oceanographic community in using the ISO 8601 standards include

- date and time values are unambiguous;
- easily readable and writable by systems;
- easily comparable and sortable;
- language independent.

## 7. RECOMMENDATION

IODE and JCOMM recommend the use of the International Standard ISO 8601:2004 *Data elements and interchange formats — Information interchange — Representation of dates and time*) for the representation of date and time for the exchange of oceanographic and marine meteorological data and metadata.

## 8. REFERENCES

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ANNEX I

**Examples of date and time representations**

**A1. DATE**

**Calendar date:** 26 May 2010

<b>Basic format</b>	<b>Extended format</b>
20100526	2010-05-26

**Calendar month:** May 2010

<b>Basic format</b>	<b>Extended format</b>
2010-05	not applicable

**Calendar year:** 2010

<b>Basic format</b>	<b>Extended format</b>
2010	not applicable

**A2. TIME OF DAY**

**Local time:** 27 minutes and 46 seconds past 15 hours

<b>Basic format</b>	<b>Extended format</b>	
152746	15:27:46	
1527	15:27	(reduced to hour and minute)
15	not applicable	(reduced to hour)

**Local time with decimal fractions:** 27 minutes and 46 and a half seconds past 15 hours

<b>Basic format</b>	<b>Extended format</b>
152746.5	15:27:46.5

**UTC time:** 20 minutes and 30 seconds past 23 hours

<b>Basic format</b>	<b>Extended format</b>	
232030Z	23:20:30Z	
2320Z	23:20Z	(reduced to hour and minute)
23Z	not applicable	(reduced to hour)

**Local time and difference from UTC:**

27 minutes and 46 seconds past 15 hours locally in Sydney (10 hours ahead of UTC)

<b>Basic format</b>	<b>Extended format</b>	
152746+1000	15:27:46+10:00	
152746+10	15:27:46+10	(time difference expressed in hours only)

27 minutes and 46 seconds past 15 hours locally in Ottawa (5 hours behind UTC)

<b>Basic format</b>	<b>Extended format</b>	
152746-0500	15:27:46-05:00	
152746-05	15:27:46-05	(time difference expressed in hours only)

27 minutes and 46 seconds past 15 hours locally in Mumbai (5½ hours ahead of UTC)

<b>Basic format</b>	<b>Extended format</b>
152746+0530	15:27:46+05:30

**Midnight**

<b>Basic format</b>	<b>Extended format</b>
---------------------	------------------------

000000	00:00:00	beginning of a calendar day
240000	24:00:00	end of a calendar day

### **A3. DATE AND TIME OF DAY**

#### **Combination of calendar date and local time**

<b>Basic format</b>	<b>Extended format</b>
20100526T152746	2010-05-26T15:27:46

#### **Combination of week date and local time**

<b>Basic format</b>	<b>Extended format</b>
2010W213T152746	2010-W21-3T15:27:46

### **A4. TIME INTERVAL**

#### **Defined by start and end:**

A time interval starting at 20 minutes and 50 seconds past 23 hours on 12 April 1995 and ending at 30 minutes past 10 hours on 25 June 1995

<b>Basic format</b>	<b>Extended format</b>
19950412T232050/19950625T103000	1995-04-12T23:20:50/1995-06-25T10:30:00

A time interval starting on 12 April 1995 and ending on 25 June 1995

<b>Basic format</b>	<b>Extended format</b>
19950412/0625	1995-04-12/06-25

A time interval of 2 years, 10 months, 15 days, 10 hours, 20 minutes, 30 seconds

<b>Basic format</b>	<b>Extended format</b>
P2Y10M15DT10H20M30S	not applicable
P00021015T102030	P0002-10-15T10:20:30

A time interval of seventy-two hours

<b>Basic format</b>	<b>Extended format</b>
PT72H	not applicable



## ANNEX II

### LIST OF ACRONYMS

IOC	Intergovernmental Oceanographic Commission of UNESCO
IODE	International Oceanographic Data and Information Exchange
ISO	International Organization for Standardization
JCOMM	Joint Commission for Oceanography and Marine Meteorology
NODC	National Oceanographic Data Centre (of IODE)
ODS	Ocean Data Standards Pilot Project
UTC	Coordinated Universal Time
WMO	World Meteorological Organization



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