# Introduction to Marine Data Source Analysis and Sharing

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**Abstract.** You should leave 8 mm of space above the abstract and 10 mm after the abstract. The heading Abstract should be typed in bold 9-point Times. The body of the abstract should be typed in normal 9-point Arial in a single paragraph, immediately following the heading. The text should be set to 1 line spacing. The abstract should be centred across the page, indented 17 mm from the left and right page margins and justified. It should not normally exceed 200 words.

## 1. Introduction

The development of marine science has roughly gone through three stages: the first is the theoretical traction stage due to the lack of observational data, the scientific research at this stage mainly relies on the establishment of scientific theories to explain ocean phenomena. The second is the observational traction stage, with vigorous development of different observation means and instruments and equipment, human footprints have advanced from the offshore to the deep sea, and established a three-dimensional observation network covering the world's oceans. The third is the data traction stage. With the continuous enrichment of observational technologies, data sources are becoming more extensive and diverse, and the amount of data has increased to the PB level [1]. It provides a strong foundation for scientific research, social economy and national security in the field.

The ocean data described in this paper [2]mainly refers to the data obtained from various types of observations and simulations conducted in the marine natural environment, including the dynamic elements of the background field of the ocean environment and the ecological elements of the ocean environment.

## 2. Ocean Data Sources

There are a wide range of marine data sources. According to the means and methods of production, this paper summarizes the marine data sources into on-site observation data, satellite telemetry data and reanalysis assimilation data. The relationship between the three is inseparable and complementary to each other. On-site observation mainly refers to shore-based, sea/subsea-based and air-based: shore-based refers to the coastal, island, offshore platform and other fixed ocean observation platform, the coastal waters of the marine hydro-meteorological environment, marine ecological environment for observation and monitoring, to obtain a long time series of marine information; sea/subsea base refers to the most basic mobile observation platform, such as marine research vessels, to obtain marine hydrometeorology, marine biochemistry, seafloor topography and geomorphology, seafloor sediments, marine geophysical fields and other elements, which are in the dominant position in marine data sources; space-based in this species refers to unpowered aerostats flying in the stratosphere, including zero-pressure high-altitude balloons, large overpressure balloons, small overpressure balloons, infrared hot air balloons, etc., generally used to measure the physical and chemical properties of the atmosphere above the near-surface layer, and high-altitude balloons are mainly used in oceanographic surveys to observe meteorological elements. Satellite telemetry data refers to all kinds of marine and atmospheric remote sensing products reflected by altimeters, radiometers, and scatterometers carried by marine satellites and meteorological satellites, which have the advantages of wide coverage, fast speed, high efficiency, and not limited by national boundaries and geography compared with shore-based, sea/subsea-based and air-based observation means. In addition, the reanalysis data based on the dynamic ocean-atmosphere model and assimilation technology effectively make up for the uneven spatial and temporal distribution of the data, and are irreplaceable fundamental information for gaining insight into the ocean-atmosphere motion at multiple spatial and temporal scales and exploring the mechanisms of sea-air interaction.

### 2.1 In-situ observation data

#### *2.1.1 Special domestic marine survey,*

The first-hand data obtained from the survey is the most direct and objective reflection of various marine phenomena and distribution patterns, and is the basic resource for conducting various types of marine scientific research and applications. Since China independently launched marine survey in 1958, it has acquired a huge

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amount of marine survey data, and successively carried out major national projects, polar expeditions and ocean resource and environment surveys. The results obtained have gained important progress in related fields and expanded the national influence. China's marine scientific investigation has undergone a gradual metamorphosis from none to have, the region from offshore to ocean, the ship from backward to advanced, equipment from reliance on imports to independent development, investigation and research personnel from less to more, the investigation environment from difficult to superior.

#### *2.1.2 Domestic marine observation/monitoring business.*

China's modern independent operational marine observation began in the early 20th century. In 1958, 119 marine hydrometeorological observation stations were set up along the coast of the country. Then, the ice survey began in the 1960s, and the voluntary ship observation began in the 1970s. The buoy observation began in the early 1980s. As of 1997, there were 524 various coastal observation stations in China, and 248 marine pollution monitoring stations nationwide [3]. In 2002, with the construction of China's marine environment monitoring system, the operational observation system was further developed, and the collection frequency and transmission time frame of observation data reached the minute level. After decades of construction and development, China's ocean observation/monitoring data sources continue to expand, management systems continue to improve, data types, quantities and timeliness grow rapidly, and data processing capabilities and technologies continue to improve. In terms of ocean observation, a global three-dimensional ocean observation network consisting of ocean stations, buoys, volunteer ships, high-frequency ground wave radar, X-band radar and standard ocean observation sections, combined with offshore oil and gas platforms, satellite/aerial remote sensing and emergency mobile platforms, has been built. In terms of marine monitoring, it has covered marine environmental quality, marine ecological status, marine environmental supervision, public welfare services, marine ecological and environmental risks, marine environmental carrying capacity monitoring and early warning, etc. The monitoring scope covers the waters under China's jurisdiction and the four Fukushima nuclear radiation monitoring areas in the western Pacific. In terms of seafloor observation, the series of ocean observation instruments and land are connected using submarine optical cable, which realizes real-time data return of ocean observation instruments and realizes all-weather, multi-parameter, long-term, real-time and continuous observation. It is a new observation platform for exploring marine scientific research and the current development needs of marine science, marine ecological research, national security analysis and natural disaster prevention.

#### *2.1.3 The International Ocean Observation Cooperation Program,*

The Program started in the 1960s, is carried out about every 10 years. The International Geophysical Year from 1956 to 1959 was the first large - scale international joint operation in the history of ocean observation. The Decade of International Ocean Expeditions from 1971 to 1980, went through a medium-sized plan from 1980 to 1985, and developed into a global change from [4]. Since then, countries and organizations still carry out ocean observation plans on a global scale through cooperation and other means such as Argo, WOD, DBCP, ICOADS and other international organizations/plans. It has realized real-time update and release of observation data and information products such as ocean temperature and salinity, ocean currents, meteorology, geology and topography for global users.

**Table 1.** Major marine international programmes

| No. | Plan Name | Country or Organization | Time | China's Contribution |
|---|---|---|---|---|
| 1 | *WOCE* | National Oceanographic Data Center | 1990~2002 | A large number of marine survey data obtained from multiple voyages such as the multidisciplinary comprehensive survey of the Western Pacific, the Sino-Japanese Kuroshio cooperative survey, and the Southern Ocean scientific survey were exchanged as WOCE data. |
| 2 | ARGO | CORIOLIS Operational Oceanography(USGODA) | 1995 to present | China's Argo Ocean Observation Project has built the basic platform of China's Argo Ocean Observation Network for the first time in the northwestern Pacific Ocean adjacent to my country, creating a long-term, high-resolution and large-scale real-time monitoring of temperature and salinity in the water depth of 0-2000 meters in my country. Monitor business. |
| 3 | TOGA-COARE | World Climate Research Program (WCRP) | 1985 to present | Eight TOGA expeditions were conducted between 1985 and 1990. Three expeditions were conducted between 1992 and 1993, contributing a large number of observations to the entire program. |
| 4 | JOGFS | JGOFS International Program Office | 1990~2000 | From 1991 to 1995, the key project voyages of the "East China Sea Shelf Edge Ocean Flux Research" were carried out . From then to 1999, more than 80 voyages were carried out in the Taiwan Strait, East China Sea, West Philippine Sea and other waters, all of which were included in the international JGOFS. The plan has effectively promoted the study of ocean fluxes at the edge of the international shelf. |
| 5 | GEOTRACES | GEOTRACES International Data Assembly Centre(GDAC) | 2010~present | China's first GEOTRACES cross-sectional survey voyage was led by Xiamen University from April to June 2019, and the mission was successfully completed by the Xiamen University "Jiageng" scientific research ship [4], demonstrating the comprehensive strength of China's marine scientific research. |
| 6 | ETOPO 5 | National Geophysical Data Center | - | The horizontal resolution of the global grid is 5′, and the horizontal resolution can reach 30″ in 48 areas near the United States. The product information includes global topographic and bathymetric data, digitized land shore boundaries and gridded gravity anomaly fields. |
| 7 | GEBCO | IHO& IOC | - | Currently, two datasets are available for download and sharing, namely the 30″ GEBCO_08 Grid dataset and the 1′ GEBCO One Minute Grid dataset. |

### 2.2 Satellite remote sensing data

The United States successfully launched the first meteorological satellite in 1960 [5], and launched the first ocean satellite again in 1978. Subsequently, active remote sensing technology corresponding fast algorithms and inversion methods have formed a situation of rapid development, and remote sensing ocean and atmospheric science application models are becoming increasingly mature. Based on the development of the aerospace

industry, the quality of satellite remote sensing data has been greatly improved. This chapter mainly introduces several types of commonly used satellite data.

### *2.2.1 Altimeter data are usually used to measure the sea surface height, effective wave height, sea surface topography and other element data, and then analyze the ocean dynamic process and mesoscale ocean phenomena [6].*

In 1991, ESA European Space Agency launched the ERS-1 satellite. The radar altimeter remote sensor was installed on the satellite to provide users with elements including the geoid, ocean gravity field, polar sea ice area, etc. The measurement accuracy of the altimeter was 3cm. In 1992, NASA and the French National Center for Space Research jointly launched the TOPEX/Poseidon satellite, which was equipped with an active radar altimeter to detect sea level. The resolution can reach 2.2km, and the standard deviation is between ±14cm [7]. Then in 2001, NASA and the French National Space Research Center jointly launched Jason-1 with an accuracy of 3.0 cm, and other indicators were consistent with the T/P satellite. At the end of 2001, EN-VISAT-1 (Environmental satellite) satellite was launched, equipped with a 13.5GHz/Ku-band radar altimeter, and its horizontal resolution under calm sea conditions was greatly improved compared with T/P satellites and Jason-1 satellites, Up to 1.7km. Countries such as Europe and the United States have successively launched a series of altimeter satellites, including ENVISAT (2002~2012), Jason-2 (2008-present), Jason-3 (2016-present), Saral/AltiKa (2013-present), Sentinel-3A (2016 to present) [8]et al. In 2011, my country launched the HY-2A, which is equipped with a dual-frequency radar altimeter, and uses a pulse-limited working method to measure sea surface height, effective wave height and sea surface wind speed. The altimeter has a high measurement accuracy of 4cm under the condition of an effective wave height of 20m, and a high accuracy of 2cm under the condition of an effective wave height of 4m.

### *2.2.2 Radiometer data is a sensor made according to passive remote sensing theory.*

The commonly used radiometer is the Advangced Very High Resolution Radiometer, which is the main detection instrument of the NOAA series of satellites, with a resolution of 1.1km and an imaging period of 6d in this range. It can be used to invert sea surface temperature, chlorophyll concentration, surface vegetation coverage and the distribution of fog in the atmosphere, etc. The inversion results have high resolution and high reliability. NOAA provides two high-resolution daily average sea surface temperature analysis products, with a spatial resolution of 0.25° × 0.25° and a temporal resolution of 1 day, covering the global ocean and the time range from 1981 to the present. The Moderate Resolution Imaging Spectroradiometer (MODIS) is an important remote sensing instrument developed by NASA. It is a passive imaging spectroradiometer that can acquire images of targets such as land and ocean temperature, primary productivity, land surface coverage, clouds, aerosols, water vapor, and fire. MODIS provides image data products with high radiometric resolution of all surfaces in the world, sunlight reflection and day and night thermal radiation, and the image resolution is between 0.25 and 1 km. Basic objectives of MODIS measurements include: land and ocean surface temperature and ground fire, ocean coloration, water sediment and chlorophyll, global vegetation mapping and change detection, cloud characterization, aerosol concentrations and properties, atmospheric temperature and humidity detection, Snow Cover and Characterization, Ocean Circulation. Commonly used microwave radiometers include TMI, AMSR-E, AMSR-2, MWRI carried by my country's FY-3 satellite, and RAD carried by HY-2 satellite.

### *2.2.3 The scatterometer data is an active microwave radar dedicated to monitoring global sea surface winds. All-weather, high-resolution global ocean near-surface wind data can be obtained using satellite-borne scatterometers.*

In 1991, ESA launched the ESA-1 satellite (European Space Agency Remote Sensing Satellite), which was equipped with a scatterometer with a working frequency of the C-band , which was used to observe the basic elements of ocean dynamics , and to retrieve wind speed and direction . The spatial resolution of wind field data products is 25 km × 25 km. In 1999 , NASA launched Quick-SCAT (quick scatter satellite) satellite, carrying the Ku-band Sea The Winds scatterometer, a satellite wind data product with a spatial resolution of 25 km × 25 km, was discontinued in 2009 due to antenna failure. In 2006, ESA launched the Metop-A meteorological satellite, which carries the ASCAT microwave scatterometer operating in the C-band. The current release of ASCAT wind field products includes ocean wind fields at 25 km and 12.5 km resolution, and nearshore ocean wind field products at 12.5 km resolution, with a spatial coverage of the global ocean. In 2011, China launched the "Ocean No. 2" (HY -2A) satellite, which is China's first marine dynamic environment monitoring satellite. The HSCAT microwave scatterometer on board is mainly used for global sea surface wind vector observation. There are four types of field data products: L1B-level data products, L2A-level data products, L2B-level data products, and L3B-level data products.

### *2.2.4 Synthetic Aperture Radar (SAR) [9]data,*

which is an active microwave remote sensing imaging radar, is usually used to observe the direction spectrum of sea surface wind, internal waves, and ocean waves [10], and can also monitor sea ice movement and marine oil spills. Since the frequency band of synthetic aperture radar is the microwave band, the instrument can work normally even in the dark, with the advantages of all-day, all-weather and penetrate all features imaging[11], its use is very wide.

Spaceborne radar has developed rapidly in the 1990s. So far, SAR has been carried on some launched satellites, such as Seasat SAR, Almaz SAR, JERS-1 SAR, and ERS-1/2 SAR. In 1999, ESA launched the Envisat-1 satellite loaded with ASAR. In 2001, Canada launched Radar Satellite 2 with full polarization measurement capability, and LightSAR launched in 2002 is a practical imaging radar with L-band multi-polarization and interferometry and scanning modes. In 2006, Japan launched the ALOS satellite, and the PALSAR radar sensor carried is a multi-polarization, multi-mode radar system. Provide rich data sources for the development of digital earth .

### 2.3 Reanalysis data

The lack of high-quality, high-resolution, long-term and continuous global observations due to the heterogeneous spatial and temporal distribution of global ocean-atmosphere observations has posed great difficulties and challenges to the in-depth understanding of global ocean-atmosphere changes, cognition of climate evolution patterns and unveiling of phenomenal mechanisms. Based on the ocean-atmosphere dynamic model, scholars use data assimilation technology to assimilate historical observation data into the ocean-atmosphere dynamic model, and obtain a class of product datasets [12]that effectively solve the above problems. This chapter mainly introduces the dynamic data used for the driving field of the ocean-atmosphere model , which is based on the reanalysis data of the observational data.

**Table 2.** Major reanalysis data products in the marine sector

| No. | Data name | Country or Organization | Basic Information |
|---|---|---|---|
| 1 | NCEP/NCAR [13] | NOAA | Carry out quality control and assimilation analysis and processing of global meteorological observation data from 1948 to the present, including ground, ships, sounding balloons, radio soundings, aircraft, and satellites. The monthly average reanalysis data is obtained four times a day, with a spatial resolution of 2.5°×2.5°, covering the period from 1948 to the present, and the coverage area is global. According to the data content, it is divided into isobaric surface data, ground data and flux data. |
| 2 | ICOADS Information | NCDC | Data sources include observation data from ships, fixed-point buoys, drifting buoys and ocean station data. Covering a variety of marine hydrology and meteorological element variables: sea surface temperature, air temperature, air pressure, humidity, meridional wind, zonal wind and cloud cover, etc., the space covers the world. |
| 3 | ECMWF | ECMWF [13] | Provide weather observation data and model forecast products as well as related data for global sea-air model calculation [14]. The data set provided by ECMWF contains a variety of variables, with a grid resolution of 2.5°×2.5°, 144 points in the latitude and 73 points in the meridian, and the data time resolution is four times a day. |
| 4 | SODA [14] | University of Maryland | The assimilation time of SODA 2.2.4 is more than 100 years, the spatial range is 0.25°E~359.75°E, 75.25°S~89.25°N, the horizontal resolution is 0.5°×0.5°, and the vertical direction is divided into 40 unequally spaced layers, From 10m to 250m, the time resolution is monthly average, and the elements include temperature, salinity, zonal flow velocity, meridional flow, sea surface height, zonal wind and meridional wind. |
| 5 | GECCO [16] | UH | Developed on the basis of ECCO products released by MITgcm [14-15]unequally spaced layers, ranging from about 10m to 500m, Product containing 6 variables: temperature, salinity, zonal flow velocity, meridional flow velocity, vertical flow and sea surface height. |
| 6 | HYCOM [14] | U.S. Naval Research Laboratory | Product [17]elements include water temperature, salinity, zonal mobility, meridional mobility, and sea surface height. The time span of the reanalysis data product is 1992~2012, the time resolution is 1 day, the latitude range is 80.48°S~80.48°N, the horizontal resolution is 1/12°, and the vertical direction is 40 layers with unequal distances. |
| 7 | OFES | The Earth Simulator Center, Japan | The average horizontal resolution of the product is about 12km, and the output variables are re-interpolated to a standard grid of 1°×1°. The vertical resolution is 50 layers, and the time resolution is the daily average. |
| 8 | GLORYS [18] | CMEMS | The time span of the product is from 1993 to 2015, and the time resolution is the daily average, including 10 variables, namely water temperature, salinity, and zonal flow velocity. |
| 9 | FIOCOM | First Institute of Oceanography | The horizontal resolution is 0.1°×0.1°, the vertical is divided into 54 layers, the depth range is 1m~5316m, and the time resolution is 1d, including 5 variables: temperature, salinity, meridional current velocity, zonal current velocity and sea surface height. |
| 10 | CRA | China Meteorological Administration | The product has a horizontal resolution of 34km and a time resolution of 6hr. It is divided into 64 layers vertically, and the height range is from the ground to 55km. |

## 3. Ocean big data sharing

The progress of marine science depends on the effective use and full sharing of scientific data. Faced with the huge amount of big data generated every day, countries have invested a lot of manpower and material resources to actively promote the sharing of marine scientific data. This chapter mainly summarizes the information released by the data sharing platform to provide reference for scientific researchers in need.

### 3.1 Domestic marine data sharing

Domestically, China has actively advocated information sharing in marine data sharing work, fully exploited marine information resources, made very important contributions in relevant international cooperation and programs, effectively promoted the development of marine scientific research, and increasingly reflected the status of a great power. The national marine authorities and relevant sea-related ministries have released a large

amount of marine data information for the use of the society through various ways and with the help of national scientific data centers and characteristic sharing platforms.

**Table 3.** Domestic Marine Data Sharing

| No. | Shared Agency | URL | Share Content |
|---|---|---|---|
| 1 | National Marine Data Information Center | http://www.nmdis.org.cn/ | Through the National Oceanographic Data Center, it provides external data sharing services, and the shared information includes marine multidisciplinary measured data, analysis and forecast products, and thematic information. |
| 2 | National Satellite Ocean Application Service | http://osdds.nsoas.org.cn | Three types of satellite data products are shared and released: HY-1A, HY-1B and HY-1C series of marine aqua satellite products, HY-2A, HY-2B and CFOSAT series of marine dynamic environmental satellite products, and high score SAR satellite products. |
| 3 | National Marine Environmental Forecasting Center | http://www.nmefc.cn/ | Provide various marine forecast products, provide real-time analysis product maps of waves and sea temperature in the Northwest Pacific Ocean, and provide special numerical forecast products for the North and South Pole. |
| 4 | Polar Research Institute of China Polar Research Institute of China | http://www.chinare.org.cn/data | The coverage of polar science data resources includes: Antarctic Zhongshan Station Area, Antarctic Great Wall Station Area, Dome A, the highest point of the Antarctic Ice Sheet, Emory Ice Shelf, Grove Mountains, Arctic Ocean Bering Sea, Chukchi Sea (Taiwan), Canada my country's important polar expedition areas such as the sea basin and the Arctic New region |
| 5 | First Institute of Oceanography, MNR | https://www.fio.org.cn/ | The China Ocean Sample Museum is affiliated to the China Ocean Mineral Resources Research and Development Association and is operated by the First Oceanographic Research Institute of the Ministry of Natural Resources, providing deep-sea sample application services. |
| 6 | Second Institute of Oceanography, MNR | https://www.sio.org.cn/ | Operate and maintain the Hangzhou Global Ocean Argo System Field Scientific Observation and Research Station, and provide Argo real-time data, Argo grid data sets and other products through anonymous ftp; Inquire. |
| 7 | Third Institute of Oceanography, MNR | http://www.tio.org.cn/ | The No. 3 Marine Research Institute builds and maintains a marine microbial strain preservation and management center, provides strain inquiry and sharing services, accepts the entrustment of various units and individuals across the country to preserve strains, and charges for strain identification matters. |
| 8 | South China Sea Institute of Oceanology, CAS | http://www.scsio.csdb.cn/ | Provide measurement data of physics, chemistry, biology, geology, geophysics and other disciplines obtained from on-site ocean observations, satellite remote sensing, ocean remote sensing, ocean model simulation and assimilation data, as well as various data products, etc. |
| 9 | The Institute of Oceanology, CAS | http://msdc.qdio.ac.cn/data/ | Released the COMS global ocean science data set, collected the global ocean observation data of WOD and China's independent survey since 1900, including 13 elements such as sea temperature, salinity, pH, dissolved oxygen, $CO_2$ partial pressure; XBT, CTD, Argo, Glider, buoy and other 11 types of instrument data. |
| 10 | Guangzhou Marine Geological Survey (GMGS) | http://www.gmgs.cgs.gov.cn/ | Relying on the geological cloud to carry out data sharing, the sharing includes geological survey business data and geological scientific research data. Geological survey business data includes five categories: basic geology, mineral geology, hydraulic environment geology, physical and chemical remote sensing, and geological drilling. The scientific research data includes geological research projects and field observation stations. The forms of sharing include space vector data, pictures and photos, audio and video, pdf files, software systems, databases, patents, methods, models, etc. |
| 11 | Qingdao Institute of marine geology | http://www.qimg.cgs.gov.cn/ | |

## 3.2 Foreign Ocean Data Sharing

In foreign countries, various international organizations are committed to the sharing of global marine data, formulating corresponding data policies and management methods, and upgrading marine data sharing to development strategies and national policies to provide data support for various marine fields.

**Table 4.** Oceanographic data sharing by foreign countries and international organizations

| No. | Country or Organization | Shared Agency | URL | Share Content |
|---|---|---|---|---|
| 1 | U.S. | NODC | ftp://ftp.nodc.noaa.gov | The WOD observation data include: temperature, salinity, dissolved oxygen, phosphate, nitrate, silicate, chlorophyll, alkalinity, pH, $pCO_2$, etc.; the WOA atlas contains objective analytical fields for the 1° square region of world ocean temperature, salinity, dissolved oxygen, dissolved oxygen satiation, nutrient salinity and statistical products used to generate WOA. |
| 2 | U.S. | NGDC | http://www.ngdc.noaa | Providing interactive access to geophysical, geological, surveying and environmental data and information products, indexed by map. |
| 3 | U.S. | NCEI | https://www.ncei.noaa.gov/ | The shared data includes 16 categories. The data update frequency is related to the data type , and can be divided into real-time update, delayed update and one-time update. For important data, NCEI adopts a delayed public release and sharing method. |
| 4 | Japan | JMA | http://www.j | Publish short-term, one-week and long-term weather |

| No. | Country or Organization | Shared Agency | URL | Share Content |
|---|---|---|---|---|
| | | | odc.go.jp/ | forecasts, as well as typhoon, snowstorm forecasts and advisories. The published data include meteorology, balloon environment and climate, oceanography, earthquakes and other disciplines, and commonly used high-resolution daily average sea surface temperature grid data. |
| 5 | Japan | JODC | http://www.jodc.go.jp/ | Providing global coverage of basic oceanographic elements such as temperature, salinity, ocean currents, tides, tidal currents, geomagnetism, gravity and water depth. |
| 6 | Japan | JAMSTEC | http://www.jamstec.go.jp | Published data include document reports, observation data (Argo, tropical moored buoy array, tropical subsurface moored ADCP database, paleoclimate data, ocean chemistry, etc.), geoscience data (crust structure, seafloor seismic data, etc.), analysis forecasts and models, etc. |
| 7 | South Korea | KMA | http://web.kma.go.kr/eng/index.jsp | Provide geophysical data on the Korean Peninsula and its surrounding areas such as sea, air and earthquakes |
| 8 | South Korea | KODC | www.nifs.go.kr/kodc/ | The released data are obtained by South Korea's independent observations, including data from oceanographic stations around South Korea and cross-sectional observation data. |
| 9 | International Organizations | WDC | http://www.wdc-mare.org/ | Provide professional data such as environmental oceanography, marine geology, and marine biology in the field of global change and earth system research. |
| 10 | International Organizations | ISA | https://www.isa.org.jm/ | Sharing data related to marine mineral resources obtained by various institutions around the world, including mining location map, navigation, side scan, CTD, water depth, electrical method, annual report and other data. The data in this database can be downloaded and authorized for use |
| 11 | International Organizations | IOC | http://ioc-unesco.org/ | Providing ocean science, ocean observations, ocean data and information exchange, and ocean services such as tsunami warnings. |
| 12 | International Organizations | IODE | http://www.iode.org | Publishing links to data nodes, marine environmental data and information resources independently operated and maintained by working groups and countries, including observational data, marine meteorological products, information services, etc. These websites mainly provide data and information through open download or registered download serve. |
| 13 | International Programs | GTSPP | https://www.nodc.noaa.gov/GTSPP/ | The data type of GTSPP is mainly temperature-salt profile data. The data time range is from 1990 to the present. The data is downloaded through the web page and ftp, which is delayed data, and the update frequency is monthly. |
| 14 | International Programs | GOOS | http://www.gsf.de/UNEP/goos.Html | Collecting and analyzing all-weather continuous observation data in various sea areas of the world's oceans, including various data sent by the World Meteorological Monitoring Network, the Global Joint Ocean Service System, the Global Sea Level Observing System, and the Oceanographic Data System of the Drifting Buoy Observation Network. |
| 15 | International Programs | Argo | http://www.jcommops.org/board?t=Argo | Argo data sharing has been released through the following platforms. The acquisition of foreign Argo data is mainly based on traditional FTP download. JCOMM has released JCOMMOPS, which enables interactive search and retrieval of Argo data. |

## 4. Conclusion

This paper introduces a variety of marine data sources, summarizes the data situation of domestic and foreign marine on-site observation/monitoring data, satellite remote sensing data and reanalysis product data, and also elaborates the basic information of major domestic platforms and international common marine data websites from the perspective of data sharing and usage. Due to the wide variety of marine data, the information listed in this paper is only a few commonly used at present. At the same time, due to the limitation of space, many good marine data cannot be listed one by one. It is hoped that this article will serve as a primer to help readers understand marine data from multiple perspectives. On the basis of the information provided in this article, readers will be able to further explore and utilize Internet resources, and give full play to the scientific value of marine data.

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