Digital Ocean:

Comprehensive Marine Information Sharing System based on Virtual Globe and Cloud Computing

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Outline

1. Introduction to NMDIS

2. Background and history of Digital Ocean

3. Achievements of the comprehensive marine information sharing system

4. Key techniques involved in Digital Ocean

Our Mission

Established in 1958
management of national marine data and information resources, and providing guidance and scientific stewardship for the national marine data and information;

providing information and technical support for marine economy, marine management, public service and marine environmental protection, and conduct related research.

Office in December 1966

New look after energy-saving reconstruction in September 2016

Office building in April 1989

National Marine Data and Information Service
(NMDIS)

NATIONAL MARINE INFORMATION CONSTRUCTION

Administrative Office

National Marine Information Resource Management

Logistic Supporting System

Administrative Office

Personnel Division

Finance & Budget Division

Division of S & T Planning and Management

Quality Management Division

Information and Network Design Division

Marine Data Center

Marine Environmental Geographic Center

Division of Marine Policy and Planning

Marine Economic Division

Marine Archives

Marine Forecast and Disaster Mitigation

Sea Area Planning and Management Division

Islands Management Division

Marine Ecological Environmental Division

SOA Key Lab of Marine Environmental Information Technology

SOA Key Lab of China Digital Ocean

Logistic Supporting Service

Printing House

Marine Strategy ,Planning and Policy Research and Development

Monitoring and Assessing National Marine Economic Operation

Ecosystem Based Marine Integrated Management

**Marine Environmental Information Support**

International Cooperation and Communication

NMDIS

Digital Earth

■ The concept of "Digital Earth" was put forth in 1998 (the speech "The Digital Earth: Understanding our planet in the 21st Century" given by AI Gore for the California Science Center in Los Angeles).

■ The 1st International Symposium on Digital Earth was launched in 1999 in Beijing, and adopted "1999 Beijing Declaration on Digital Earth" .

■ The kernel of Digital Earth is, to get access to, process and apply spatial data concerning natural geography and humanity culture, display the true earth and relevant phenomenon combined with its application model in a digital way, and thus solve the global difficulties.
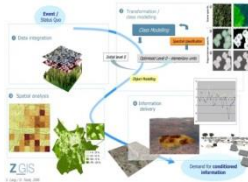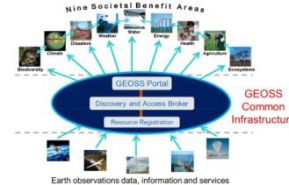

town design   scientific computation   Digital Earth   Disaster visualization   spatial data sharing

Digital Ocean

■ The concept of "Digital Ocean" was proposed by Chinese marine researchers, inspired by the concept of "Digital Earth".

■ Digital Ocean integrates a huge number of marine observation and monitoring data, analytical algorithms, and numerical models together, take advantages of 3S, virtual reality technologies, and establishes a comprehensive virtual marine system.
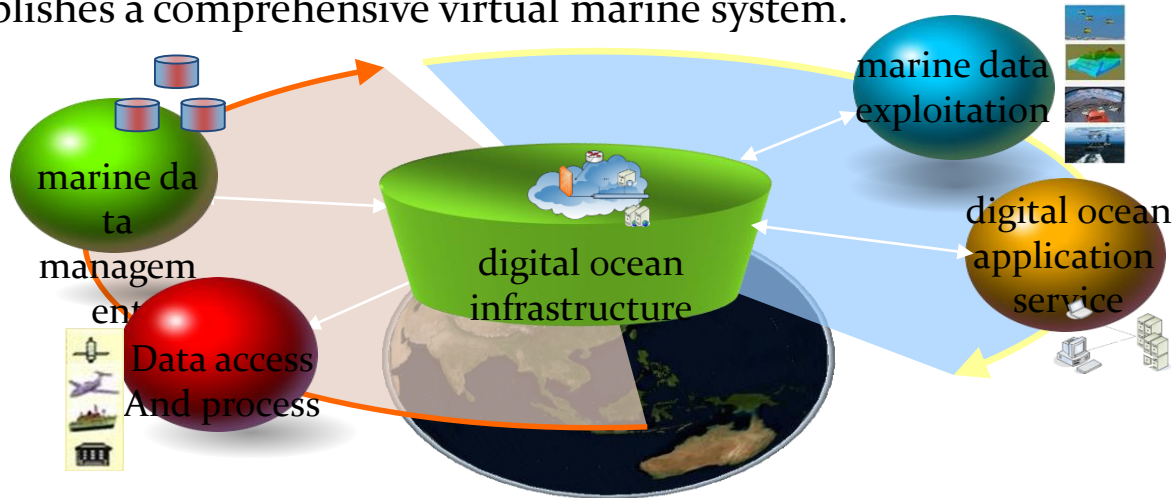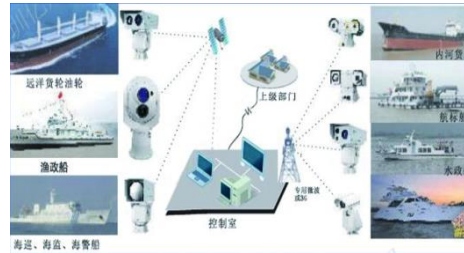
Key Laboratory of Digital Oceanic Science and Technology

■ the laboratory was founded in 2011, and involves a large number of fields.

Efforts are made to

■ **conduct** researches on the basic methods, key techniques and application services in China's marine information development,

■ **provide** technical supports on promoting the development of Digital Ocean.

Research focused on

■ **theoretical exploration** on Digital Ocean

■ marine **data management** and **visualized analysis**

■ **information integration** and **application service**

2011

The Laboratory was officially founded
The laboratory was founded in 2011, which is supported by NMDIS.

2012

Academic Committee

The first meeting of the Key Laboratory of Digital Oceanic Science and Technology's Academic Committee was held

Senior Seminar

The senior seminar on Digital Ocean System Engineering and Key techniques was held in 2012, Tianjin. There are 95 participants taking part in the seminar totally.

2015

Other Academic Conference
➢ The 3rd China Digital Ocean Forum was held in 2012.
➢ 2 Annual Meeting of Digital Ocean Laboratory was held in Tianjin
➢ 2 Intercommunications Meeting of Digital Ocean Operating Divisions was held in 2013 and 2015 individually.
➢ The Workshop of Digital Ocean fundamental Geographic information Platform was held in Beijing in 2015.

Capacity Building Activities

Capacity Building

The Fifth Training Course on Ocean Governance conducted by IOI-China Regional Center for the West Pacific region from August 22 to 18 September 2016, Tianjin, China.

Second International Symposium on Marine Economy: Oceans in National Income Account: Definition, Classification and Methodology, August 25 to 28 October 2016, Tianjin, China.

1st ODINWESTPAC Advisory Group Meeting (Tianjin, China, 27-28 Jan 2016).

ODINWESTPAC

• 12 representatives of 6 member countries: CHINA, INDONESIA, JAPAN, REPUBLIC OF KOREA, and THAILAND, and the IODE and IOC/WESTPAC Secretary.

•ODINWESTPAC training course was conducted during 21-25 April 2014 in Tianjin China and WESTPAC regional node was deployed.

Oceanographic D&I Management and Exchange

Efforts are made to promote data and information sharing & exchange data and information products service marine knowledge service, and improve capacity of WESTPAC members in scientific research, marine environmental protection, disaster reduction, economic development, marine biodiversity conservation, etc.

Digital Earth

ISDE 10 & Locate 17

The meeting was held in Sydney 2017, 3 representatives of NMDIS attend the meeting, and gave 2 speeches on DOAS and ODINWESTPAC, share the achievements of China's marine information development.

Awards

Certificate of Award & Honors

•Ministerial and provincial-level: 1 grand prizes, 6 first prizes, 16 second prizes, 1 third prizes,
•Military Progress in Science and Technology: 1 second prizes, 2 third prizes,
•Geometrics Industry Quality Engineering: 1 prize.

Publications

Academic books, papers, and software copyrights

•The laboratory members published 67 papers,
•Published 3 books,
•Applied for 26 software copyrights.
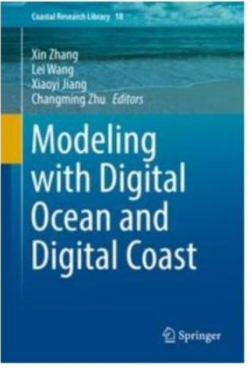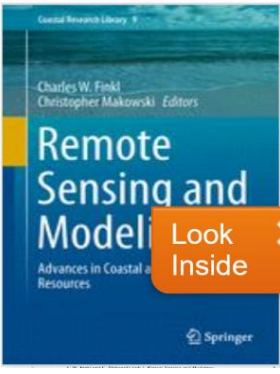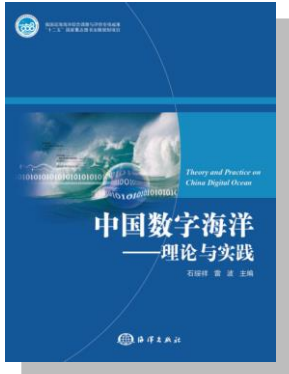
DOAS: Digital Ocean Application Service

■ DOAS is a comprehensive marine information sharing system. The system was developed independently by the Key Laboratory of Digital Oceanic Science and Technology.
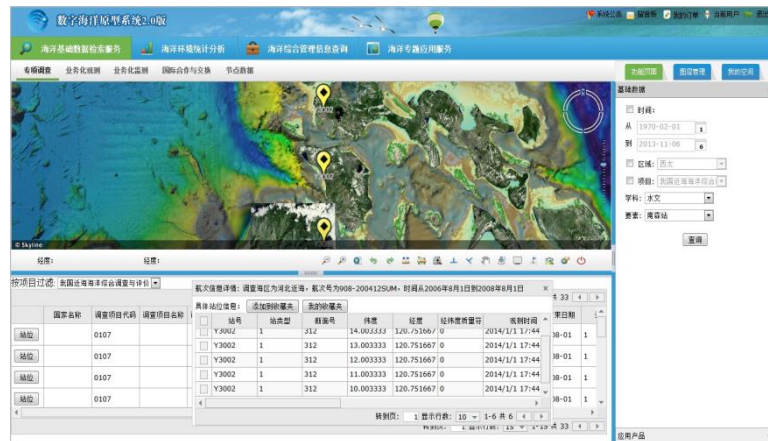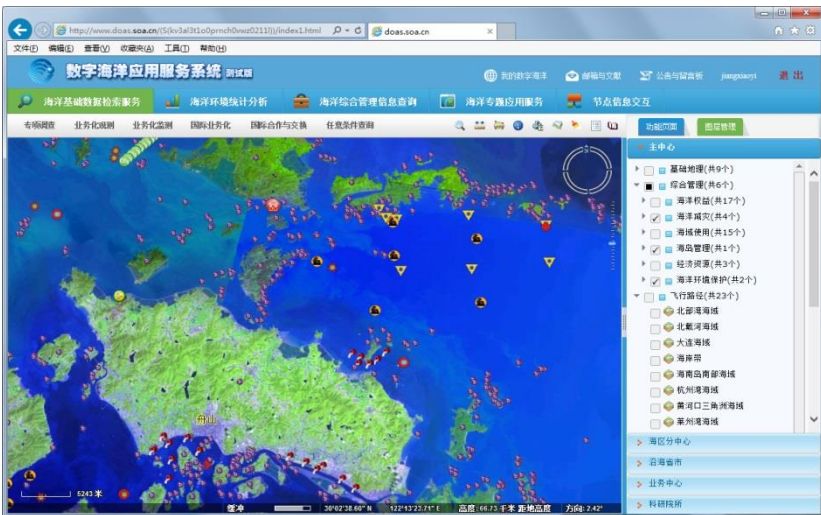
◆ Panoramic space digital presentation (1)

Digital presentation of basic geography, images and terrain, marine administrative data, including the sea floor, the water, sea level, island, costal zone, etc.
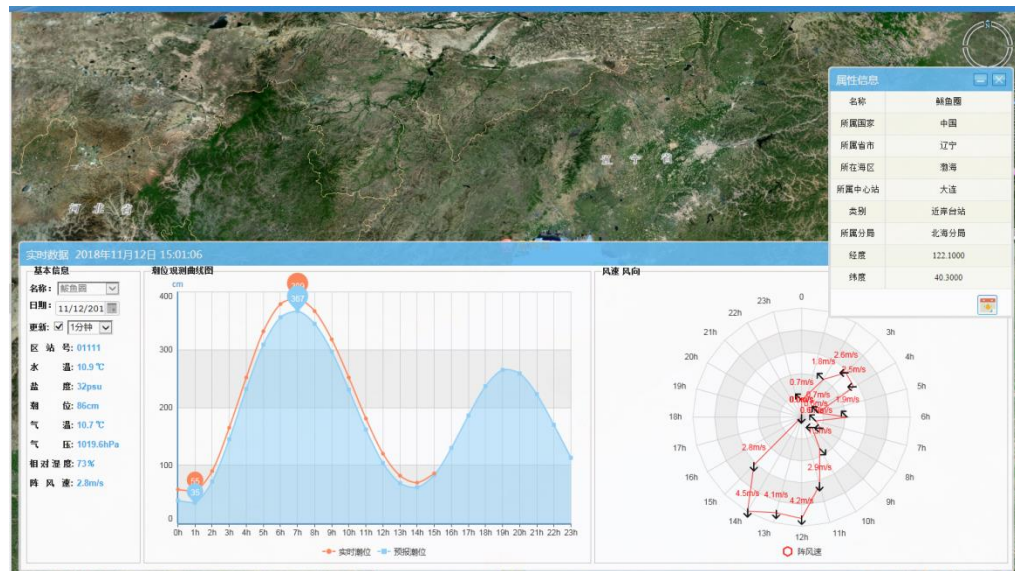
◆ **Panoramic space digital presentation (4)**

Real-time data loading and updating

- What is being observed?---parameters
- How ? ----instrument, frequency
- What had been done before data are
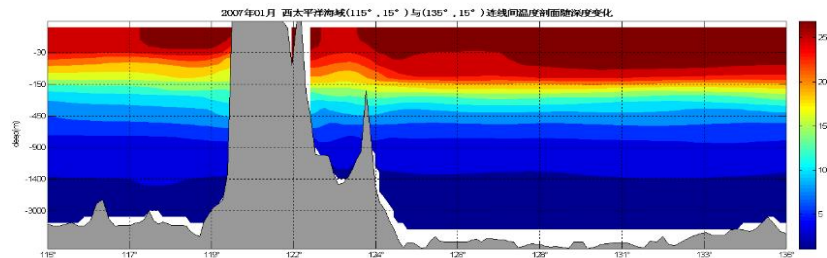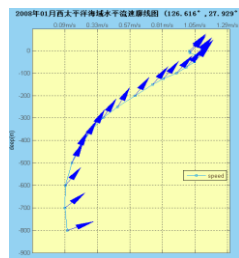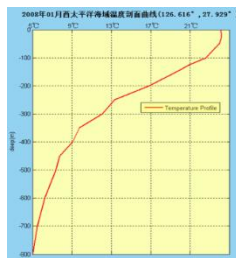 publicly available?—QC? Quality assurance ?
- Who manage the data ?

   ...

Laohutan Marine
Environment
Monitoring Station

◆ Dynamic visualization of marine environmental data (1)

■ DOAS integrates re-analytical products and real-time and forecasting data, presents various marine elements' dynamic changes, including temperature, salinity, density, acoustics, sea level, etc. with diverse demonstrative means. The dynamic presentation helps marine researches to explore marine environment's past circumstances, current situations and its future developing trends.

◆ **Big data organization and quick retrieval**

■ DOAS adopts marine data organizational management and database design architecture .

■ The spatial-temporal index database is used to design the marine environmental spatial-temporal distribution graph.

■ The database architecture has its advantages of extensibility, dynamic migration and convenient use.

◆ **Cloud computing**

■ DOAS Supporting Environment

Integrates various kinds of calculating and storage resources, establishes the supporting environment suitable for the development of marine informatization.


数据
加载　数据
访问　备份

统一动态存储资源管理　监控和调度管理

存储资源池

存储阵列　磁盘

数据服务器

■ Resource virtualization and dispatching

Virtualization enables all resources created dynamically, adjusted flexibly, managed automatically and provided services according to needs, and monitor and dispatch cloud resources in real-time.

■ Digital Ocean Intranet was established, covering 39 focal points, including the major costal provinces and cities.

■ DOAS has been launched to all the focal points and the number of virtual desktop terminal is close to 500.

■ All the marine data sharing in the DOAS system is open to users freely, and the total data volume is approximately 36TB.
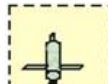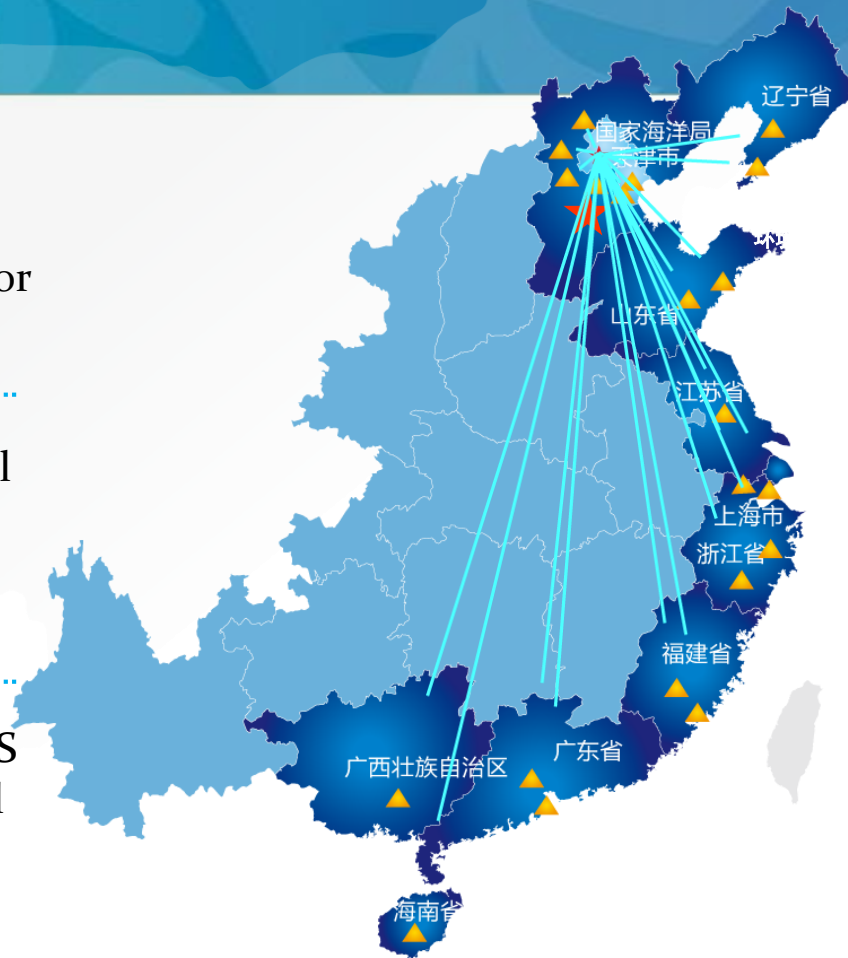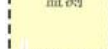
GIS softewares

□ **Commercial GIS softwares**

◆ ESRI ArcGIS

◆ SuperMap

◆ Skyline TerraSuits

◆ EV-Globe

◆ …

□ **Open Source softwares**

◆ QGIS

◆ GeoTools

◆ World Wind

◆ OSG Earth

◆ …

◆ ESRI ArcGIS – working smarter with ArcGIS

- ArcGIS provides contextual tools for mapping and spatial reasoning so you can explore data and share location-based insights.

- ArcGIS creates deeper understanding, allowing you to quickly see where things are happening and how information is connected.

- ArcGIS offers a unique set of capabilities for applying location-based analysis to your business practices.

- Gain greater insights using contextual tools to analyze and visualize your data. Then share these insights and collaborate with others via apps, maps, and reports.

◆ **Skyline**

http://www.skylinesoft.com

- The Skyline Globe software suite sets the standard for 3D desktop and web-based applications, enabling an enterprise to build, edit, navigate, query, and analyze realistic 3D environments, and rapidly and efficiently distribute them to users.

◆ **Skyline**

http://www.skylinesoft.com
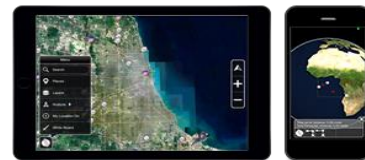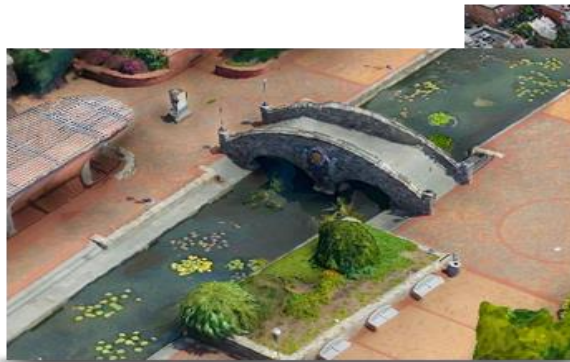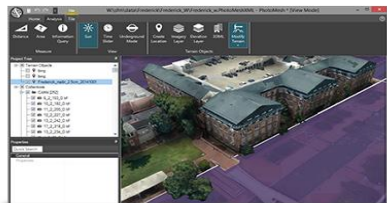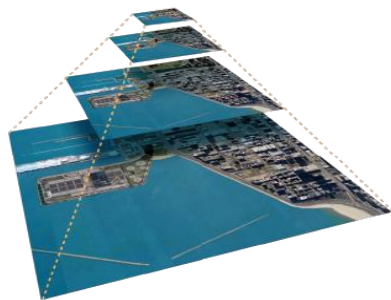
Some advantages:

- Advanced terrain analysis tools provide critical geospatial understanding
- Multi-sensor data fusion and robust data collection tools enable generation of realistic, geographically accurate visualizations
- Create a terrain database on-the-fly using the latest satellite pictures
- Interfaces to GPS Tracking, provide real-time tracking capabilities

Thank You!

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