# Marine Environmental monitoring with GF-1 satellite data

**Bin ZOU,Lijian SHI, Qimao WANG**
**National Satellite Ocean Application Service**

**MNR, CHINA**

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Objective:

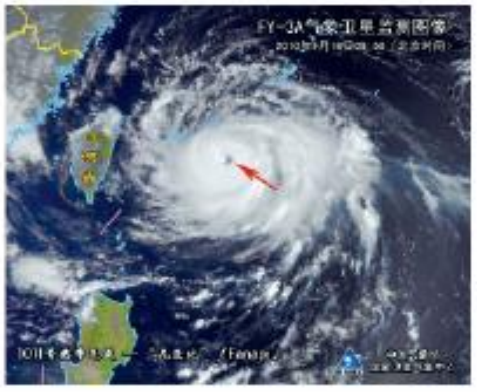
- Gaofen (GF) is a series of Chinese High-Definition Earth Observation Satellite (HDEOS).
- It was launched on Apr. 26, 2013 on a CZ-2D rocket from China's Jiuquan space center.
- Marine disaster monitoring with GF-1 data, give more detailed information.

# Outline

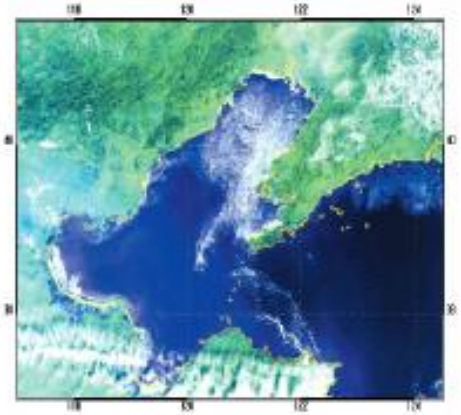
1. Introduction
2. Sensors
3. Marine Application
4. Conclusions
5. Intro to the HY-1C ocean color satellite

# 1. Introduction

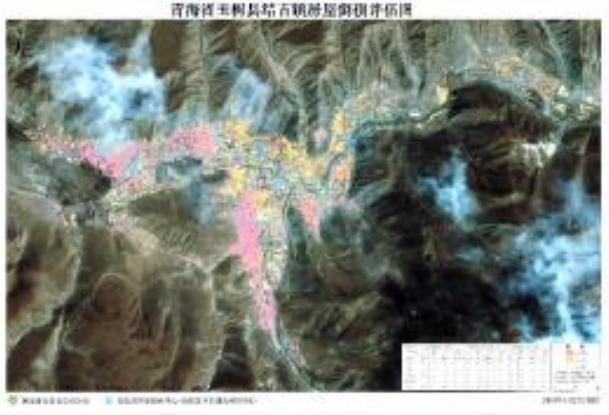
- China has developed Fengyun, Haiyang, Ziyuan and Huanjing satellite series. These satellites has made great contributions in weather forecasting, ocean monitoring, environment and disaster monitoring etc.



Typhoon monitoring image acquired by FY-3A satellite (Sept. 18, 2010)



Sea ice remote sensing image from HY-1B/ COCTS (Feb. 13, 2010)

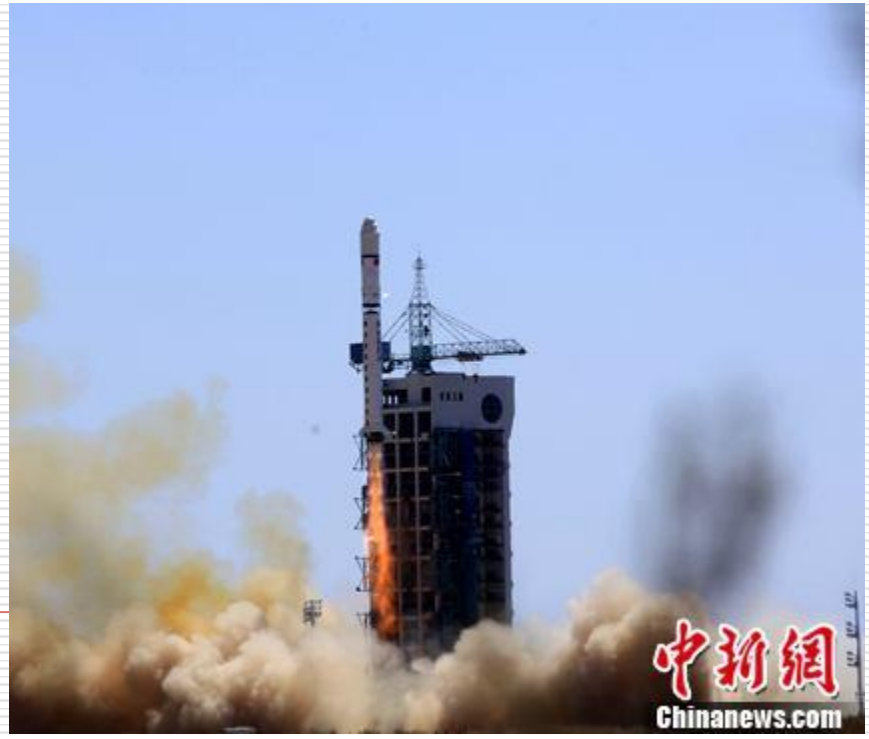


Evaluation image for the damaged and collapsed houses in Gyegu Town, Yushu County, Qinghai Province

# 1. Introduction

- In order to improve the comprehensive capabilities of China's earth observation system, in 2010, the Chinese government approved to implement Chiina Hiigh-resollutiion Earth Observatiion System (CHEOS).

- Gaofen 1(GF-1) was launched on Apr. 26, 2013 on a CZ-2D rocket from China's Jiuquan space center.
- GF-1(02,03,04) 3 successor satellites was launched by CZ-4C on Mar. 31,2018.



# 2. Sensors

- PMS: Panchromatic and Multi-spectral CCD Camera;
- WFV: Wild Field Camera.

| Load | Band No. | Spectral range (μm) | Spatial resolution (m) | Swath width(km) | Side-looking ablilty | Repetition cycle (days) |
|---|---|---|---|---|---|---|
| Panchromatic& Multispectral Camera | 1 | 0.45～0.90 | 2 | 60 (2 Camera Stitching with ) | ±35° | 4 |
| | 2 | 0.45～0.52 | 8 | | | |
| | 3 | 0.52～0.59 | | | | |
| | 4 | 0.63～0.69 | | | | |
| | 5 | 0.77～0.89 | | | | |
| Multispectral Camera | 6 | 0.45～0.52 | 16 | 800 (4 Camera Stitching with) | | 2 |
| | 7 | 0.52～0.59 | | | | |
| | 8 | 0.63～0.69 | | | | |
| | 9 | 0.77～0.89 | | | | |

# 2. Sensors

2m panchromatic/8m multispectral camera fusion image of the Gaofen-1 satellite, Beijing District in China, acquisition time: May 1, 2013

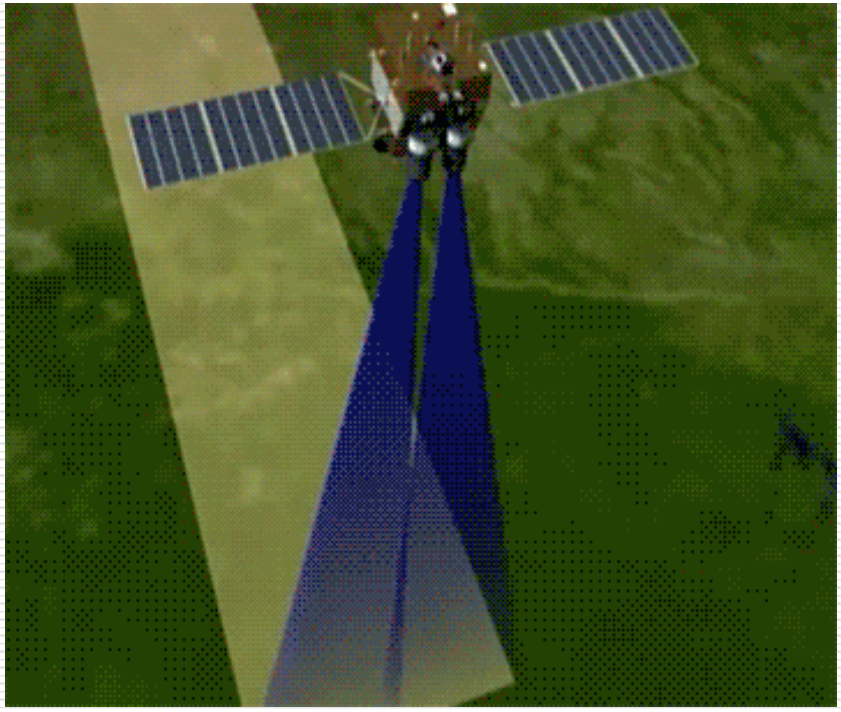
# 2. Sensors

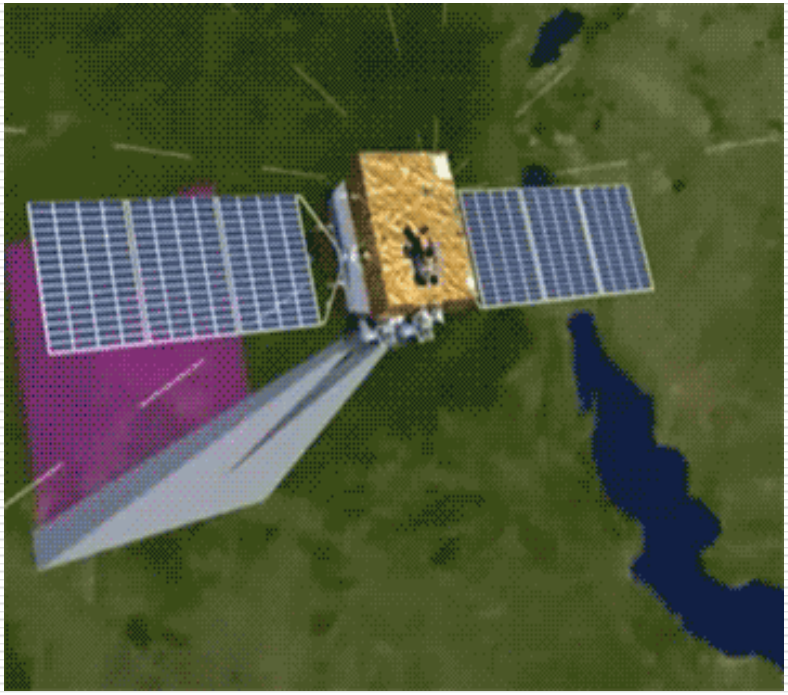
16m multispectral camera image of the Gaofen-1 satellite. Yellow River Delta region in China, acquisition time: May 21, 2013

# 2. Sensors

**Launch of a Long March 4C rocket took place at 03:22 UTC (11:22 Beijing time) on Saturday, carrying the Gaofen-1 02, 03 and 04 satellites into a Sun-synchronous orbit at an altitude of around 645 kilometres. The satellites carry with them 2-meter resolution CCD cameras, 8m resolution multi-spectrum imagers.**

# 15 days coverage
# 2 days revisit





# 3. Marine Application

- Oil spill detection
- Sea ice classification
- Red tide detection
- Green tide detection

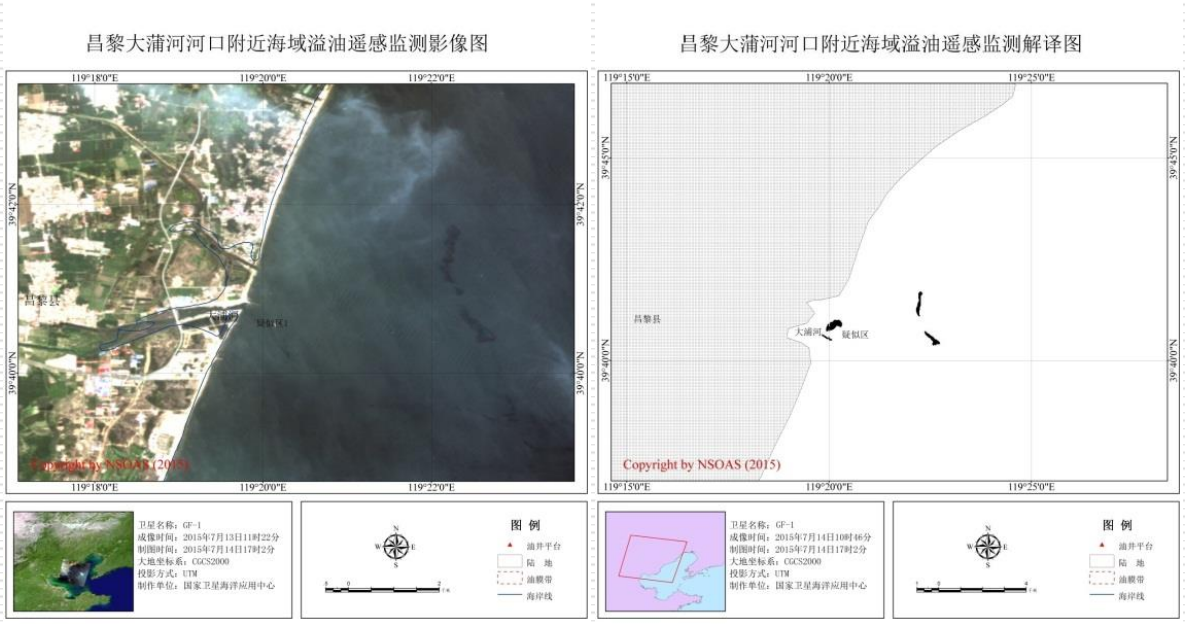
# Oil spill detection

**In recent years, With growing offshore oil exploration, transportation, various types of oil spill accidents occur frequently.**

- **Australia oil platform leaked in 2009**
- **Platform exploded in the Gulf of Mexico in 2010**
- **Oil spill of Penglai 19-3 platform in 2011**

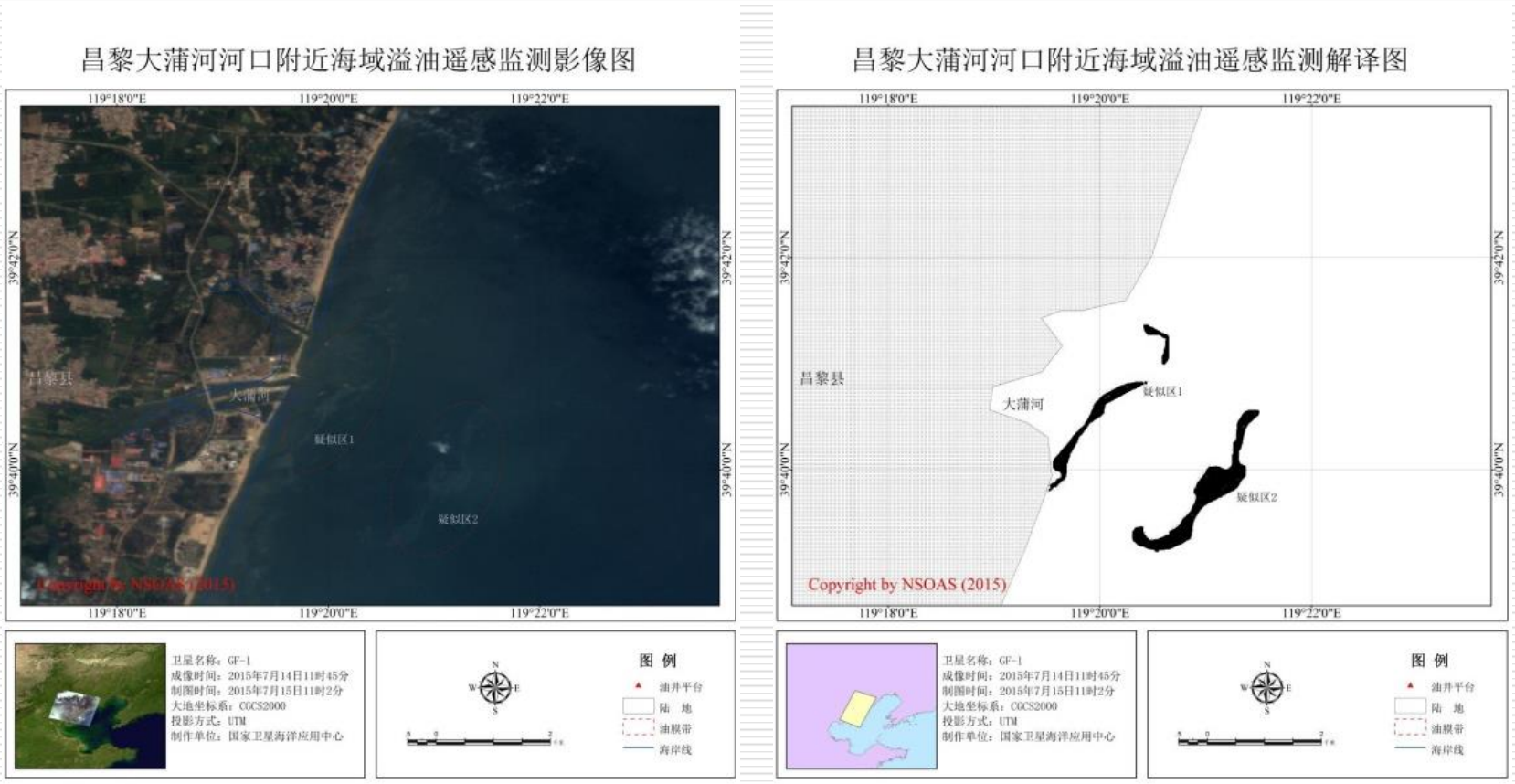
# Oil spill detection

- A ship sinking accident happened on the sea area near the estuary of Dapu river in the Changli district of Hebei province on July 13, 2015 in the morning.
- On July13 and July 14, we continuously used the GF-1 satellite images to tracking monitor the oil spills on the sea surface, and released two monitoring reports timely.



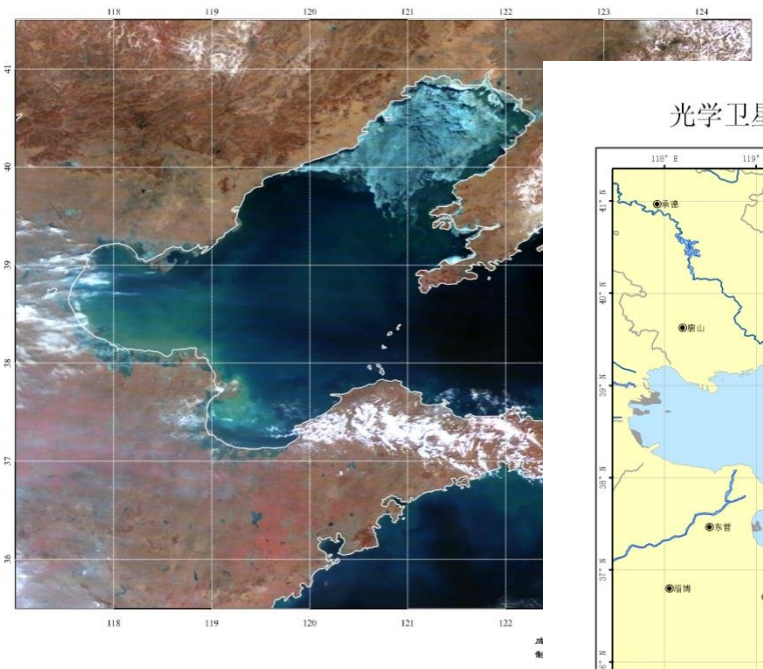

GF-1 image and corresponding oil spill monitoring thematic map on July 13, 2015

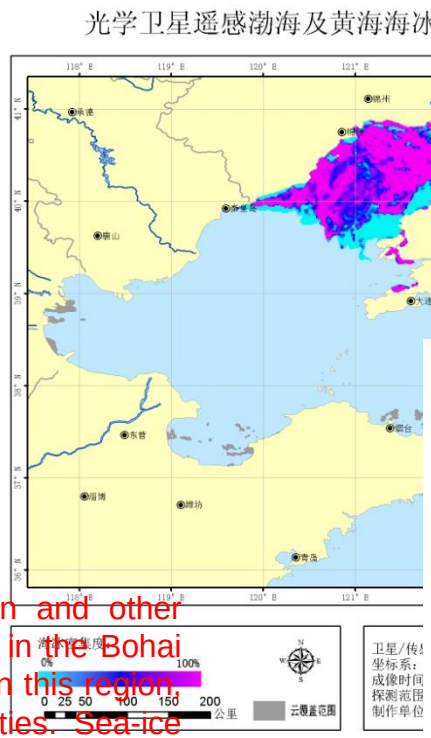
# Oil spill detection



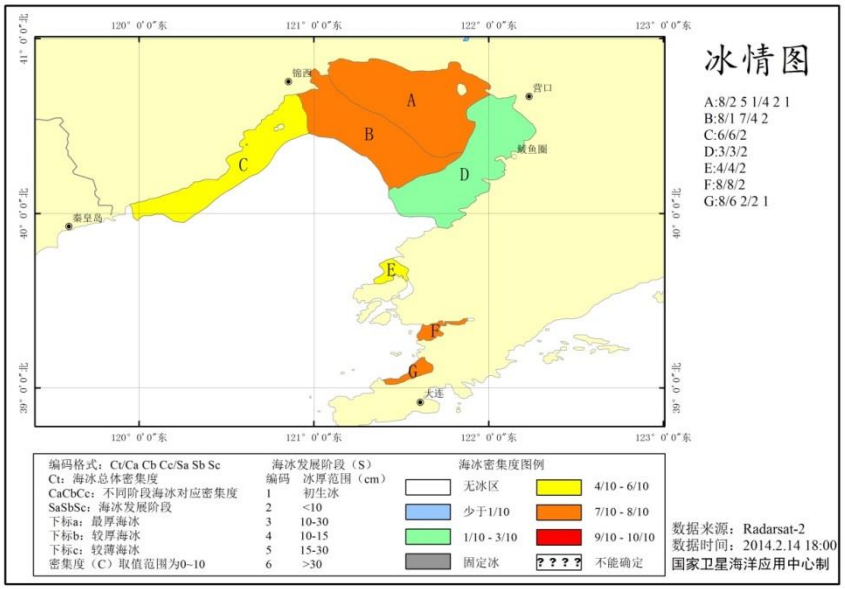

**GF-1 image and corresponding oil spill monitoring thematic map on July 14, 2015**

# Sea ice detection in Bohai Sea









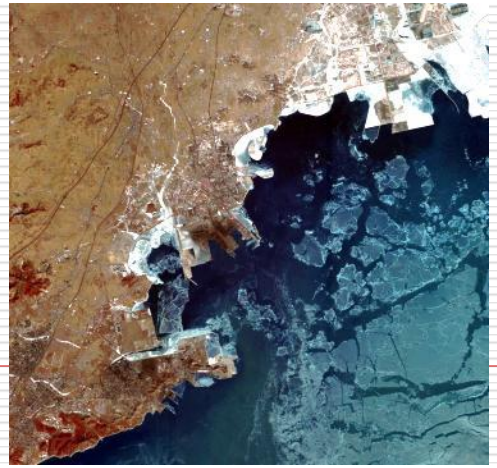

Oil and gas exploration and production and other maritime activities are rapidly increasing in the Bohai Sea. Since sea ice occurs every winter in this region, it poses serious threats to these activities. Sea-ice hazard causes serious harm to aquaculture, marine navigation, offshore oil production and other activities in the Bohai Sea of China.

# Data source for sea ice

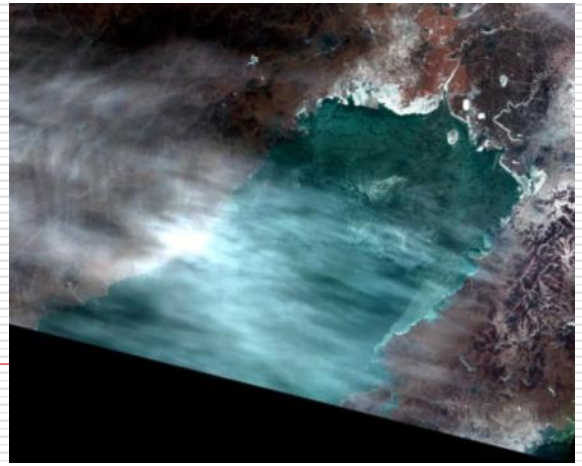
HY-1B

Radarsat-2

MODIS



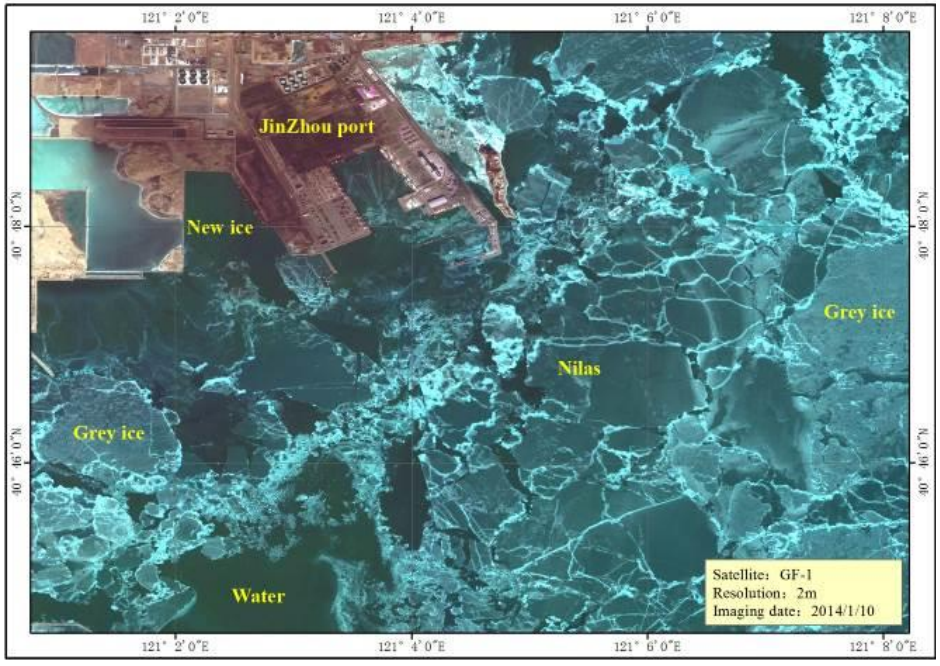
GF-01

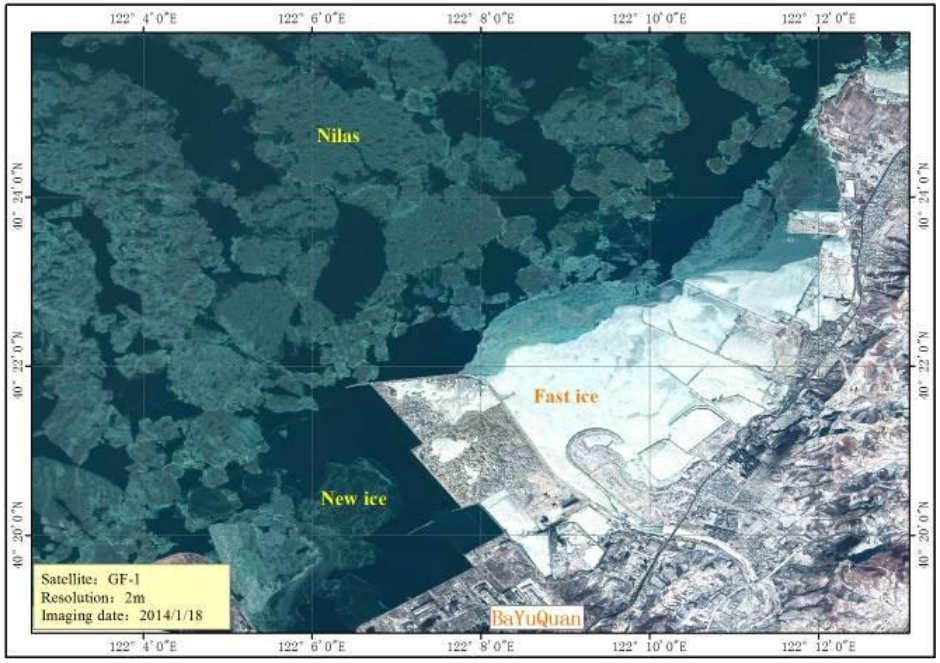


HJ-1A/B

# Sea ice classification

**Though merging 2m panchromatic image and 8m multispectral image, the RGB color images with 2m resolution can be used to get the sea ice information over the port zone. Figures show the different sea ice type over the Jinzhou port and BaYuQuan port on Jan. 10, 2014. These thematic maps supplied the detailed sea ice information for ship navigation.**

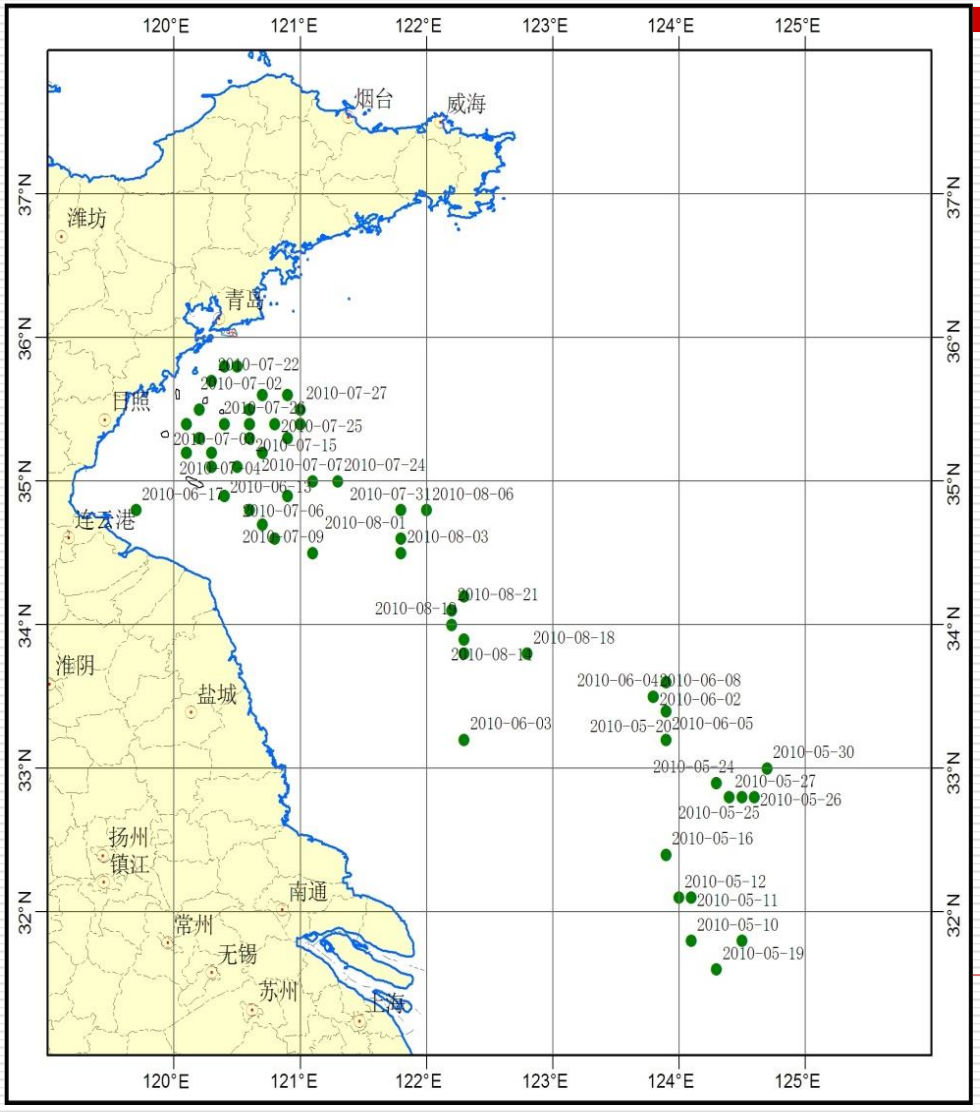


# Green tide detection

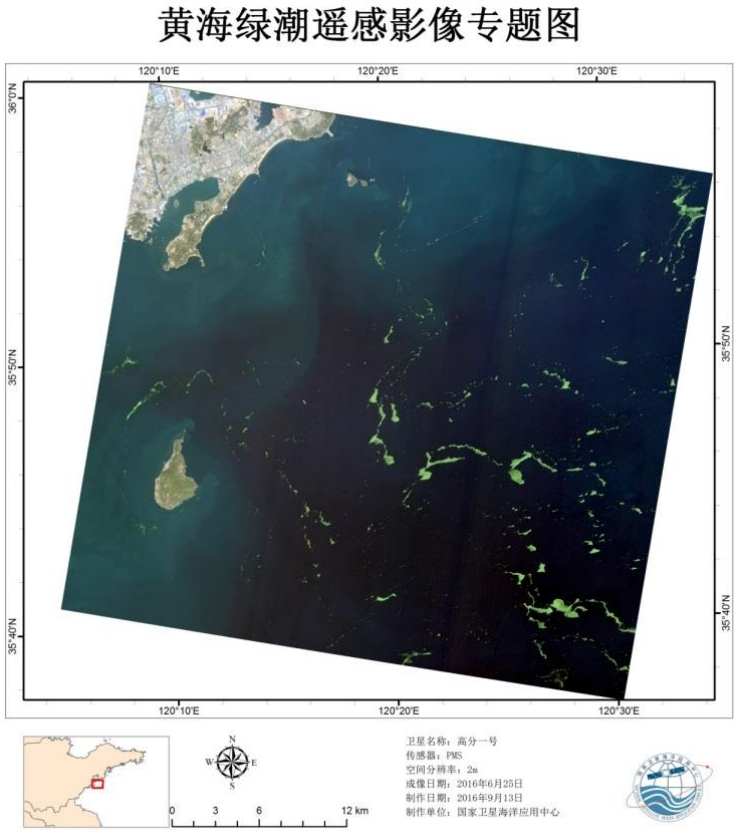
**Shandong province suffered a severe green algae invasion in recent years. Although the green algae is not poisonous, it can hinder fishery industry and tourism in affected areas;**

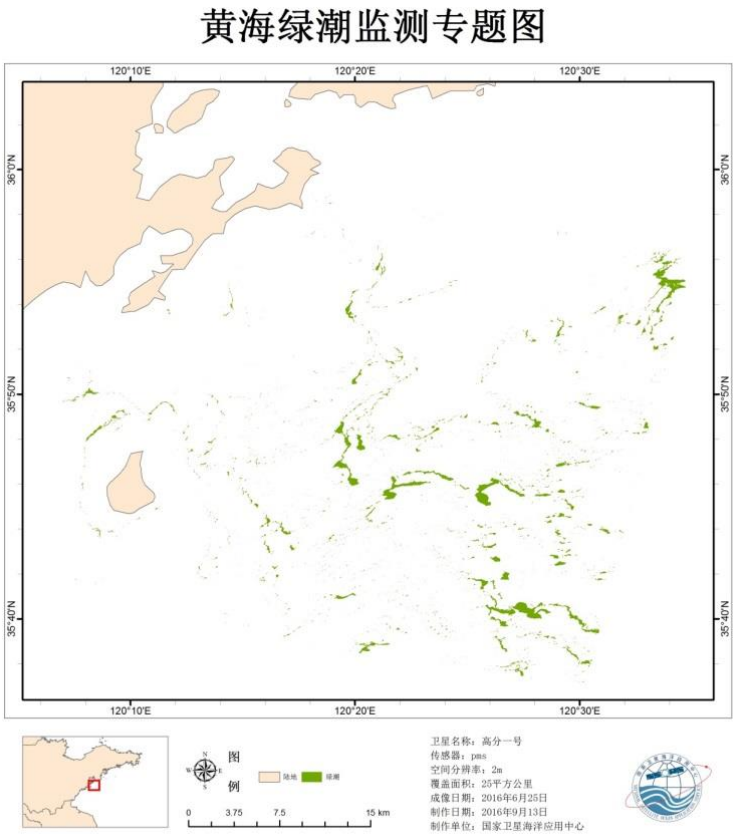

# Green tide detection(detailed information)



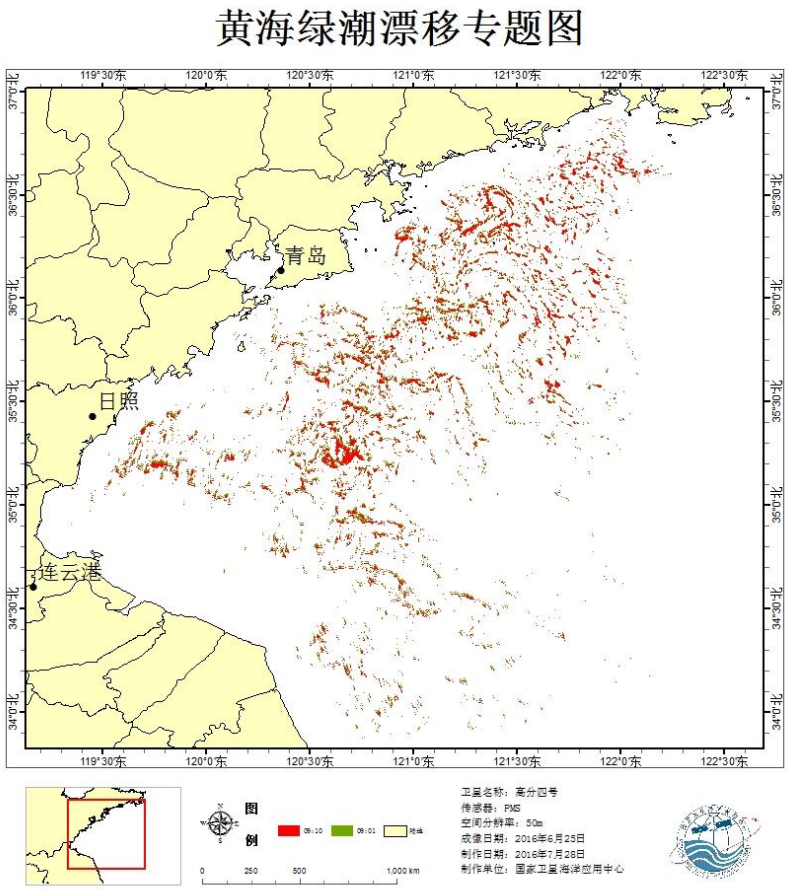

# Green tide detection

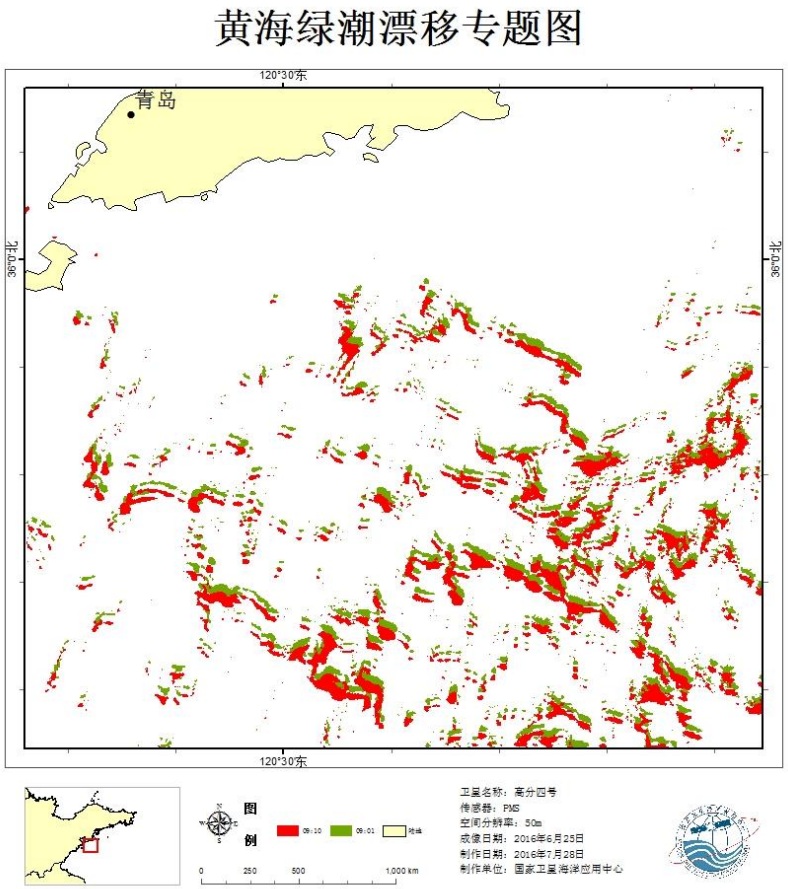
## ➢ Satellite image and result



# Green tide detection (drift)




**With 16m multispectral images of WFV, we can get the green tide cover area. Figure shows the green tide detection results with GF-1 WFV (green color) and Aqua MODIS (red color) on Jul. 4, 2015. There is a time gap of 2 hours between GF-1 and Aqua images.**

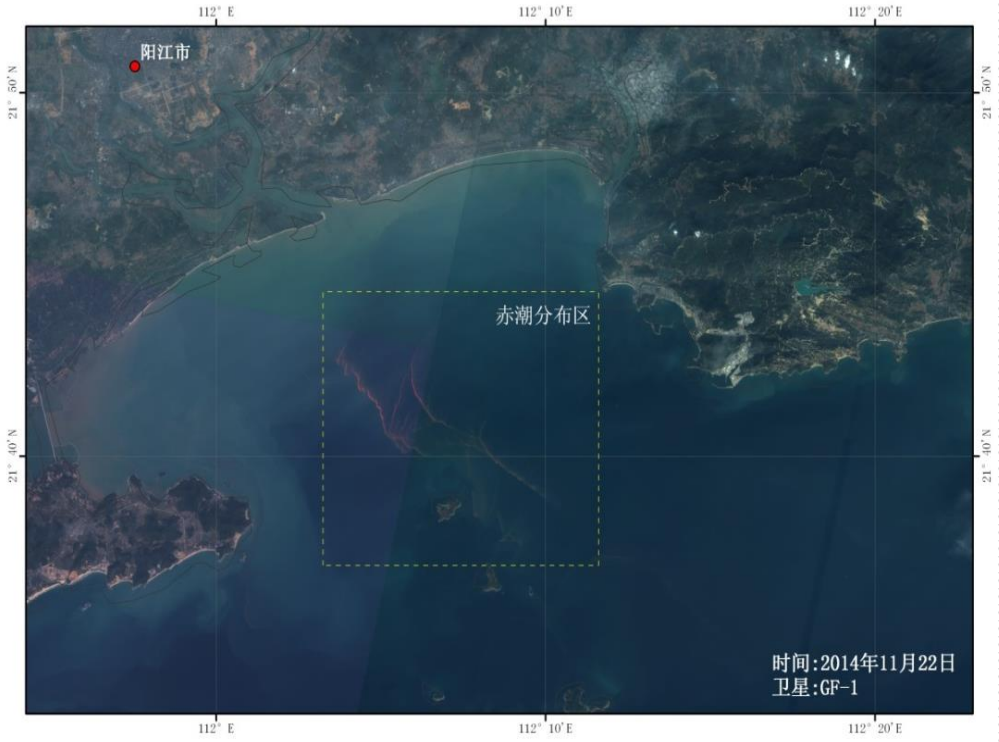
# Red tide detection

- **Harmful algal, be harmful to water quality and fiseries;**
- **It can be detected by satellite sensors because of "different color", provides information for monitoring and forecasting;**

# Red tide detection

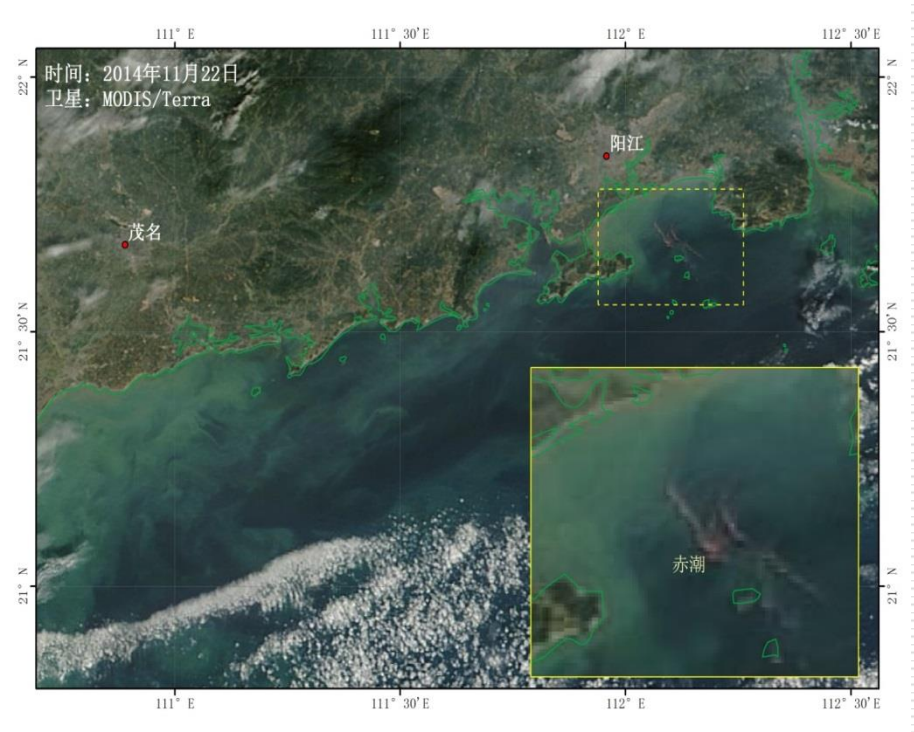

News (from internet)

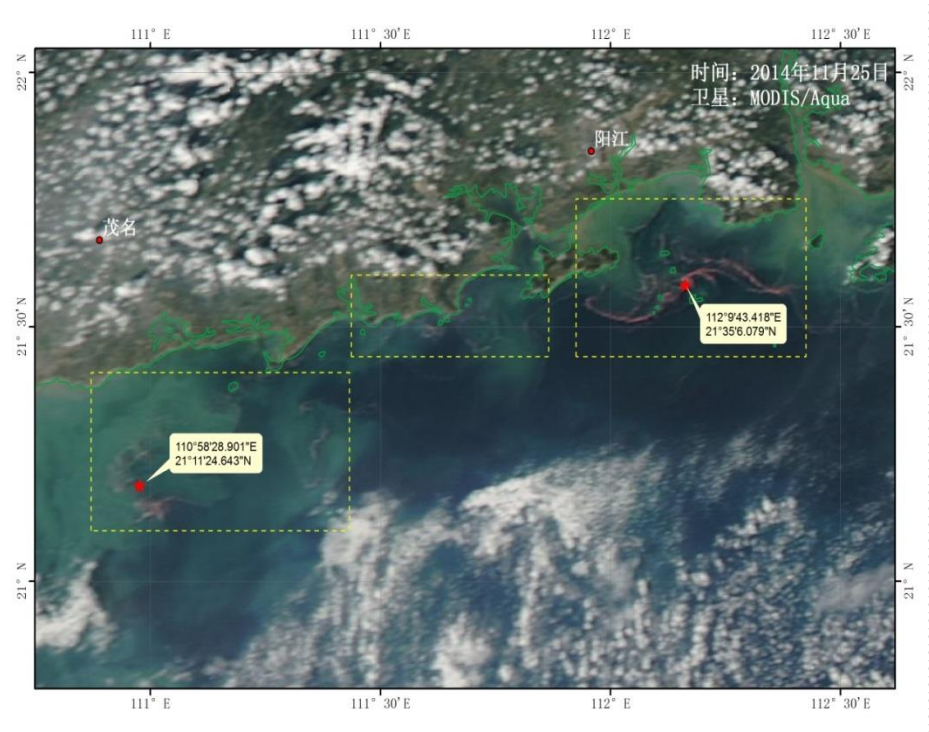

Picture from plane




Red tide in image of GF-1 on Nov. 22, 2014

# Red tide detection (with MODIS)



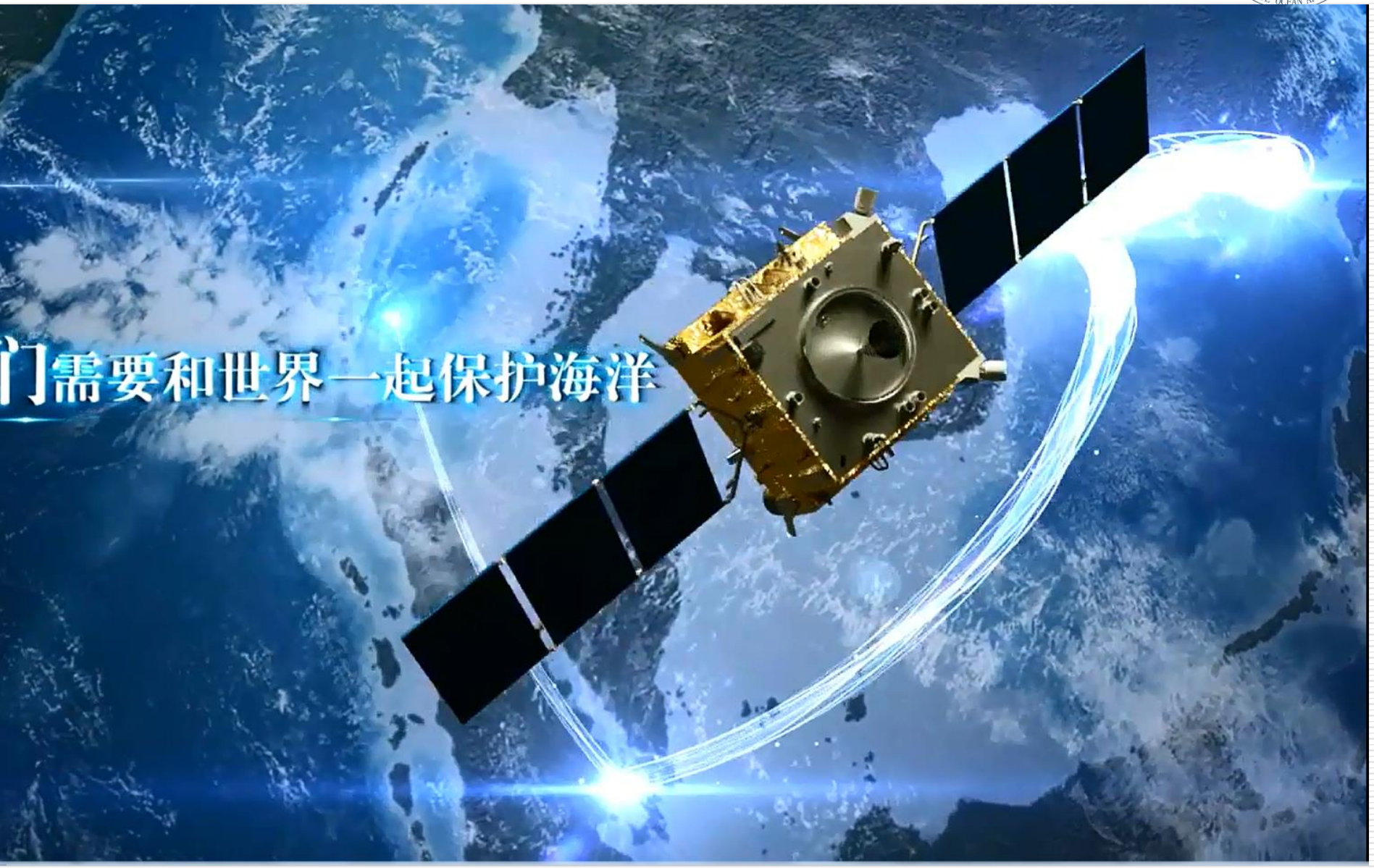




**Red tide in image of MODIS on Nov. 22 and 25, 2014**

# 4. Conclusions

- **With the data of GF-1's 2m /8m PMS and 16m WFV, the detailed information of oil spill, sea ice, red tide, and green tide was supplied.**
- **These information is very important for the disaster and pollution prevention and control over the coastal zone.**

# 3rd China Ocean Color Sat (HY-1C) was launched on Sep.7,2018


们需要和世界一起保护海洋

# Five Main Payloads

## COCTS/UVI

- 1km, 1day revisit
- Global monitoring all the time
- 8 visible and nir band
- 2 infrared band
- 2 ultra violet band for atm.corr
- High Dynamic Range

## CZI

- *50m,3 day revisit*
- *4 visible and nir band*
- *High Dynamic Range*

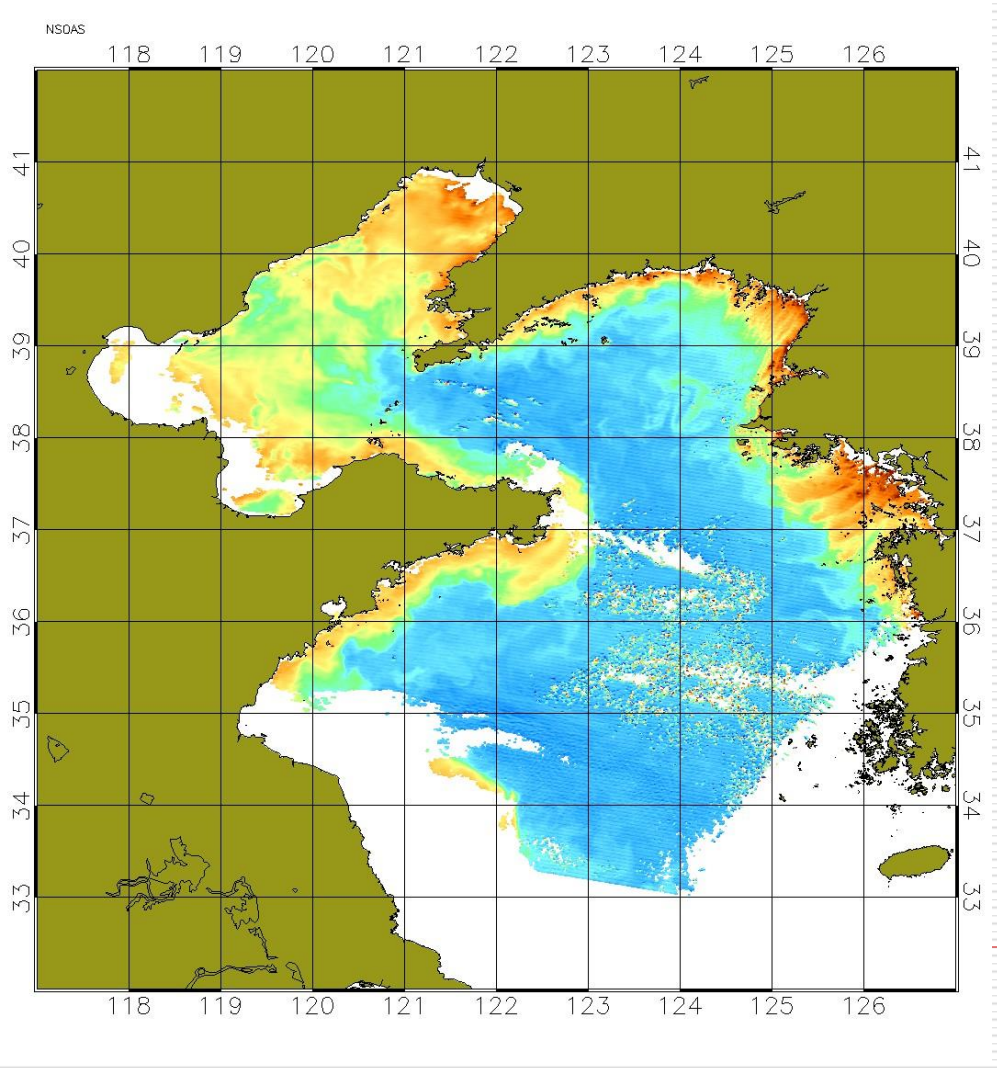
## AIS

- *Global ship AIS data*

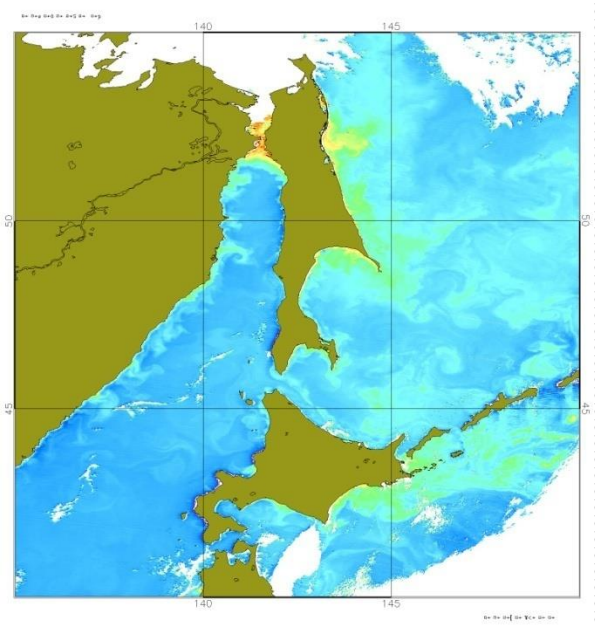
## SCI

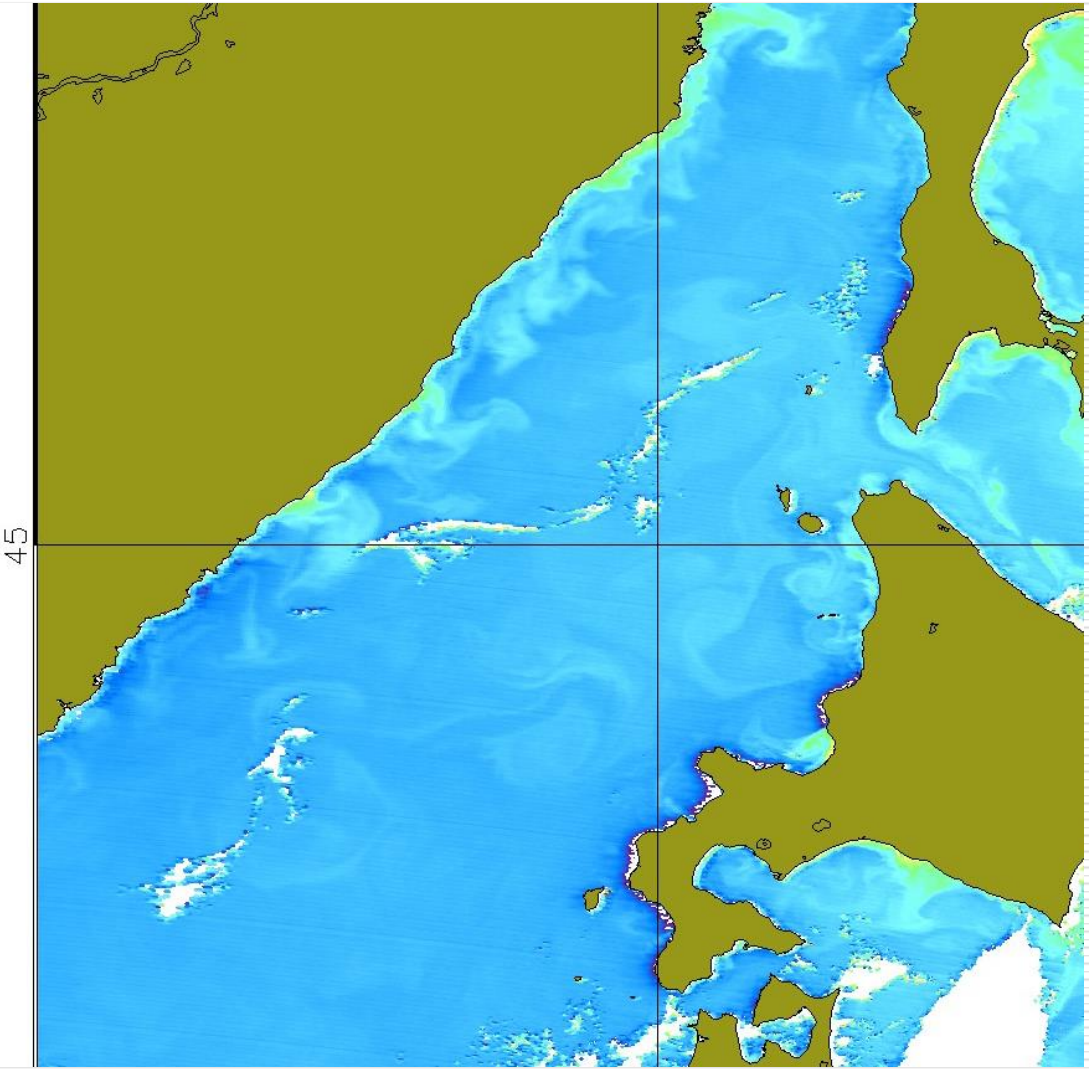
- *on board Calibration*

# Bohai Sea

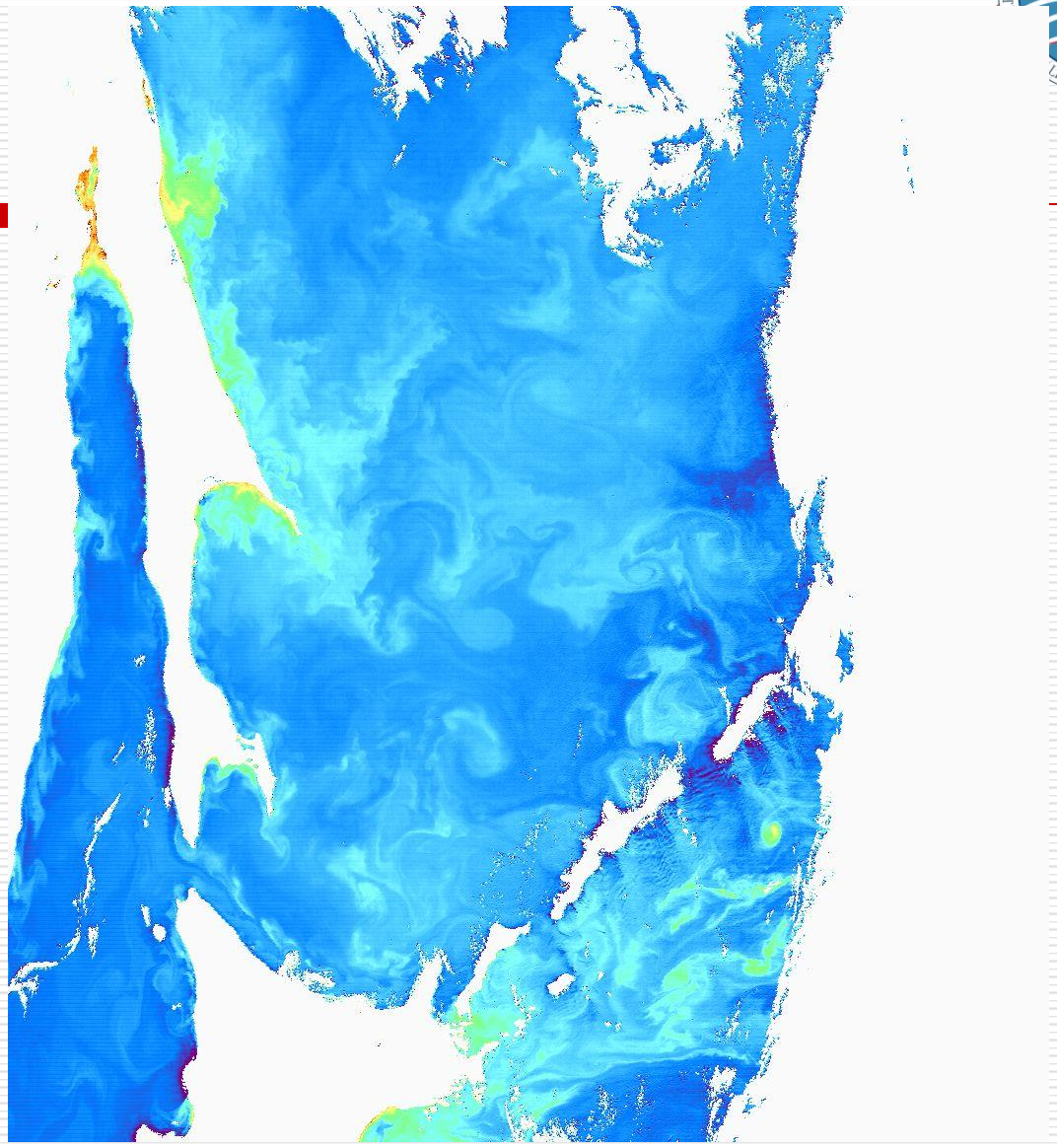

NSOAS
118 119 120 121 122 123 124 125 126
41 40 39 38 37 36 35 34 33

# Sea of Japan

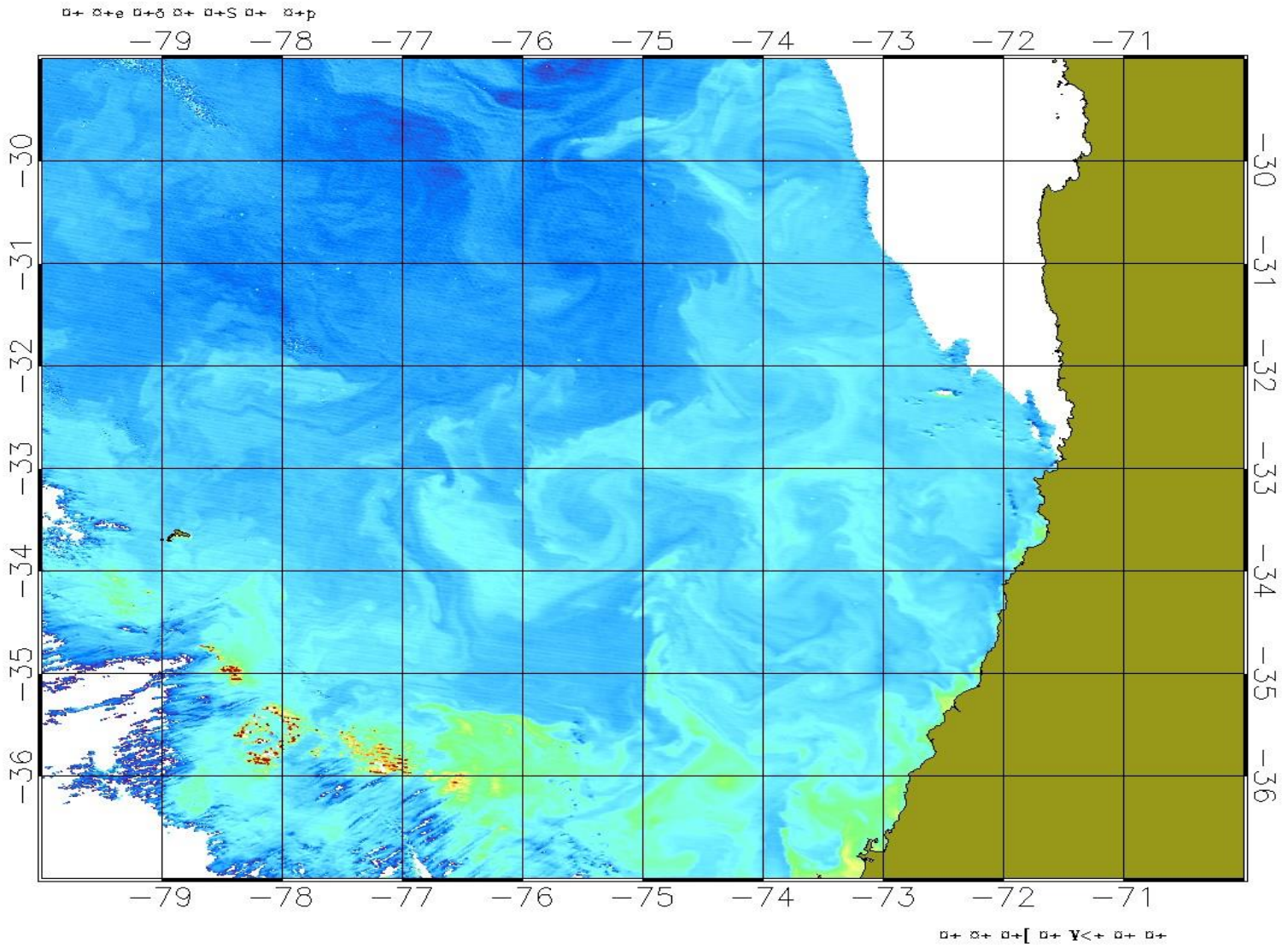


# Okhotsk Sea



# West of South Africa



# 日本樱岛活火山遥感影像图


国家卫星海洋应用中心

1:60,000

3 1.5 0 3 6 9 12 千米

CGCS2000坐标系
2018年制作

卫星名称：HY-1C/CZI
成像日期：2018年10月26日

# Thank you!