Maritime Search and Rescue and offshore Oil Spill emergency Decision-Support System

Jiangling Xu

North China Sea Forecast and Disaster Mitigation Center (NCSFDMC),
Ministry of Natural Resources
Email: xujiangling@nrc.mnr.gov.cn

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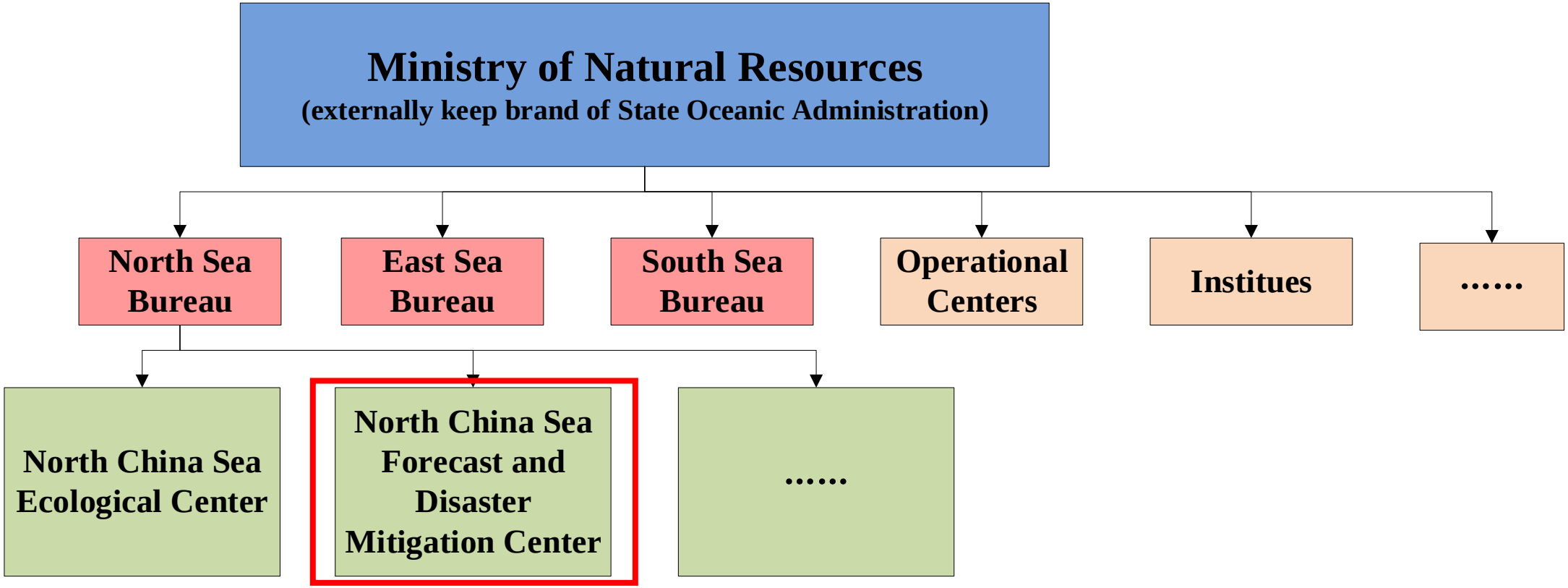
CONTENTS

01

Introduction of NCSFDMC

1. Introduction of NCSFDMC

- NCSFDMC was founded in 1965. It is affiliated to the North Sea Bureau of the Ministry of Natural Resources.
- It is a regional center that fully performs the duties of marine observation, forecast, early warning, disaster prevention and mitigation in the North China Sea region. It has issued marine forecasts, warnings and bulletins of various disasters, and participated in the emergency response of major marine disasters.
- There are 165 employees, including 11 professor-level Senior engineers, 50 senior engineers, 24 PhD.



1. Introduction of NCSFDMC

Business Process


Expert consultation


Super computer

Prediction

Production

FAX

SMS

TV

Internet

Radio

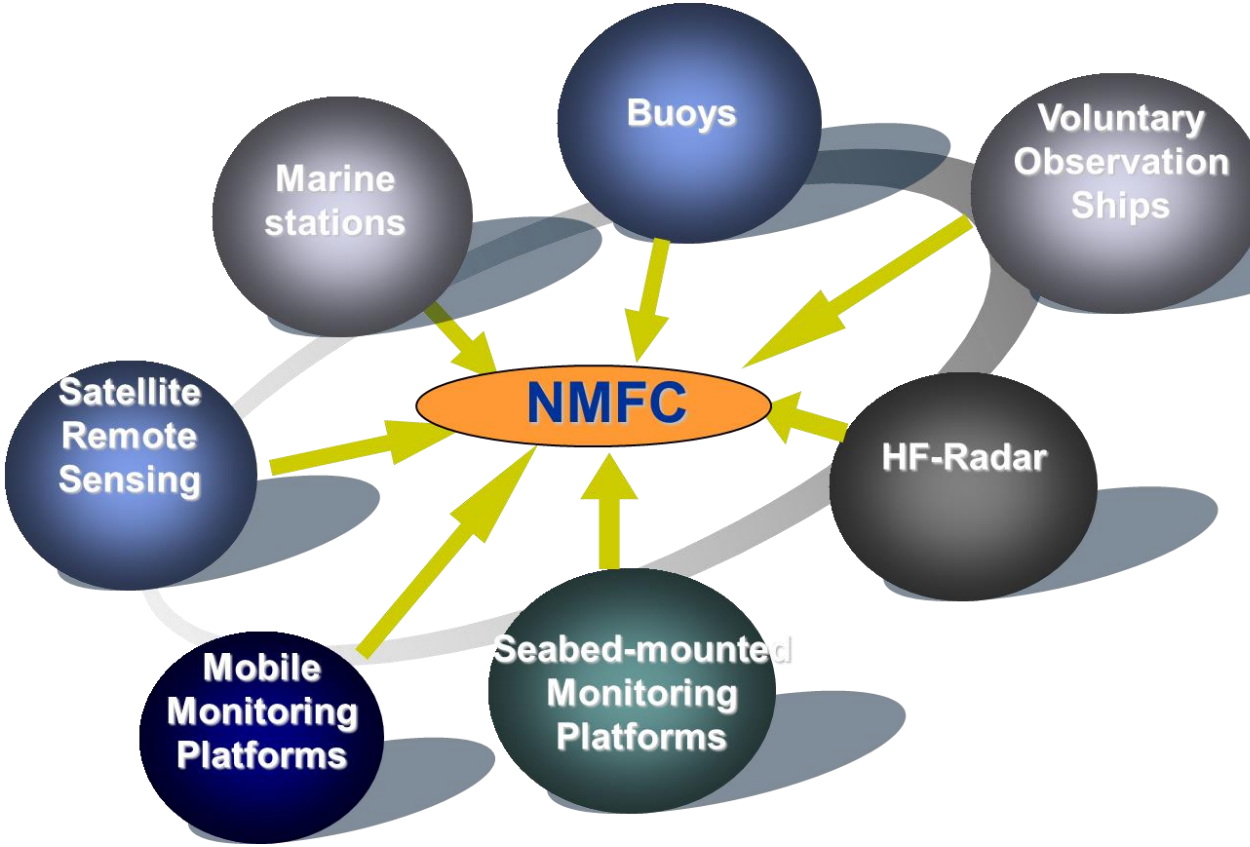
Data to Users

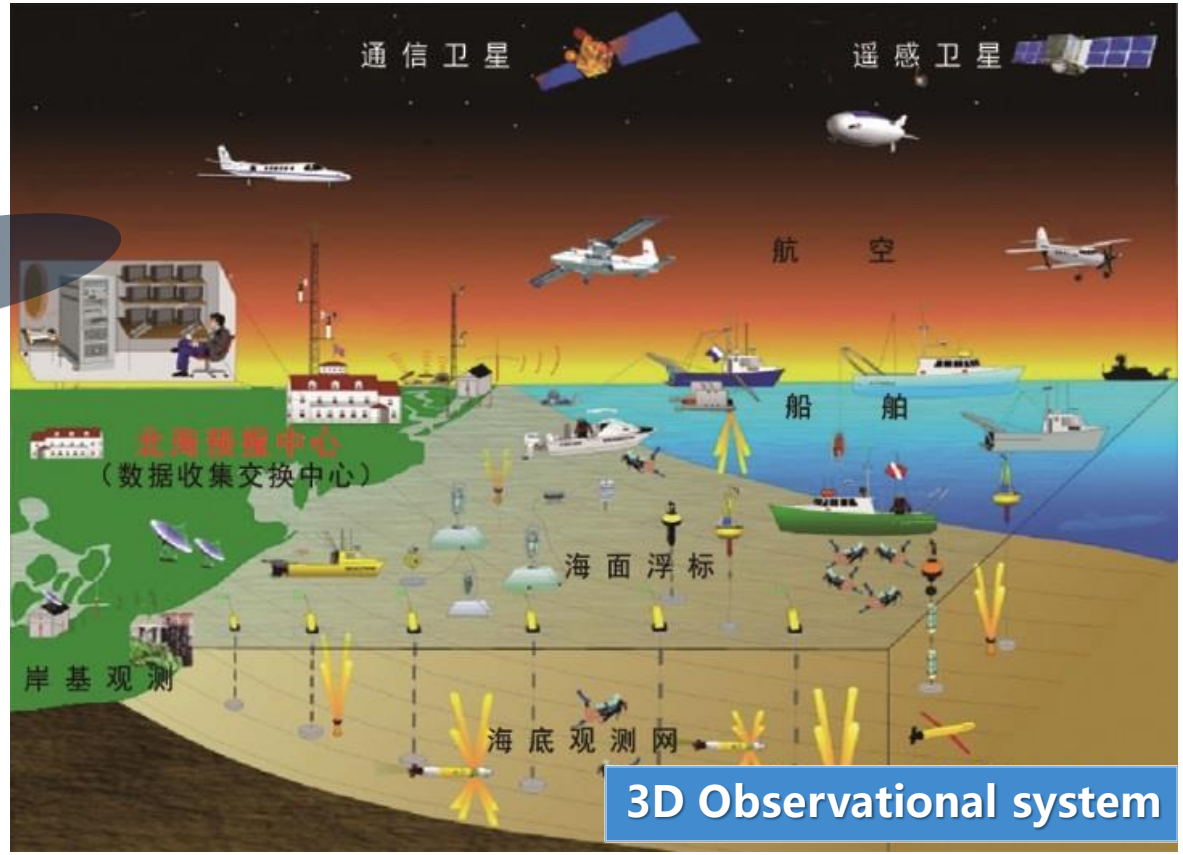
On average, more than 110,000 early warning products are issued every year.

1. Introduction of NCSFDMC

Observation

Over 50 years' development, our center has built a real-time marine environmental observation network, including marine stations, buoys, HF-Radar, voluntary ships, satellite remote sensing, etc.. Besides, operationally run tsunami warning and earthquake stations.



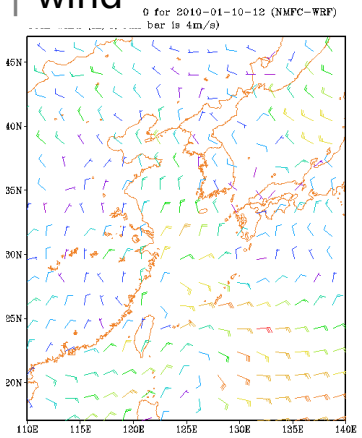


1. Introduction of NCSFDMC

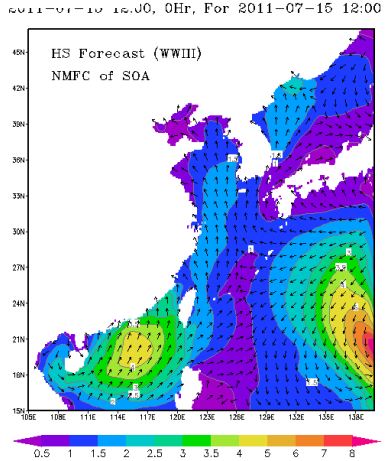
Prediction

More than 100 kinds of products are generated every day, including wind, sea wave, tide, current, temperature, storm surge, sea ice, and climate, ecological product.

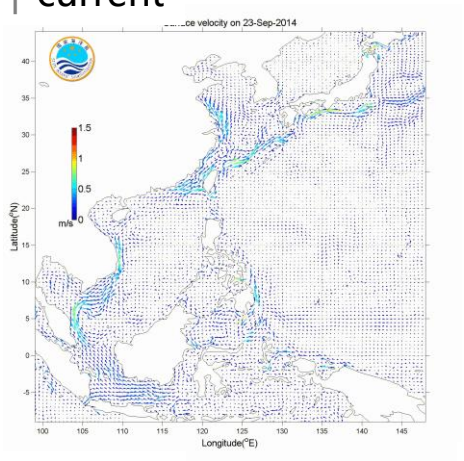
wind



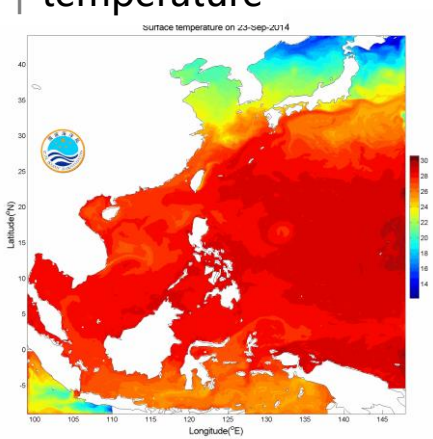
wave



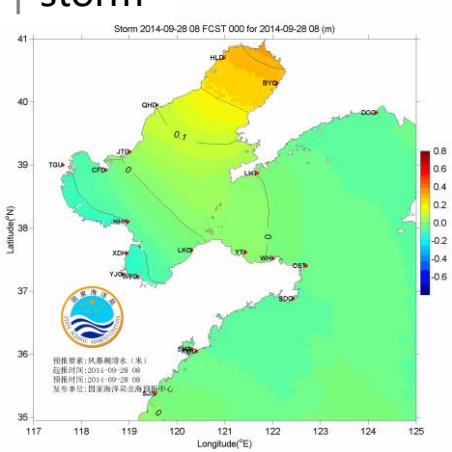
current



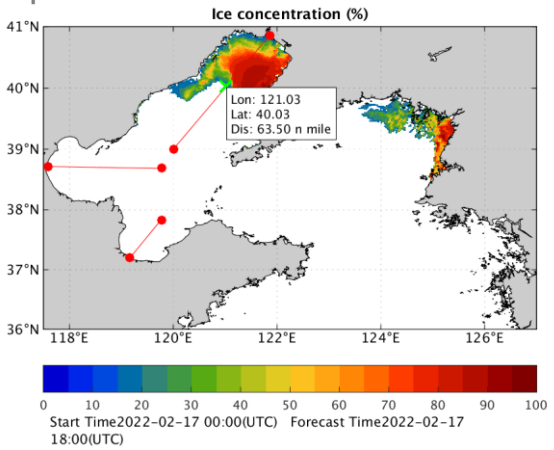
temperature



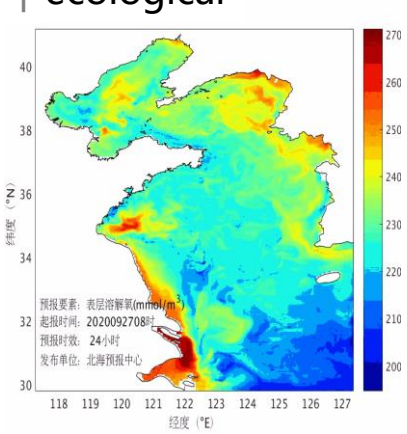
storm



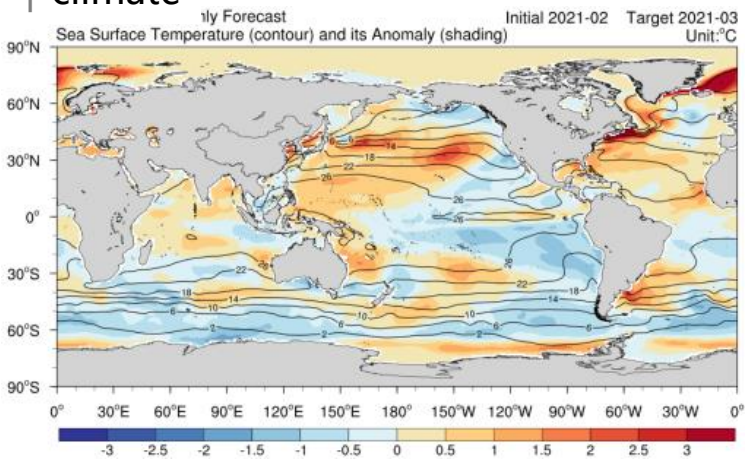
sea ice



ecological

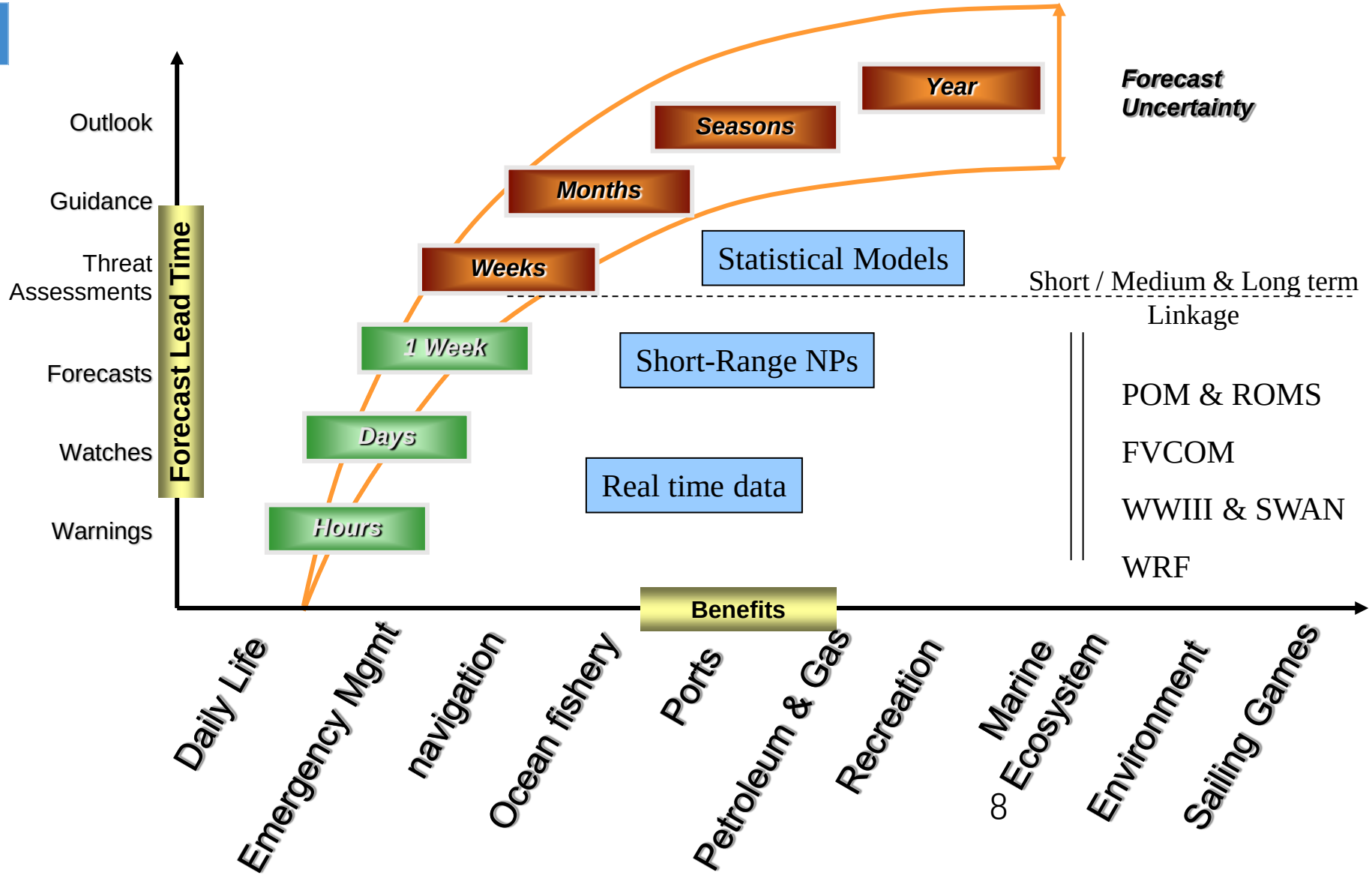


climate

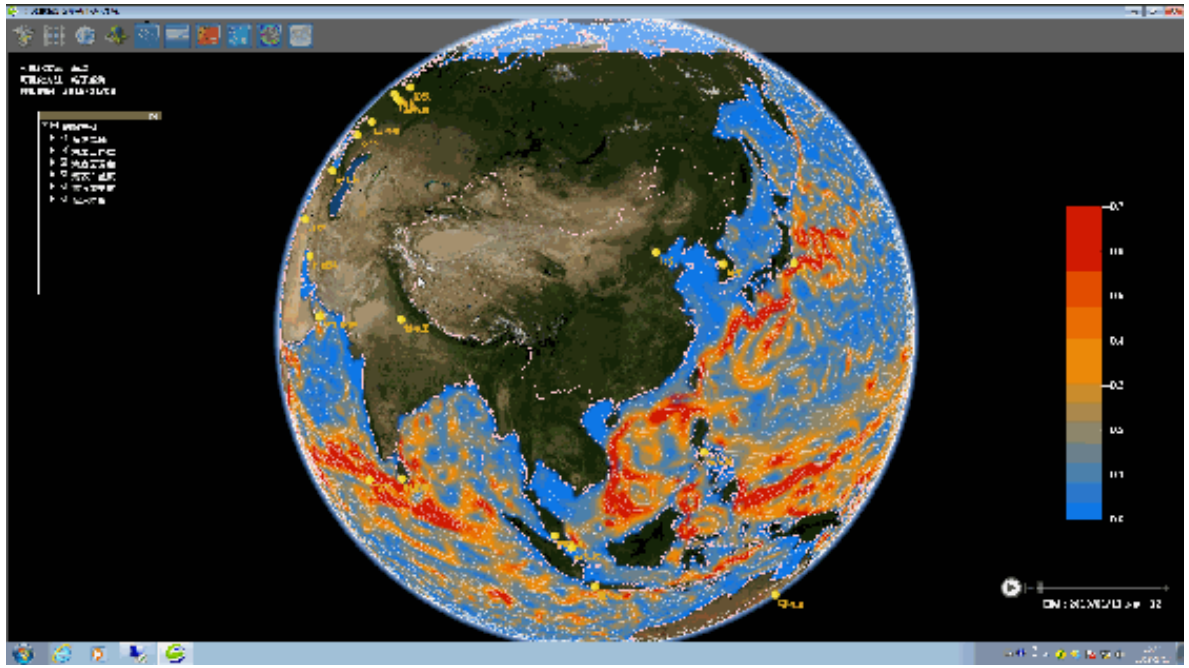


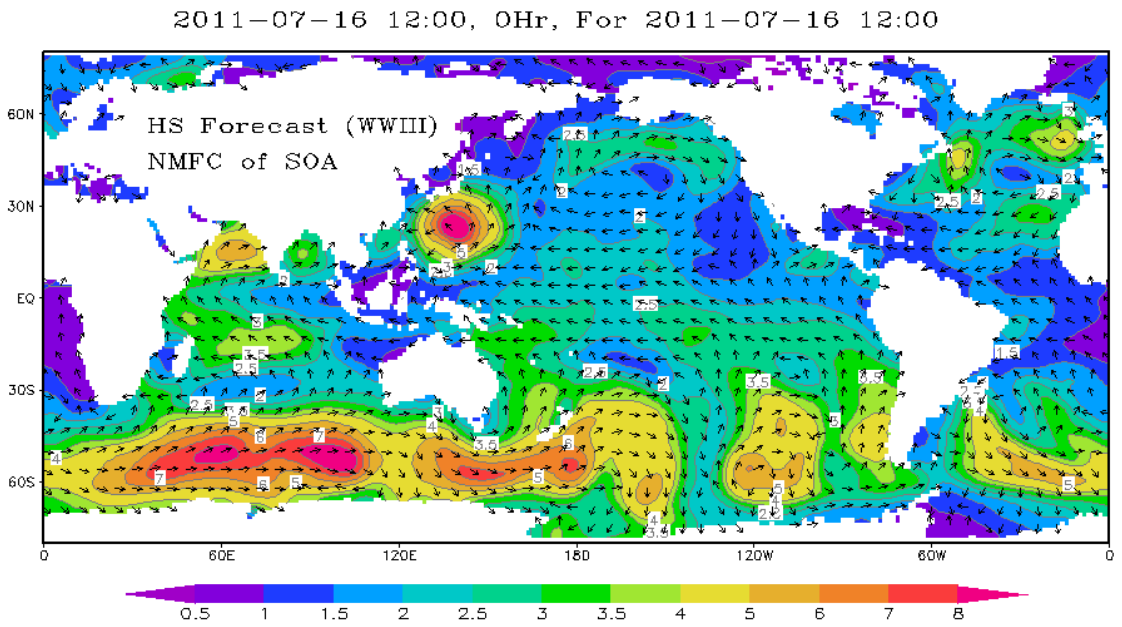
1. Introduction of NCSFDMC

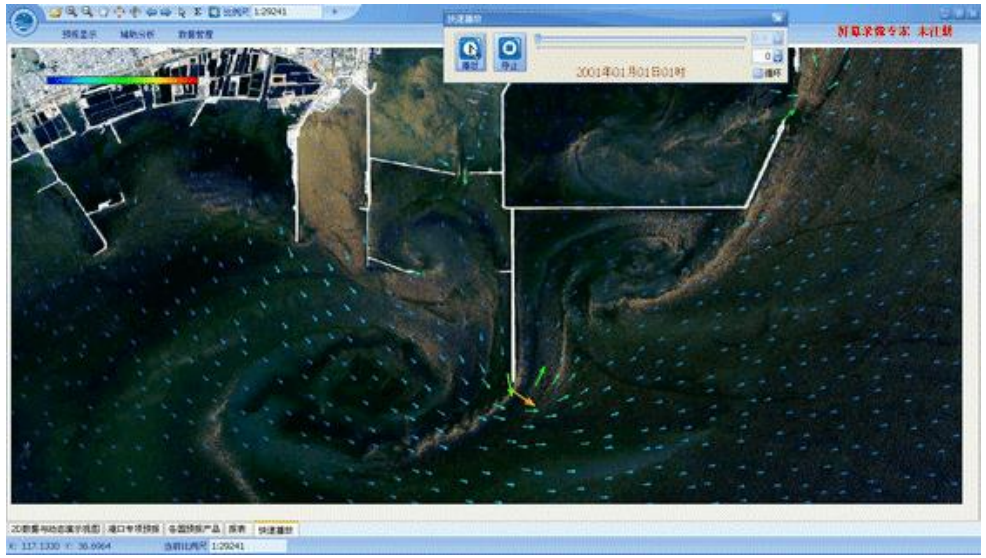
Prediction

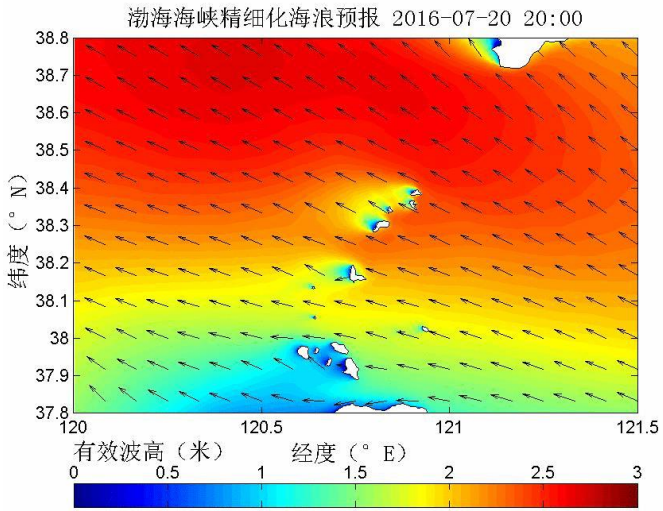


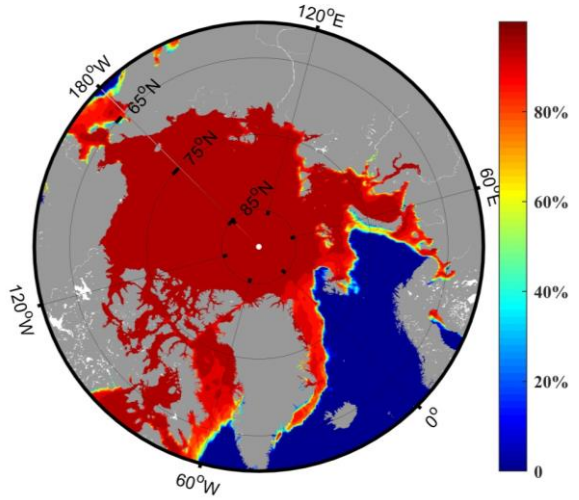
1. Introduction of NCSFDMC





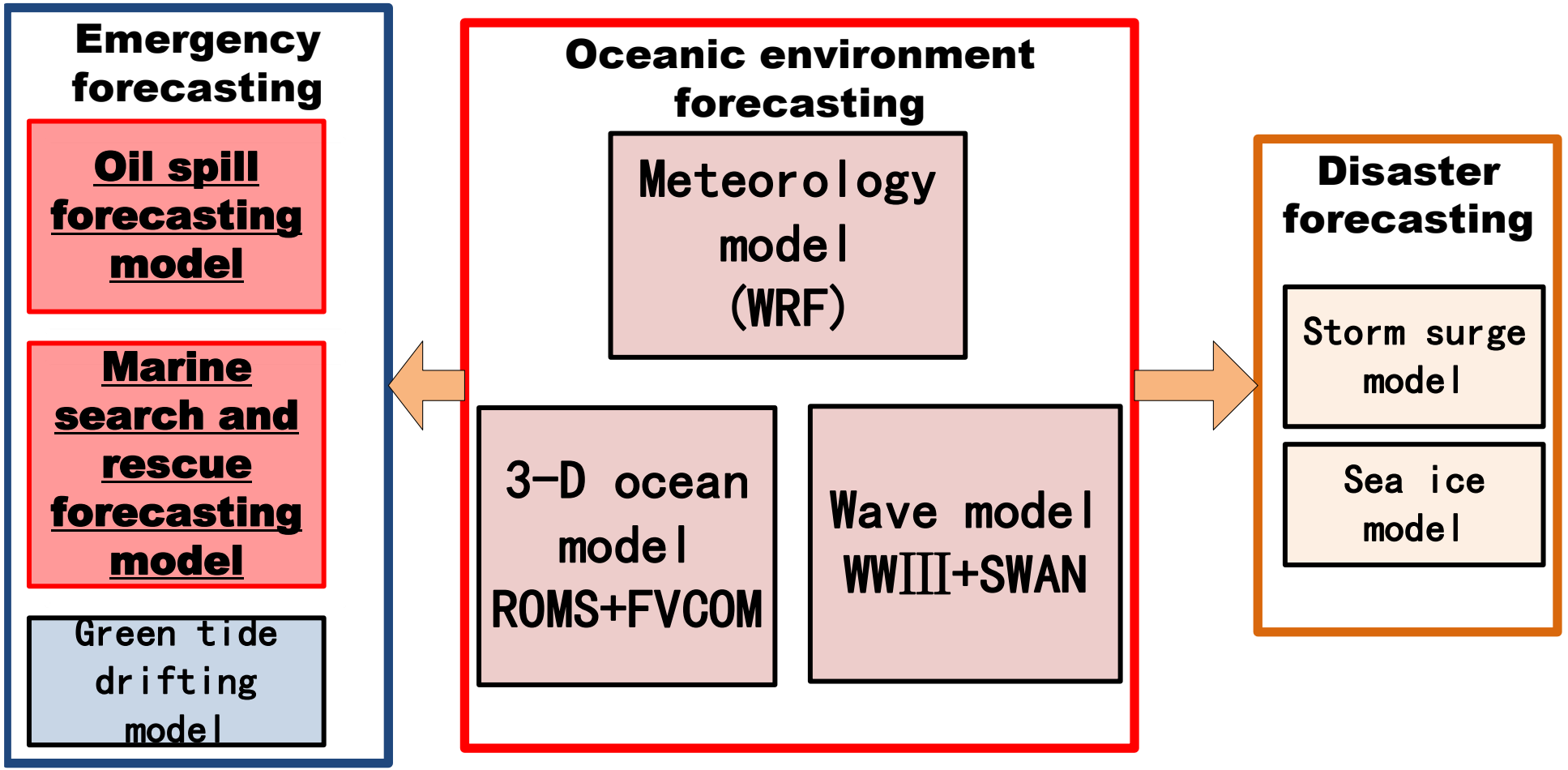






1. Introduction of NCSFDMC

Prediction--Numerical models



1. Introduction of NCSFDMC

There are two sets of high-performance computers with computing power of 90 trillion times per second and 600T of available storage.

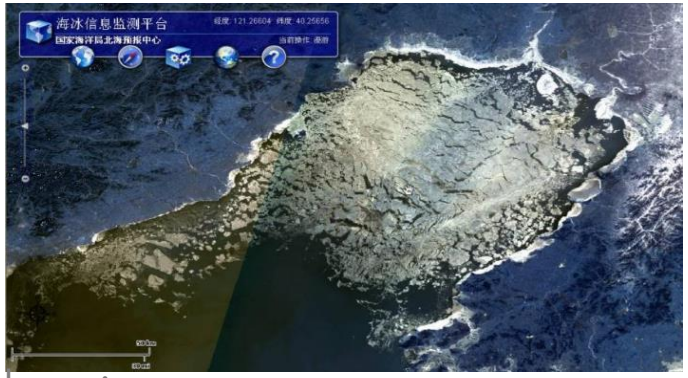
1. Introduction of NCSFDMC

Disaster prevention and mitigation

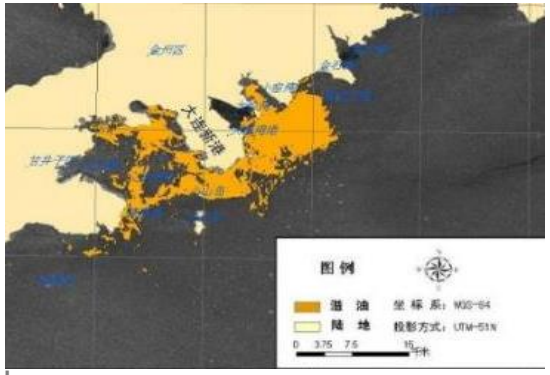
Release early warning for marine disasters, including storm surge, huge waves, sea ice. Publish monitoring and forecast for marine ecological disasters, like Green Tide and Red Tide, as well as oil spill or other pollution leakage.

Storm surge

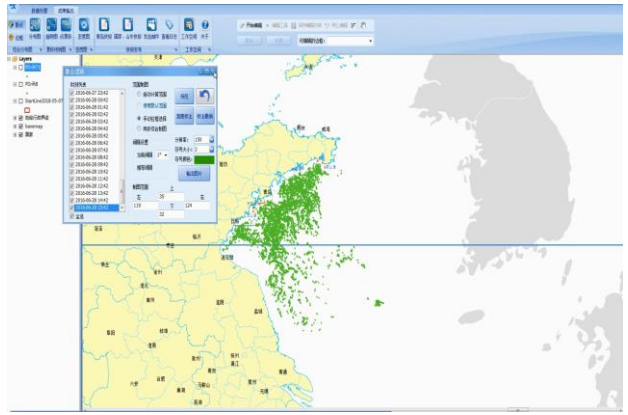
Huge wave



sea ice

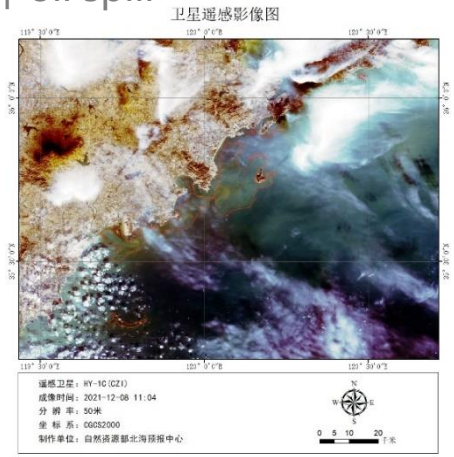


oil spill



Green Tide

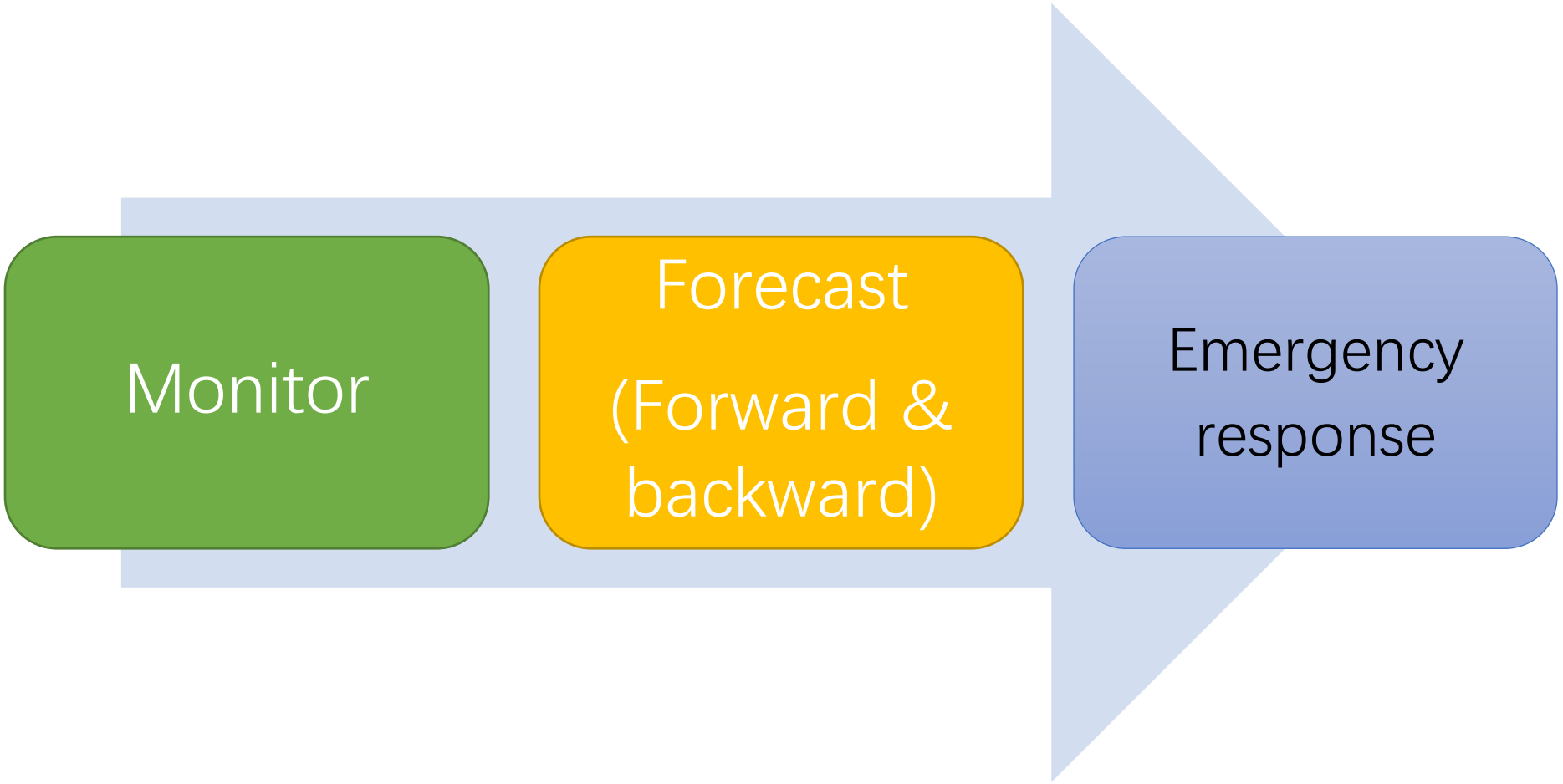
Red Tide



02

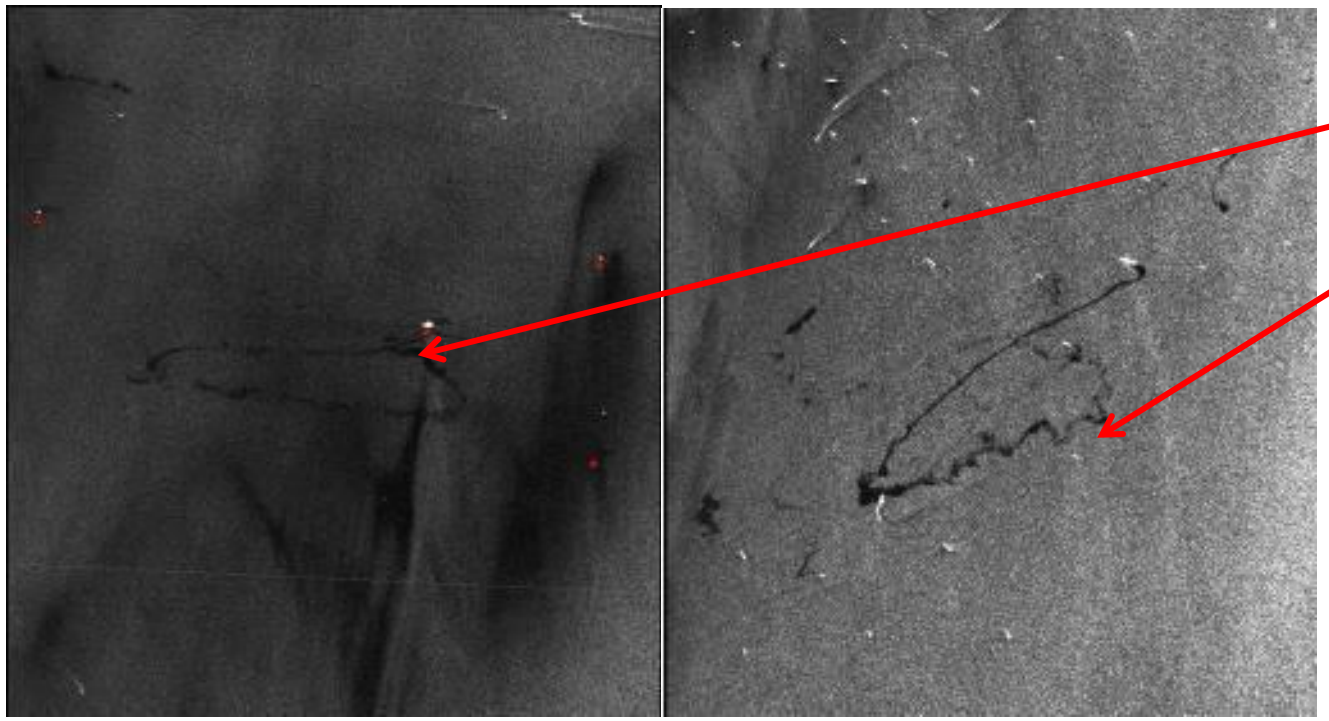
Decision support system for offshore oil spill

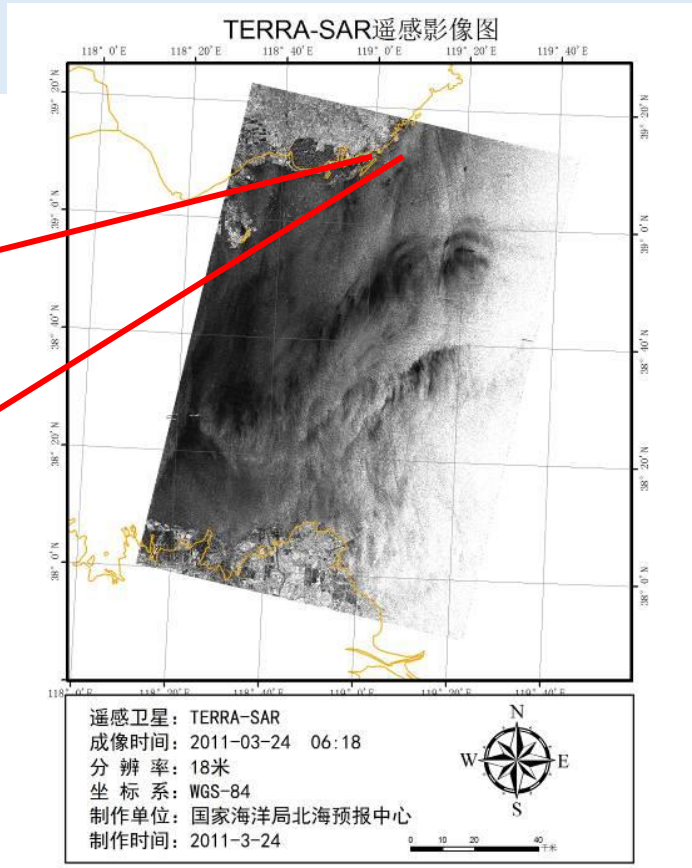
2. Emergency response system for offshore oil spill



2. Monitoring technology of offshore oil spill

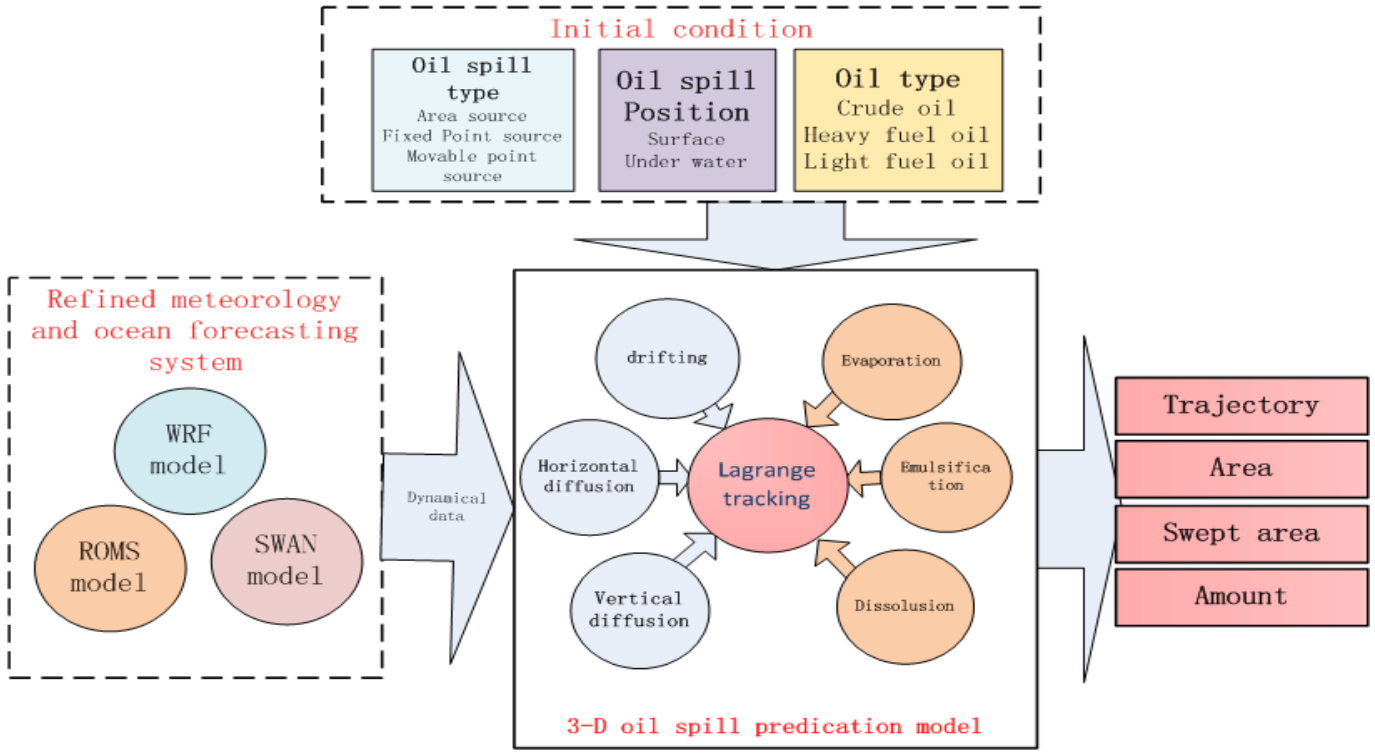
- Since the 1990s, research has been conducted on offshore oil spill accidents and has played an important role in technical support.
- Using multi-source SAR and domestic optical satellite remote sensing data, oil spill remote sensing monitoring technology has been developed to form full coverage and all-weather monitoring of oil spill in the North Sea.
- Multiscale segmentation algorithm of SAR images for oils monitoring.
- Optical image extraction technology for oil spill information .

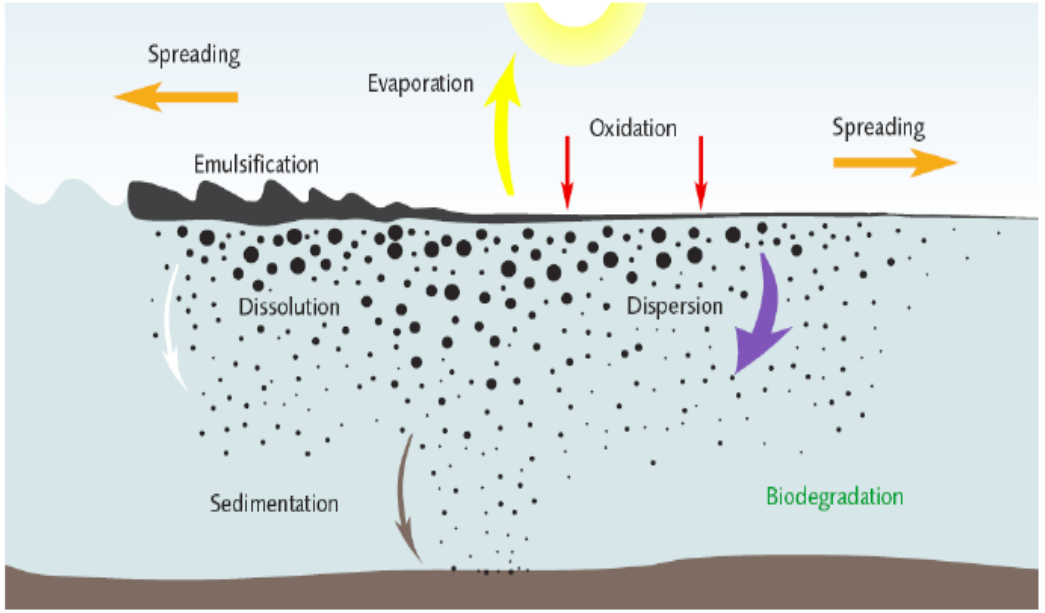




2. Prediction model of offshore oil spill

- Based on Lagrange method, we established numerical ‘oil model’ to simulate the behavior and fate of spilled oil in the water, including oils’ spreading, evaporation on the surface, as well as its dissolution and sedimentation in the water.
- The model is driven by oceanic environment operation forecast system run by our center, which is composed of WRF, ROMS, FVCOM and SWAN models.
- The input of the model is information about oil, such as its type, amount, position and so on. The outputs are its trajectory, swept area, region of influence, and residual oil amount.

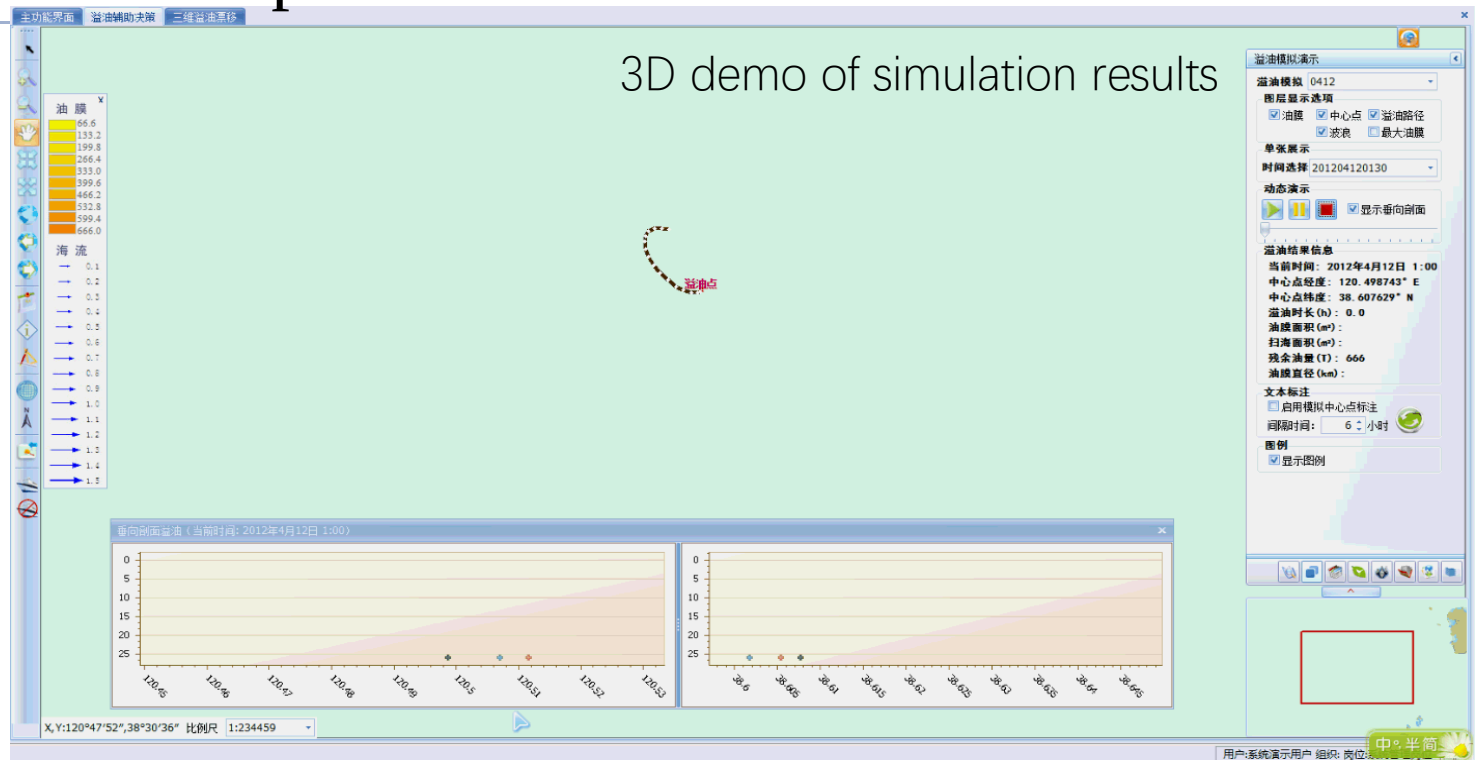


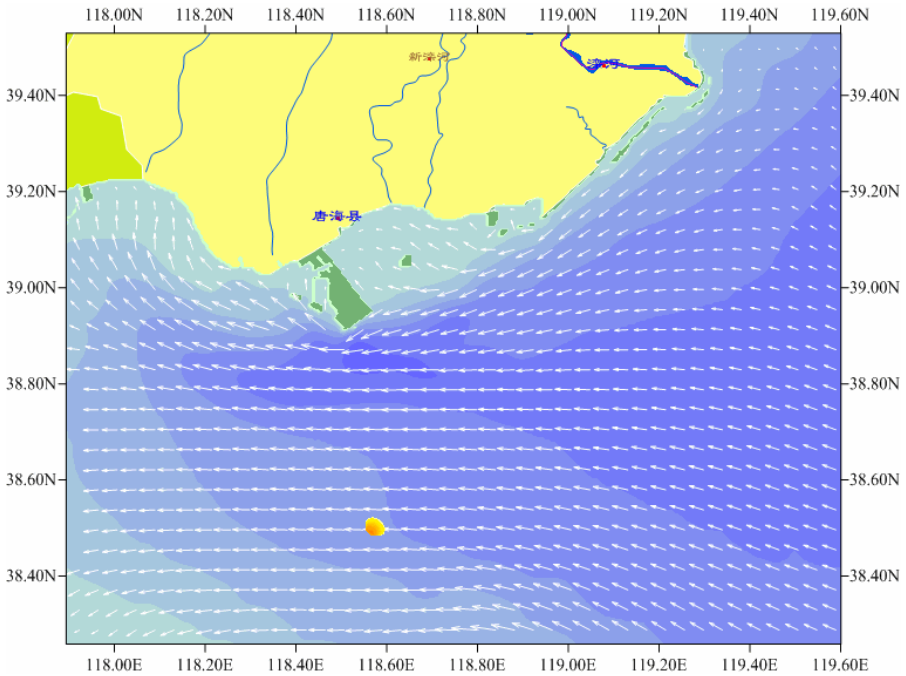


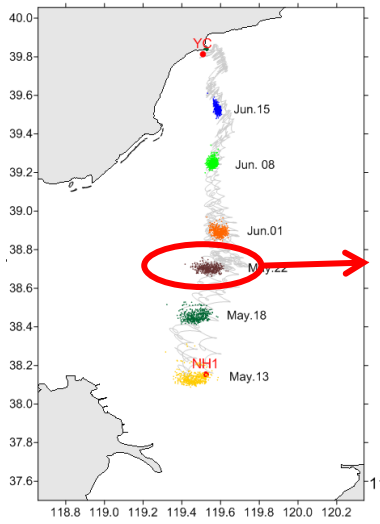
2. Prediction model of offshore oil spill

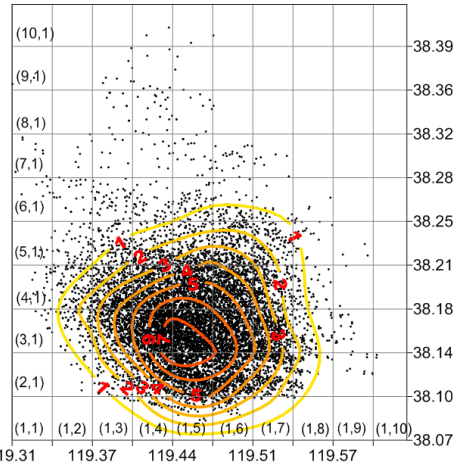
Emergency prediction system of oil spill

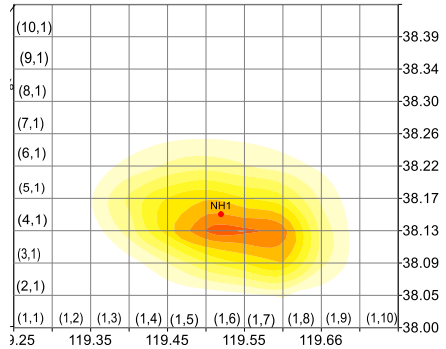
- Rapid forecast of trajectory
- 2d drifting forecast
- 3d drifting and fate forecast
- Back-tracing





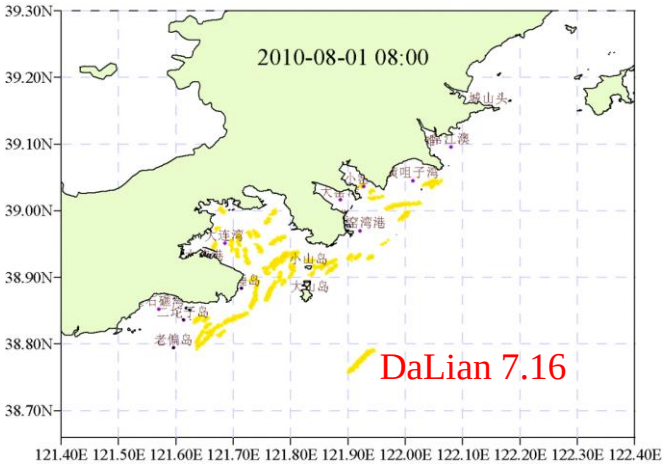


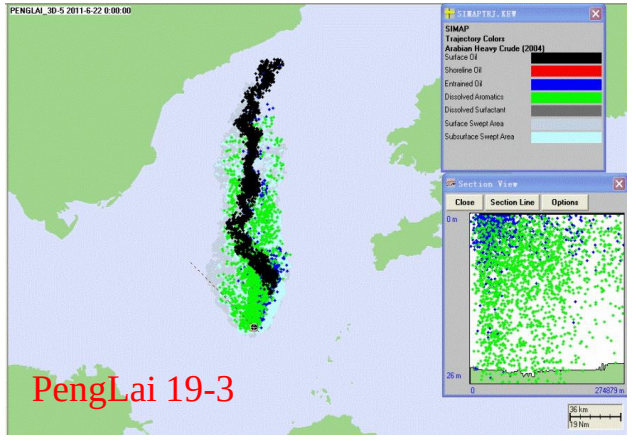




2. “One map” for emergency response of offshore oil spill

Developed “One map” for emergency response of offshore oil spill, which integrates present status of oil spill and its drifting tendency, disposal resources, environmental forecasting and real-time monitoring, gives the analysis on development of oil pollution, and the disposal plan or strategies. That will help managers make their decisions quickly.





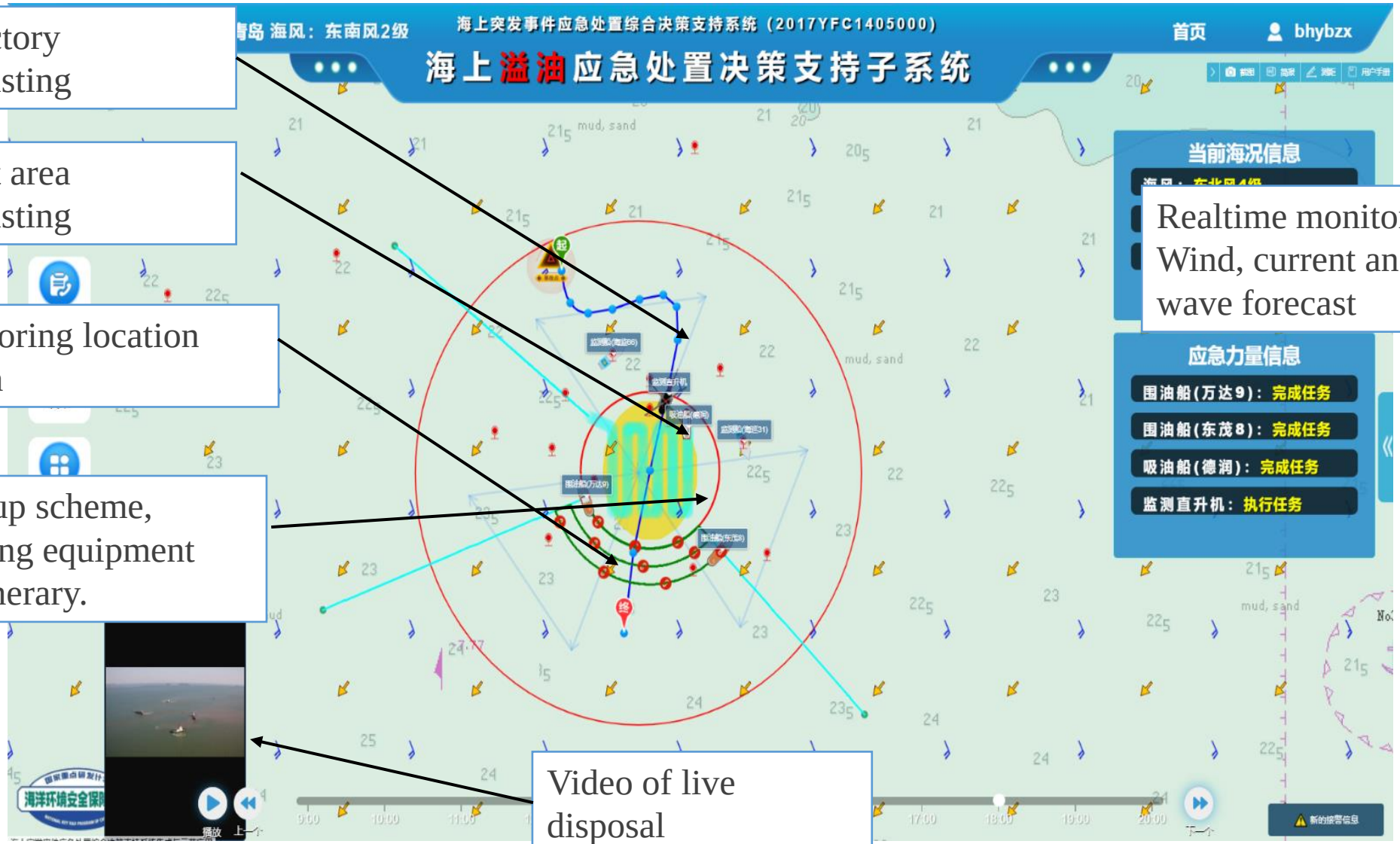
2. Decision support system for offshore oil spill

Trajectory forecasting

Swept area forecasting

Monitoring location design

Clean up scheme, including equipment and itinerary.



Realtime monitoring Wind, current and wave forecast

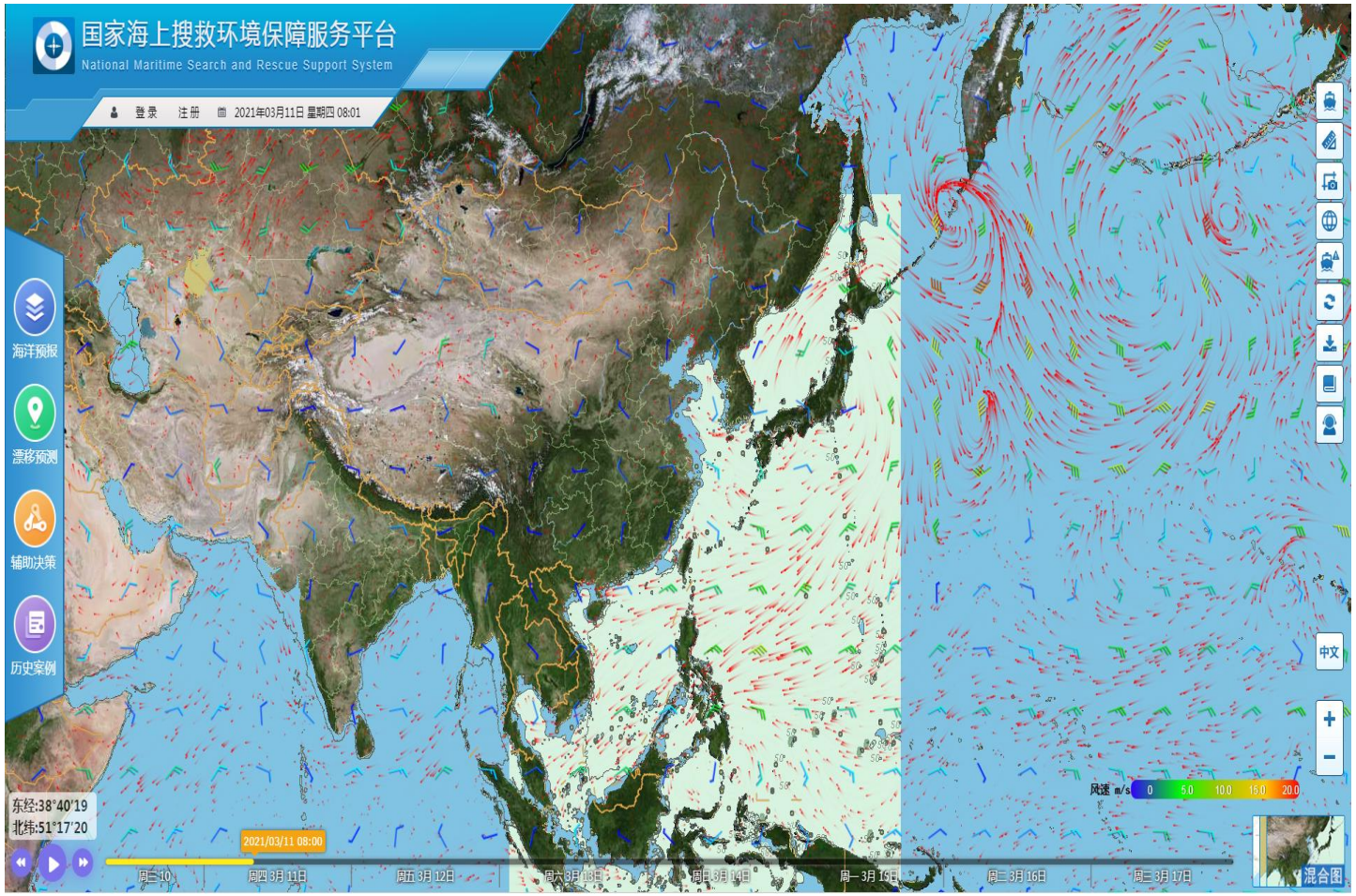
Video of live disposal

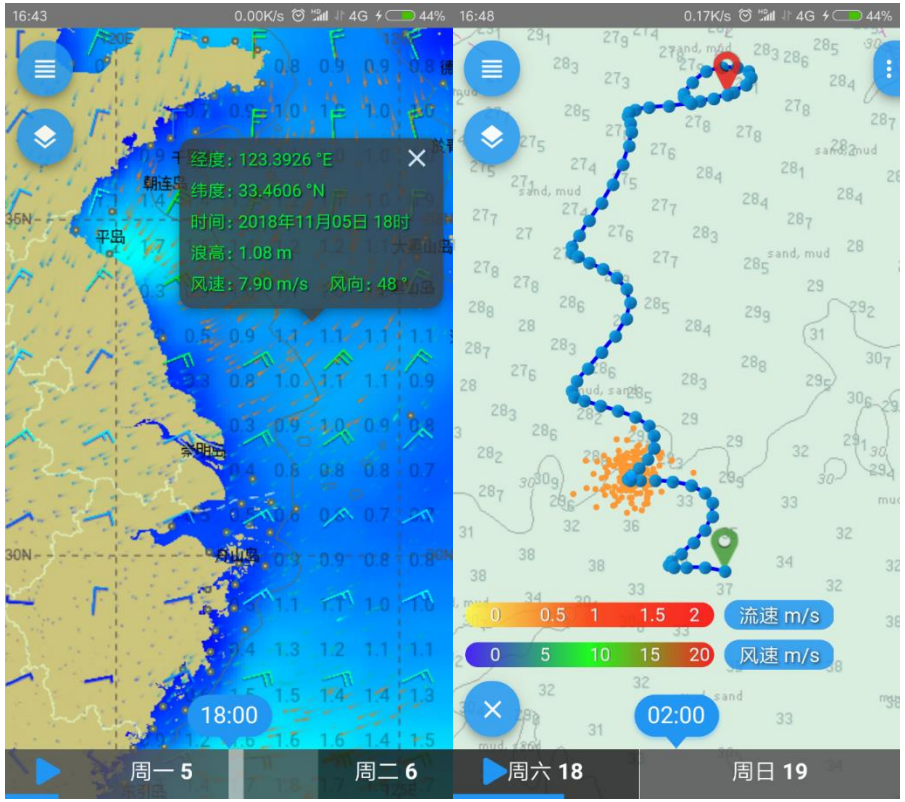
03

Decision support system for maritime search and rescue

3. Decision support system for maritime search and rescue

As a member of the National Maritime Search and Rescue (SAR) joint meeting, our mainly responsibility is to provide oceanic forecast and decision support information. We developed the national maritime search and rescue support platform, which has been applied to the maritime search and rescue centers in various provinces and cities across the country. The users are more than 900.





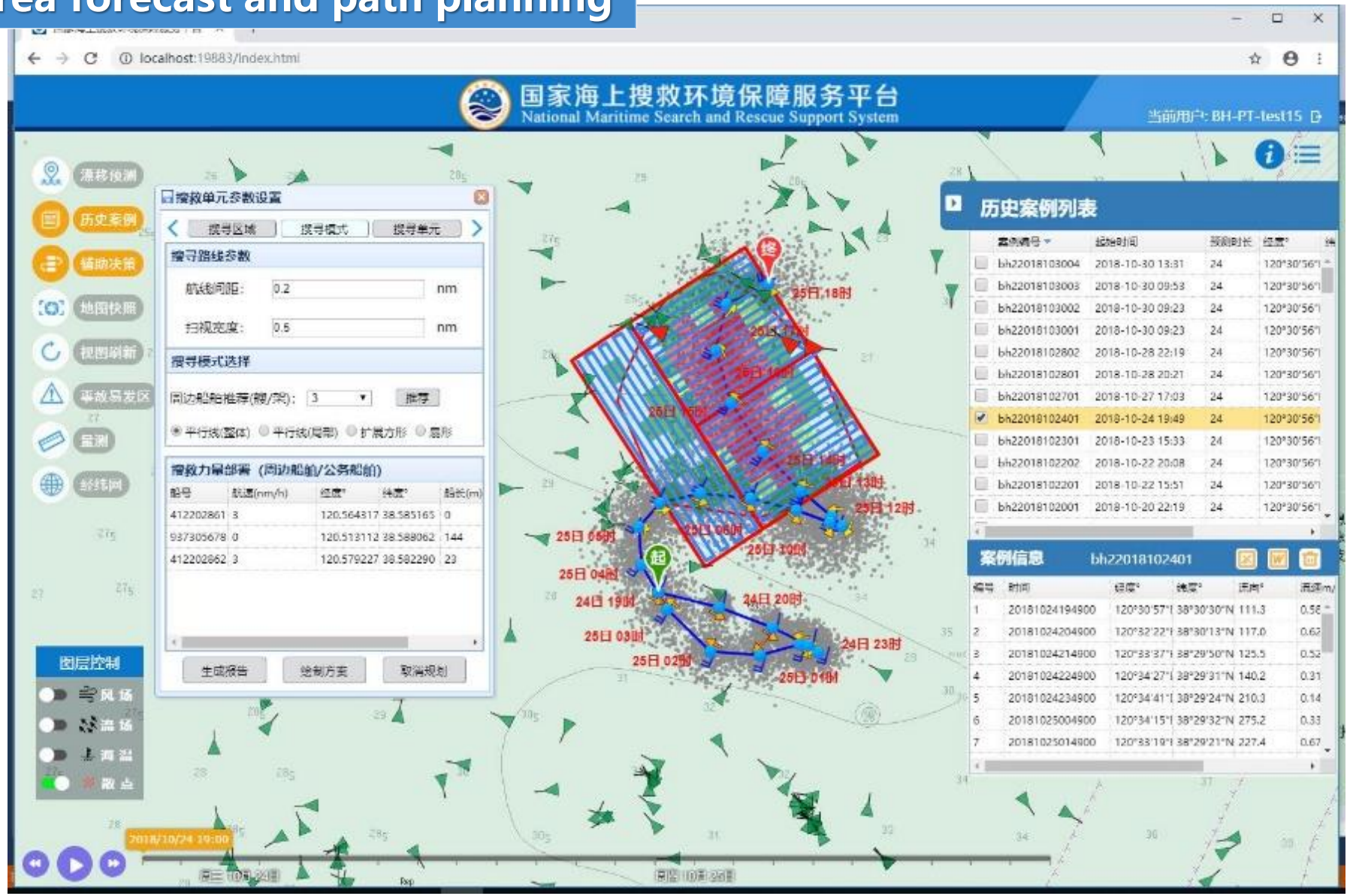
3. Decision support system for maritime search and rescue

Trajectory forecast

< 2 min

3. Decision support system for maritime search and rescue

Searching area forecast and path planning



04

Cooperation and Application

4. International Cooperation

University of Hamburg

Danish meteorological institute

Finnish meteorological institute

Arctic Council

PICES

China-ASEAN

Malaysia, Indonesia

Commonwealth Scientific and Industrial Research Organization, Australia

Bedford Institute of Oceanography

NOAA GLERL

North Carolina State University

4. Cooperation on offshore oil spill

There was one oil spill case happened in Indonesia on July 12, 2019. With our monitoring technology, we obtained the distribution information of spilled oils from 20th to 30th, and sent the results to our partner (Institute Technology of Bandung, ITB). And they confirmed that the monitoring results were consistent with the actual location.

Q:Where and when did you find the oil on the coast?

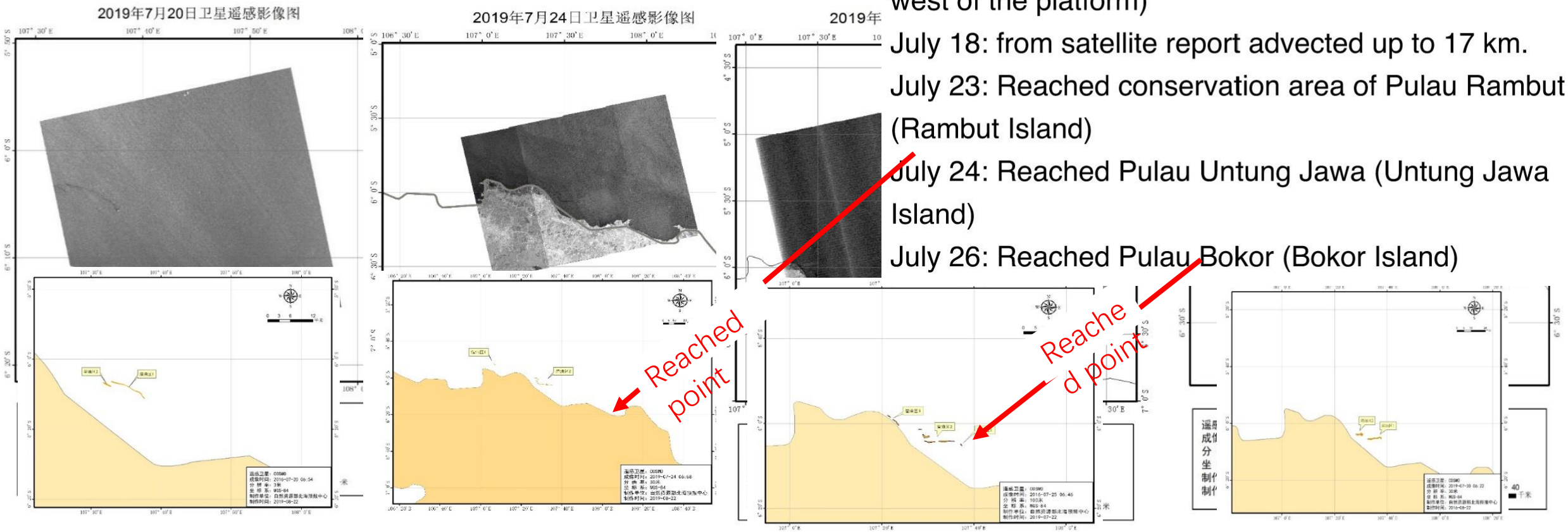
A: July 18: coastal impact started to occur (2 km from west of the platform)

July 18: from satellite report advected up to 17 km.

July 23: Reached conservation area of Pulau Rambut (Rambut Island)

July 24: Reached Pulau Untung Jawa (Untung Jawa Island)

July 26: Reached Pulau Bokor (Bokor Island)



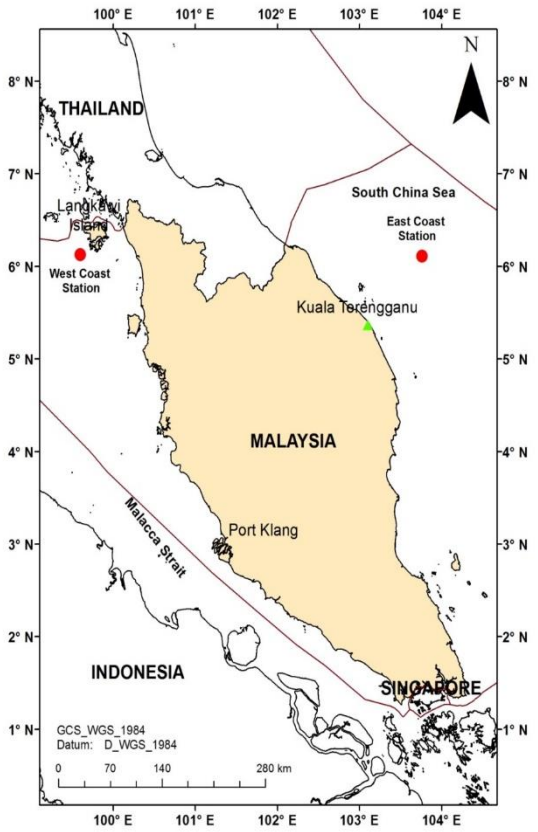
4. Application of National maritime search and rescue platform

- 2018.01, China-Indonesia Maritime Search and Rescue Technology Training Conference.
- 2018.03, signed the memorandum of understanding between Institut Teknologi Bandung (ITB) of Indonesia and NCSFDMC of China.

4. Application of National maritime search and rescue platform

- Jointly drifting experiment

2018.07.21-31, our center and the University Malaysia Terengganu (UMT) jointly carried out the drift tracking test of search and rescue targets in the east and west coast of Malaysia.

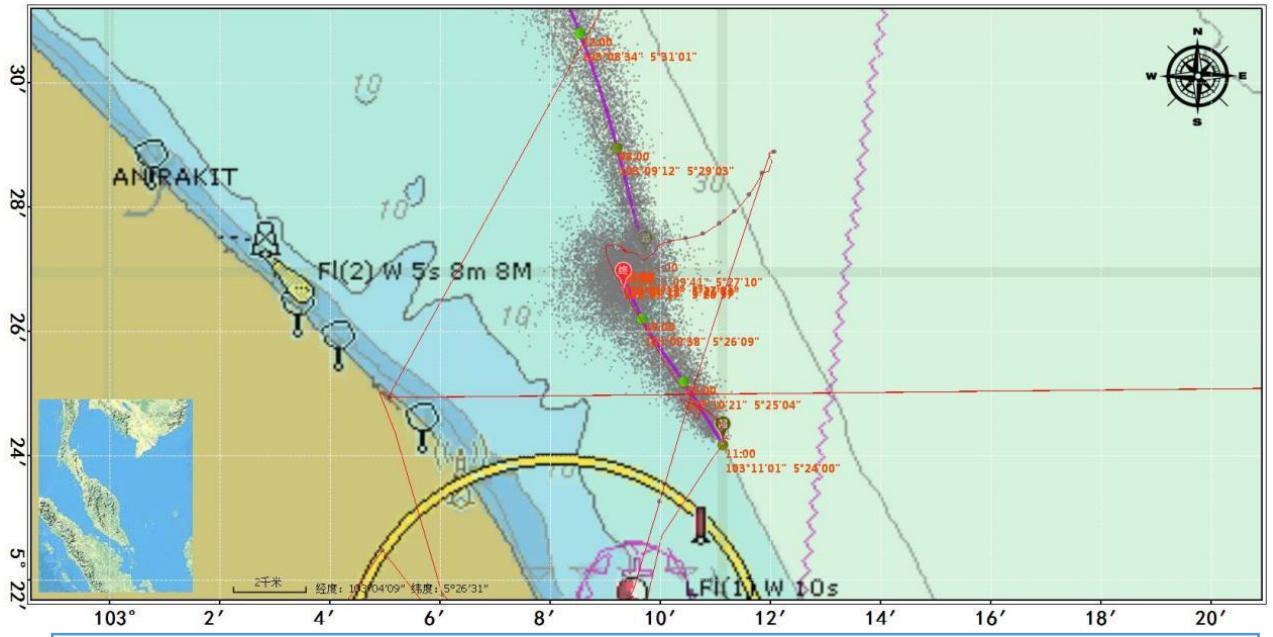


4. Application of National maritime search and rescue platform

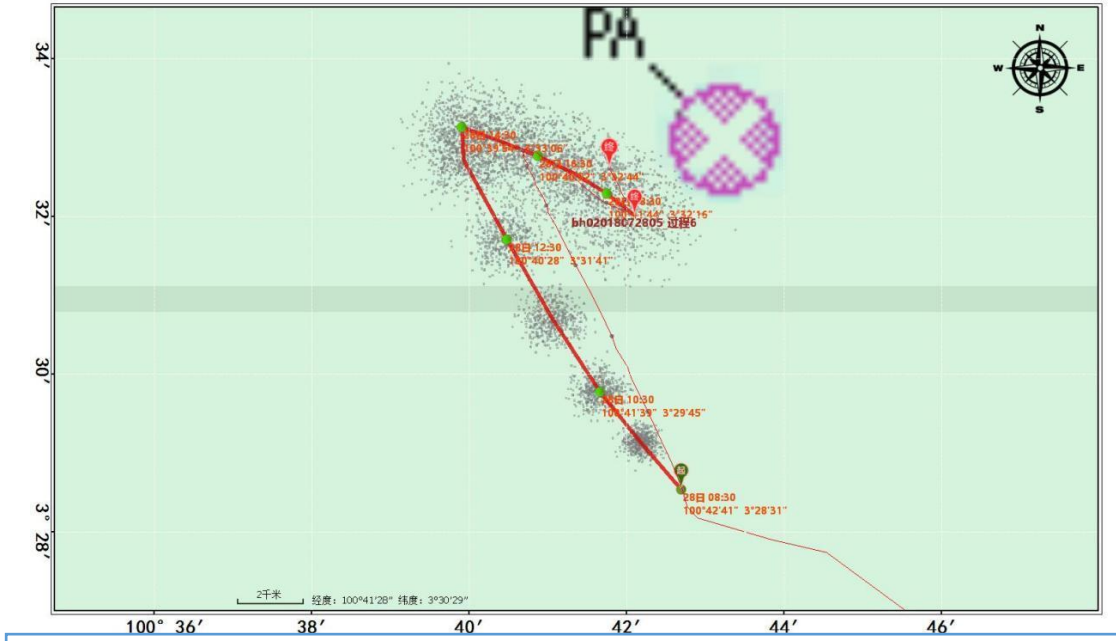
- Independently developed dummy for drift simulation
- The density of the dummy is the same as that of the human body, and its weight is equal to the average body weight
- Automatic location with real-time transmission,
- Diving grade seal, collision protection

4. Application of National maritime search and rescue platform

- Based on this experiments, we calculate the forecast error of our platform. The results show, that our forecast trajectories agree very well with the actual ones, with the average distance deviation less than 1km and the average direction angle deviation less than 15°.



Observational trajectory (purple) vs forecast trajectory (red), in the east coast.



Observational trajectory (thick) vs forecast trajectory (thin), in the west coast.

谢谢！

Thank You