

Introduction of Operational Marine Environmental Disaster Monitoring using Remote Sensing Data

HY-1B
HY-2A

Bin Zou

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Hyderabad, India, 2016-3-8

National Satellite Ocean Application Service, China

OUTLINE

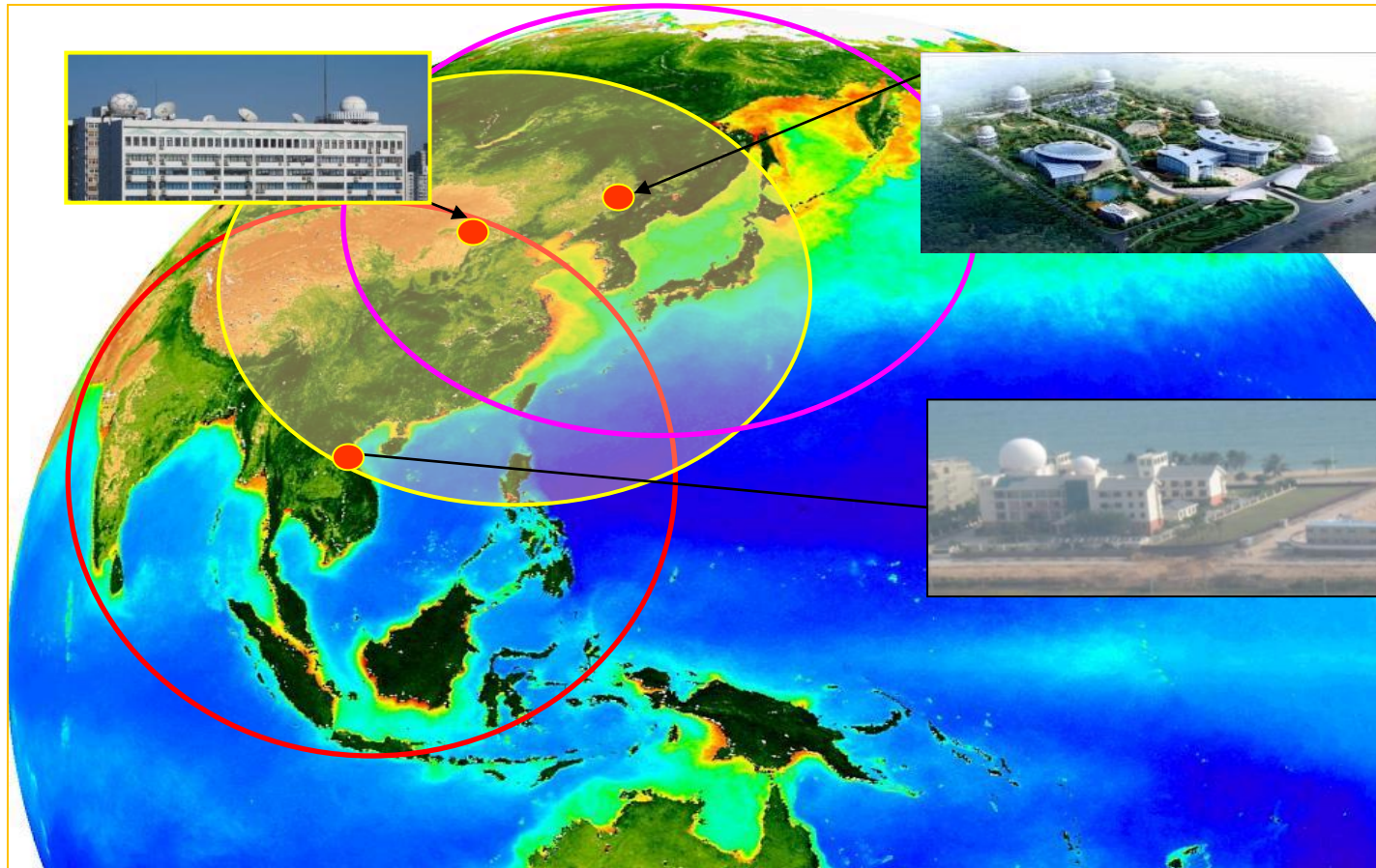
- 1. Who is NSOAS**
 - 2. The operational system**
 - oil spill**
 - sea ice, green tide**
 - typhoon**
 - Emergency monitoring Team**
 - 3. International cooperation**
 - 4. Summary**
-

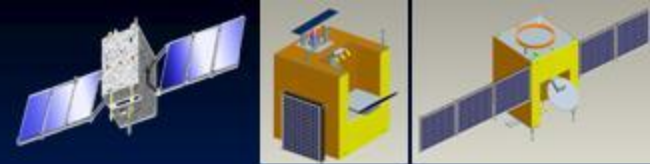
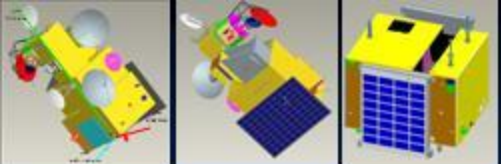
1. Who is NSOAS

- **The National Satellite Ocean Application Service (NSOAS) was founded on Nov. 19th, 1998. It is a scientific research and operational service department under the State Oceanic Administration of China**
- **The main functions of NSOAS include:**
- **---To make strategy and development program for Chinese oceanic satellites.**
- **---To build up ground segment for Chinese oceanic satellites**
- **---To fulfill scientific researches on oceanic satellite technology**
- **---To be responsible for receiving, processing, distributing and application of oceanic satellite data.**
- **---To carry out satellite marine monitoring system**



One Processing Center and three Station



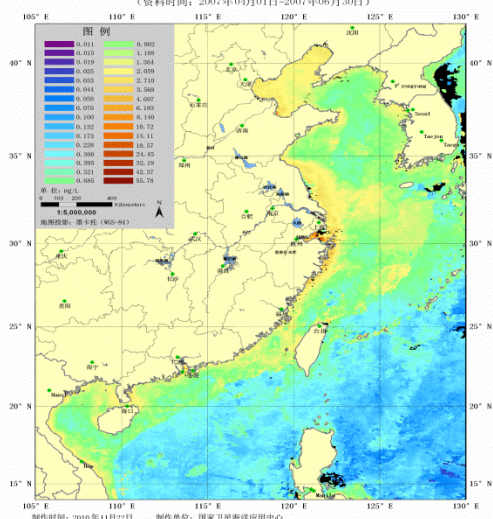


China Ocean Satellite Plan & Status

- ***HY-1A 2002.5.15 (Stop work)***
- ***HY-1B 2007.4.11 (Stop work in Feb. 2016)***
- ***HY-2A 2011.8.16 launch***
 - *For Ocean dynamic environment parameters (Wind, SSH, SST)*
 - *Sensor are ALT, SCA, MR, GPS, DORIS*
- ***HY-1C/1D (will be approved)***
 - *For Ocean color, SST, Coast zone*
 - *Sensor are COCTS (Chinese ocean color and temperature scanner) ,CZI (Coast zone imager)*
- ***HY-3***
 - *For pollution hazard, sea ice, ship, coast zone*
 - *Sensor are SAR, ...*



卫星遥感水体叶绿素浓度专题图



chlorophyll

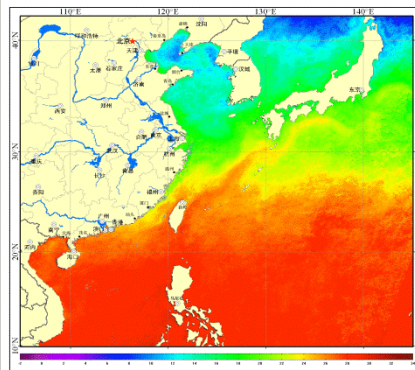


Green algae bloom

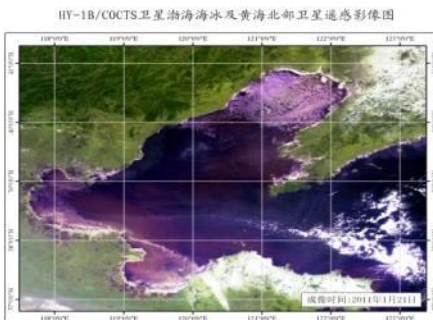


suspended sediment

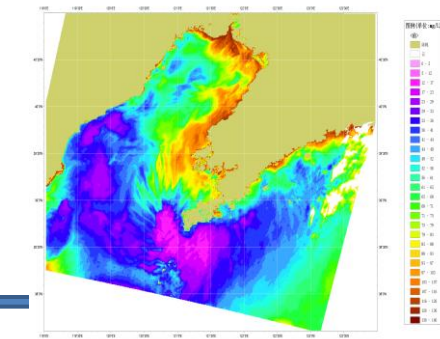
HY-1B卫星遥感海面温度专题图



SST

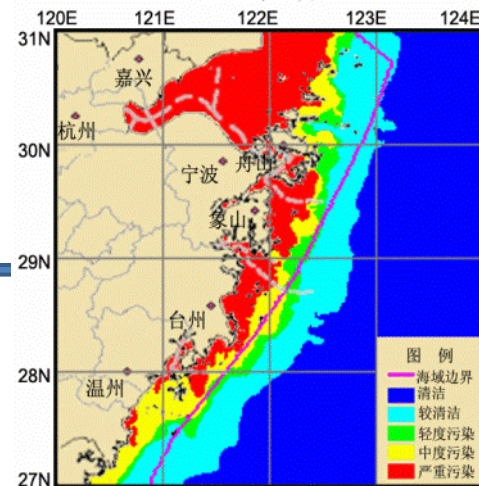


Sea ice

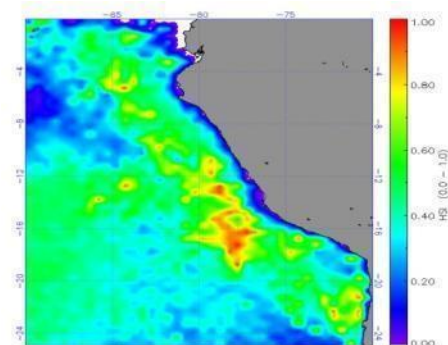


Estuary and coastal zone

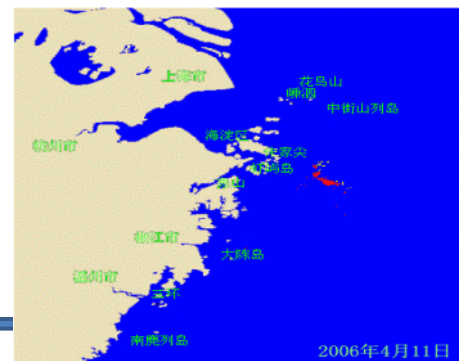
2008年01月



Water quality



Fishery environment

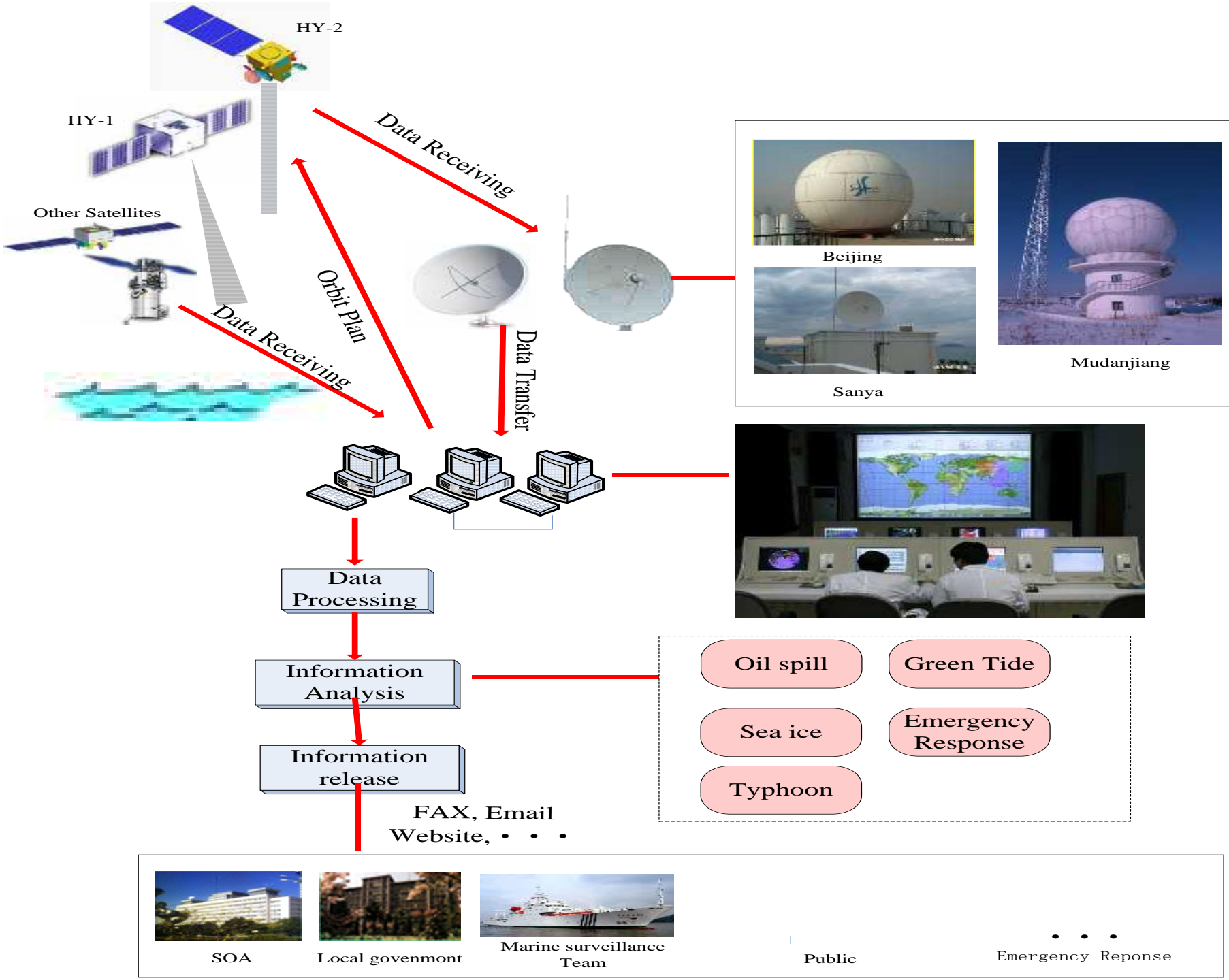


Red tide

2. The operational system

Remote sensing system for marine disaster monitoring

Providing useful data products and information derived from satellite sensors on a continued basis for its use in routine monitoring applications related to marine environmental disaster, like sea ice, oil spill , red tide and typhoon for local and state governments, commercial entities, academic institutes, non-governmental agencies and public at large for early warning and emergency response.



HY-2

HY-1

Other Satellites

Data Receiving

Orbit Plan

Data Receiving

Data Transfer

Beijing

Sanya

Mudanjiang

Data Processing

Information Analysis

Information release

FAX, Email
Website, . . .

Oil spill

Green Tide

Sea ice

Emergency Response

Typhoon

SOA

Local government

Marine surveillance Team

Public

Emergency Response

Satellites

www.nsoas.gov.cn

Type	satellite
Oil spill	ENVISAT-ASAR, RADARSAT-2, TerraSAR-X, COSMO-1/2/3/4, HJ-1A/B, Terra-MODIS, Aqua-MODIS
Sea ice	HY-1B/COCTS、Terra/MODIS、Aqua/MODIS、RADARSAT-2、COSMO-1/2/3/4、HJ-1A/B
Algae bloom	HY-1B/COCTS、Terra/MODIS和Aqua/MODIS、FY3/MERSI、HJ-1A/CCD、HJ-1B/CCD、RADARSAT-2、COSMO-1/2/3/4
Typhoon	HY2-SCAT

2.1 Oil Spill Monitoring in Action

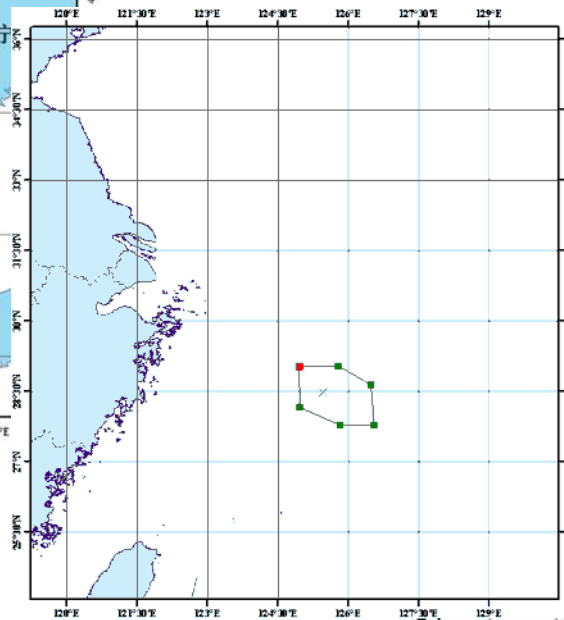
- NSOAS carries out operational monitoring of oil spill by remote sensing since 2007, Under RS and GIS support, NSOAS uses SAR data, in combination with other data to monitor marine oil spill, focusing on the Bohai Sea, South China Sea, East China Sea.
- NSOAS has processed over 3000 ENVISAT data , and 600 COSMO ,Radarsat-2 data, 500 Monitoring Reports published. particularly in the July 25, 2007 , NSOAS firstly monitors the one oil pipeline oil spill incidents, severing for China Marine surveillance.
- Take part in many oil spill Emergency response actions.
- Intentional oil spill
- Improve the efficiency of decision making and cleaning.

Oil Spill Operation Monitoring Zones

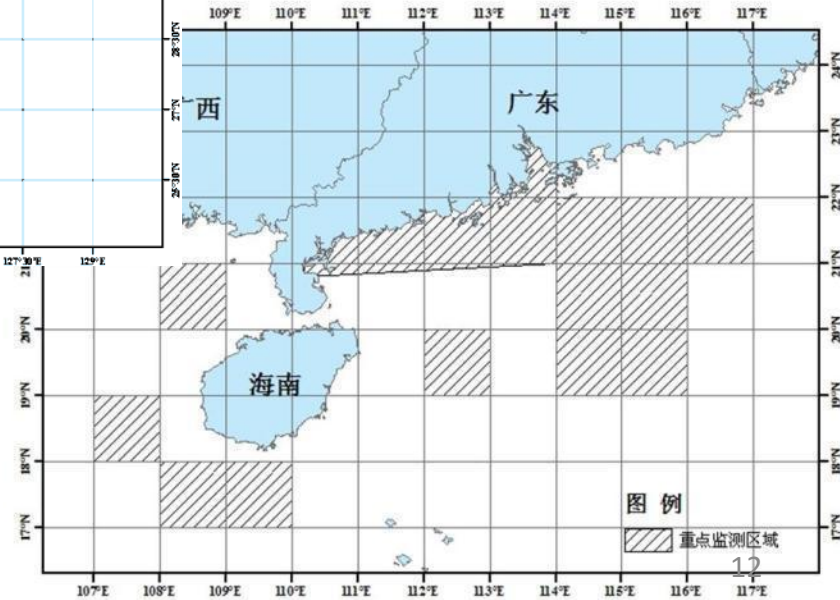


Bohai Sea (from 2007)

East China Sea (from 2009)



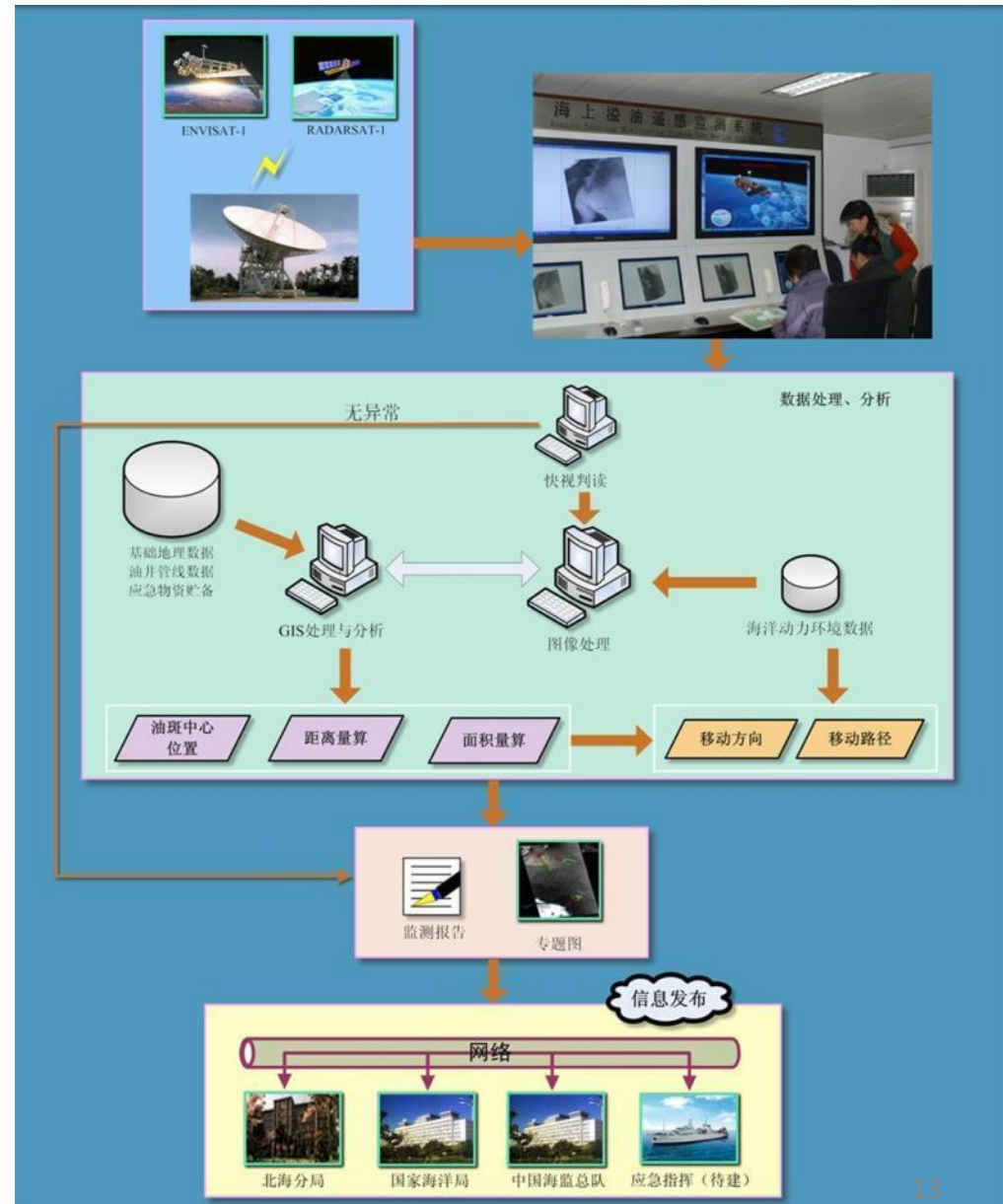
South China Sea (from 2008)



Operation steps

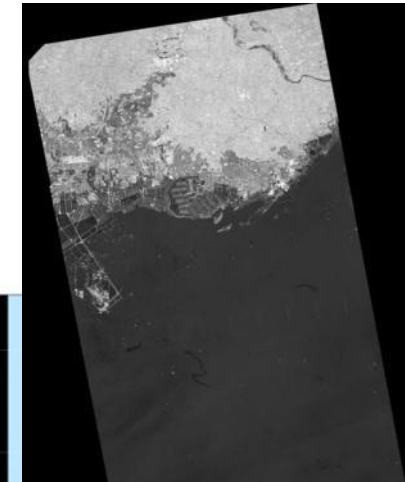
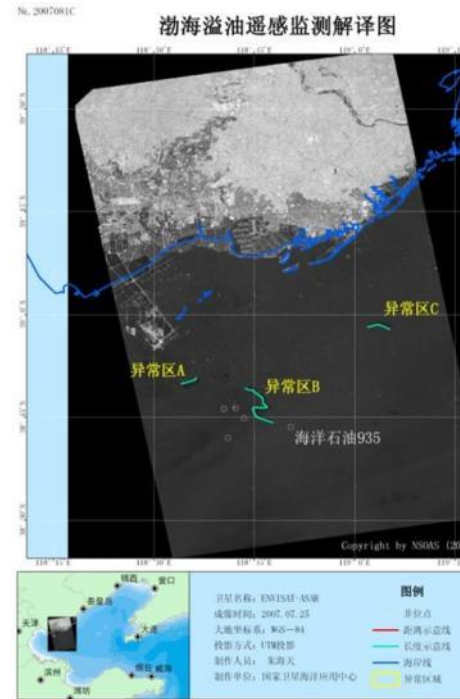
Analyse the interest of several data sources (SAR, colour, SST, currents, oceanographic model forecasts) as an auxiliary data set for improved detection and environmental conditions for first guess of the spill drift.

In case of an oil-spill detection, an analytical report is sent to run the oil-spill model for 3-day forecast based on the detection data. The SAR image analysis results together with the model forecasts will be available to the end-user through a dedicated web site.



Monitoring reports

- Service description
 - Geo-location, date
 - Parameters: area, size, orientation, complexity, contrast
 - Reliability
 - Potential Source (Ship, platform, ...)
 - Metocean environmental conditions
- Early warning system:
 - Semi-automatic detection scheme
 - Validation by trained operators
- Required evolution
 - Ancillary information to reduce FAR (ambiguous slicks)
 - Coupling with AIS



No. 2007081C

渤海溢油遥感监测

2007 第 081 期

通信地址: 北京市海淀区大慧寺 8 号
电 话: (010) 62105704
国家卫星海洋应用中心

2007 年 07 月 26 日 0 时 发布

数据类型:	ENVISAT IMG 模式	坐标系:	WGS-84
成像时间:	2007 年 07 月 25 日 22 时 04 分 24 秒	轨道号:	28235
传输完成时间:	2007 年 07 月 25 日 23 分 38 分 26 秒	制作完成时间:	2007 年 07 月 26 日 00 分 10 分 23 秒
西北角坐标:	东经 118° 16' 49" 北纬 39° 36' 50"	东北角坐标:	东经 119° 16' 55" 北纬 39° 39' 2"
西南角坐标:	东经 118° 21' 38" 北纬 38° 26' 2"	东南角坐标:	东经 119° 20' 43" 北纬 38° 23' 56"

溢油情况:	
是否发现异常:	发现异常
油斑数量:	3

异常描述:
曹妃甸海域发现三处异常。

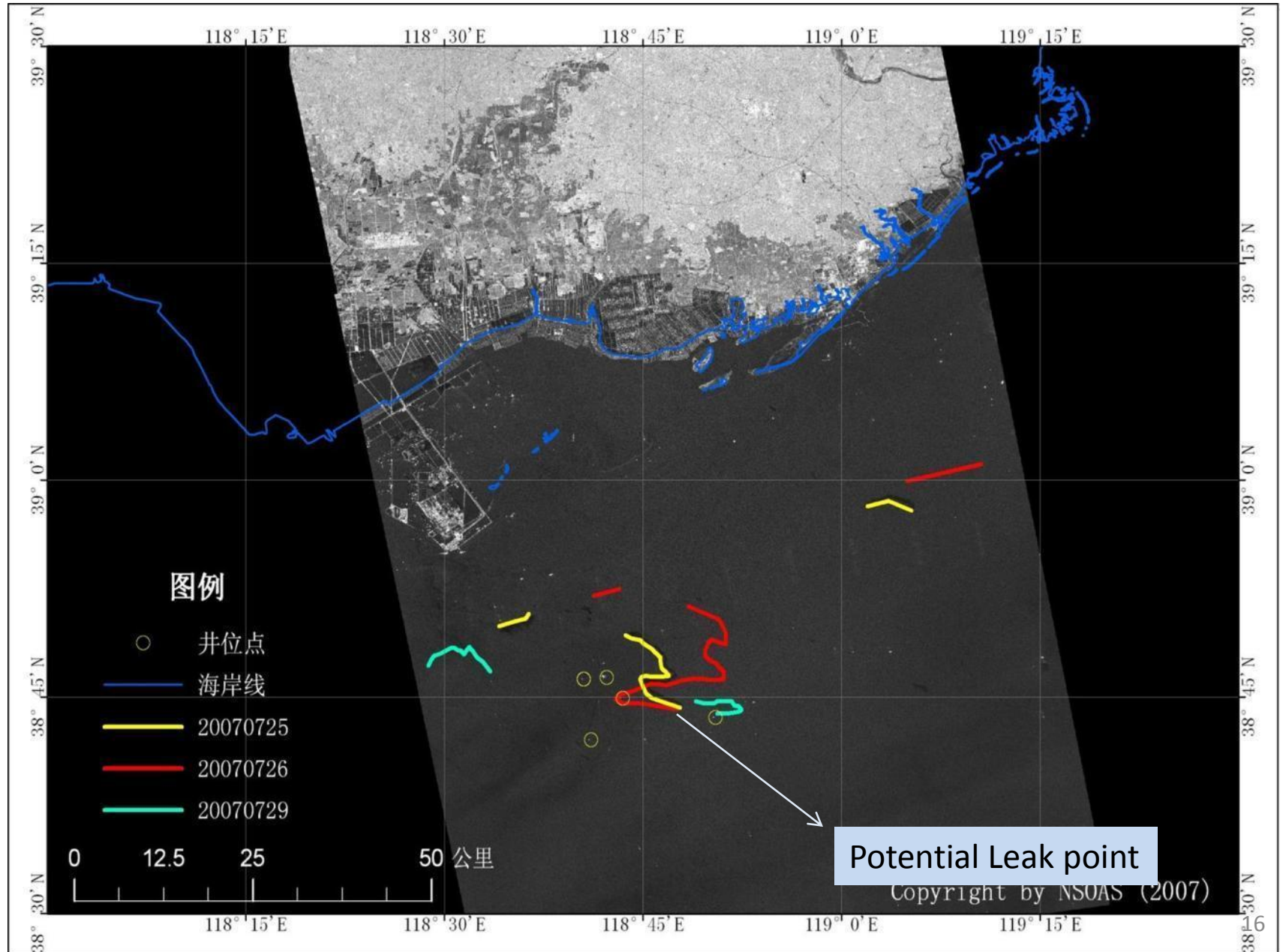
- ① 异常区 A: 呈粗带状, 长约 3.7 公里, 起止经纬度为 (118° 31' 13"E, 38° 49' 32"N) 至 (118° 36' 50"E, 38° 50' 39"N)。
- ② 异常区 B 呈之字形细长条带状, 长约 17.1 公里, 从距离“海洋石油 935”3.5 公里处起, 向西北方向延伸, 起止经纬度为 (118° 43' 51"E, 38° 49' 27"N) 至 (118° 48' 00"E, 38° 44' 26"N)。
- ③ 异常区 C: 呈带状, 长约 5.2 公里, 起止经纬度为 (119° 01' 45"E, 38° 58' 23"N) 至 (119° 05' 28"E, 38° 58' 08"N)。

值班员: 朱海天
审 核: 王华
签 发: 王华

Oil spill response system



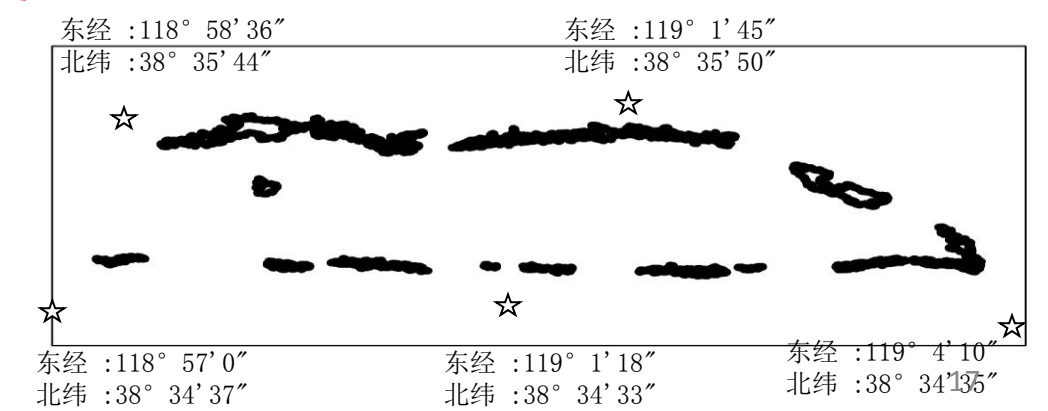
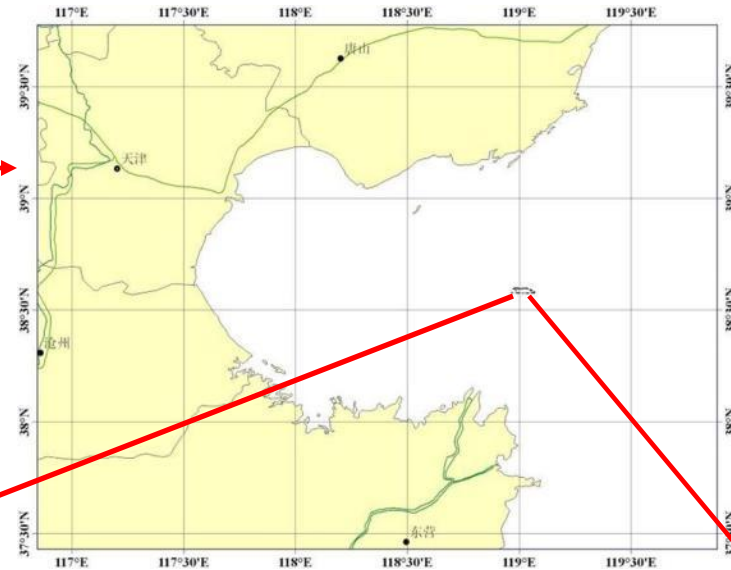
2007.07.25/26/29 multiple image anylisis



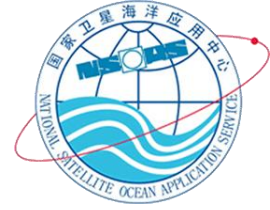
Joint Action to deal with oil spill in effect



31, Mar., 2009 Bohai oil spill



Dalian Oil Spill, 2010

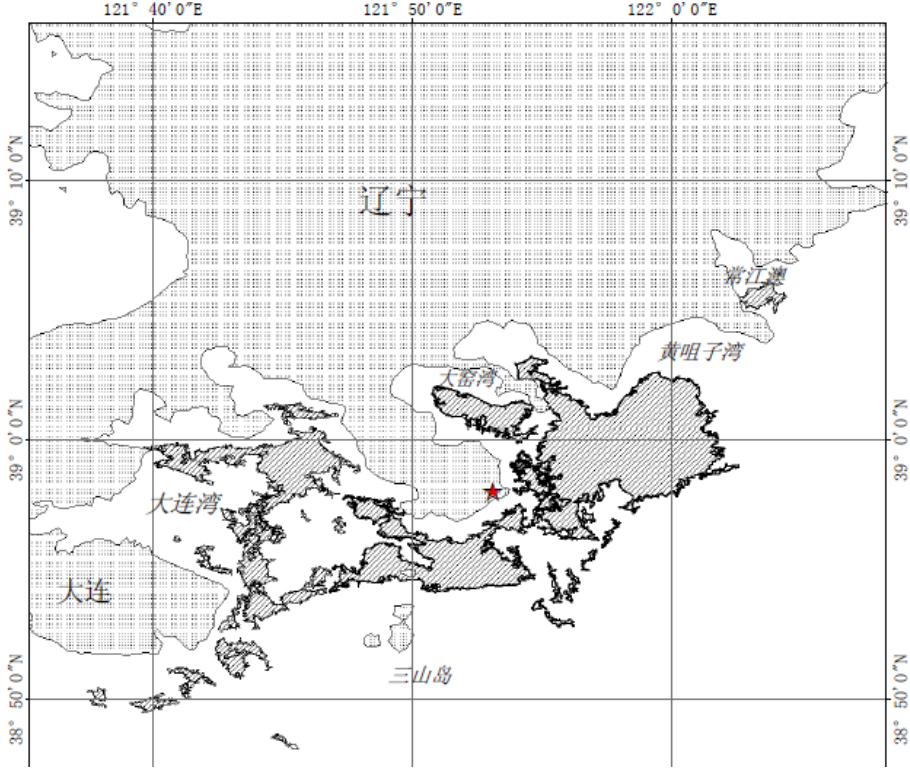
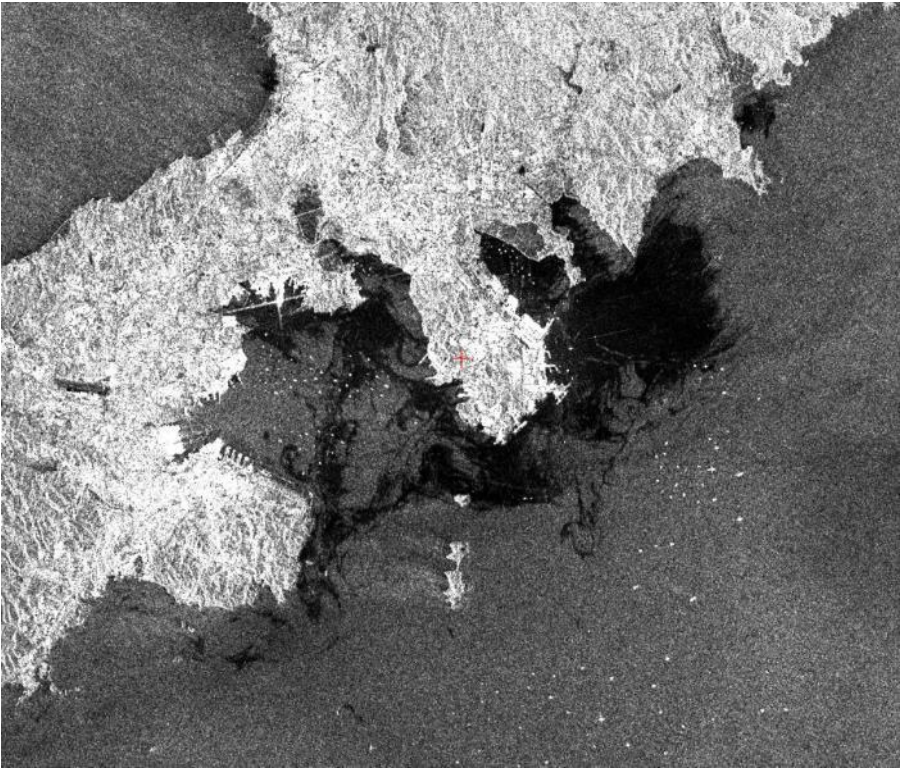


A fisherman displays cultured sea snails polluted by the oil pipeline explosion on July 16 in Dalian, a port city in Northeast China's Liaoning province, in this file photo taken on July 20. Provided to China Daily



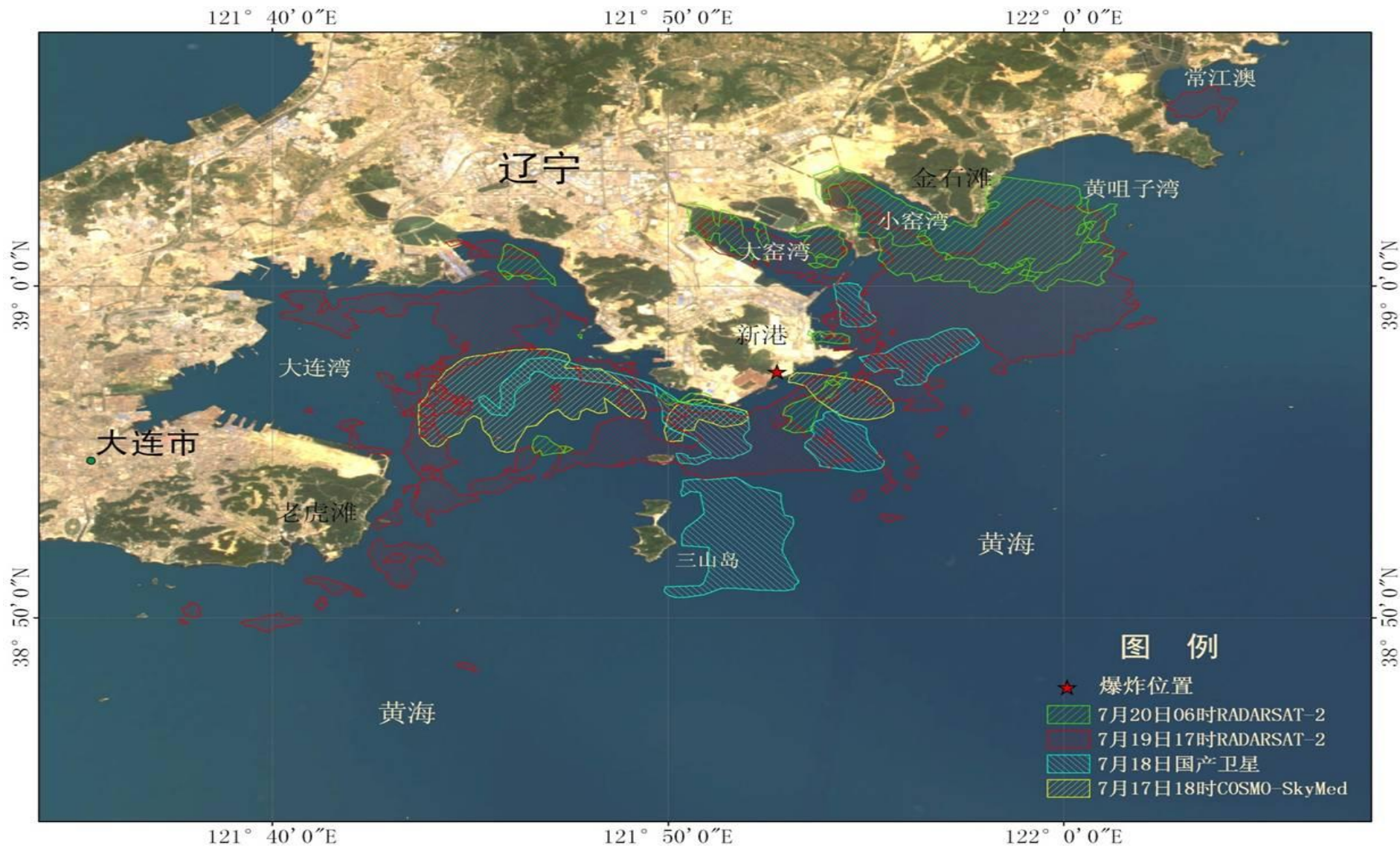
China Daily, Sep.16, 2010

Dalian Xingang oil pipeline explosion in July, 2010



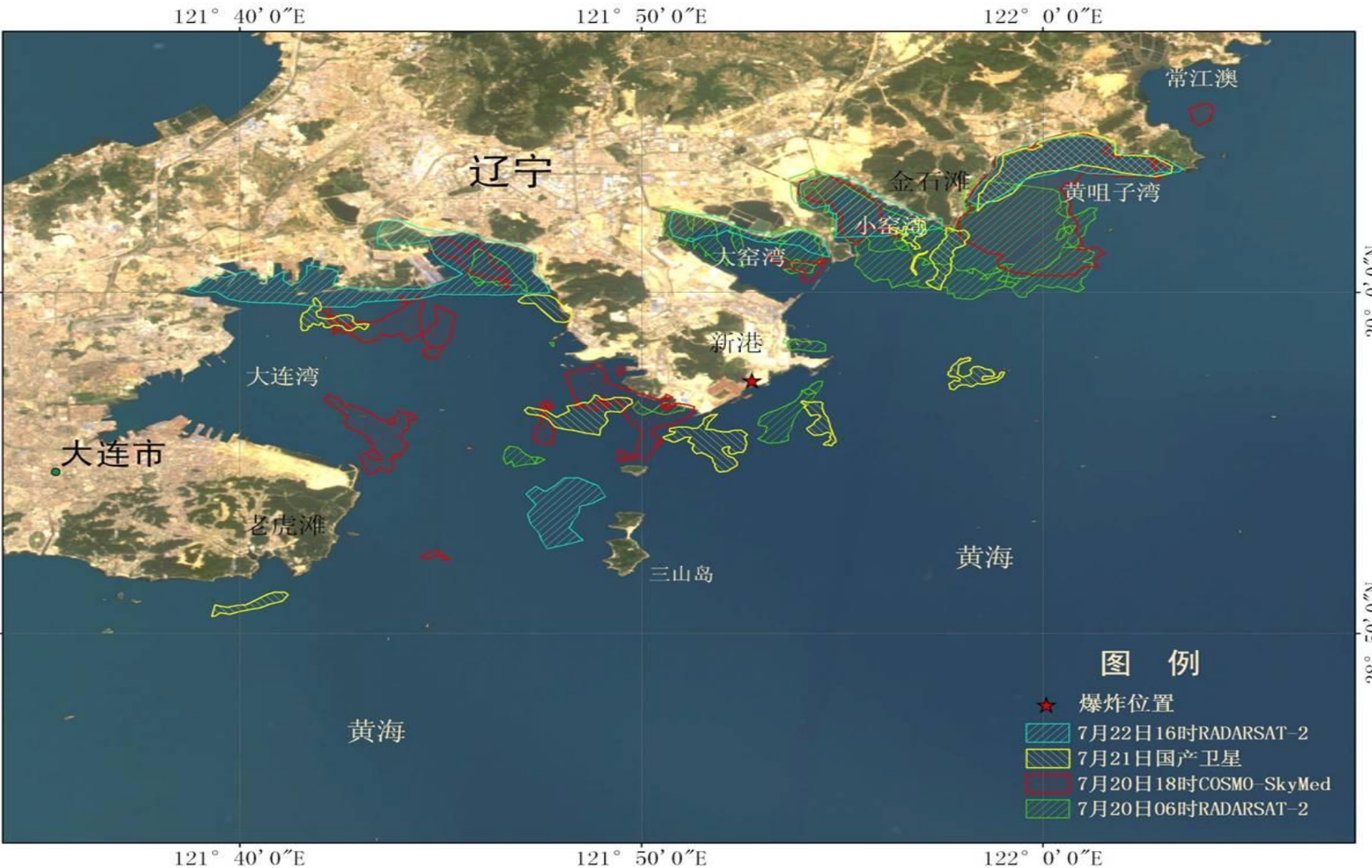
Dalian Xingang oil pipeline explosion 17-20 July, 2010

海面漂油分布7月17日至20日



Dalian Xingang oil pipeline explosion 20-22 July, 2010

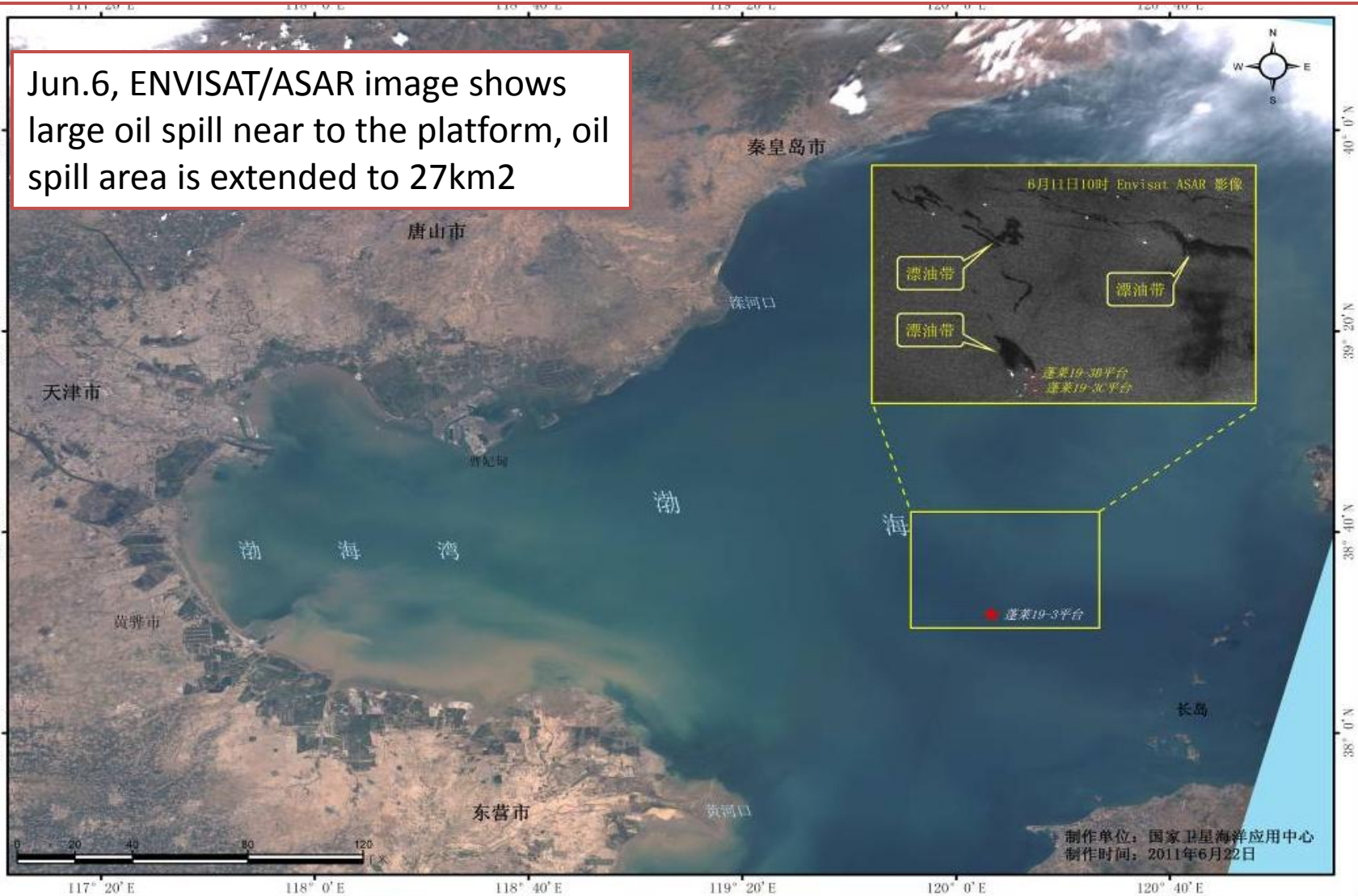
海面漂油分布7月20日至22日



❖ Penglai 19-3 platform accident in 2011

Penglai 19-3 oil spill accident brought great damage to marine ecological environment, satellite data help the decision making and law enforcement.

Jun.6, ENVISAT/ASAR image shows large oil spill near to the platform, oil spill area is extended to 27km²



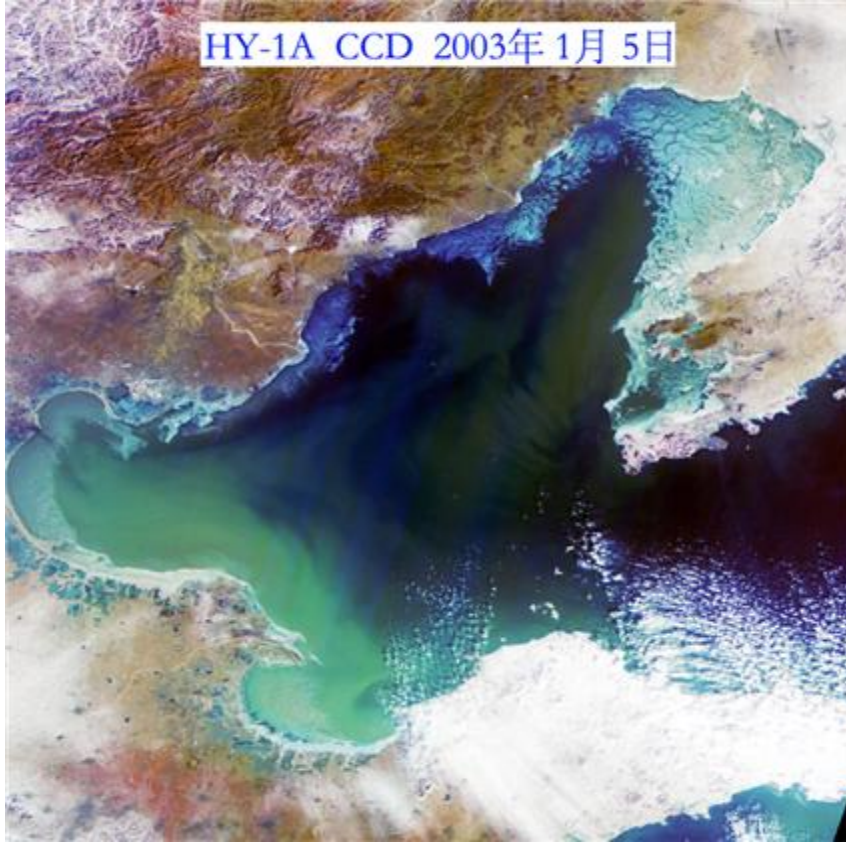
Penglai 19-3 platform accident in 2011



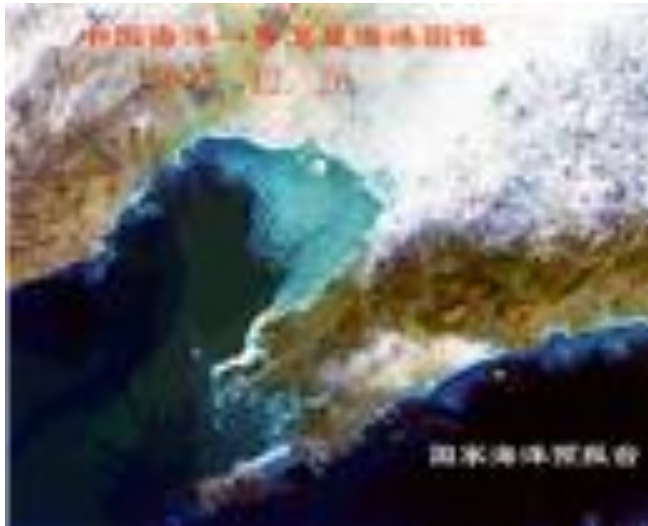
2.2 Sea Ice Monitoring

- carries out operational monitoring of Bohai sea ice by remote sensing since 2001
- uses HY-1,NOAA,MODIS data, in combination with other data to monitor sea ice on Bohai.
- Dec. 1st - Mar. 31st

HY-1/CCD and EOS-modis Sea Ice image



Bohai Sea ice



Sea ice thickness, concentration,

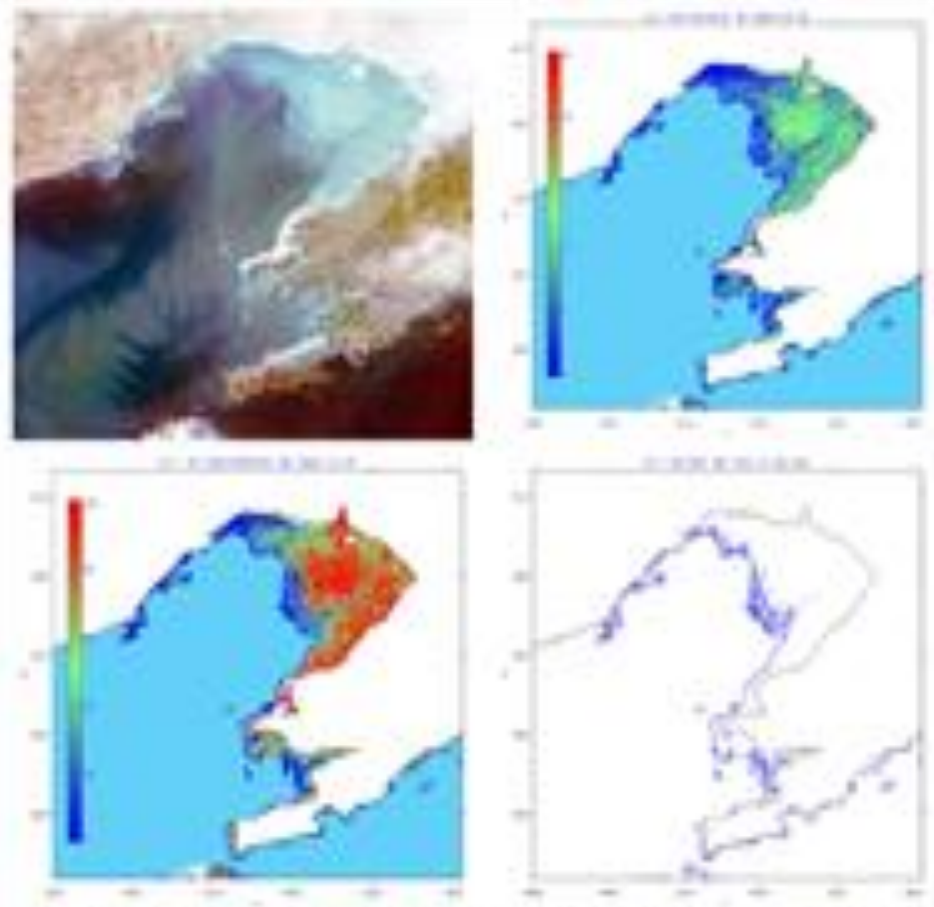
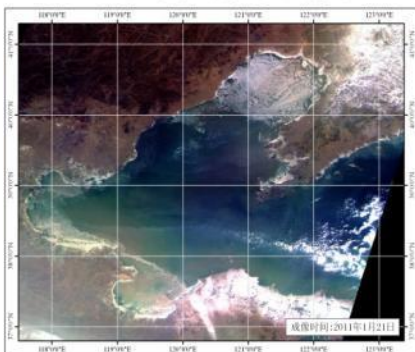


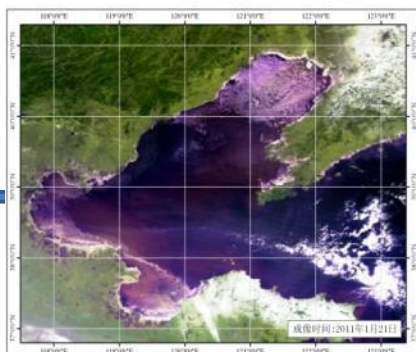
Figure 7. The sea ice image and ice thickness, concentration, edge distribution from CCD

Provide initial parameter for sea ice forecast

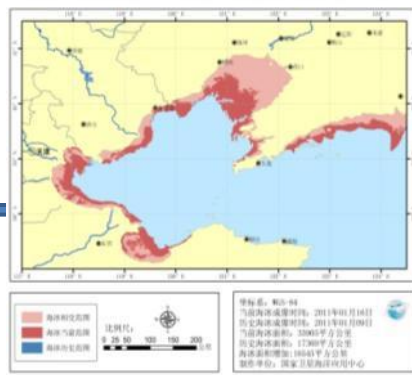
HY-1B/CZI卫星渤海海冰及黄海北部卫星遥感影像图



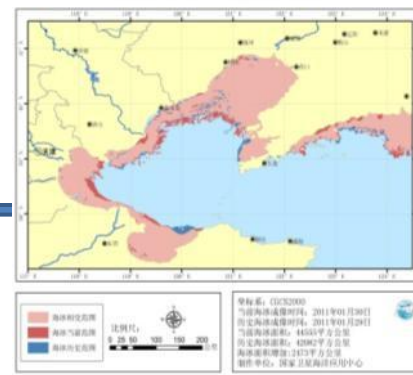
HY-1B/COCTS卫星渤海海冰及黄海北部卫星遥感影像图



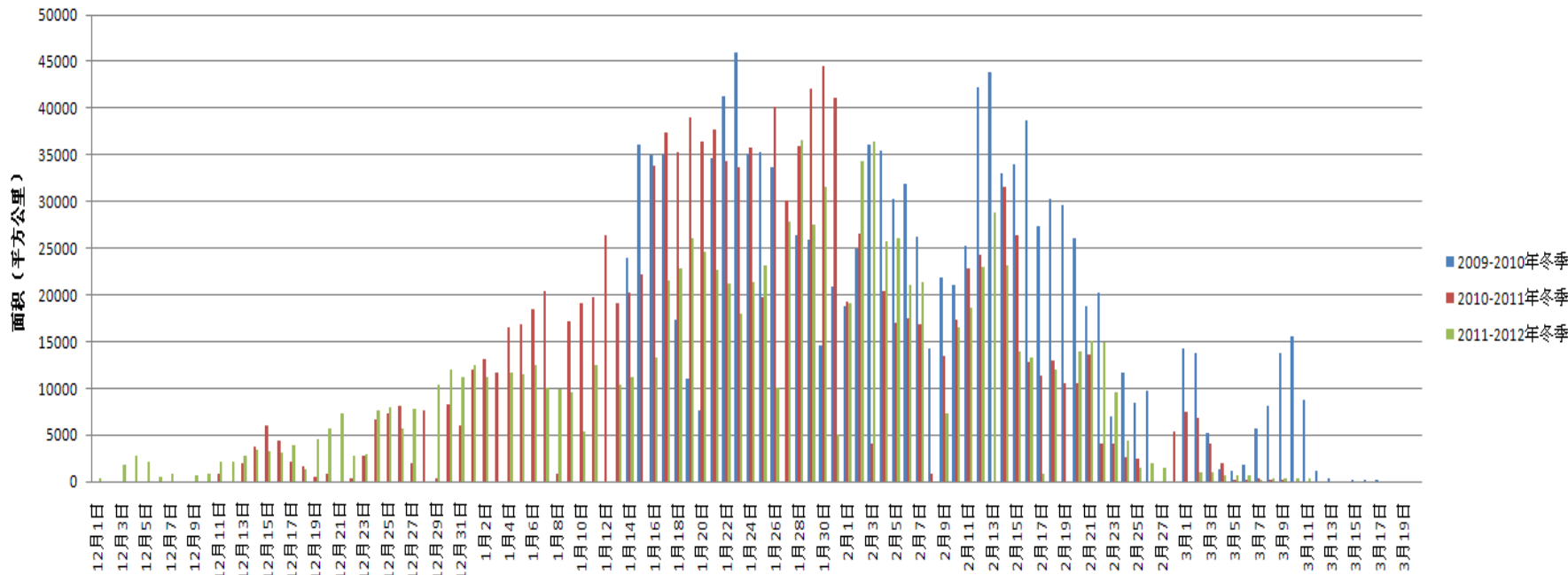
光学卫星遥感渤海及黄海北部海冰生长分析专题图



光学卫星遥感渤海海冰专题图



渤海和黄海海冰近三年分布面积统计分析



2.2 Green Algae monitoring

Is it greensward?

No. It is green tide.

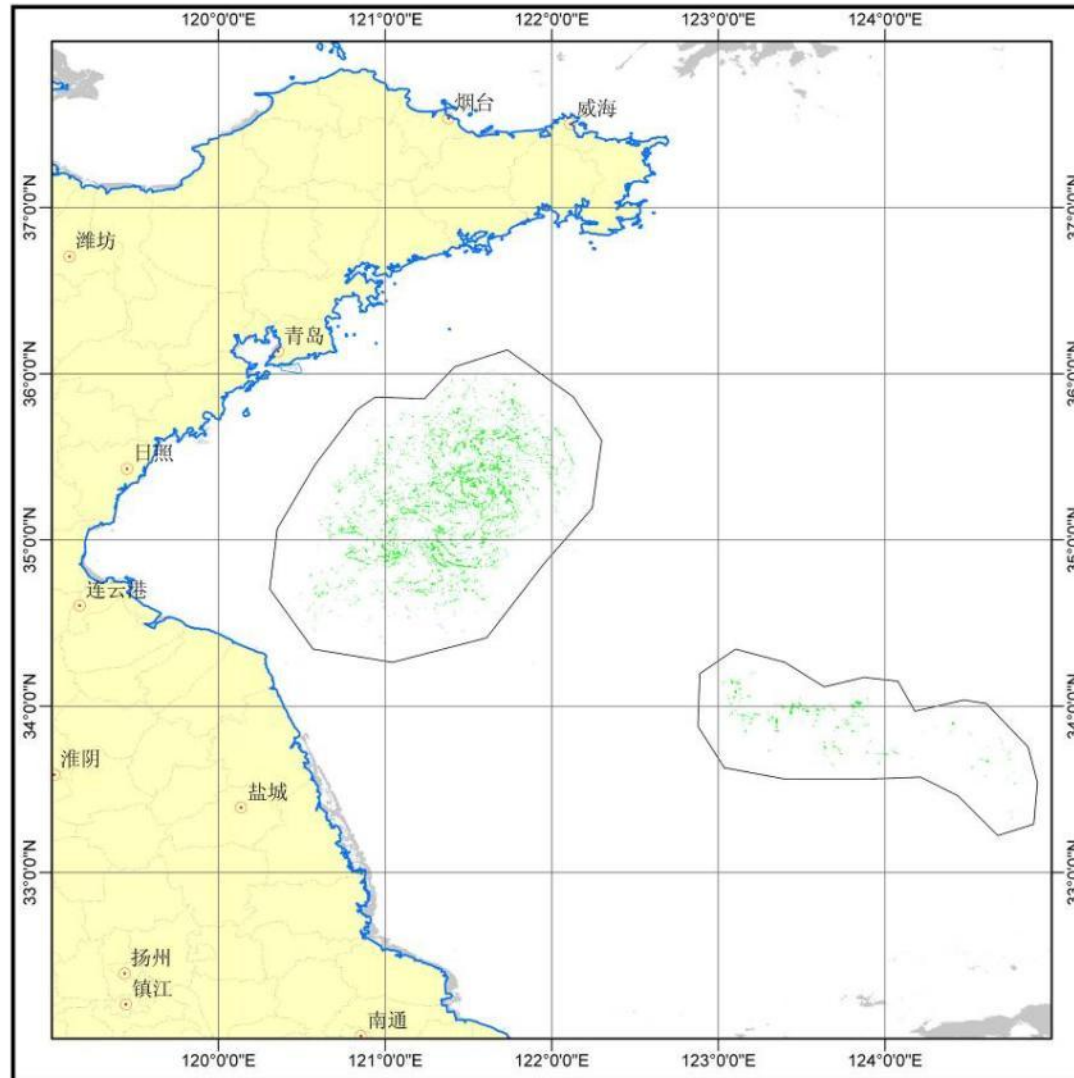




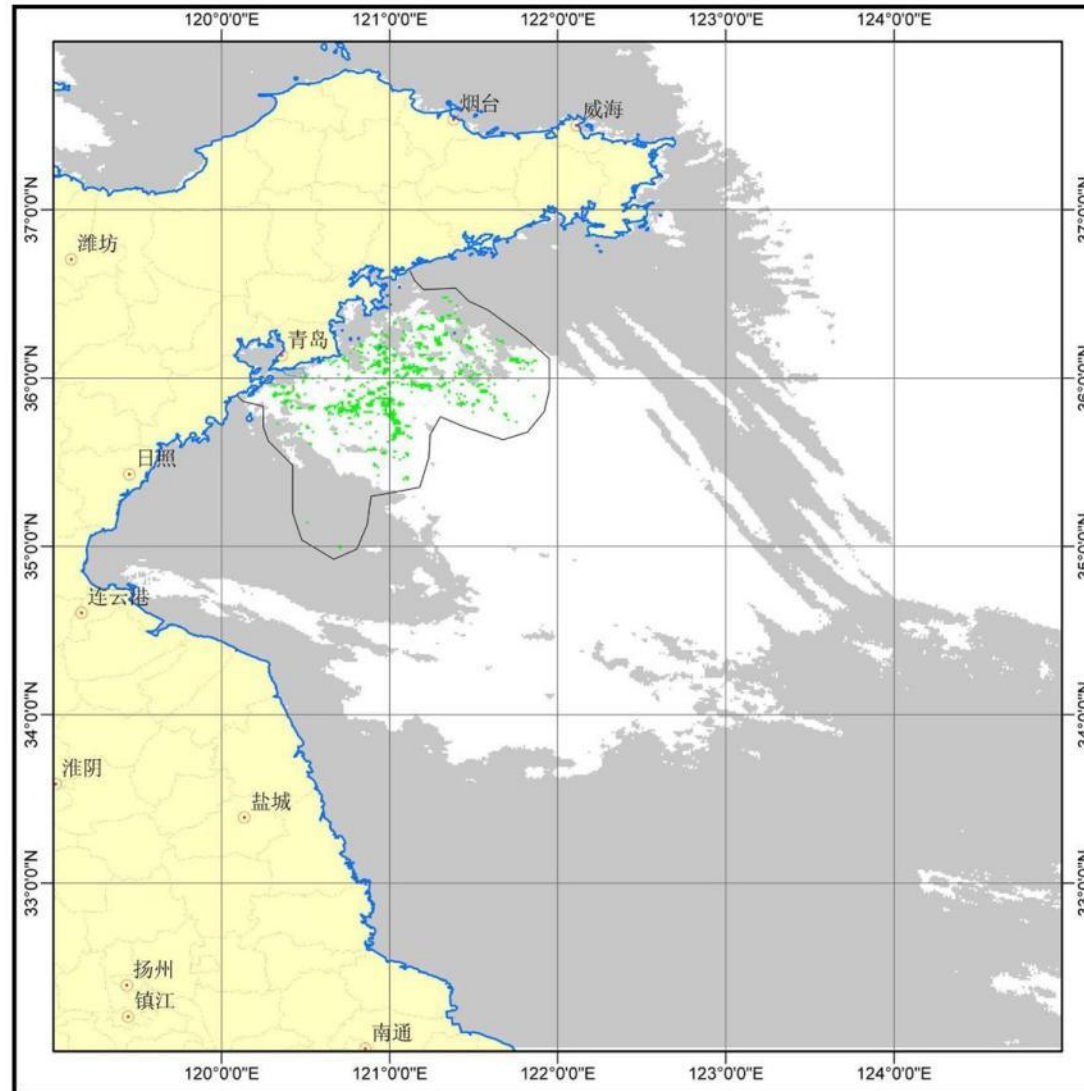
Qingdao Green Algae Bloom Remote Sensing Monitoring



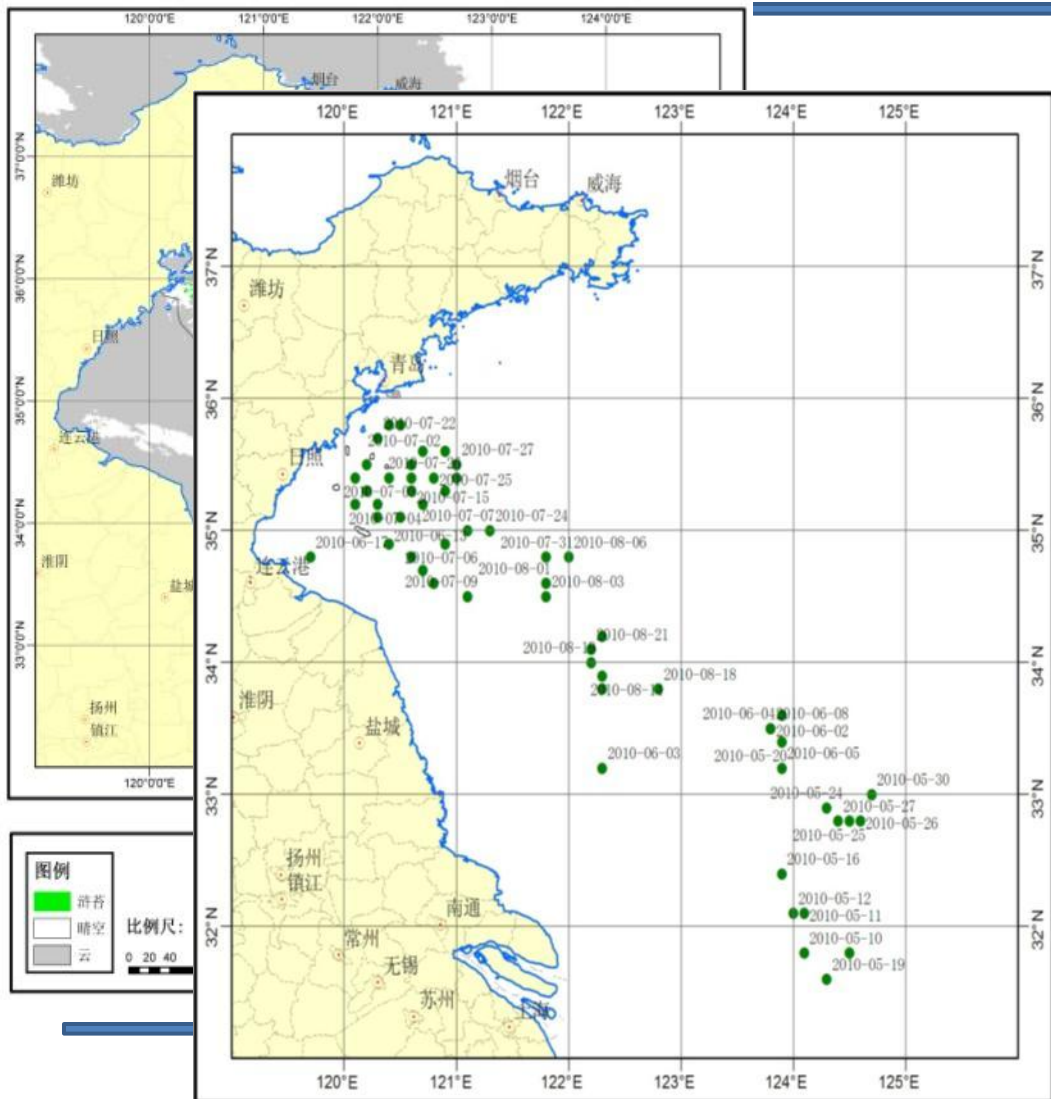
31th May, 2008 HY-1B image



15th, June, 2008 green algae

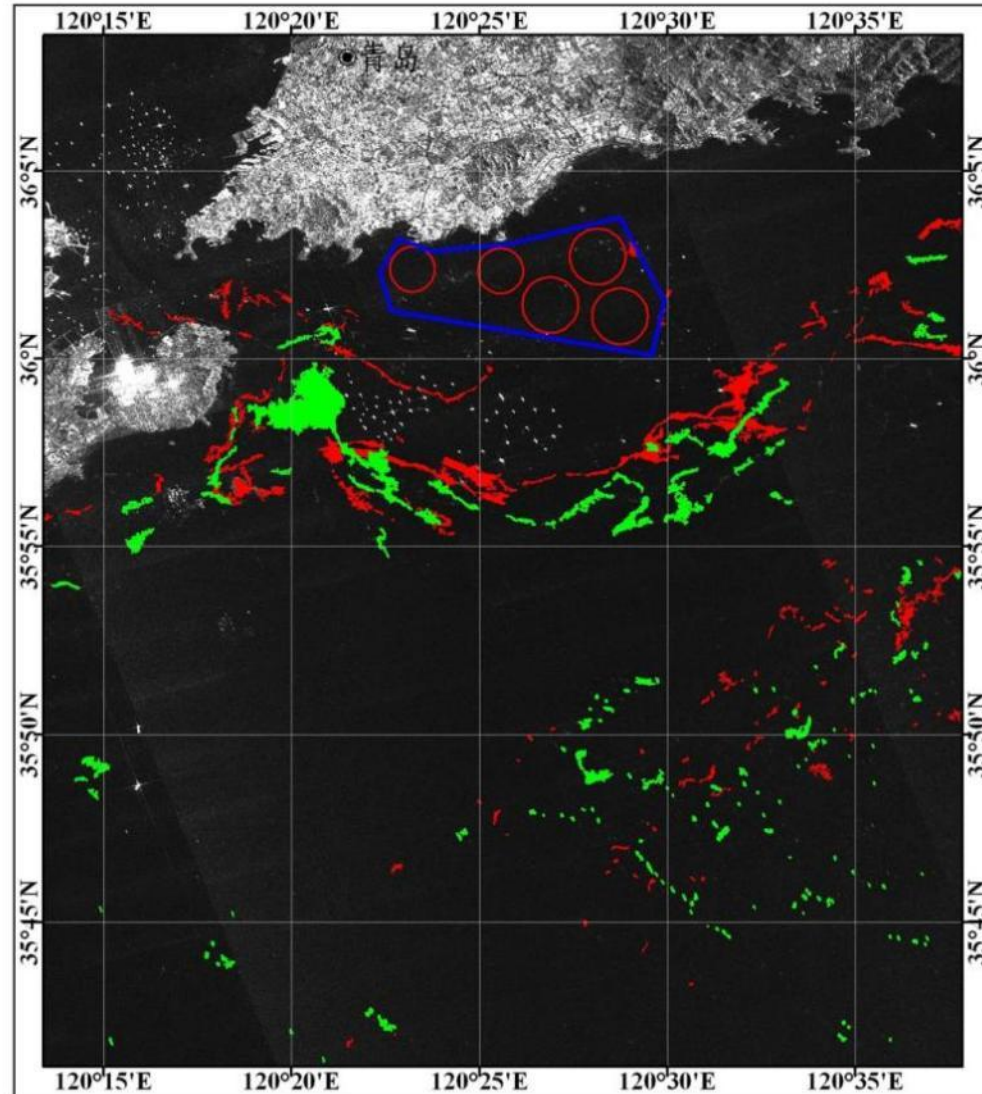


绿潮监测



青岛近海浒苔遥感监测变化解译图 (SAR)

Half Day
Change



遥感卫星: COSMO-1
传感器: SAR
分辨率: 30米

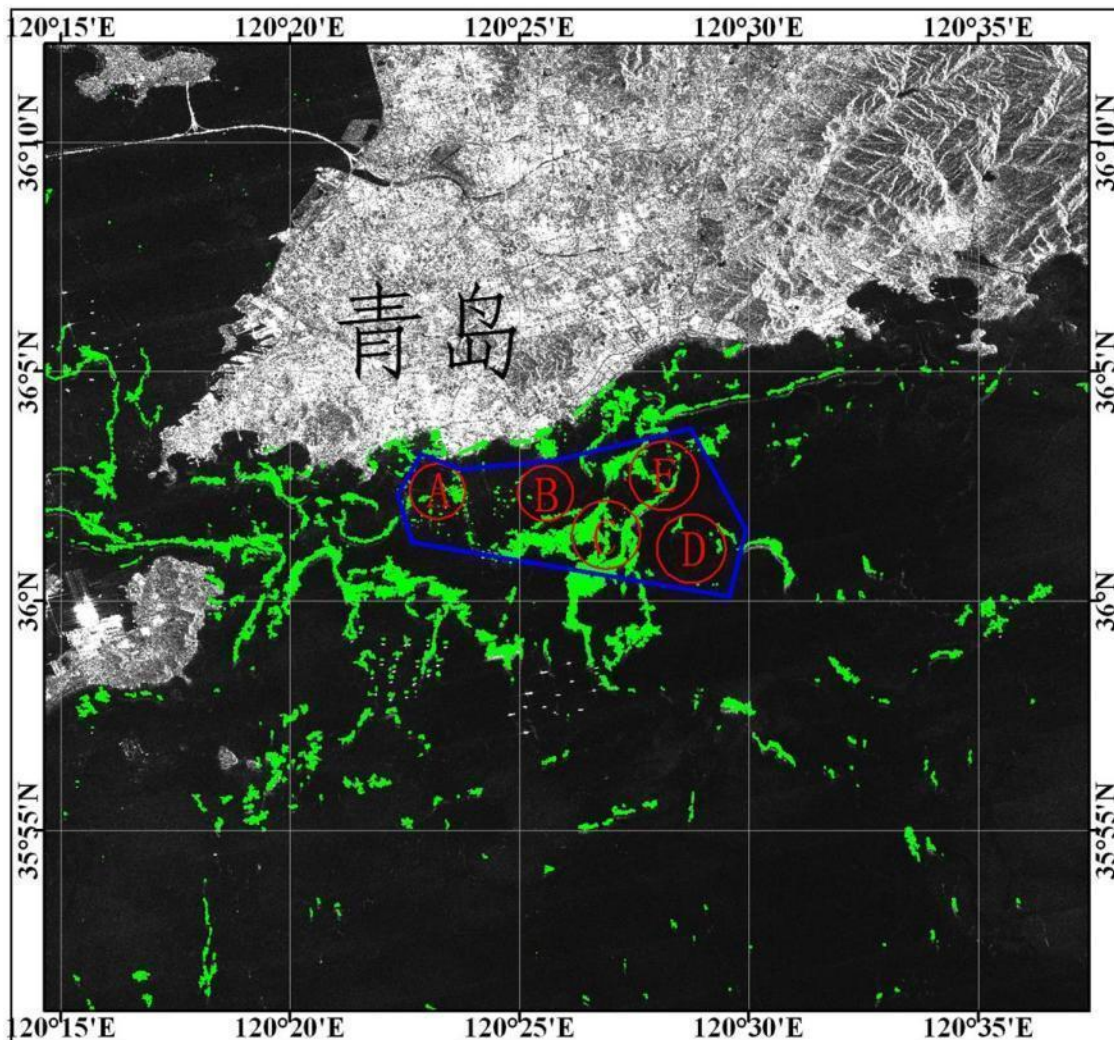
成像时间: 18:16/05:08
成像日期: 2008年07月8日/9日
制作时间: 2008年07月10日

■ COSMO-1 8日18:16
■ COSMO-1 9日05:08

制作单位: 国家卫星海洋应用中心

青岛近海浒苔遥感监测解译图 (SAR)

2nd
July, 2008



统计数据

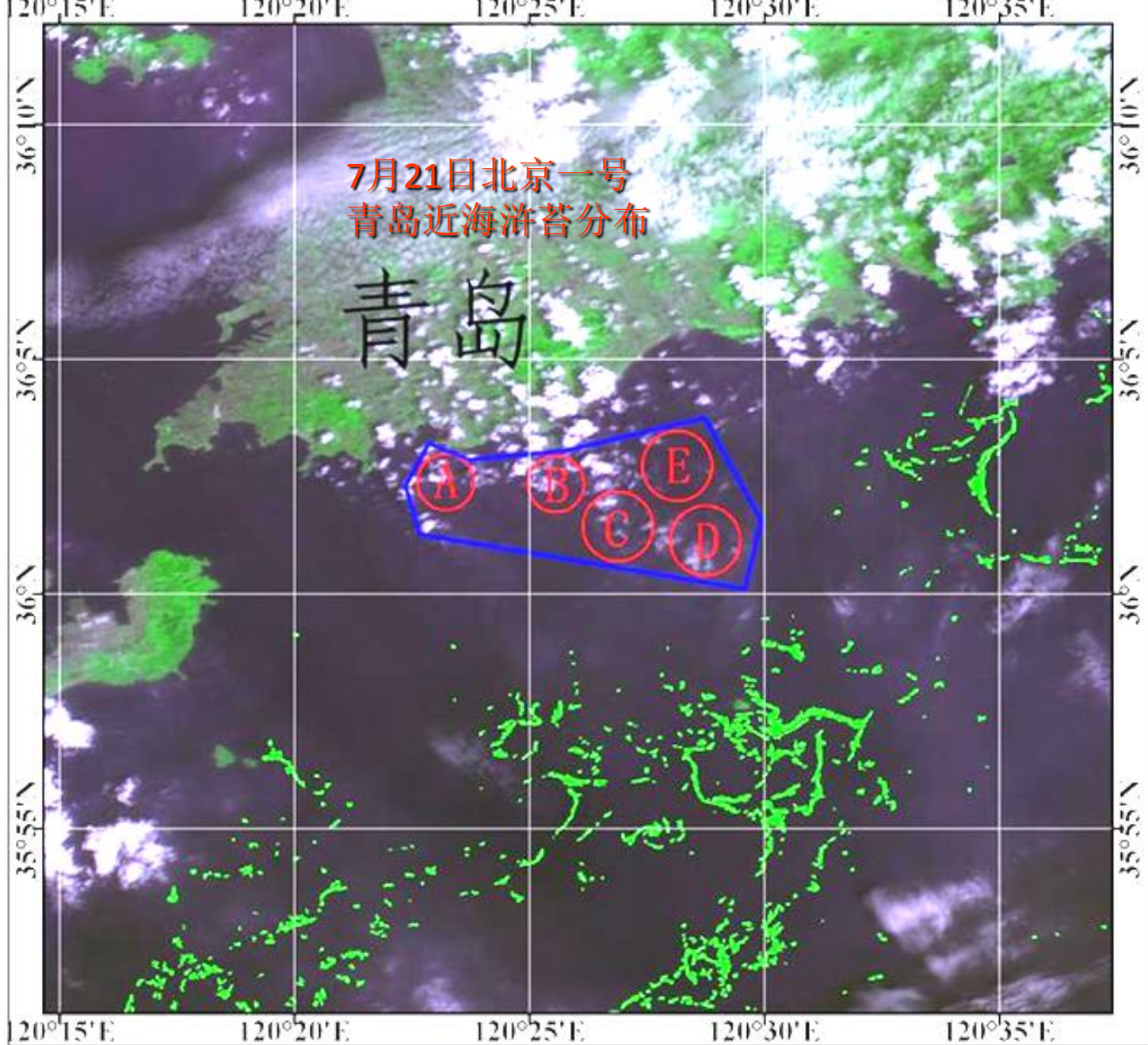
遥感监测面积: 1200平方公里
 浒苔面积: 33.13平方公里
 浒苔覆盖率: 2.76%
 警戒区面积: 49.48平方公里

图例

- 陆地
- 浒苔
- 奥帆赛区

遥感卫星: COSMO-1
 传感器: SAR
 分辨率: 30米
 坐标系: WGS-84
 成像时间: 05:26
 成像日期: 2008年07月02日

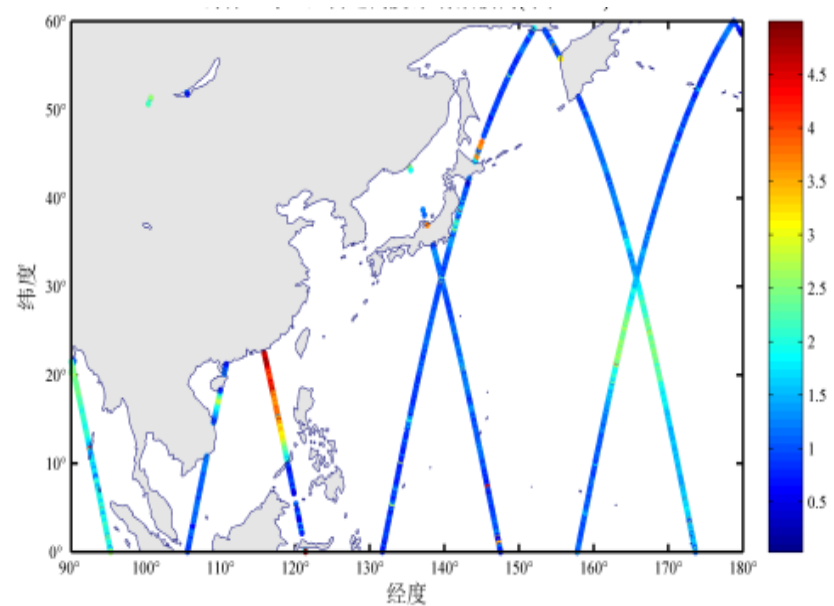
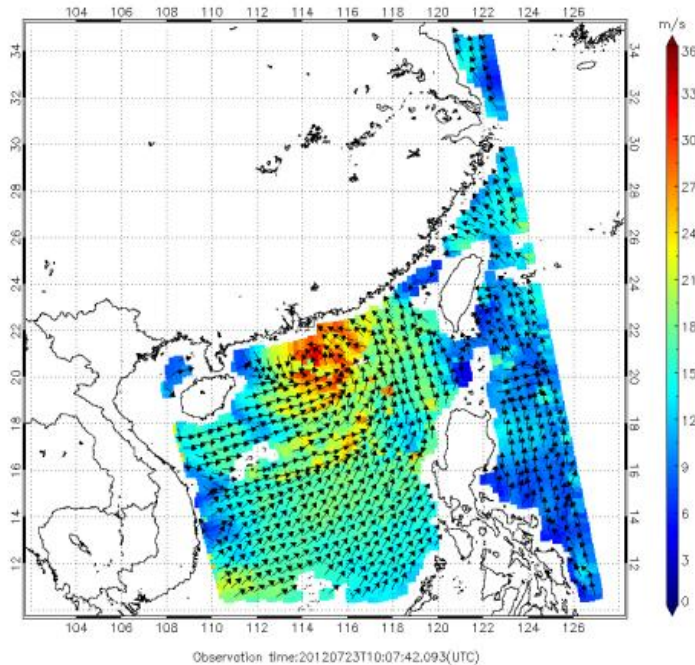




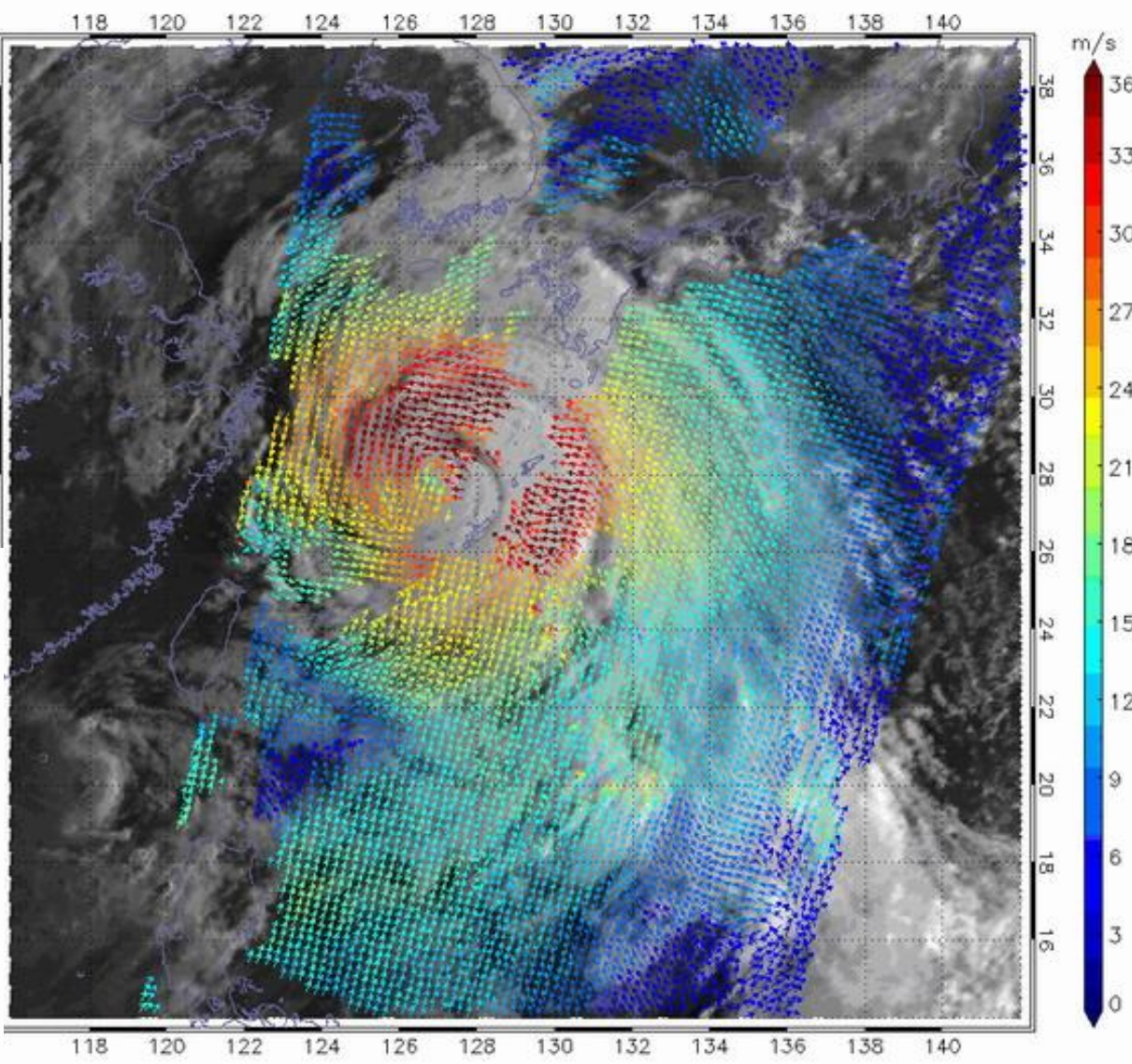
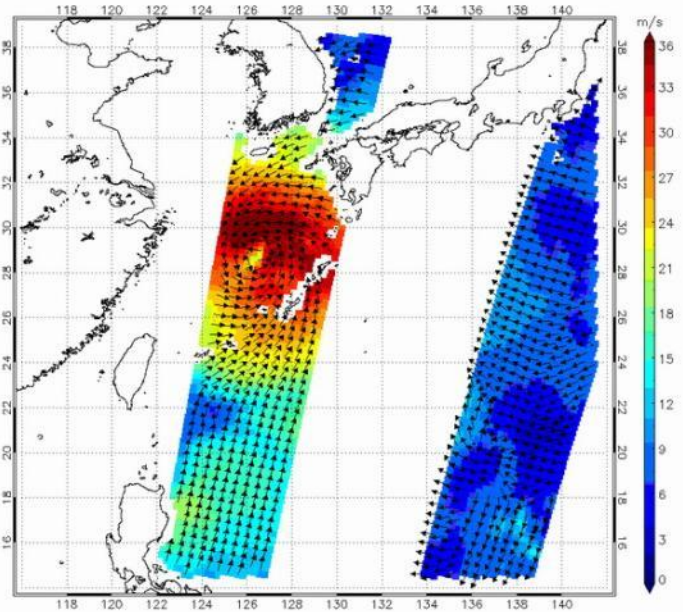
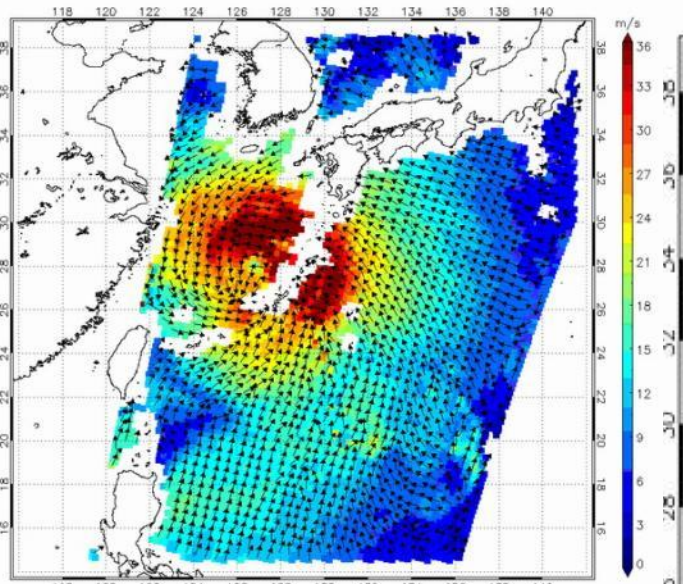
2.3 Typhoon monitoring

- **The microwave scatterometer and altimeter on HY-2A successfully monitored all typhoons from 2012 to 2014**
 - **In the life cycle of each typhoon, it has been observed once at least**
 - **79 typhoons have been monitored from 2012 to 2014**
 - **HY-2A satellite provides accurate data sources for scientific research, typhoon analysis and typhoon forecasting**
-

Typhoon monitoring

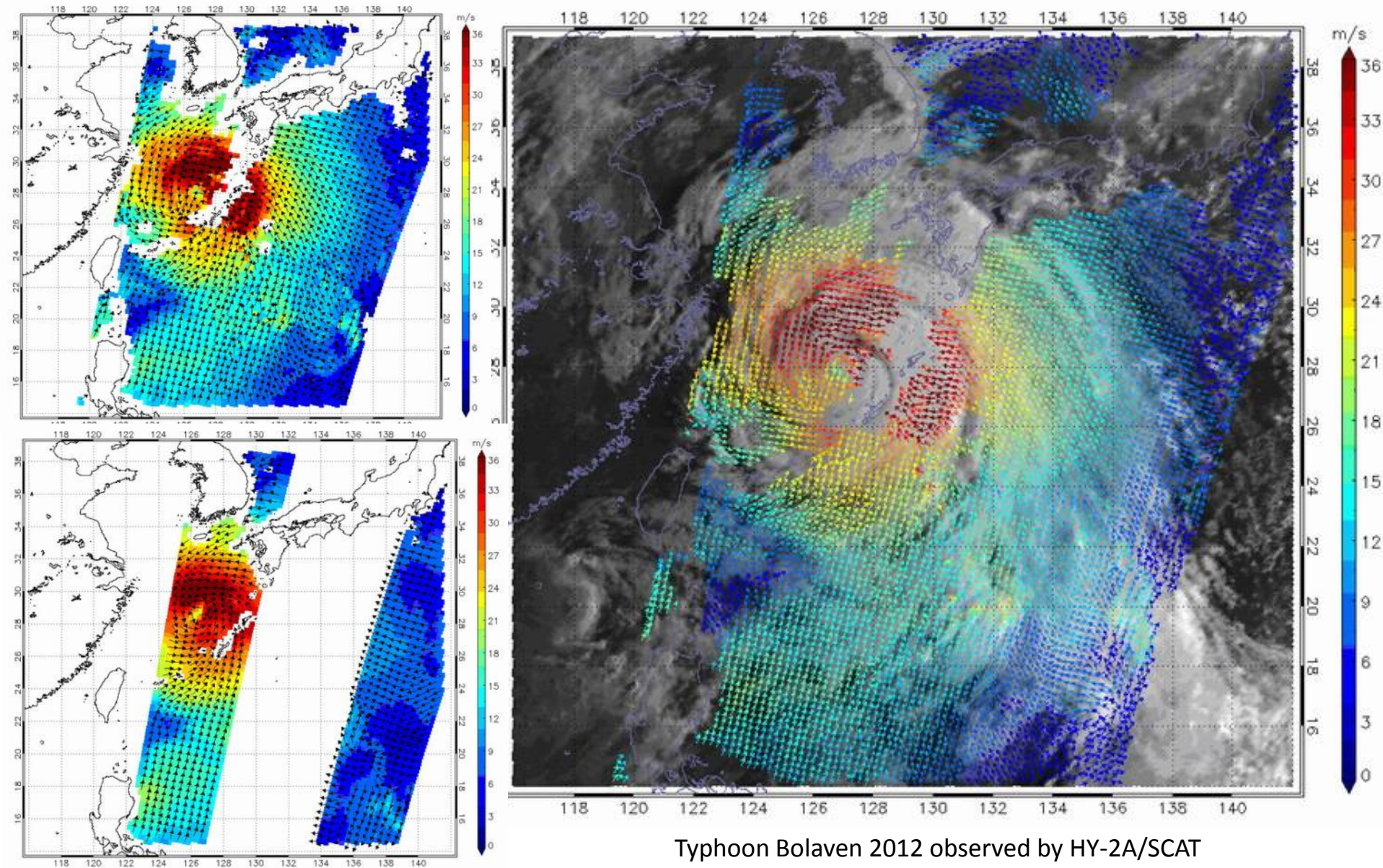


The wind field and significant wave height of typhoon “Vicente” observed by HY-2A in July 23, 2012



2012-8-26-21:42:52 ,

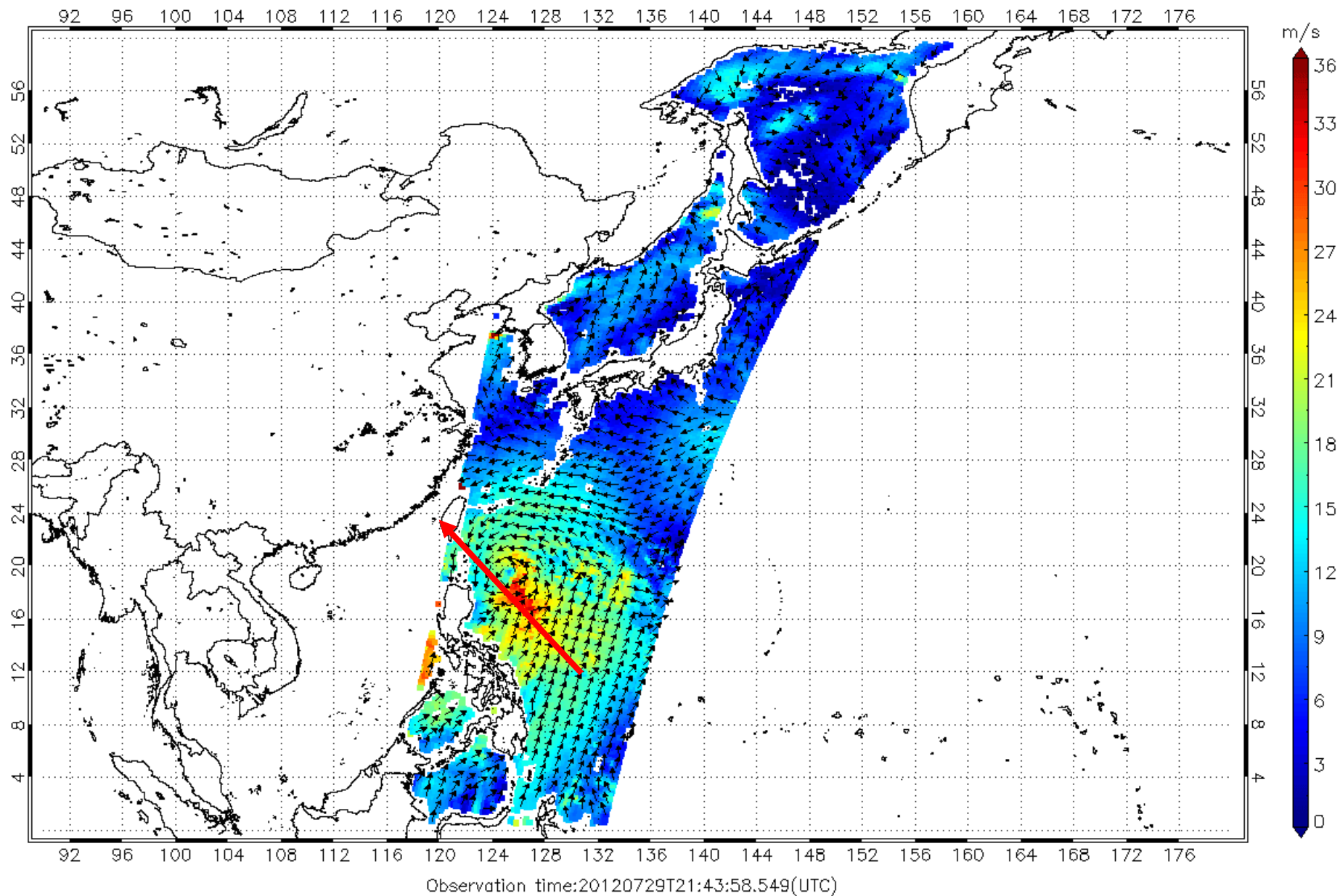
**Typhoon Bolaven observed by HY-2A/SCAT
Background is the cloud chart provided by
FY2E stationary satellite visible channel**



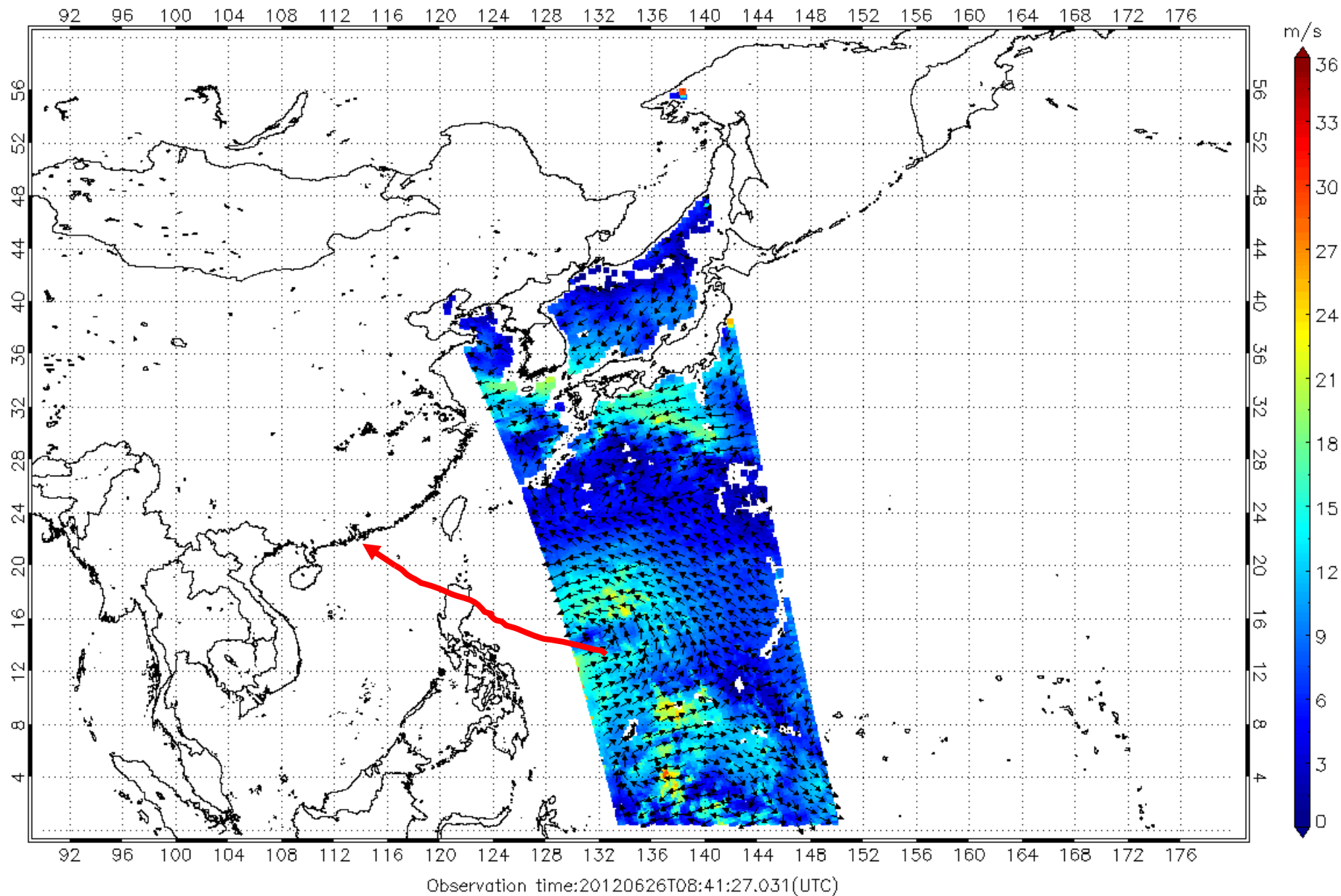
Typhoon Bolaven 2012 observed by HY-2A/SCAT

Background is the cloud chart provided by FY2E stationary satellite visible channel

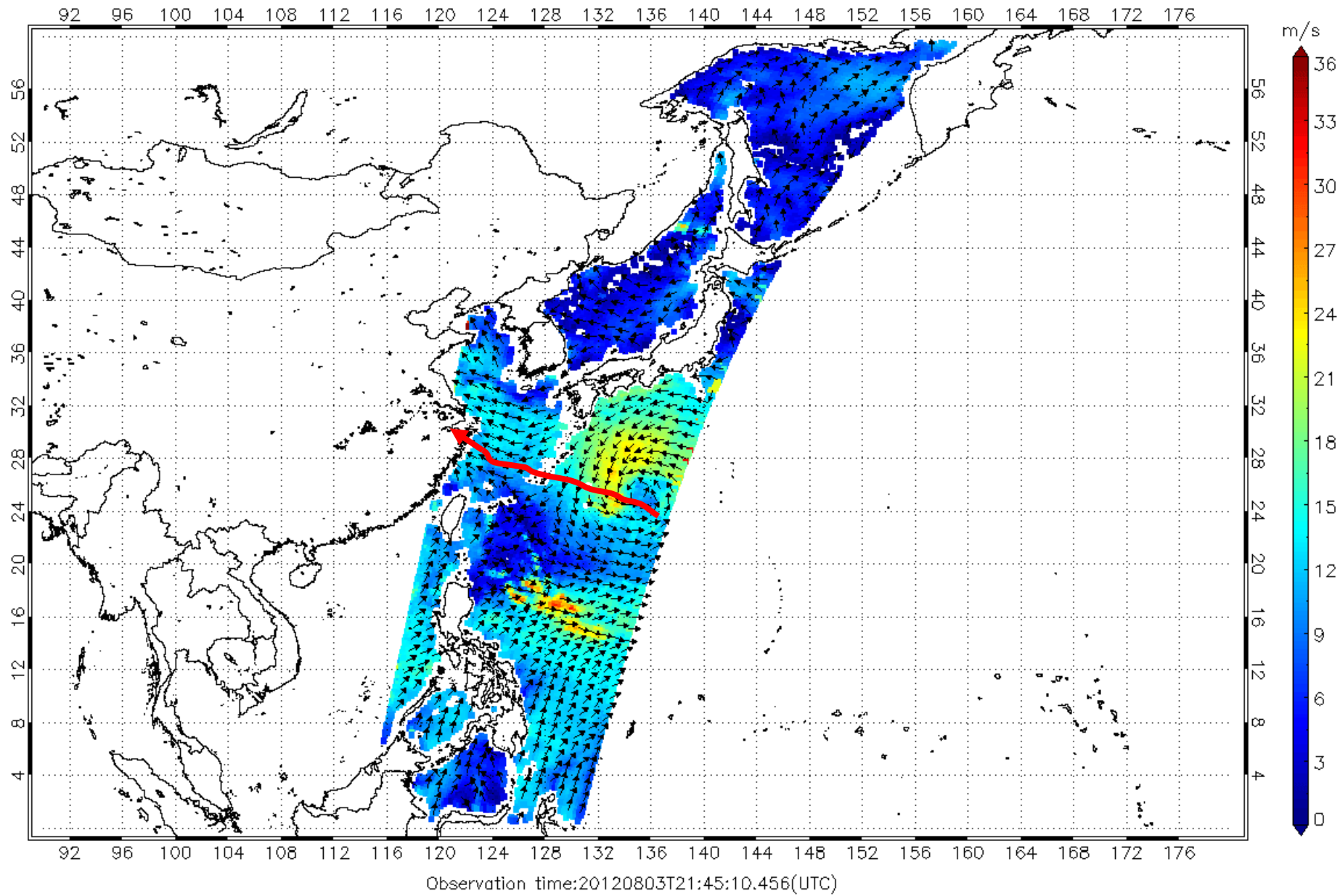
2012-8-26-21:42:52 ,



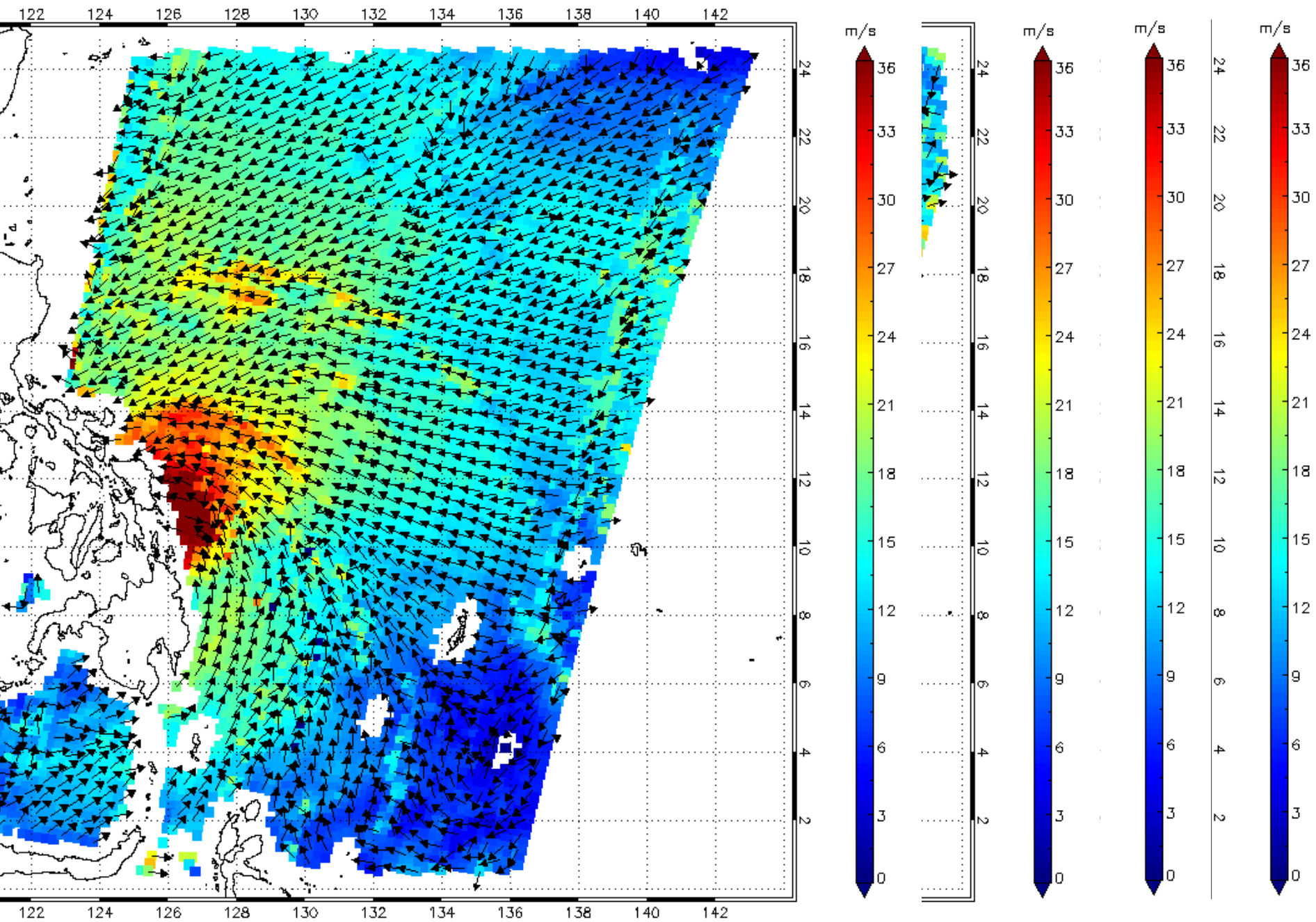
Typhoon Saola, 29 July-3 Aug.2012



Typhoon Du Surui, 26-30 June,2012

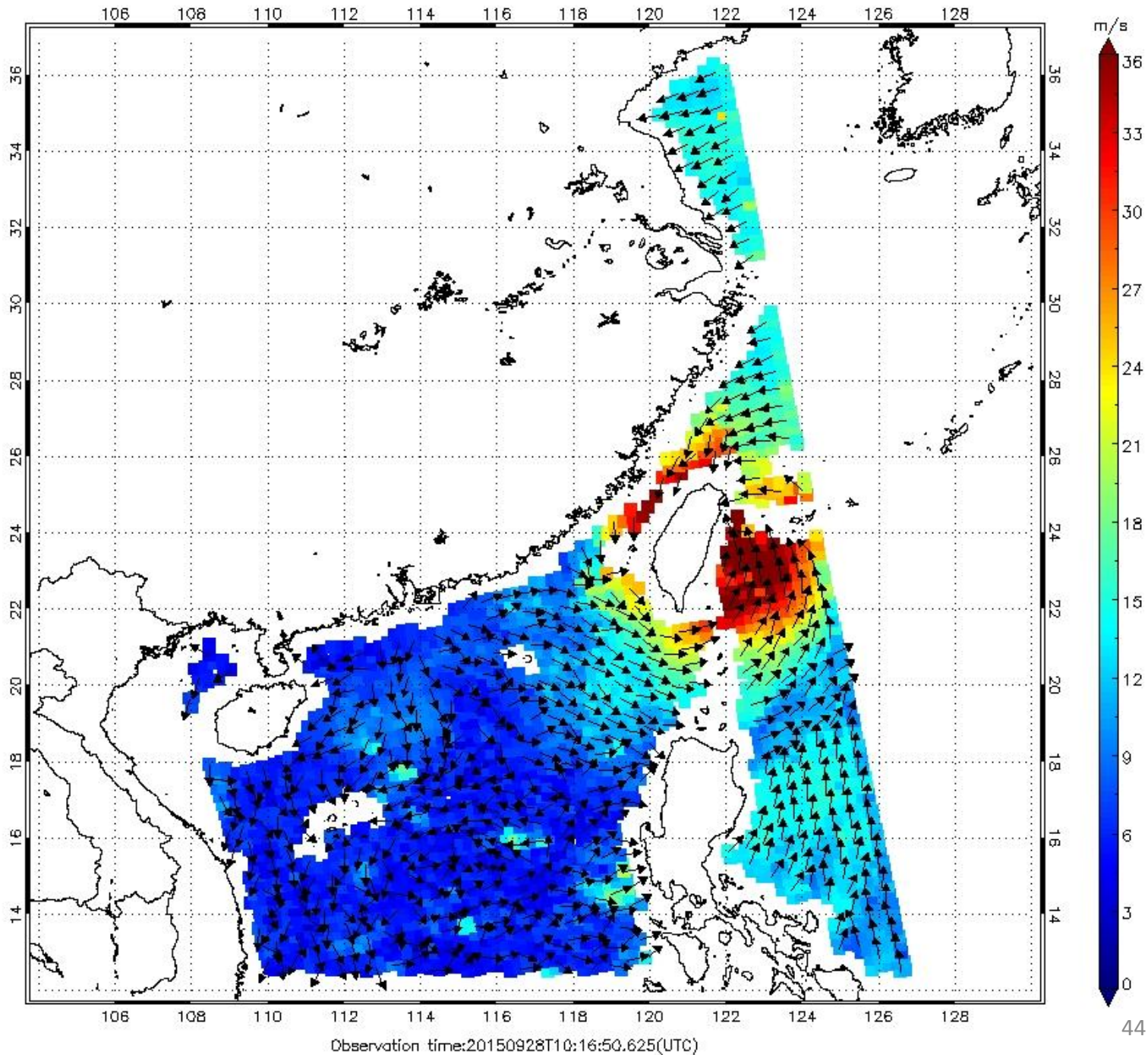


Typhoon Haikui, 03-08 Aug., 2012

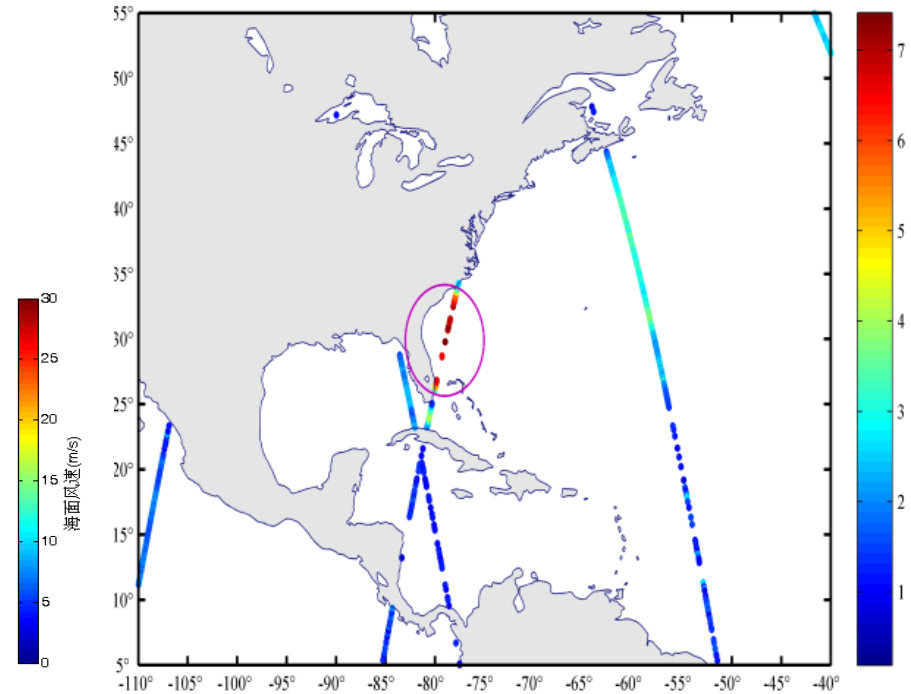
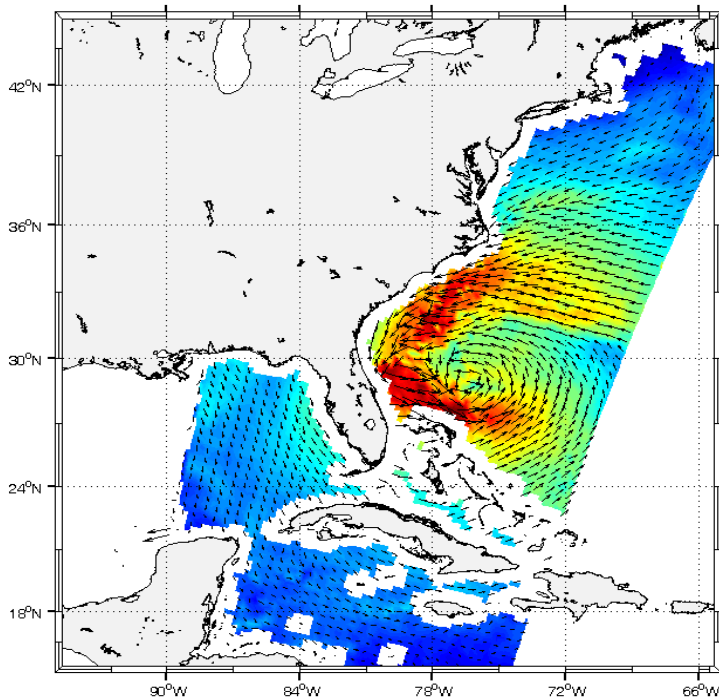


Observation time:20131107T21:36(UTC)

**Typhoon
Dujan
No.21, 2015
27-29, Sep.**



Typhoon monitoring

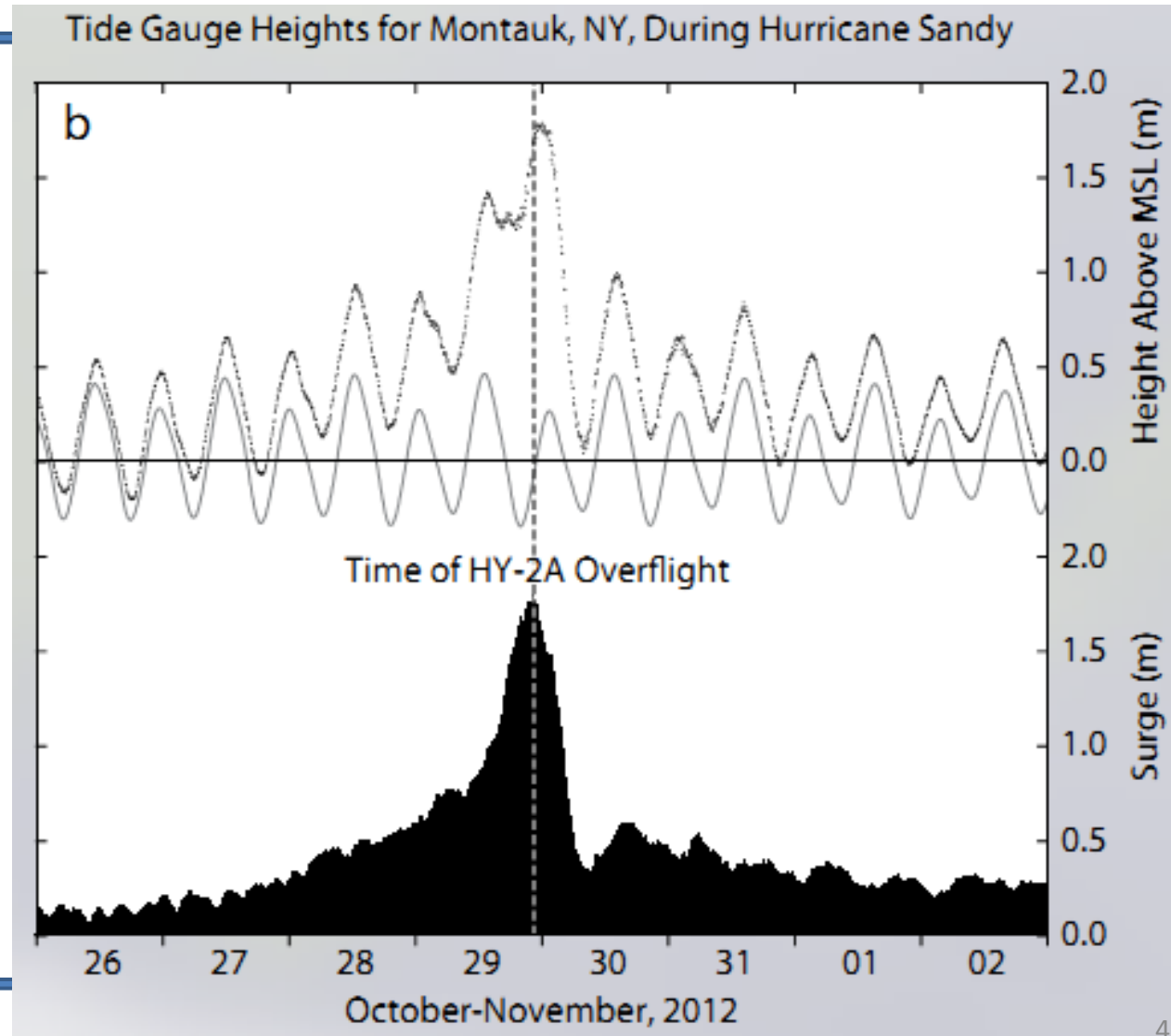


The changes of sea surface wind field and significant wave height during hurricane “Sandy” , 28-30, Oct. 2012.

Typhoon(tsunami) monitoring

stormy tide
by Hurricane
Sandy

(Lillibridge, Lin
et al., 2013.
Oceanography)



2.5 Keep an eye on Emergency event

- **Established a remote sensing emergency response team.**
- **Keep an eye on emergency event**
 - **collecting remote sensing data**
 - **Analysis of the satellite data**
 - **Information release**
 - **Improve the efficiency of decision making and cleaning.**
- **MH370, Russia ship in Antarctica, large oil spill by routine monitoring, ship accident, pollution, request by the local government or other unit.**

China Ocean Satellite Plan & Status

- *HY-1A 2002.5.15 (Stop work)*
- *HY-1B 2007.4.11 (operational)*
- *HY-1C/1D (will be approved)*
 - *For Ocean color, SST, Coast zone*
 - *Sensor are COCTS (Chinese ocean color and temperature scanner), CZI (Coast zone imager)*
- *HY-2 2011.8.16 launch*
 - *For Ocean dynamic environment parameters (Wind, SSH, SST)*
 - *Sensor are ALT, SCA, MR, GPS, DORIS*
- *HY-3 (Sensor are SAR, ...)*
 - *For pollution hazard, sea ice, ship, coast zone*

To 2020, 6-8 Ocean Satellite will be available

3. International cooperation

- *To 2020, 6-8 Chinese Ocean Satellite will be available*
 - Data is **FREE**.
 - Non near-realtime download
 - Download data application form from <http://www.nsoas.org.cn>
 - Fill in Application form
 - Submit to the website
 - Download data
 - Operational obtaining data contact NSOAS
 - Data receiving station oversea??
 - Looking forward internation cooperation
-

summary

- Marine Disaster monitoring and reduction cannot afford ignoring high resolution and observation capacity of Satellite series
- Significant progress:
 - Mature processing techniques and products
 - Beginning of a decade with over 8 satellites(ocean color/microwave/SAR,) simultaneously
- Successful demonstration of operational satellite-derived marine environmental disaster monitoring system
 - Oil spill
 - Typhoon
 - Sea ice
 - Green tide/red tide

⇒ **Continue to develop operational use of satellite data**

Thanks!

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