DRAGONESS WP4- Ocean and coastal information products and services
Activity Report on

Assessment of current status on the ocean and coastal information products and services in China

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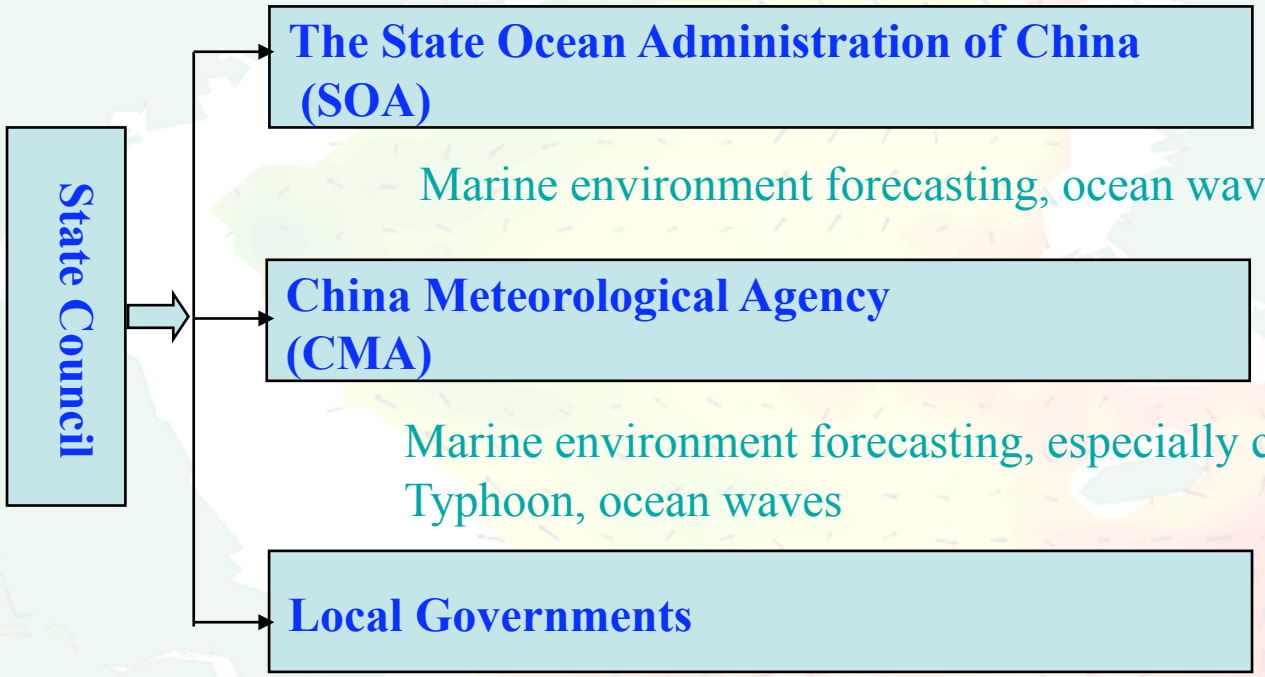
I. Introduction of the marine environment forecast products and service

- **The administrative infrastructure of the marine environment forecasting systems in China**



Introduction of the marine environment forecast products and service

➢ Products and services in China

•The marine environment forecast products in China mainly include:

- •ocean waves
- •sea surface temperature
- •storm surge
- •sea ice
- •tide, tidal current
- •ship best route selection
- …

Services:

Coverage: China seas and the northwest Pacific

Parameters:

wave forecast:	everyday by TV, telefax, etc.
SST:	in ten-day
Storm Surge:	storm surge news, warning or urgent alarming
Sea Ice	in ten-day period or monthly in winter

Forecasting Method

- The empirical forecasting method
  - Cities coast, Travelling areas
- The mathematical-statistical method
  - Weekly, Monthly
- The numerical forecasting method
  - Daily, Now-cast

Time Scales

- Annual
  - Typhoon, ENSO, Tide, Sea ice
- Monthly
  - Weather, Ocean Wave, Storm Surge, Sea ice (in winter)
- Weekly
  - Weather, Ocean Wave, Storm Surge, Sea Temperature, Red tide, Sea ice (in winter)
  - Daily
  - Weather, Ocean Wave, Storm Surge, Sea Temperature, Sea current, Ecosystem, Sea ice (in winter)
  - Now-cast
  - Oil spill, Green tide, Rescue

Forecast Models

China

- Sea Temperature and Current
  - MOM4, ROMS, HYCOM, POM, FVCOM
- Ocean Wave
  - WaveWatchIII, WAM, SWAM
- Storm Surge
  - CTS (China Typhoon Surge) Model, CES (China Extratropical Surge) Model, High Resolution Orthogonal Curvilinear Typhoon Surge Forecast Model (CTS-CUR),Storm Surge Inundation Model (CTS-WD)

Europe

- Sea Temperature and Current
  - PSY3V2(NEMO,OPA9 + LIM), FOAM, POLCOMS ,TOPAZ3 (HYCOM), DMI-BSHCmod Ver.2 , MFS V2
- Ocean Wave
  - BMO model in UK, HYPA model in Germany, VENICE model in Italy, WAM in ECMWF, NTUA model in Greece
- Storm Surge
  - POL storm surge model in England
  - DCSM system in Netherlands

Forecast Models

China

- Sea Ice
  - Hibler Sea Ice Model, Particle in Cell (PIC) Sea Ice Model, Ice-Ocean Coupling Model
- Ecosystem
  - FVCOM Coupled with EPA Water Quality Model, COHERENS Model, EFDC Model
- Tsunami
  - Operational China Tsunami Transit Time Forecast Model (CTTT), Operational China Numerical Forecast Model of Tsunami (CTSU)

Europe

- Sea Ice
  TOPAZ
- Ecosystem
  MRCS，Medium-Resolution Continental Shelf
  ERSEM, the European Regional Seas Ecosystem Model
  HadOCC, the Hadley Centre Ocean Carbon Cycle model
- Tsunami

II. Typical Ocean and coastal information products and the difference

Ocean waves

Marine environmental parameter profile simulation and forecasting

(1) Ocean Wave

☐ Background and Research

The late-1980s, NMEFC started the ocean wave forecasting.

MRI model from Japan, BMO model from UK,
WAM model

Ocean wave numerical model development in China

The 7th- 5 year and the 8th -5 year science and technology program

Wen model (1994,1999), the hybrid ocean wave numerical model

Wave Energy Numerical Model (WEN model)

Ocean University of China

WEN model running operationally in NMEFC and local marine forecasting center

LAGFD-WAM wave model proposed by Yuan et al (1992)

Based on WAM model with the modification of source function in wave energy diffusion and considering wave-current interaction

Especially used in ocean engineering computation.

At present, 3 projects related ocean wave numerical model are carried out in NMEFC in the 11th-5 year program

- Operational ocean wave numerical model for coastal area with high efficiency
- The fine wave forecasting technique for the fixed point in coastal area
- The global ocean wave numerical model

According to Ocean Yearbook 2008

☐ Ocean wave model, product and service

Operational ocean wave numerical model are carried out in NMEFC of the State of Ocean Administration (SOA) and in National weather forecasting center of China Meteorological Agency (CMA)

➢ NMEFC operational ocean wave numerical model

Model: SWAN model for shallow water
WAM4 model for deep water
NMEFC model for shallow / deep water
WEN model for shallow / deep water

Coverage: Northwest Pacific ocean
10-45N 105-155E with grid 0.5x0.5
Yangtze River Esturary
29-33N 120-123E
Beibu Gulf 18-22N 105-110E with grid 1/30x1/30
Bohai Sea 37-41N 117.5-122.5E

Wind forcing field: NMEFC ocean wind numerical model based on MM5

10-45N 105-155E with grid 0.5x0.5

Basetime and forecasting time step:

20:00 Local time T+0 – T+72 hrs

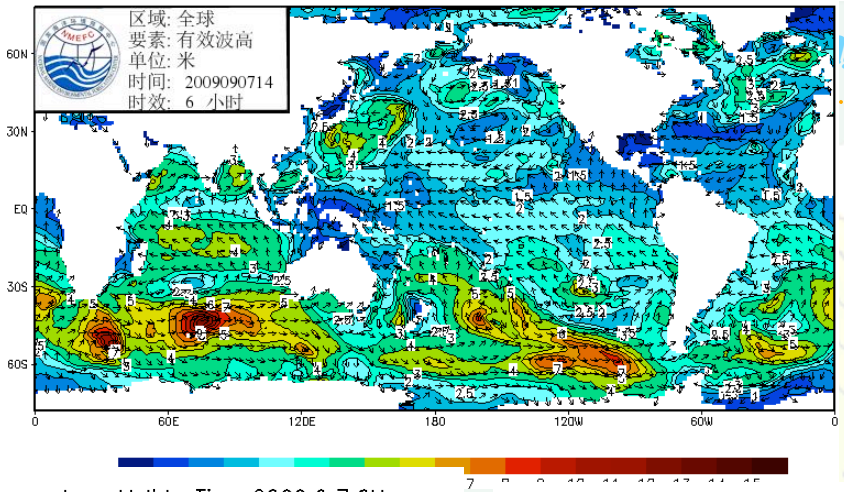
Forecasting products Service: http://www.nmefc.gov.cn/szyb/qh1.aspx

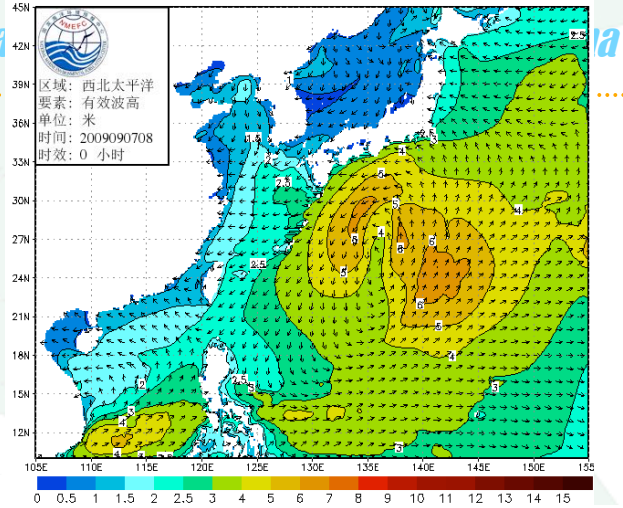
CCTV, radio, telefax, etc

Download available but for registered user only

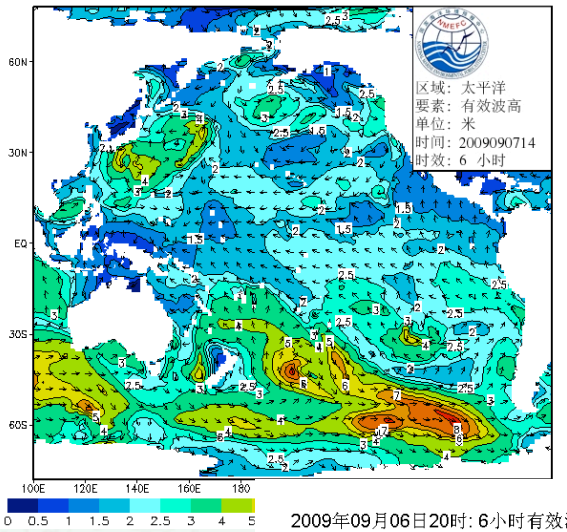
http://mds.coi.gov.cn/ybfw.asp

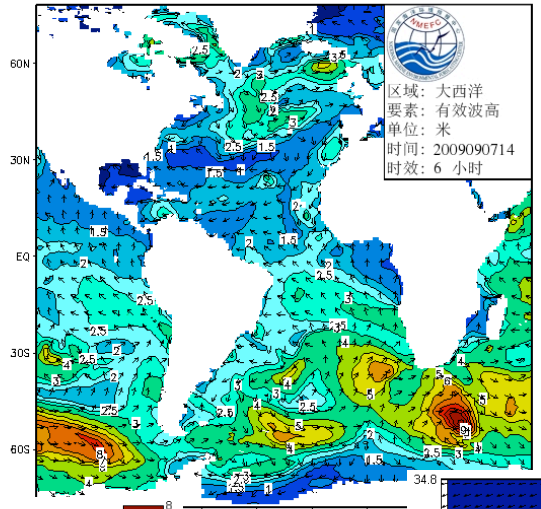
国家海洋科学数据共享中心 NMDIS

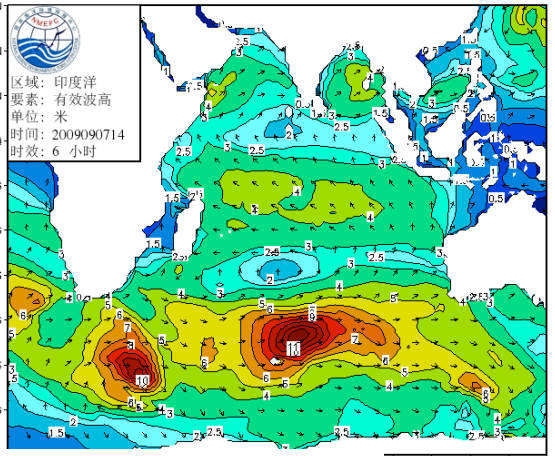


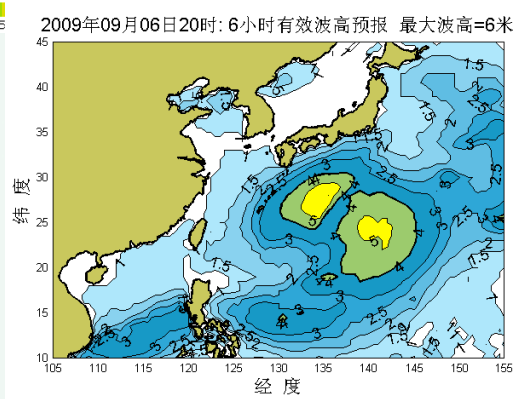


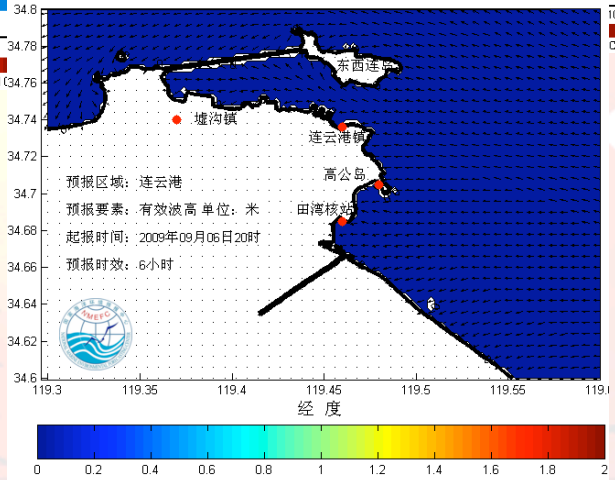
6Hr Forecast Valid Time:2009:9:7:6H











National Weather Center of China Meteorological Agency (CMA) provide global ocean wave forecasting service.

Model: WAVEWATCH III

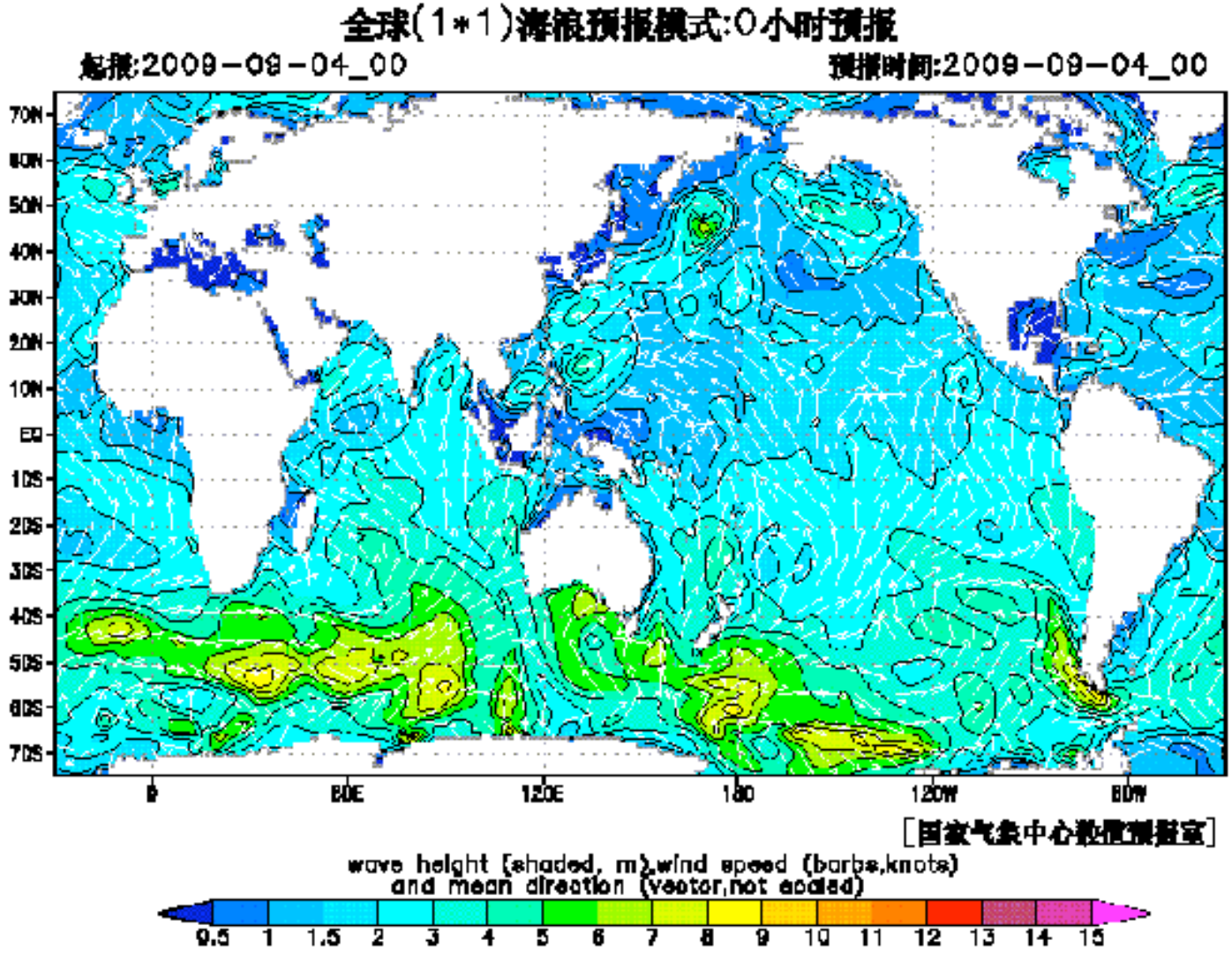
Coverage: global ocean with grid 1x1 degree

Wind field: the medium-range numerical weather forecasting system (T213)

Forecasting: 72 hrs

Data verification: NOAA/NDBC buoy data

Model products: http://www.nmc.gov.cn/publish/nwp/ww3/index.htm



http://www.nmc.gov.cn/publish/nwp/ww3/index.htm

☐ European ocean wave numerical model

Many different wave model runs operational in Europe.

BMO model in UK
HYPA model in Germany
VENICE model in Italy
WAM in European Centre for Medium-Range Weather Forecasts （ECMWF）

WAM in ECMWF

WAM 4 one of the most popular wave models

Operationally working more than 10 years in Europe

Coverage: for global ocean with grid of 1/4 x 1/4 degree

for European waters with grid of 1/8 x 1/8 degree

Products:

http://www.ecmwf.int/products/forecasts/wavecharts/index.html#forecasts

Only registered user and WMO member can access

Global ocean wave model

Parameters

- ***Forecast and Analysis fields***
  - 2D wave spectra (2DFD)
  - Mean direction of total swell (MDTS)
  - Mean direction of wind waves (MDWW)
  - Mean period of total swell (MPTS)
  - Mean period of wind waves (MPWW)
  - Mean wave direction (MWD)
  - Mean wave period (MWP)
  - Mean wave period based on second moment (MP2)
  - Mean wave period based on second moment for swell (P2PS)
  - Mean wave period based on second moment for wind waves (P2WW)
  - Peak period of 1D-spectra (PP1D)
  - Significant height of total swell (SHTS)
  - Significant height of wind waves (SHWW)
  - Significant wave height (SWH)

Product resolution

- 0.25° x 0.25° lat/long grid or any multiple thereof (global or sub-area)

Forecast time-steps

- T+3h to T+72h at 3-hour intervals and T+78h to T+240h at 6-hour intervals
- T+6h to T+120h at 6-hour intervals for 2D wave spectra (2DFD)

Base times

- 00 UTC, 12 UTC

Analysis times

- 00 UTC, 06 UTC, 12 UTC, 18 UTC

ECMWF wave model output parameters

ECMWF wave model products:

As only registered user and WMO members can access the data
no data example available shown here.

ECMWF WAM model development:

- The introduction of the assimilation of altimeter wave height data;
- The two way wind-wave interaction;
- The effects of unresolved bathymetry;
- A new dissipation source function;
- 4D var assimilation of all sky microwave imager data in model Cycle 3552

Model product verification:

In situ ocean wave observations

Satellite data assimilation in WAM Cycle 3553:

The significant wave height from Envisat/ALT and Jason-2
The Envisat/SAR wave mode data

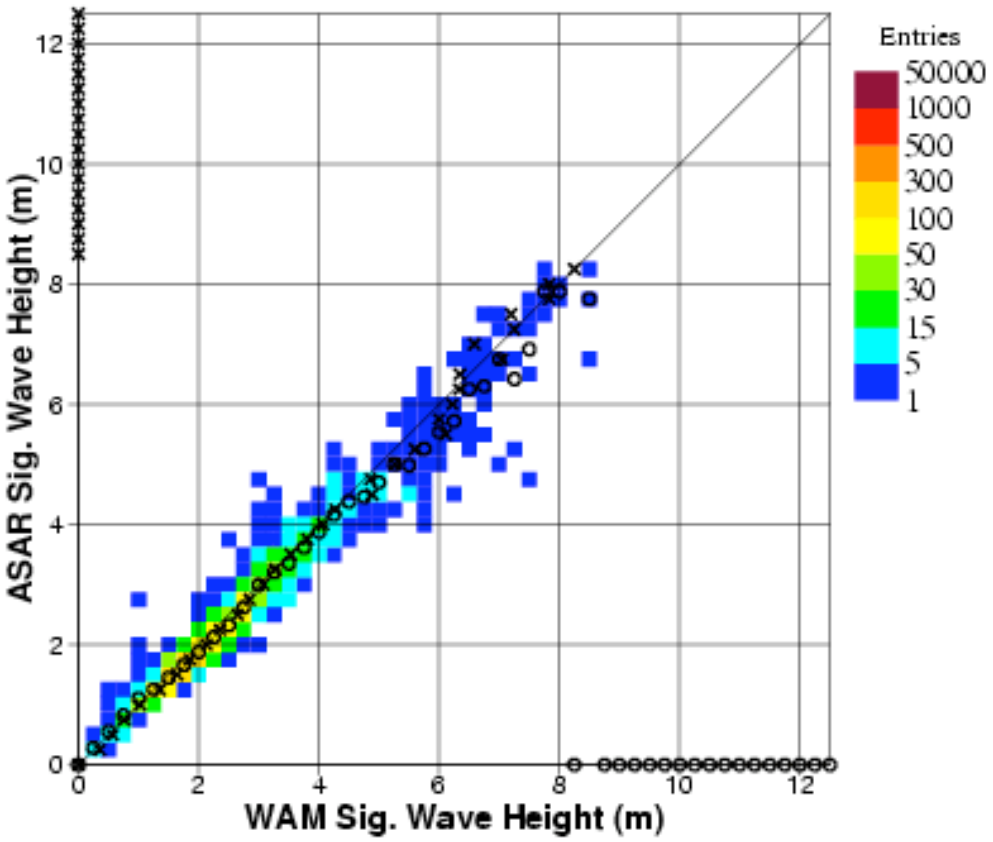
WAM / ENVISAT Comparison

ASAR sig. wave height

GLOBAL 0.5° AUG 2009

(model field: AN, Wave data assimilation: on)

26. 8. 9:00 UTC to 27. 8. 9:00 UTC



STATISTICS		
ENTRIES	2292	
MEAN WAM	2.4875	
MEAN ASAR	2.3770	
BIAS (ENVISAT - WAM)	-0.1105	
STANDARD DEVIATION	0.2770	
SCATTER INDEX	0.1113	
CORRELATION	0.9743	
SYMMETRIC SLOPE	0.9579	(0.0046)
REGR. COEFFICIENT	0.9427	(0.0046)
REGR. CONSTANT	0.0321	(0.0126)

☐ The difference or gaps in ocean wave numerical model forecasting

- The accuracy of ocean wave numerical models relies entirely on the quality of input meteorological data. The research for the forcing wind field is not paid much attention to up to now.

- In situ ocean wave monitoring buoy or related equipment is very limited. Little in situ data could be used in model verification / validation in China seas.

- Compared with ECMWF, no altimeter or other satellite data is assimilated in ocean wave numerical model at present in China.

- The wave numerical model forecasting product and its utilization should be improved.

- Ocean weave numerical model should be improved as the new research result on ocean wave or data assimilation appears.

(Refer to Xu (2005))

(2) Marine environmental parameter profile simulation and forecasting

☐ Background and research

➢ **The SST empirical forecasting** is based on SST's continuity, periodic, similarity and its relationship to other parameters.

➢ **The mathematical-statistical forecasting method** is based on several mathematical-statistical forecasting equations established by Ocean University of China and NMEFC respectively, and it was the main SST forecasting method before the late-1980s.

➢ **The SST numerical forecasting method**

developed in the 1980s under the support of the national 7th -5year science and technology program with the project entitled "Marine environment numerical forecasting research" (NMEFC and OUC).

- The **three-dimensional ocean numerical model** for China Seas

Bohai 3-dimensional ocean model developed by NMEFC in 2004

Model coverage: 10-45N, 103-145E with a spatial resolution of 1/12ºx1/12º
the sigma coordinate in the vertical direction with 21 layers
The initial field: WOD global dataset.

3-dimensional ocean numerical model for Taiwan and its adjacent areas

a resolution of (1/30ºx1/30º)
21 layers in vertical direction (sigma coordination)
on the basis of the Princeton ocean model (POM) model.

ocean-atmospheric coupling model based on the MM5v3 atmospheric model and the POM ocean model

by NMEFC and Shanghai Typhoon Research Institute
Verification: the in-situ data (buoy data, telemetry data and remote sensing)

3-dimensional ocean assimilation research

by Ocean University of China and NMEFC
established **temperature vertical structural model and a three dimensional assimilation system**.

ocean wave-circulation theory and developed ocean wave-circulation coupling model (Qiao et al, 2004) and
The atmospheric-ocean waves-circulation coupling numerical model (Song et al 2007))

- **Assimilation methods in simulation**

  A general ocean data assimilation system, based on the 3D variation method, which can be used to **assimilate in situ temperature/salinity data and altimeter data**.(Zhu et al. 2007)

- **Model development in China**

  Global ocean circulation model, Ocean circulation model in the North Pacific T63L30 by IOA/CAS, CMA, FIO/SOA during the 9th-5 year Program

  3D ocean numerical model based on POM
  Ocean circulation model in the Northwest Pacific ocean based on MOM
  T63L30 ocean circulation model with the grid of 0.5x0.5
  during the 10th-5year program

☐ Ocean numerical model, product and service

NMEFC has established **ocean current numerical model based on MOM4 model for the global ocean and HYCOM for the Pacific ocean, and the regional simulation model on the basis of POM, FVCOM for China Seas**.

Like: 3D ocean numerical model for Bohai Sea

Coverage:

117.5-112.5E and 37-41N with the grid of 2.5'x2.5'

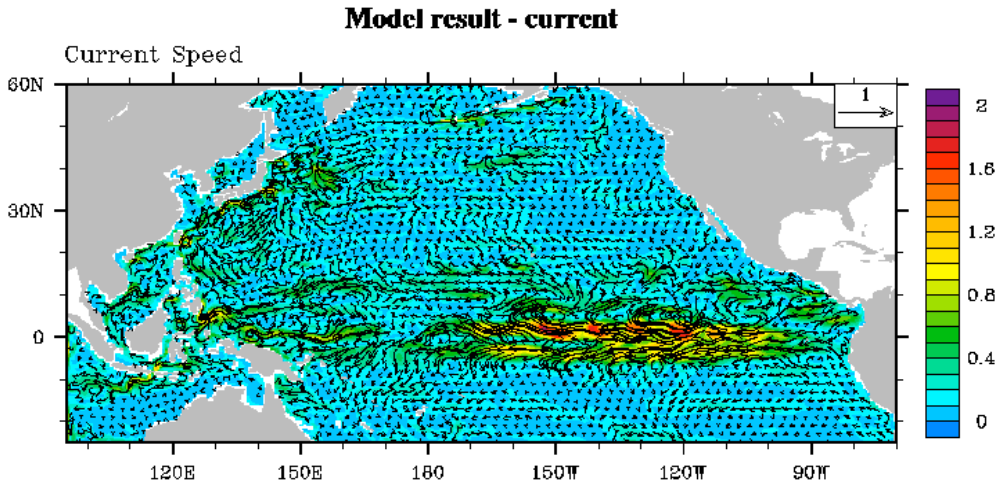
Model output at the depth: surface, 5m, 10m

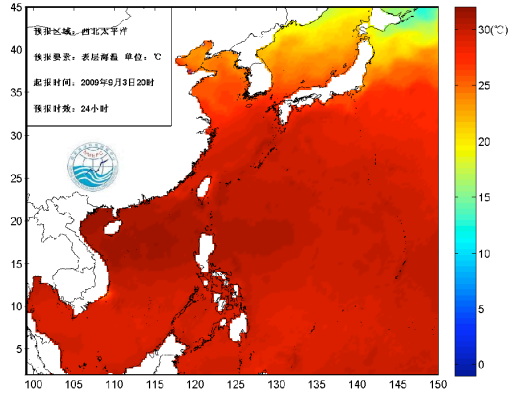
Forcing field: wind, air temperature, and humidity provided by NMEFC ocean wind numerical model

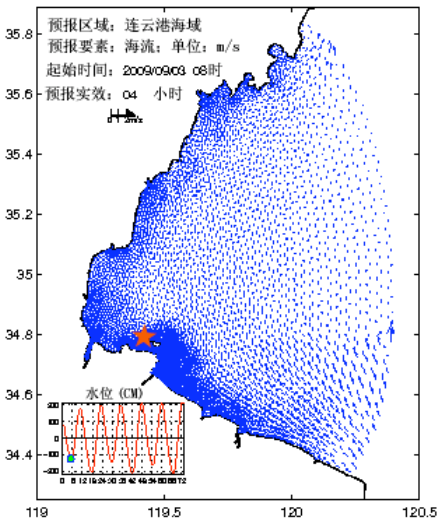
Model products:

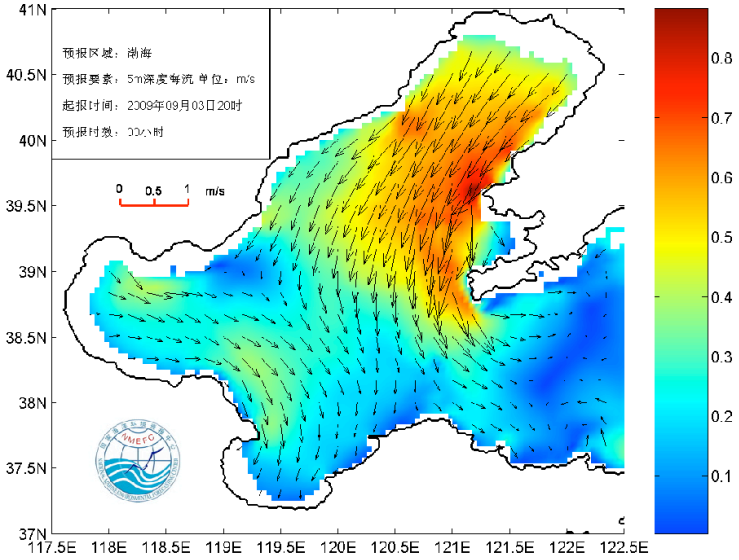
published at the homepage: http://www.nmefc.gov.cn

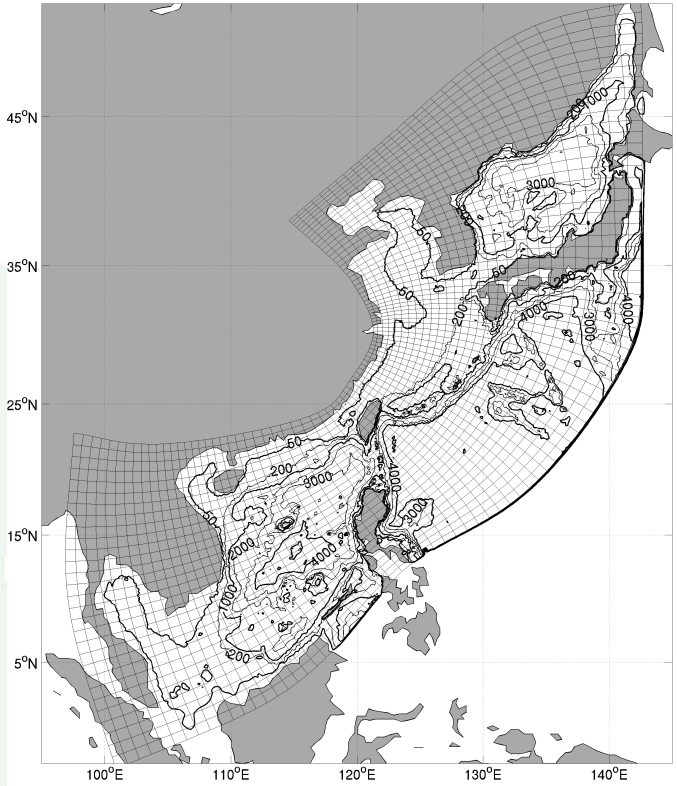
Chinese Forecasting Systems

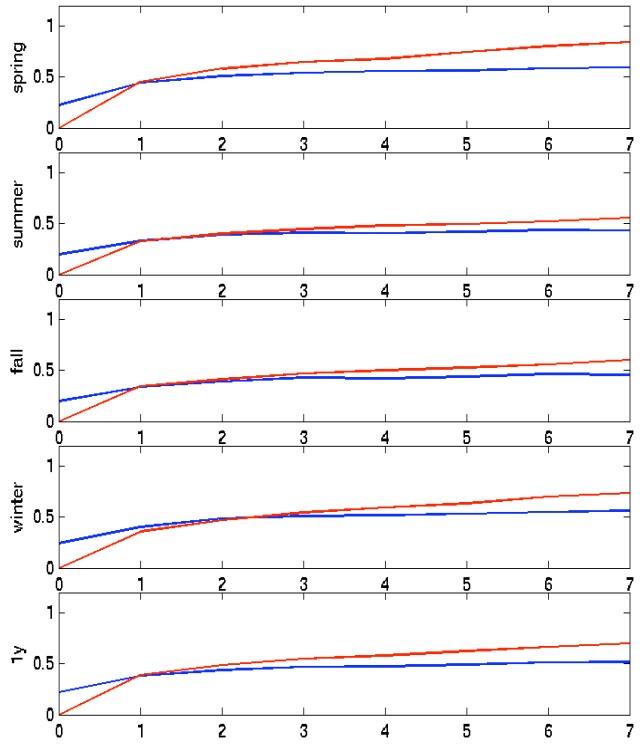




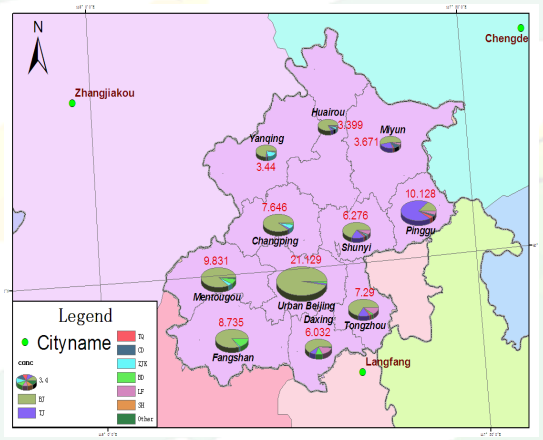


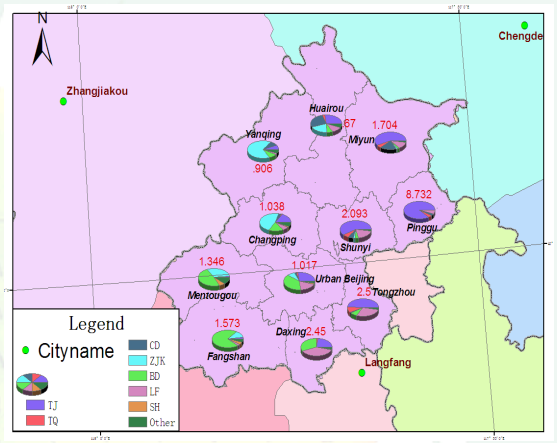


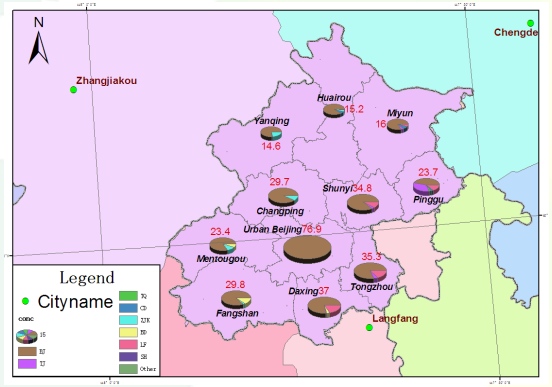




The model domain and the SST forecast error growth in SCS.
The blue curves are prediction and the red curves are persistence

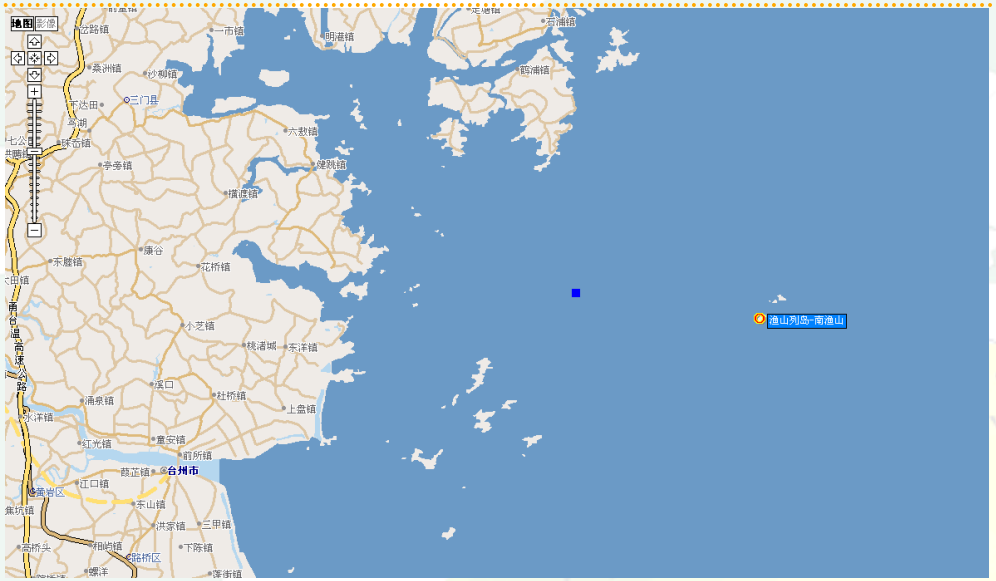


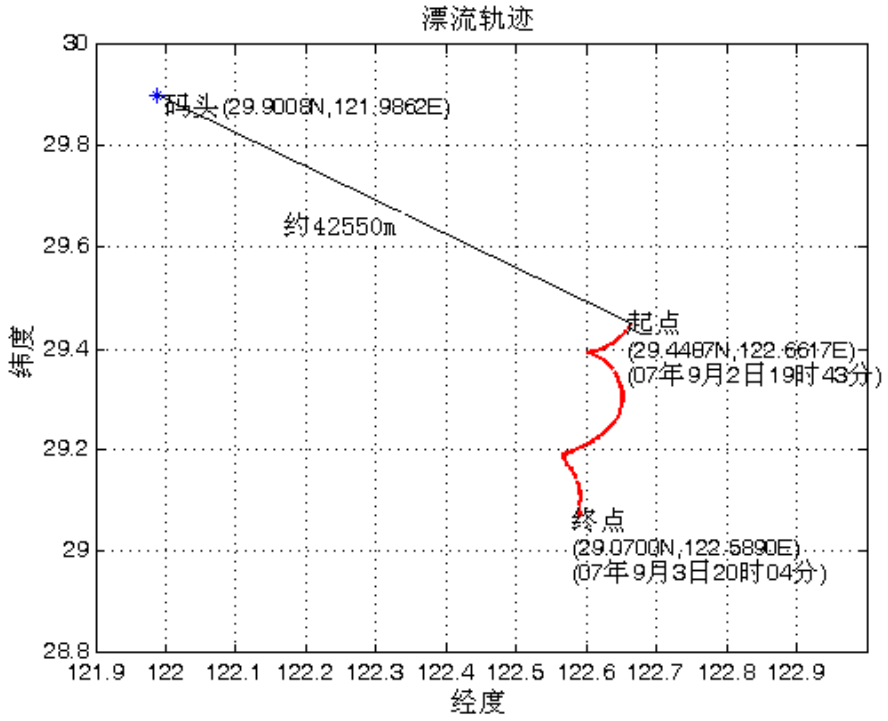


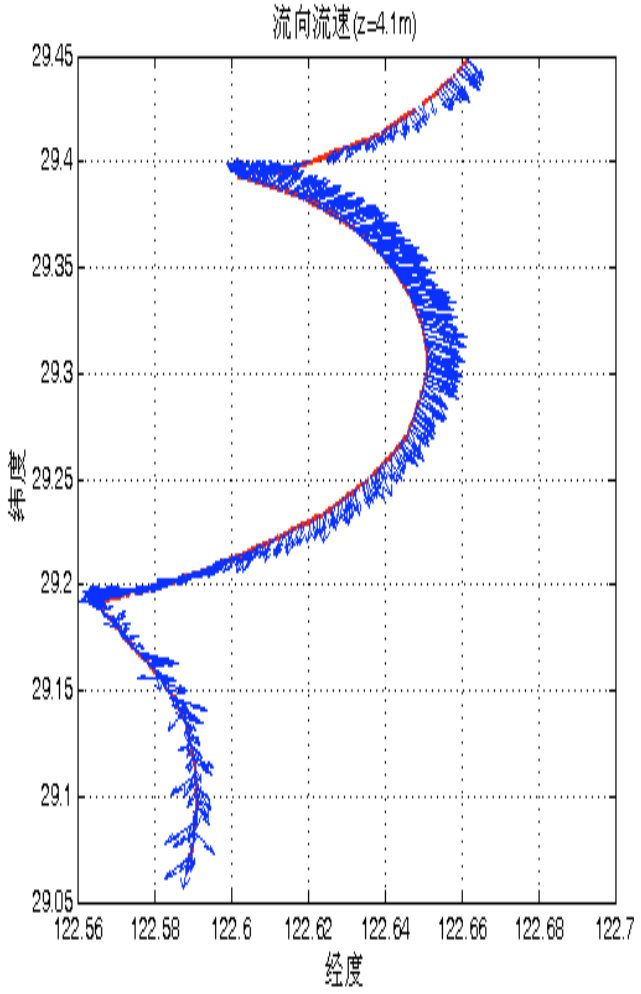


Contribution of surrounding areas to monthly mean SO2 concentration (ppb) and monthly mean PM10 concentration (μg/m3) over Beijing counties including Beijing local contribution (left) and without beijing local contribution (right) under base scenario.

Rescue forecast







Public users
Government users
Special users

Users / variables	Oil companies	Marine Security	Fishery	Ship	Military affairs	Travels	Others
Storm surge	√	√	√	√		√	
Sea current	√	√	√		√		√
Ocean wave	√	√	√	√	√	√	√
Tsunami	√	√	√		√	√	
Sea Ice	√	√	√	√			
Oil spill	√	√					
Typhoon	√	√	√	√	√	√	
Salinity tide							√
Sea temperature			√			√	
Weather	√	√	√	√	√	√	√
Pole research				√			
Red tide			√				

TV Forecast Program show

NMEFC owns high performance audio and video editing system, which can make high quality marine environment forecast audio and video products, and these audio and video products are released to the public through CCTV, CETV, TCTV and CCBS (Chinese Central Broadcasting Station).

Movie

- **Main gaps compared with European ocean numerical model**

European Oceanic Forecasting Systems------A Joint Effort

The European countries are now trying to integrating the available ocean forecasting products through some joint projects, for example, the **Myocean** project (following the **Mersea** project.)

These projects will allow all users to **access a catalogue of worldwide and European regional Ocean Products** (real time observations, analysis and forecast, added value diagnostics) that have been made available under previous projects step by step.

These efforts are gathering **all the relevant European capabilities to ensure that operational systems are maintained at the most advanced level**. Most of the operational forecasting systems are using sophisticated schemes for model parameterizations and data assimilation.

Model Configuration and outputs------Basin scale to regional

The European oceanic operational forecasting systems usually provide both global/basin scale coverage forecasts and regional forecasts. The resolutions of **the global/basin scale forecasts vary from 2° to 1/12° in the close future** and the resolution of **the regional forecast is usually higher than ~1/12.** There are usually 30~50 vertical levels in the simulation systems.

Forecast products include temperature, salinity, zonal and meridional velocity, free surface elevation, sea ice variables (thickness, concentration, temperature, zonal and meridional ice velocity, snow thickness on ice, ice heat content), mixed layer depth (density diagnostic), mass transport by density class through sections and meridional heat transports.
All these products will be available through **MyOcean** web site.

Sophisticated assimilation schemes in European forecasting systems

All of the operational oceanic forecasting systems are (or will be) using sophisticated assimilation schemes to better the forecasts. The optimal interpolation, different forms of Kalman filters, SEEK filter (ensemble base scheme) and variational methods are widely used. Some are fully multivariate and multi data schemes. There are weekly to daily analysis and forecast.

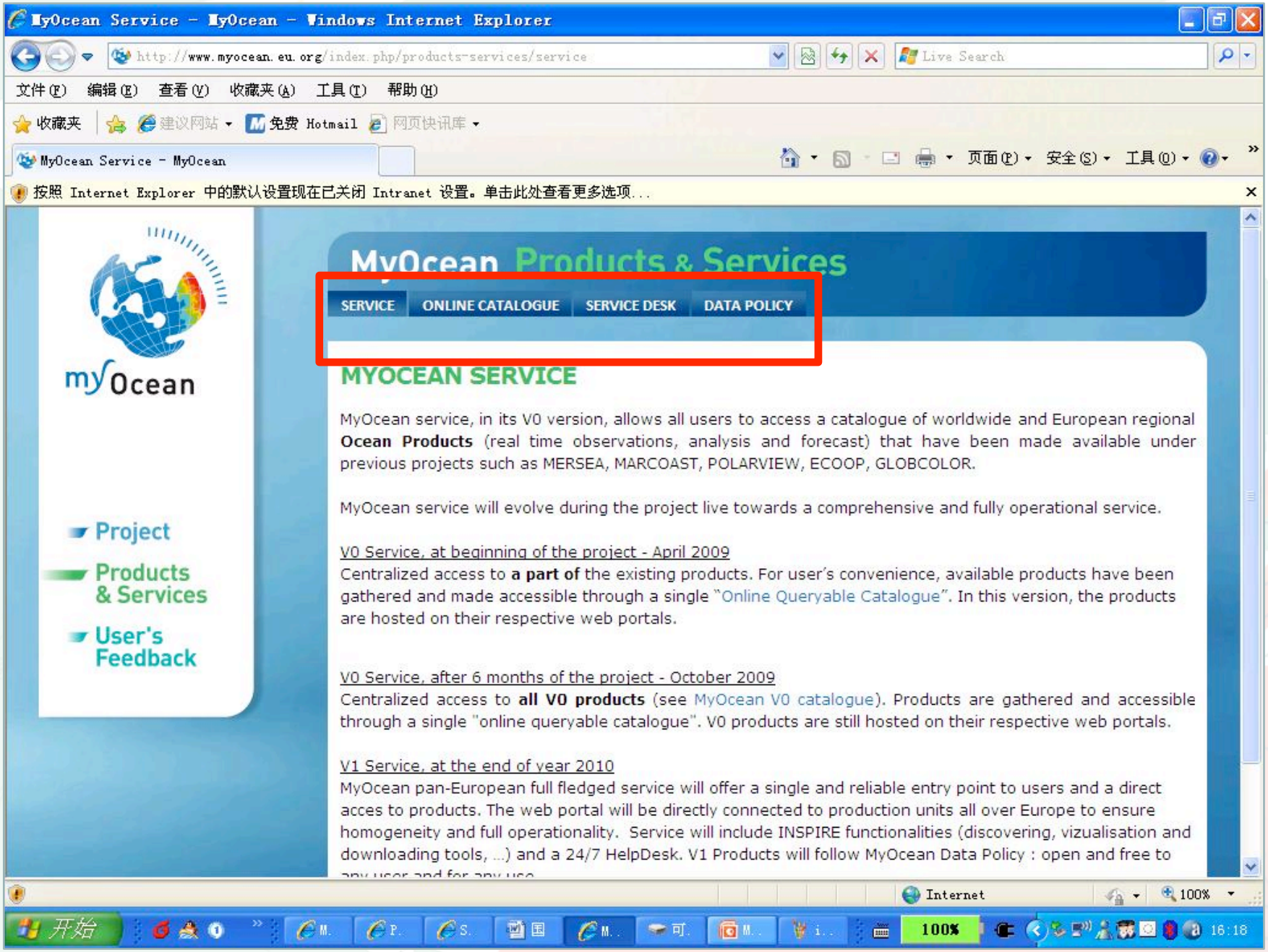
Satellite data (sea level anomaly, sea surface temperature, sea surface wind) and in-situ measurements (temperature, salinity and current) are assimilated in most of the operational systems.

MyOcean and the future european organisation:

Forecast, observations and diagnostics will be available on a single web site. They will be 7 MFC (Monitoring and Forecasting Center, 1 global and 6 regionals) and 6 TAC (Thematic Assembly Center) for observations:

- Insitu Data
- SST
- Ocean Color
- SLA
- Atmospheric forcing
- Sea Ice

The forcasting centers (global and regional) have to be fully operational at the end of MyOcean project.


MyOcean Service - MyOcean - Windows Internet Explorer
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Live Search
文件(F) 编辑(E) 查看(V) 收藏夹(A) 工具(T) 帮助(H)
收藏夹
建议网站
免费 Hotmail
网页快讯库
MyOcean Service - MyOcean
页面(P) 安全(S) 工具(O)
按照 Internet Explorer 中的默认设置现在已关闭 Intranet 设置。单击此处查看更多选项...
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Project
Products & Services
User's Feedback
MyOcean Products & Services
SERVICE
ONLINE CATALOGUE
SERVICE DESK
DATA POLICY
MYOCEAN SERVICE
MyOcean service, in its V0 version, allows all users to access a catalogue of worldwide and European regional Ocean Products (real time observations, analysis and forecast) that have been made available under previous projects such as MERSEA, MARCOAST, POLARVIEW, ECOOP, GLOBCOLOR.
MyOcean service will evolve during the project live towards a comprehensive and fully operational service.
V0 Service, at beginning of the project - April 2009
Centralized access to a part of the existing products. For user's convenience, available products have been gathered and made accessible through a single "Online Queryable Catalogue". In this version, the products are hosted on their respective web portals.
V0 Service, after 6 months of the project - October 2009
Centralized access to all V0 products (see MyOcean V0 catalogue). Products are gathered and accessible through a single "online queryable catalogue". V0 products are still hosted on their respective web portals.
V1 Service, at the end of year 2010
MyOcean pan-European full fledged service will offer a single and reliable entry point to users and a direct acces to products. The web portal will be directly connected to production units all over Europe to ensure homogeneity and full operationality. Service will include INSPIRE functionalities (discovering, vizualisation and downloading tools, ...) and a 24/7 HelpDesk. V1 Products will follow MyOcean Data Policy : open and free to
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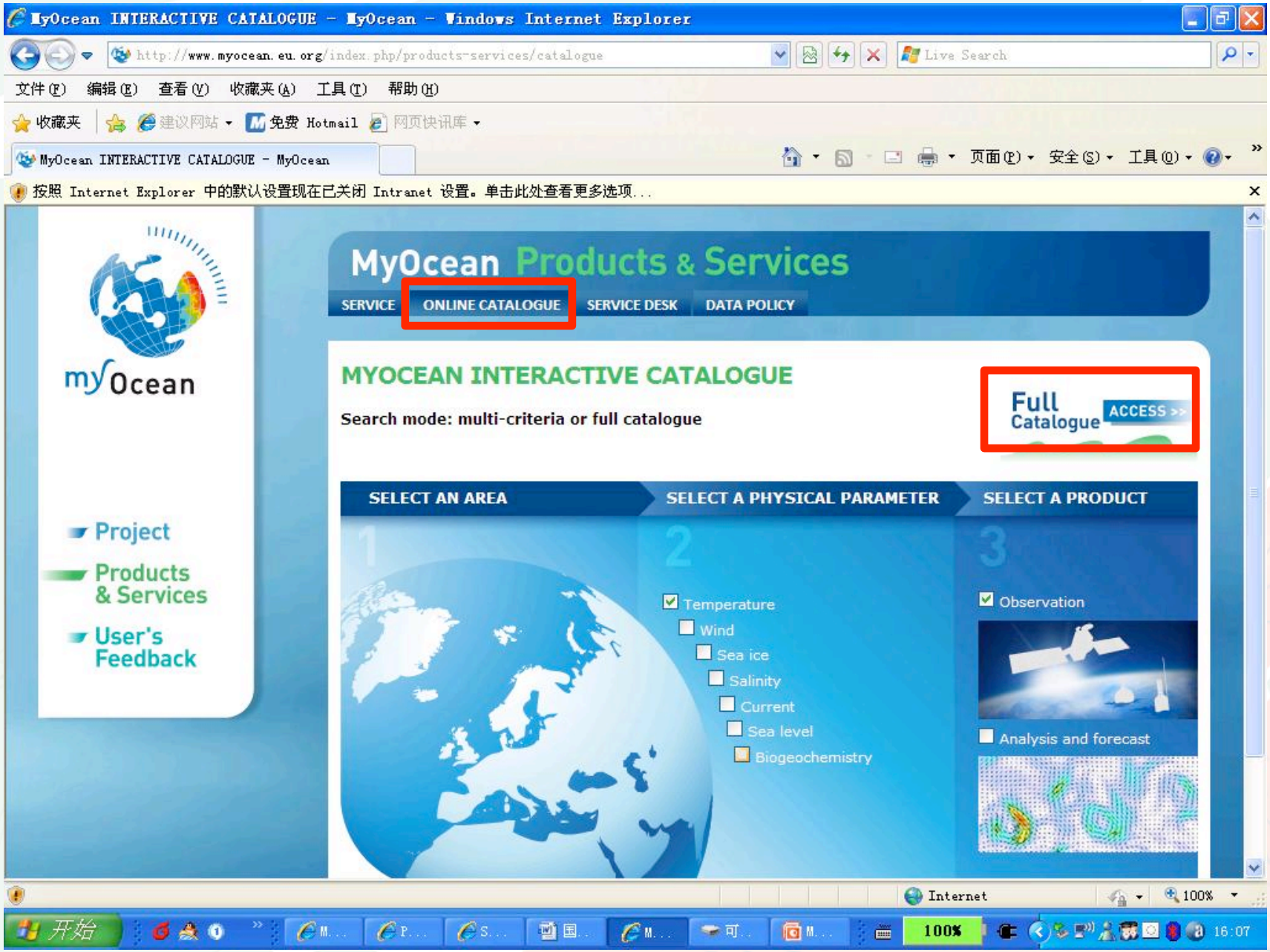
MyOcean INTERACTIVE CATALOGUE - MyOcean - Windows Internet Explorer
http://www.myocean.eu.org/index.php/products-services/catalogue
Live Search
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收藏夹
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MyOcean Products & Services
SERVICE
ONLINE CATALOGUE
SERVICE DESK
DATA POLICY
MYOCEAN INTERACTIVE CATALOGUE
Search mode: multi-criteria or full catalogue
Full Catalogue ACCESS >>
Project
Products & Services
User's Feedback
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SELECT A PHYSICAL PARAMETER
SELECT A PRODUCT
Temperature
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Salinity
Current
Sea level
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Observation
Analysis and forecast
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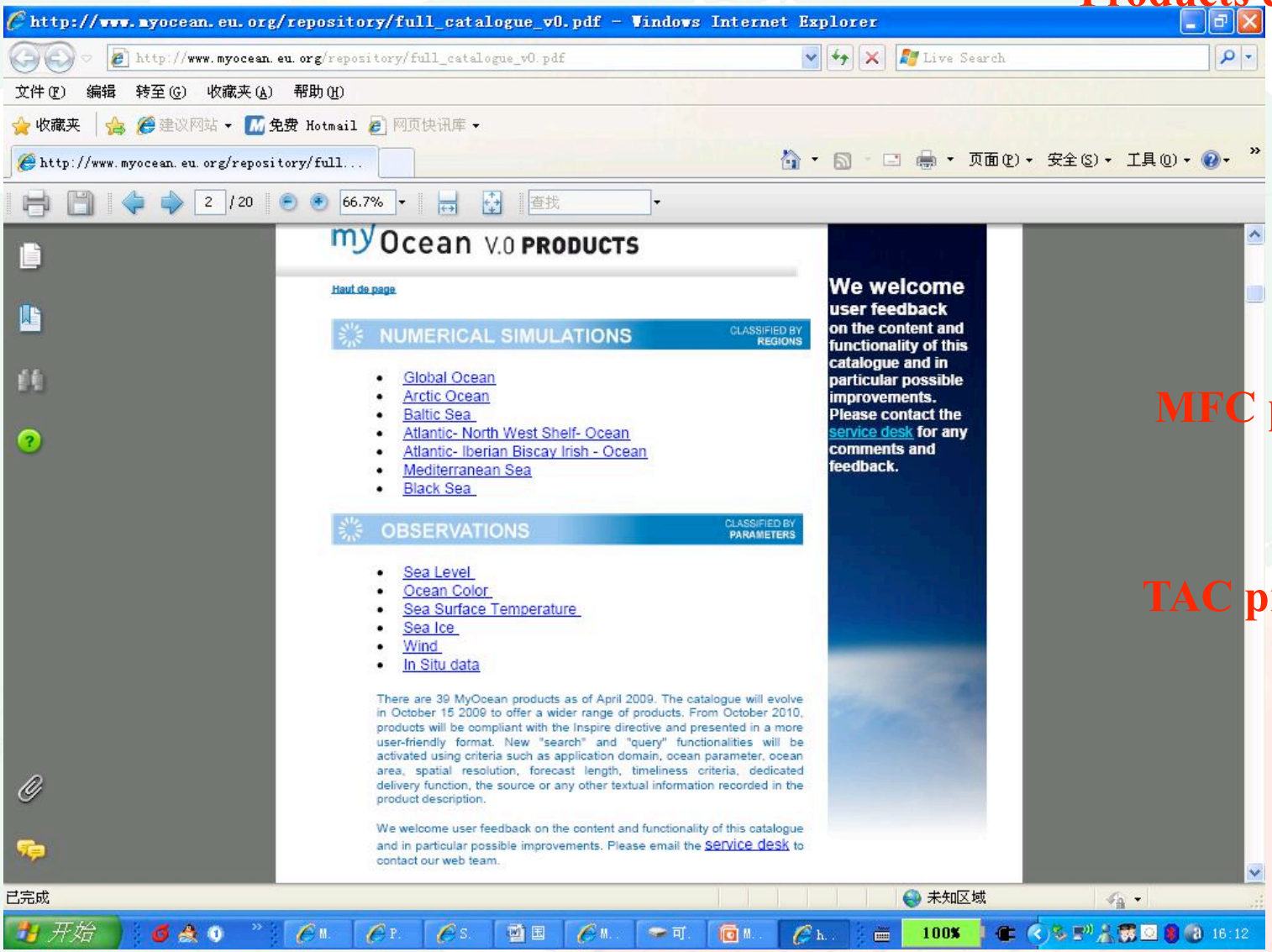
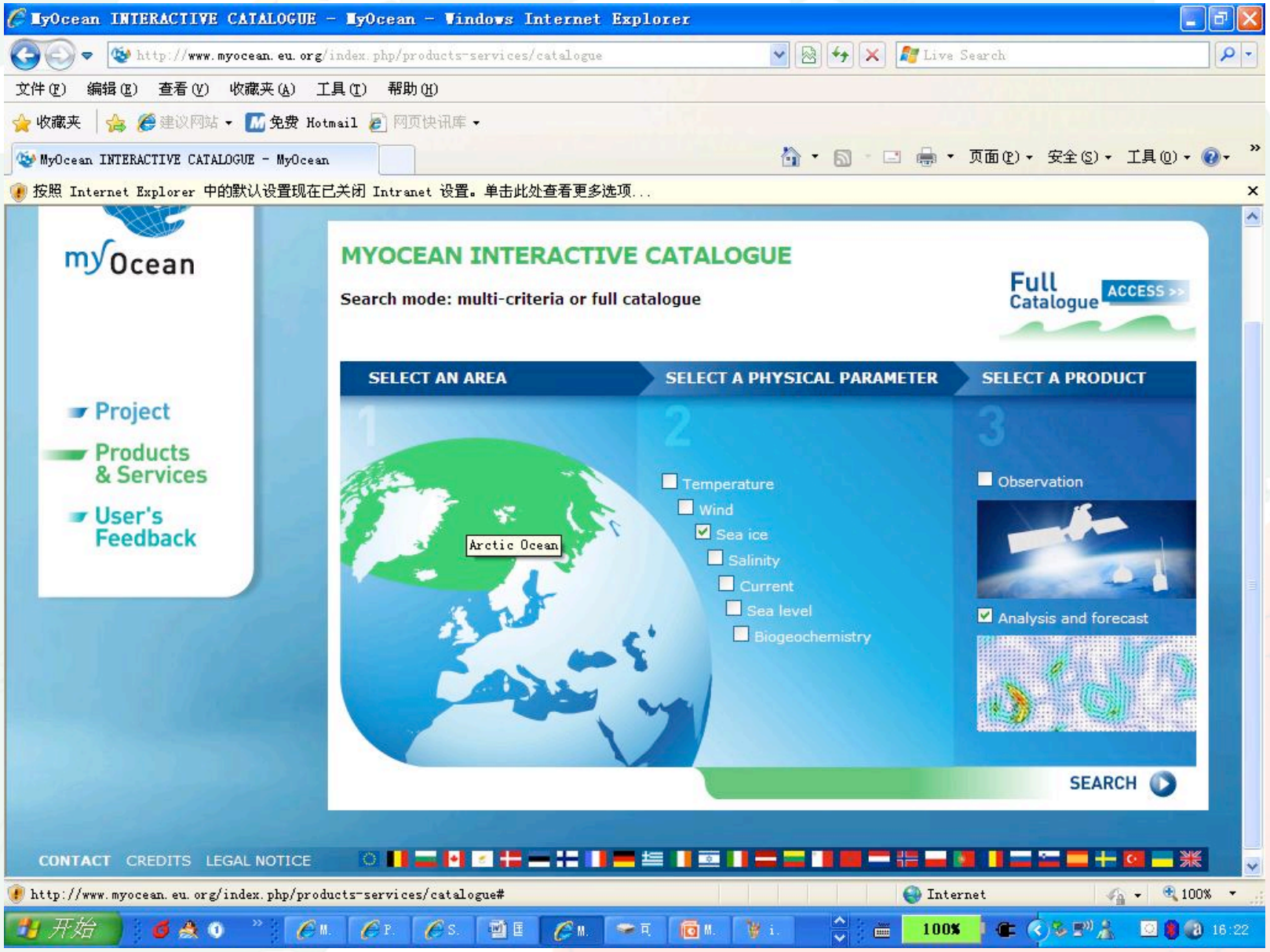
Products catalogue



MFC products

TAC products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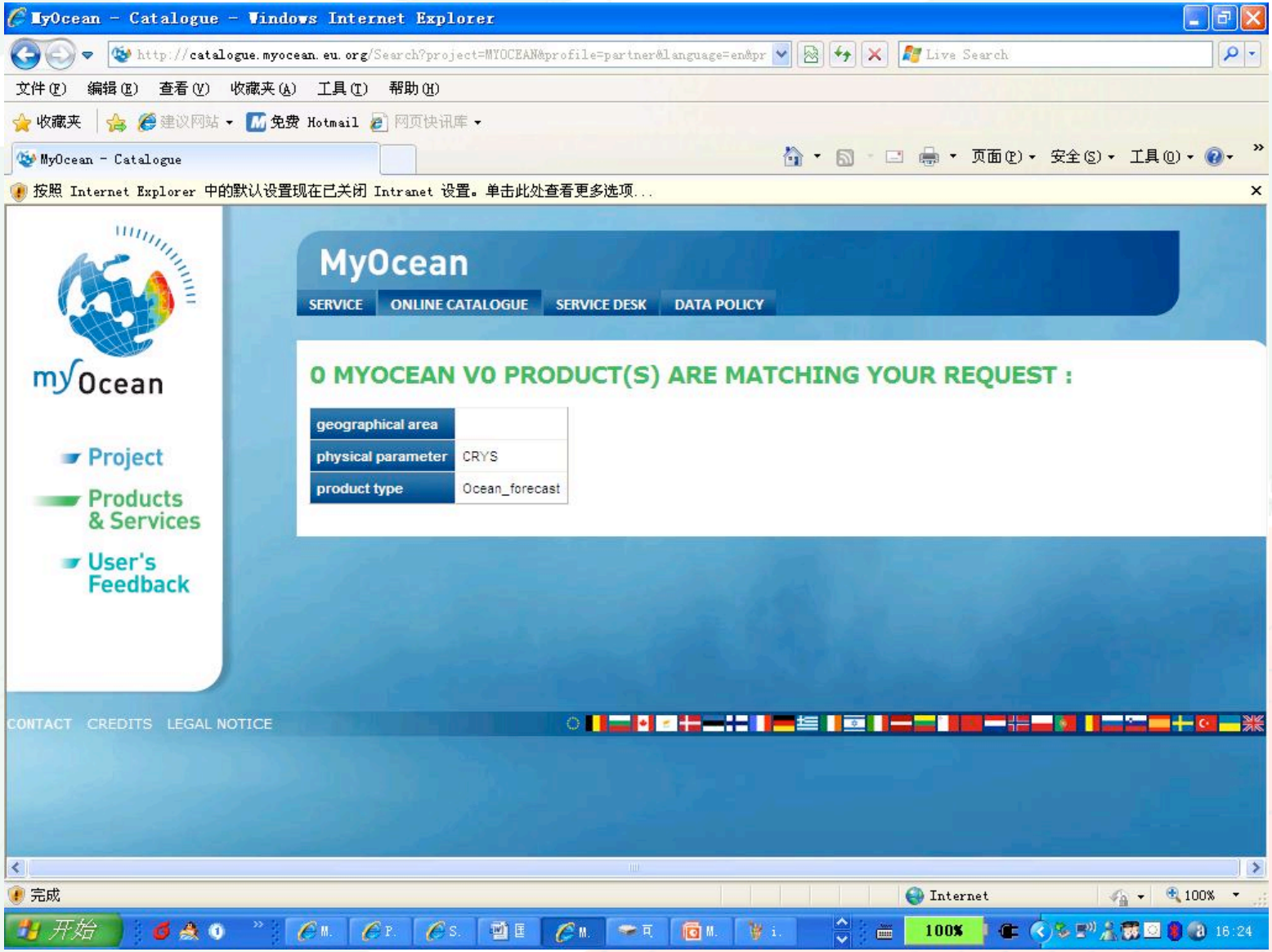

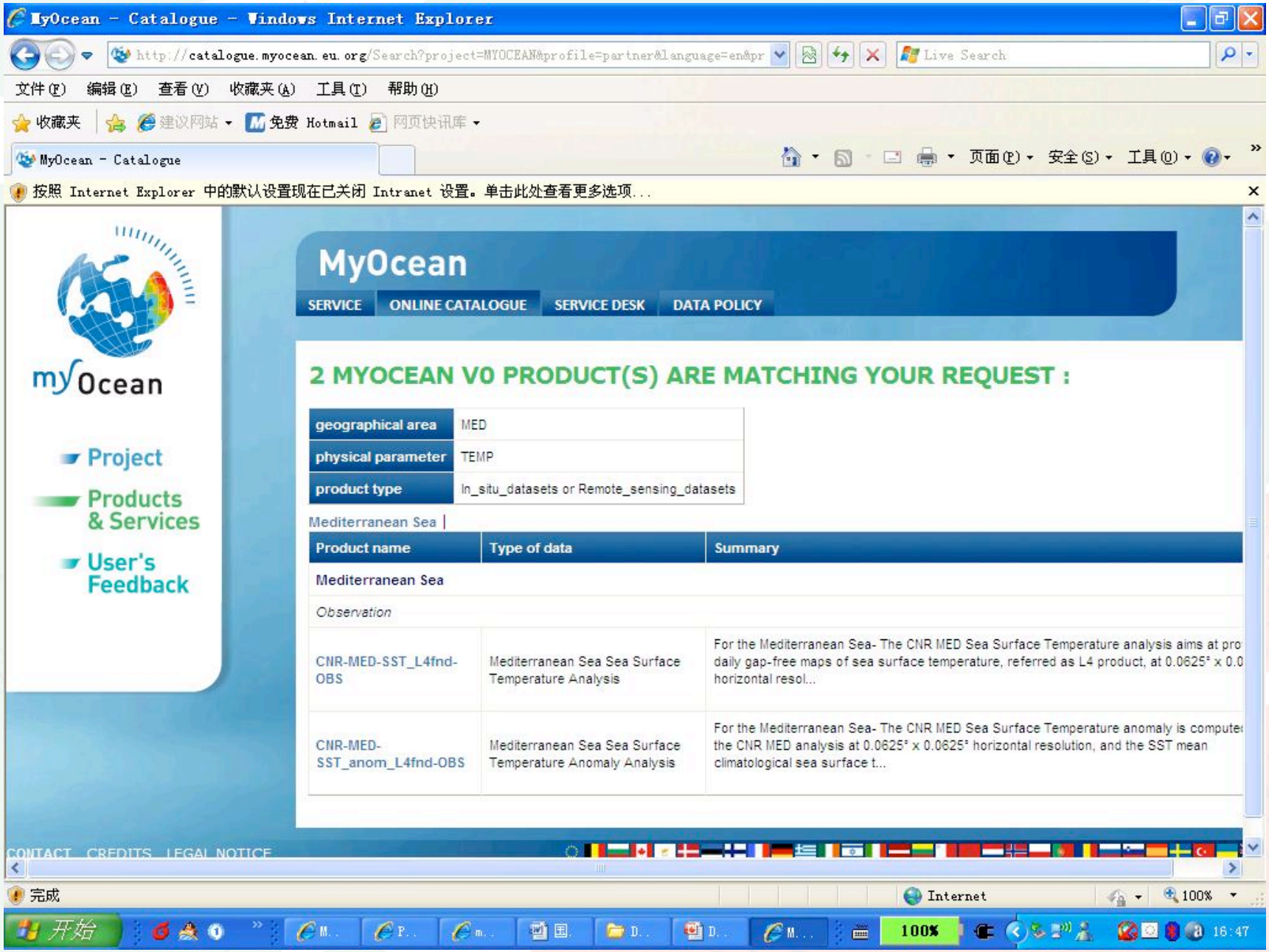
MyOcean - Catalogue - Windows Internet Explorer
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Live Search
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2 MYOCEAN V0 PRODUCT(S) ARE MATCHING YOUR REQUEST :
geographical area
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physical parameter
TEMP
product type
In_situ_datasets or Remote_sensing_datasets
Mediterranean Sea
Product name
Type of data
Summary
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Observation
CNR-MED-SST_L4fnd-OBS
Mediterranean Sea Sea Surface Temperature Analysis
For the Mediterranean Sea- The CNR MED Sea Surface Temperature analysis aims at pro daily gap-free maps of sea surface temperature, referred as L4 product, at 0.0625° x 0.0 horizontal resol...
CNR-MED-SST_anom_L4fnd-OBS
Mediterranean Sea Sea Surface Temperature Anomaly Analysis
For the Mediterranean Sea- The CNR MED Sea Surface Temperature anomaly is compute the CNR MED analysis at 0.0625° x 0.0625° horizontal resolution, and the SST mean climatological sea surface t...
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Remarks

Ocean environmental forecasting system and the related products could be provided are introduced. We take ocean wave forecasting and ocean model simulation as examples to discuss the main difference of ocean environment numerical forecasting between China and Europe. The main gaps could be summarized as follows:

- **The initial forcing field and data assimilation availabilities**. The wind field with high quality and accuracy are needed in both ocean wave modeling and ocean numerical modeling. 4-D variables data assimilation especially with in situ data and satellite data should be much improved in the future.
- **Mechanism of some key physical process studies and parameterization** especially in coastal area. Air-sea interaction and coupling techniques. Further studies are needed in air-sea coupling processes including wind storm – wave – tide – current – ice processes, and solar radiation and its scattering processes, and atmosphere – ocean coupling techniques.
- **Model products' verification and validation.** Class 1-3 metrics are introduced in ocean numerical modeling in MERSEA.
- **In situ data, satellite data and model forecasting data service should be improved**. The model and related information should be provided accompanying with the model products.

Remarks

Mean differences are:

- **No real operational european coastal products**. Europe starts from regional and global to coastal areas. Downscaling is in preparation.
- **European centralisation of input data and output products in dedicated centers.**
- **Products access mostly freely via web site.**

Thank you for your attentions !