PICES-2010, Portland, USA October 21-31, 2010

Introduction of Korea Operational Oceanographic System (KOOS)

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Outline

1. Introduction
2. Korea Operational Oceanographic System (KOOS)
3. Applications

What is KOOS ?

A system which can produce and provide a nowcast and forecast information of ocean/ coastal environmental change required for different maritime operations and a solution of pending problems in ocean related governmental agency, industrial circles and the public in Korea

Korea Operational Oceanographic System (KOOS)

Provide data/Info required for more rapid detection & timely prediction of ocean and coastal state changes for better management decisions, different industrial activities and a solution of pending problems

Real-time ocean observing System

Data Transmission, Management

Numerical Modelling

Nowcast and Forecast

Applications

Project scope

(August, 2009 ~ July, 2013)

High-resolution Meteor. info. & input data for ocean prediction model

High-resolution coastal sea state prediction system

3D regional and local ocean circulation model

High-resolution sea surface winds, waves, storm surges, tides, currents and 3D regional/local circulation prediction info.

Applications (Oil spill, Search & Rescue, Storm surge, etc.)

Web-GIS based operational ocean information system

What Does It forecast?
Some Core Variables

Basic variables

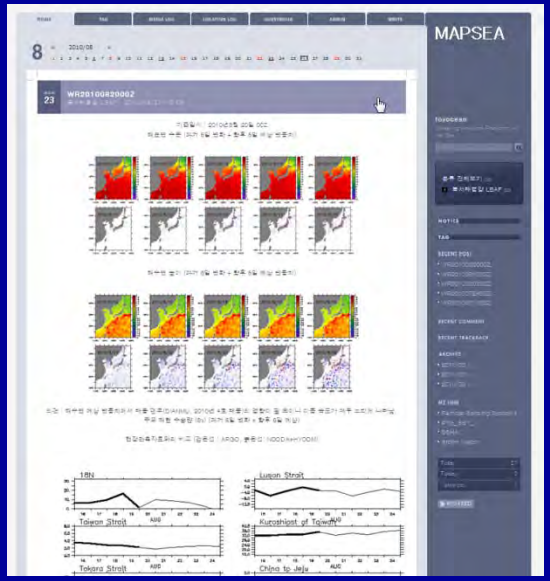
- Sea surface winds
- Sea surface waves
- Storm surges
- Tide, tidal currents
- 3D circulation (Regional/Local)
- Temperature, salinity
- Suspended sediment

Applications

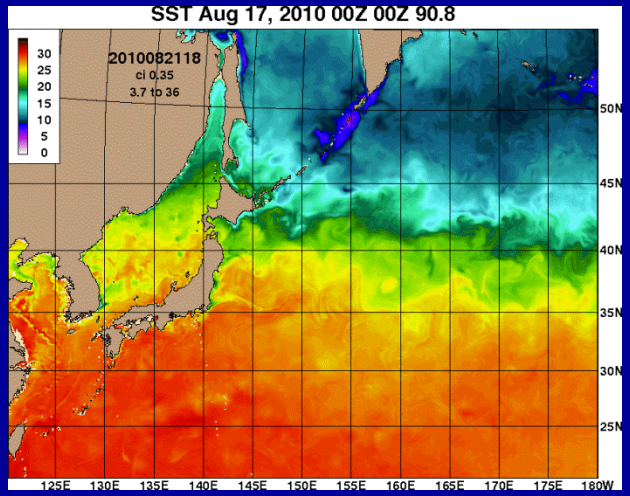
- Storm surges
- Search and Rescue
- Oil spill
- I-MAPS (Integrated-MAritime port Prediction System)
- Sediment transport

Open boundary and Initial conditions for Ocean numerical models

- **NHYCOM(NCODA HYCOM)**
  - Navy Coupled Ocean Data Assimilation,
    HYBRID COORDINATE OCEAN MODEL
  - Global 1/12°, 32 vertical layers
    5 day hindcast and a 5 day forecast



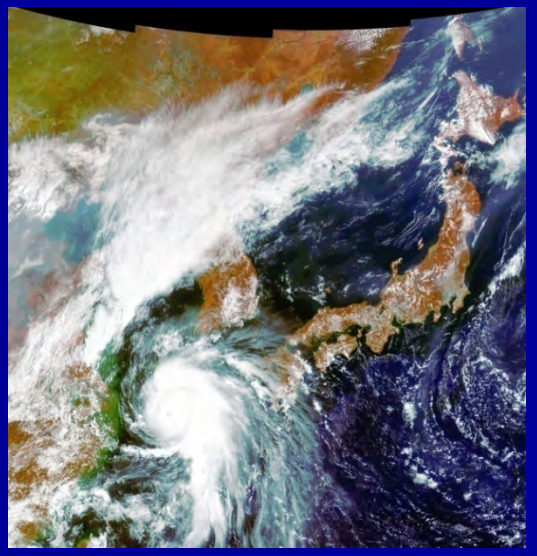
- **Data comparison to ARGO**
- **JAMSTEC(JAPAN) global model data**



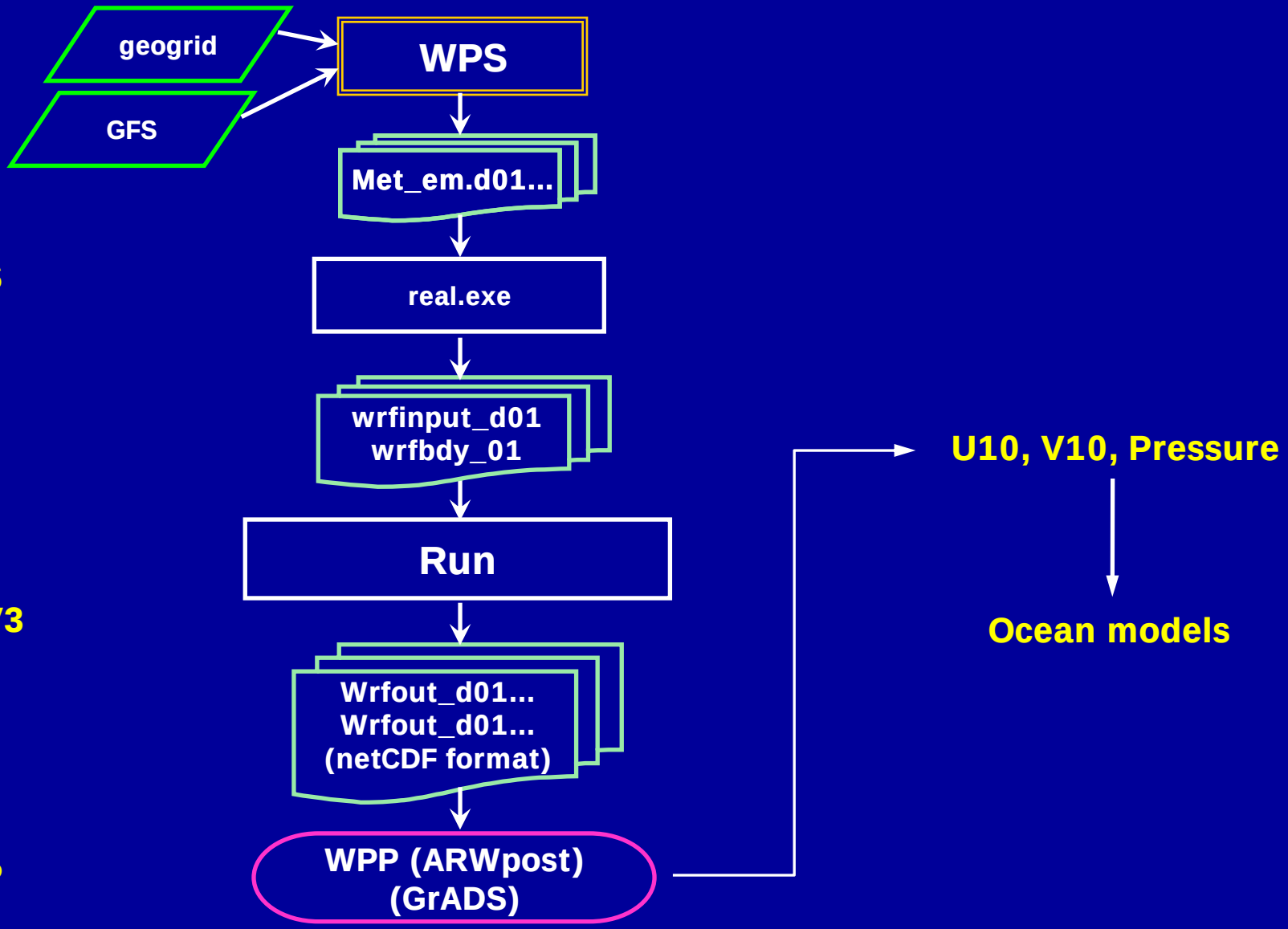
Observations for input data & validation

- **Real-time ocean observing data**
  - Ocean stations, buoys, tidal stations, etc.

- **Remote sensing data**
  - GOCI (Geostationary Ocean Color Imager)
  - NOAA AVHRR (SST, SSH) and etc.

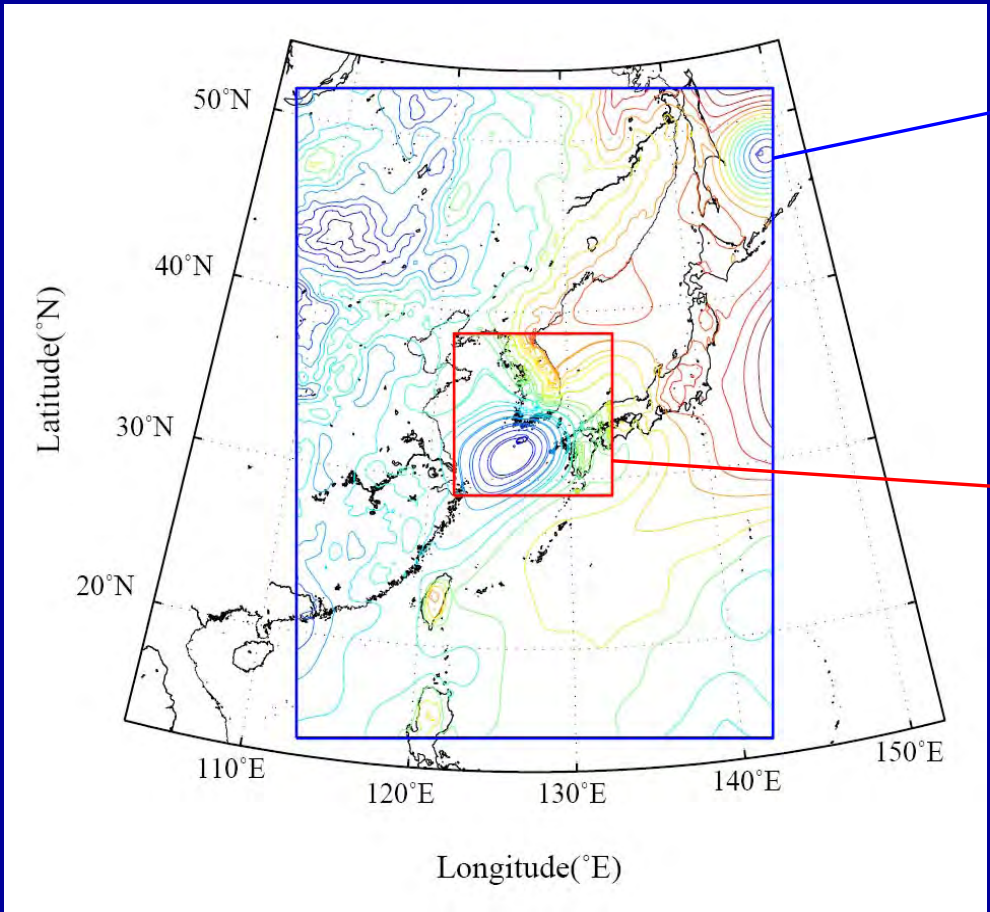


Operational Weather Forecasting System(WRF)



Operational Weather Forecasting System(WRF)

WRF runs 2 times per day (09, 21LST)
for 72 hours prediction



D01 (20km)

- Grid : 163 × 217
- Latitude : 14.9°N ~ 52.5°N
- Longitude : 104.6°E ~ 150.4°E

D02 (4km)

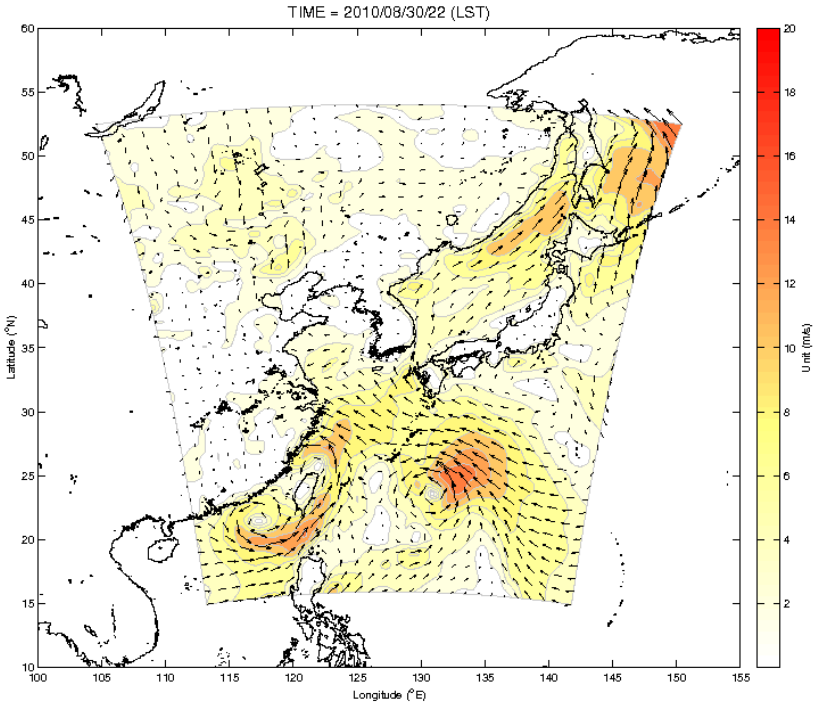
- Grid : 270 × 270
- Latitude : 29.9°N ~ 39.6°N
- Longitude : 121.1°E ~ 133.6°E

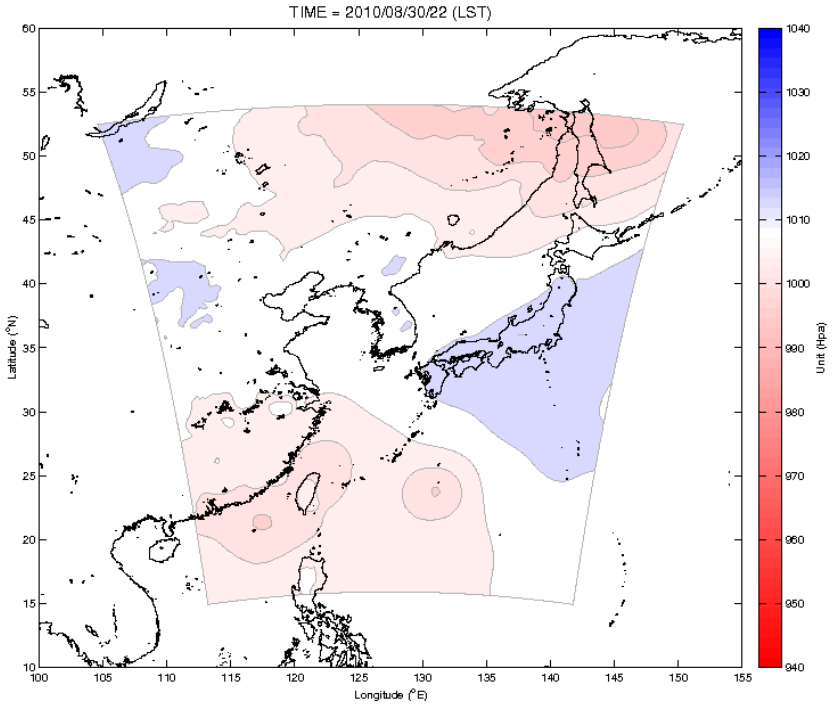
Operational Weather Forecasting System(WRF)

Sea surface wind

Domain 1

Sea level pressure

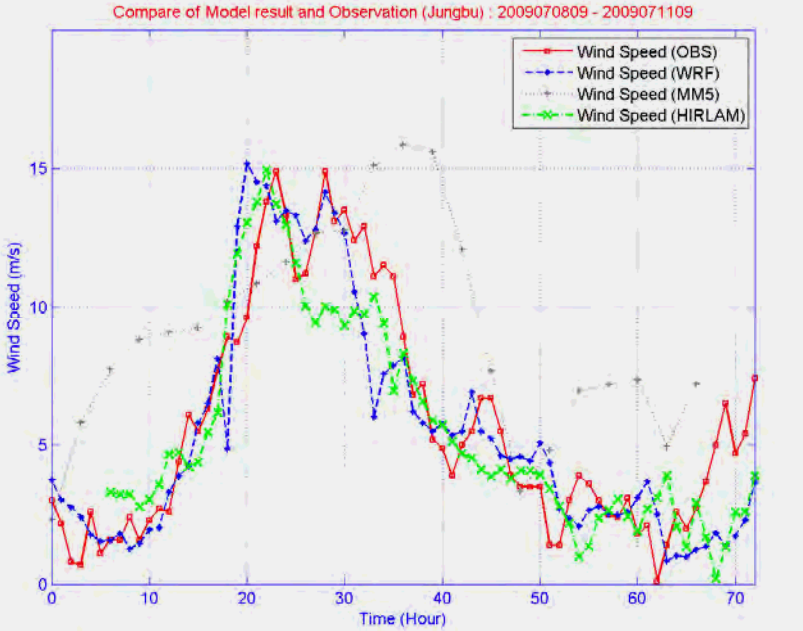


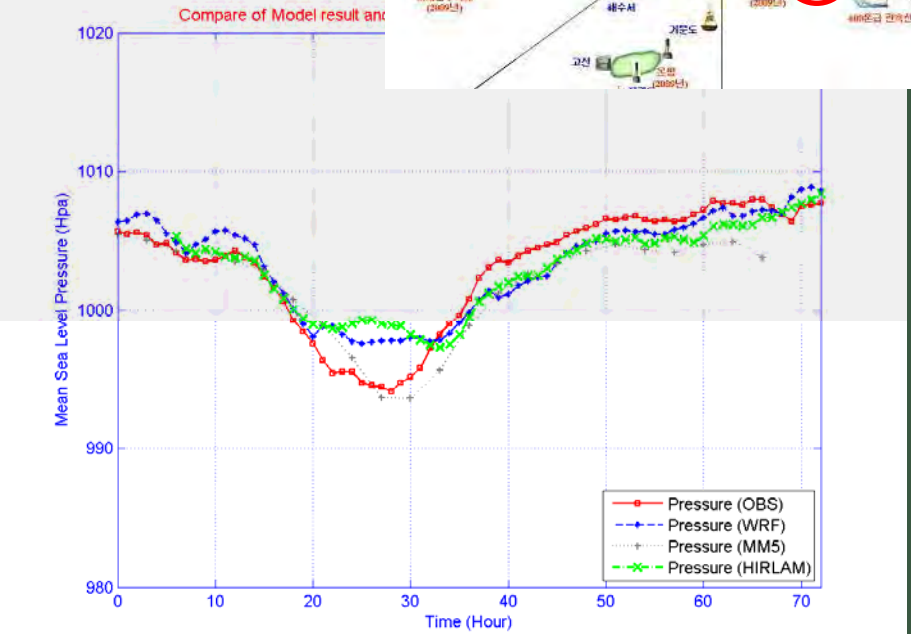


2010/8/30/21 ~ 2010/09/02/21 (LST)

Comparisons of Wind Speed and Pressure
– WRF, MM5, HIRLAM, OBS.

Site : Yellow Sea Buoy

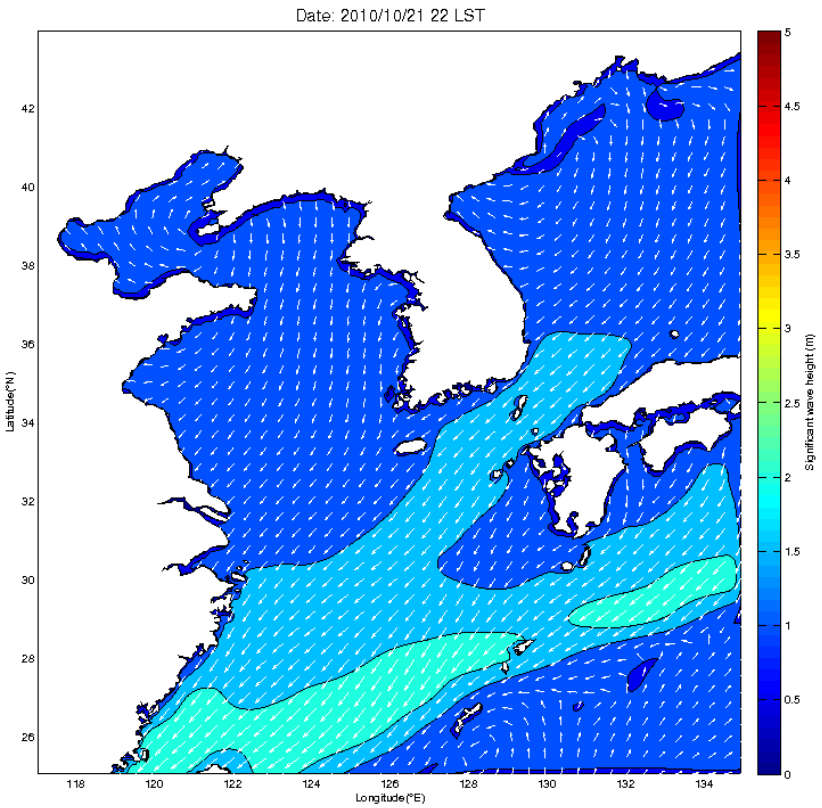




WRF : 4km, MM5 : 30km, HIRLAM : 7.5km

Operational Wave Forecasting System (WAM, 72 hrs)

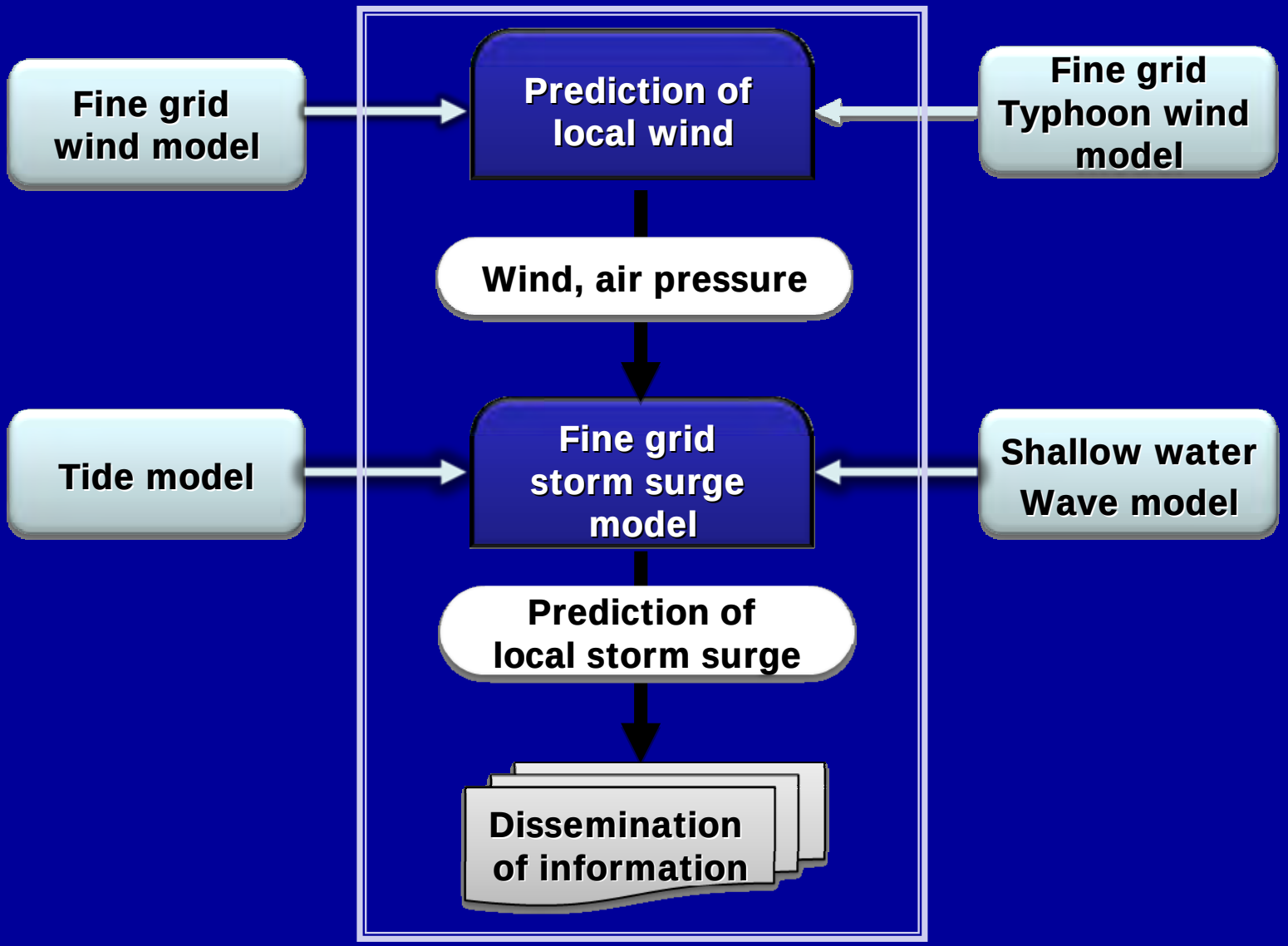
Wave Analysis Model (WAM) with WRF results



2010/10/21/21 ~ 2010/10/24/21 (LST)

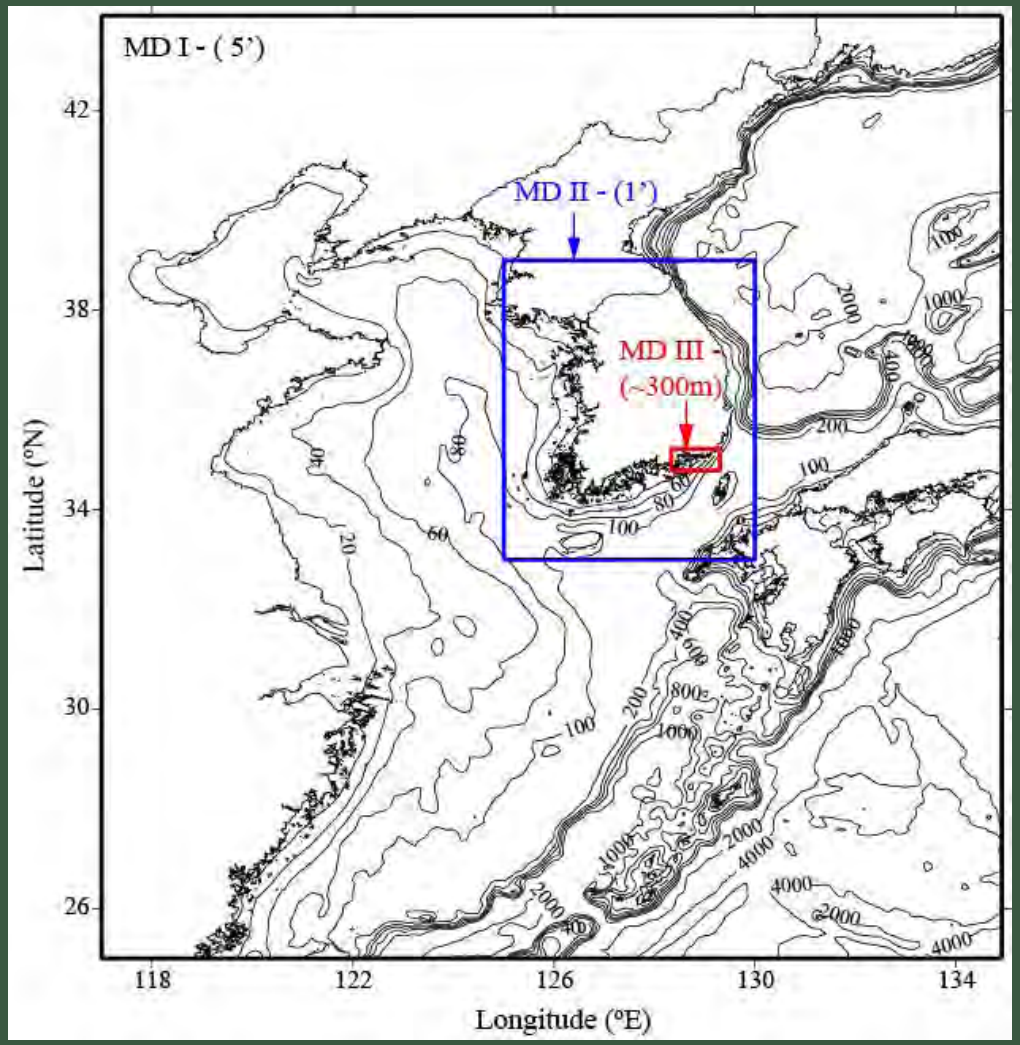
Resolution: ~9 Km

Operational storm surge prediction system



Operational storm surge prediction system

Nested grid systems (KORDI-S)



◇ Domain :
117-135 °E, 25-44 ° N

◇ Depth : Etopo5

◇ Nested grids :
1) MD I : 5' (~9 km)
2) MD II : 1' (~2 km)
3) MD III: ~ 300 m

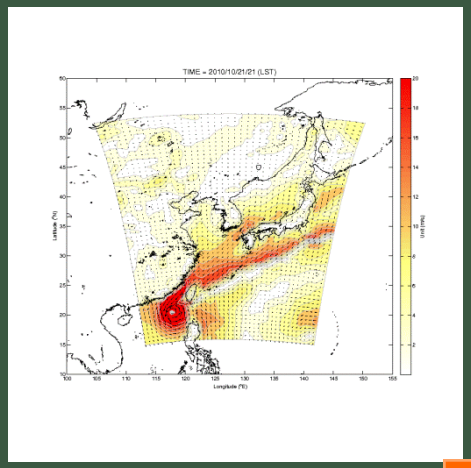
◇ One-way Nesting

◇ Forcing
- 4 tidal constituents (M2,S2,O1,K1)
- wind and pressure (PVM)

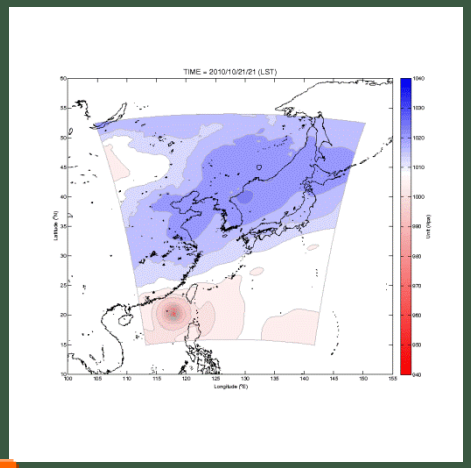
Operational storm surge prediction system

(2010.10.21 21:00 ~ 2010.10.24. 21:00)

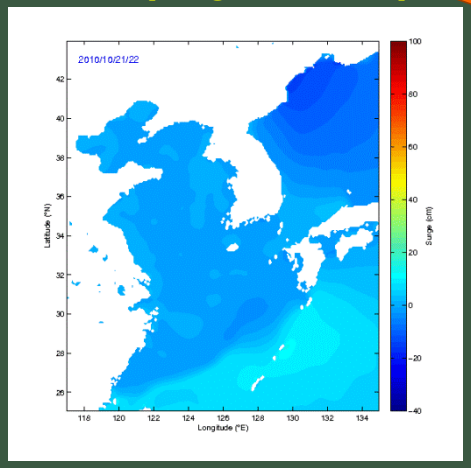
Wind



Pressure

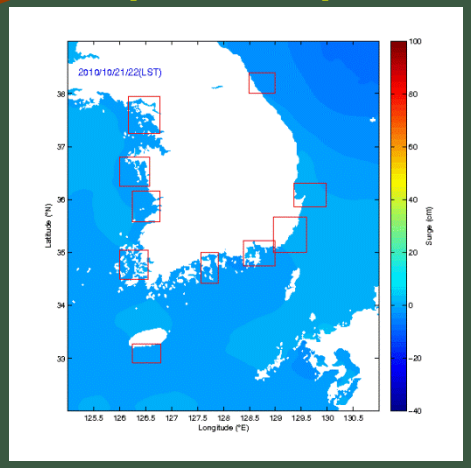


Storm surge (Regional sea)



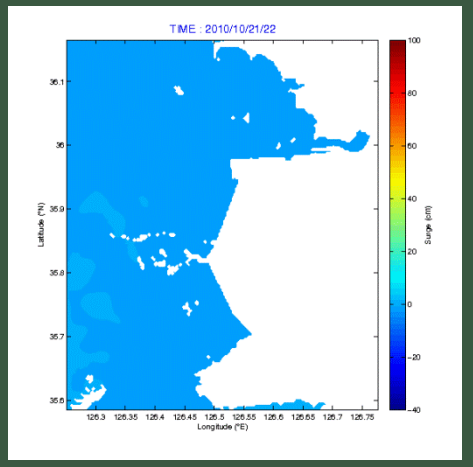
9km

Storm surge (local area)

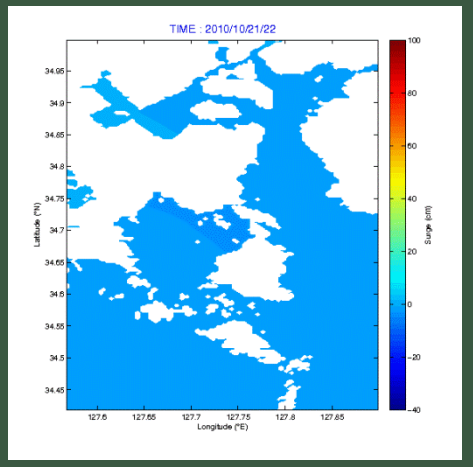


2km

Gunsan



Yeosu



300m

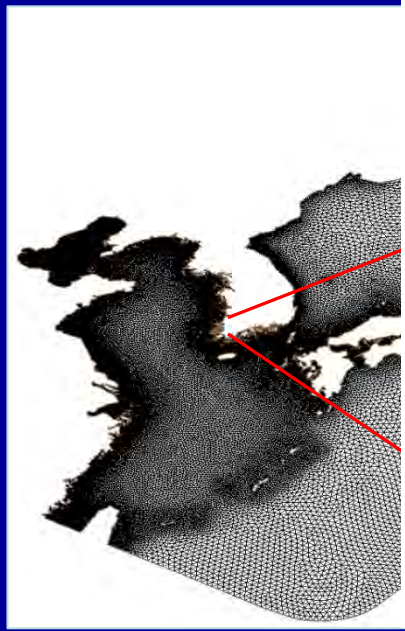
Operational Regional/Local Circulation Forecasting System(72 hrs)

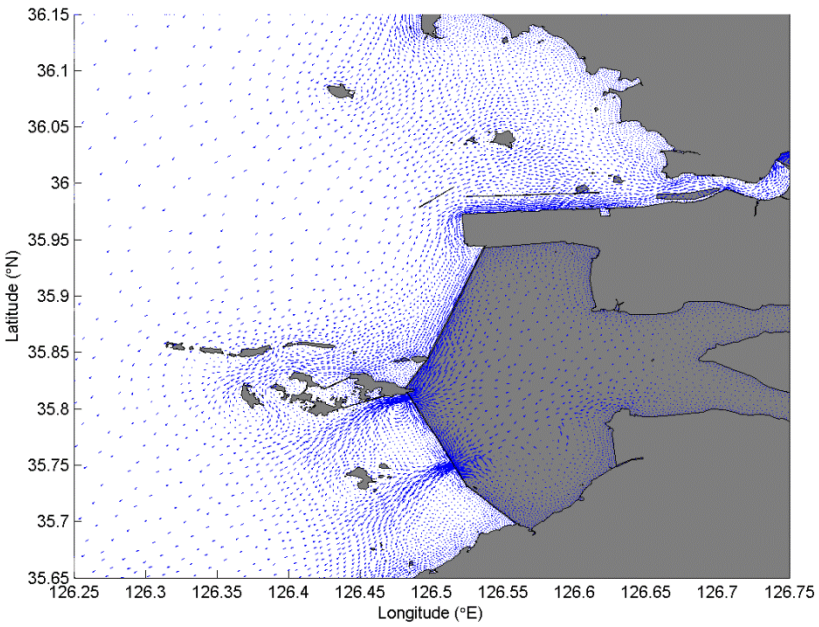
1) FVCOM

~ About 400m resolution with WRF results

~ Tides, storm surge, oil spill, sediment transport

~ SWAN coupling (under study)





Node = 240,517
Element = 455,906

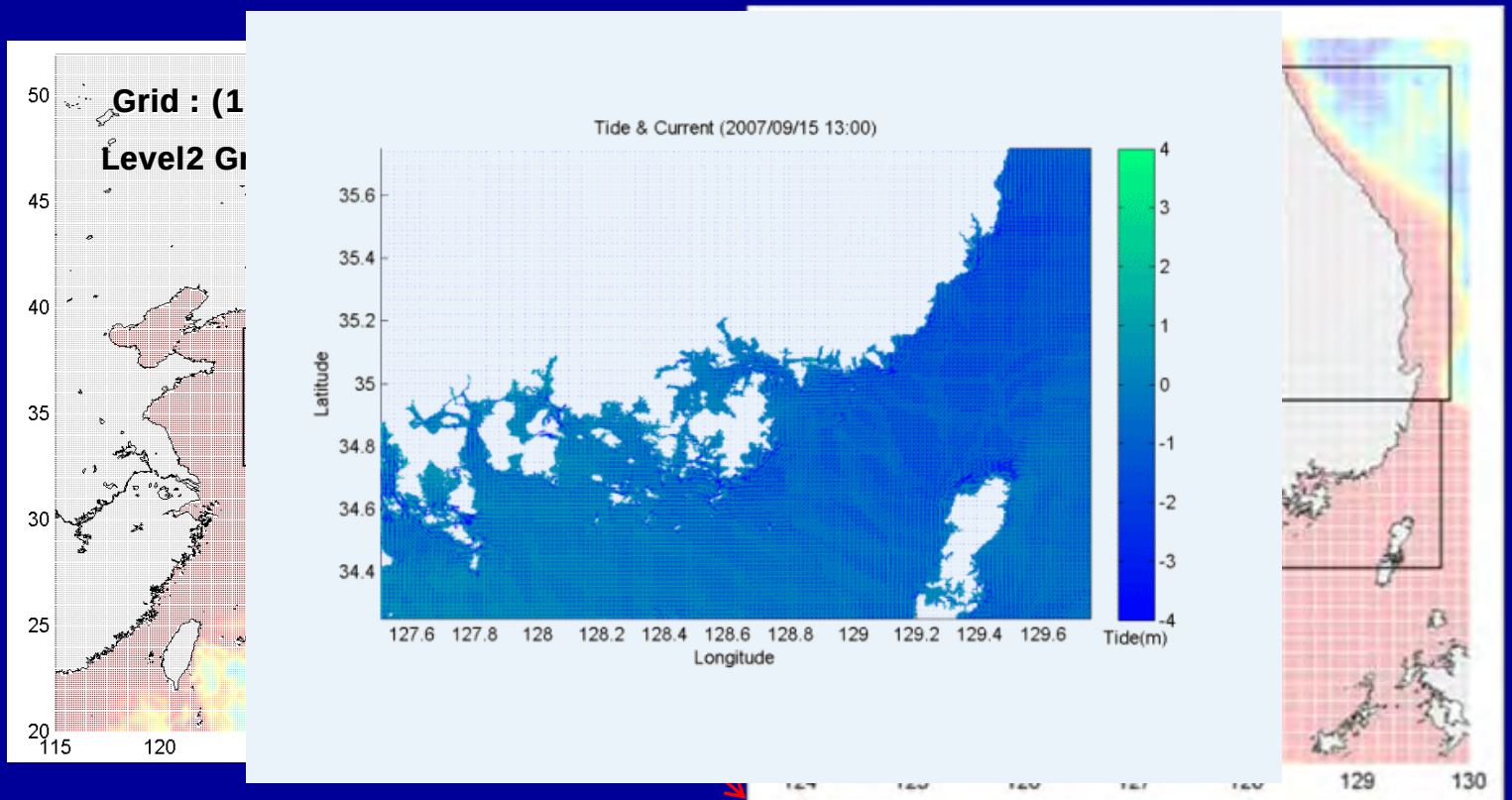
Operational Regional/Local Circulation Forecasting System(72 hrs)

2) MOHID

~ 3 step nesting about 300m resolution with WRF results

~ Tides, storm surge, SAR, sediment transport

~ SWAN coupling (under study)



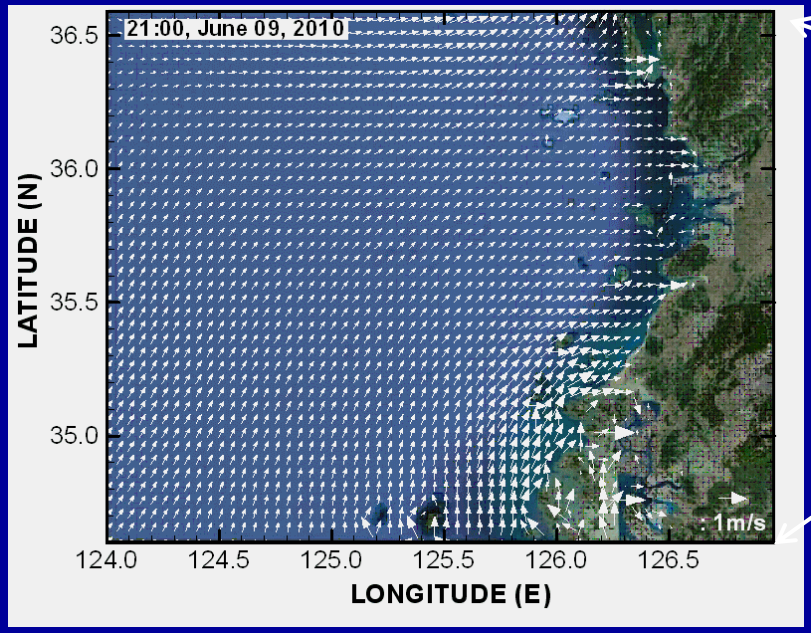
Operational Regional/Local Circulation Forecasting System(72 hrs)

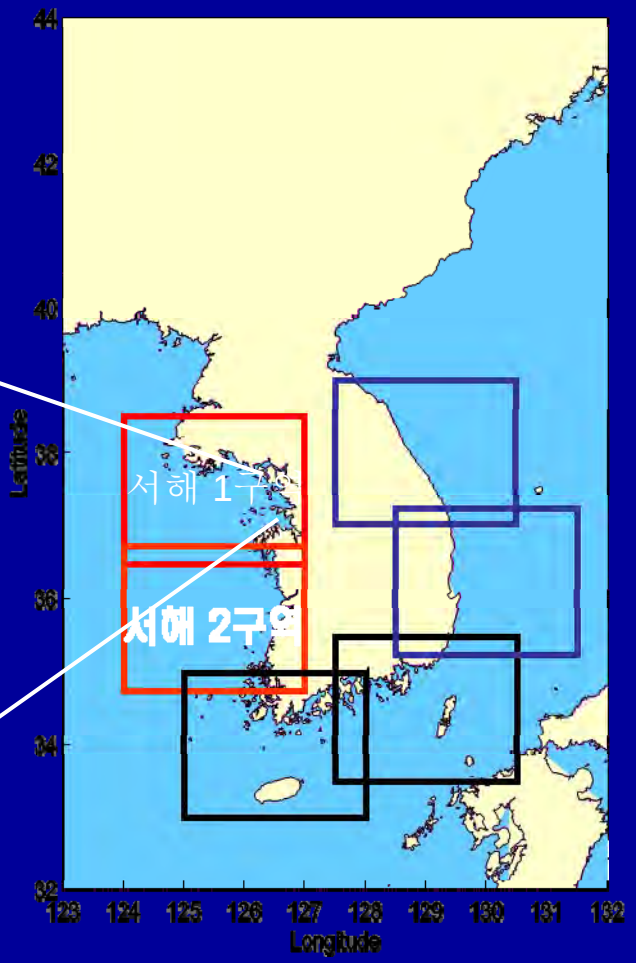
3) ROMS

~ 2 regions, nesting up 50m resolution with WRF results

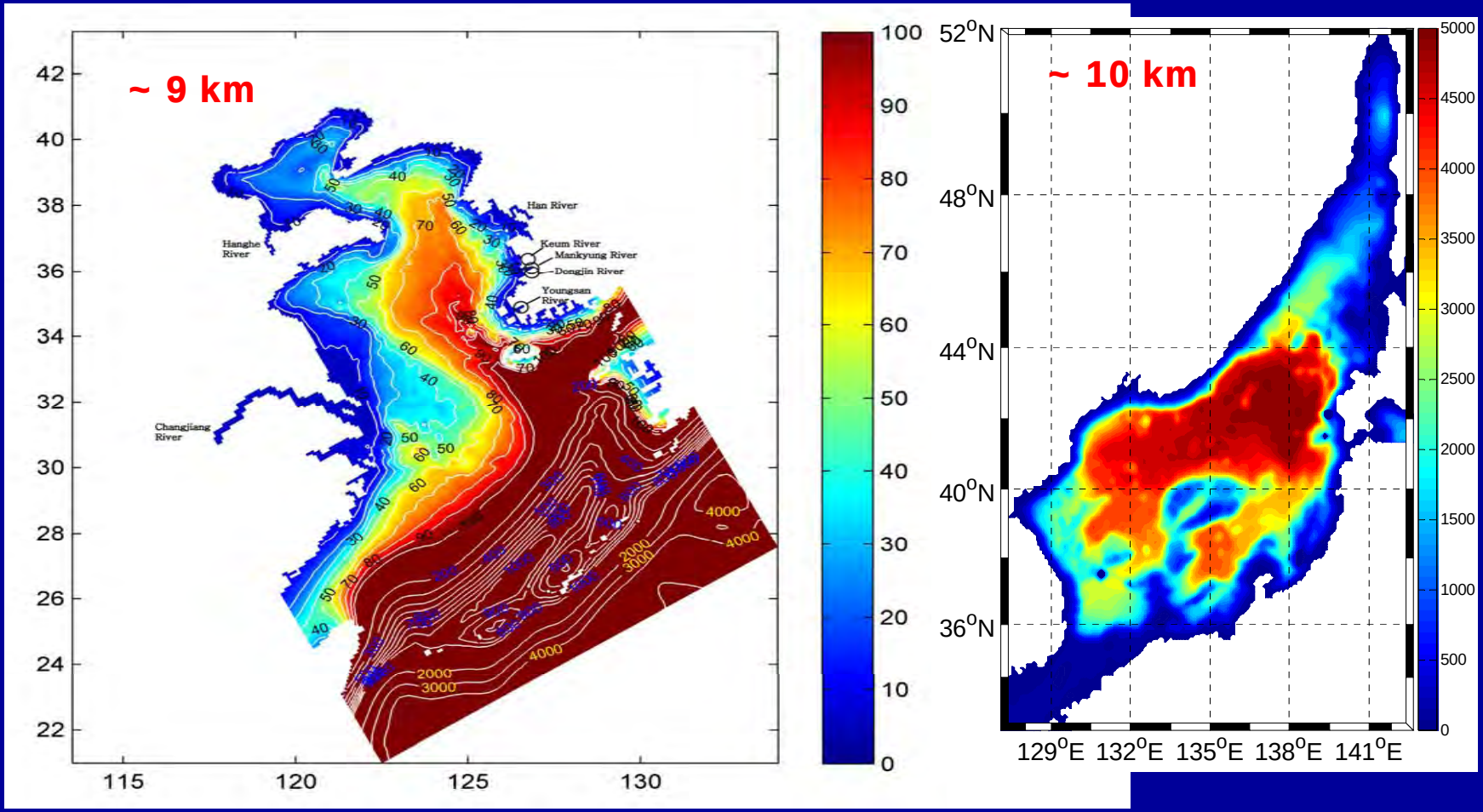
~ 2 way coupling with SWAN

~ Tides, SAR, Sediment transport



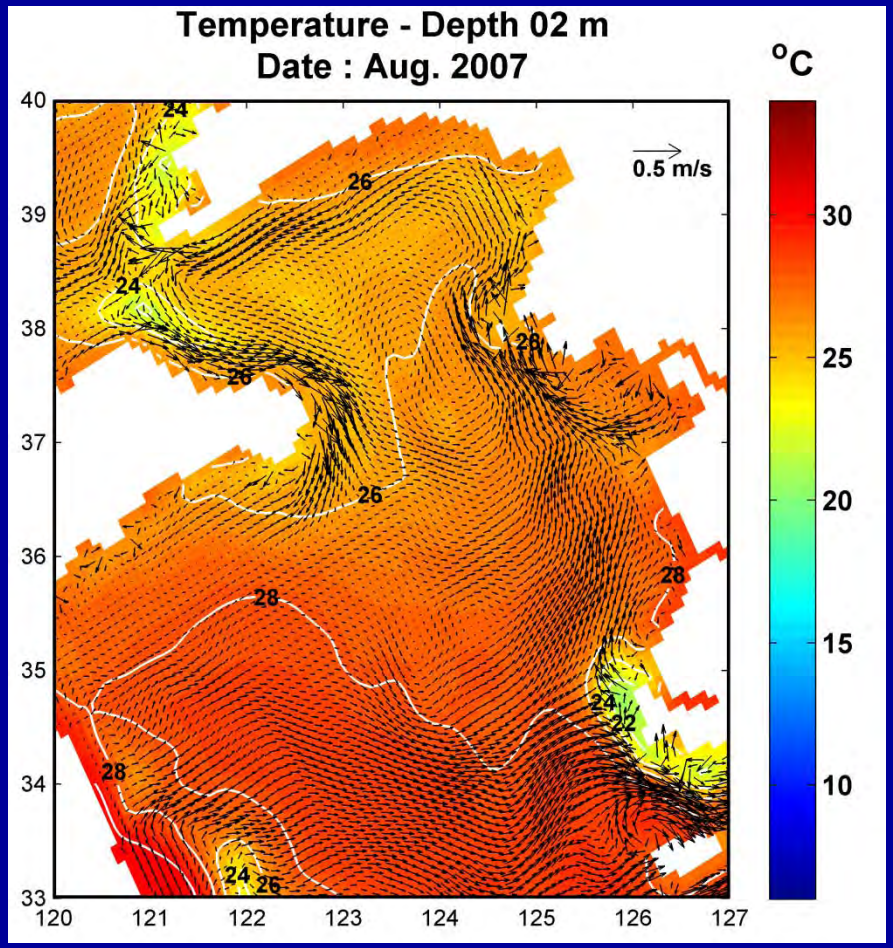


Operational 3D circulation forecasting system(72 hrs)

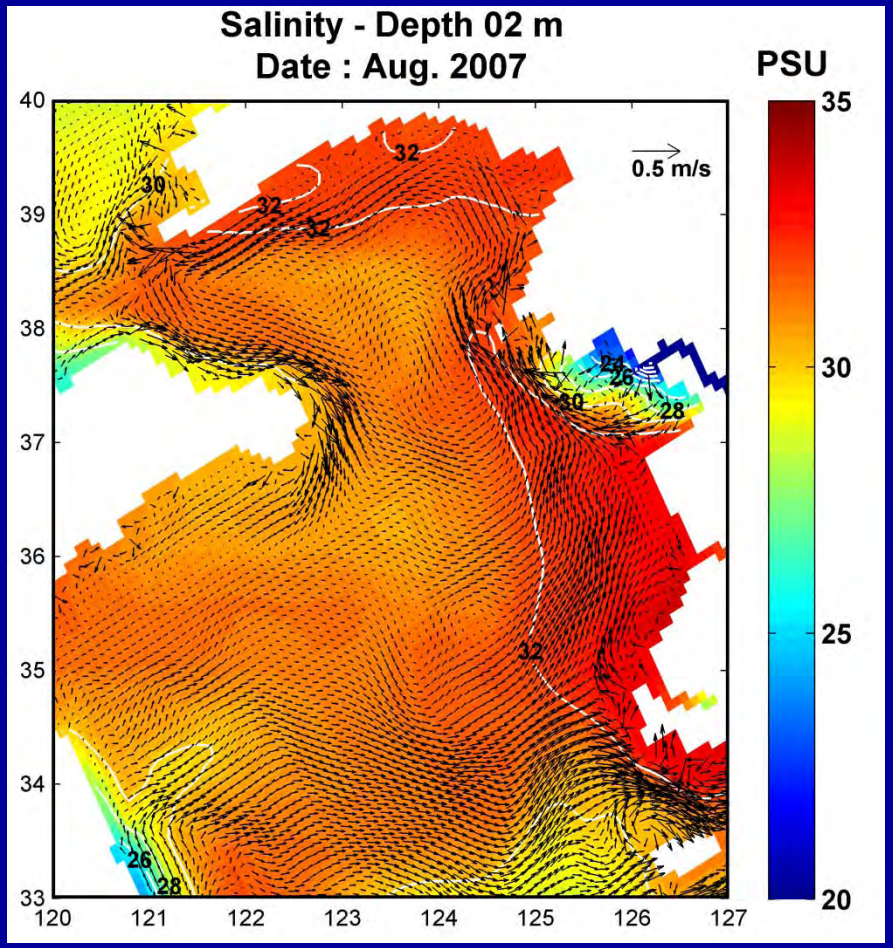


Operational 3D circulation forecasting system(72 hrs)

Temperature



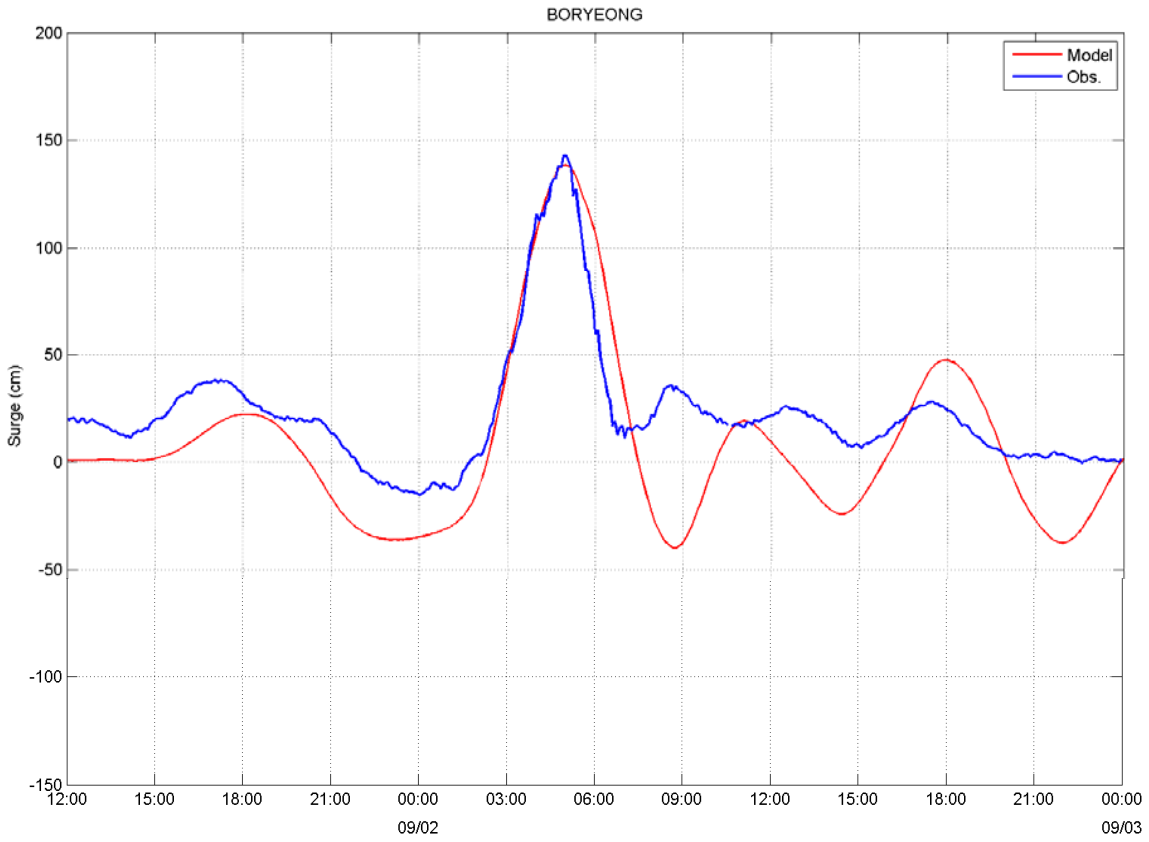
Salinity



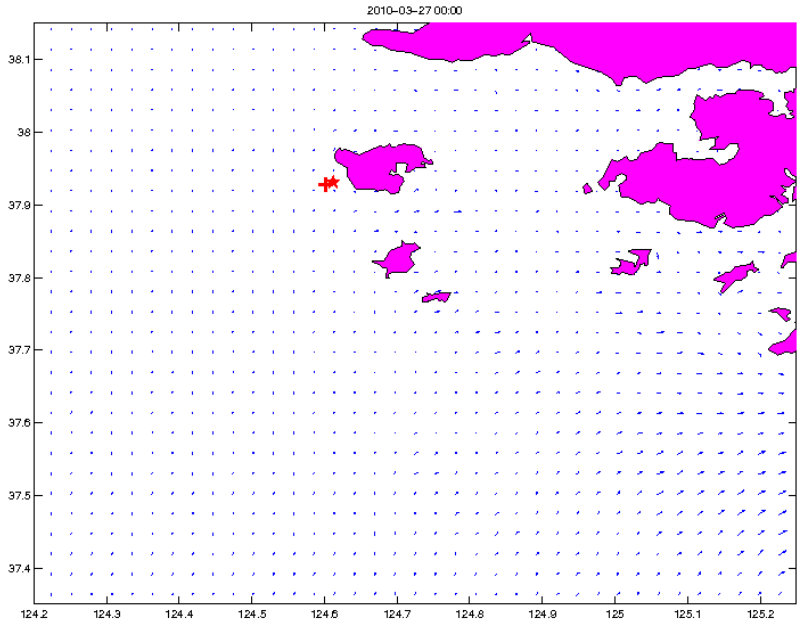
Applications (Storm surge)

Model Verification

Typhoon KOMPAS in Sep. 2010



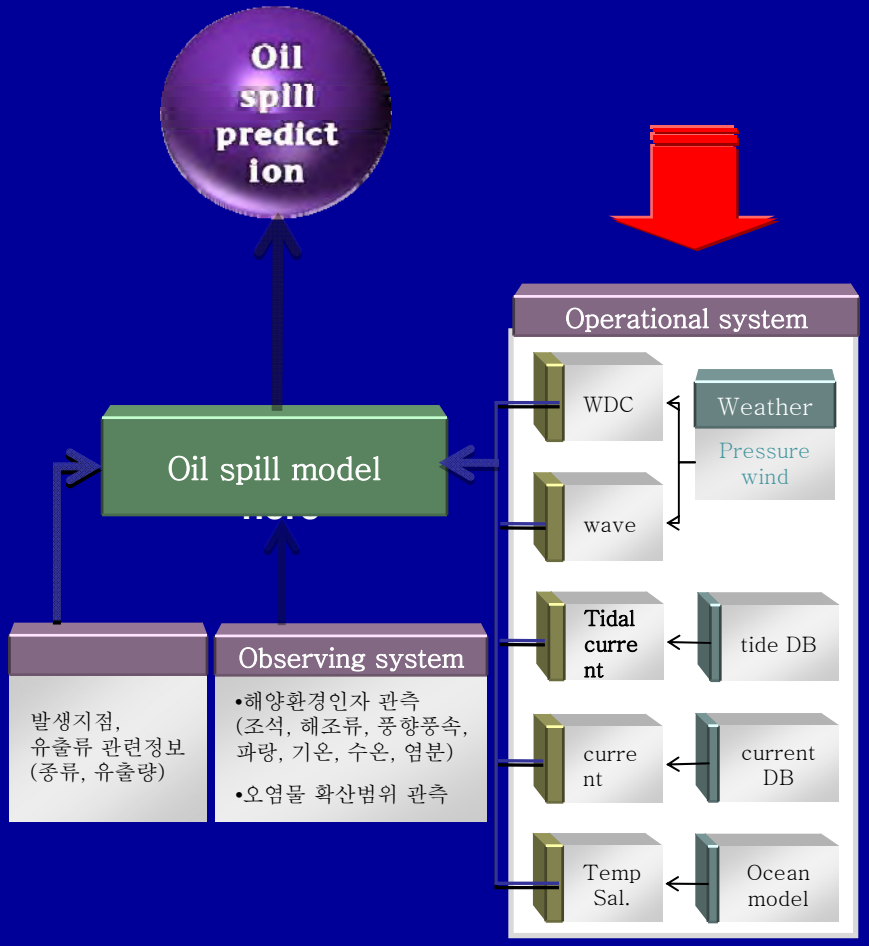
Applications (SAR)



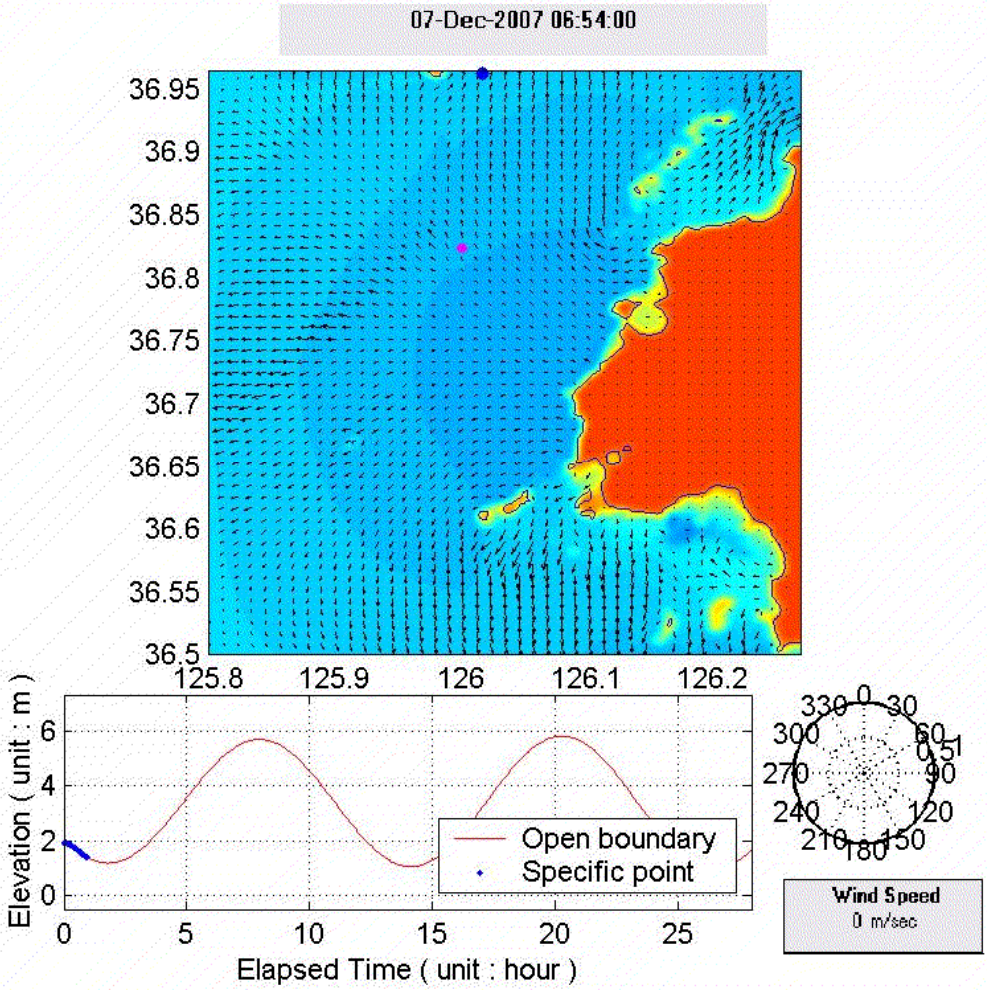
An example of SAR simulation

Oil spill simulation using FVCOM

Flow chart of oil spill prediction



(ex) Hebei spirit oil spill accident simulation(07.12.7)

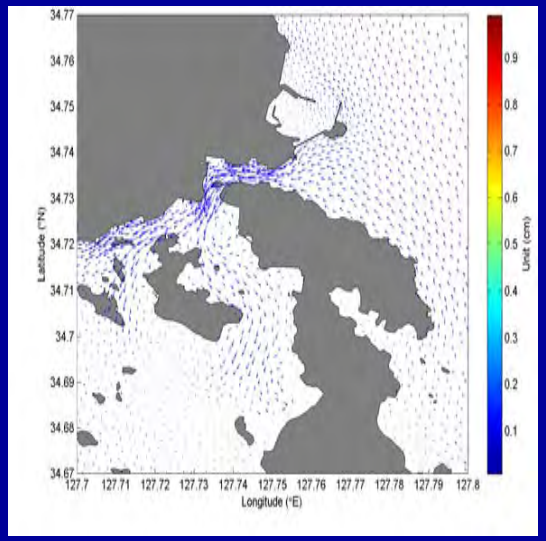


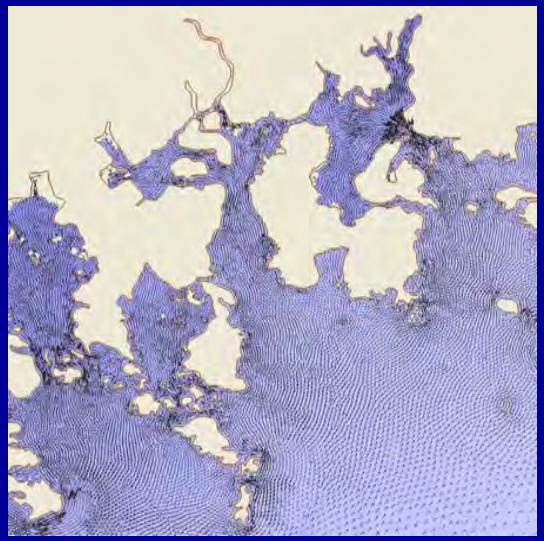
Applications

I-MAPS (Integrated-MAritime port Prediction System)

<Yeosu>

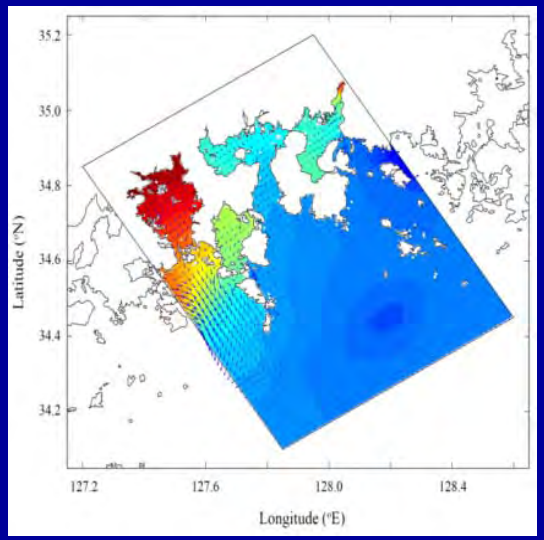
FVCOM

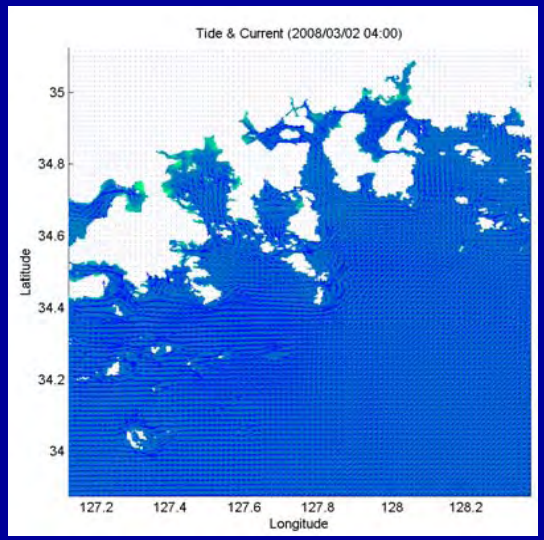




ADCIRC

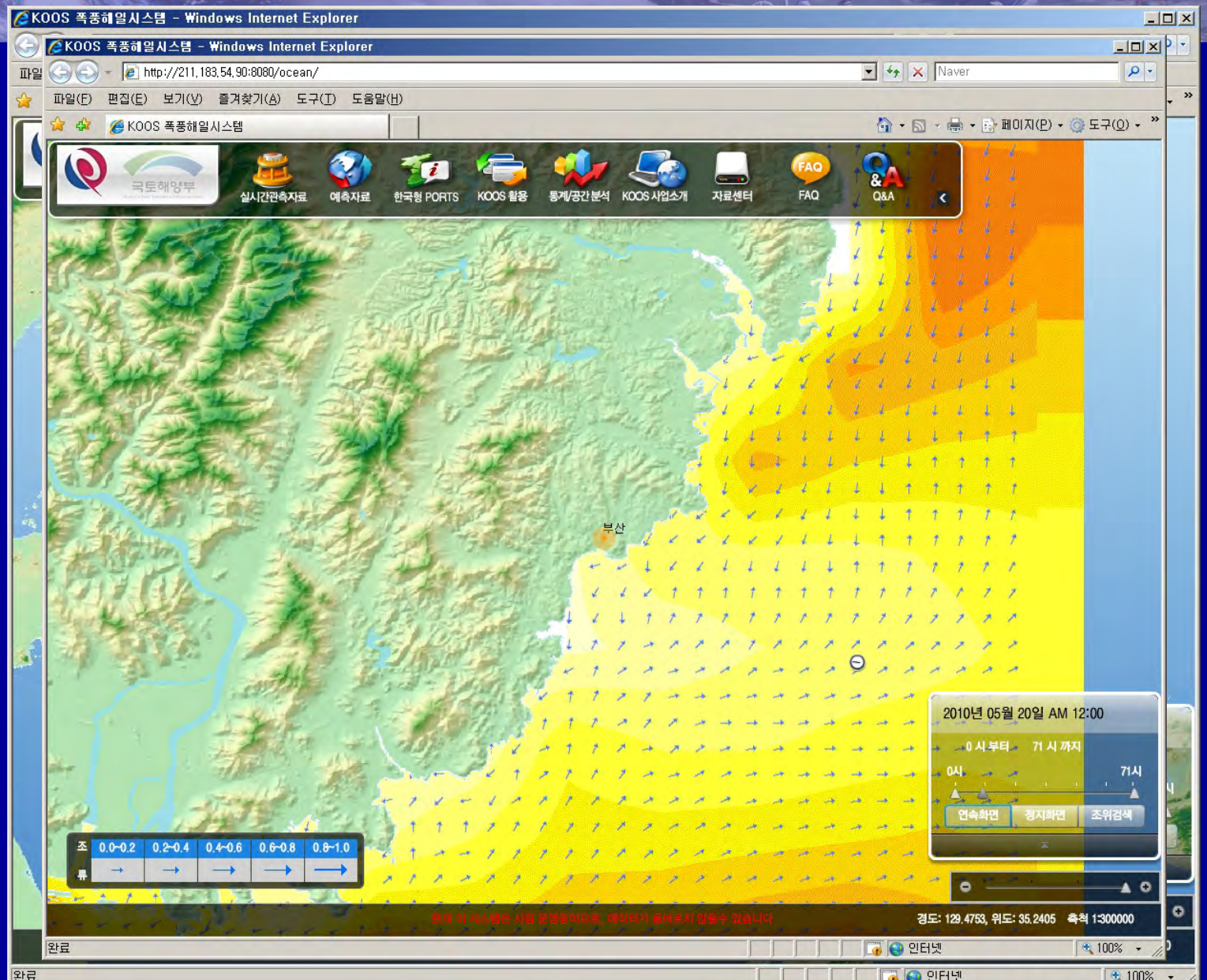
ROMS





MOHID

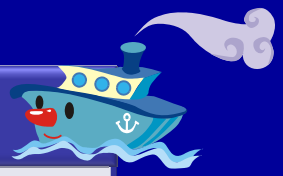
Data Management System & Web-GIS



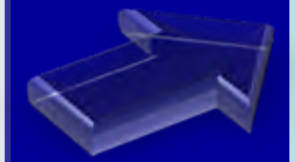
Products of KOOS

Forecasting information on ocean/coastal environment

What are forecast informations ?



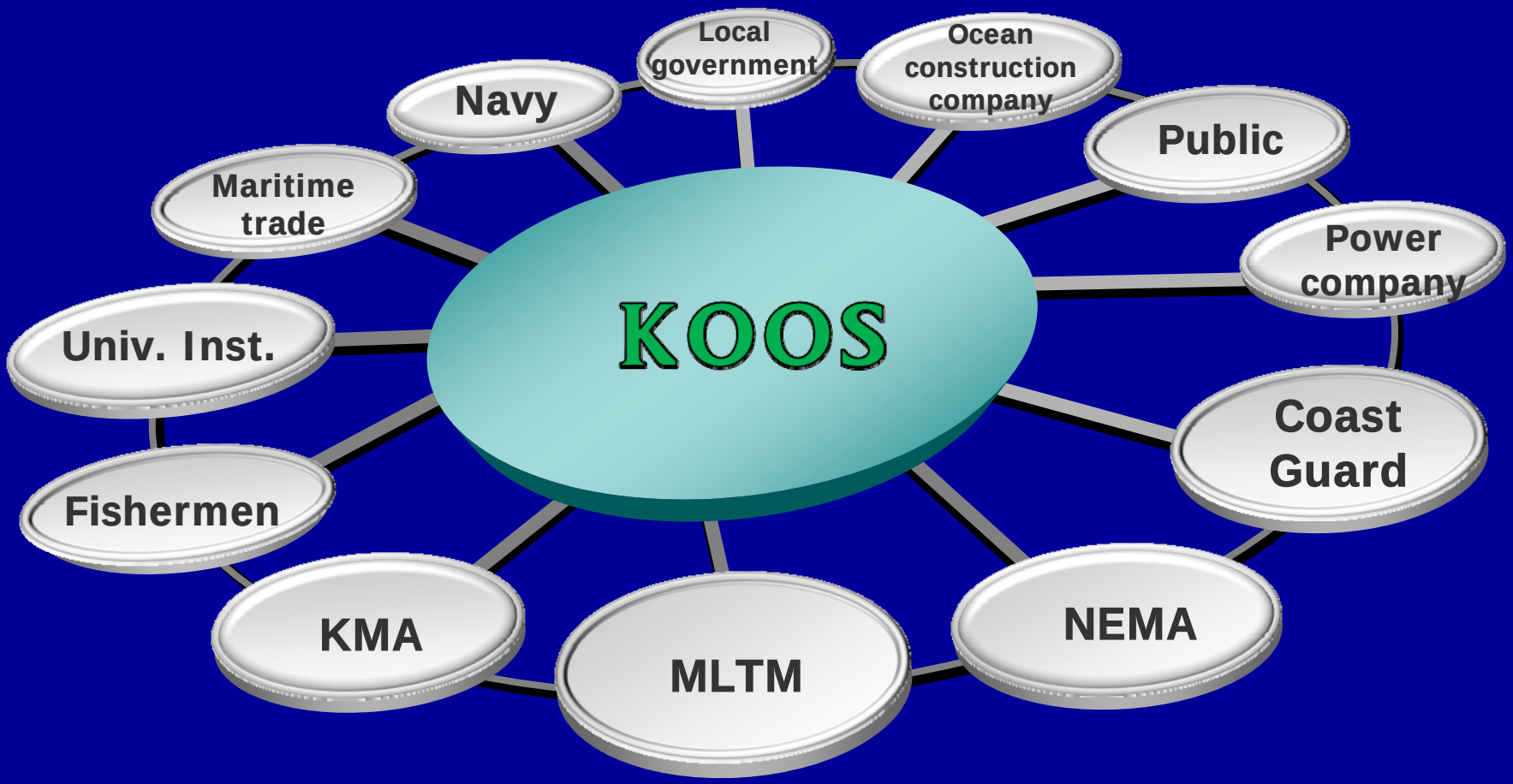
- local sea surface wind
- local wave
- local storm surge
- tides
- current
- wind driven current
- temperature
- salinity
- suspended sediment conc.



What are applications?

- Mitigation of coastal disaster
- Protection/restoration of environment and ecosystem
- Oil spill
- Improvement of Maritime operation
- SAR
- Sustaining use of ocean/coastal resources
- Ocean tourism/Leisure

Users



NEMA : National Emergency management Agency

Closing Remarks

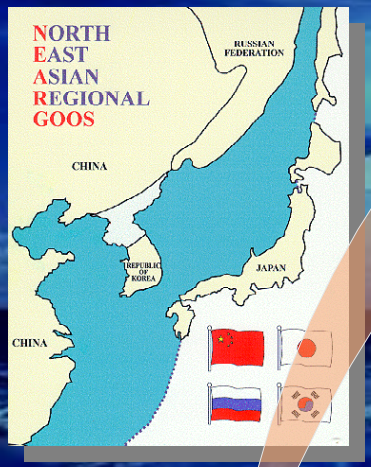
- As the first stage of KOOS, Korea has been establishing real-time coastal/ocean monitoring system since 2001. Currently, 94 real-time coastal observing stations are operating.

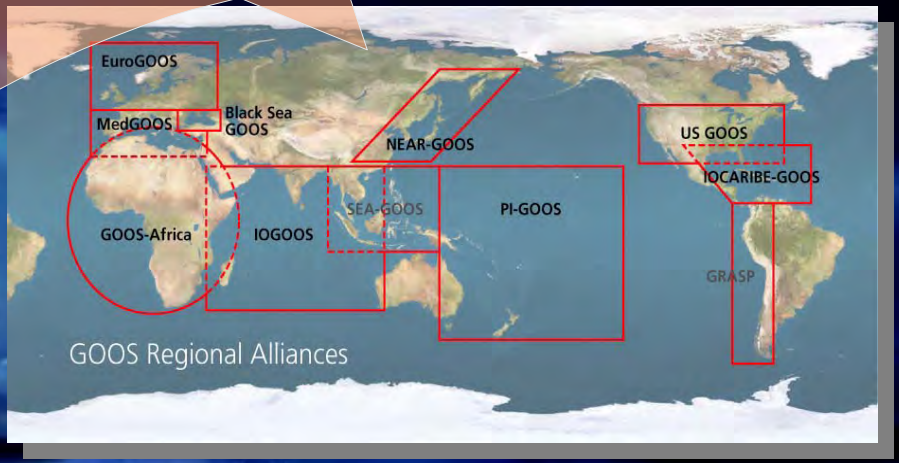
- As the 2nd stage of KOOS, KORDI has been carrying out a national program for development of coastal/ocean forecasting system since August 2009. So far, various ocean models and applications have been established and under testing.

- KOOS can contribute to development of ocean observing system and can be part of ocean observing system in North East Asian Region (NEAR-GOOS).

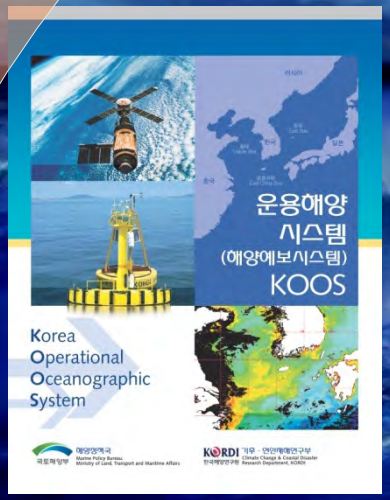
GEOSS

NEAR-GOOS





GOOS



KOOS

Thank you!