

KHOA's ocean forecasting activities and their application:

Korea Ocean Observing and Forecasting System (KOOFS)



Do-Seong Byun

Korea Hydrographic and Oceanographic Agency

Outline

1

Background

- KHOA – who we are, what we do
- Organizations involved in forecasting model establishment & operation

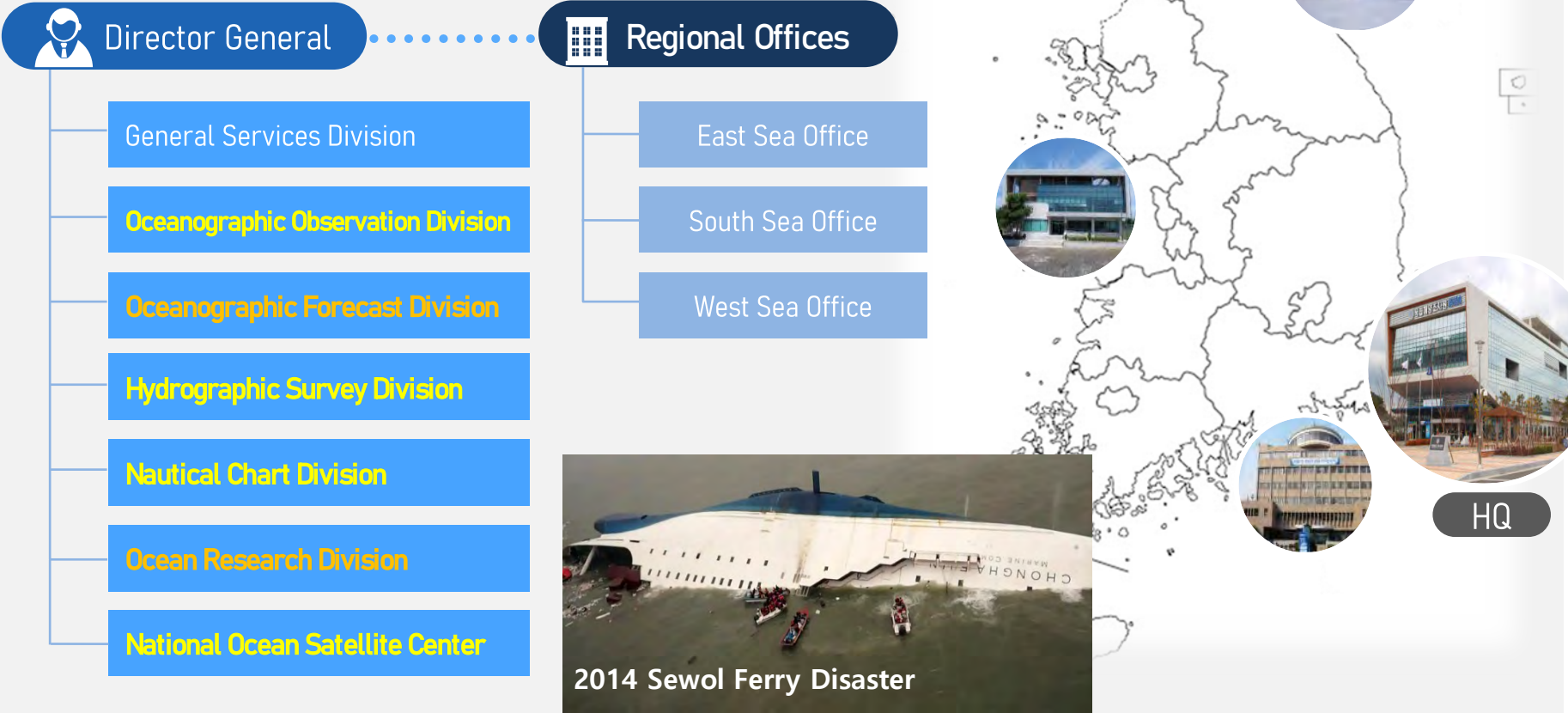
2

KHOA's forecasting & application systems

- The operation of KOOFS
- Validating the forecast data
- Forecast applications & services

KHOA's organization (1949~)

7 Divisions, 3 Regional Offices, 240 staff



Organizations of model establishment & operation

KOOFSS Operation

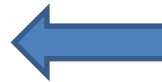
Korea **O**cean **O**bserving and
Forecasting **S**ystem



Ministry of Oceans and Fisheries
Korea Hydrographic
and Oceanographic Agency

Oceanographic Forecast Division

Model
transfer



Model Establishment



Ministry of Oceans and Fisheries
Korea Hydrographic
and Oceanographic Agency

Ocean Research Division



**(Korea Institute of Ocean
Science and Technology)**

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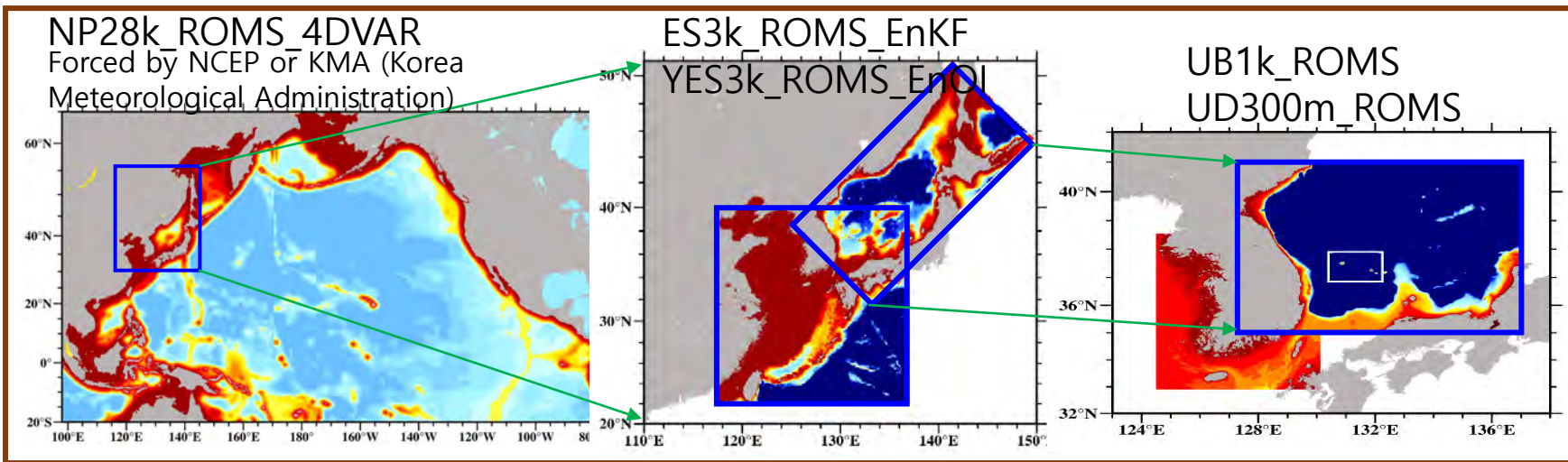
KHOA's forecasting & application systems

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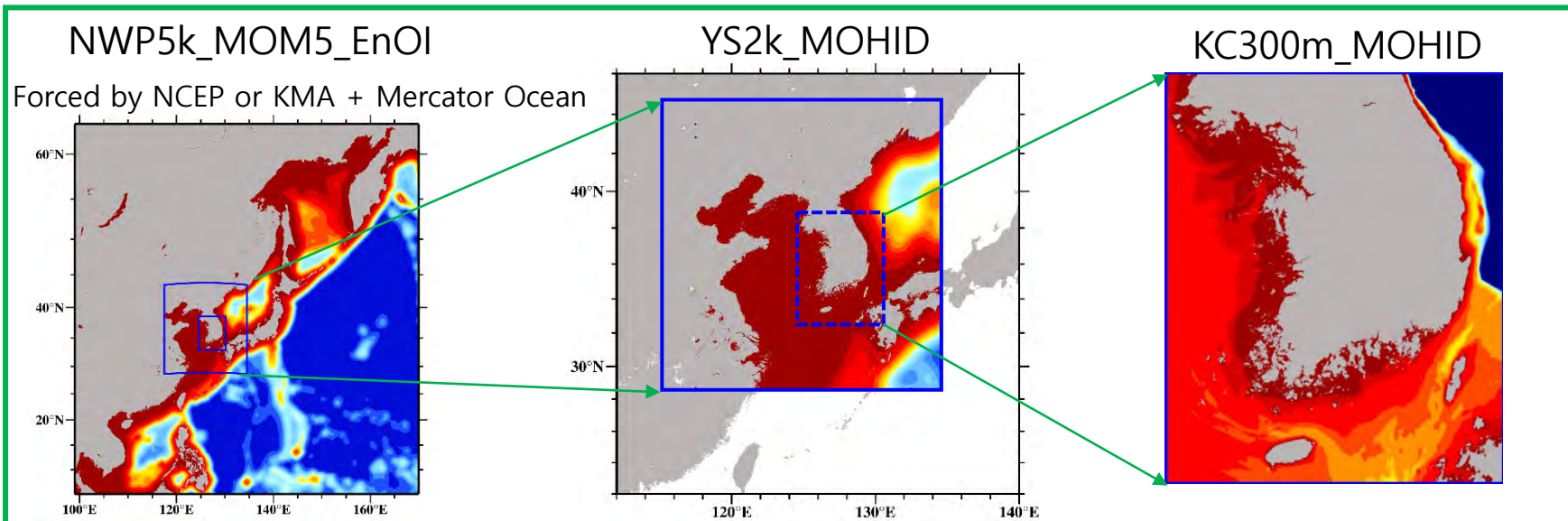
Operating ocean circulation forecast models

Regional (2) → Sub-regional (3) → Basin (1) & Coastal (2)

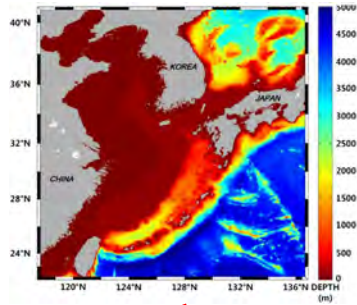
KHOA



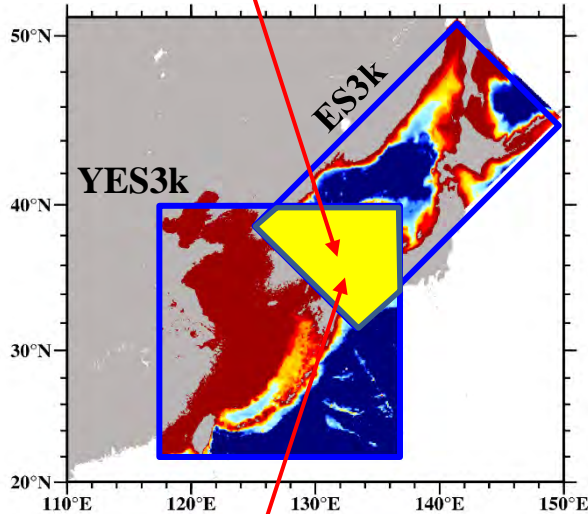
KIOST



YES3k_ROMS_EnOI

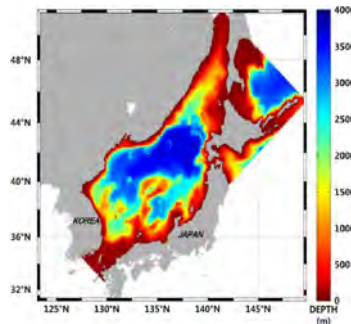


- **Problem** = 2 sub-regional models produce different results for common areas.
- **Solution** = an integrated model: *EYES2.5k, East Sea and Yellow East China Seas Model*, start to establish in 2021

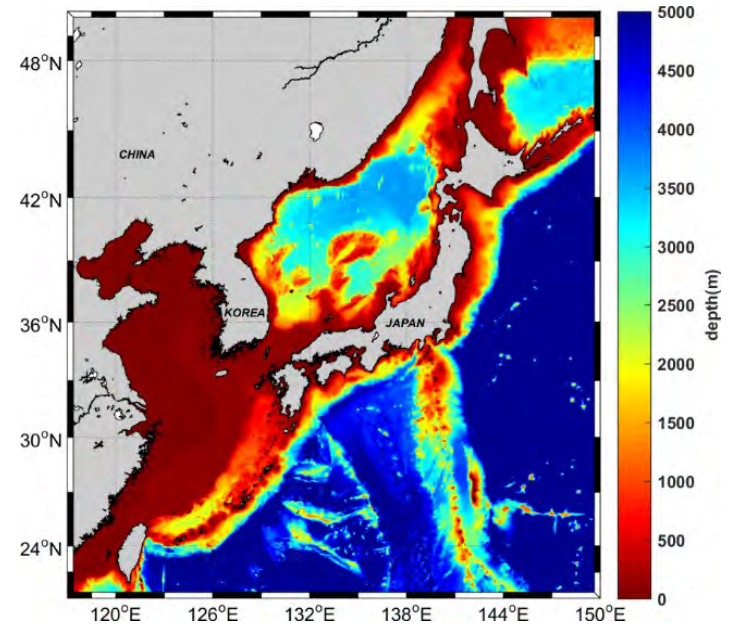


2021-2025

ES3k_ROMS_EnOI



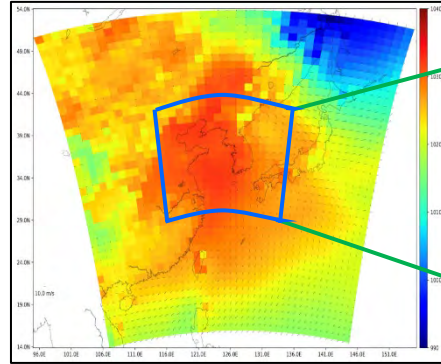
EYES2.5k_ROMS_EnOI



Atmospheric models ►

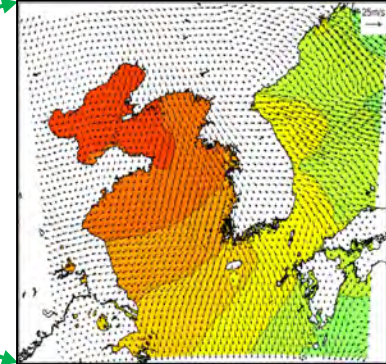
Regional model

NWP20k_WRF_3DVAR
Forced by NCEP or KMA



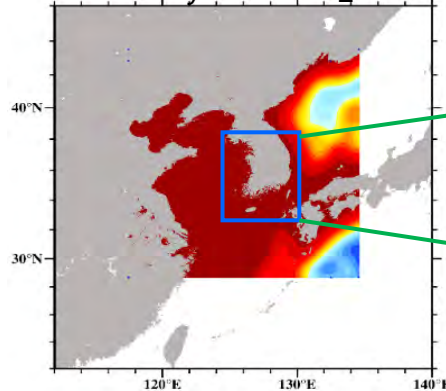
Sub-regional model

YS4k_WRF_3DVAR
Forced by NWP20k_WRF



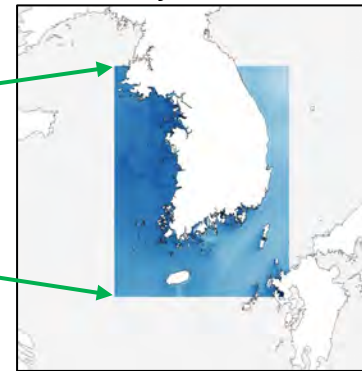
Sub-regional model

YS2k_SWAN
Forced by NWP20k_WRF



Coastal model

KC300m_SWAN
Forced by YS4k_WRF



Wave models ►

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- KHOA's organization
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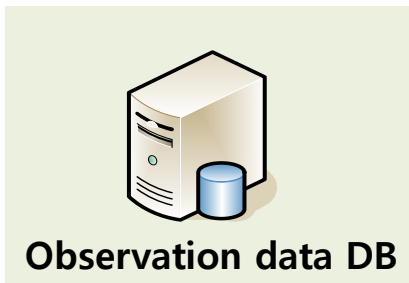
KHOA's forecasting & application systems

- Operational forecasting system
- Forecast data validation system
- Application & service

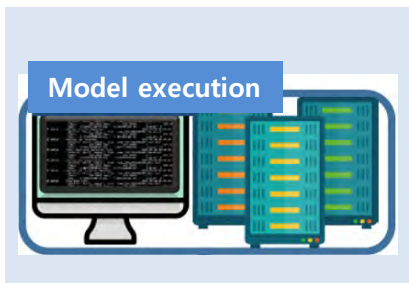
Numerical forecast data validation system

- Korea Ocean Modelling Validation System (KOMVAS)

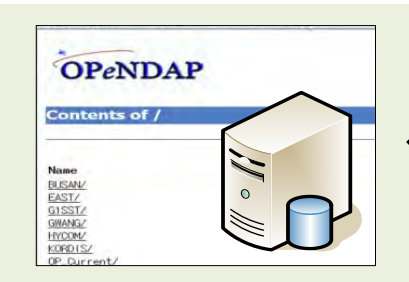
Observation data management



Operational system

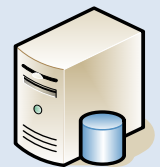


Forecast data management



Internal web-based system

Korea Ocean Modelling Validation System



KOMVAS

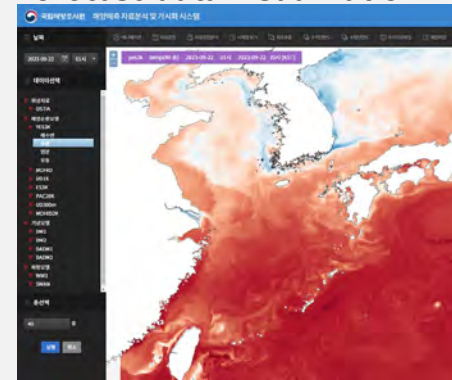
Forecast data validation



Model execution monitoring



Forecast data visualization



Forecast validation using observations

Sea-level height: 52 tide stations + 3 ocean research stations

Temperature & salinity: KHOA's 45 & KMA's 26 ocean buoys + SST (OSTIA)

Ocean currents: KHOA's 45 ocean buoys + HF radar

해양예측모델 성과지표

해수면	해수온(1)	해수온(2)	수온	염분
R	BIAS	BIAS	RMSE	RMSE
98.00%	73.33%	70.00%	78.67%	11.32%

방법

- 조위관측소 ▲ 해양기상부이 ● 해양기상관표
- ◆ 해양관측소 ▼ 해양관측부이 ✱ 해양과학기지
- HF-RADAR

[일계지] ■ 양호(R>0.800) ■ 불량(R<0.800) ■ 자료없음

관측지표 수집현황 (자료없음 개수 / 전체개수)

해수위					수온(T) / 염분(S)			해수염분	
위성자료	조위관측소	해양관측소	해양과학기지	해양과학기지	해양관측부이	해양기상부이	위성자료	해양관측부이	HF-RADAR
0/1	1/52	0/3	0/3	1/2(T) 1/2(S)	9/45(T) 3/31(S)	2/26(T)	0/1 (T)	10/45	10/10

해양예측모델 스텟값(시계열)

종결연	위치	R	RMSE	RMSE%	BIAS
DT_0058	결인항	-	-	-	-
DT_0061	살천포	0.9696	0.2670	7.4462	0.1959
DT_0062	마산	0.9645	0.3147	10.2829	0.2905
DT_0063	가덕도	0.9666	0.3946	7.9643	0.3813
DT_0067	안동	0.9961	0.2485	2.7063	0.2107
DT_0068	위도	0.9959	0.2558	2.7213	0.2126
DT_0091	포항	0.7954	0.4690	18.2638	0.4666
IE_0060	미어포	0.9490	1.2169	8.5542	1.2119
IE_0061	신안가거초	0.9829	1.3070	9.8244	1.3018
IE_0062	송진소정초	0.9927	2.1209	3.8453	2.1194
CF(%)		98.00%	76.00%	72.00%	58.00%

기간통계

관측기간: 2023-09-22 ~ 2023-09-22

자료선택: ROMS, 황동중국해3K, 해수면, R

황동중국해3K / 해수면 / R (2023-09-22 ~ 2023-09-22)

CF(%)


날짜	R1	R2	R3
2023년09월22일	98.00	100.00	100.00
평균	98.00	100.00	100.00

속력 112.443

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➔ Adding functions for the intercomparison of model results

Monitoring forecasting model execution



국립해양조사원

해양
예측자료
검증평가
시스템

Korea Ocean
Modelling
Validation System

ENGLISH

관리자

시스템소개

해양예측자료
검증평가

해양예측자료
모니터링

해양예측자료
가시화시스템

HOME > 해양예측자료 모니터링

모니터링 현황 상세보기

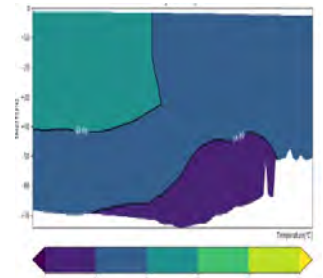
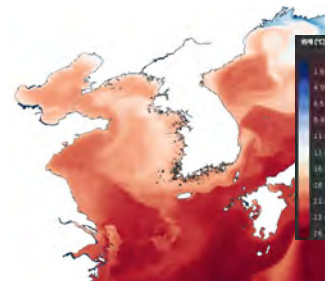
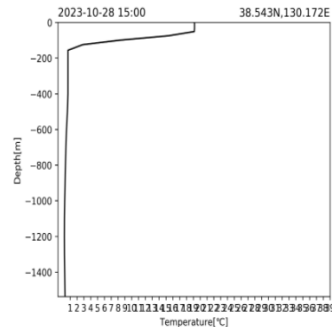
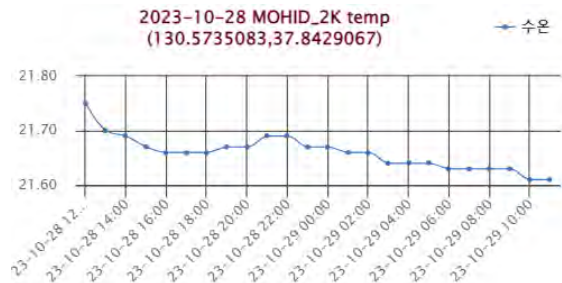
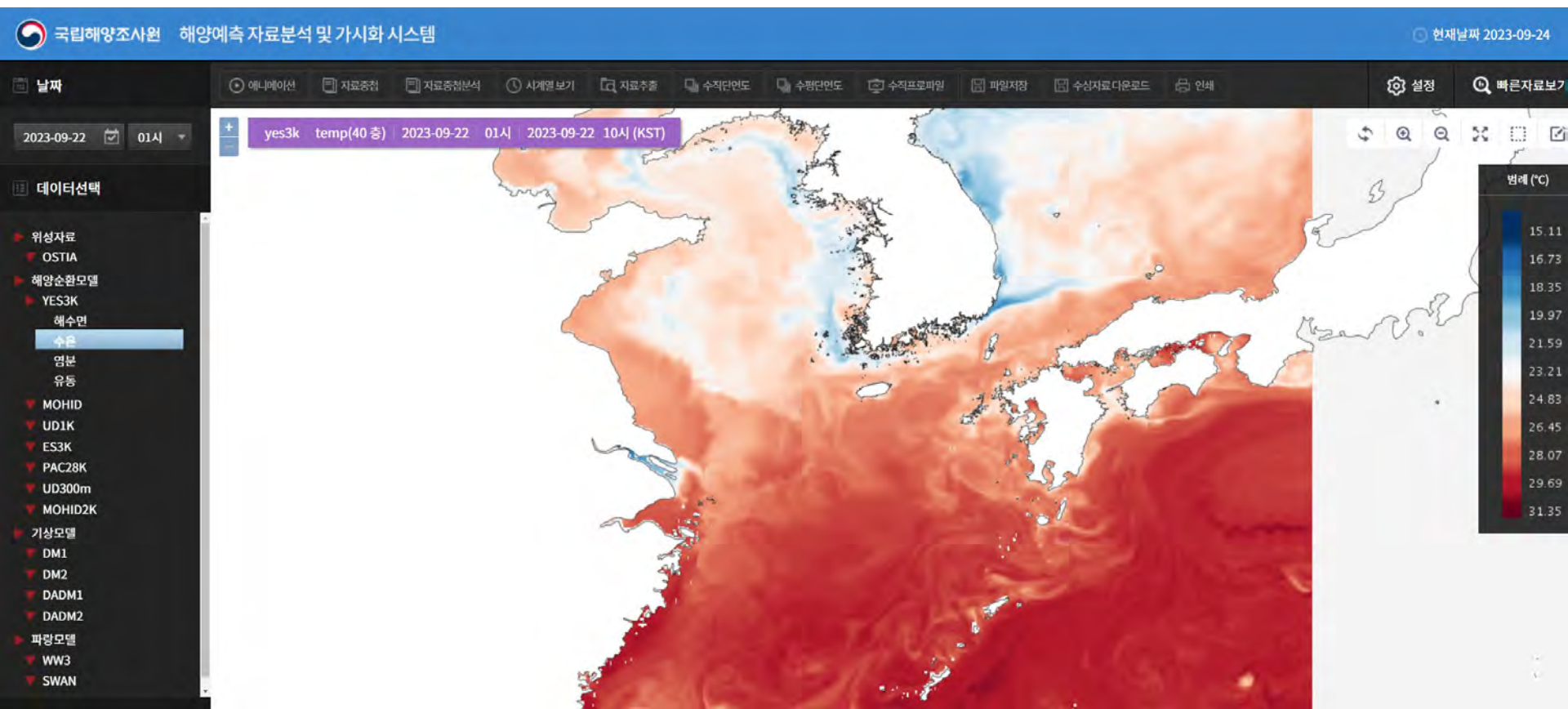
해양예측자료 모니터링 현황 Status board

현재시간 : 2023-09-22 13:22:40
기준시간 : 2023-09-22 12시 기준

Progress (P) Success (S) Failure (F)
■ 생성대기 ■ 생성성공 ■ 생성실패

Model	Running status	Start time	End time	Status of input data generation		
				Atmosphere forcing	Boundary	Initial field
YES3k_ROMS	성공 S	04:00	06:48	Ok	Ok	Ok
ES3k_ROMS	성공 S	04:00	05:51	Ok	Ok	Ok
UD0.3k_ROMS	대기 P	07:40	-	-	-	-
UB1k_ROMS	성공 S	07:40	09:24	Ok	Ok	Ok
YS2k_SWAN	성공 S	00:00	02:10	Ok	Ok	Ok
NWP20k_WRF	성공 S	01:00	01:34	Ok	Ok	Ok
YS4k_WRF	성공 S	01:00	01:32	Ok	Ok	Ok
YS2k_MOHID	성공 S	00:00	02:56	Ok	Ok	Ok
UB1k_ROMS	성공 S	00:00	00:35	Ok	Ok	Ok
UD0.3_ROMS	성공 S	00:00	00:35	Ok	Ok	Ok
KC0.3k_SWAN	성공 S	00:00	03:02	Ok	Ok	Ok

Visualizing forecast data



Outline

1

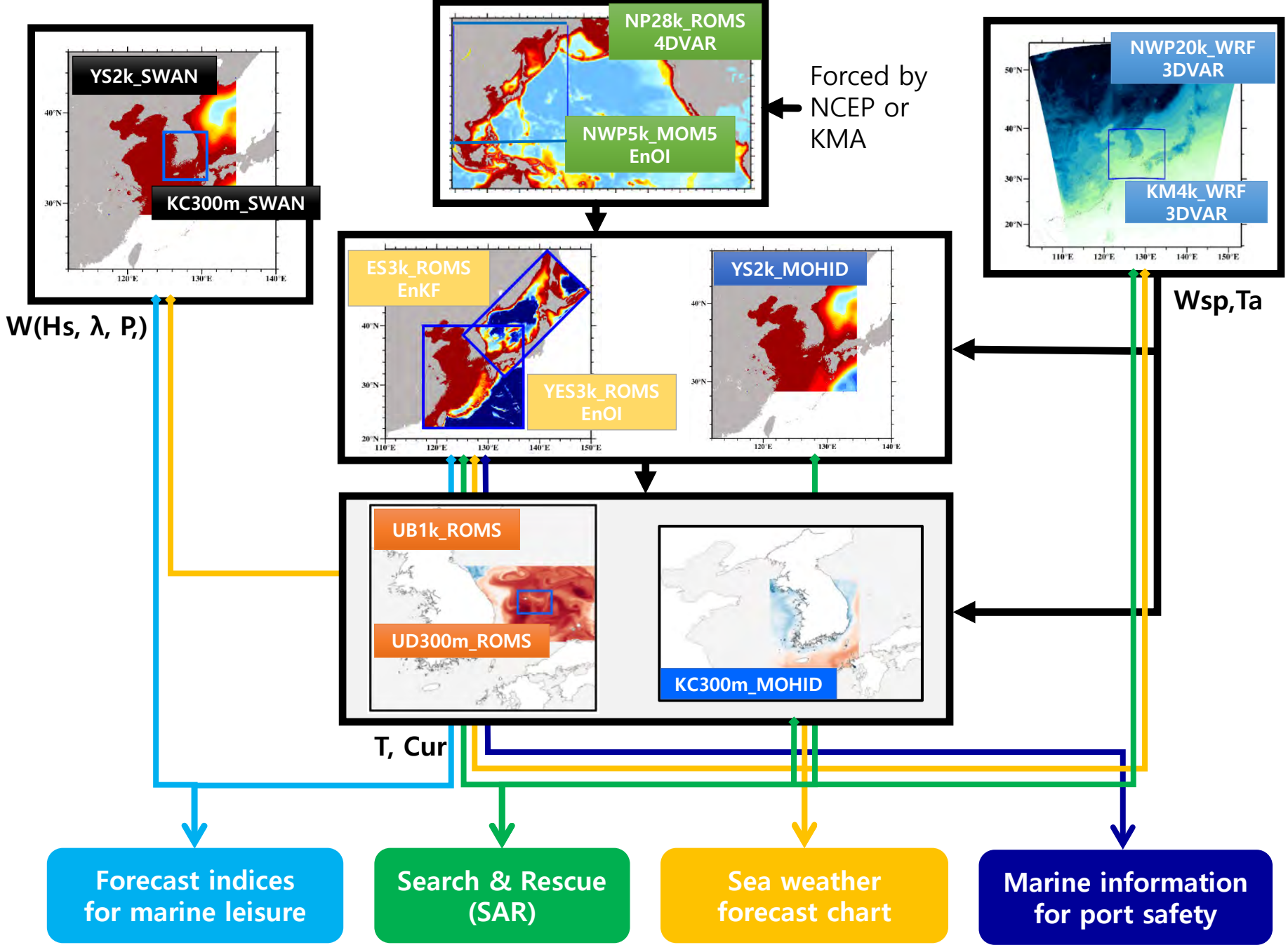
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Forecast indices for marine leisure

Index

(used data)

Excellent

Good

Regular

Bad

Very bad

Swimming

(T, Hs, Ta, Wsp)



Seasickness

(Hs, Wsp)



Fishing

(T, Hs, Ta, Wsp)



Skin scuba

(T, Hs, Cur)



Sea parting experience

(Ta, Wsp, Tide)



Tidal flat experience

(Ta, Wsp, Tide)



Sea trip

(T, Hs, Cur, Ta, Wsp)



Surfing

(T, W(Hs, λ, P), Ta, Wsp)



Early response support system for marine incidents



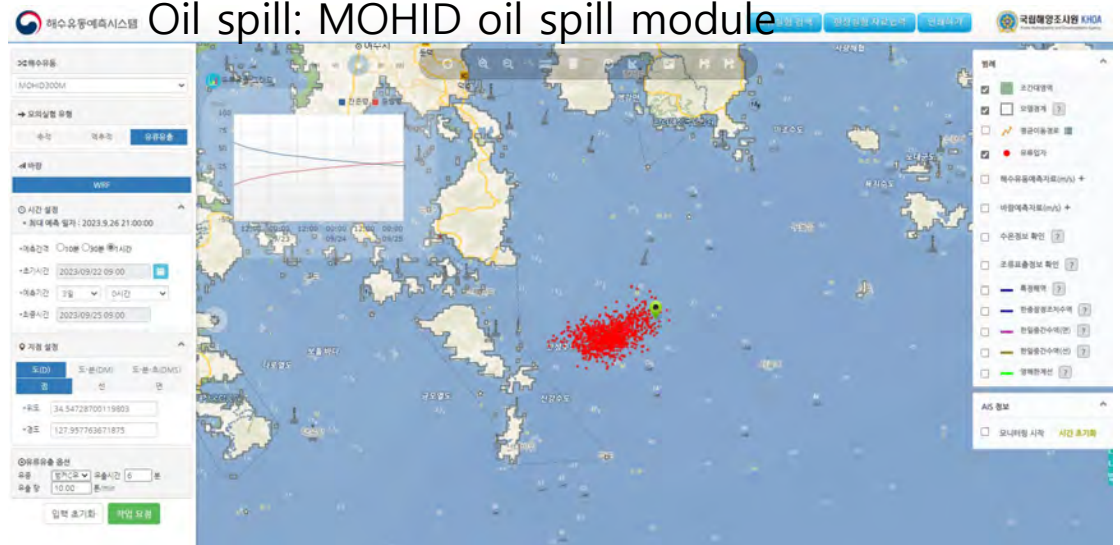
SAR: U.S. Coast Guard Addendum (2013)



Search & rescue

Oil spill application

Oil spill: MOHID oil spill module

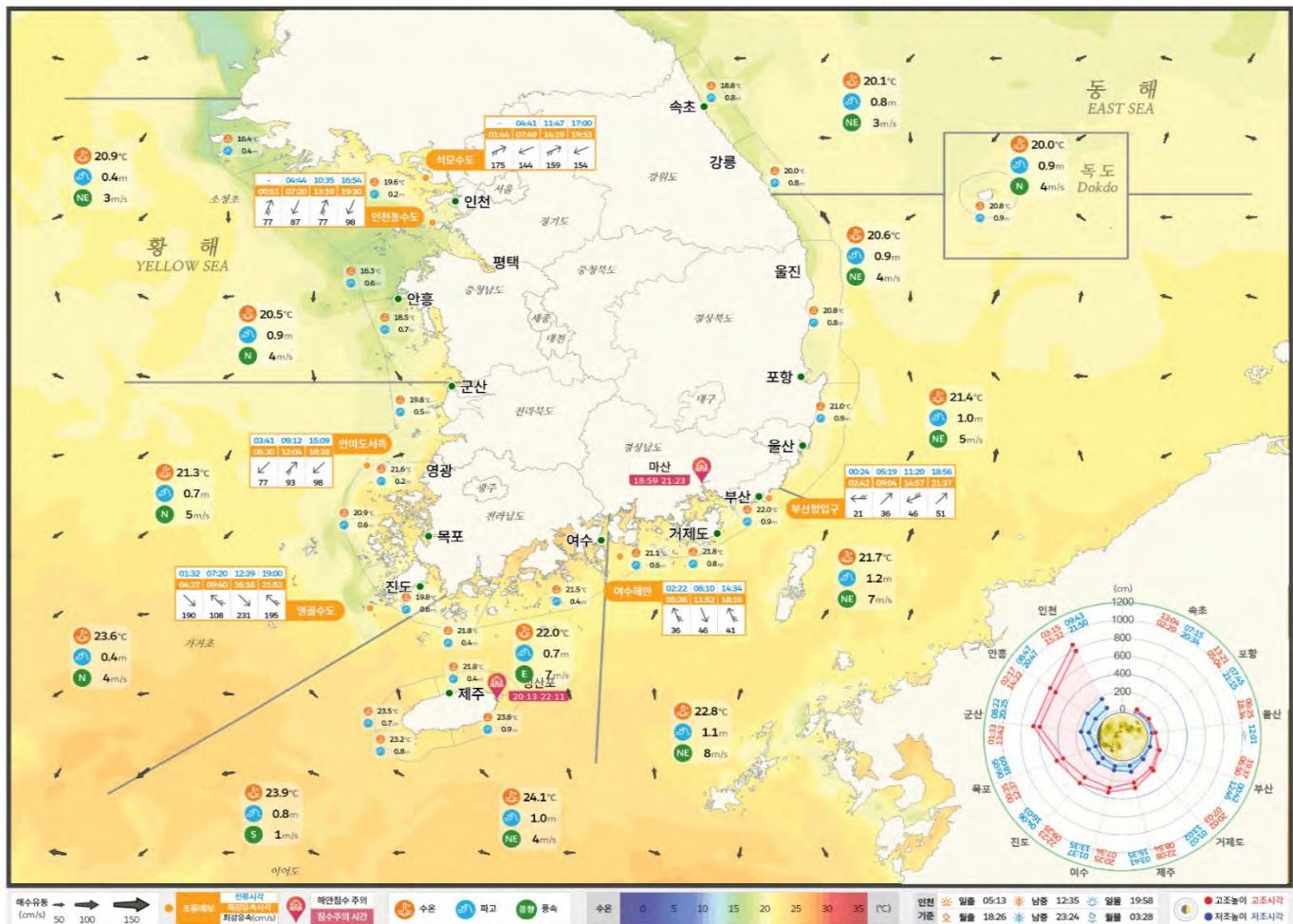


Sea weather forecast chart

How: 3-hourly interval (00, 03, 06, 09, 12, 15, 18, 21 hr) for 3 days

What: temperature, sea-level height, current velocity, wave height, wind

해양수산부 국립해양조사원 **내일의 바다**[海況예보도] 2021년 6월 23일 9시 (음력 5월 14일)



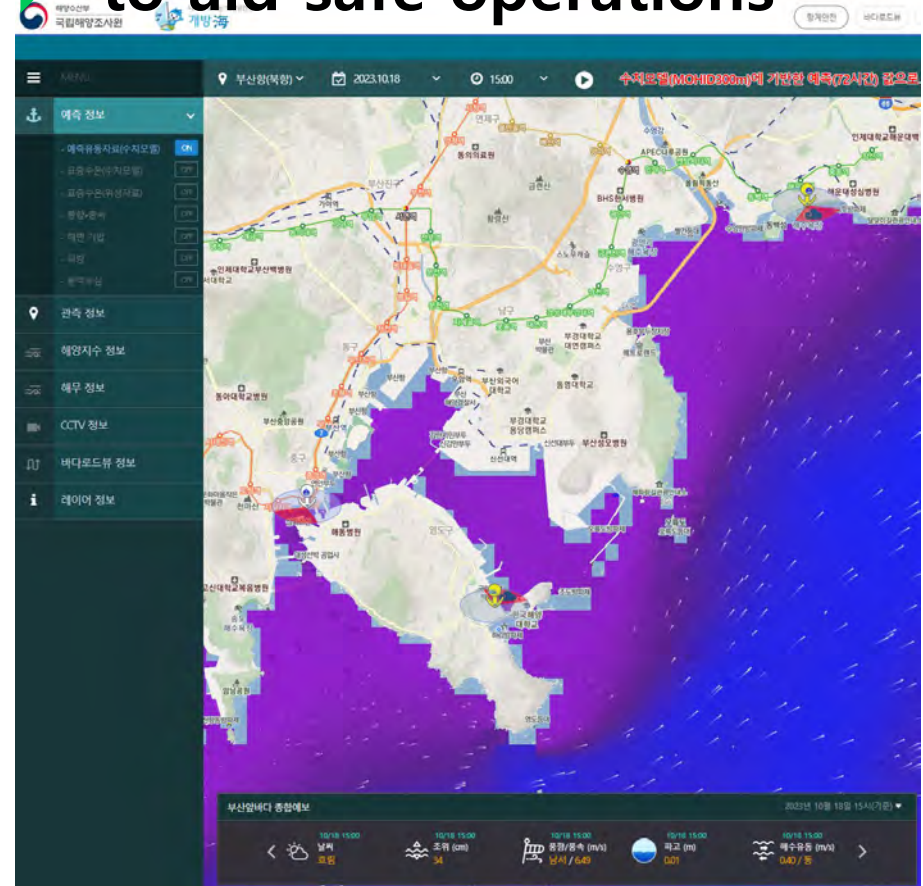
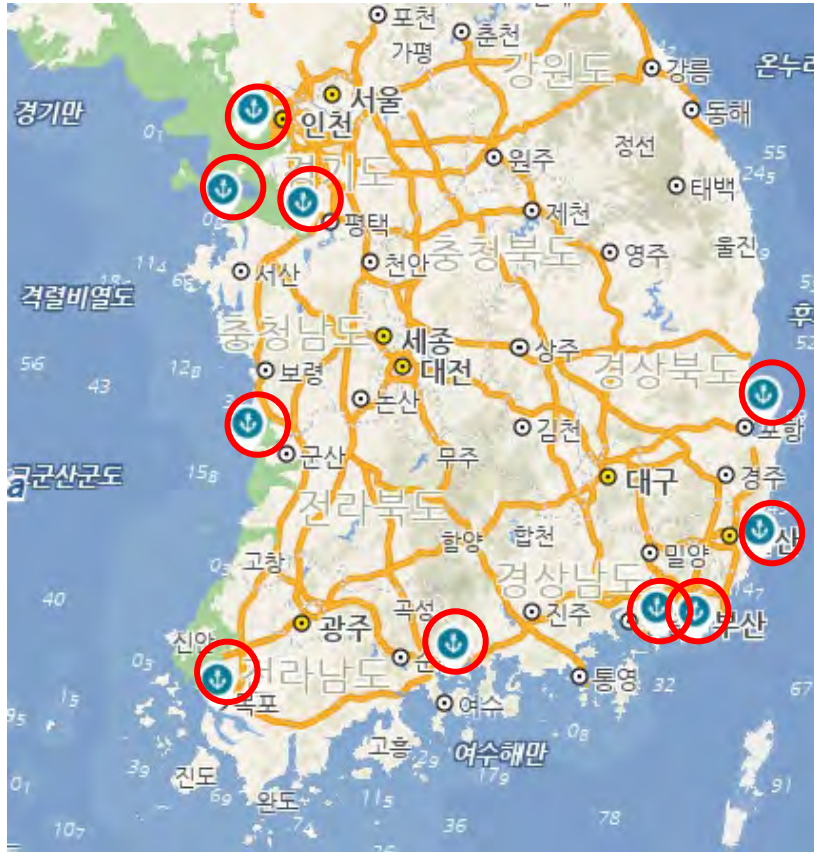
-  current
-  temperature
-  wave height
-  wind
-  sea-level height

Marine information for port safety

10 target ports serviced



to aid safe operations



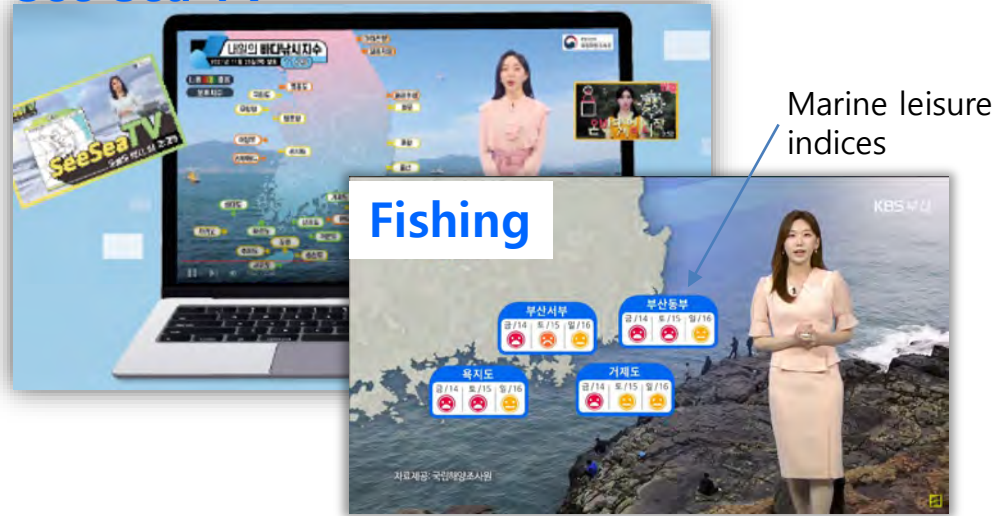
Marine condition forecasts:
currents, temperatures, waves & sea-fog

Ocean Forecast Broadcasting Studio

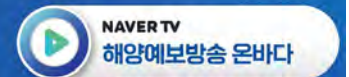
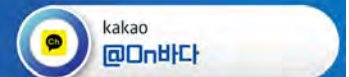
(Onbada Studio)



See Sea TV



Shared via Ocean Forecast Broadcasting Channels



Open question

Does your institute have a policy for storing daily forecasting data?

- For how long are your forecast data kept?
- How do you store these data?
e.g. magnetic tape, compressed, hourly data?

Thank you!



Sea parting experience

Exposed sea bed road



● Excellent
 ● Good
 ● Regular
 ● Bad
 ● Very bad
 ● No exposure





SURVEY VESSELS

Haeyang 2000 (2 161 t)



Badaro 1 (695 t)



Badaro 2 (273 t)



Badaro 5 (189 t)



Namhaero (52 t)



Dongaero (136 t)



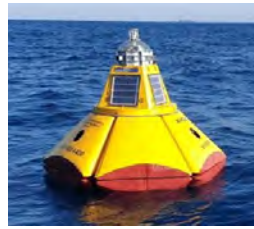
Hwanghaero (77 t)



Haeyangnuri (90 t)



KOREA OCEAN OBSERVING NETWORK (KOON)



OCEAN RESEARCH STATION (3)

TIDE, WAVE,
WATER TEMPERATURE & SALINITY,
AIR TEMPERATURE & PRESSURE,
WIND SPEED & DIRECTION

OCEAN BUOY (35)

CURRENT, WAVE,
WATER TEMPERATURE,
AIR TEMPERATURE & PRESSURE,
WIND SPEED & DIRECTION

TIDAL STATION (55)

TIDE,
WATER TEMPERATURE & SALINITY,
AIR TEMPERATURE & PRESSURE,
WIND SPEED & DIRECTION

HF RADAR (44)

CURRENT