

# Approach for the Application of S- 111 (Surface current prediction)

2019. 04.11.

IHO TWCWG

8-11 April. 2019 / Busan , Korea

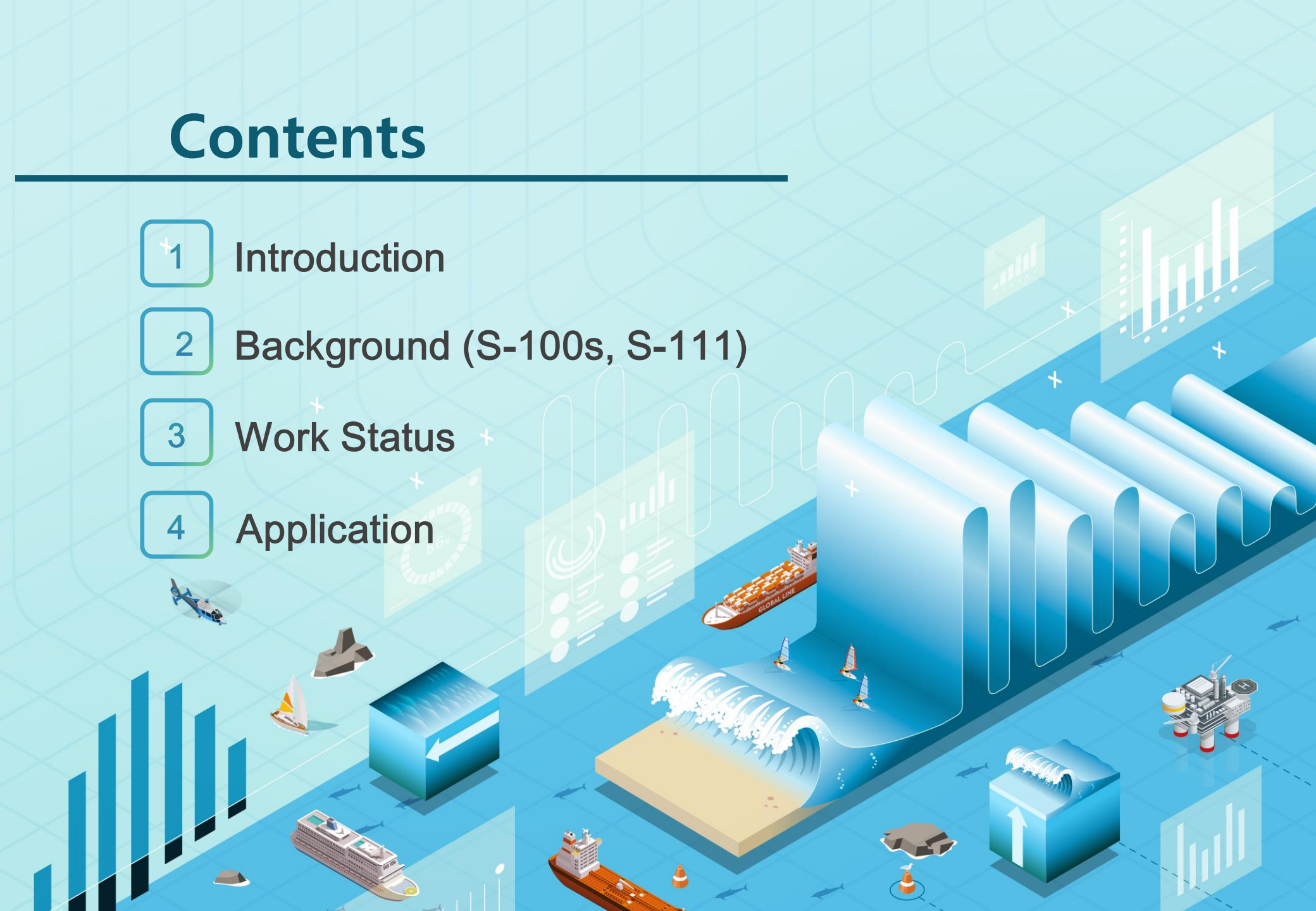
Korea Hydrographic and Oceanographic Agency (KHOA)  
Oceanographic Forecast Division

Kim Young Taeg, Ph.D.

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- 4 Application



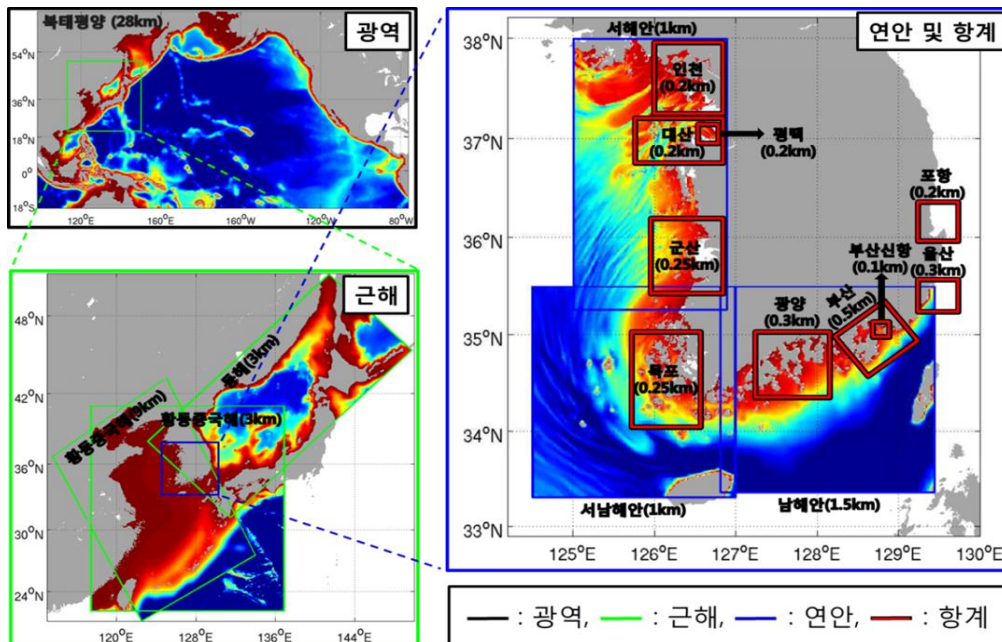


- This presentation introduces the services related to the surface current provided by the Korea Hydrographic and Oceanographic Agency(KHOA) and the background of S-111 specification, results of S-111 application and further proposals.

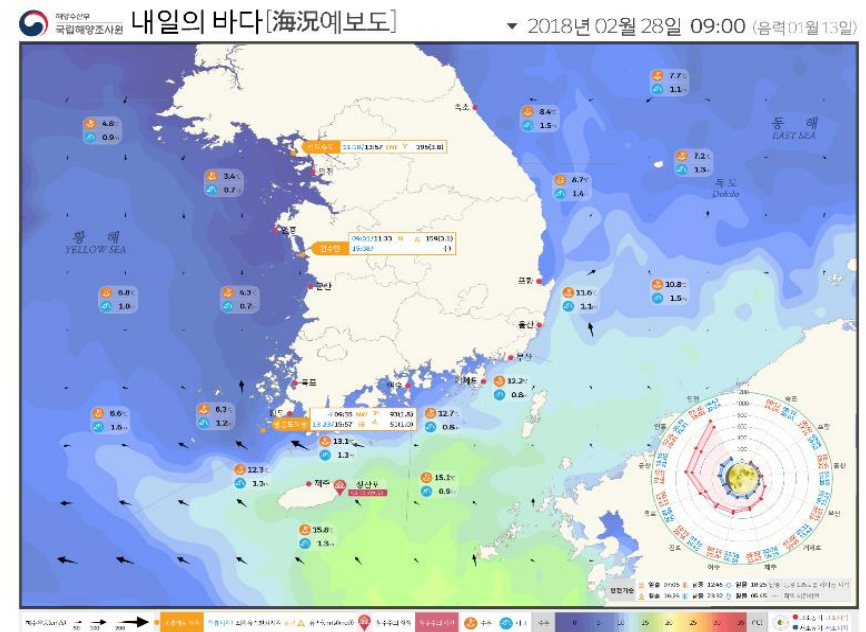
## Marine Forecast Chart from numerical forecasting model for safety navigation

- KHOA is officially operating 22 numerical models for the ocean forecast. After the prediction, we produce marine forecast chart for safety navigation like the weather chart..

### National Ocean Prediction System(NOPS)



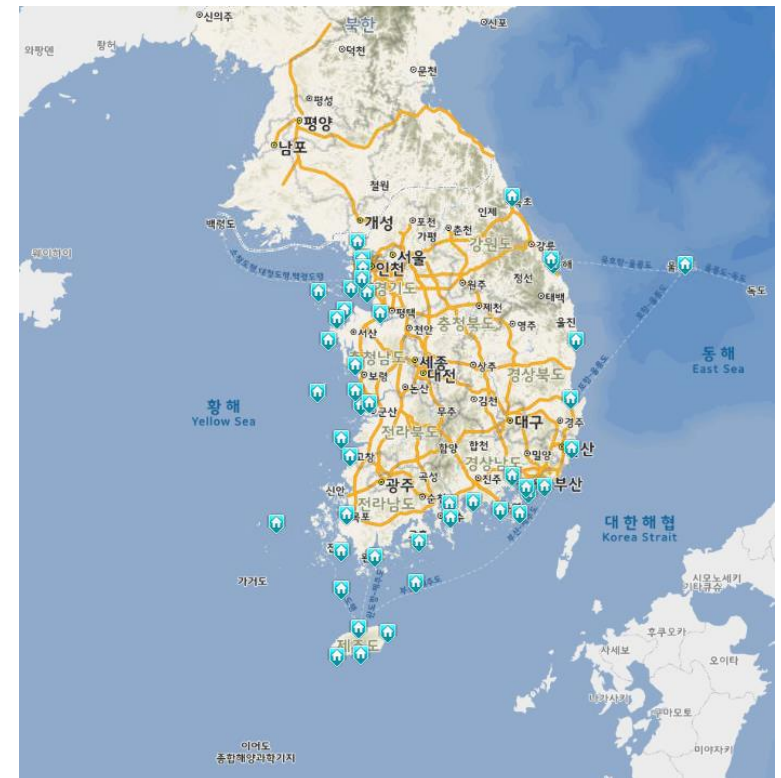
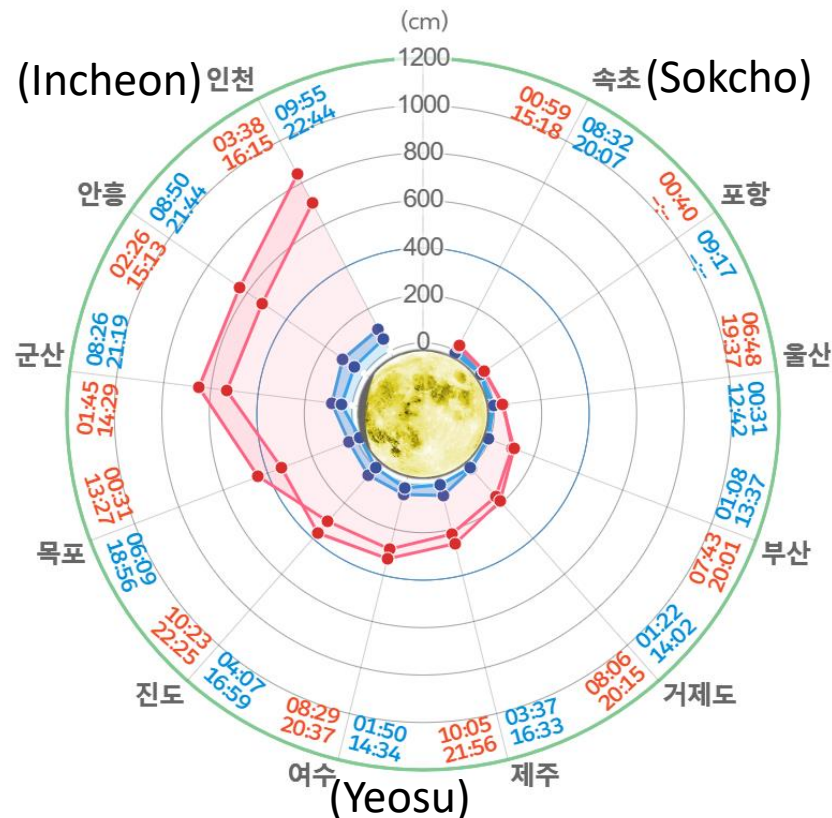
### Marine Forecast Chart



- This presentation introduces the services related to the surface current provided by the Korea Hydrographic and Oceanographic Agency(KHOA) and the background of S-111 specification, results of S-111 application and further proposals.

## Marine Forecast Chart from numerical forecasting model for safety navigation

- Tide spiral diagram, an unofficial name, shows high and low tide heights, their times, and tidal propagation from east (Sokcho(속초)) to west (Incheon(인천)) through southern sea (Yeosu(여수)). In preparation of patent





POIS

Provides information on real-time observations, forecasts(surface current, water temperature, salinity) and port marine index

**POIS** System Introduction 한국어 Ministry of Oceans and Fisheries Korea Hydrographic and Oceanographic Agency

A Cornerstone Of Maritime Information Services For Safe Seas

## Port Oceanographic Information System

항계안전 해양정보 제공시스템

**Busan Port** A little cloudy

Choryang-dong, Dong-gu, Busan

**Port characteristics**  
The largest port of commerce in South Korea.  
Container Terminal Volume 5

**Forecast at coastal waters**  
2019-03-29  
AM(09:00)/PM(15:00)

**Tide (cm)**  
70 01:51 42 09:04  
63 15:02 44 20:52

**Water flow (kn)**  
AM 0.05 / SE  
PM 0.16 / NW

**Water temperature (°C)**  
AM 12.4  
PM 13.3

**Wave height (m)**  
AM 1  
PM 0.5

**Wind speed (direction) (kn)**  
AM WNW / 15.55  
PM WNW / 16.72

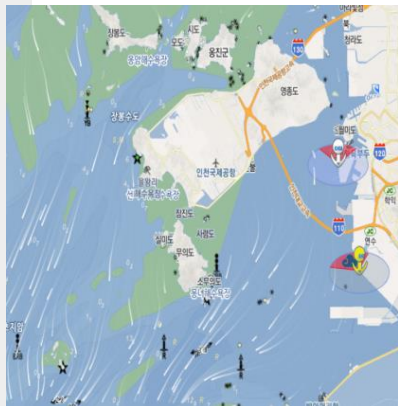
Select

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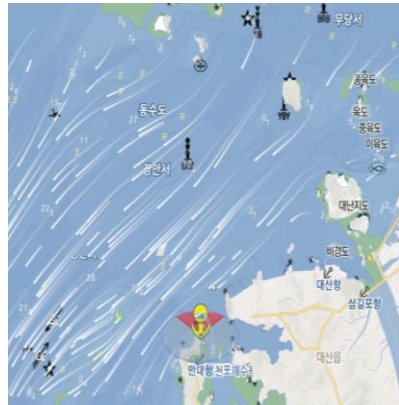


## Predictive model area

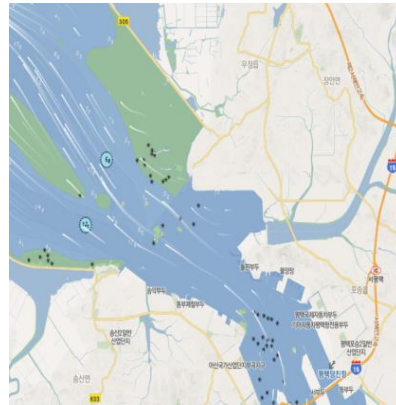
Prediction of sea level, sea water flow, water temperature and salinity for 3days(72hours) using the ROMS model.



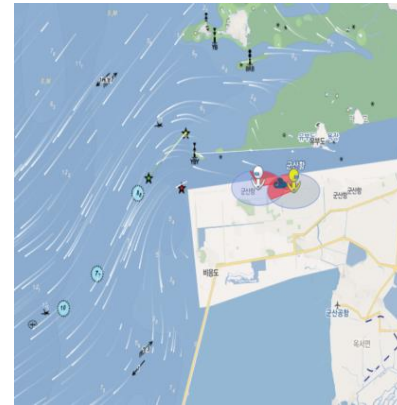
Incheon Port(200m)



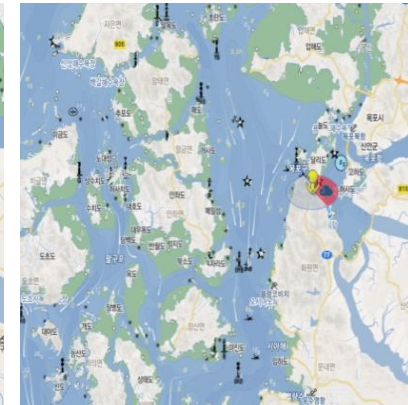
Daesan Port(200m)



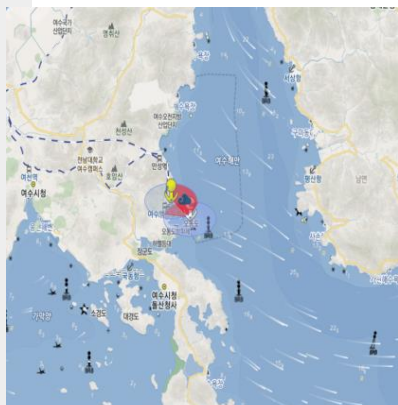
Pyeongtaek Port(200m)



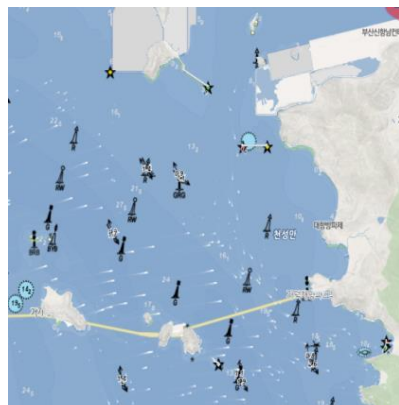
Gunsan Port(250m)



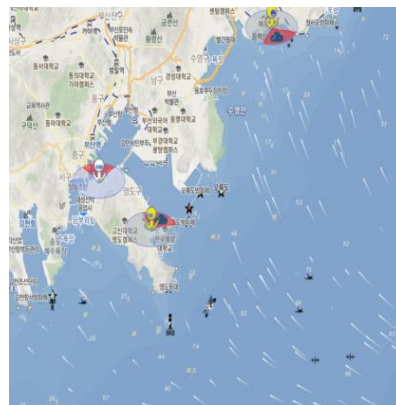
Mokpo Port(200m)



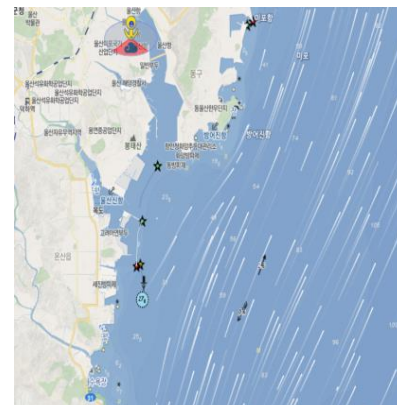
Gwangyang Port(300m)



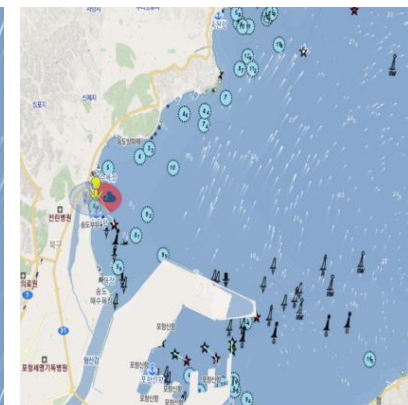
Busan new Port(100m)



Busan Port(500m)



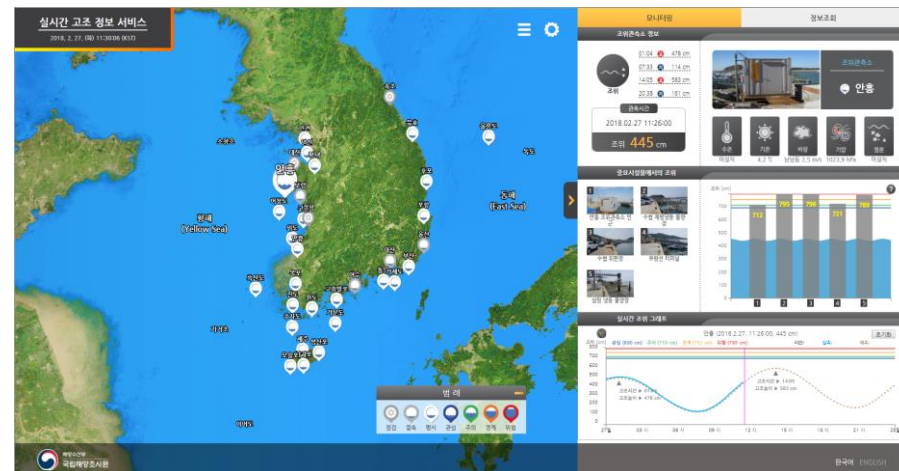
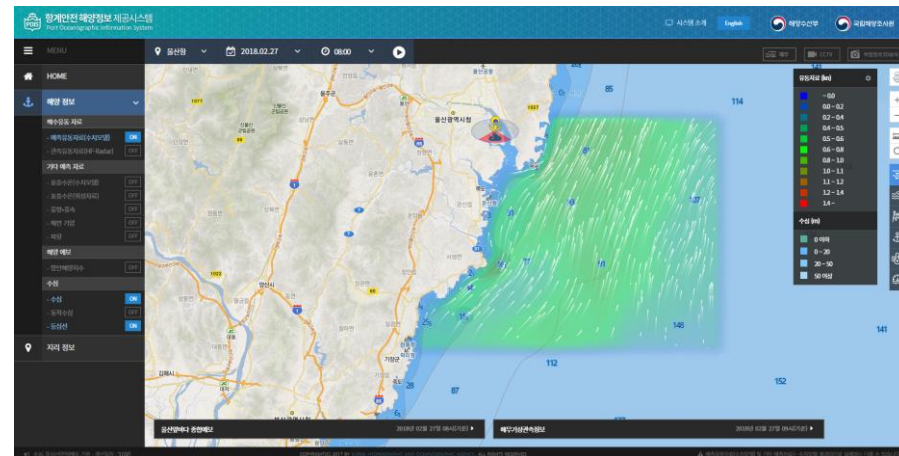
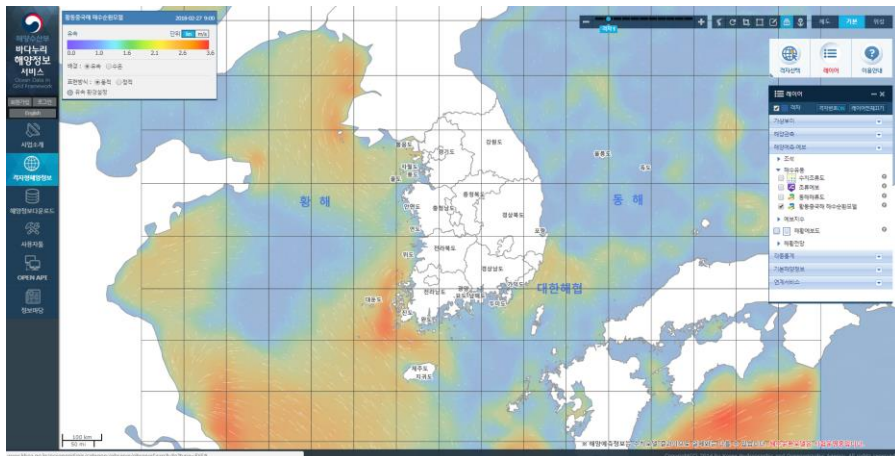
Ulsan Port(300m)



Pohang Port(200m)

## Marine Forecast Visualization

This presentation introduces the services related to the visualization of predicted data to show effectively for users such as Baroview and Badanuri service which is based on GIS.





## S-100

A framework for the development of product standards required for waterway, marine and GIS as well as next generation electronic charts.

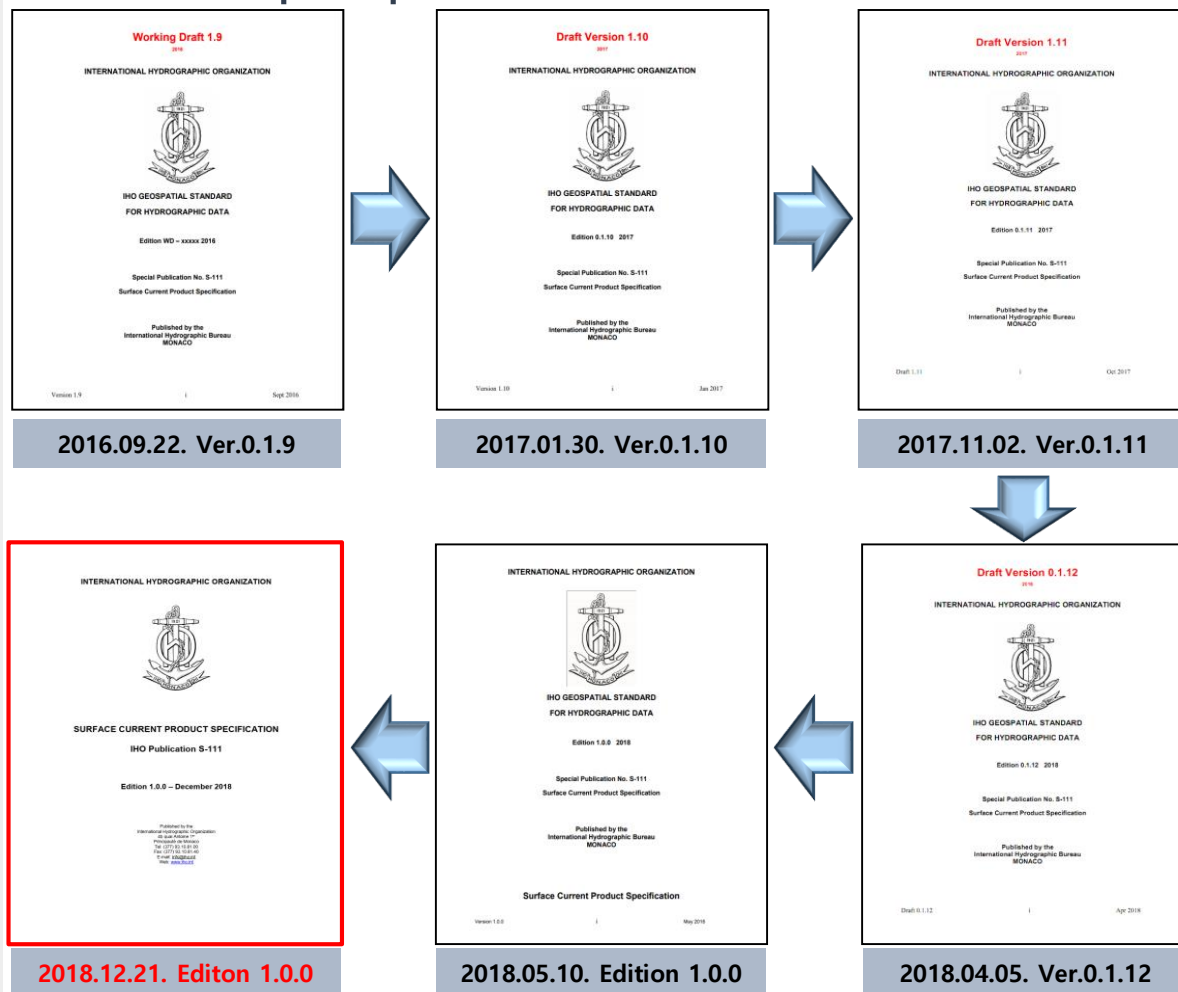
S-100 **WORLD**



## S-111

Describe all characteristics, properties and relationships of sea water flow and data set drawing.

➤ S-111 development process



## Meeting Information



### Tides, Water level and Currents Working Group

TWCWG1	2016.04.25. – 04.29. Niterói, Brazil
TWCWG2	2017.08.12. – 12.12. Victoria, Canada
TWCWG3	2018.04.16. – 04.20. Viña del Mar, Chile
TWCWG4	<b>2019.04.08. – 04.12.</b> <b>Busan, Republic of Korea</b>

## Data source

Use historical and real-time seawater flow data and future seawater flow predictions.

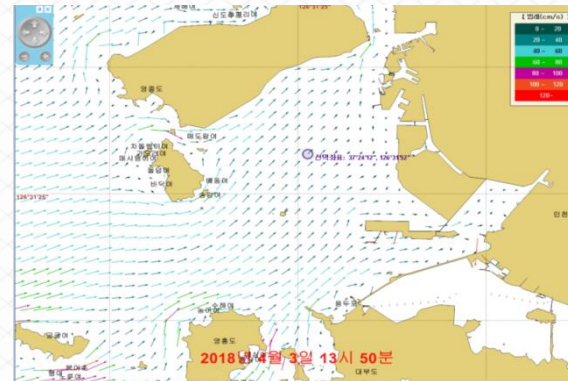
### 1. Historical and real-time observation

- Historical observation
- Real-time observation



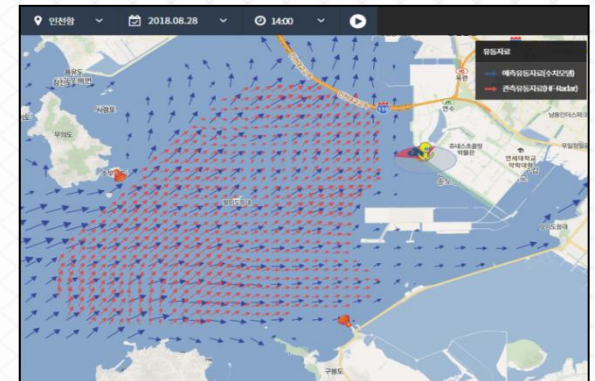
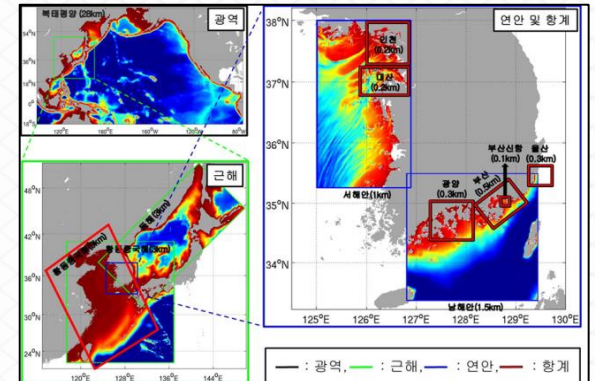
### 2. Astronomical prediction

- Astronomical prediction



### 3. Hydrodynamic model hindcast and forecast

- Hydrodynamic model hindcast
- Hydrodynamic model forecast





## Portrayal

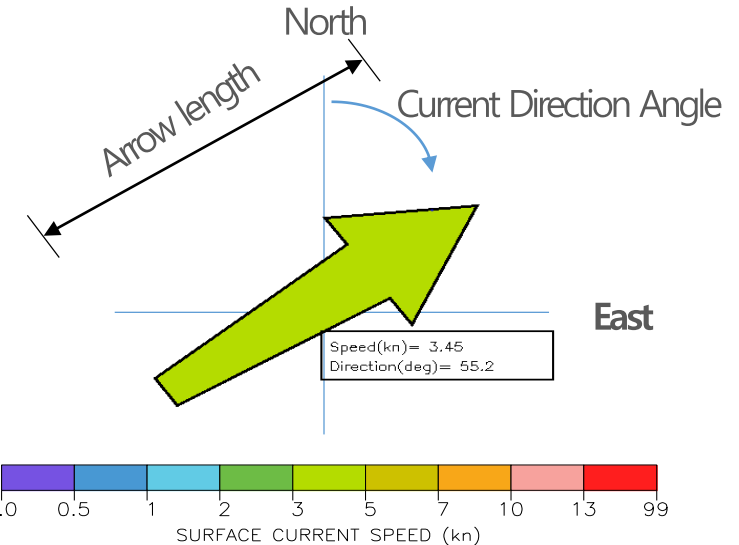
### Drawing criterion for direction and size of seawater flow.

#### ➤ Arrow direction

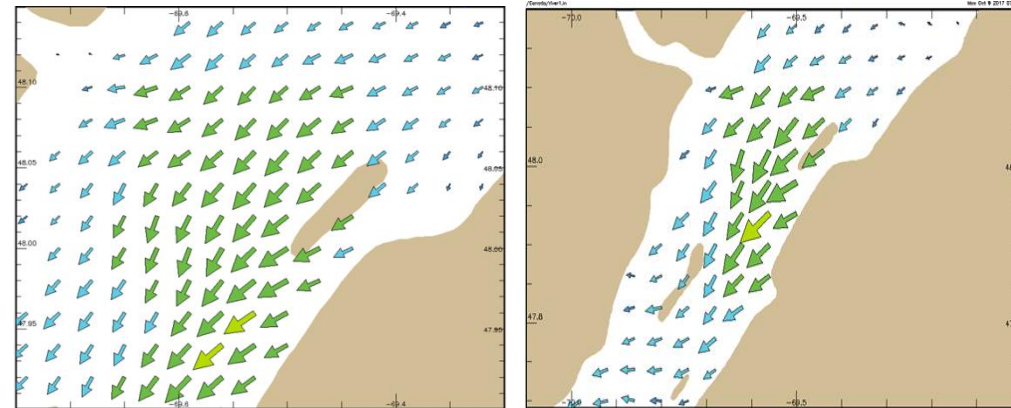
- The direction of the arrow symbol must be the direction(relative to true north).
- If the map projection is Mercator, angles are preserved, so current direction is identical to direction on the screen.
- For other map projections, the portrayed direction must be computed.

#### ➤ Arrow size

- The arrow size must be a function of the current speed.
- The value of  $S_{high}$  should be the same for all data sets from multiple sources so that the same speed in different data will be displayed with the same arrow length.
- It is desirable to display a small arrow at a location where data is usually available but the speed is less than 0.01 kn.



$H = H_{ref} \cdot \min\{\max(S_{low}, S), S_{high}\}/S_{ref}$		
Constant	Description	Recommended Value
$H_{ref}$	Reference height for arrow scaling	10.0 mm
$S_{ref}$	Reference speed for arrow scaling	5.0 kn
$S_{low}$	Minimum speed to be used for arrow length computations	0.01 kn
$S_{high}$	Maximum speed to be used for arrow length computations	13.0 kn



Portrayal example

# Data creation process

## Produce seawater flow data and then produce standardized HDF5 files.

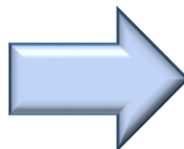
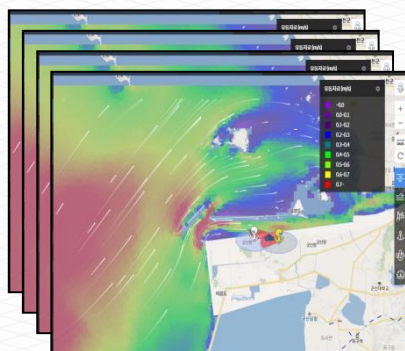
## 1. Production of sea water flow data



## Sea water flow data



Seawater  
forecast data  
(72hours)



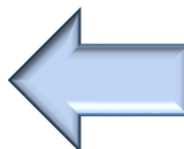
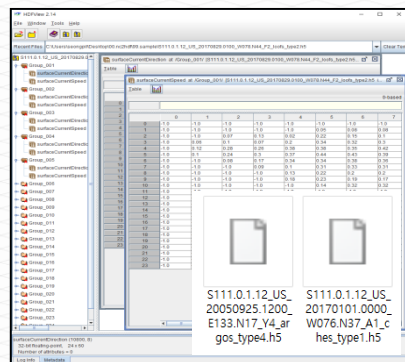
## 2. Sea water flow data collection



국명	연도	연도별 GDP	연도별 GDP
AFG	2018-01-01	2018-01-01	2018-01-01
BAN	2018-01-01	2018-01-01	2018-01-01
CHN	2018-01-01	2018-01-01	2018-01-01
DEN	2018-01-01	2018-01-01	2018-01-01
ESP	2018-01-01	2018-01-01	2018-01-01
FIN	2018-01-01	2018-01-01	2018-01-01
FRA	2018-01-01	2018-01-01	2018-01-01
GER	2018-01-01	2018-01-01	2018-01-01
GRC	2018-01-01	2018-01-01	2018-01-01
IND	2018-01-01	2018-01-01	2018-01-01
ITA	2018-01-01	2018-01-01	2018-01-01
JPN	2018-01-01	2018-01-01	2018-01-01
KOR	2018-01-01	2018-01-01	2018-01-01
LTU	2018-01-01	2018-01-01	2018-01-01
LUX	2018-01-01	2018-01-01	2018-01-01
MEX	2018-01-01	2018-01-01	2018-01-01
NLD	2018-01-01	2018-01-01	2018-01-01
PER	2018-01-01	2018-01-01	2018-01-01
POL	2018-01-01	2018-01-01	2018-01-01
ROU	2018-01-01	2018-01-01	2018-01-01
SWE	2018-01-01	2018-01-01	2018-01-01
THA	2018-01-01	2018-01-01	2018-01-01
TUR	2018-01-01	2018-01-01	2018-01-01
UKR	2018-01-01	2018-01-01	2018-01-01
USA	2018-01-01	2018-01-01	2018-01-01
VNM	2018-01-01	2018-01-01	2018-01-01
WLD	2018-01-01	2018-01-01	2018-01-01
YUN	2018-01-01	2018-01-01	2018-01-01



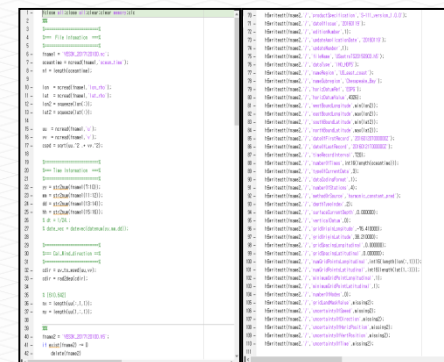
## 4. Standardized file production



### 3. Standardization criteria applied



## Data processing using software

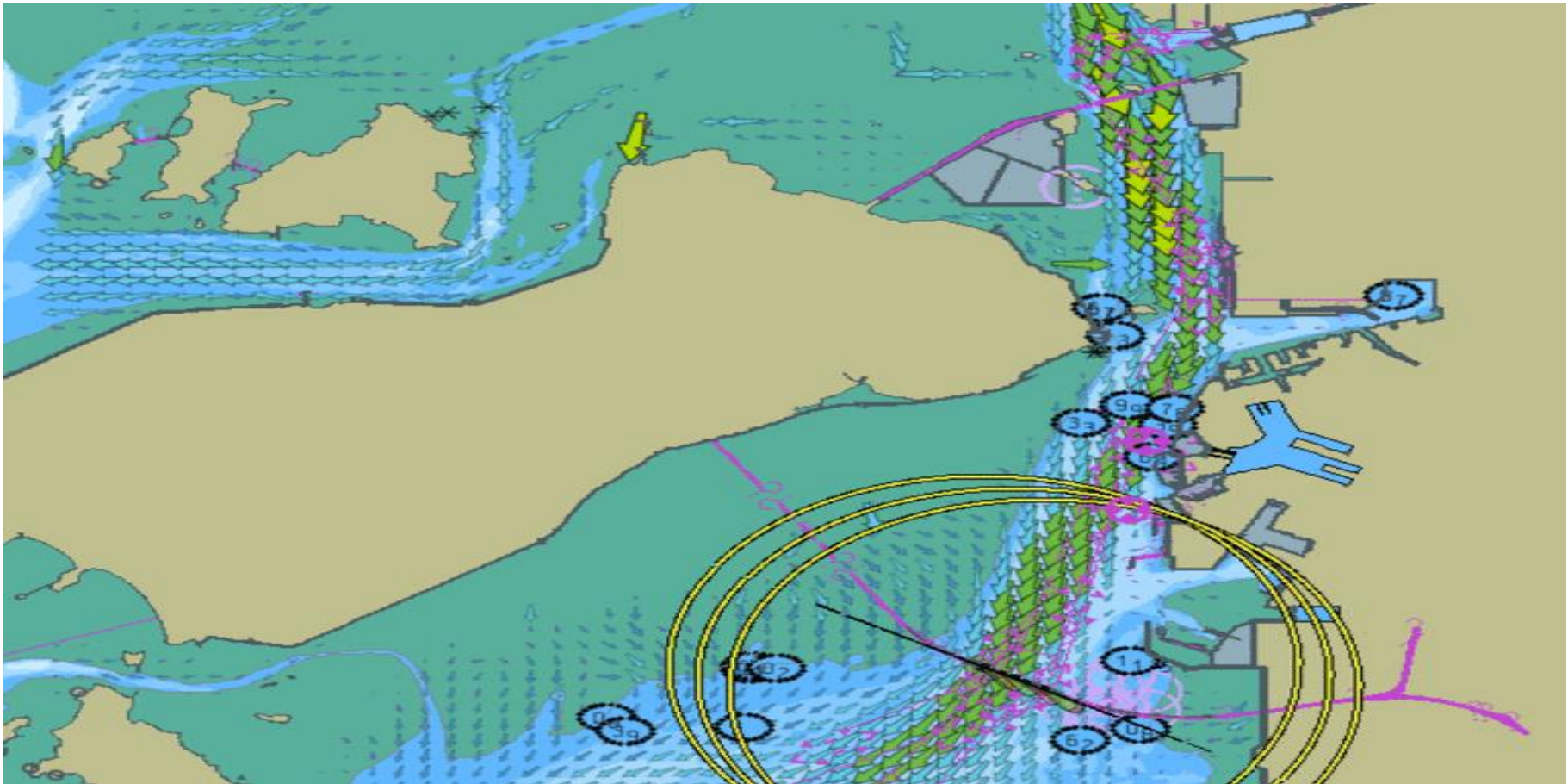




## S-111 Application

Conversion to standard exchange file format(HDF5) presented by S-111(Incheon Port).

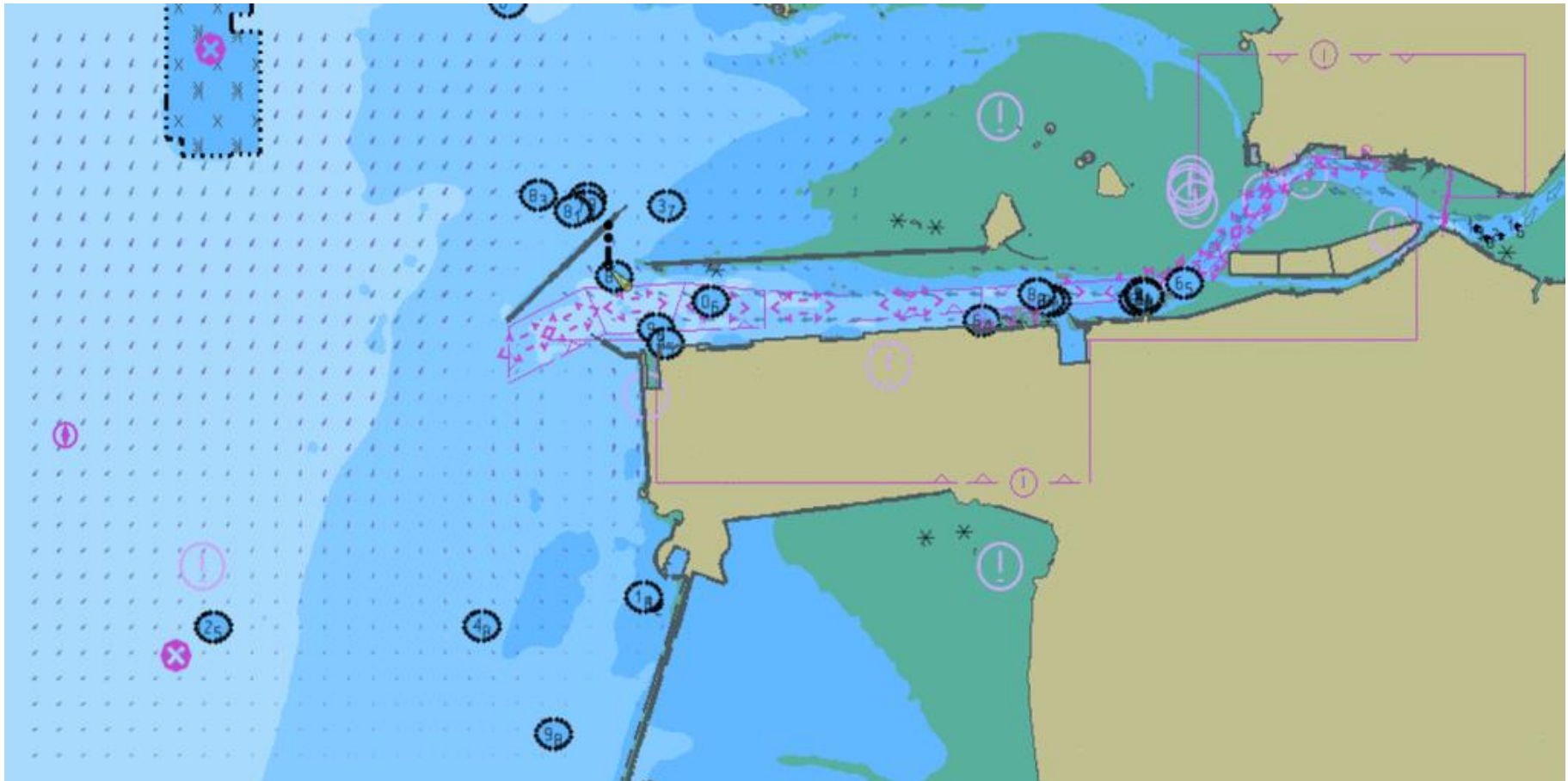
- Time : 2019030501 ~ 2019030524 UTC
- Model and Resolution : ROMS / 200m



## S-111 Application

Conversion to standard exchange file format(HDF5) presented by S-111(Gunsan Port).

- Time : 2019030501 ~ 2019030524 UTC
- Model and Resolution : ROMS / 250m

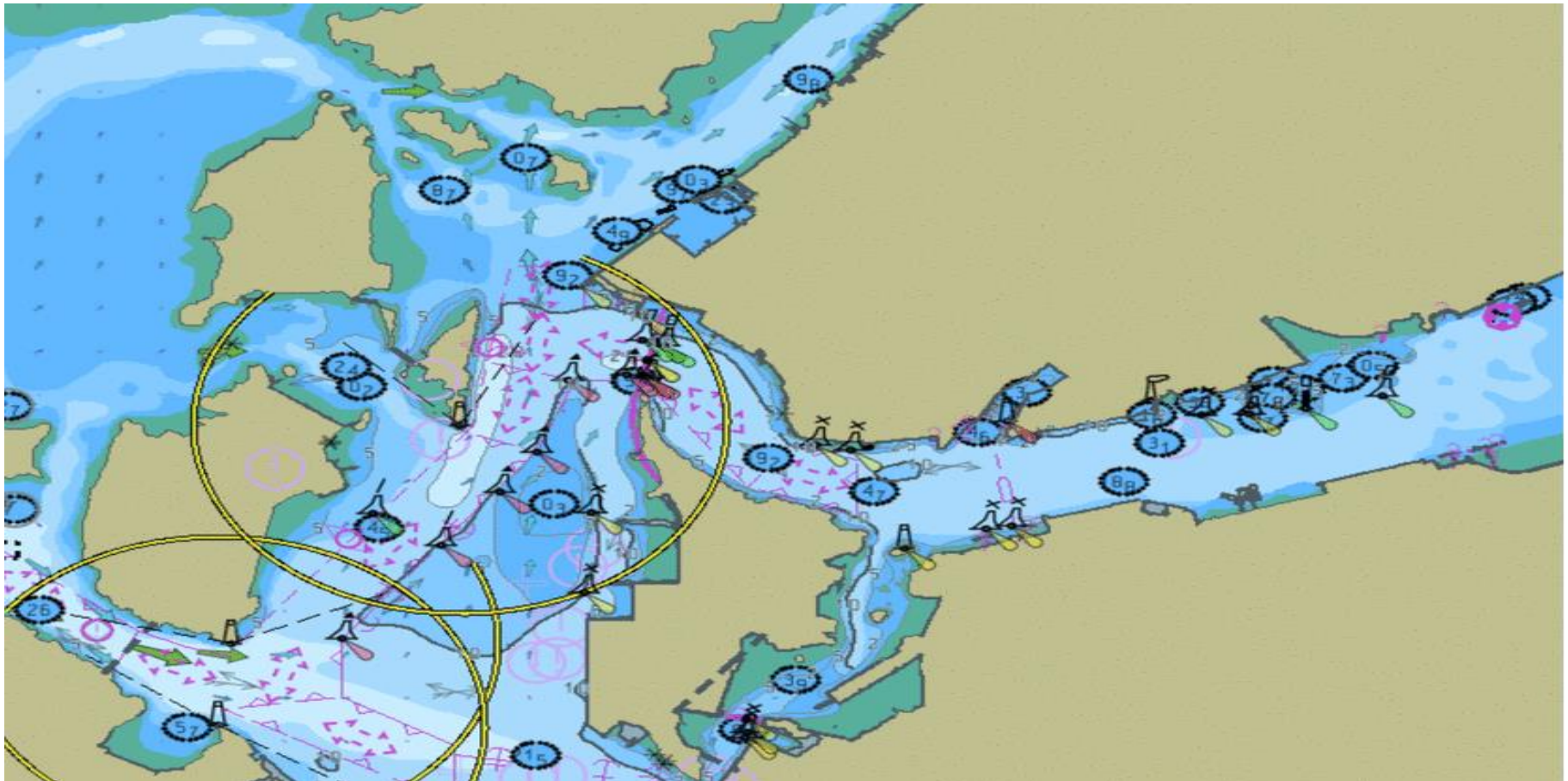




## S-111 Application

Conversion to standard exchange file format(HDF5) presented by S-111(Mokpo Port).

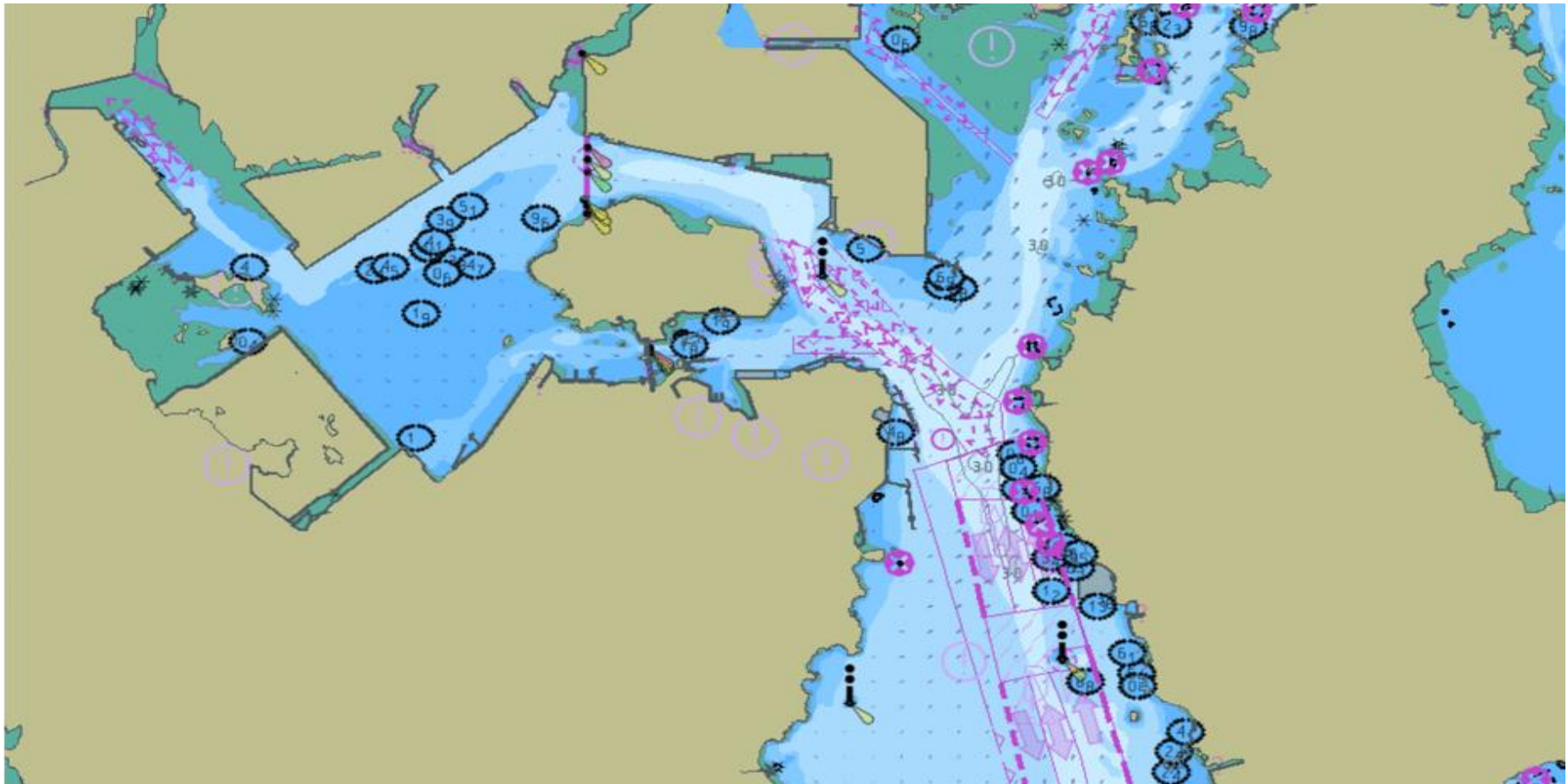
- Time : 2019030501 ~ 2019030524 UTC
- Model and Resolution : ROMS / 250m



## S-111 Application

Conversion to standard exchange file format(HDF5) presented by S-111(Gwangyang Port).

- Time : 2019030501 ~ 2019030524 UTC
- Model and Resolution : ROMS / 300m

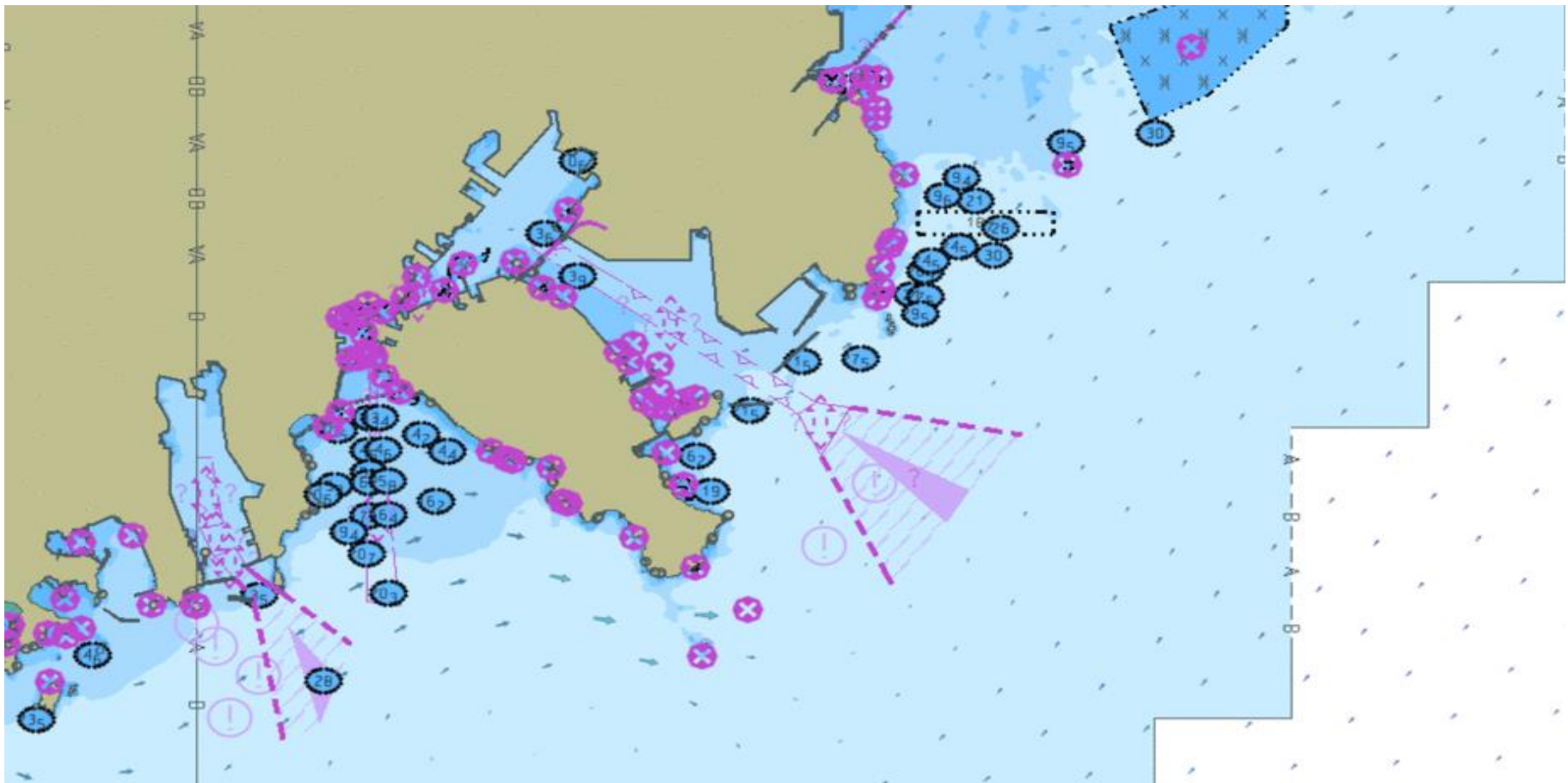




**S-111 Application**

Conversion to standard exchange file format(HDF5) presented by S-111(Busan Port).

- Time : 2019030501 ~ 2019030524 UTC
- Model and Resolution : ROMS / 500m





Thank you for your attention !!