

**IALA ENG8 Committee  
Related to Task 2.3.3**

# **Real-Time Tidal Current Monitoring and Informing System in Korea**

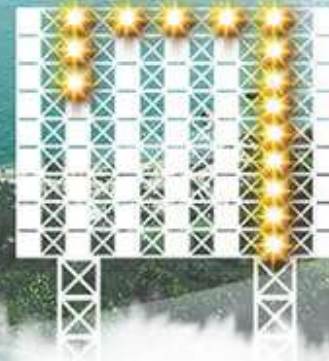
**Kim, Sung-Jun., GeoSystem Research Corp.**

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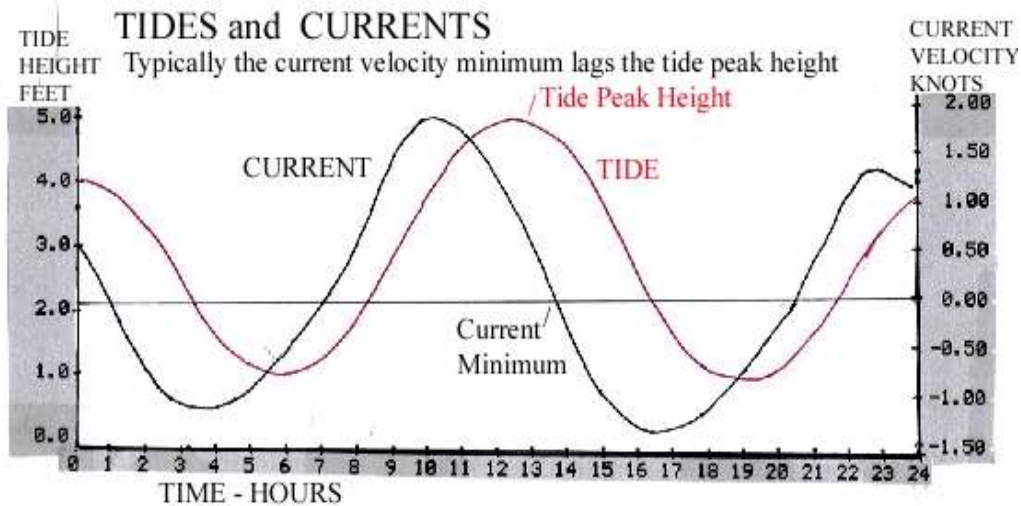
- ❖ Introduction
- ❖ Real-time Tidal Current Monitoring and Informing Systems in Korea
- ❖ Real-time Tidal Current Signal Systems in Incheon
- ❖ Real-time Tidal Current Signal Systems in Jindo
- ❖ The reliability Improvement of Tidal Current Data Acquisition,  
Processing, and Dissemination
- ❖ Benefits of Tidal Current Signal Systems



# Introduction



# Tidal Current



## Tide

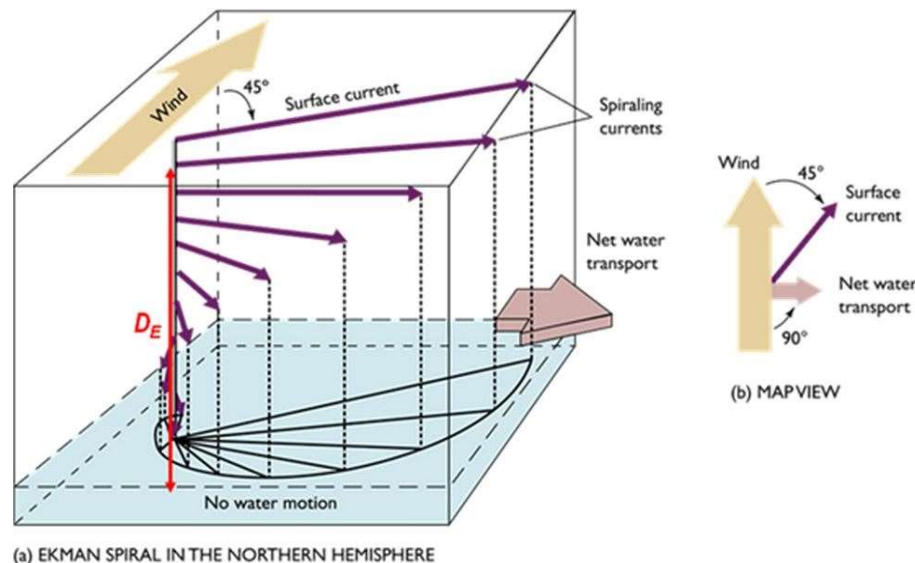
Daily variation in the ocean's sea level

## Current

Horizontal movement of water

## Tidal Current

Periodical horizontal movements of the sea due to tide generating forces



## Ekman Spiral Theory

The change in current direction and speed with depth form spiral.

One of the most important parameters for vessel navigational safety (draft line).

# The Fastest Tidal Current Coasts around the World



Country	<b>Korea</b>	<b>Japan</b>	<b>Norway</b>	<b>England</b>	<b>Canada</b>	<b>France</b>	<b>Indonesia</b>	<b>USA</b>
Max. Current	11.5	8~10	22	17	15	6~8	6~8	5~7
Area	Jindo Uldolmog	Seymour Narrow	Saltstraumen	Pentland Firth	Bay of Fundy	Normandes Islands	Lombok Strait	East River NY



# The Fastest Tidal Current Coasts around the World



Saltstraumen, Norway



Pentland Firth, England



Bay of Fundy, Canada



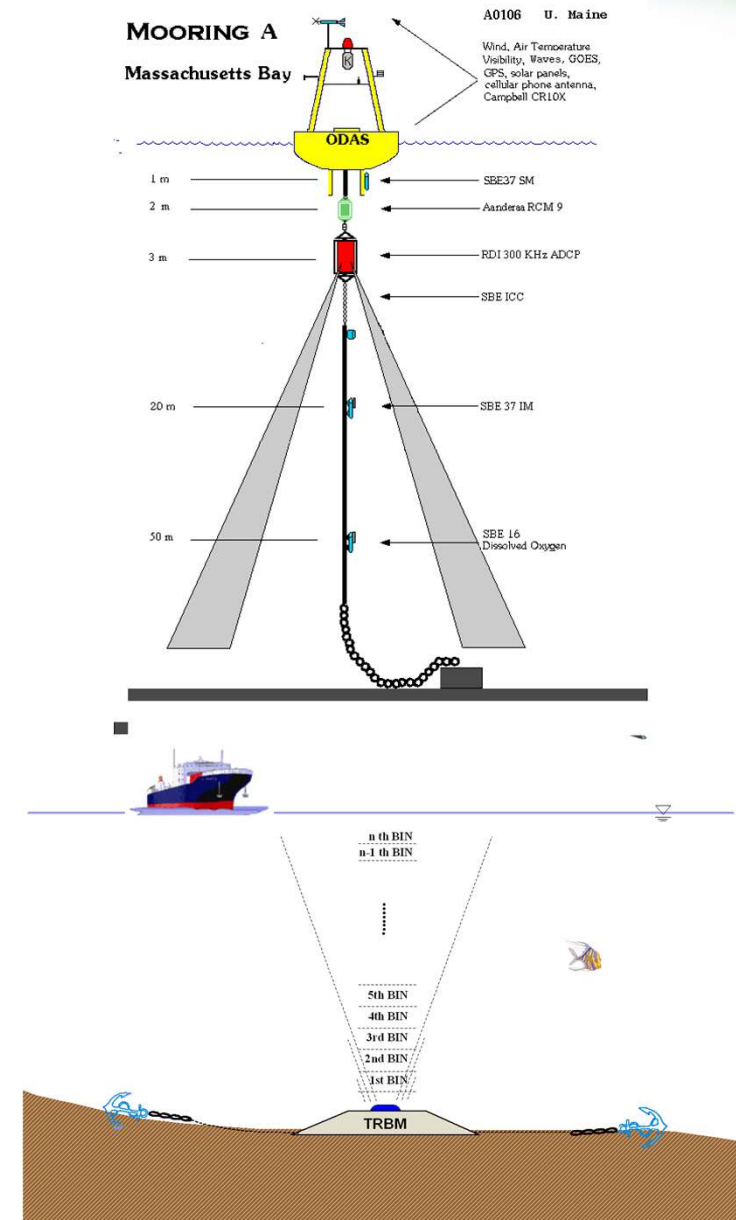
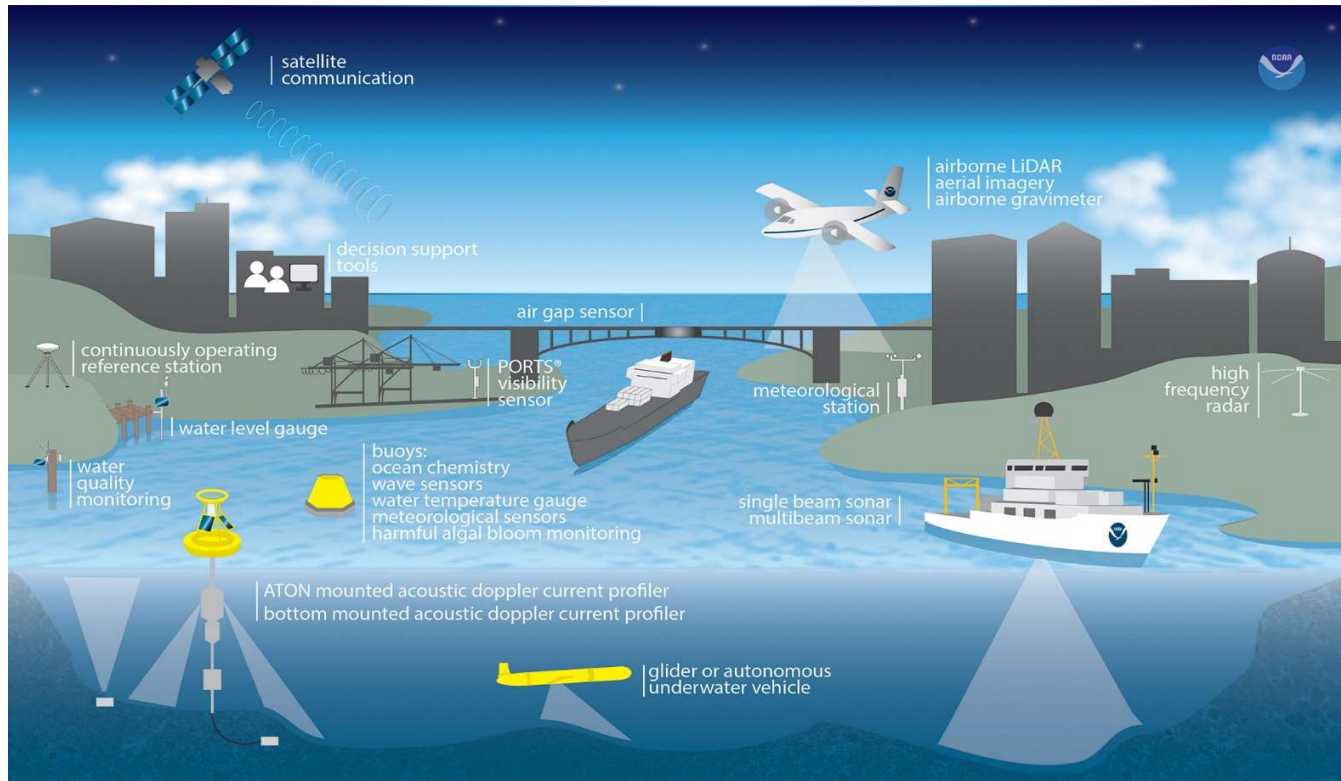
Naruto Strait, Japan



Mont St. Michel, France



# Tidal Current Monitoring System

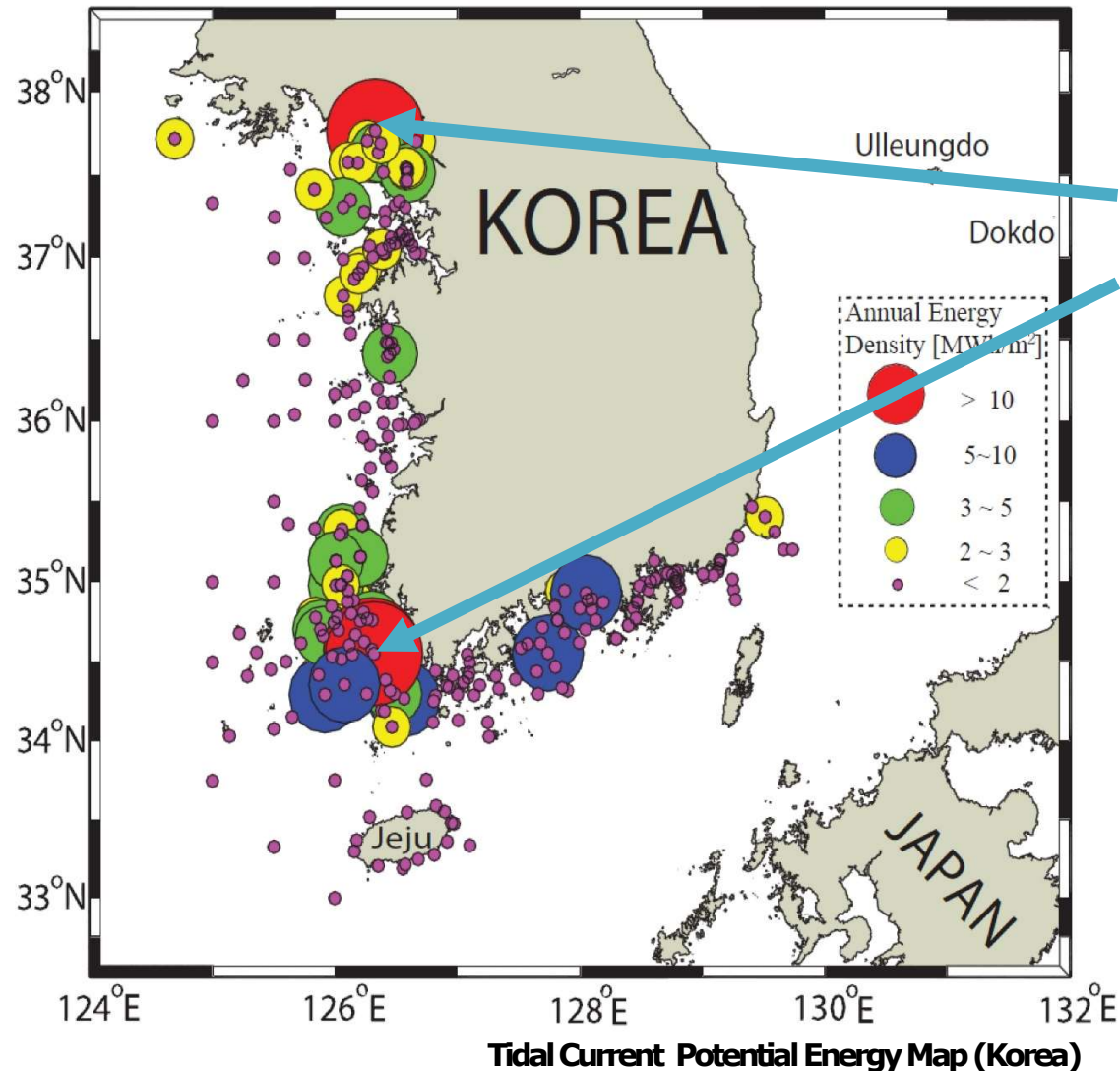


# **Real-time Tidal Current Monitoring and Informing Systems in Korea**



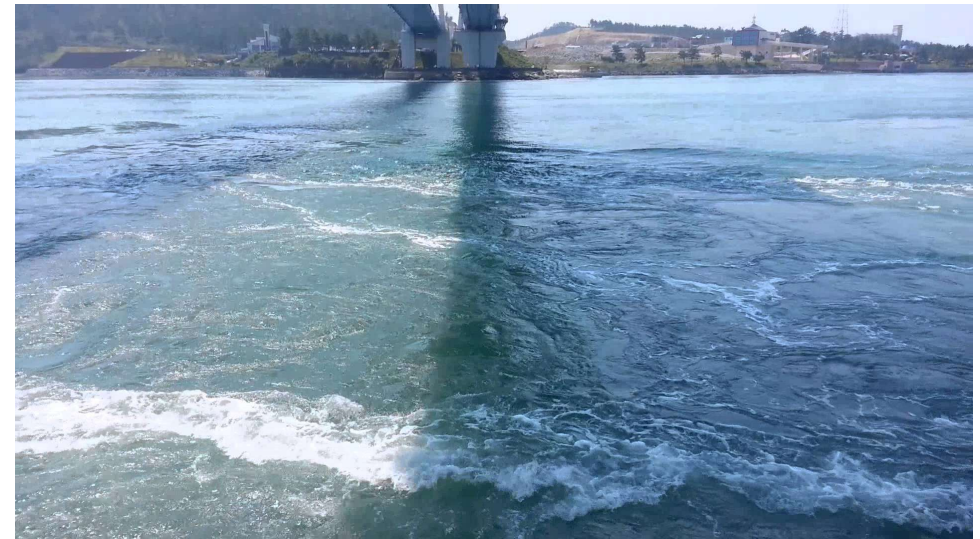


# The Tidal Current Environment in Korea

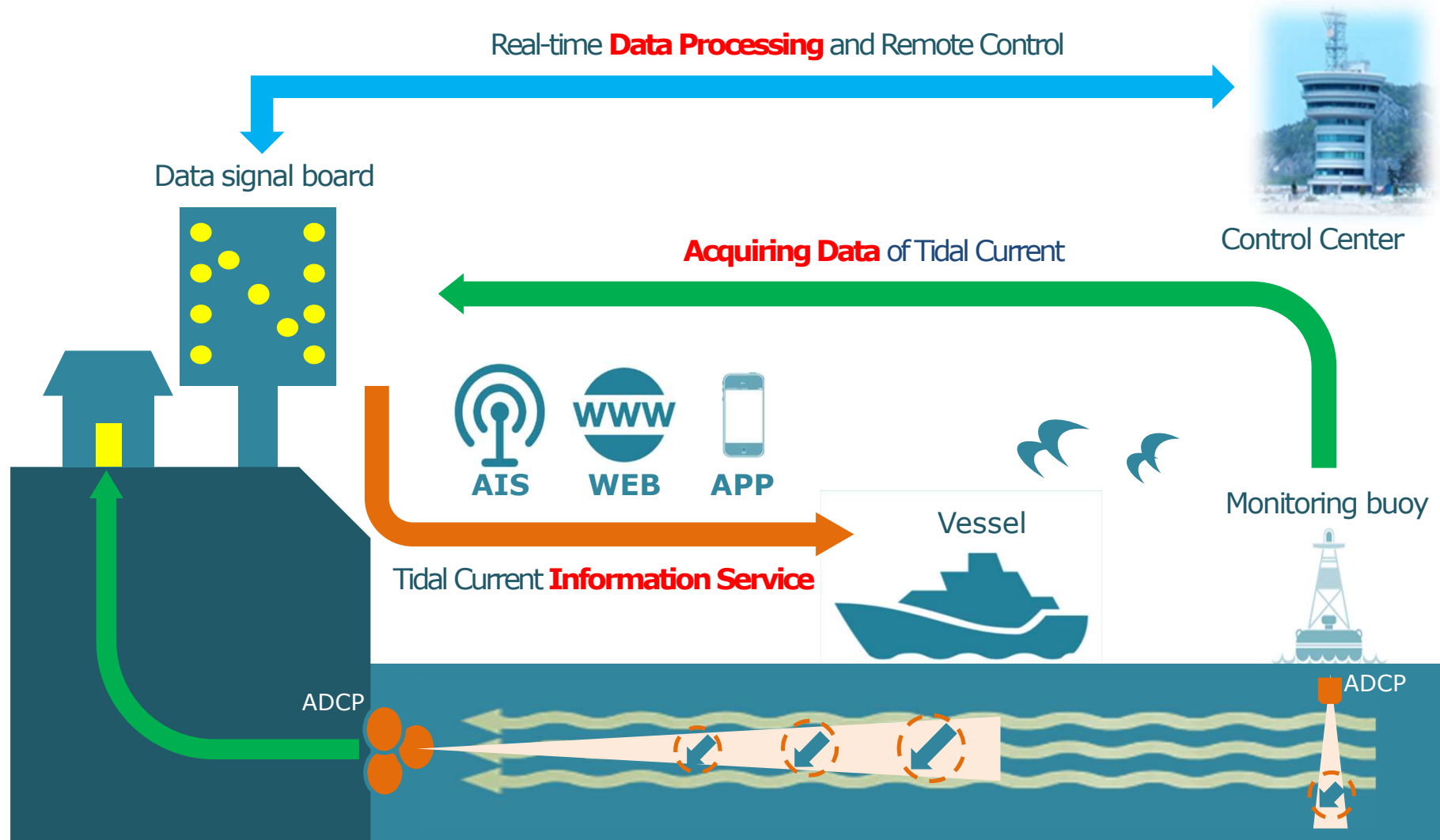


## One of the fastest tidal current Country in the world

- Incheon : 4~6 knots
- Jindo : 6~11 knots
- resource of tidal current energy
- potential navigational safety risk

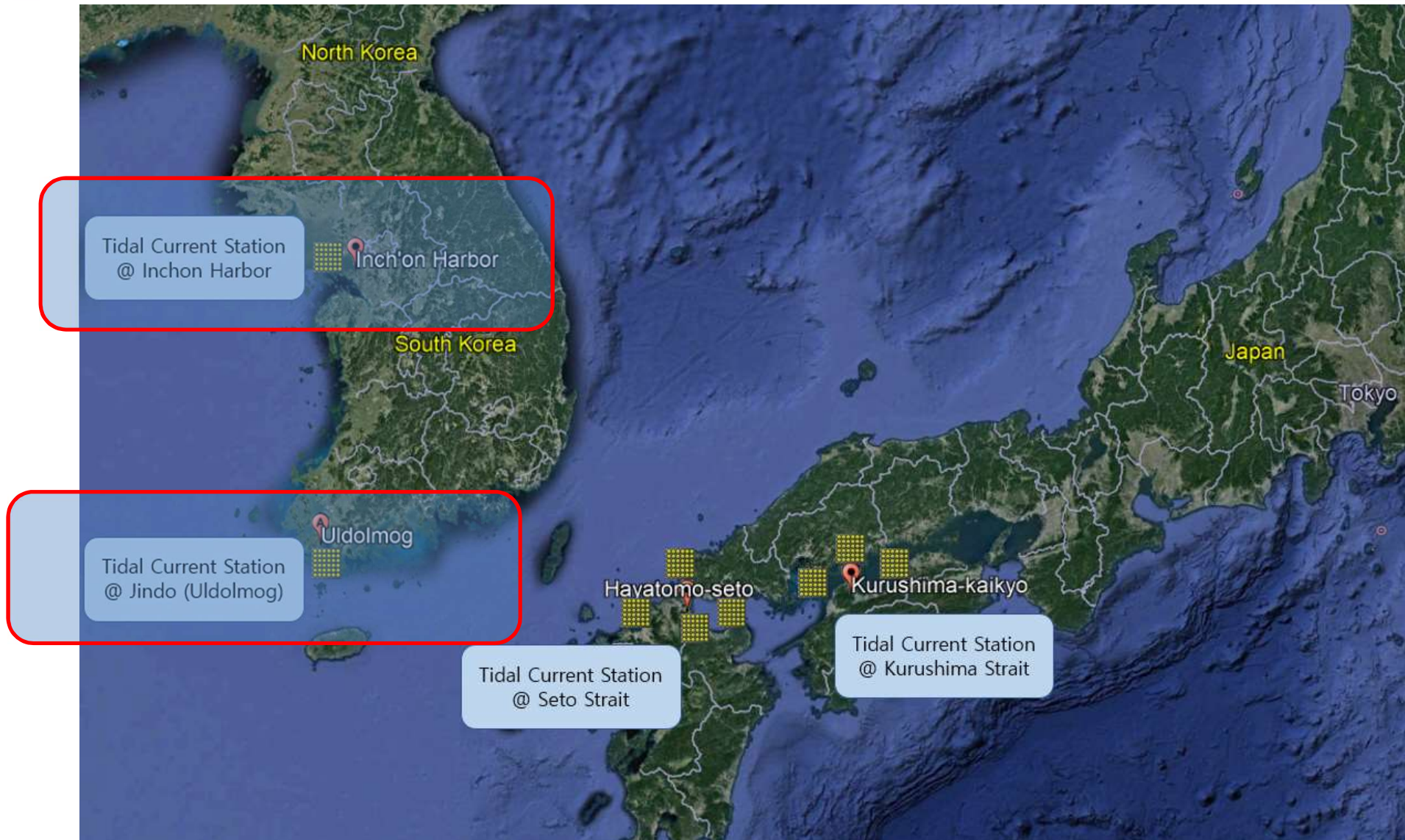


# The Tidal Current Monitoring & Informing System





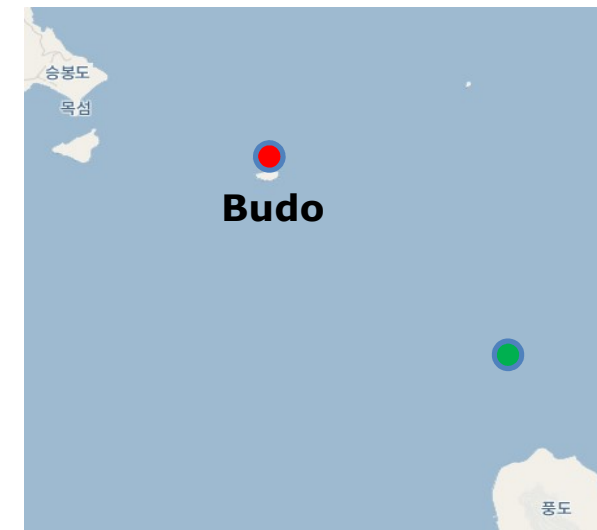
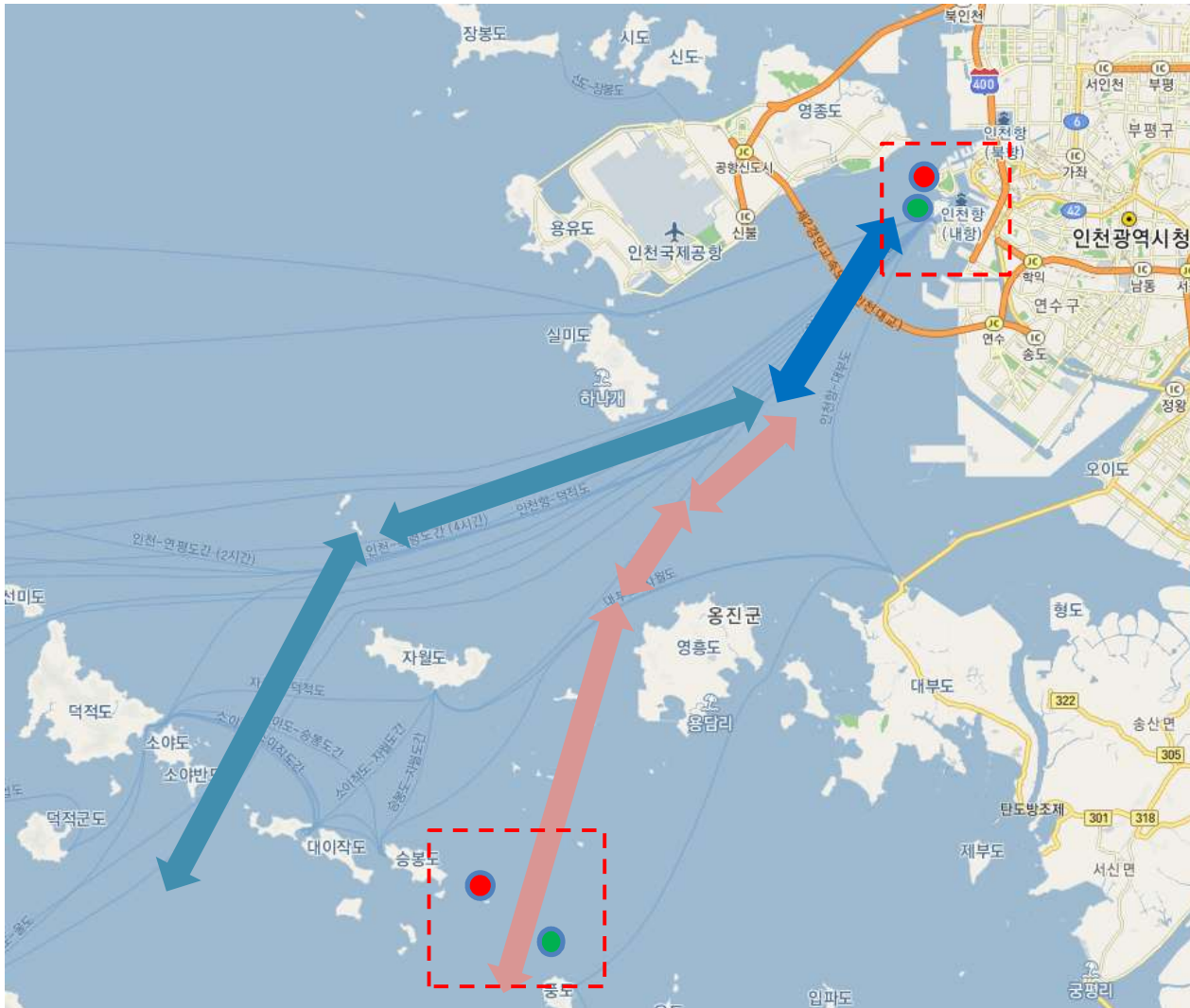
# The Tidal Current Monitoring & Informing System



# The Tidal Current Monitoring & Informing System

● Signal Board & Local Site

● Sensor(ADCP)

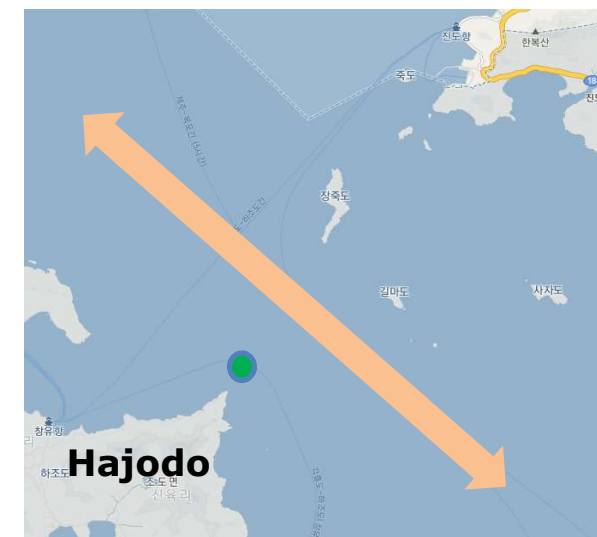
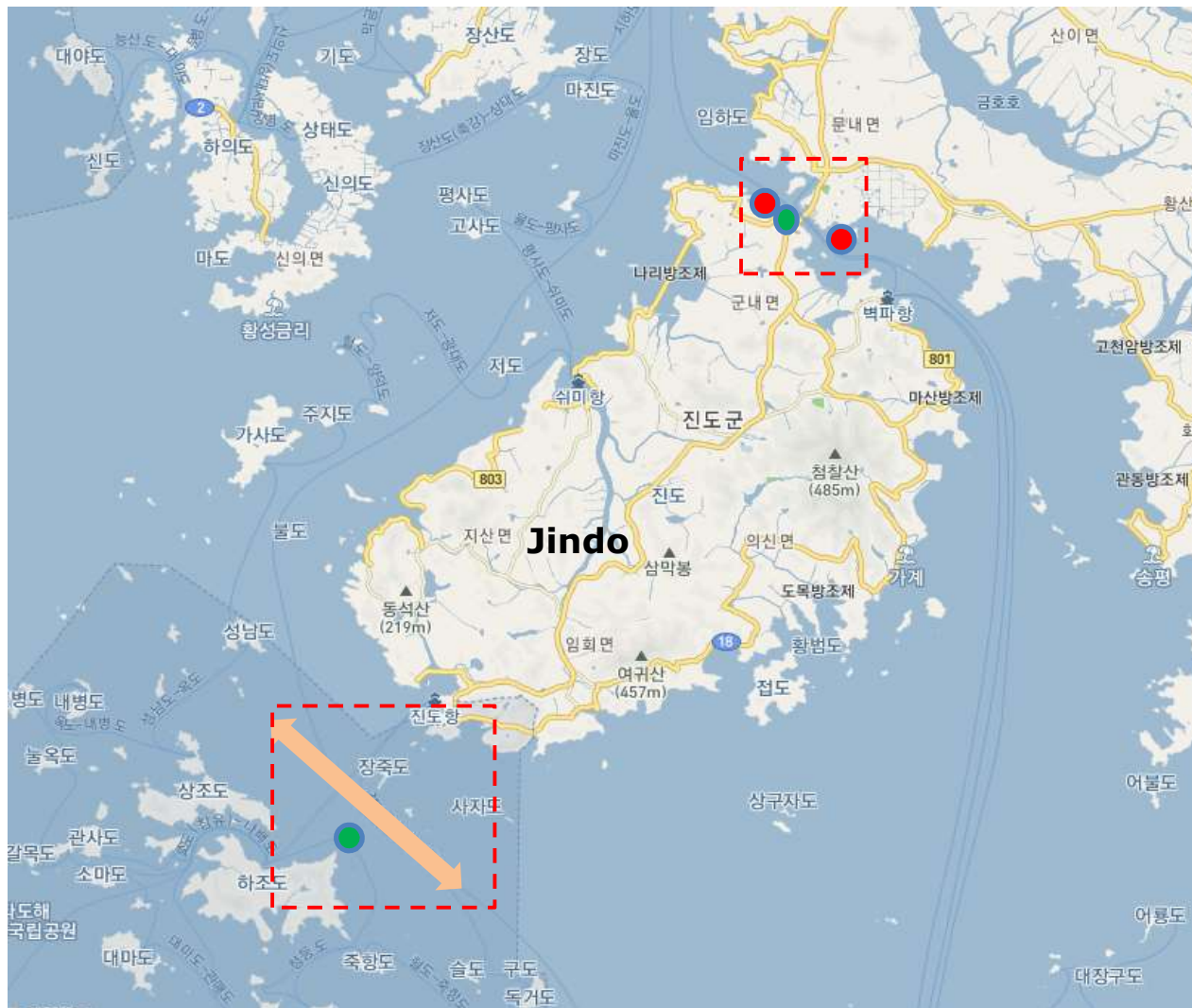




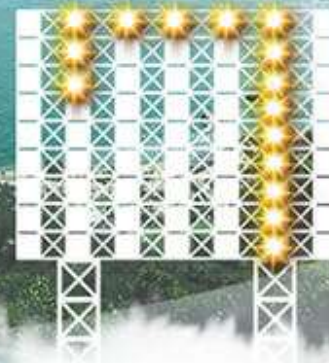
# The Tidal Current Monitoring & Informing System

● Signal Board & Local Site

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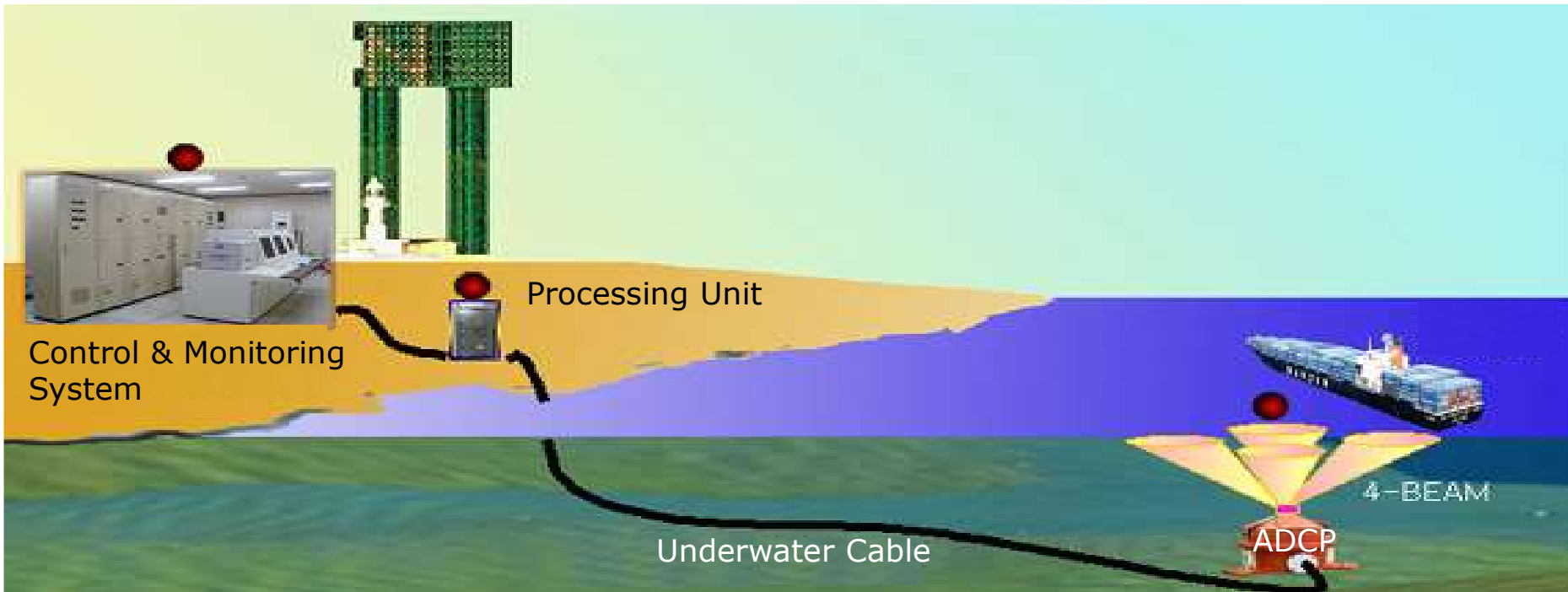


# Real-time Tidal Current Signal Systems in Incheon





# Tidal Current Monitoring System at Incheon Port



# Tidal Current Signal System at Incheon Port



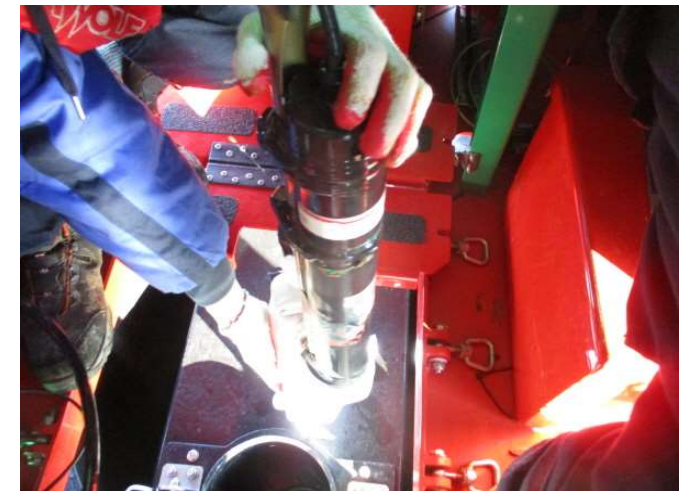
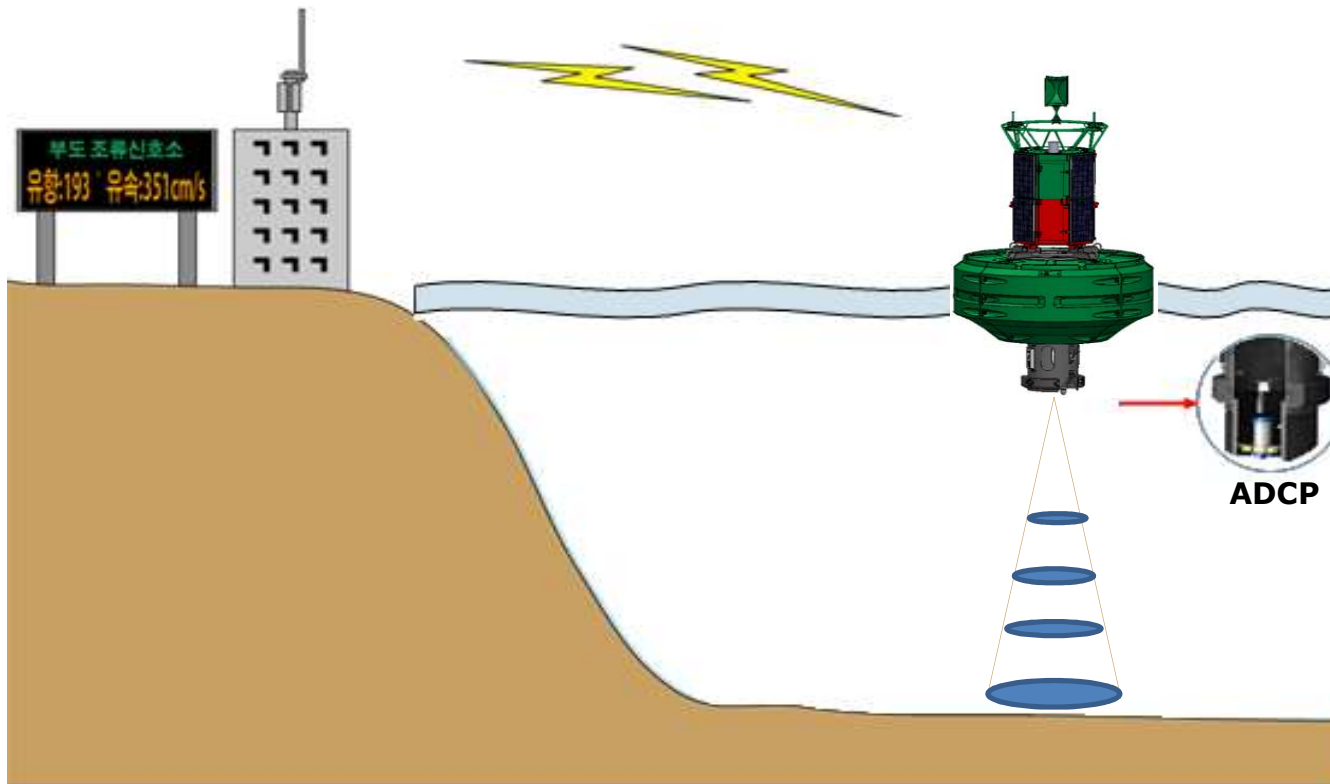
Signal Board (Shield Lamp)



Control Units



# Tidal Current Monitoring System at Budo



# Tidal Current Signal System at Budo



Signal Board (Shield Lamp)



Control Units

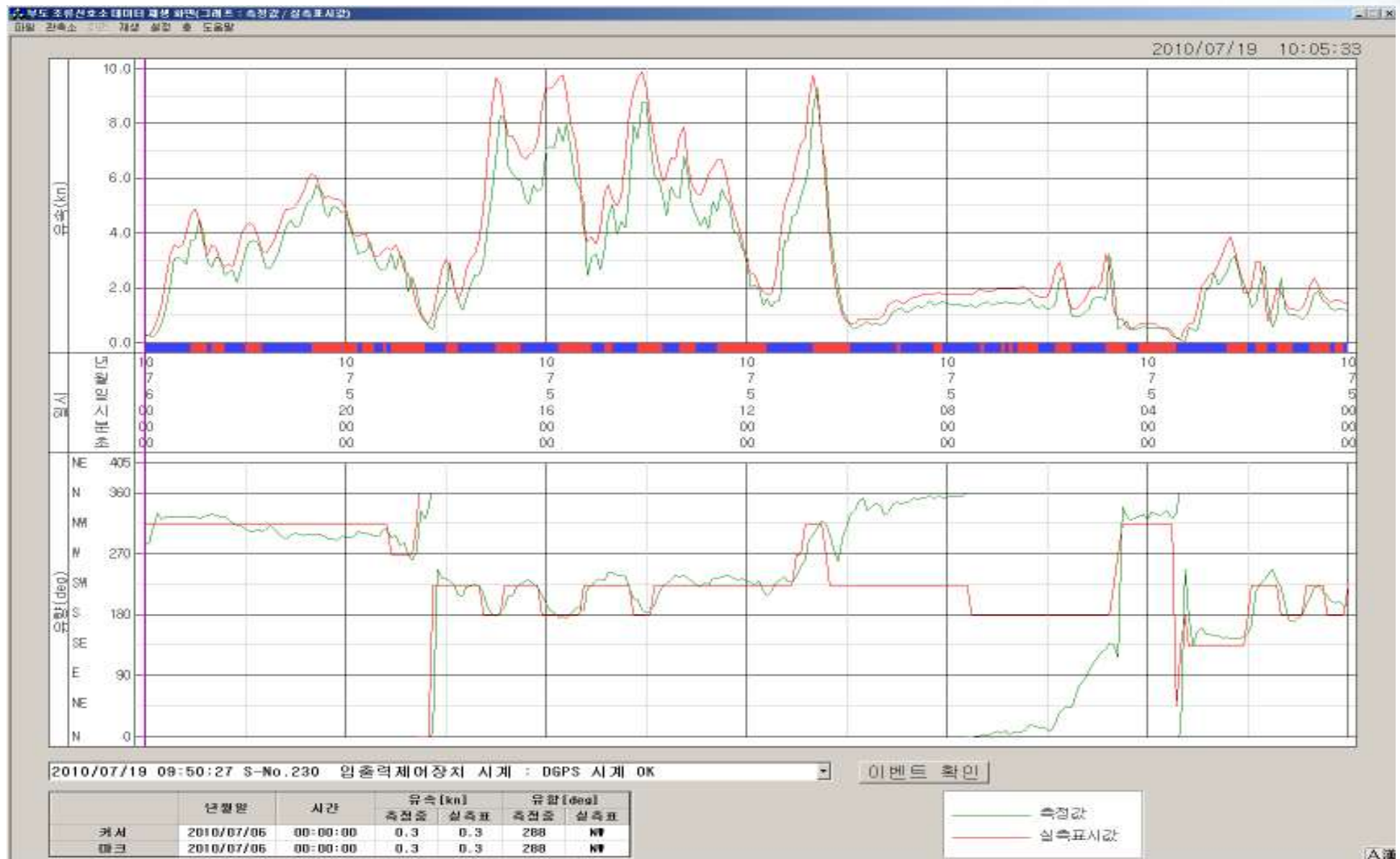


# Tidal Current Monitoring & Control Center in Incheon



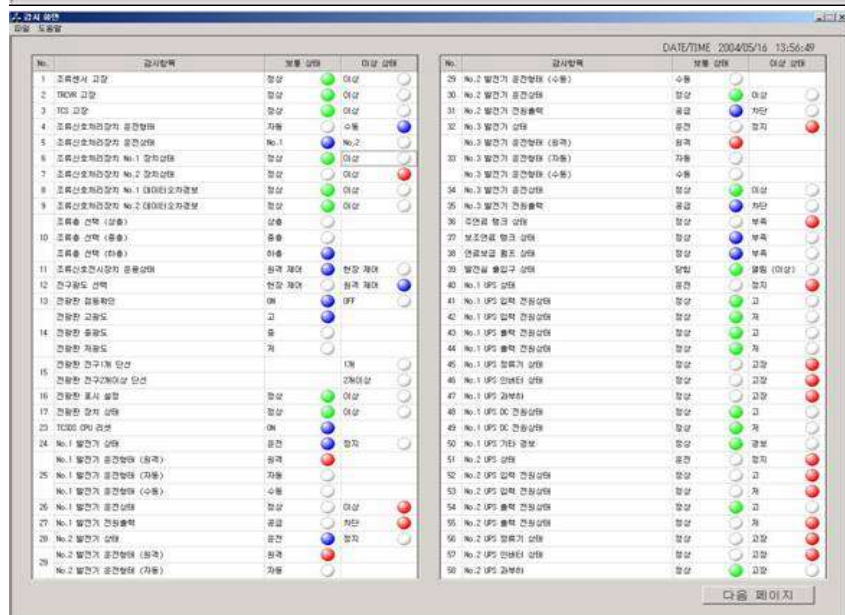
- ① : Tidal Current Data Monitoring & Control system)
- ② ③ : Tidal Current Signal Processing System
- ④ : Printer
- ⑤ : DGPS Server & Network System

# Tidal Current Monitoring Software





## A scenic view of the Venice Lagoon. In the foreground, a small boat is on the water. In the middle ground, a large bridge with a lighthouse on top is visible. In the background, there are hills and a small boat. The sky is blue with some clouds.



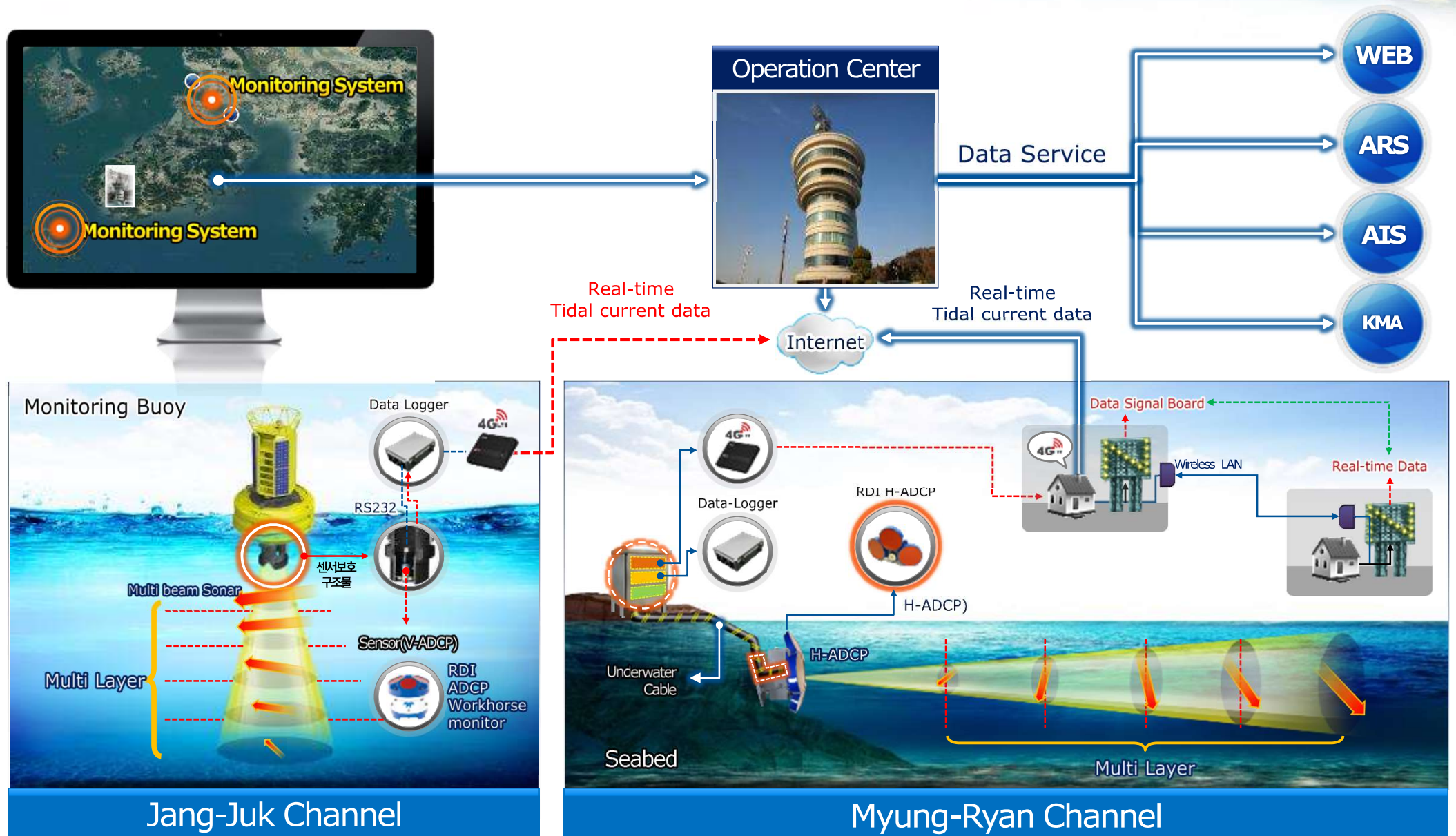
제어항목명		관측국 제어 파라미터	
No.		종착상태	정지상태
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2	조류신호차리장치 선택	No.1	<input type="radio"/> No.2 <input type="radio"/>
3	조류출 선택 (상층)	상층	<input type="radio"/>
	조류출 선택 (중층)	중층	<input type="radio"/>
	조류출 선택 (하층)	하층	<input type="radio"/>
4	광도 제어 선택	시동	<input type="radio"/> 수동 <input type="radio"/>
5	전광판 소등 설정	ON	<input checked="" type="radio"/> OFF <input type="radio"/>
6	전광판 "교광도" 설정	교광도	<input type="radio"/>
	전광판 "충광도" 설정	충광도	<input type="radio"/>
	전광판 "저광도" 설정	저광도	<input type="radio"/>
7	TCSDS 광량 리셋	ON	<input type="radio"/>
10	TCSDS CPU 리셋	리셋	<input type="radio"/>
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12	No.1 발전기 전원출력	정급	<input type="radio"/> 차단 <input type="radio"/>
13	No.1 발전기 경보 리셋	리셋	<input type="radio"/>
14	No.2 발전기 조작	시동	<input type="radio"/> 정지 <input type="radio"/> <input type="radio"/> 차단 <input type="radio"/>
15	No.2 발전기 전원출력	정급	<input type="radio"/> 차단 <input type="radio"/>
16	No.2 발전기 경보 리셋	리셋	<input type="radio"/>
17	No.3 발전기 조작	시동	<input type="radio"/> 정지 <input type="radio"/> <input type="radio"/> 차단 <input type="radio"/>
18	No.3 발전기 전원출력	정급	<input type="radio"/> 차단 <input type="radio"/>
19	No.3 발전기 경보 리셋	리셋	<input type="radio"/>

# Real-time Tidal Current Signal Systems in Jindo





# Tidal Current Monitoring System at Jindo Coastal Area



# Tidal Current Signal System at Jindo Coast



Service Distance	3km
Service Angle	60°

[Calculation of 1 LED Light]

- ✓ Night : 6.5cd, Light Distance 2.14km
- ✓ Day : 4,000cd, Light Distance 1.74km

[ Display ]





# Tidal Current Signal System at Jindo Coast

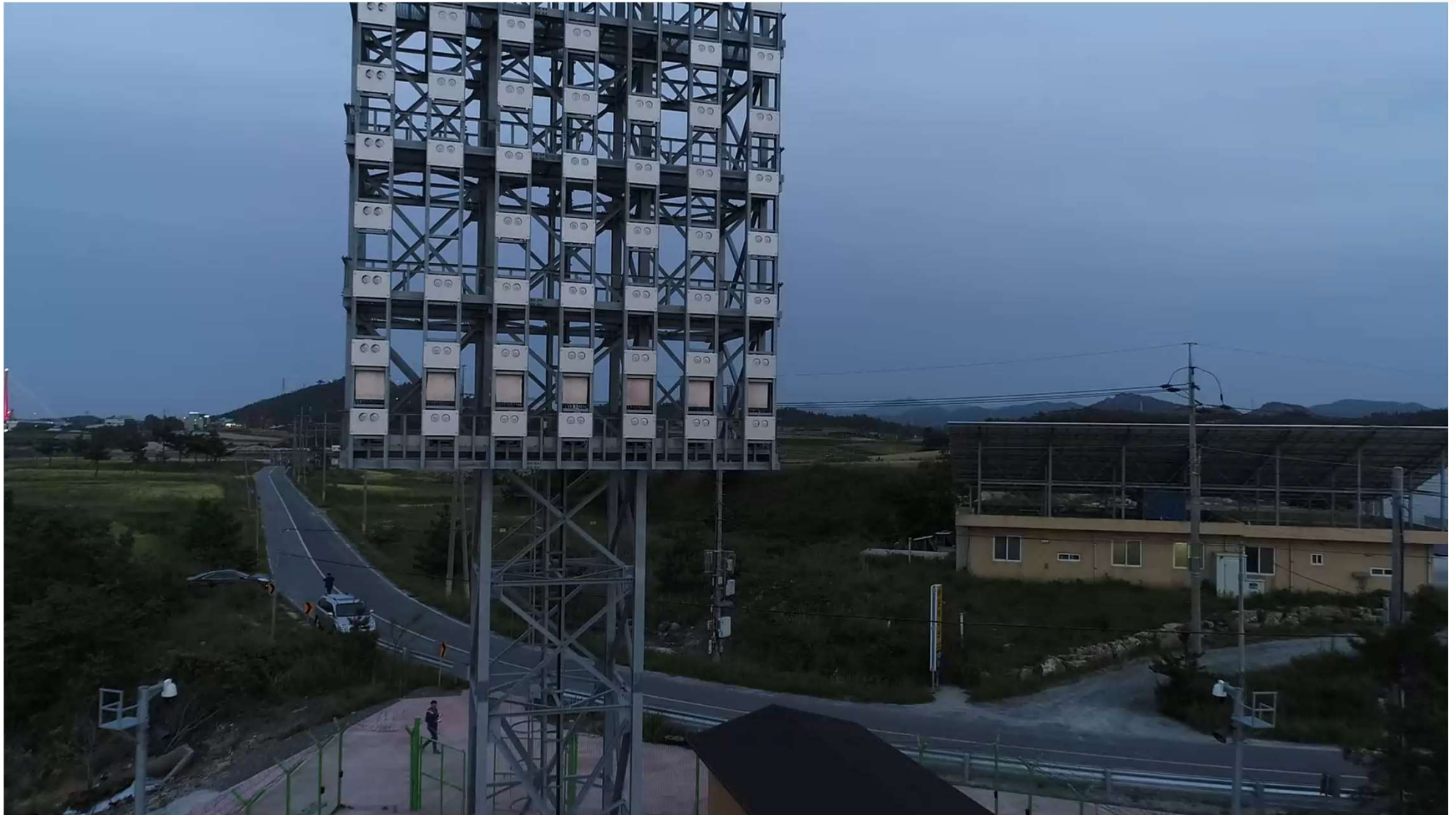


# Tidal Current Signal System at Jindo Coast





# Tidal Current Signal System at Jindo Coast



# Tidal Current Monitoring & Control Center in Jindo

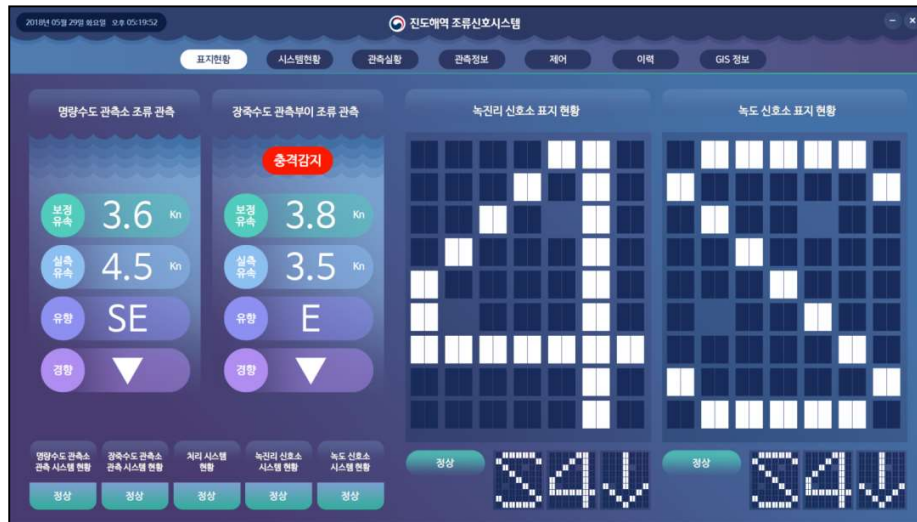


No.	Units
1	Data Signal Board Monitoring Unit
2	Data Observation Monitoring Unit
3	System Monitoring & Remote Control Unit
4	Data Time-Series Graph Monitoring Unit
5	Security System Monitoring Unit
6	Integrated Visualization Display





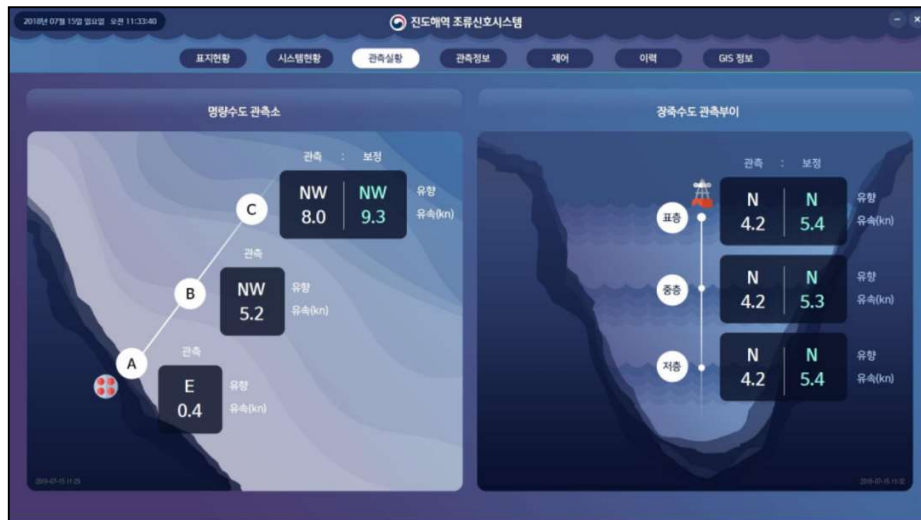
# Tidal Current Monitoring Software



[Data Signal Board Monitoring]



## [System Monitoring & Remote Control]



[Tidal Current Observation System Monitoring]



[Tidal Current Time-Series Graph]

# **The reliability Improvement of Tidal Current Data Acquisition, Processing, and Dissemination**





# The reliability Improvement of Tidal Current Data Acquisition, Processing



## **1 Preliminary Study**

Site selection, monitoring location, information service study

## **2 Tidal Current Numerical Modeling Study**

Observing & data processing evaluation with modeling study

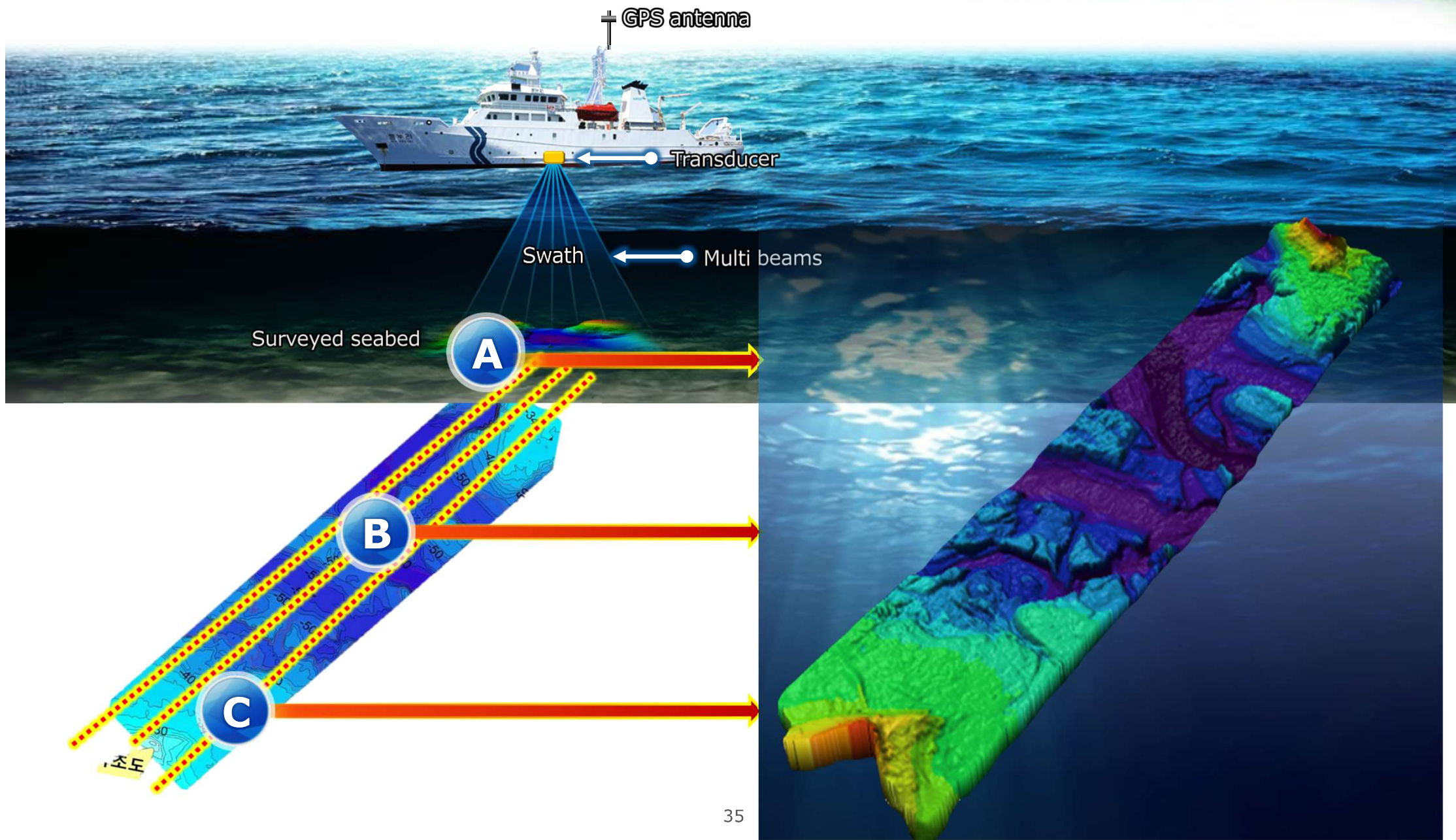
## **3 Verification of Observation Data**

Observed data quality control & quality assurance

## **4 Applying Environment Variables**

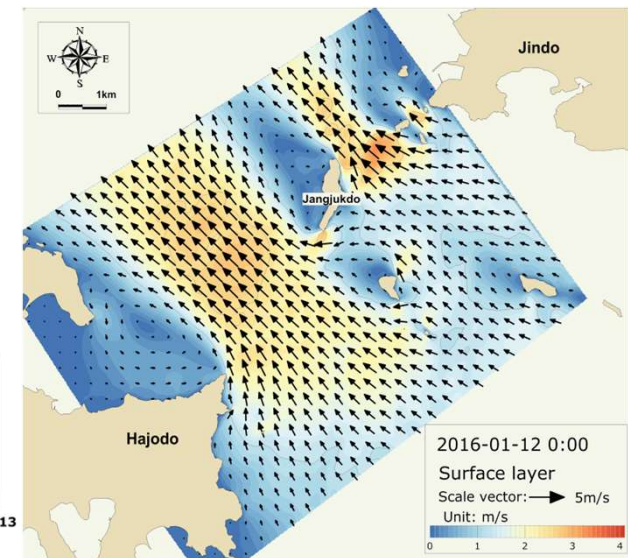
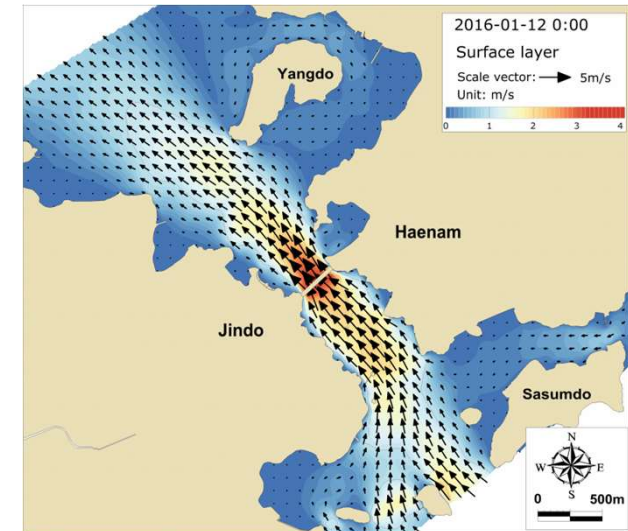
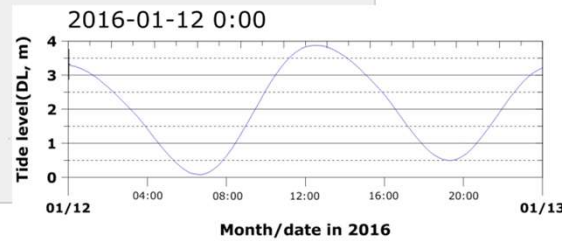
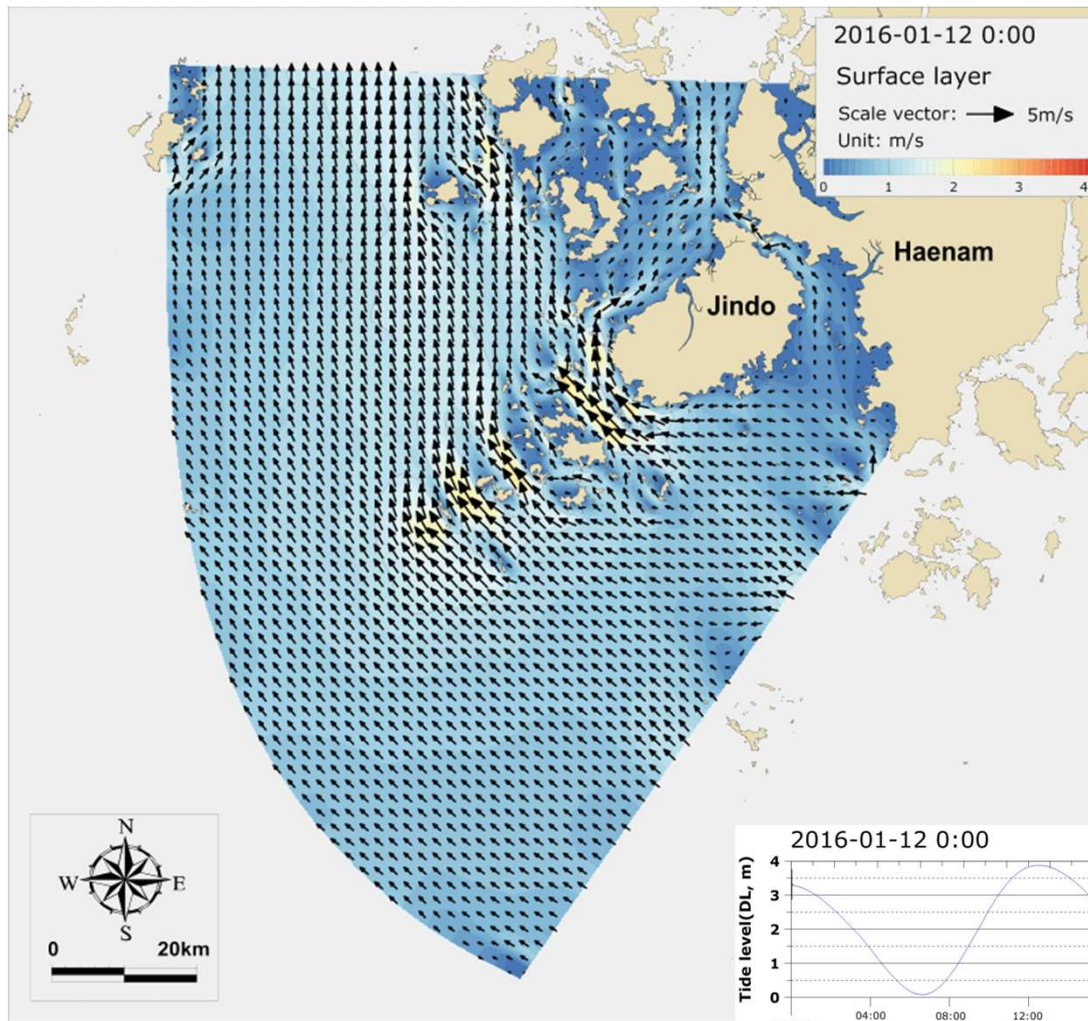
Data processing and applying with other environmental parameters, such as weather and geological information

# The Preliminary Study





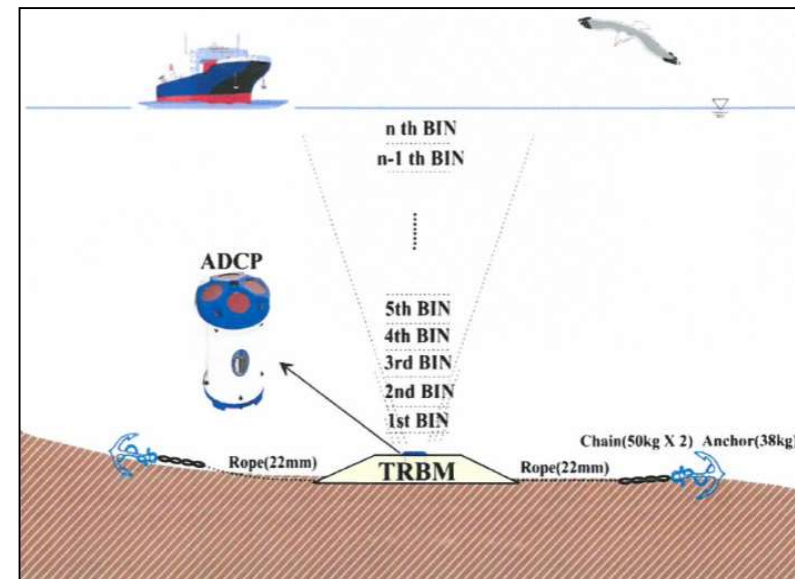
# Tidal Current Numerical Modeling Study



# Verification of Observation Data



- After the observed system installation, full-time bottom mounted observation should be performed for data verification.
- Accurate data is the most critical issue for navigational safety and public service.





# Applying Environment Variables



2018년 05월 30일 오전 10:30:44

진도해역 조류신호시스템

표지판항

시스템현황

관측실태

관측정보

제어

이력

GIS 정보

지점

평량수도 관측소

장측수도 부이

날짜

2018년 05월 30일 (수요일)

-7일

-1일

+1일

+7일

오늘

C지점

조회

관측 그래프

조류관측

기상관측



Weather Sensor

# Tidal Current Information Services

## 1 Data Signal Board

Data information service using large electronic display boards : the intuitively delivering real-time data

## 2 WEB Service

Data information service using web page

## 3 AtoN AIS (MSG 8)

Data information service using AtoN AIS (Message 8)

## 4 ARS & FAX Services

Data information service using ARS & Fax



# An Example of Tidal Current Signal Board

6 Repeated Display (updated every 10 min.)



1 Direction  
(2sec. ON)

2 Off  
(2sec. OFF)

3 Speed  
(2sec. ON)

4 Off  
(2sec. OFF)

5 Inclination  
(2sec. ON)

Meaning

Tidal current is North-going, 6 knot speed, and decreasing condition

Direction

N, S, W, E

Speed

0~11 knots

Inclination

↑ (increasing),  
↓ (decreasing)

# An Example of Tidal Current Information Web Services

인천국제공항

인천지방해양수산청

(통합검색) 검색어를 입력해주세요

Q 검색

사이트맵

LANGUAGE

GO

정보공개

민원바다

알림마당

광안물류

선원회사

해양수산관광

항로표지

인천항/경인항

기관소개

## 항로표지

항로표지

항로표지 관리소

인천항주요정보운영센터

- 조류신호시스템
  - 소개
  - 운영원리
  - 조류신호식
- 시설현황
- 조류정보 이용범위
- 조류측량원리
- 조류정보
  - 인천항
  - 부도
- 조류정보 자료요청
- 실시간 해양기상정보
- 자료실

## 부도

[홈](#) | [항로표지](#) | [인천항조류정보운영센터](#) | [조류신호시스템](#) | [조류정보](#) | **부도**

기

간

2017-10-01 00:00

-

2017-10-02 14:32

검색

구분  
일차

부도					
상 조		중 조		하 조	
유속	류향	경향	유속	경향	류향
2017-10-02 14:31	5.5	NW	중가	5.6	NW
2017-10-02 14:29	5.5	NW	중가	5.6	NW
2017-10-02 14:27	5.5	NW	중가	5.6	NW
2017-10-02 14:25	5.5	NW	중가	5.6	NW
2017-10-02 14:23	5.5	NW	중가	5.6	NW
2017-10-02 14:21	5.5	NW	중가	5.6	NW

출력하기

실시간  
조류정보  
인천항물류  
유속  
경향  
부도  
유향  
출력

국립해양측위정보원

소개

실시간 해양기상정보

해양기상 통계자료

해양기상정보 서비스

전체(해역별)

전체(지방청별)

기상표지 리스트

(기상)가거도등대

(기상)계마항방파제등대

(기상)대노곶도등대

(기상)매물도등대

(기상)외달도등표

(기상)우세도등대

(기상)홍도등대

가덕도등대

가진서등대

감천항유도등부표(랜비)

개민포등대

견내항등표

고도등표

고식이등표

고암등대

고암부표(파)

검색어 입력

🔍

전체

풍향

유향

파향

기온

수온

시정

풍속

유속

파고

기압

습도

염분

W/A

정비 마칠치, '-' 정보 없음

표지명 :

위치 :

🌀

풍향

🌊

풍속 m/s

🌡️

기온 °C

🌡️

수온 °C

👁️

시정 km

🌊

파고 m

🌊

파향

🌊

유향

🌊

유속 kn

🌊

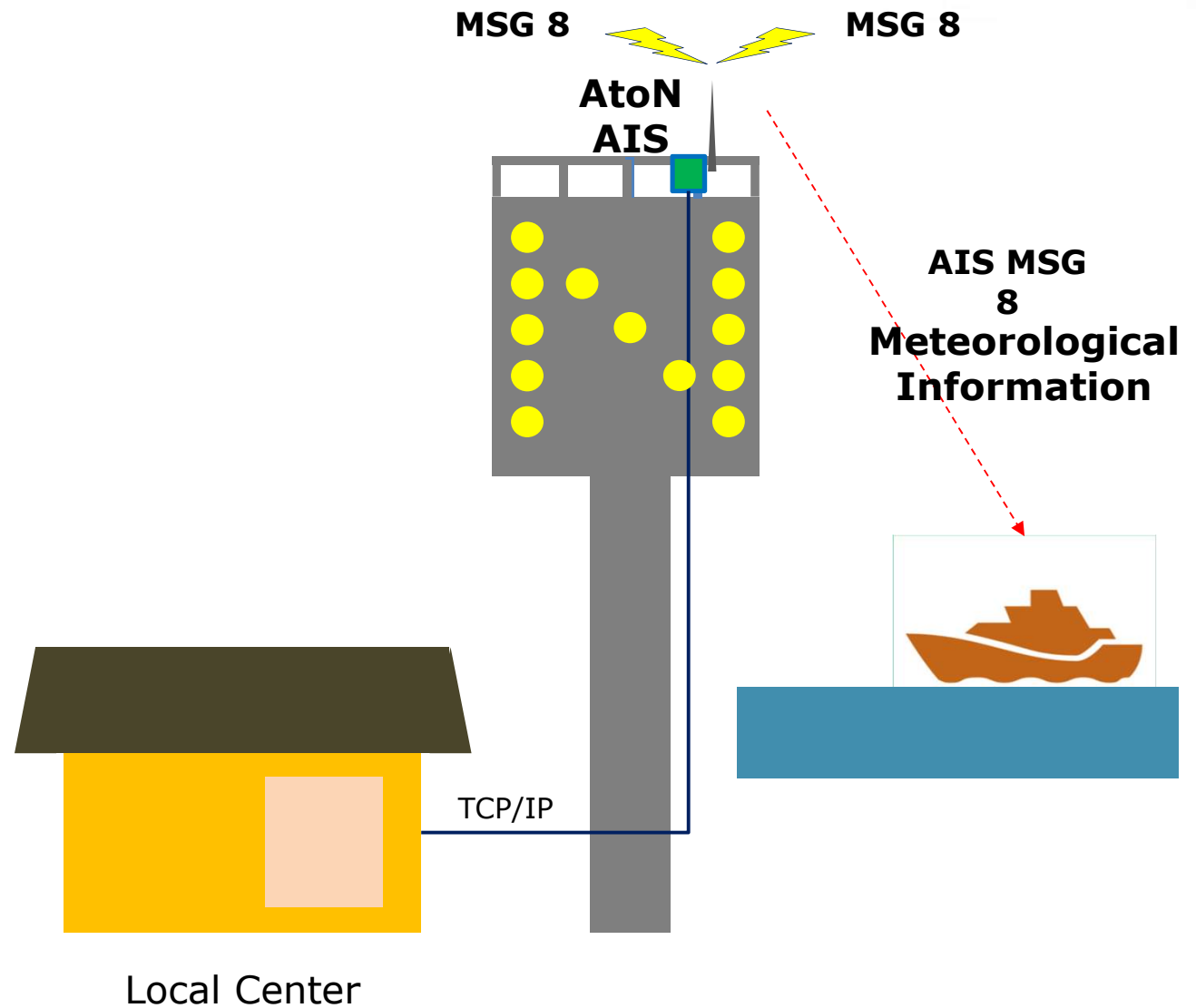
기압 hPa



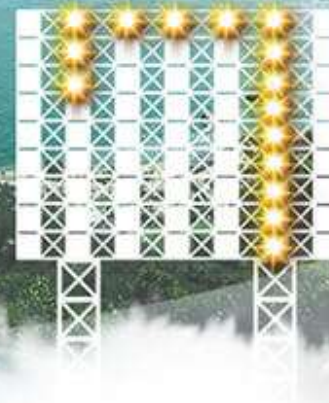
# An Example of Tidal Current AtoN AIS Service



**AtoN AIS (Type 3)**



# Benefits of Tidal Current Signal Systems





# Benefits of Tidal Current Signal Systems

- The tide and current data are an essential to provide vital information for safe and efficient navigation of vessels, but also knowing how fast water is moving (and in what direction) is important for anyone involved in water-related activities.
- The large electronic display board information service is the intuitively delivering real-time data directly to the surrounding vessels provides detailed information for vessels and improve visibility and convenience for safe navigation.

Confidence Level	Source of Benefit	Nature of Benefit
<b>Usually quantifiable with high degree of confidence</b> reasonably good confidence and/or direct evidence for benefits	Avoided groundings (commercial vessels)	Avoided costs (surplus)
	Increased draft, cargo loading	Efficiency (surplus)
	Reduced delays (commercial vessels)	Avoided costs (surplus)
	Improved spill response (present practice)	Avoided costs (surplus)
<b>Usually quantifiable with lower degree of confidence</b> more significant assumptions required to estimate benefits; less direct evidence	Reduced distress cases (recreational boats)	Avoided costs (surplus, value of life)
	Improved weather forecasts	Non-market consumer surplus
	Improved storm surge forecasts	Avoided costs (surplus)
	Improved spill response (with additional models)	Avoided costs (potential)
	Enhanced recreational boating	Non-market consumer surplus
	Enhanced recreational and commercial fishing	Efficiency (surplus)
<b>Non-quantified benefits</b>	Educational use	Non-market
	Scientific research	Non-market



**GeoSystem Research Corp.**

**Managing Director**

**Kevin S. Kim**

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**E-MAIL: [SJKIM@GeoSR.com](mailto:SJKIM@GeoSR.com)**

