2016 PICES Annual Meeting
San Diego, CA. USA

Introduction to the Ocean Research Stations (ORSs) in Korea and application activities


Gageocho ORS (GORS)


Ieodo ORS (IORS)


Socheongcho ORS (SORS)

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Overview

- Program : "**Construction of Ocean Research Station and their Application Studies**"

  by **KIOST** (Korea Institute of Ocean Science & Technology)
- Fund : **MOF** (Ministry of Oceans and Fisheries)
- Own and Operation : **KHOA** (Korea Hydrographic and Observation Agency)
- 3 Ocean Research Stations (ORSs)
  - **Ieodo** ORS (Jun. 2003)
  - **Gageocho** ORS (Oct. 2009)
  - **Socheongcho** ORS (Oct. 2014)
- Features
  - Steel structure and fixed ocean platform (jacket & deck)
  - Powered by hybrid system (solar, wind + diesel generators)
  - Scientists can stay for several days in the ORSs

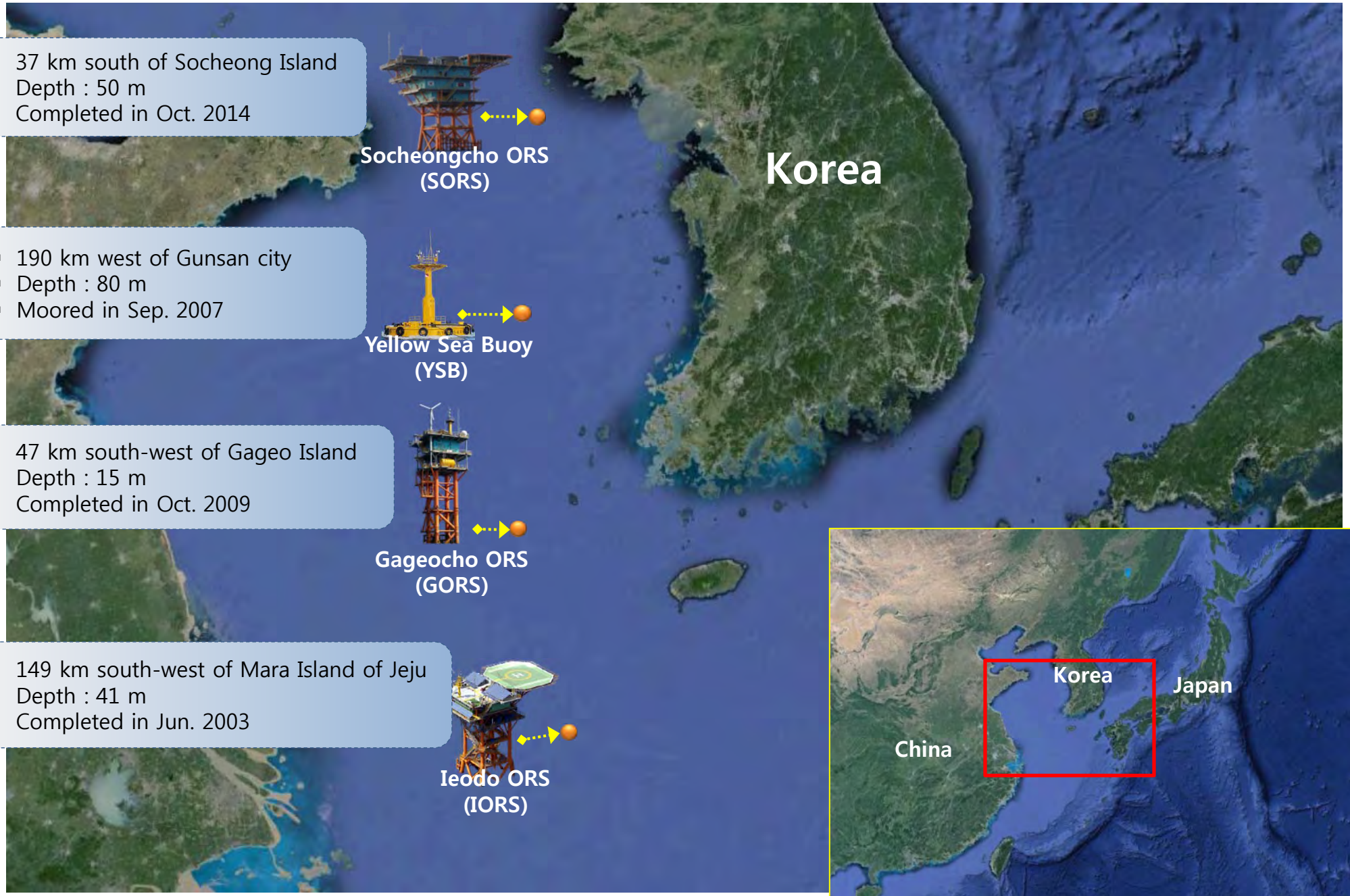
Features

- Large offshore structure with scientific facilities
  - **In-situ laboratory**
    - ➔Measuring physical parameters, preprocessing of samples
    - ➔in-situ experiment
  - **Expandability**
    - ➔install new sensors from interdisciplinary field
    - ➔replacement up-to-dated sensors, user modifying sensors,…
- Long life span
  - 50~100 years
  - **Long-term time series data**
- Stable against extreme weather conditions
  - 70 m/s gust wind speed, 21 m wave height
  - **Typhoons, tropical storms**, etc.

Main applications

- **Improving comprehensive ocean and weather observations**
- Providing core scientific information and data for the **global environmental change studies**
- Investigating **typhoon** dynamics
- Providing basic information for **fisheries** and **ocean prediction** as well as **regional ocean studies**
- Functioning as **a ground station of satellite ocean remote sensing** work
- Investigating movement and distribution of **atmospheric constituents** such as Asian dust (yellow dust)

Where are the Ocean Research Stations?



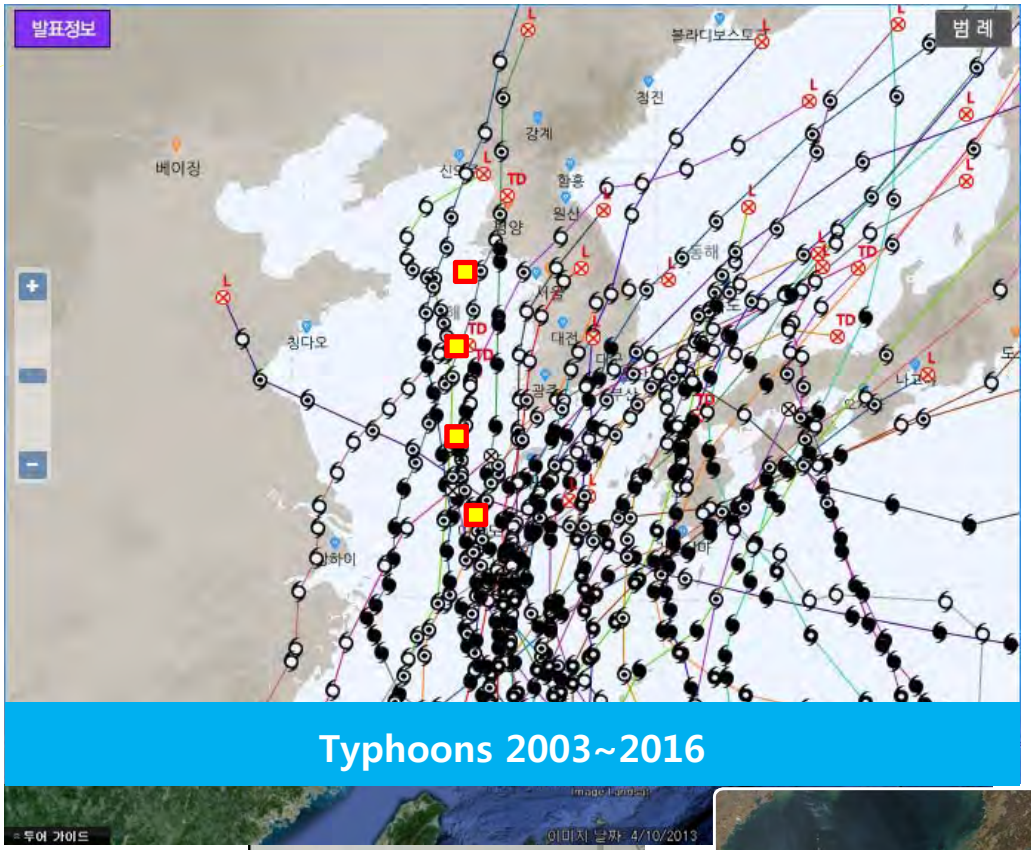
- 37 km south of Socheong Island
- Depth : 50 m
- Completed in Oct. 2014

- 190 km west of Gunsan city
- Depth : 80 m
- Moored in Sep. 2007

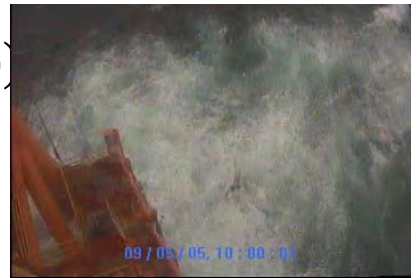
- 47 km south-west of Gageo Island
- Depth : 15 m
- Completed in Oct. 2009

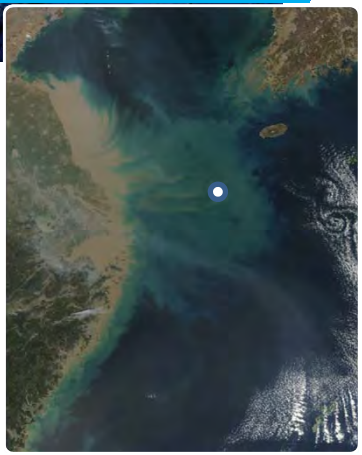
- 149 km south-west of Mara Island of Jeju
- Depth : 41 m
- Completed in Jun. 2003

Location

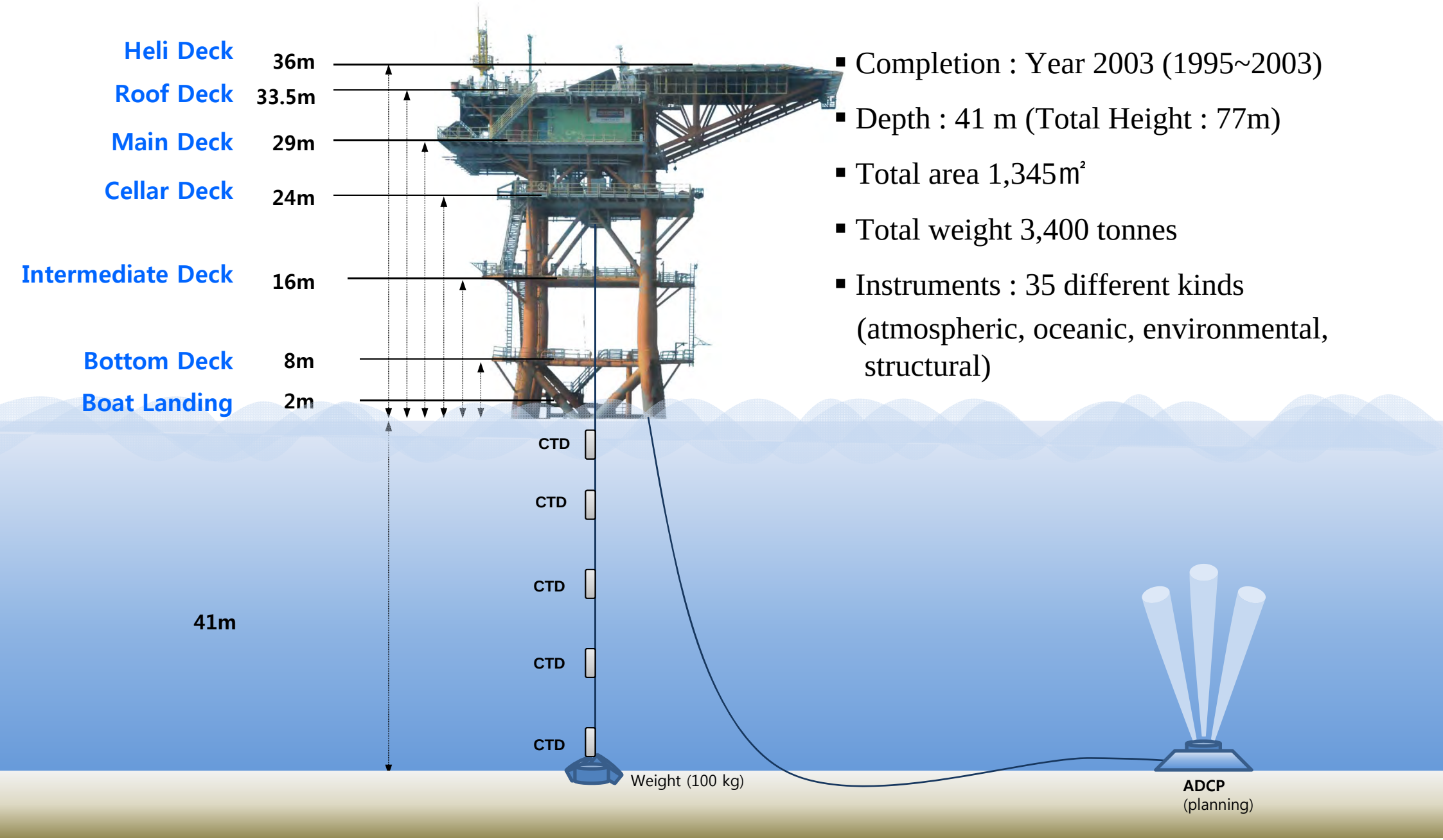


- Located **in the Yellow Sea & East China Sea**
- **On the track of major typhoons** affecting the Korean peninsula (about half of the typhoons had passed the IORS)
- Affected by fresh water (Changjiang diluted water (CDW))
- No Land around the IORS within 150 km



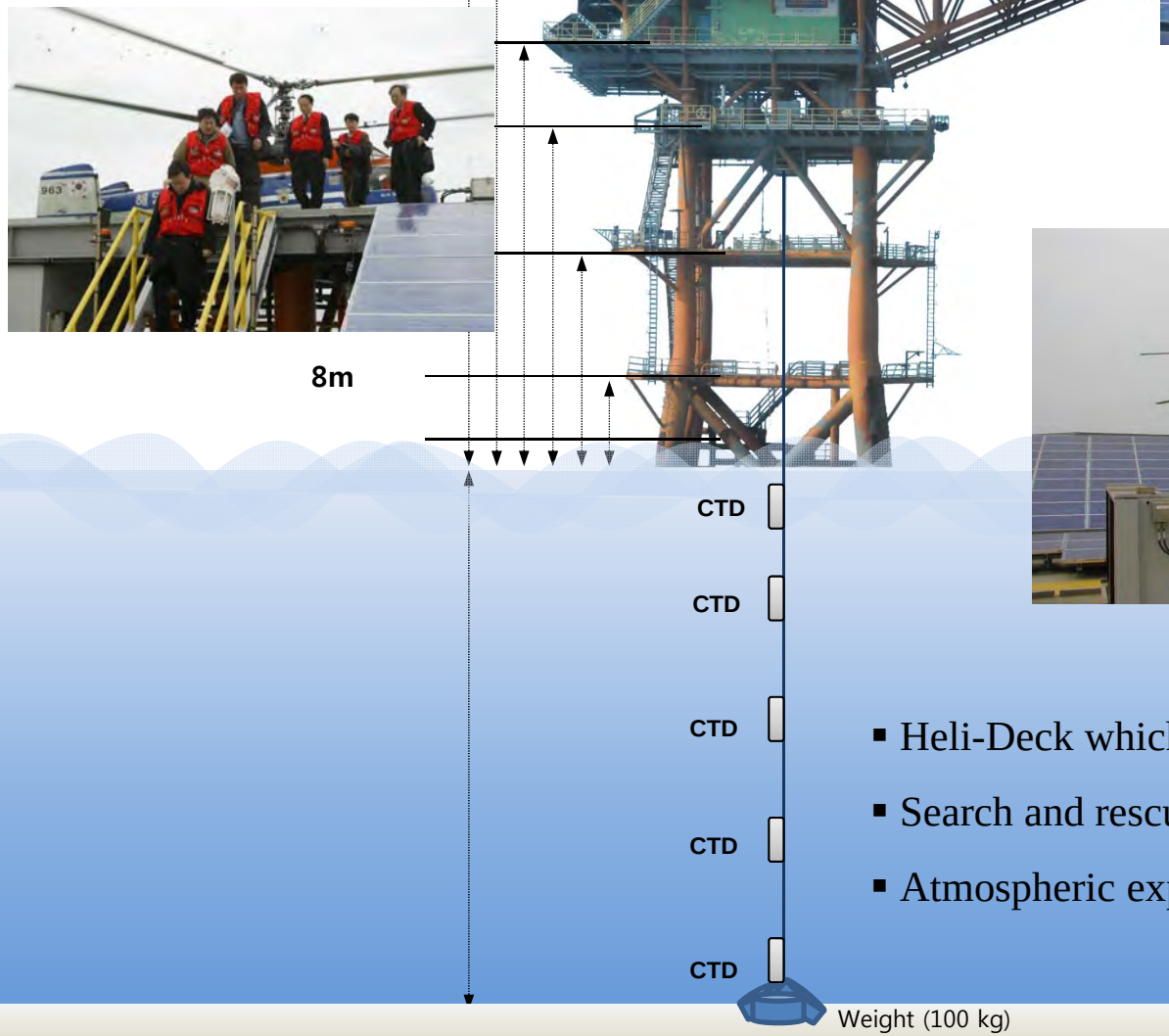


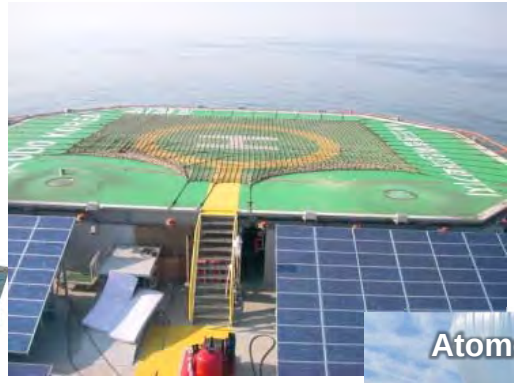
The IORS



- Completion : Year 2003 (1995~2003)
- Depth : 41 m (Total Height : 77m)
- Total area 1,345㎡
- Total weight 3,400 tonnes
- Instruments : 35 different kinds (atmospheric, oceanic, environmental, structural)

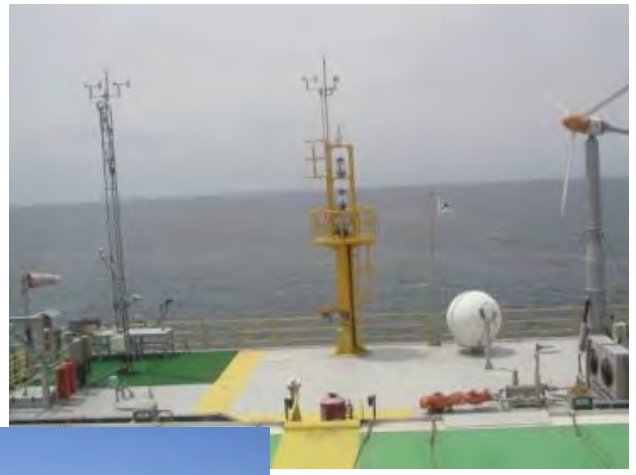
The IORS : Heli-Deck

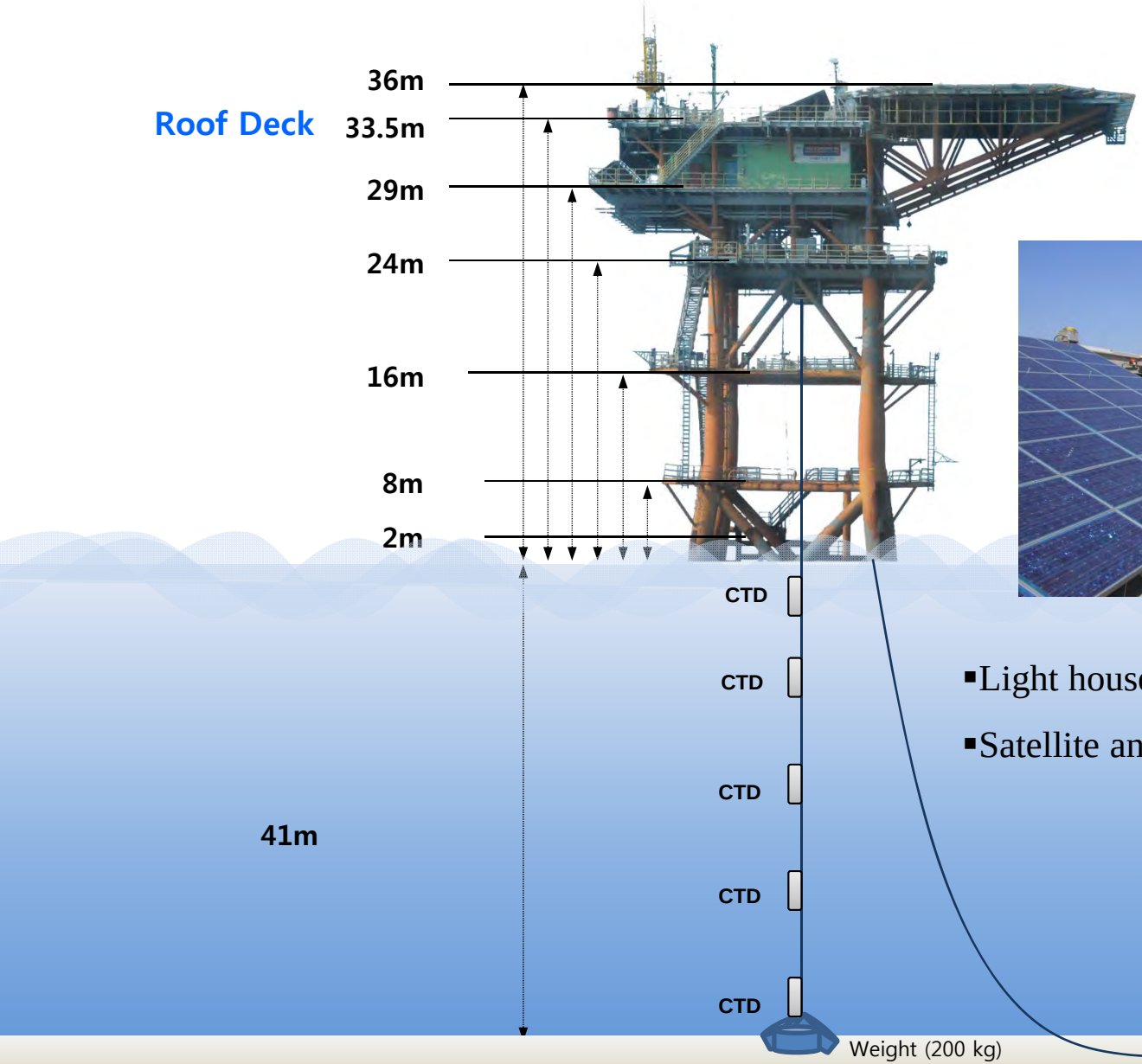




- Heli-Deck which can let researchers to get easy access to the IORS
- Search and rescue
- Atmospheric experiments

The IORS : Roof Deck





- Light house, MET. tower & table, wind turbine, and solar panels
- Satellite antenna for data transmission

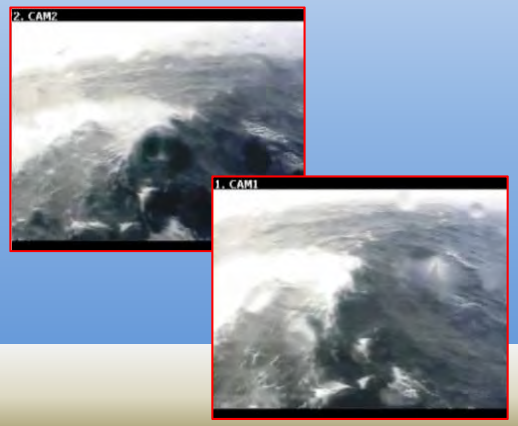
The IORS : Roof Deck

Roof Deck

36m
33.5m
29m
24m
16m
8m
2m

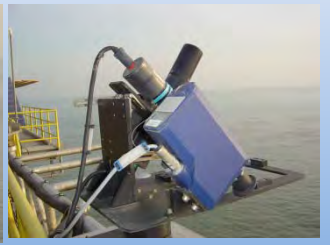
Wave Radar

Camera



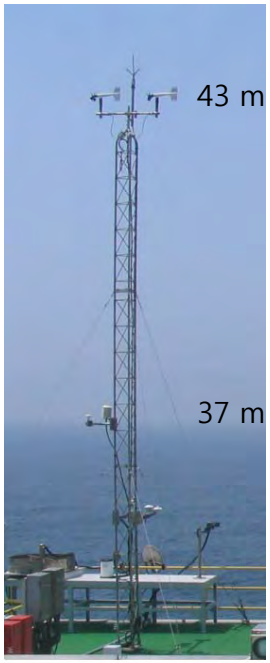
CTD
CTD
CTD
CTD
CTD

Weight (100 kg)



Spectroradio Meter
IR Thermometer

Wind Monitor
Thermometer & Hygrometer
Barometer
Pyranometer
Ultraviolet Radiometer
Sunshine Duration Meter
Rain Gauge
Ceilometer
Present Weather Detector
Radioactivity Sensor

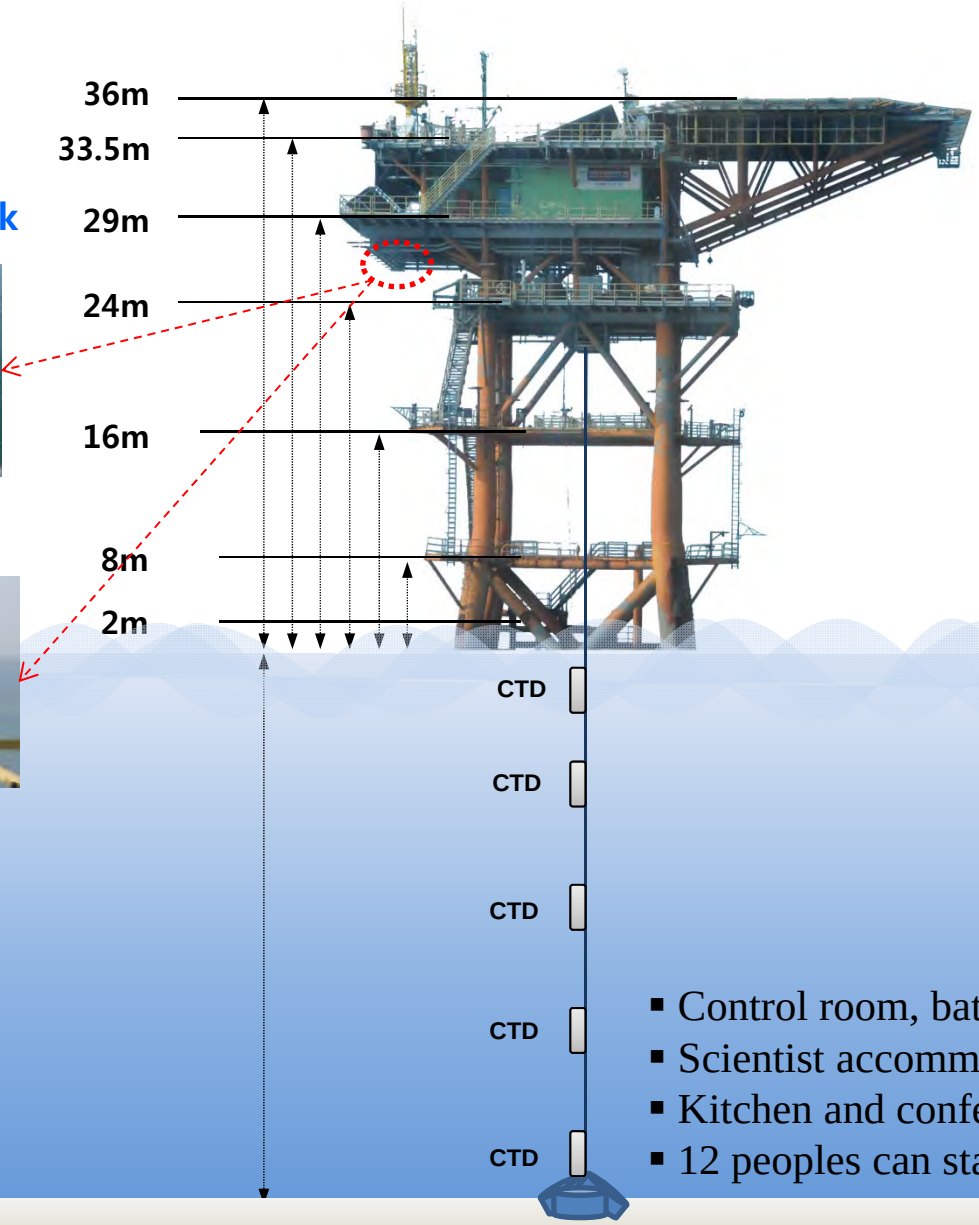


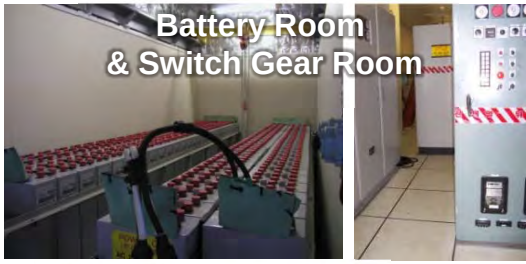
Meteorological Tower

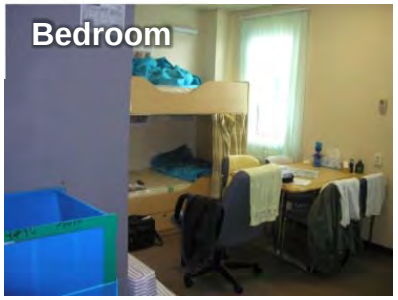
The IORS : Main Deck

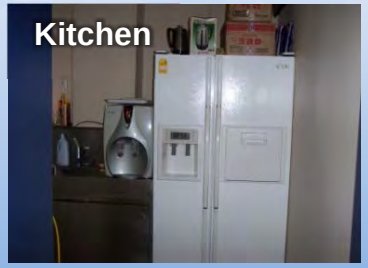
Sea Level Monitor

AERONET-OC



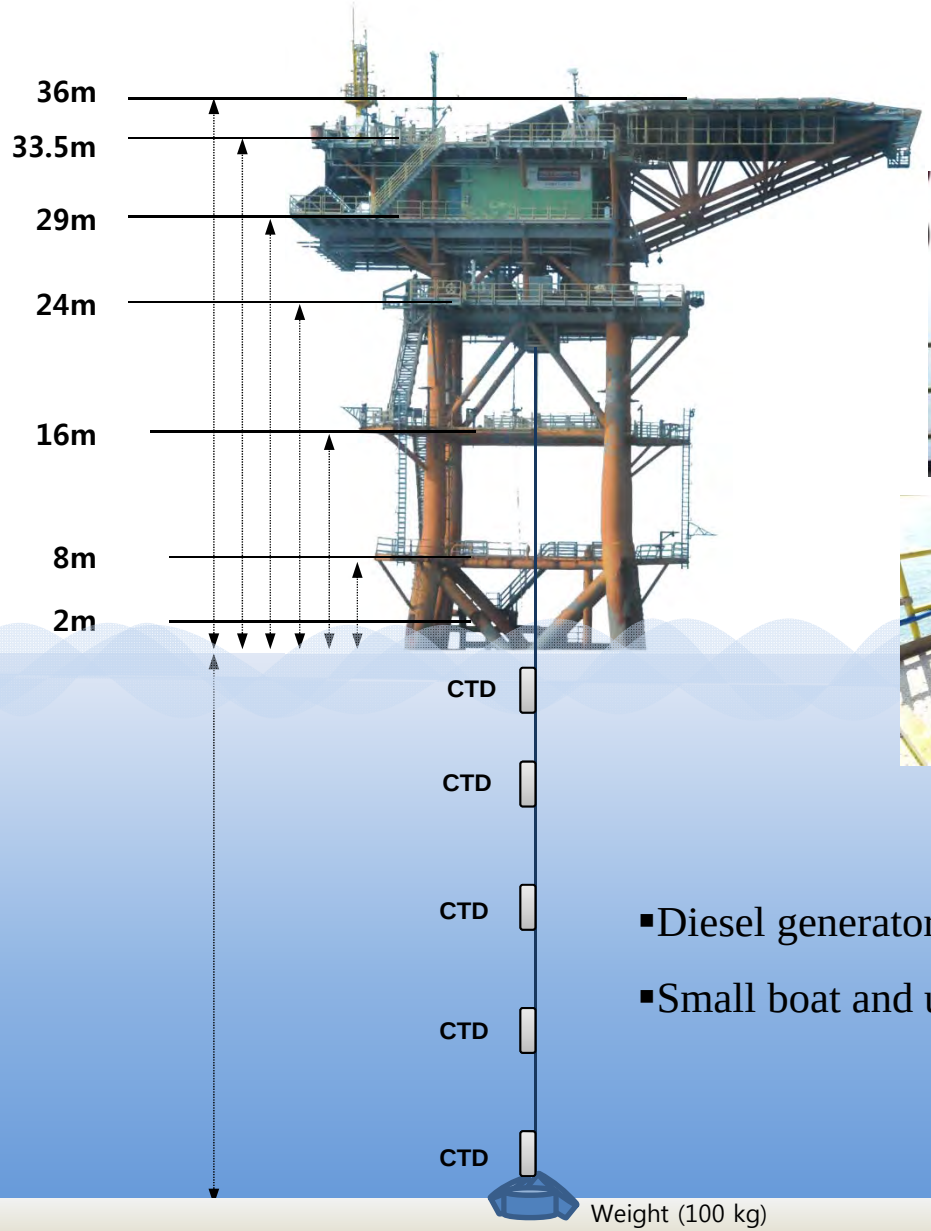


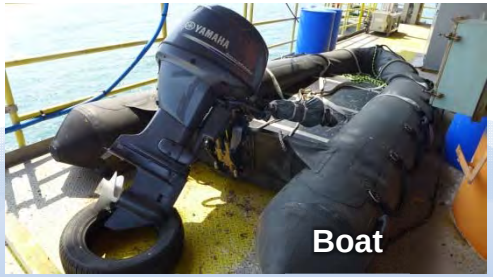




- Control room, battery & switch gear room
- Scientist accommodation and bath
- Kitchen and conference room
- 12 peoples can stay for more than 2-wks without additional supplies

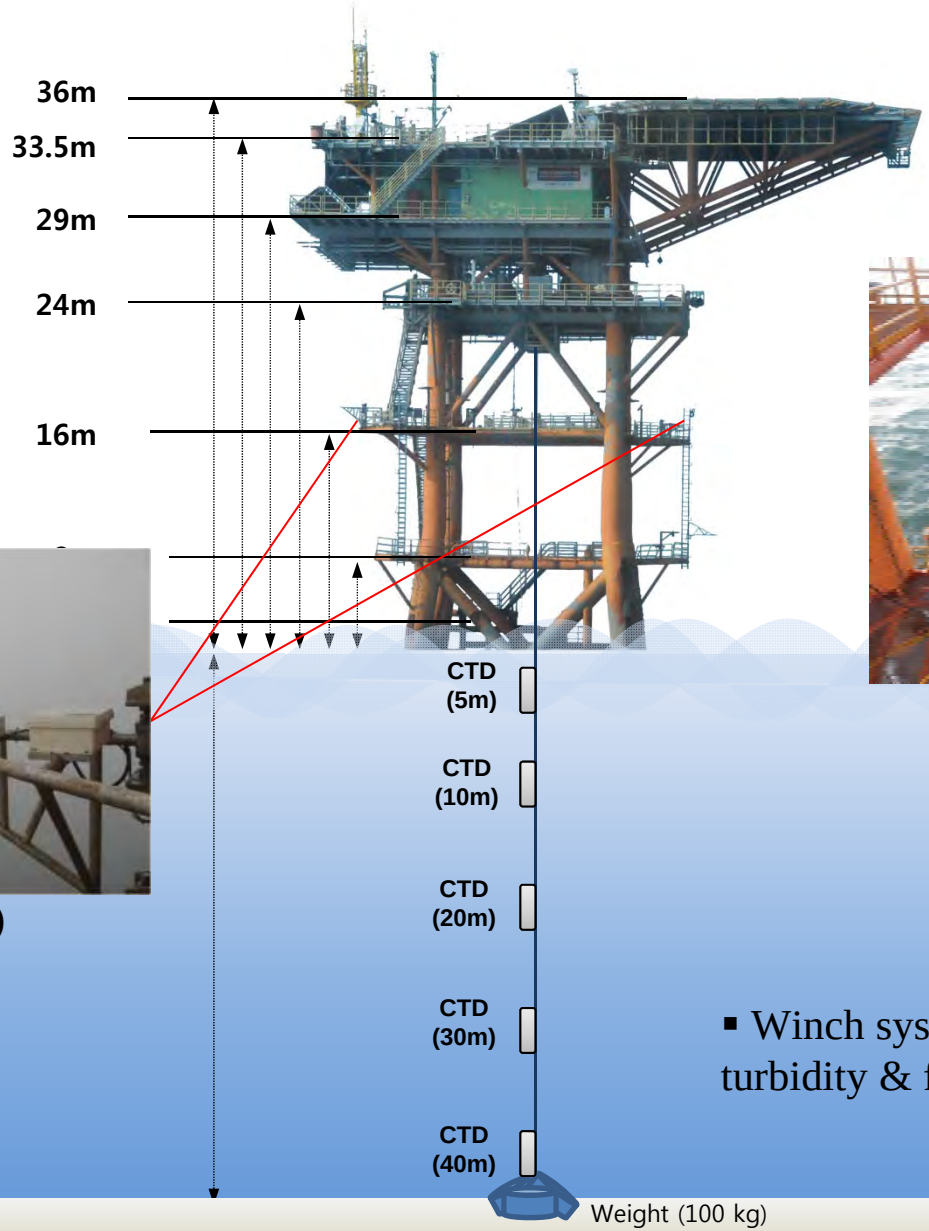
The IORS : Cellar Deck





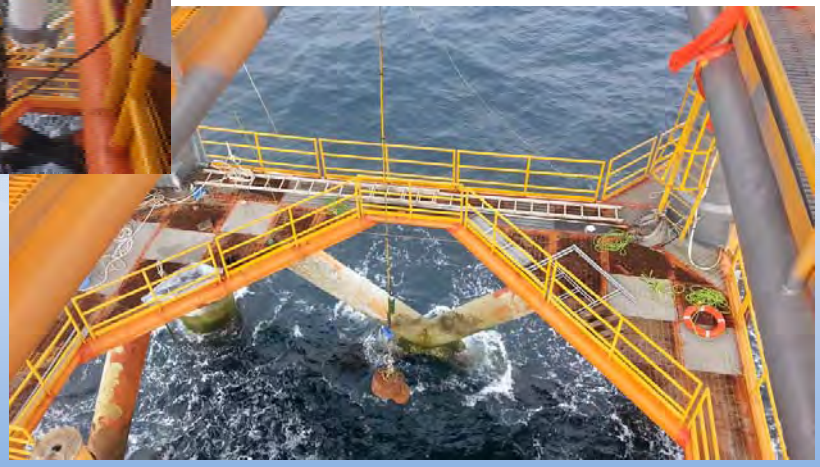
- Diesel generator, desalinator, purifier
- Small boat and underwater activity supporting equipments

The IORS : Intermediate Deck



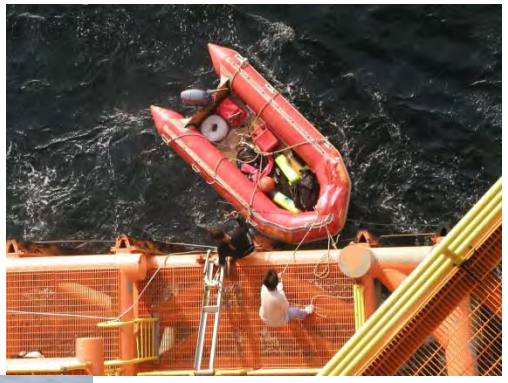
Intermediate Deck

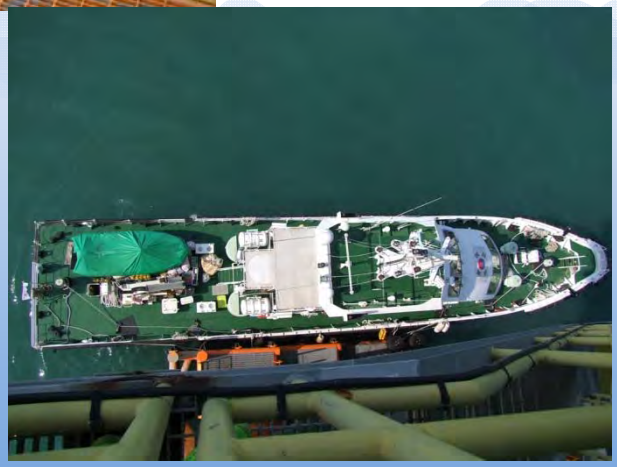
CSAT (flux)
NW & SE

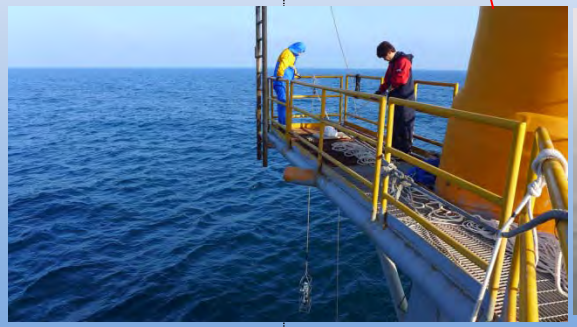


- Winch system for underwater monitoring sensors (CTD, turbidity & fluorescence sensors,…)

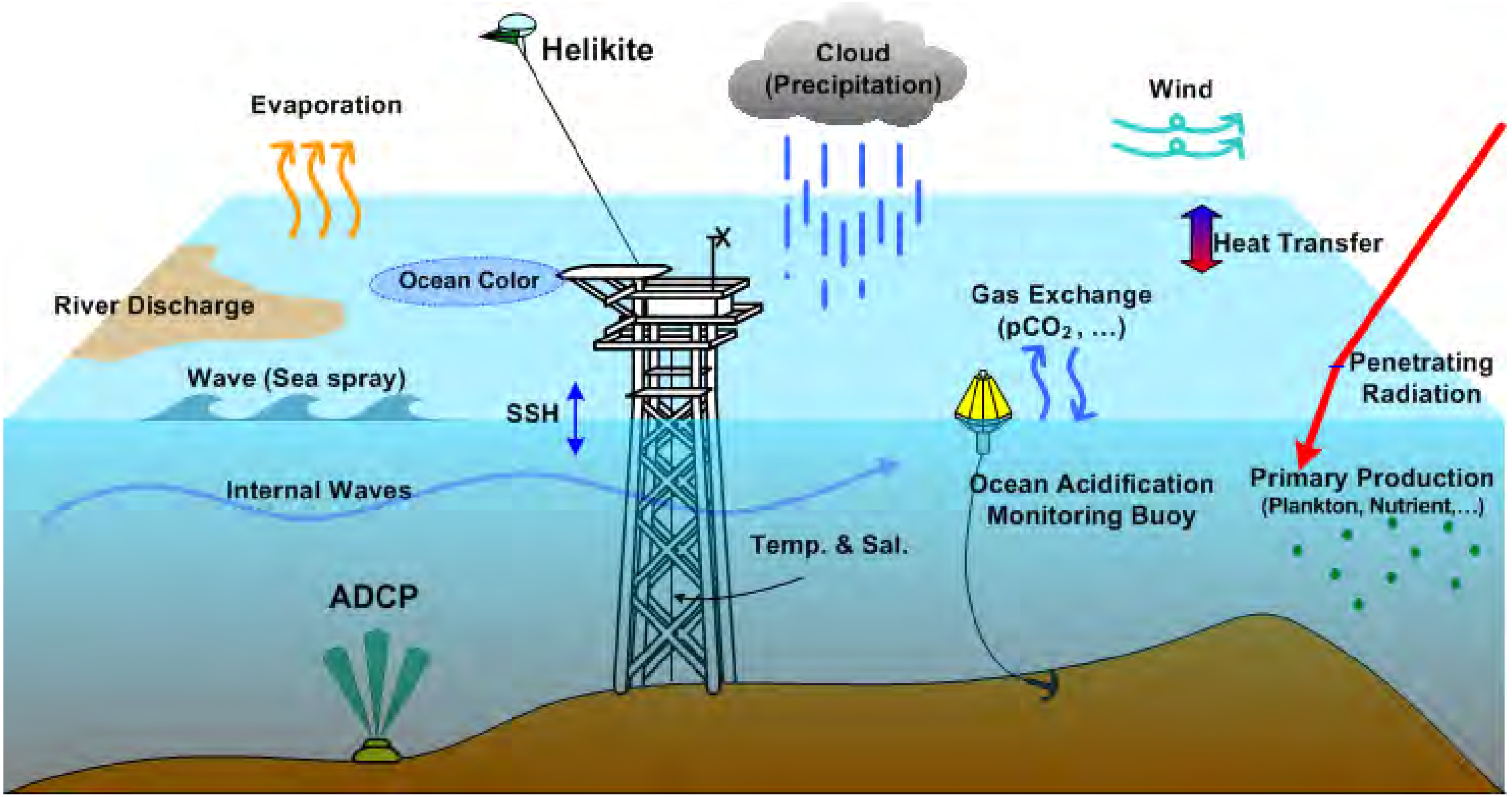
The IORS : Bottom Deck & boat landing







Science themes related to the IORS

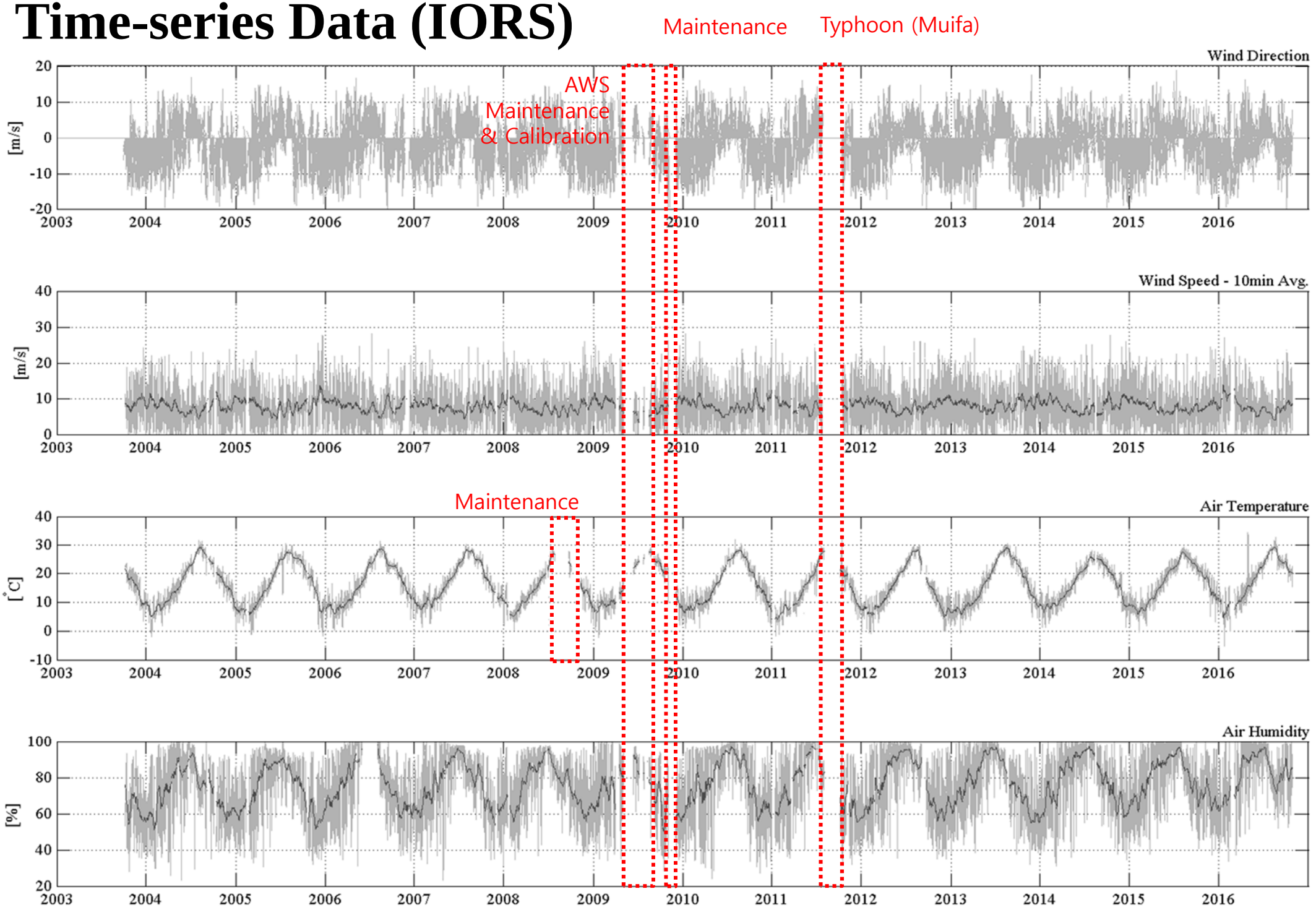


Sensors

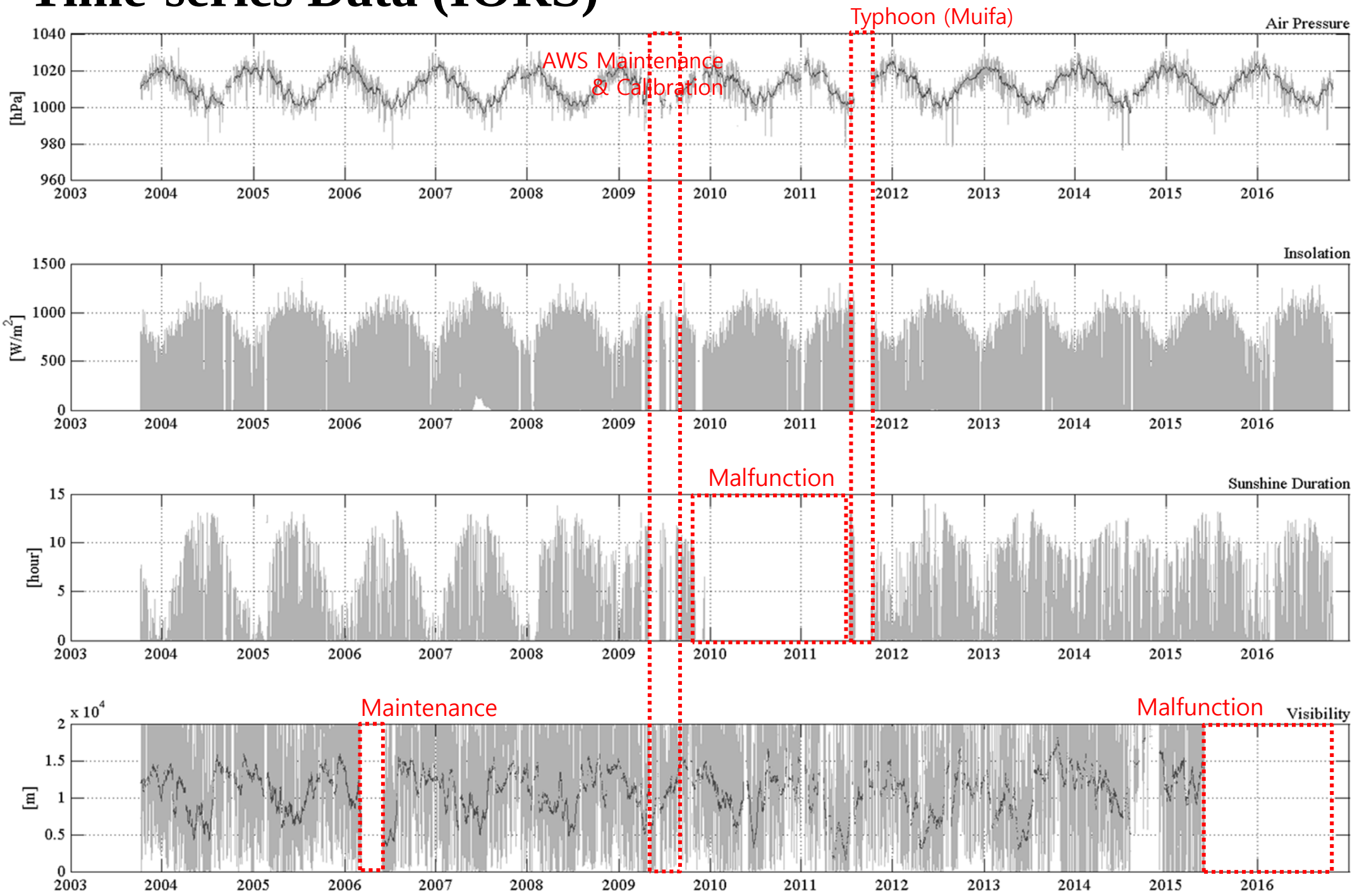
	Instruments / Models	Parameters
Meteoro-Logical	Wind Monitor/ 01506	Wind Speed & Direction,
	Ultrasonic Wind / VENTUS	Wind Speed & Direction,
	Anenometer / HMP155	Temp, Humidity
	Barometer / PTB210B	Atmospheric pressure
	Insolation Sensor / CMP21	Insolation
	Sunshine Sensor / CSD3	Duration of sunshine
	Ultraviolet solar radiation Sensor / CUV5	Ultraviolet rays
	Rainfall Sensor / ERG(H)	Rainfall
	Visibility meter / PWD-22	Visibility
	Ceilometer / CL31	Cloud
	Multi weather sensor / WS600	Wind, Temp, Humidity, Atmospheric pressure
	3dimension wind / CSAT3	3dimension wind
Atmospheric Environment	Ultrafine particles sensor / FH62C14	PM2.5 monitoring
	O3 analyzer / 49i	O3 monitoring
	Gas Analyzer / EC-150	CO2, H2O
	Environmental radiation / EFRD 3500	Environmental radiation
	Black carbon sensor / 5012	BC monitoring
	CO, CO2, H2O, CH4 monitoring / G2401	CO, CO2, H2O, CH4 monitoring
Structure Monitoring	Accelerometer / Accelerometer	Structure acceleration
	Clinometer / Clinometer	Structure gradient
	GNSS / GR25	Structure displacement

	Instruments / Models	Parameters
Oceanographic	WAVE RADAR /SM-050	Wave, Period, Wave direction, Spectrum
	Range Finder / SM-140	Sea level height, Wave, Period
	Hyperspectral Radiometer / RAMSES	Intensity of radiation
	CTD / RBR Concerto CTD	Temperature & Salinity
	ADCP / WHS300	Stratification velocity
	Sea Prism / Spectro-Photometer	Ocean color
	Underwater sound Sensor	Underwater sound monitoring
	Fluorometer / ECO FLNTU	Chlorophyll
	UV fluorometer / MicroFlu-CDOM	Colored dissolved organic matter
	Profiling sensors / 19plus&Auxiliary	Water Temp, Salinity, PAR, Fluorescence, DO
	Surface CT sensor / SBE37SM & SBE39	Surface Water Temp&Salinity
	UV NITRATE Sensor/ SUNA V2	Nitrate
	Fluorometer / In situ FIRe	Fluorescence
	IR Sensor / KT19.85 II	Surface Water Temp(IR)
	DO Sensor / 43	Dissolved oxygen
	Fast Ocean system / FRRf	Fluorescence Profile

Time-series Data (IORS)



Time-series Data (IORS)



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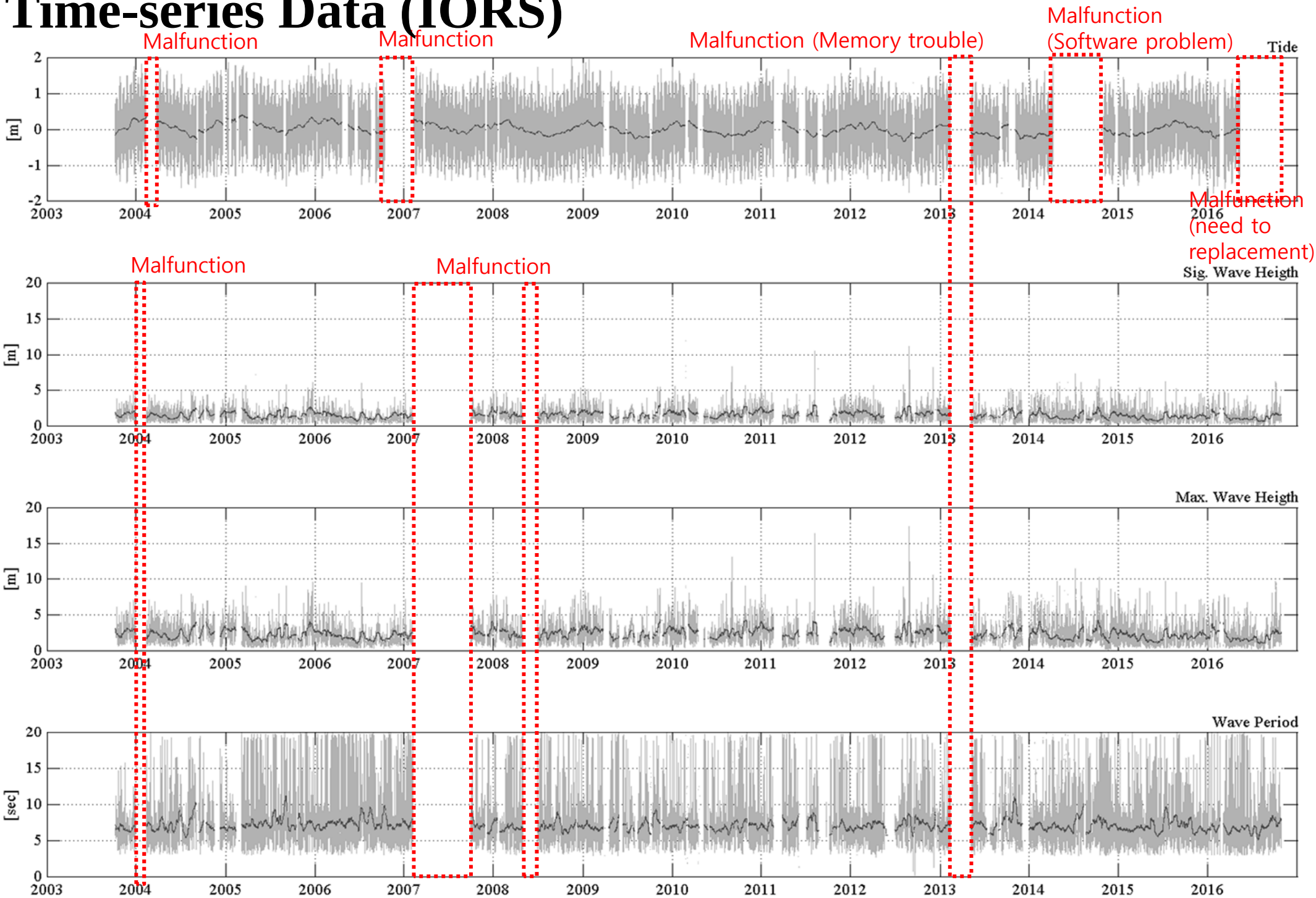
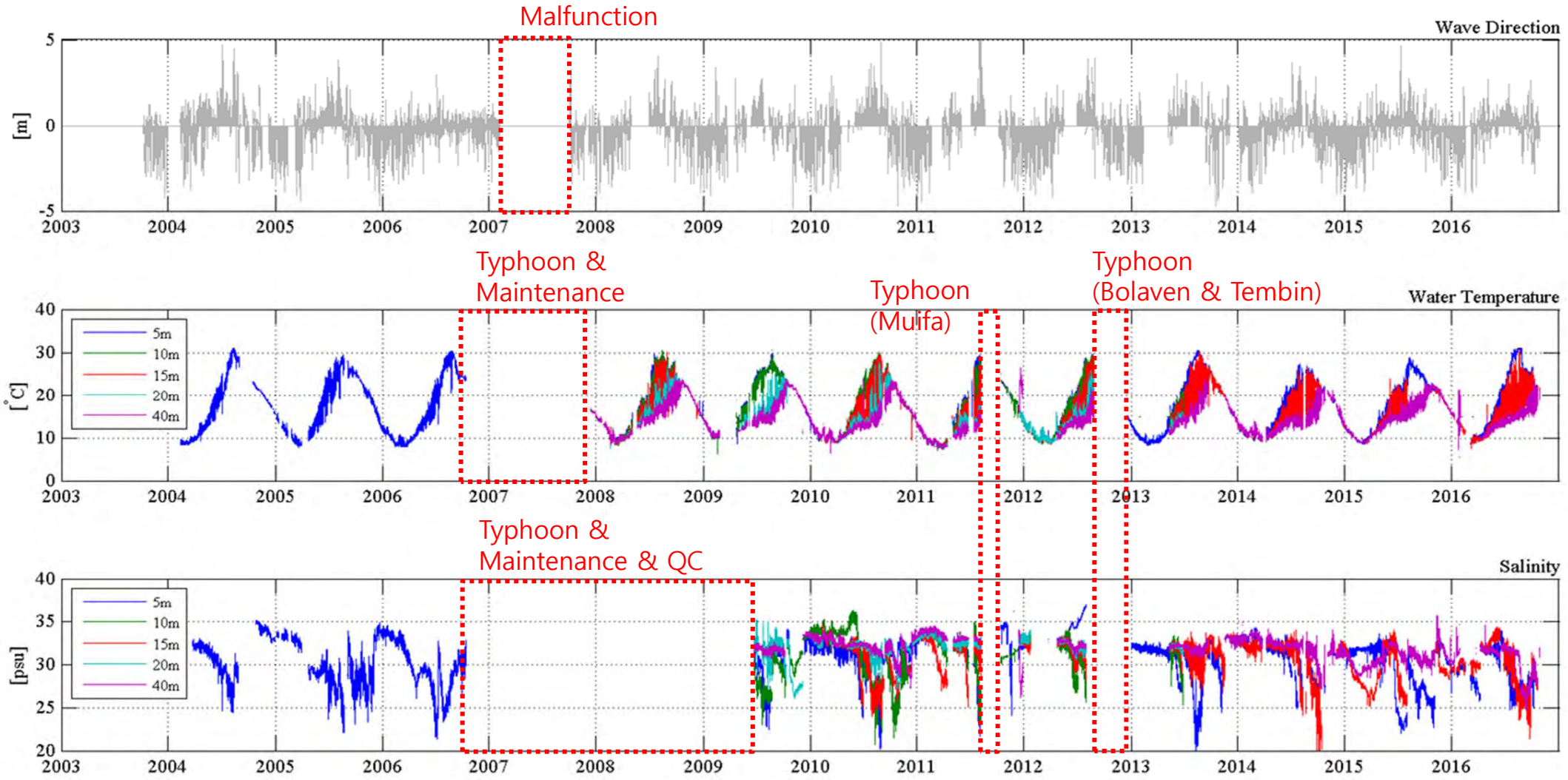
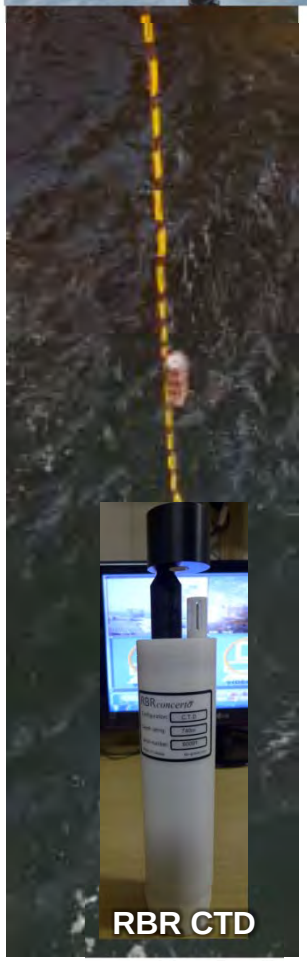
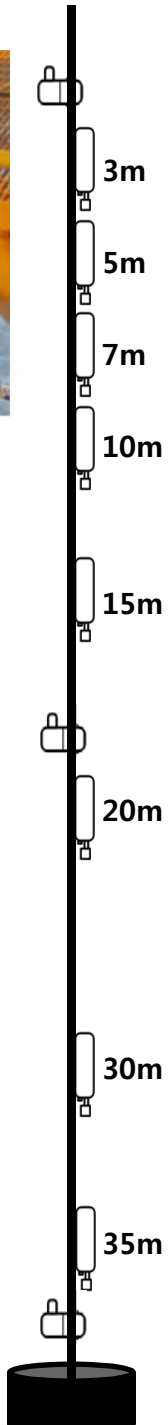


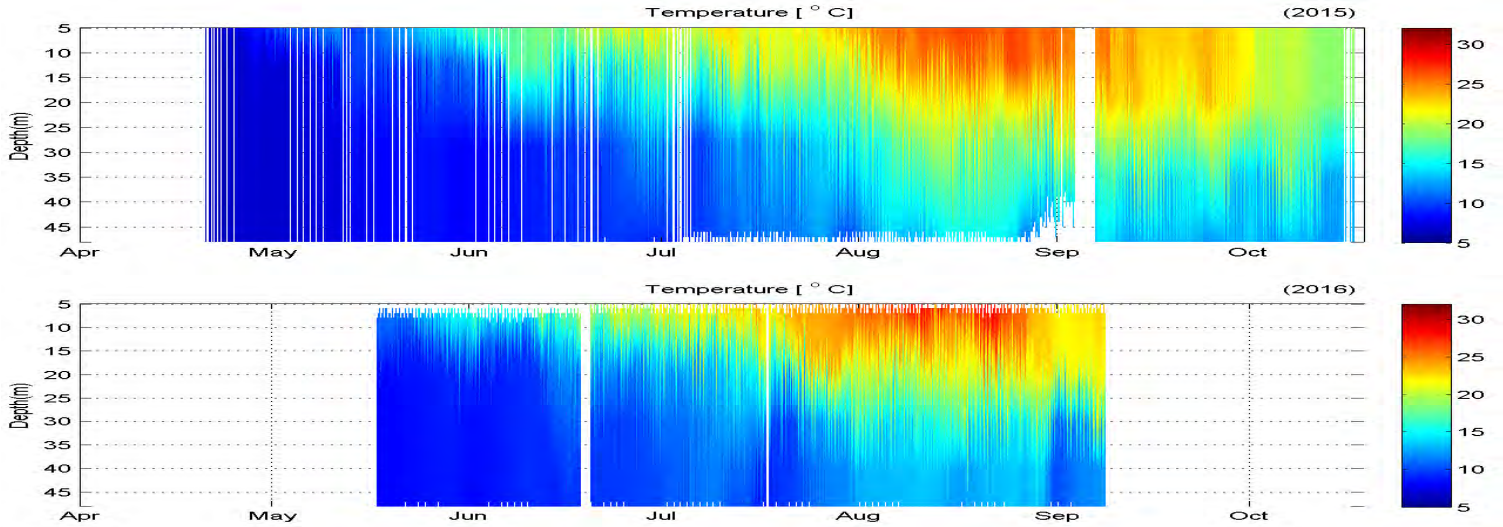
Time-series Data (IORS)



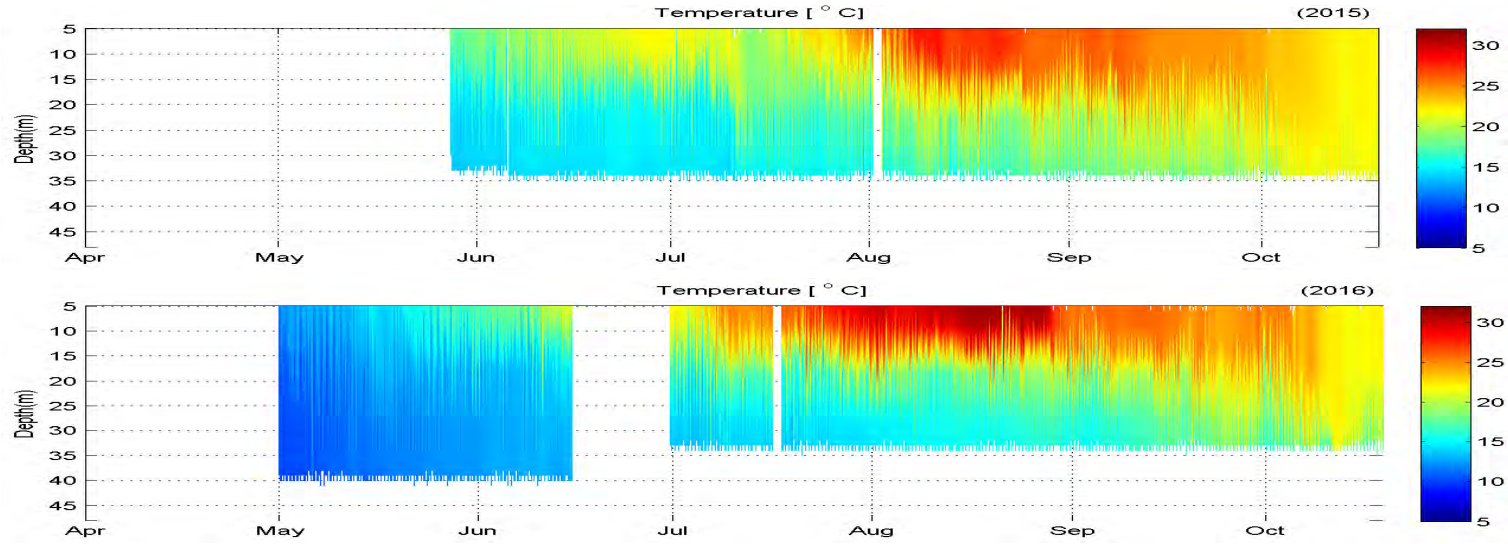
Data (CTD mooring ➔ Temperature profile, 2015~2016)







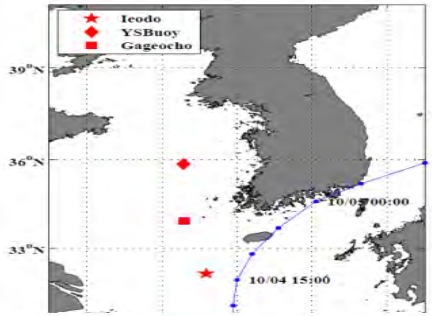
SORS (37.5ºN)

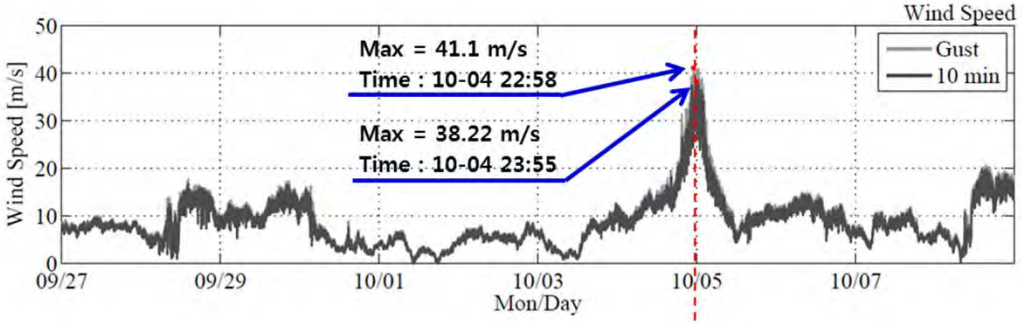


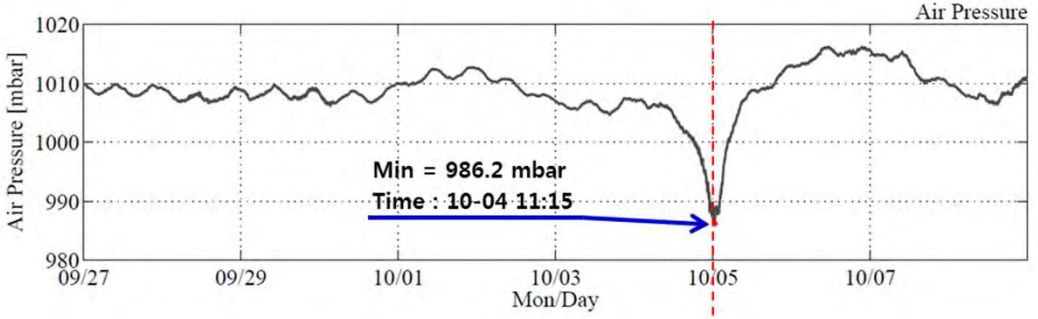
IORS (32ºN)

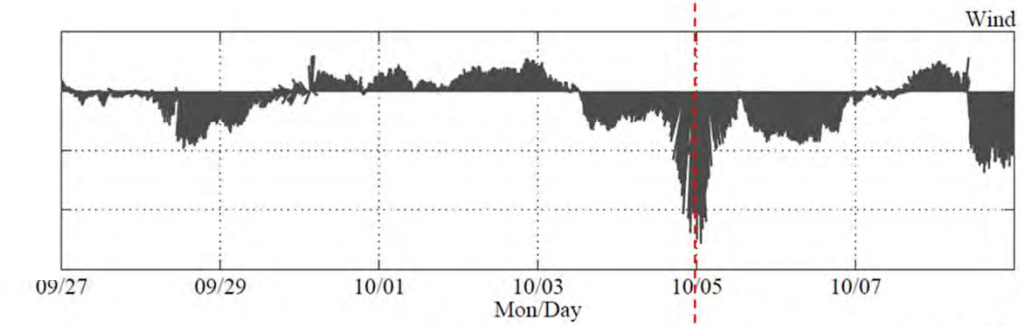
Typhoon Monitoring

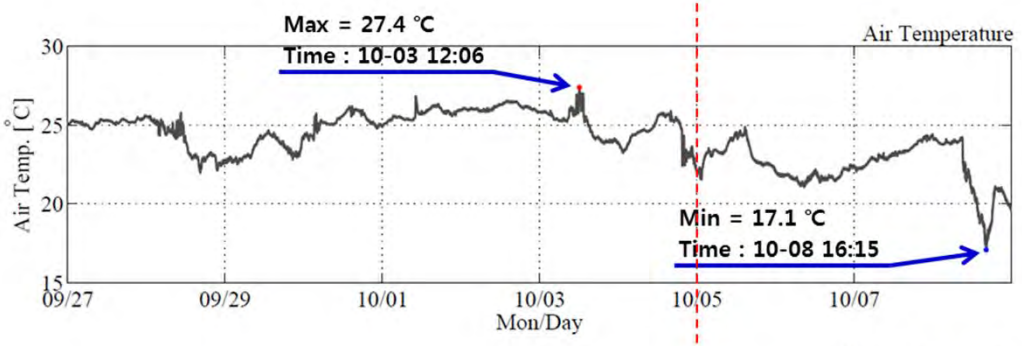
Chaba (1618), 5,Oct. 2016

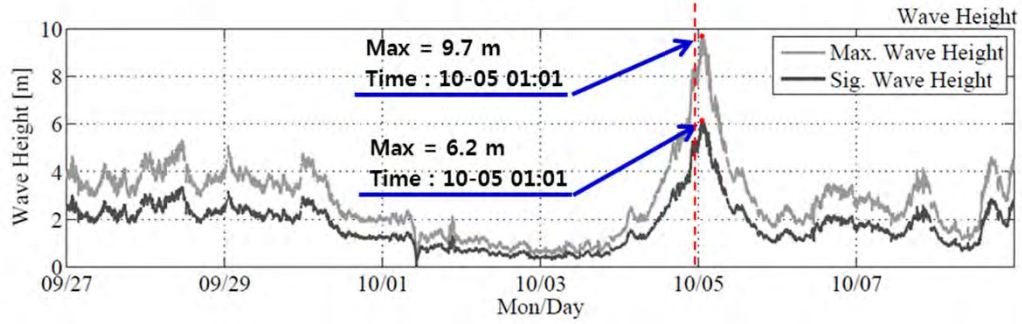


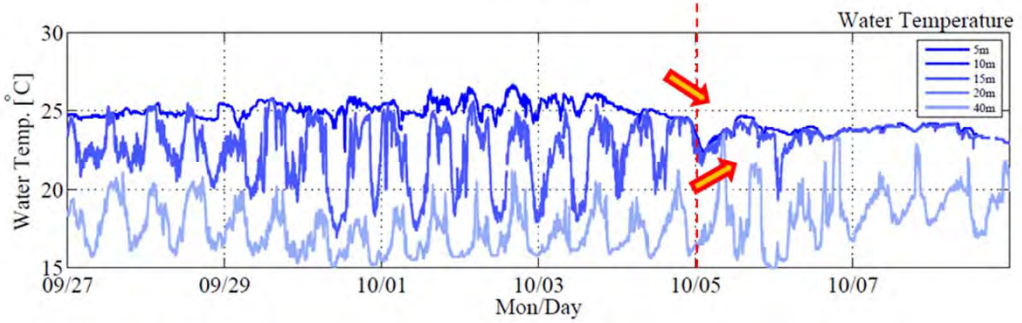






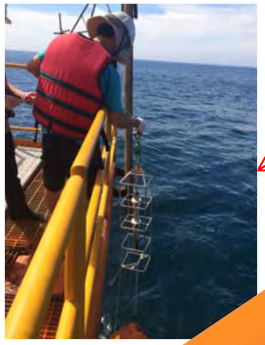


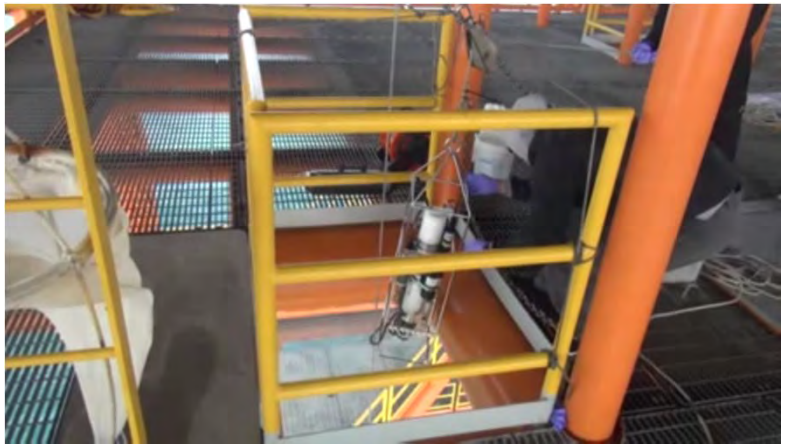




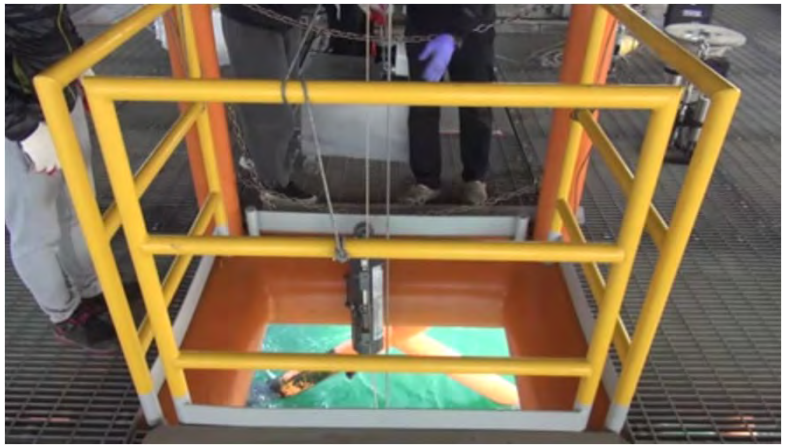
ORS in-situ Measurement and Maintenance

How often? ➔ +1 times per one month
How long? ➔ for 5~7 days

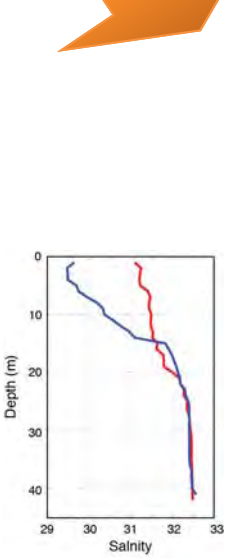


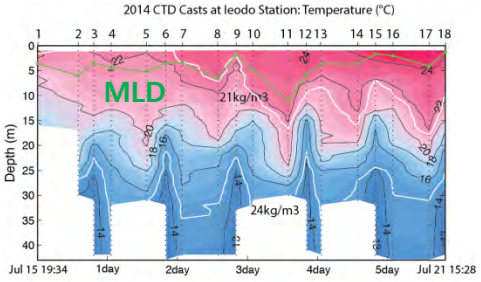


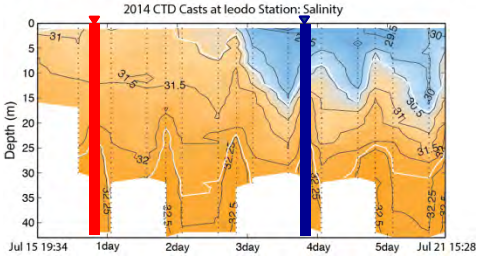
CTD Profiling
(+2 times a day)



Water Sampling
(+2 times a day)



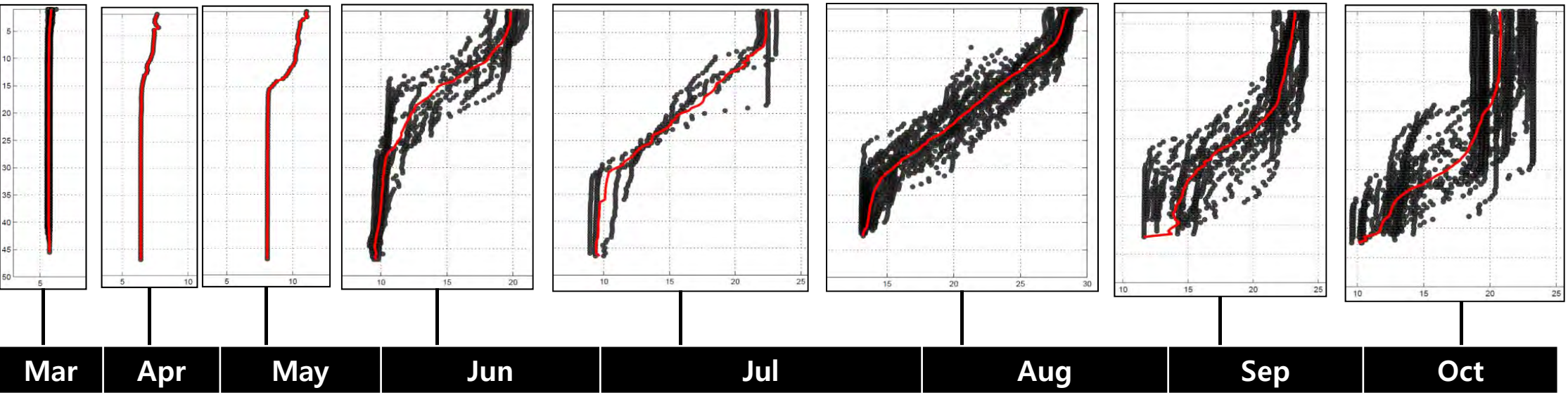


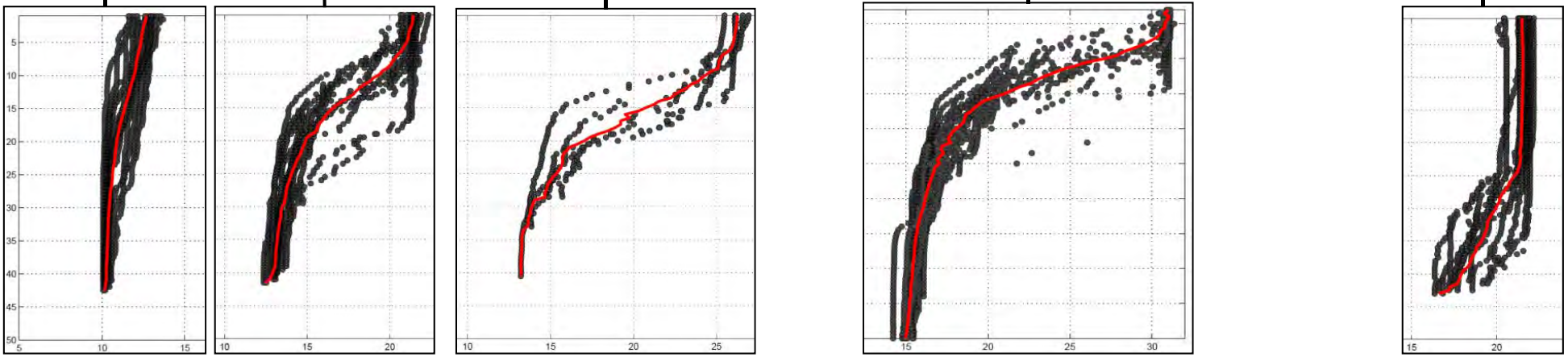


Plankton Sampling
(+2 times a day)

Data (Sea Temperature Profile, 2016)

Socheongcho ORS

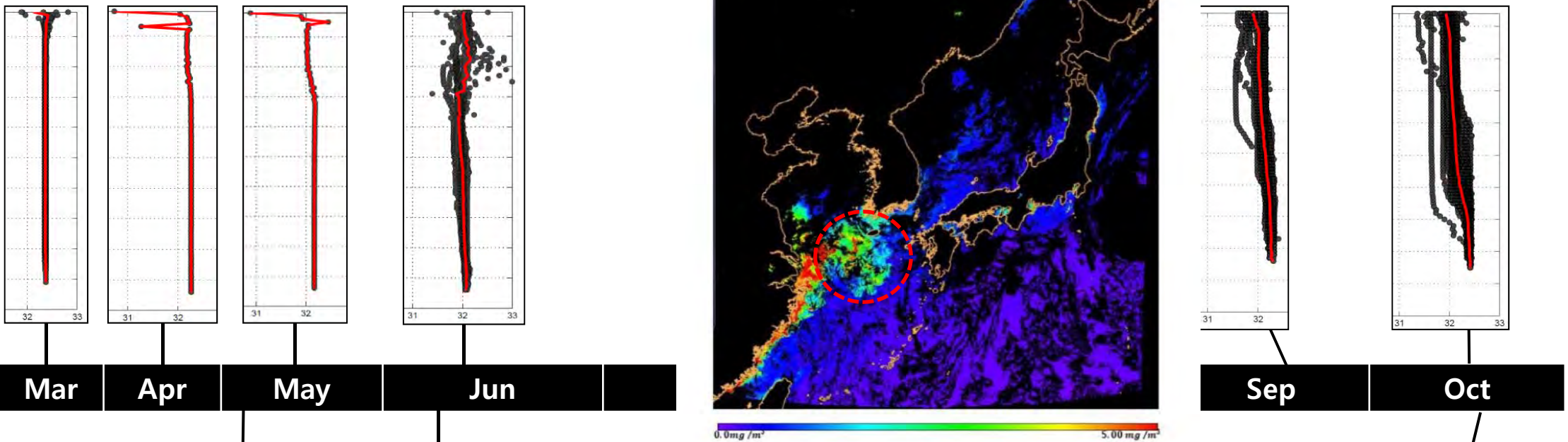


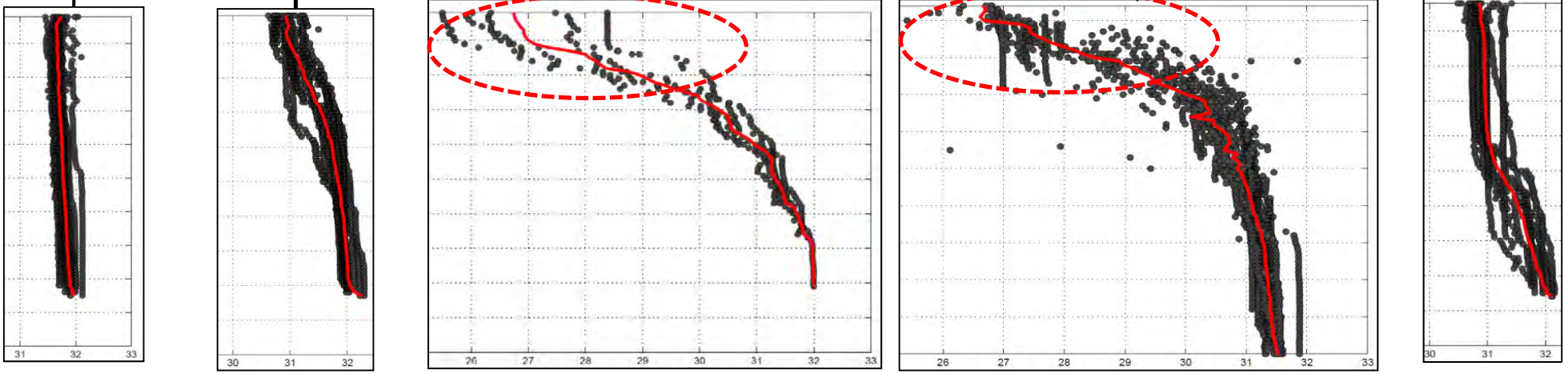


Ieodo ORS

Data (Salinity, 2016)

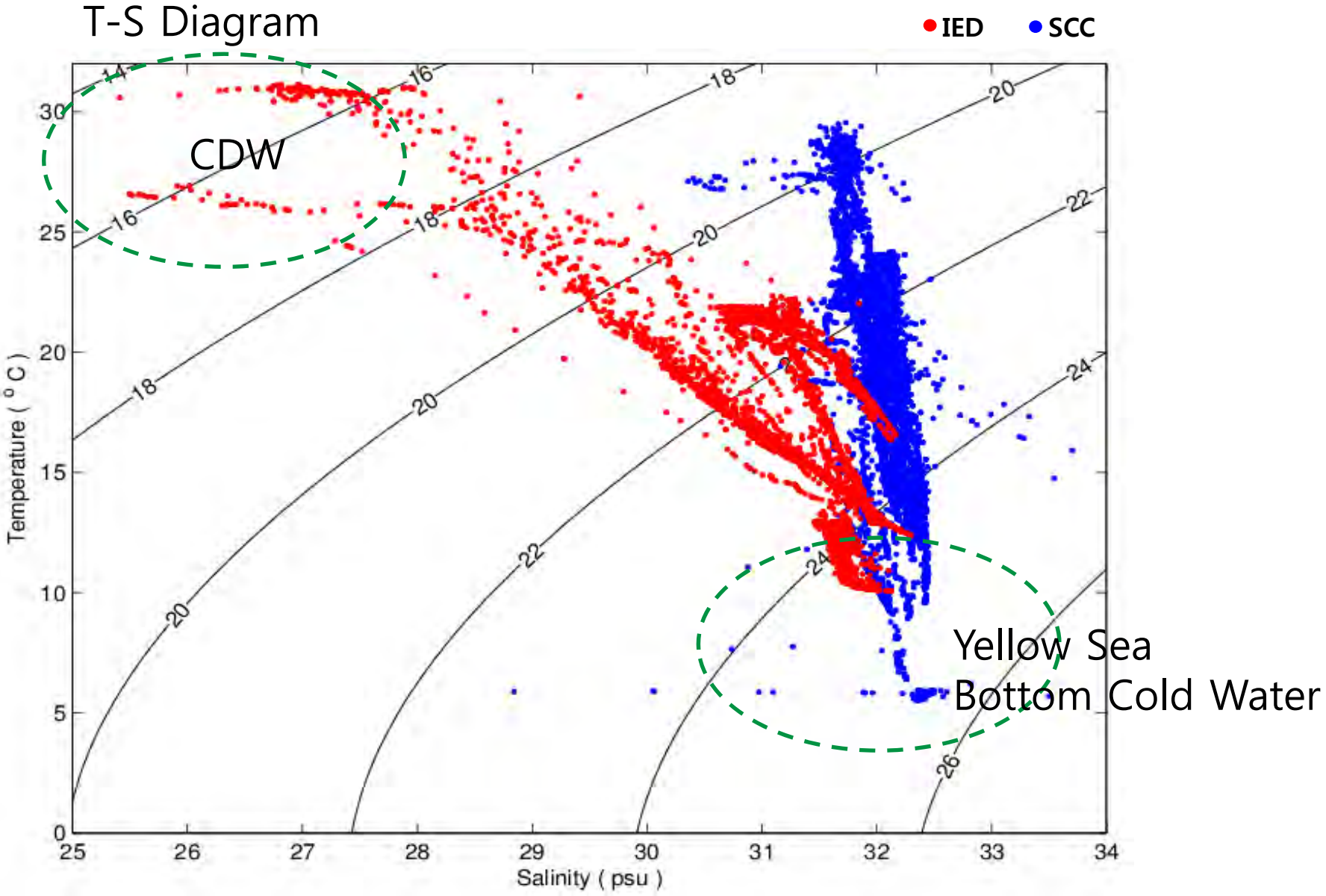
Socheongcho ORS



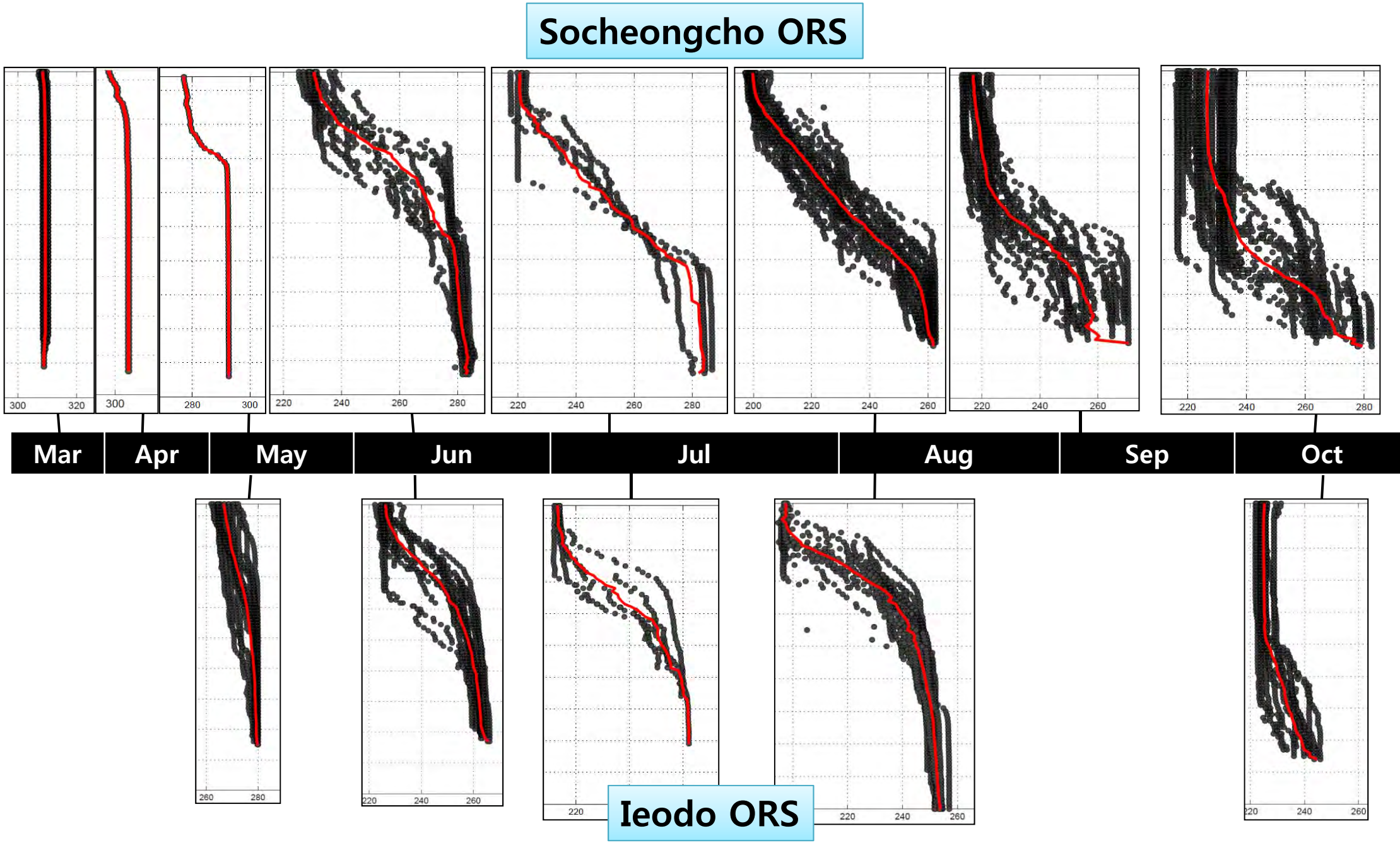


Ieodo ORS

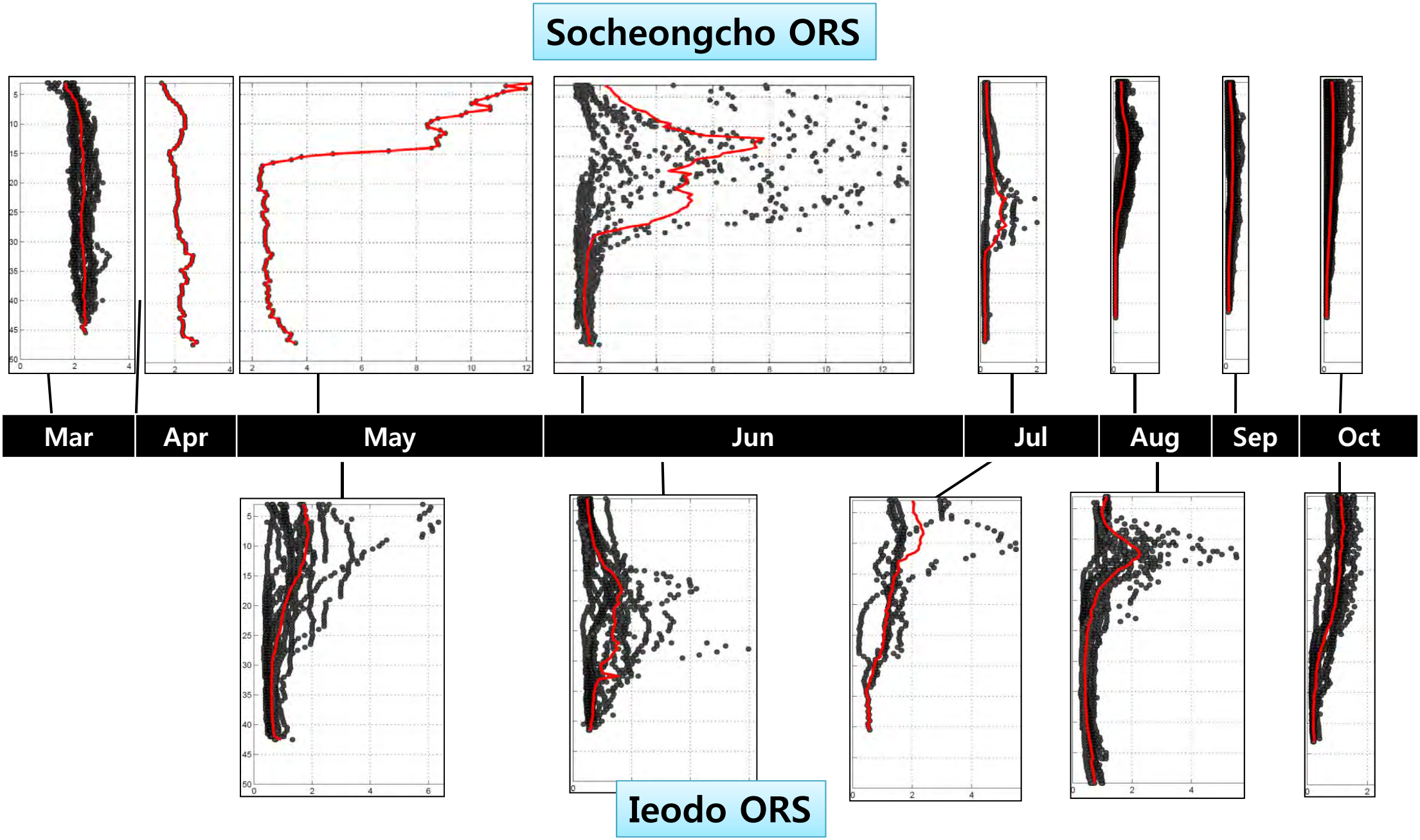
Data (Temperature & Salinity, 2016)



Data (Dissolved Oxygen [umol/kg], 2016)

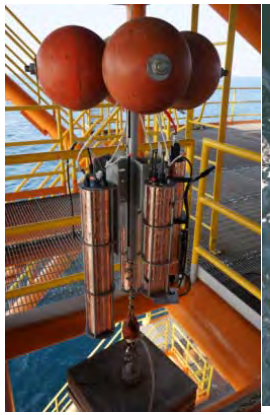


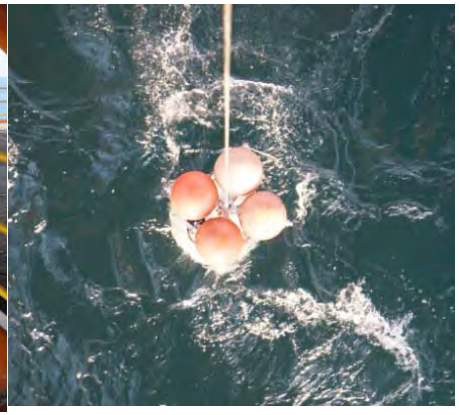
Data (Fluorescence [mg/m^3], 2016)

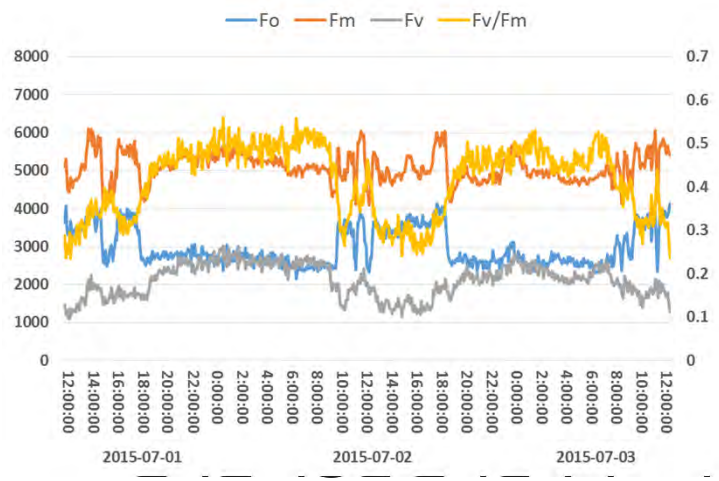


Data (Primary Production)

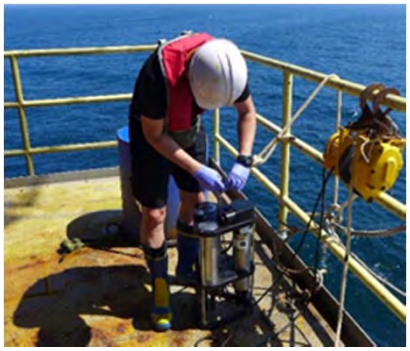
In-Situ FIRe ➔ fluorescence at sea surface

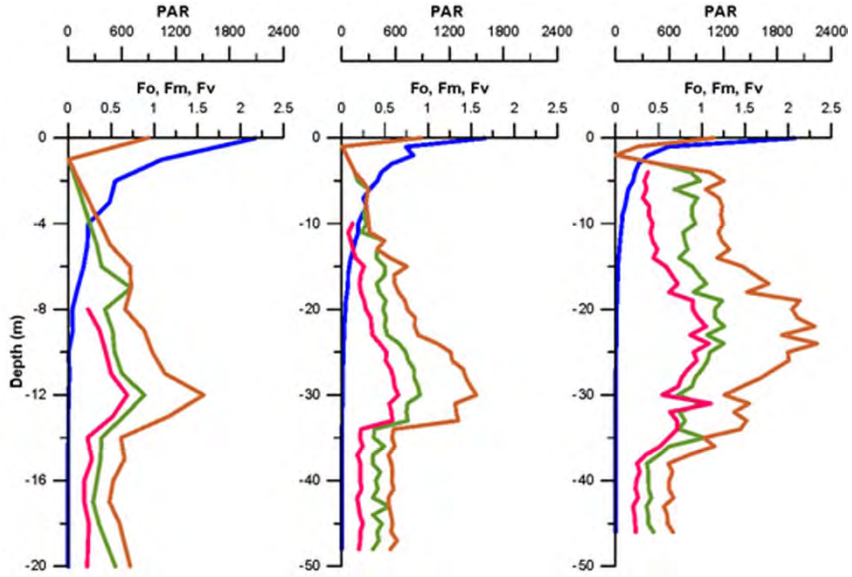




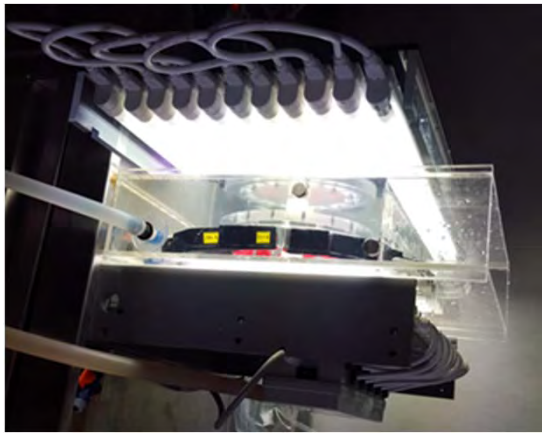


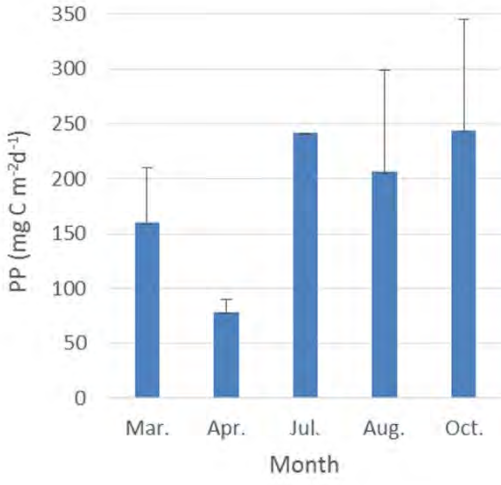
FRRF➔ fluorescence profile with depth



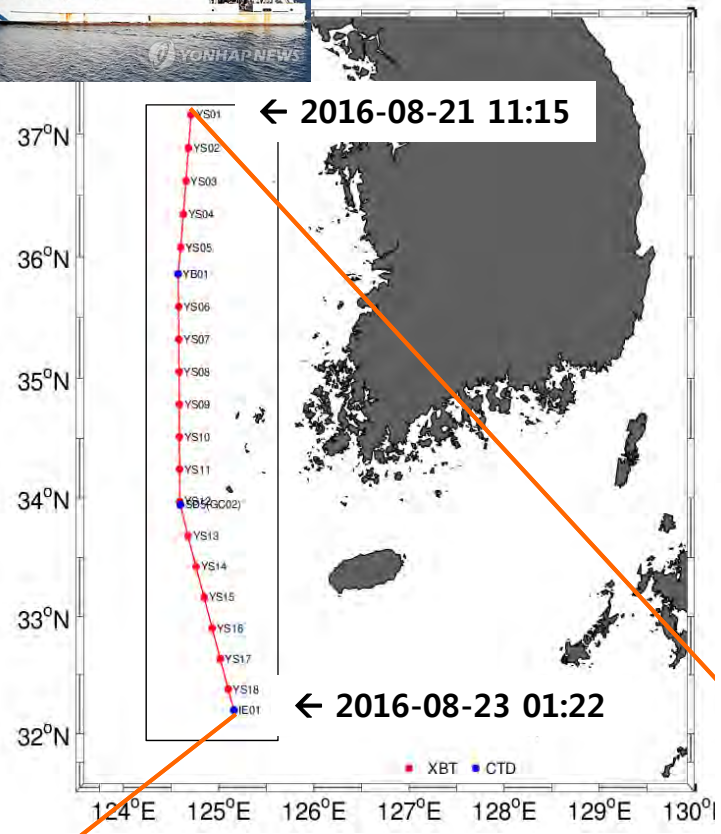


In-situ Cultivation: (using C14 isotope method)

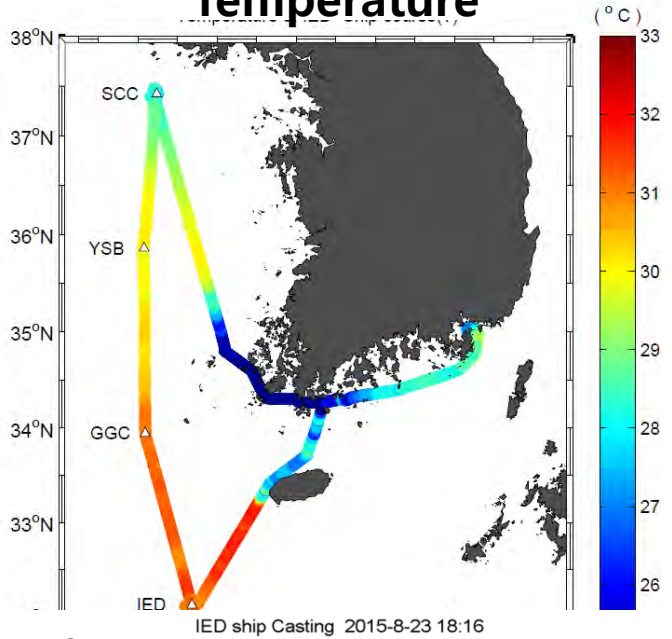


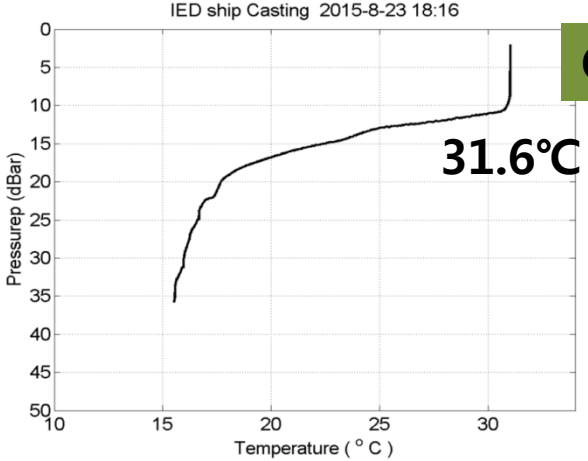


Observation (R.V. Eardo)



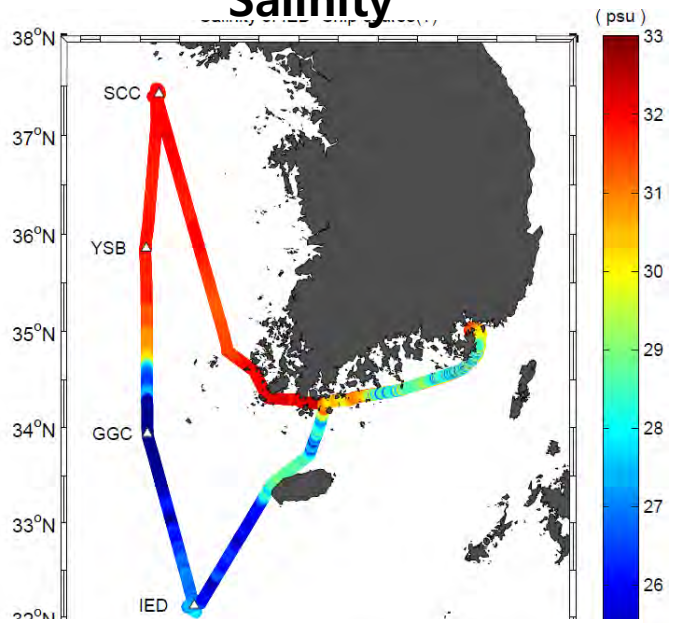
Temperature

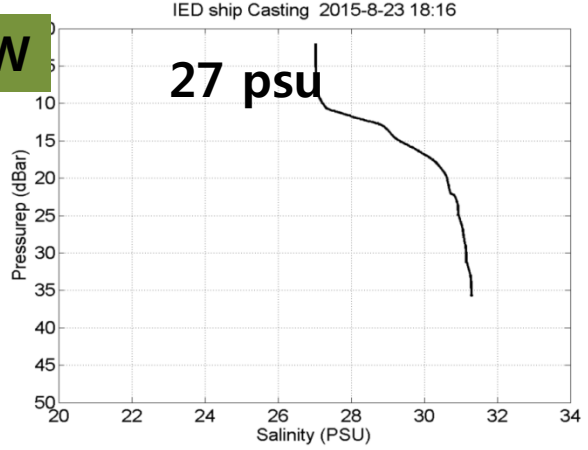




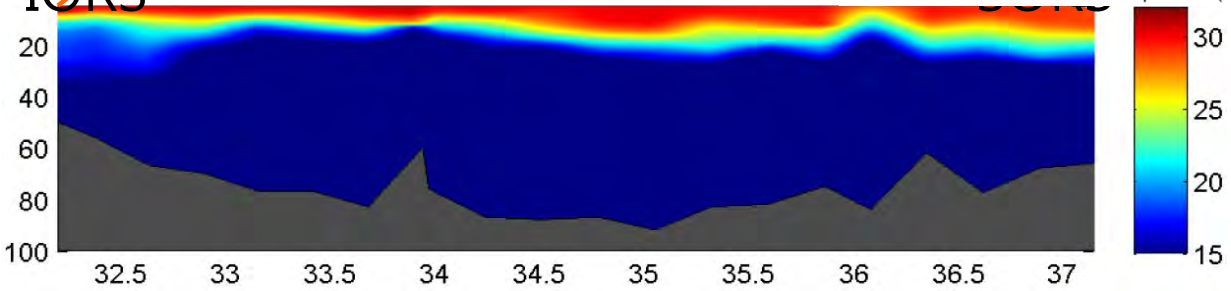
CDW

Salinity

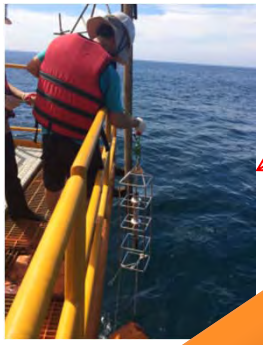


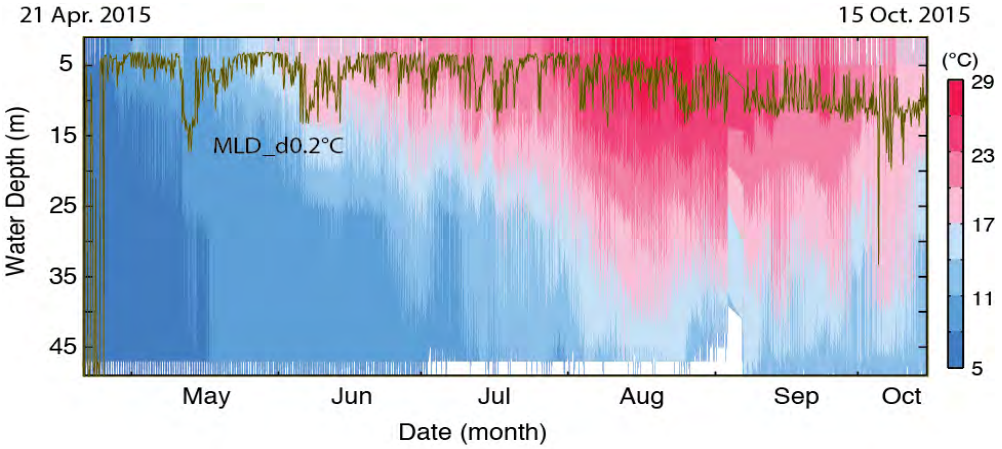


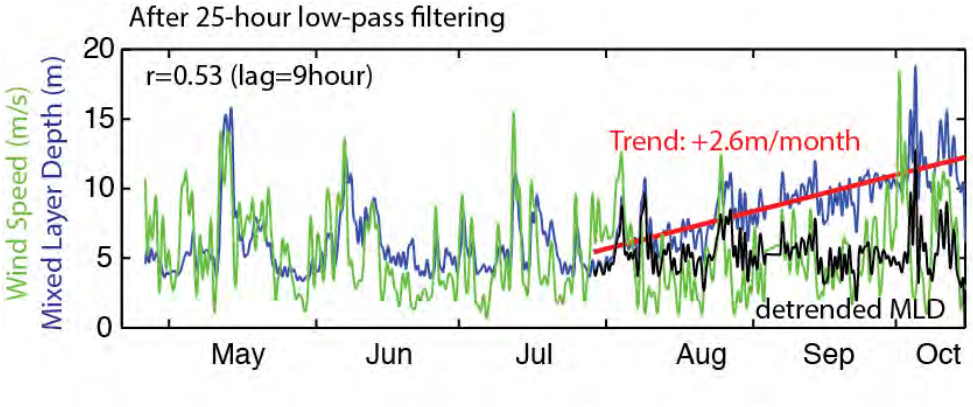
IORS

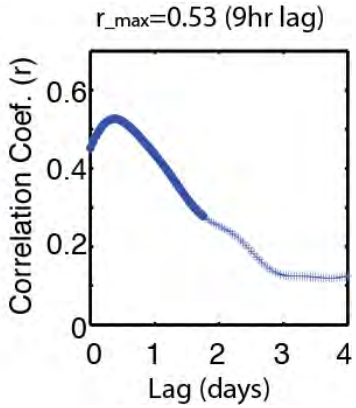


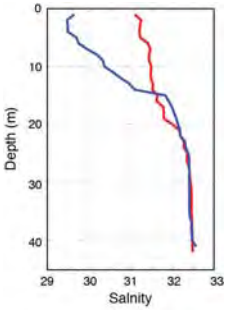
Ocean Mixed Layer

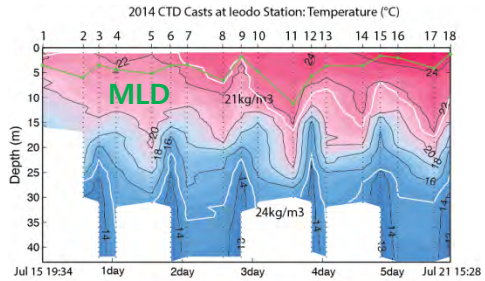


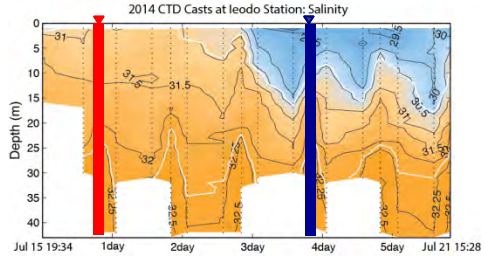




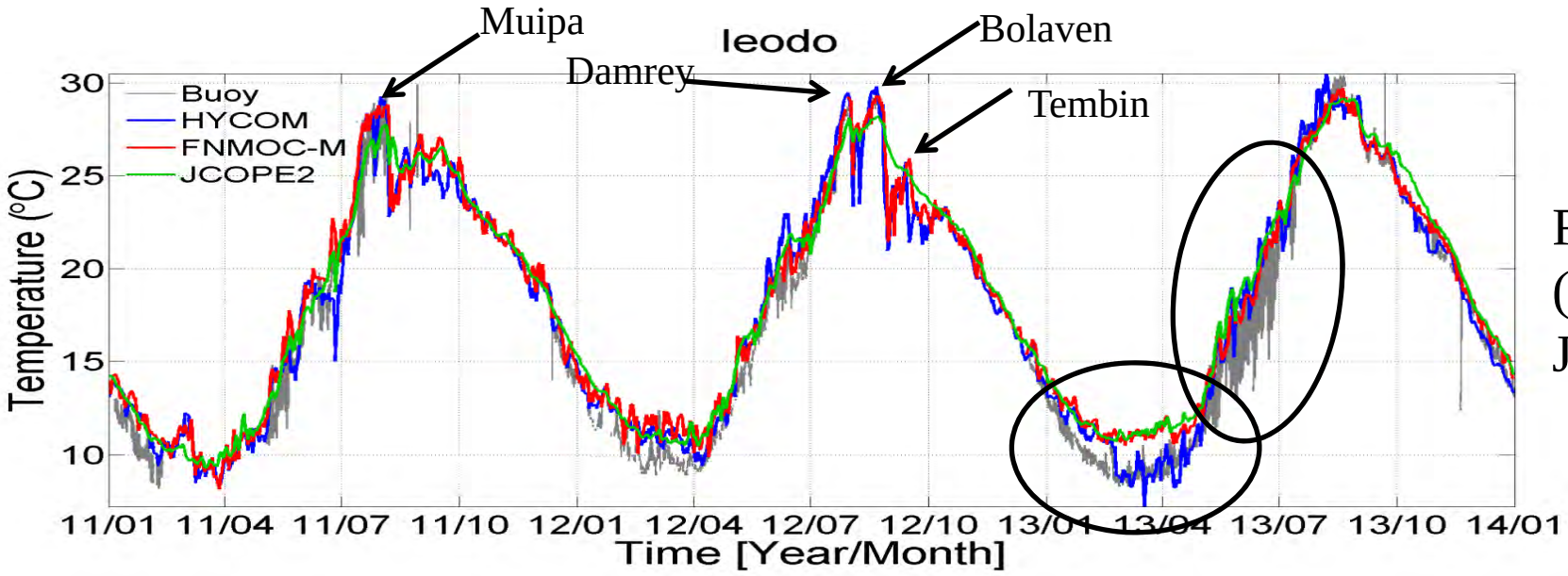




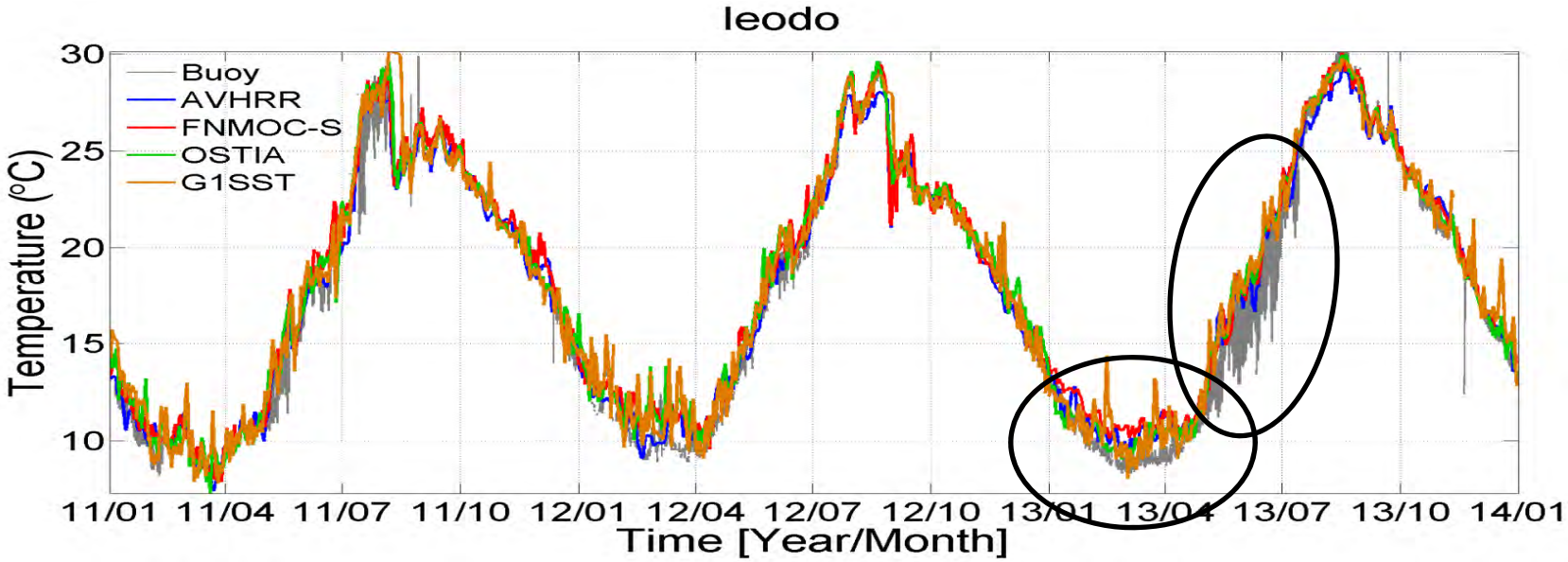




Validation of the Model & Remote Sensing Data

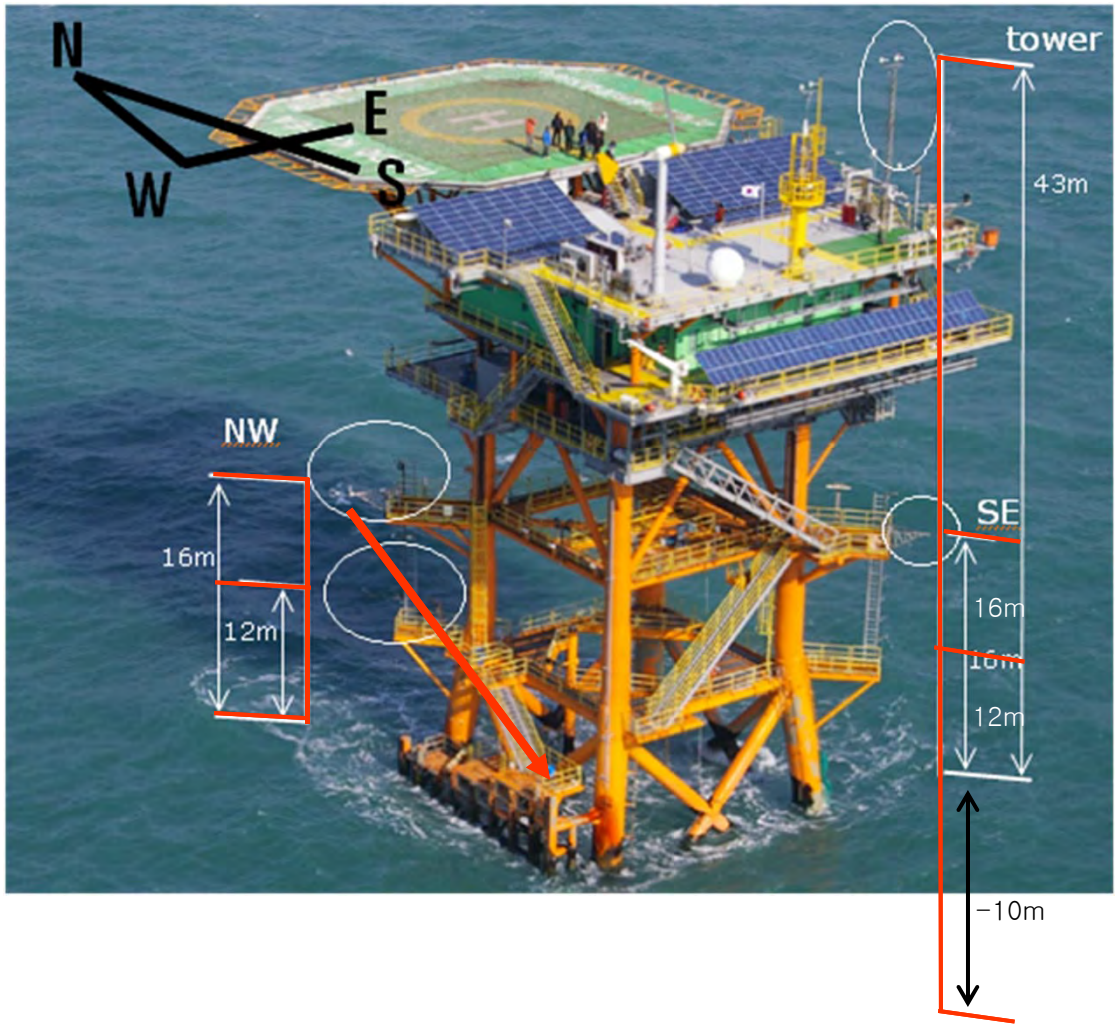


Reanalysis data (HYCOM, FNMOC-M, JCOPE2)



Remote sensing data (OSTIA, G1SST, AVHRR, FNMOC-S)

Air-Sea Interaction Study



Atmopheric

Air temperature	**Relative humidity**
Wind direction	
Wind speed	Air pressure
Insolation	**Precipitation**

Flux (CSAT3+LI7500)

Ux	**H_2O concentration**
Uy	CO_2 concentration
Uz	CO_2 flux
Wind speed	**Latent heat flux**
Wind direction	**Sensible heat flux**
Air Temperature	**Momentum Flux**
Air pressure	**Friction Velocity**

Wave (MIROS Wave Radar)

Significant wave height	**Peak period**
Maximum wave height	CO_2 concentration

CTD

Water temperature

- **Air-Sea interaction study**
- **Development of the IORS optimized observation and post-processing algorithm**
  - ➔ **Numerical model (Coarse3.0, etc)**

Data (http://www.khoa.go.kr/koofs/eng/observation/obs_real.do)

Summary & Suggestion

- The first ORSs in Korea**, Ieodo, had been completed in 2003** and have produced more than 10 years of data.
- **3 ORSs are now in operation** including the GORS and SORS.
- Equipped with more than 30 different kinds of instruments.
- The IORS is located on the main track of **typhoons.**
- High risk, but high return. The ORSs are producing unique observation data.
- There are about **20 on-going research subjects** for the ORSs
- **We are willing to collaborate with any researchers and institutes who have research topics related to the ORSs**

**Refer to the poster: S13-P6 (Title : The present and future of Ocean Research Stations (ORSs) of the Korea Hydrographic and Oceanographic Agency (KHOA), by Chungho Lee)

Contact: jyjeong@kiost.ac.kr


Thank you