

Integrative Approach for the Coastal Dynamics and Ecosystem in the Kangjin Bay, South Sea, Korea



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Contents

□ Objectives

□ Methods

- Realtime Monitoring network in Korea

- Realtime Monitoring network in Kangjin Bay

□ Results

- Dynamics

- Fishery and Ecosystem

- Cause of mass mortality for large-arc Shell

Motivation

➤ To find out the cause of Mass Death of Shellfish (*Scapharca broughtonii*)

➤ 3 hypothetical candidates of cause

- Physical (environmental) ✓ Physical (environmental)
 - Role of Tidal Circulation and Mixing
 - River Runoff and Stratification in Summer
 - Water Exchange and Flushing of Bay Water
 - To understand the processes for water quality
- Hydrodynamics very Complicated with ✓ Physiological
 - Geometry
 - Bottom Topography
 - Three Inlets
 - Two Rivers
- Formation of hypoxic conditions in summer ✓ Trophic dynamics

Objectives

- Role of Tidal Circulation and Mixing
- Impact of the Nam Gang Dam Discharge and Stratification in Summer
- To understand the processes for water quality
 - Formation of **hypoxic conditions** in summer

Results

- Numerical Model of Tidal Circulation
 - With Dam water Discharge
- Reproduce Tidal and Density current
- Reproduce strong stratification and inhibited vertical diffusion
- Hypoxia from a simple 1-D diffusion-sod
- Still working on with 3-D circulation + Water Quality + Ecosystem model



(Peking)

Yellow Sea

East (Japan) Sea

Seoul



Taejon



South
Sea



(Pusan)

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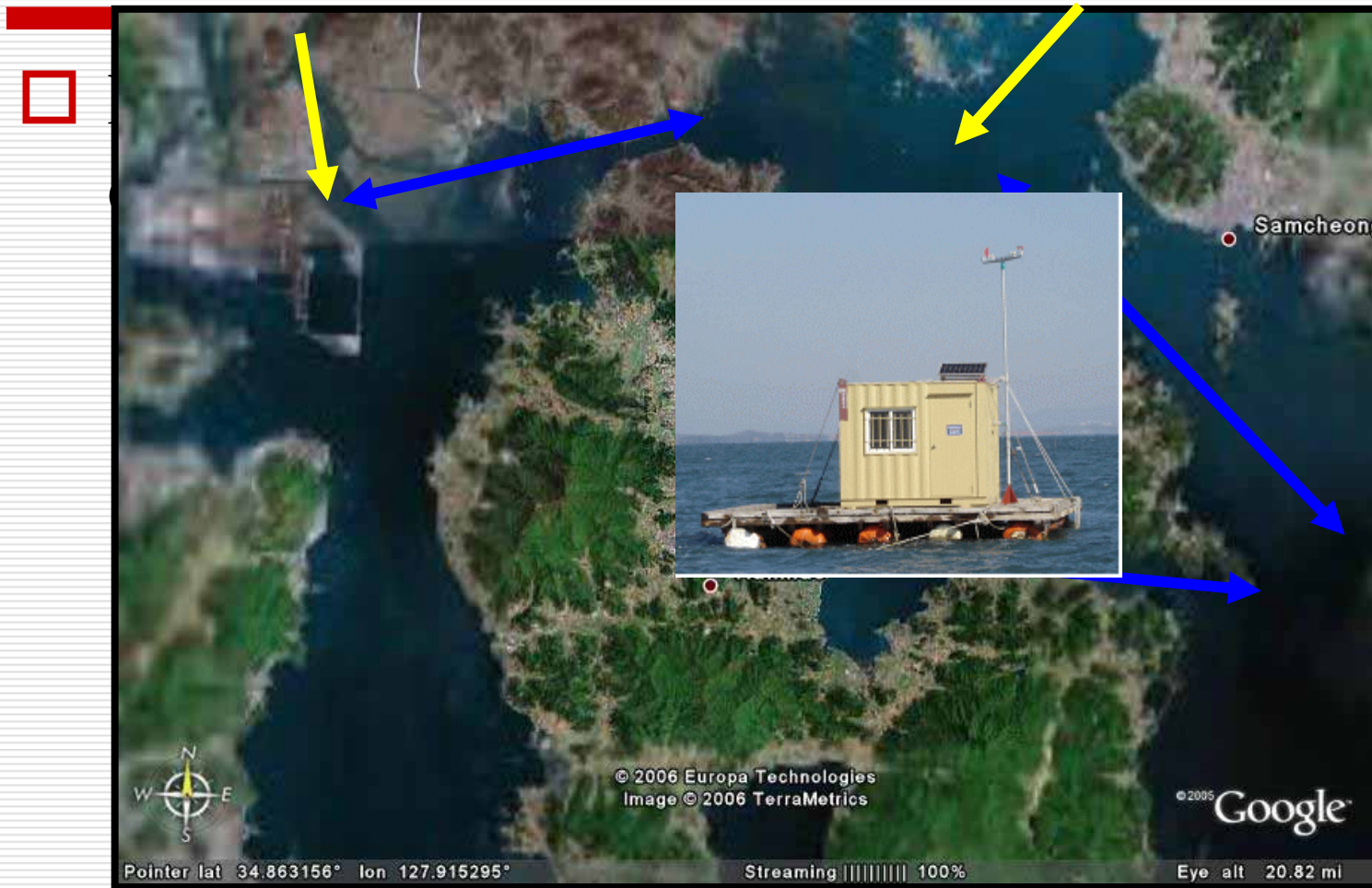


Pointer 36°37'29.87" N 131°47'51.30" E

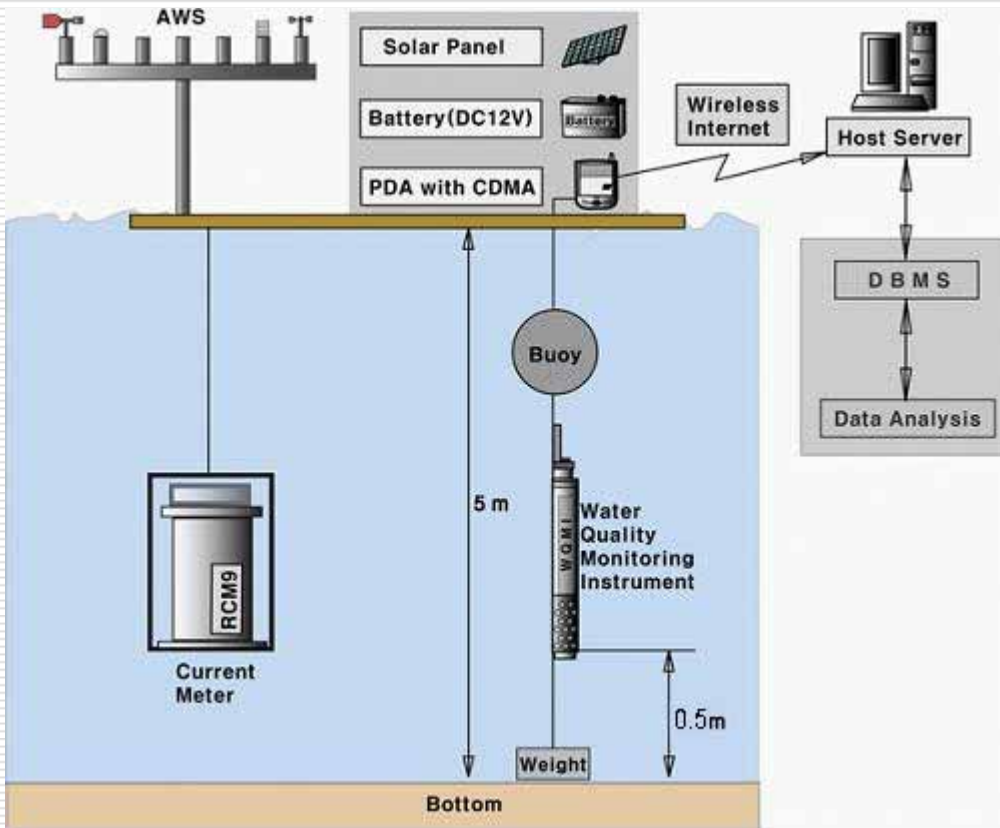
Streaming ||||| 100%

Eye alt 1178.40

Korean Coastal Waters in the South Sea



Year-Round Continuous Operation of Realtime Monitoring



Three Big Issues for RT Monitoring

- Hardware maintenance
- Data Q/C
- Analysis of RT Data and Modeling

System Configuration

- Hardware (Field)

- **Sensor and Data Logger / Communication CDMA**

- Interface

- Components

- Parameters

- Software on Host Computer

- Web Server

- CDMA Communication

- Graphic Engine

- Database Management

- Warning Messaging

Maintenance Field works

Regular On-site Cleaning and Calibration
Lab.

How often

Summer : 2 weeks

Winter : 4-6 weeks

Labor Intensive Jobs : No more details

Data Quality Control Issues

Realtime Mode

Data quality corruption due to

Bio-fouling

Long-term shift

Delayed Mode

Check the data values with in situ measured data

Check time series for spikes and trend

Analysis and Oceanographic applications

Statistical Analysis

- **Time Series**

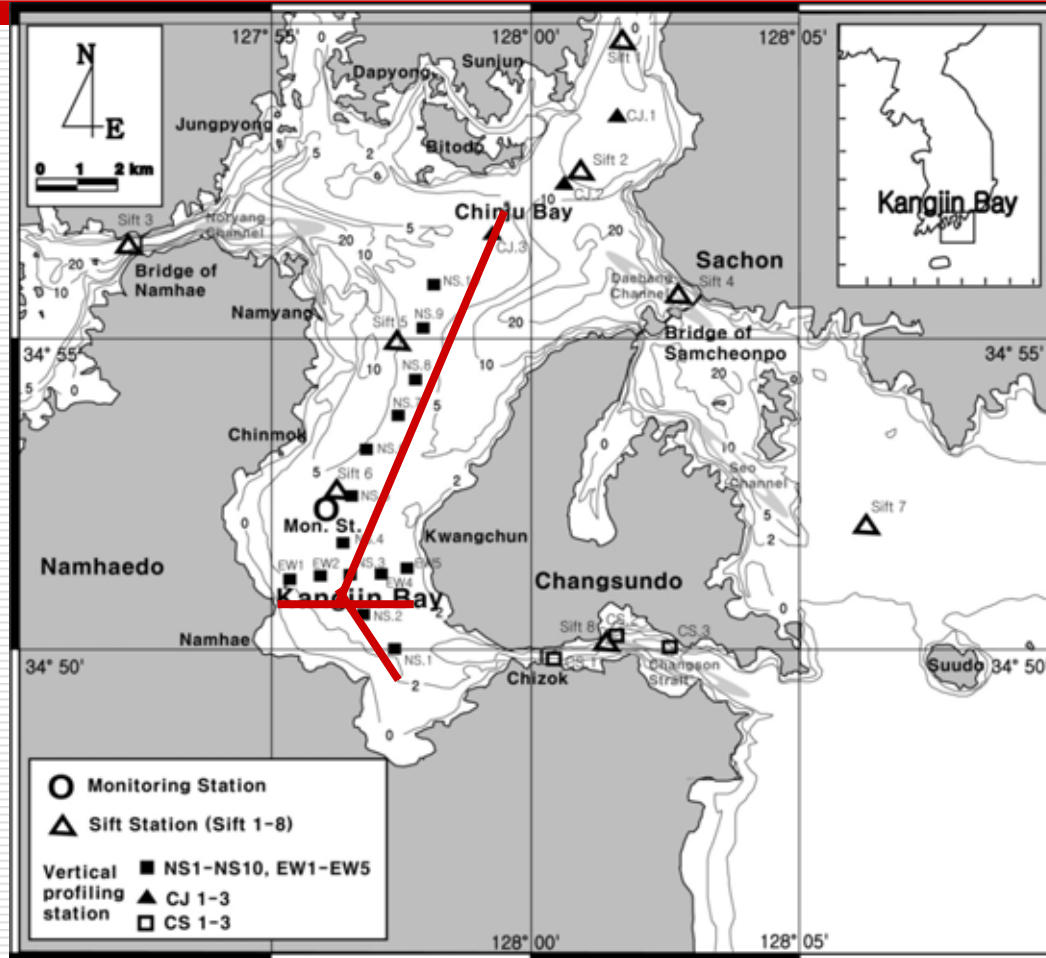
Oceanographic applications

- **Mechanism Study of the Hypoxia Formation**
- **Numerical Modeling w/Data Assimilation**
- **Forecasting Operational Oceanography**

Operational and Practical applications

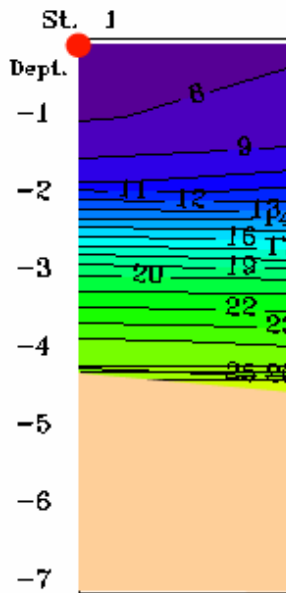
- **Fishery culture**

St.map

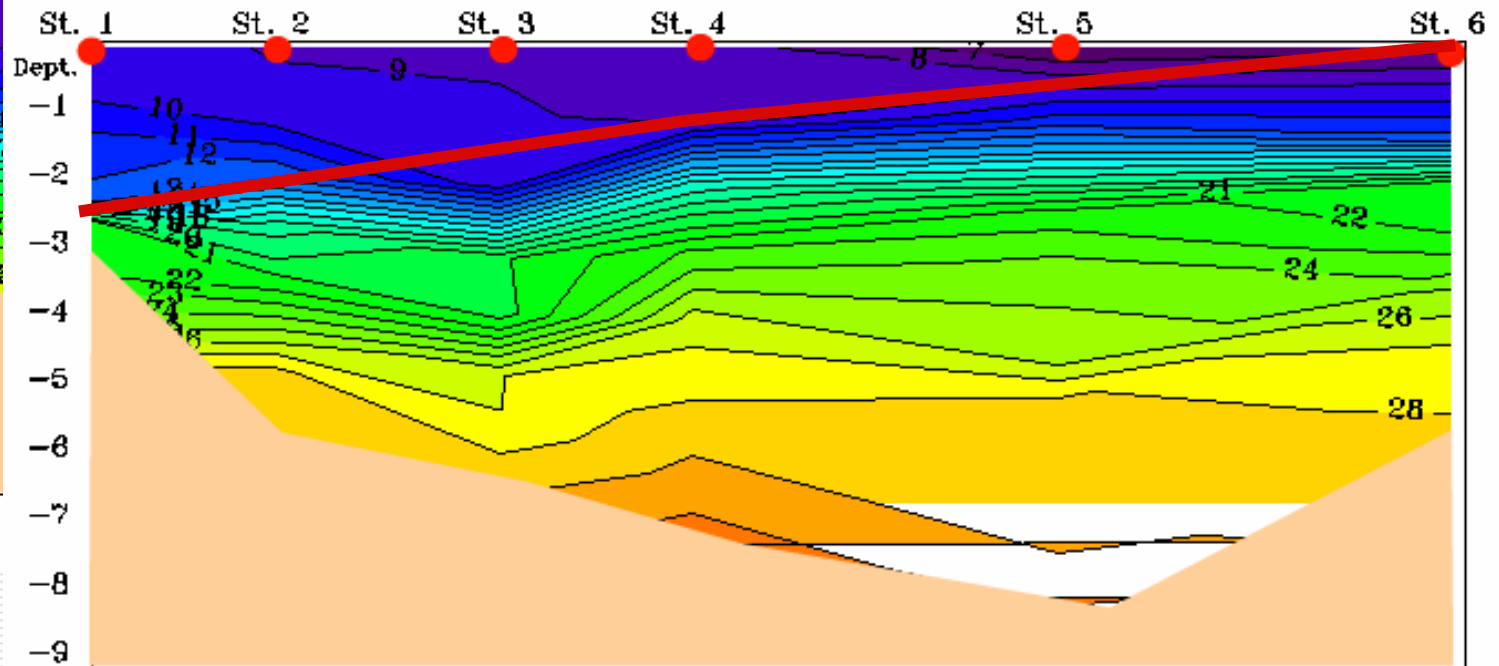


Cross sectional distri. of Salinity

Salt. Vertical profile(E-W) of Kangjin Bay (2004.8.25)

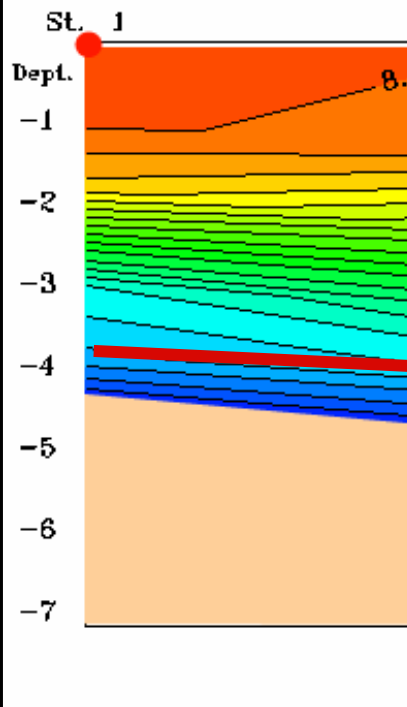


Salt. Vertical profile(S-N) of Kangjin Bay (2004.8.25)

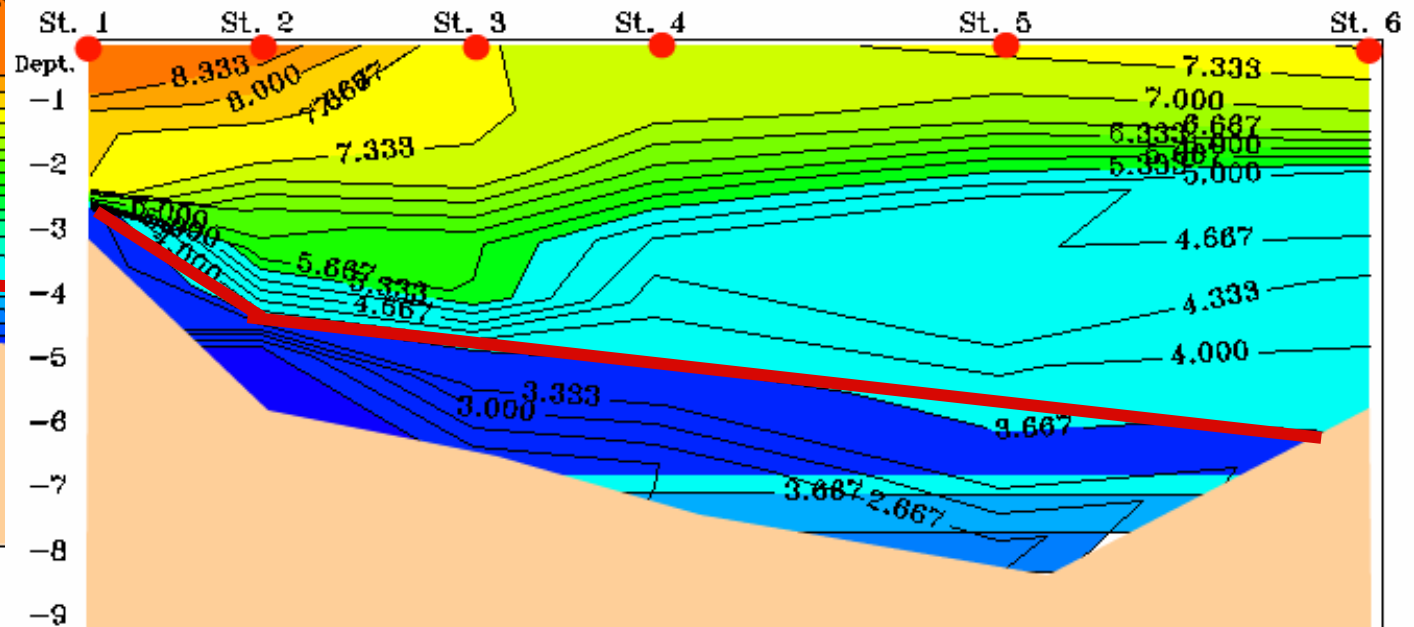


DO Cross Section in Summer, 2004

D.O. Vertical profile(E-W) of Kangjin Bay (2004.8.25)



D.O. Vertical profile(S-N) of Kangjin Bay (2004.8.25)



Hypoxia in the Kangjin Bay

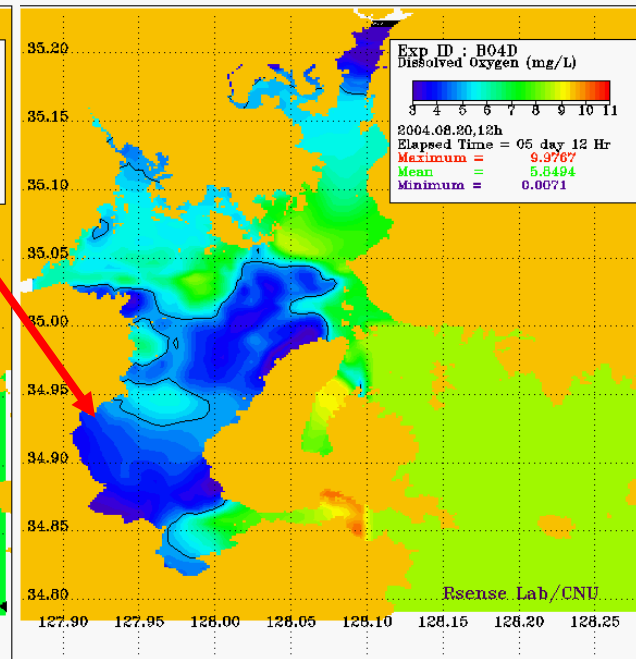
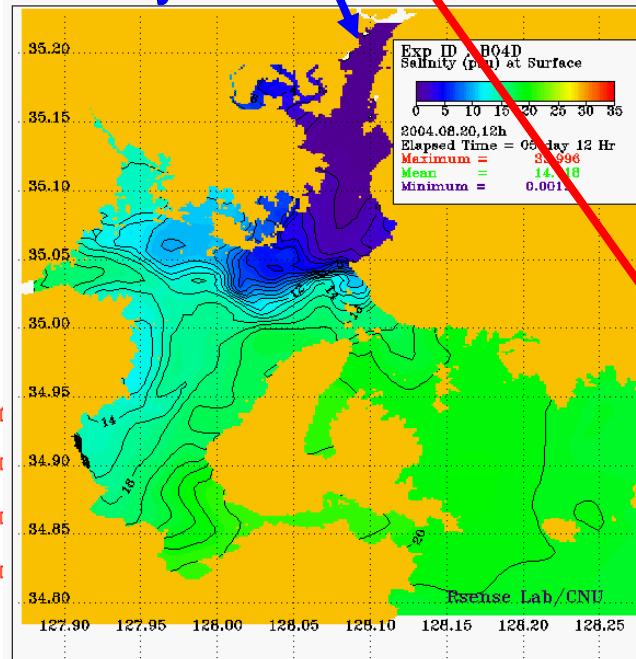
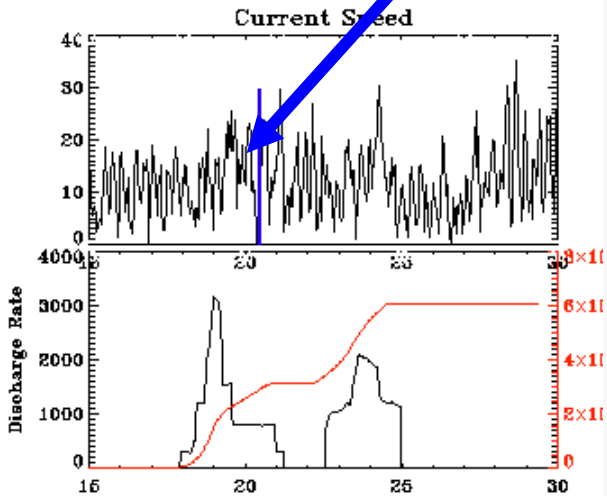
Dam Water Release

Fresh water Into Sachon Bay

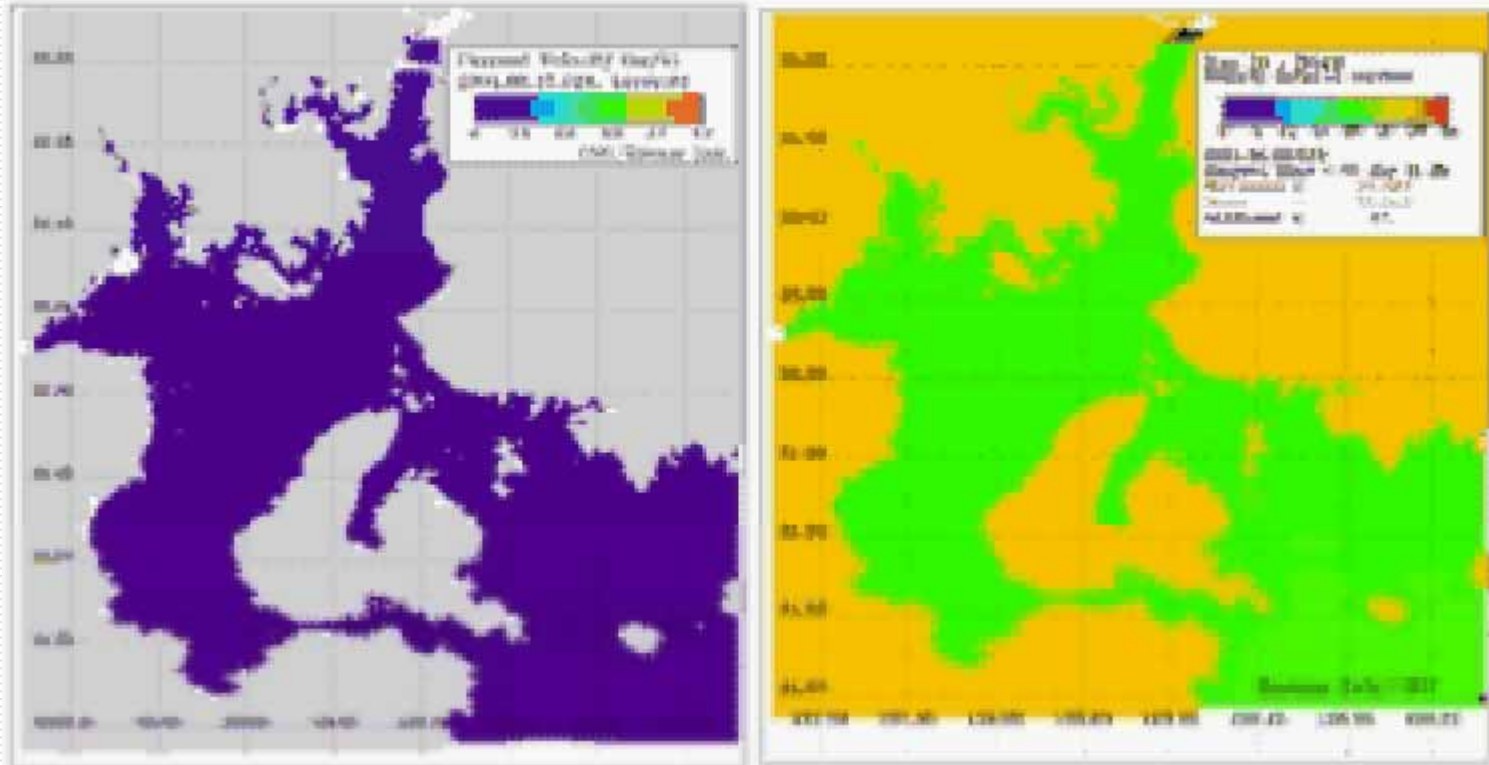
Hypoxia in KB

Kangjin Bay Model Exp. B04D

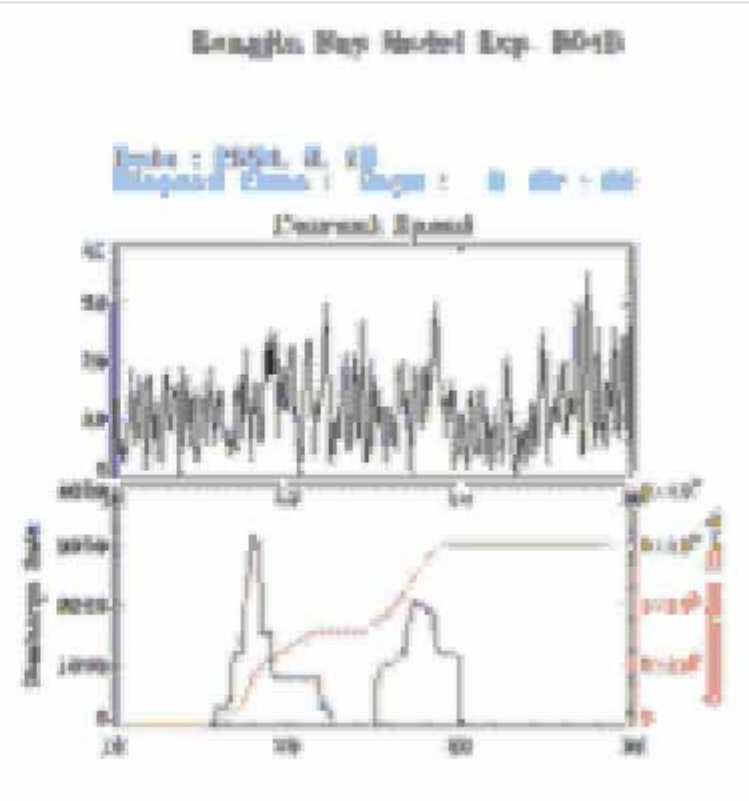
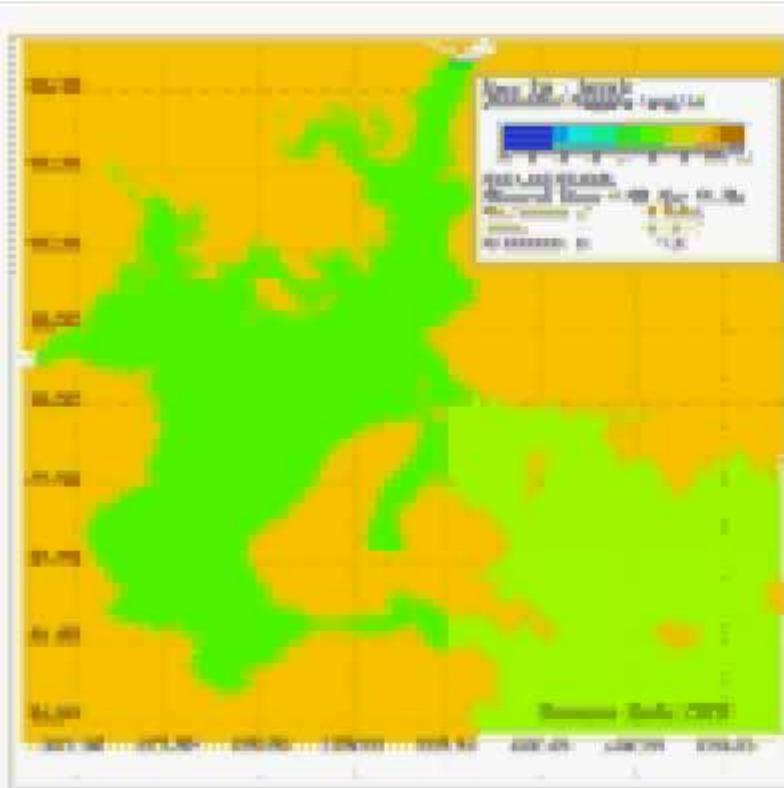
Date : 2004. 8. 20
Elapsed Time : Days : 5 Hr : 12



Tidal Current Animation



DO Animation



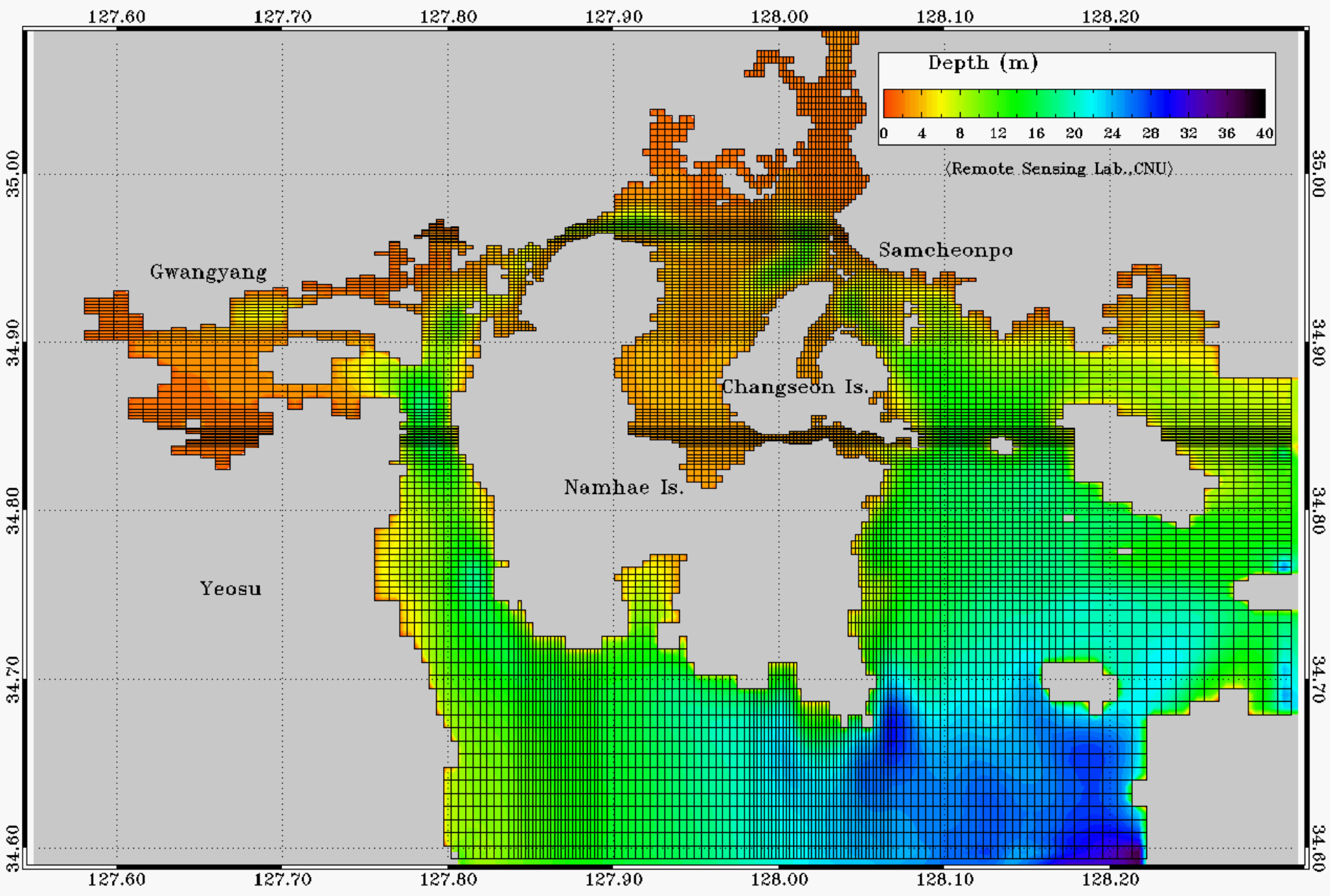
Conclusions

- Numerical Modeling of**
 - Tidal Circulation**
 - Nam Gang Dam Water Discharge**
- Understand the mechanism for the formation of Hypoxic Conditions**

River Runoff → Stratification → Pycnocline
→ Hypoxia → Mass Death → Collapse of Local Aqua-farming Industry
- Understand the Impact of Low-Salinity and Hypoxic Shock with Toxicological Tests**

Conclusions cont.

- Ruled out other hypotheses
 - Poor water quality
 - Under-nutrition after spawning
 - Diseases
- How to Prevent these Shocks and Impact to the Eco-system (National Policy)



Thank you for your attentions

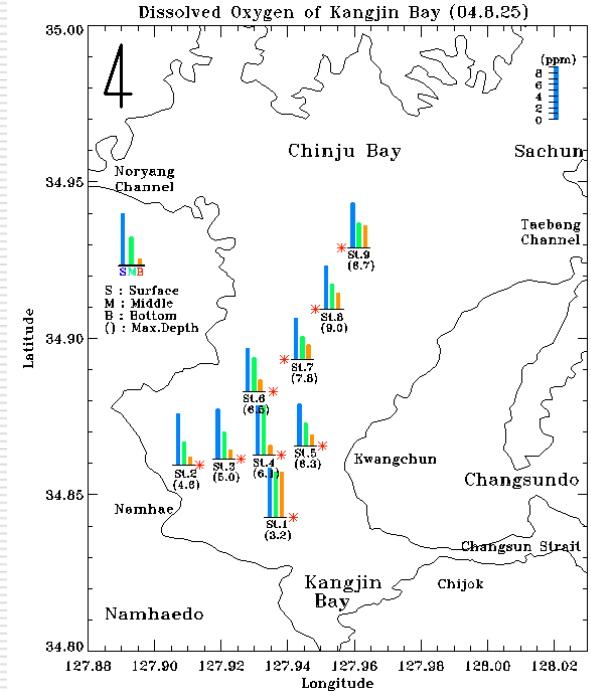
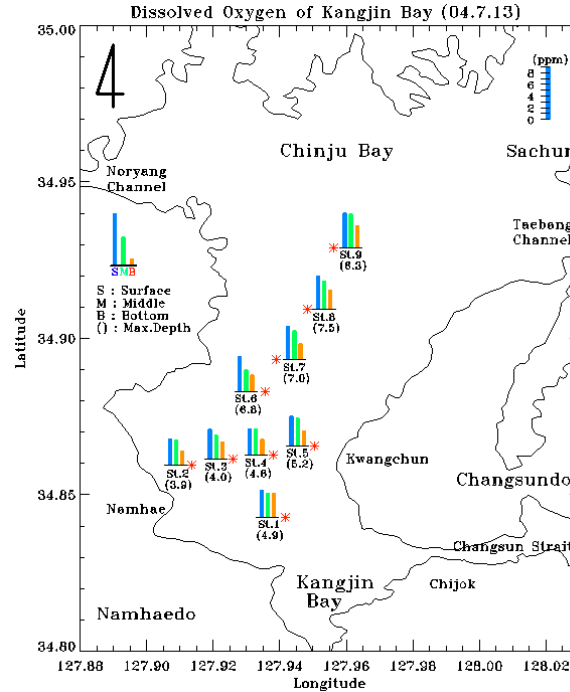
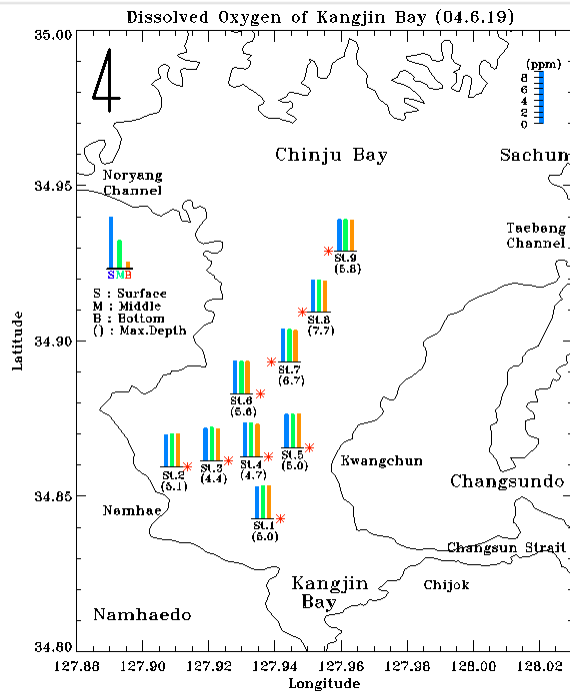
ありがとうございます

謝謝

Спасибо

감사합니다

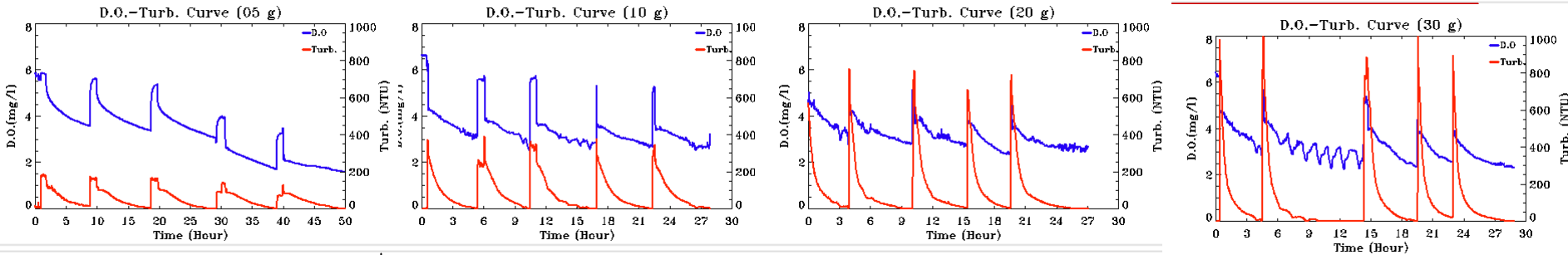
Vertical Profile of DO



Lab. Experiment for DO by SOD

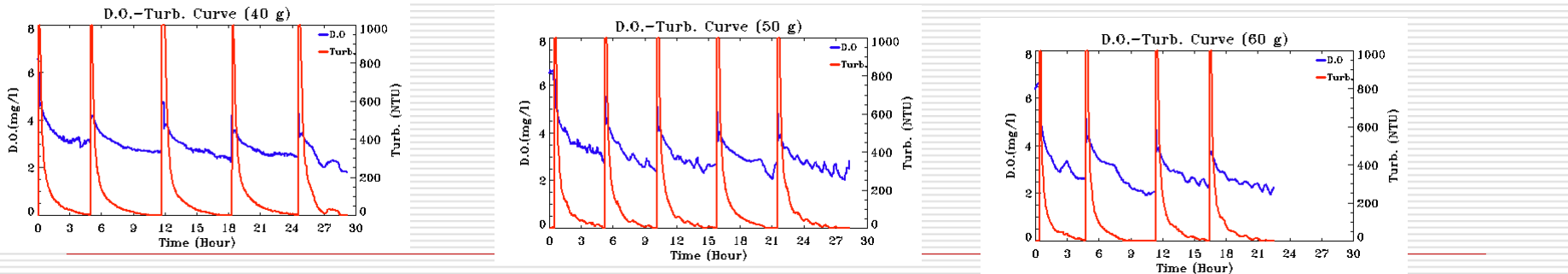
- Lab Experiments Setup
 - 7 different SOD conditions
 - Measure time series of DO conc.
- Results reduction
 - Estimate consumption rates

Lab. Experiment for DO consumption by SOD : Results



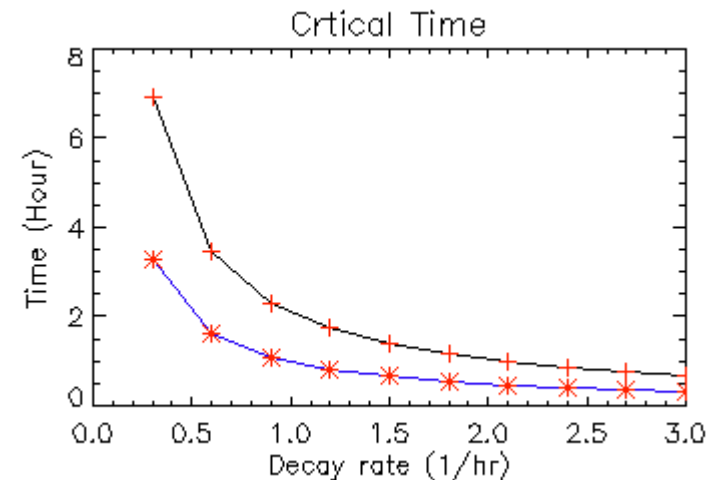
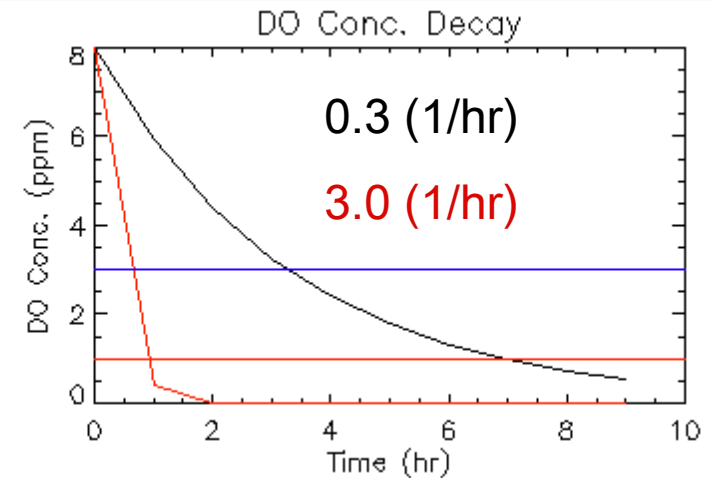
DO Conc.

Time



Oxygen Consumption Rate due to SOD

- Fit to Model
 - $C=C_0 \exp(-rt)$
- Consumption Rate
 - 0.3 ~ 2.56 (Hr⁻¹)
- Time needed to become Hypoxia (3 ppm)
 - 6.9 ~ 3.2 시간
 - 0.69 ~ 0.32



Intro. to Real-time Ocean Observing System in Korea



Organizations related to Coastal and Ocean Observation

 **MOMAF (Ministry of Maritime Affairs and Fisheries)** 海洋水産部

 **NORI (National Oceanographic Research Institute)**

 **NFRDI (National Fisheries Research and Development Institute)**

 **KORDI (Korea Ocean Research and Development Institute)**

 **Universities (SNU, CNU, PNU, etc)**

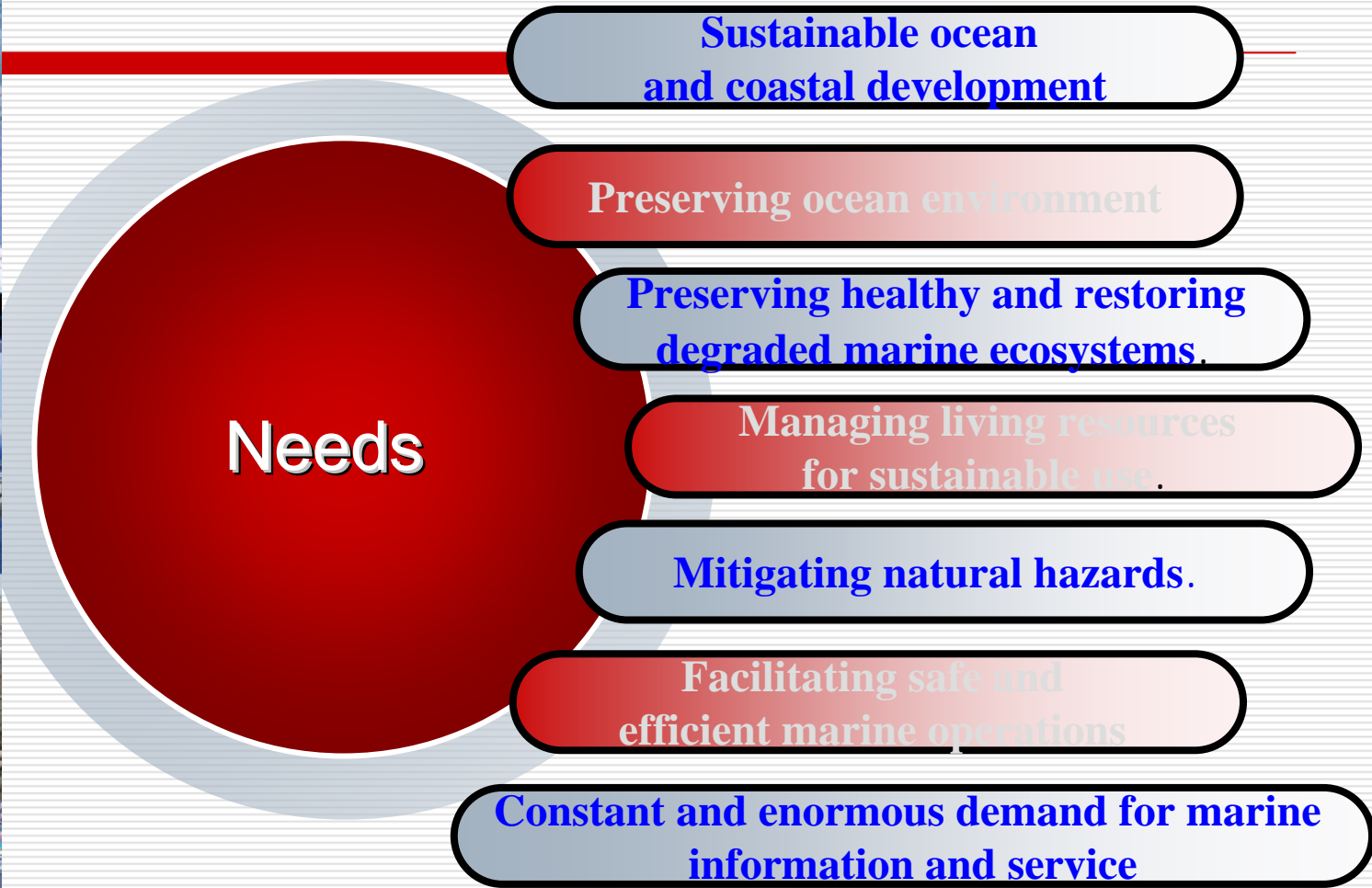
NORI (National Oceanographic Research Institute)

- **Branch of the Ministry of Maritime Affairs Fisheries (MOMAF)**
- **Hydrographic survey and oceanographic observation**
- **Production of nautical charts, publications, and other oceanographic data.**

NFRDI (National Fisheries Research and Development Institute)

- **Branch of the Ministry of Maritime Affairs Fisheries (MOMAF)**
- **Observations and researches on the integrated water quality environment through oceanographic observations, marine pollution observations, fresh water pollution observations, and marine remote sensing in order to assure and efficient use and the conservation of fisheries resources.**

Needs of Integrated Ocean Observing System



Implementation plan for the real-time coastal observing system

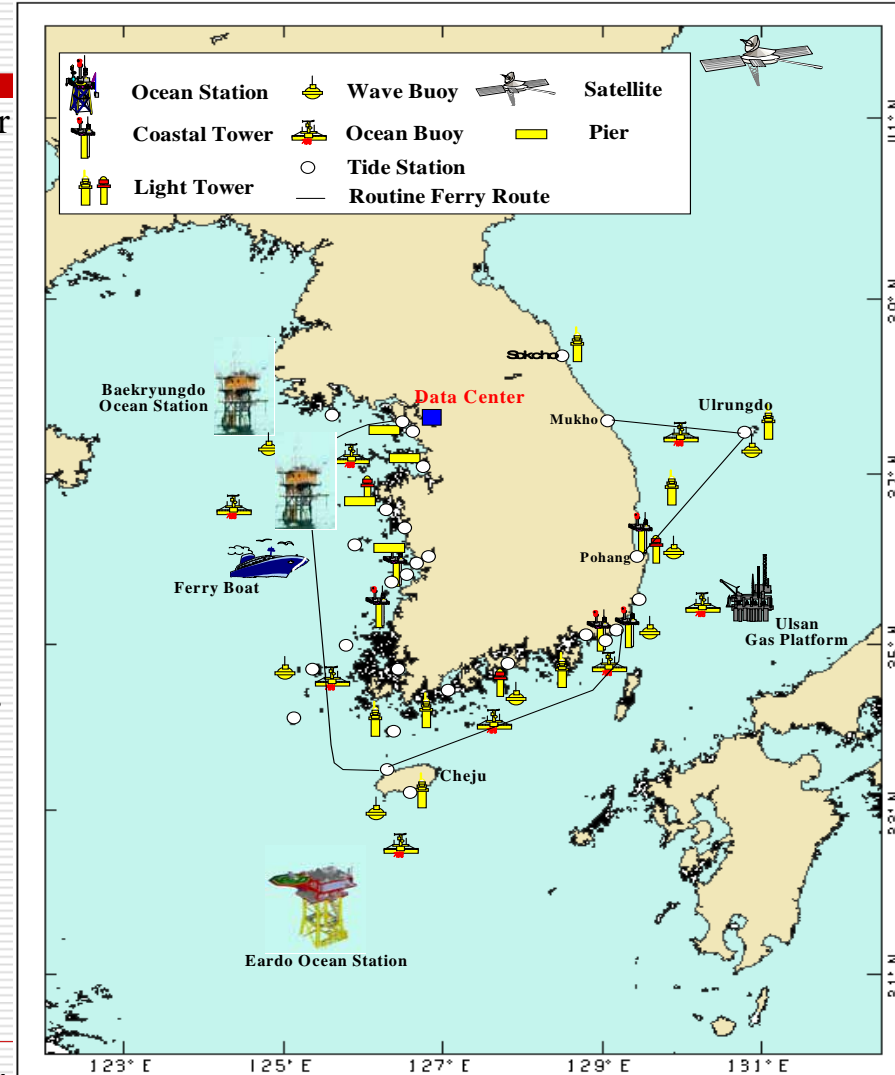
Background

- Need for the systematic real-time coastal monitoring system for the efficient use of coastal and open ocean in Korea
- Great demand for the efficient use of coastal space
- Needs for real-time coastal environmental parameters to solve ocean-related problems.
- Development of the technologies for the establishment of the Integrated Coastal Observing System
- **Establishment of the NEAR-GOOS**

Goal

- **to acquire stable and continuous long-term data and to establish the permanent observation stations economically.**

This plan is going to implement in stages by 2010.

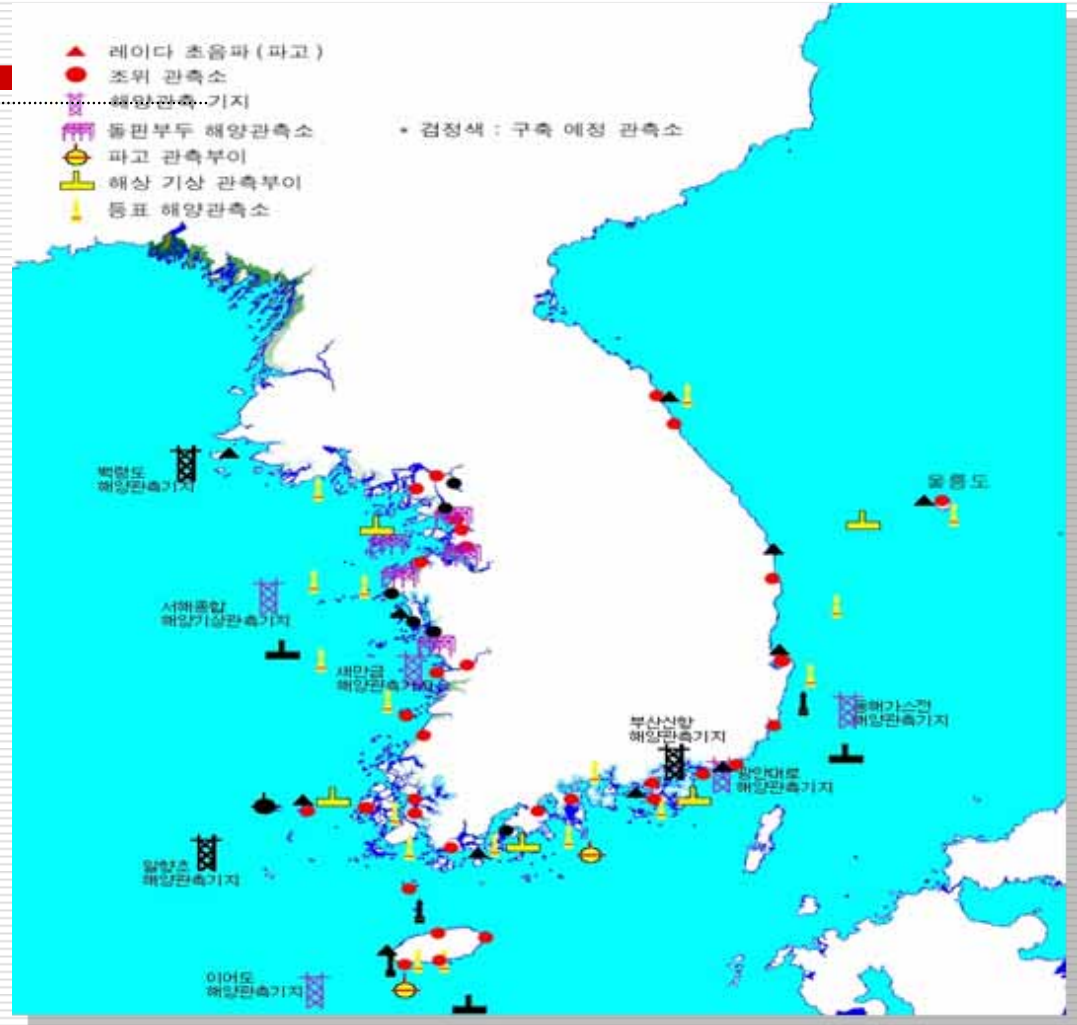


Basic plan for the implementation of real-time coastal and ocean observing system in Korea

The present status of real-time ocean observing system

79 stations as of the end of 2007

- NORI : 32 tide station, 1 buoy
- KORDI : 19 stations including IEODO
- KMA : 5 buoy, 8 LT, 1 station



Serial Oceanographic Observation in the Korean Waters



Oct. 30, 2007

PICES

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