Realtime Monitoring of the Oceanic State Variables in the Kangjin Bay, South Sea, Korea

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Contents

- Motivation and Objectives
- Realtime(RT) Monitoring System
- Data Production
- Analysis and Applications

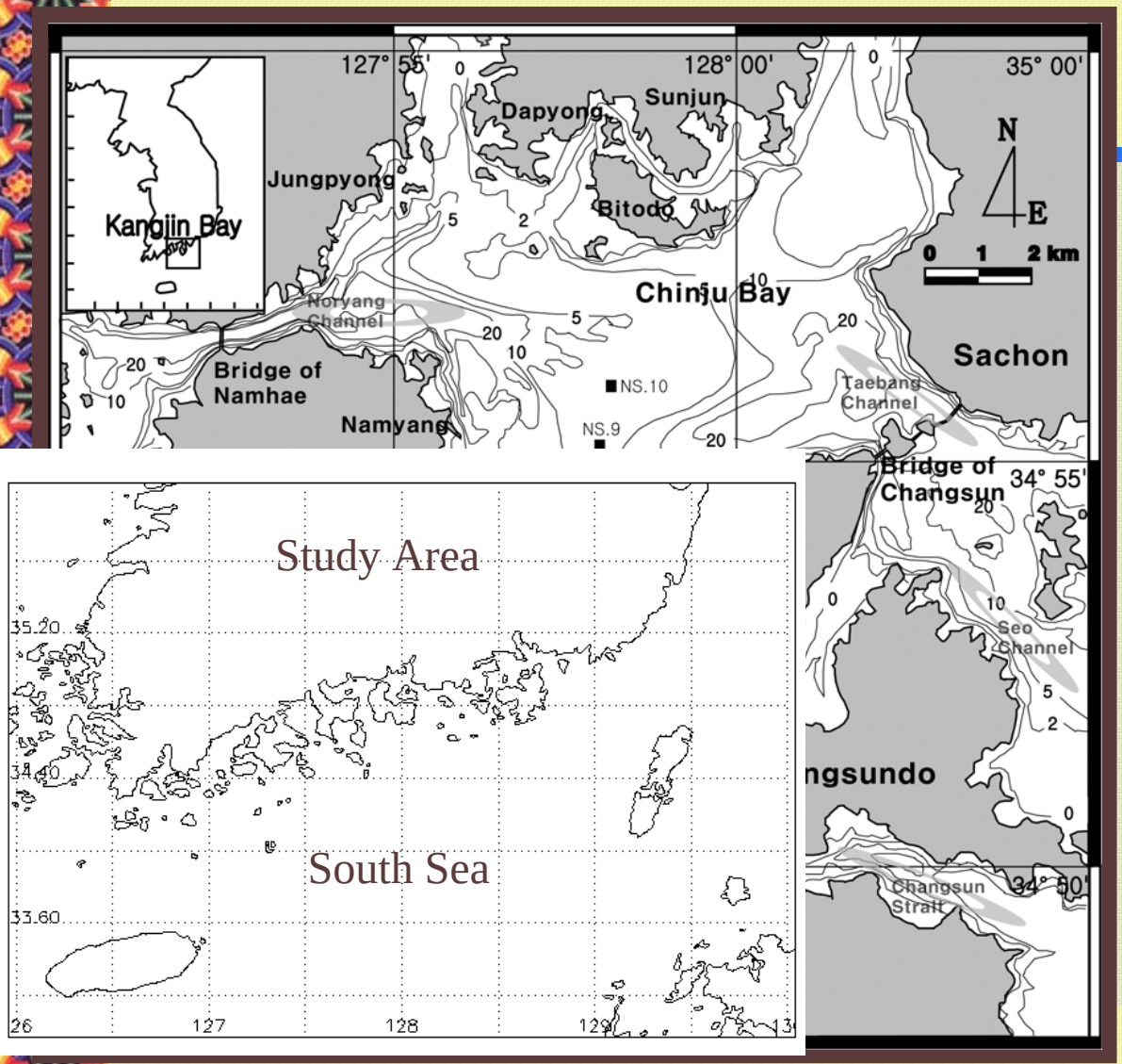
Motivation

- To find out the cause of Mass Death of Shell-fish (*Scapharca broughtonii*)
  - 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
- Formation of hypoxic conditions in summer
- Hydrodynamics very Complicated with
  - Geometry
  - Bottom Topography
  - Three Inlets
  - Two Rivers

Objectives

- **To understand the Seasonal variability of the Hydrography**
- **To understand the role of the tidal and non-tidal dynamics in salinity and dissolved oxygen mixing and diffusion**

Site map



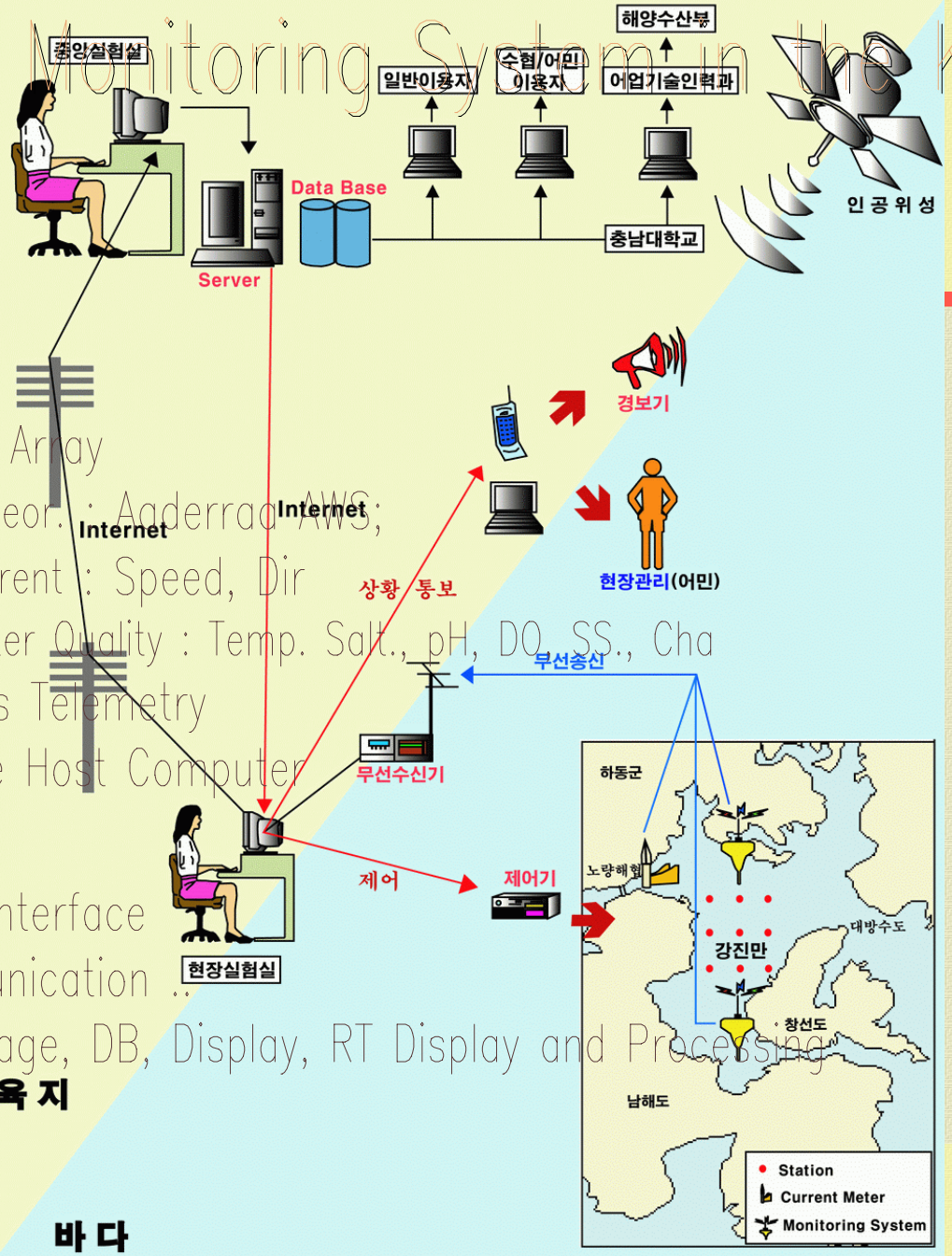
* Bathymetry of the Kangjin Bay and sampling stations

Water Quality

- Period
  : 2004. 1. ~ 2005. 3.
  : 15months, 10min.

- Parameter
  : Temp. Salt., DO, pH, SS, Cha

RT Monitoring System in the KB



- Hardware
  - Sensor Array
    - Meteor. : Aanderaa AWS;
    - current : Speed, Dir
    - Water Quality : Temp. Salt., pH, DO, SS., Cha
  - Wireless Telemetry
  - Remote Host Computer
- Software
  - CDMA interface
  - Communication ...
  - Homepage, DB, Display, RT Display and Processing

Inegration of 3 T

- **Communication Technology (CT)**
  - **Wireless Internet**
- **Information Technology (IT)**
  - **Web display**
  - **Database Query**
- **Ocean Modeling (OT)**
  - **Stochastic and Regression Model**
  - **Intelligent Warning System**
  - **Numerical Model**

강진만 피조개 어장환경 실시간 감시 시스템

충남대학교 해양학과 원격탐사실

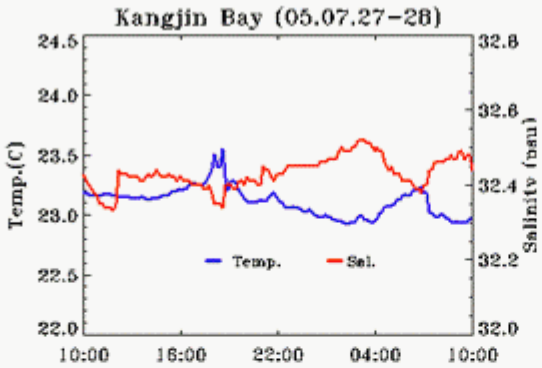
실시간 자료

| 최근 자료 : (kj1_0507281111.dat) | | 날짜: 2005 . 7. 28 | | 시간: 11: 23: 58 |

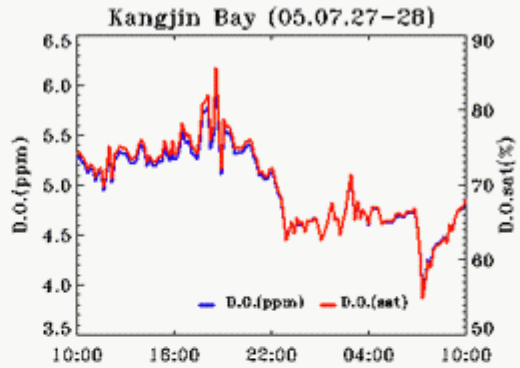
| 수온: 23.02 ℃ | | 염분: 32.5 PSU | | D.O: 66.8 % / 4.75ppm | | pH: 0.57 |

2005년 7월 28일 오전 11,

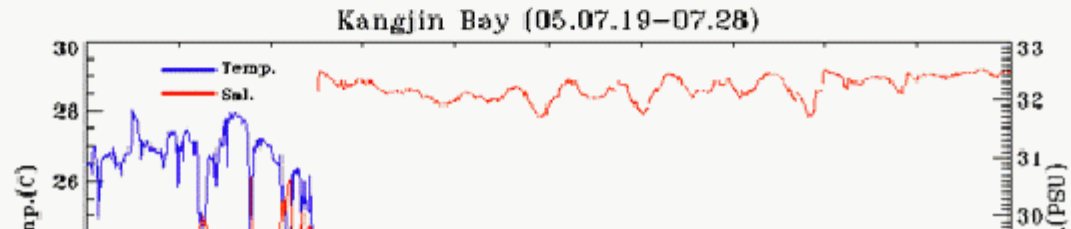
최근 24시간 수온, 염분 그래프



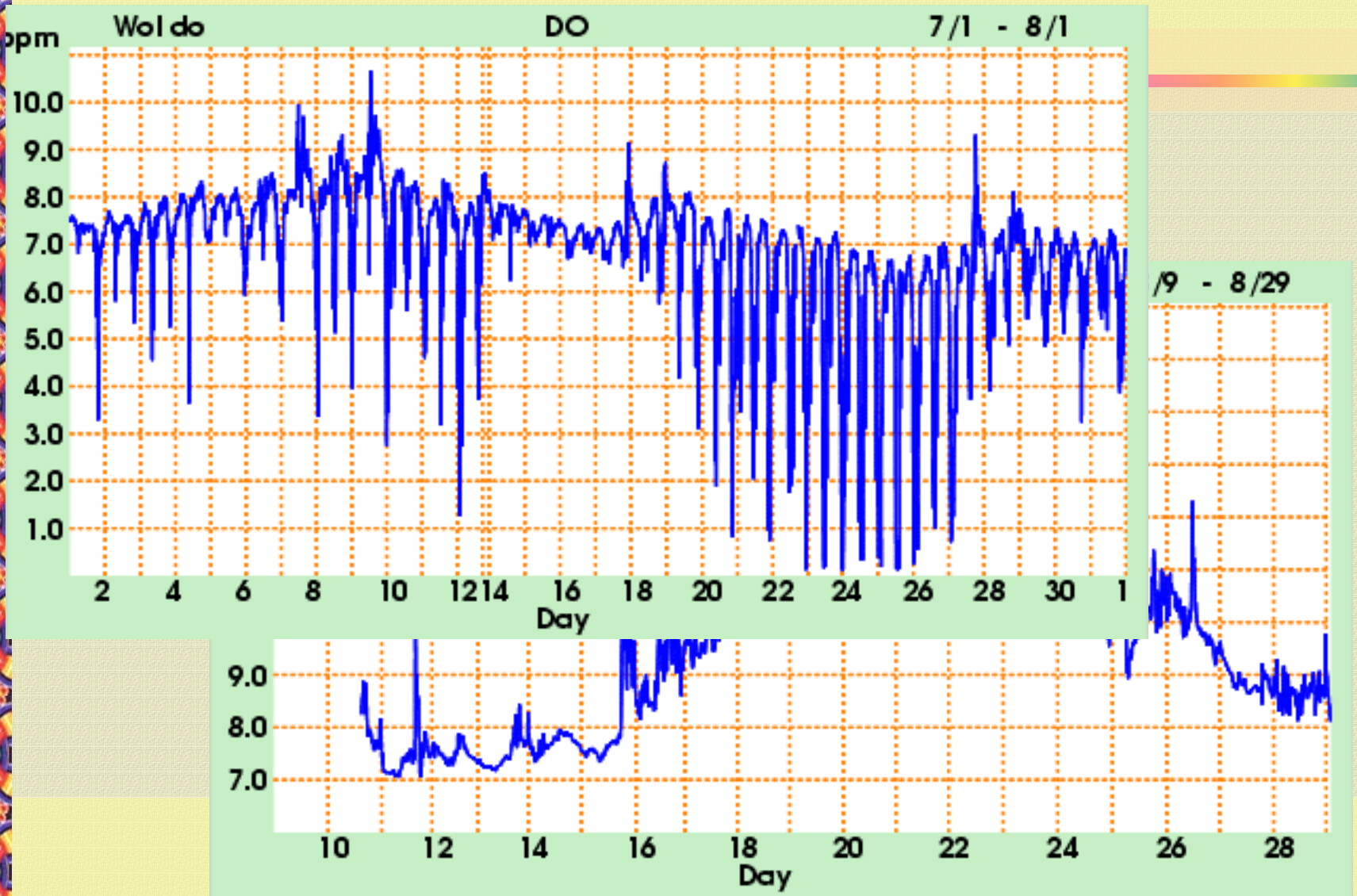
최근 24시간 용존산소, pH 그래프



최근 10일 수온, 염분 그래프



Oxygen Depletion Case

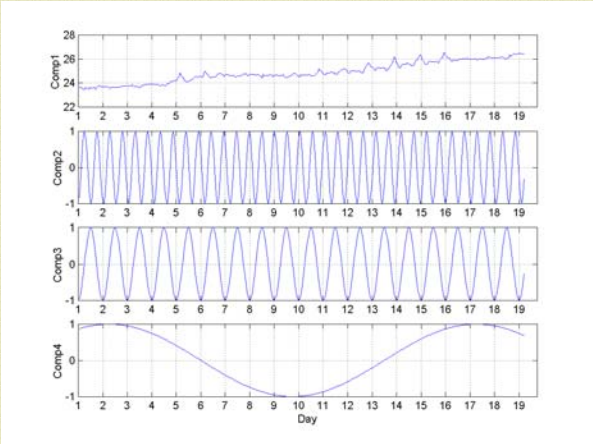


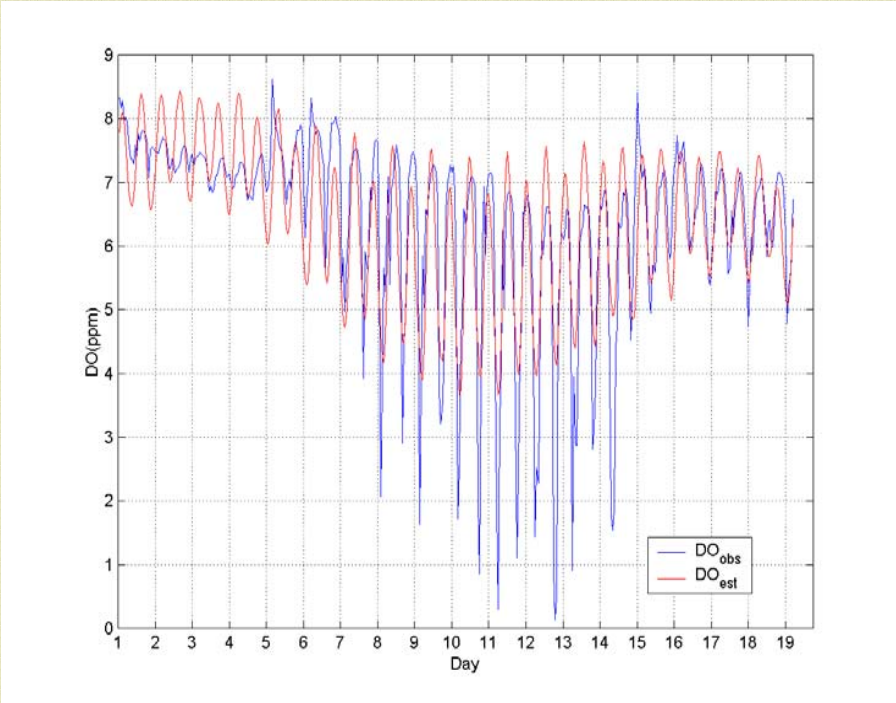
Regression DO Model

Multiple Linear Regression

DO = f(temp, nB, nC)

- temp : Sea water temp.
- nB : net biological production
- nC : reaeration by water movement

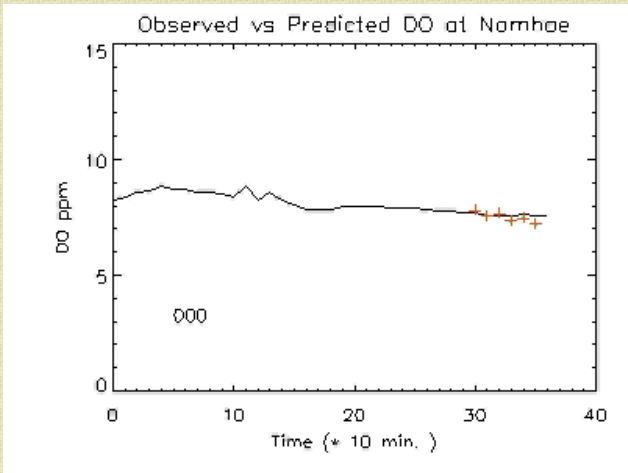


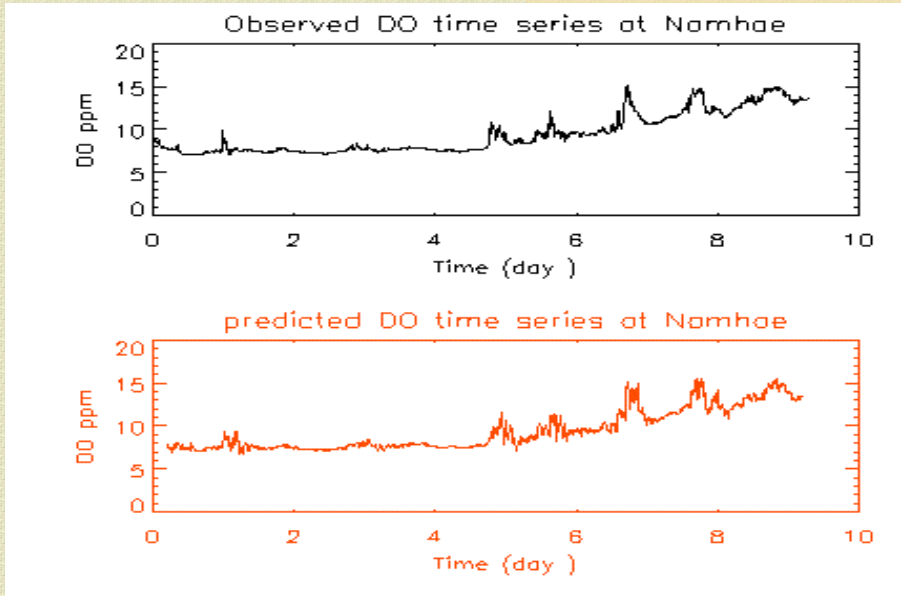


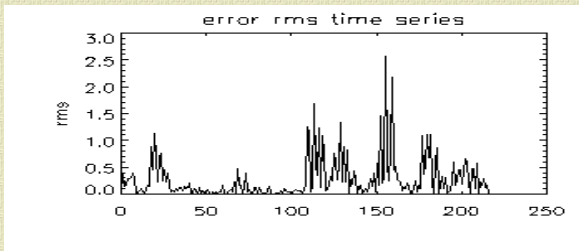
Stochastic DO Prediction

$$DO_t = \sum_{i=1}^{p} a_i DO_{t-i} + e_t$$

- DO_t : Predicted DO at time t
- DO_{t-i} : Observed DO at t-i time (i=1,...,p)
- a_i : Empirical factor
- e_t : Random error



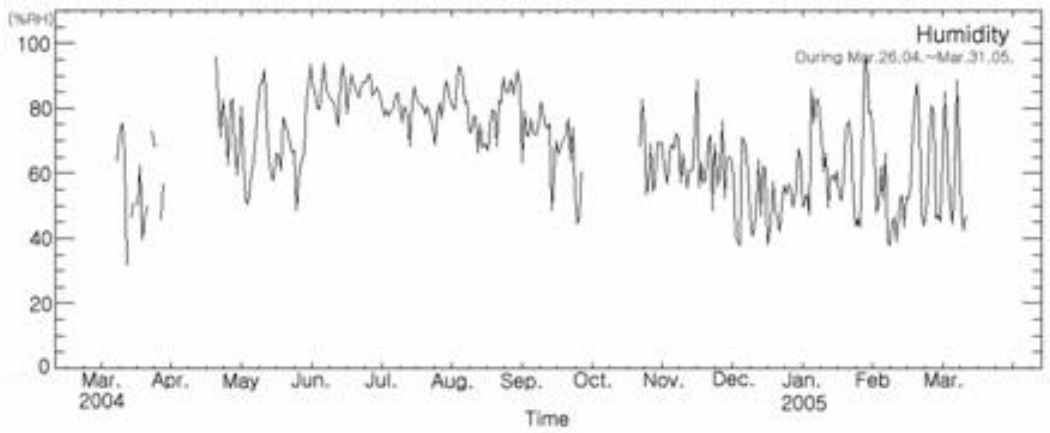


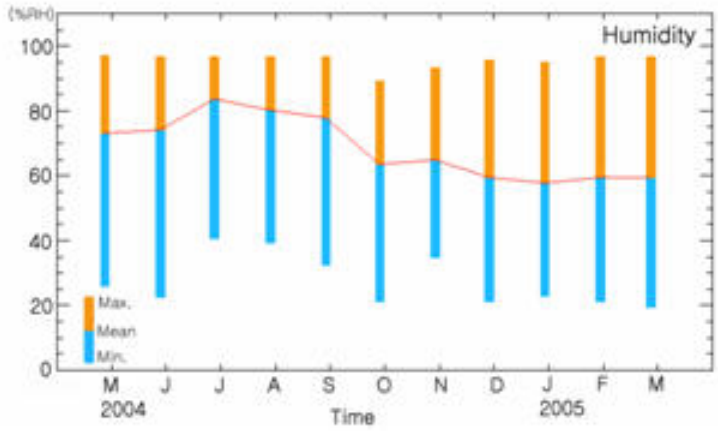


Analysis of Produced Datasets

- Air and Water Temperature
  - Period of Observation : 2004/3 ~ 2005/ 7
    10 min. interval , 16 months
    Parameters : Air Temp. Pressure, Humidity, Radiation, Wind speed and Dir.
- Salinity and Dissolved Oxygen
- Wind Speed

Meteorological Records at KB St.

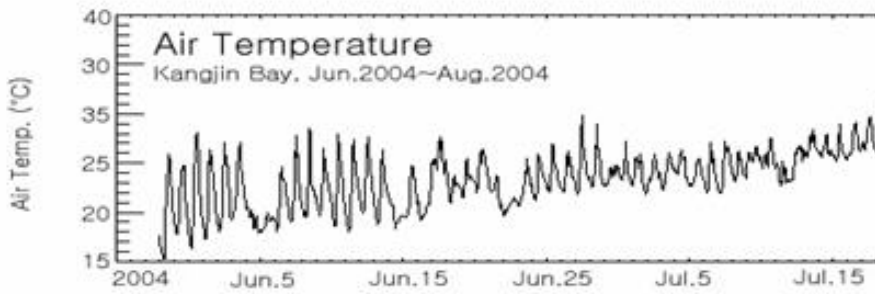


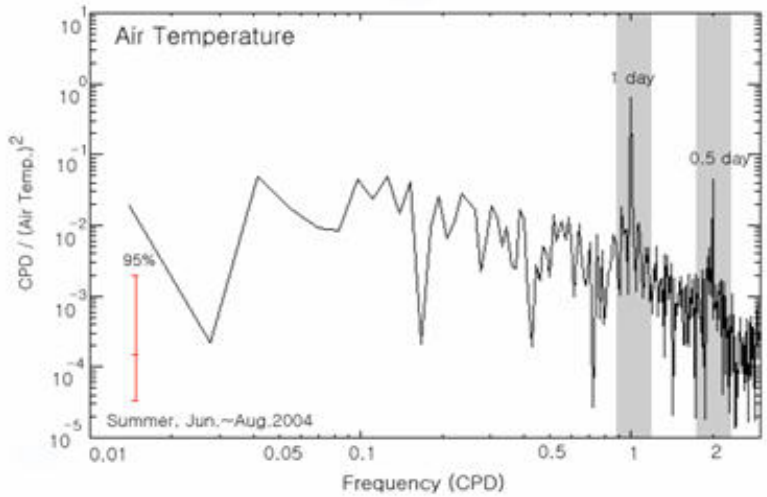


월	기온 (℃)			기압 (hPa)			풍속 (m/sec)			습도 (RH%)			복사량 (W/m²)		
	최대	최소	평균	최대	최소	평균	최대	최소	평균	최대	최소	평균	최대	최소	평균
2004년 8월	35.74	20.02	26.15	1013	980.6	1007	16.6	0.0	3.68	96.65	39.60	80.09	1225	-23.10	229.3
2005년 2월	10.82	-6.48	2.40	1032	100.9	1021	15.9	0.0	4.78	96.55	96.55	21.24	984	-13.60	169.9

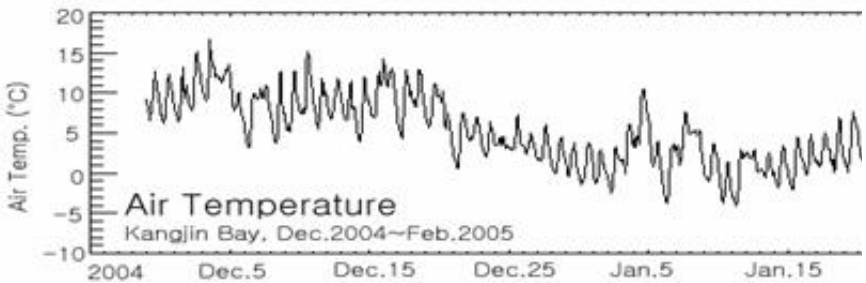
Air Temperature

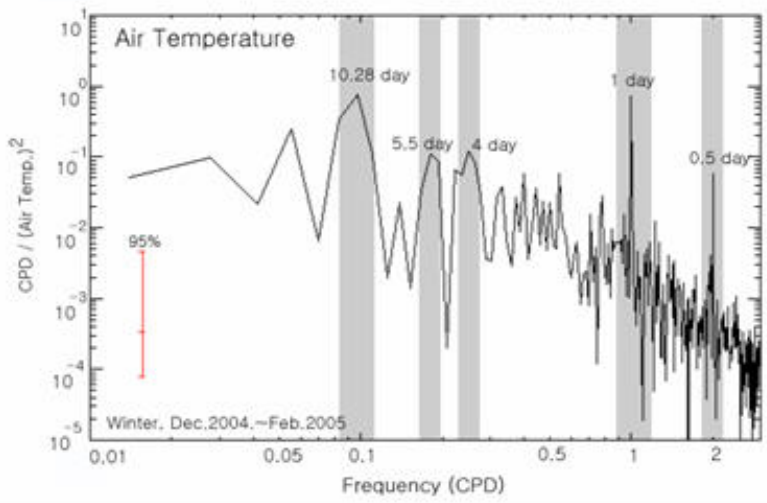
Summer





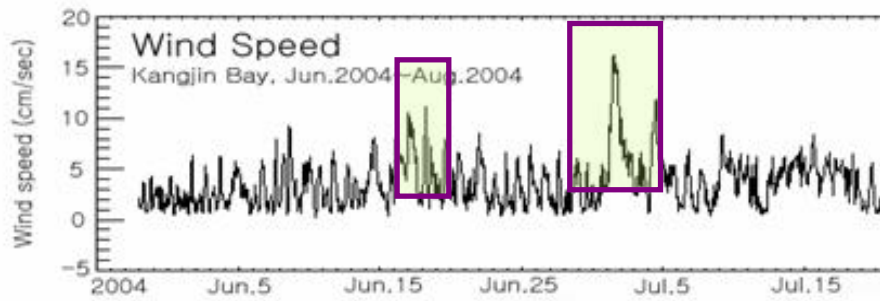
Winter

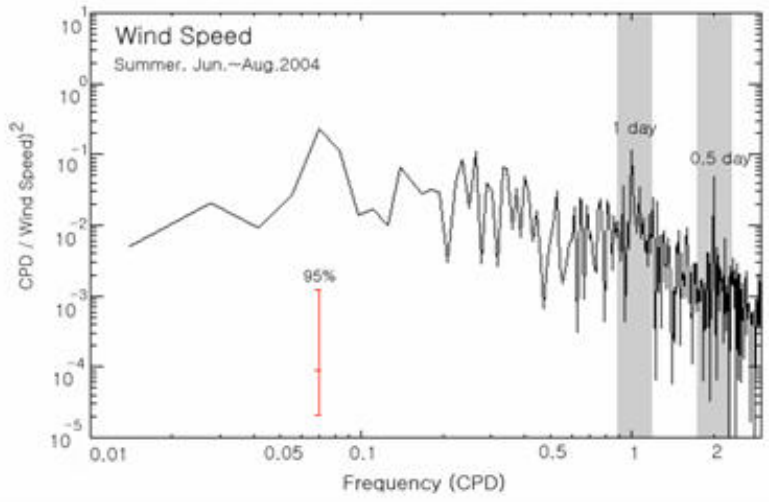




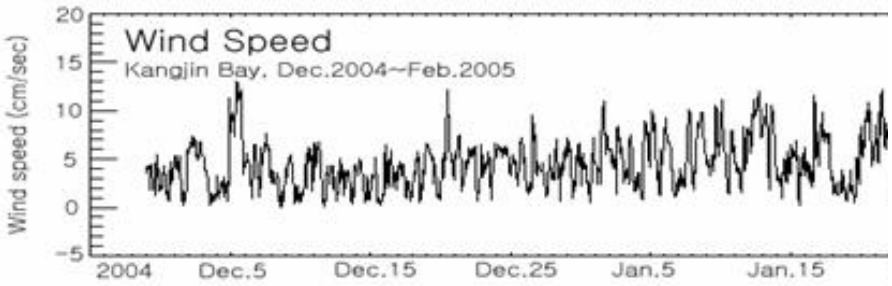
Wind Speed

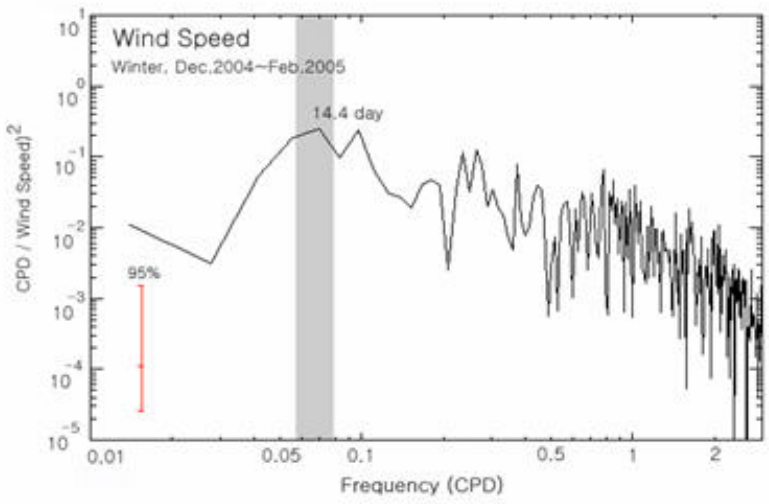
Summer





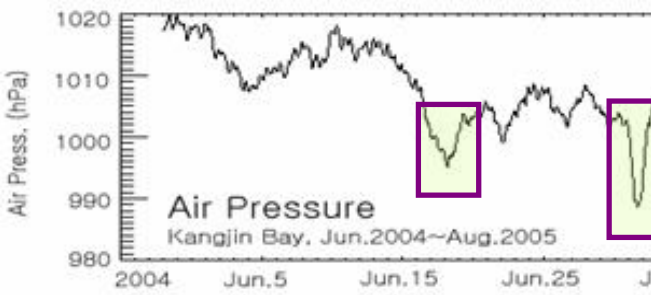
Winter



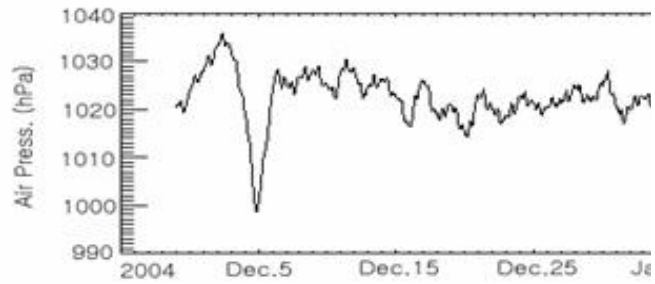


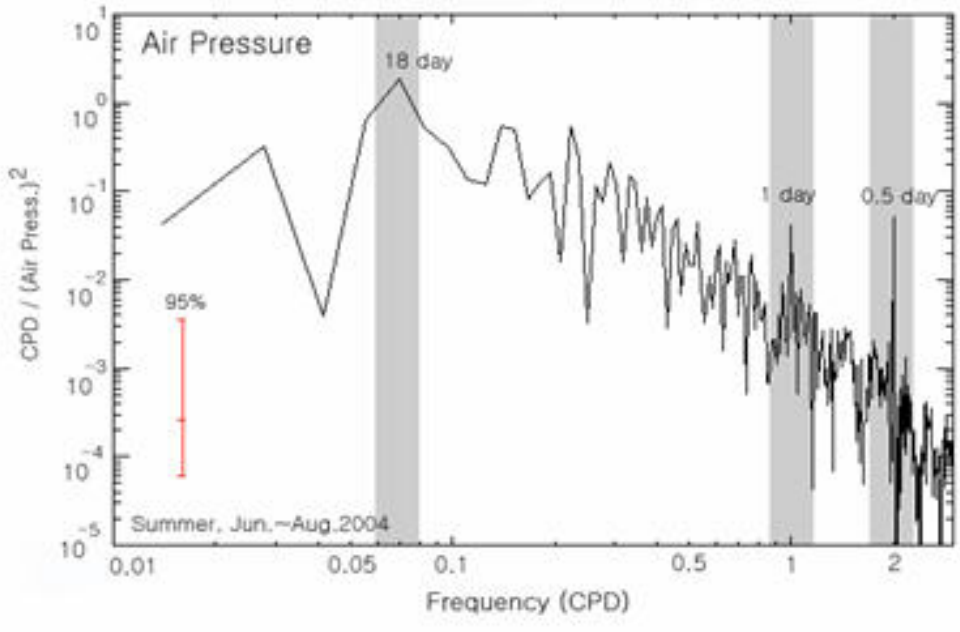
Air Pressure

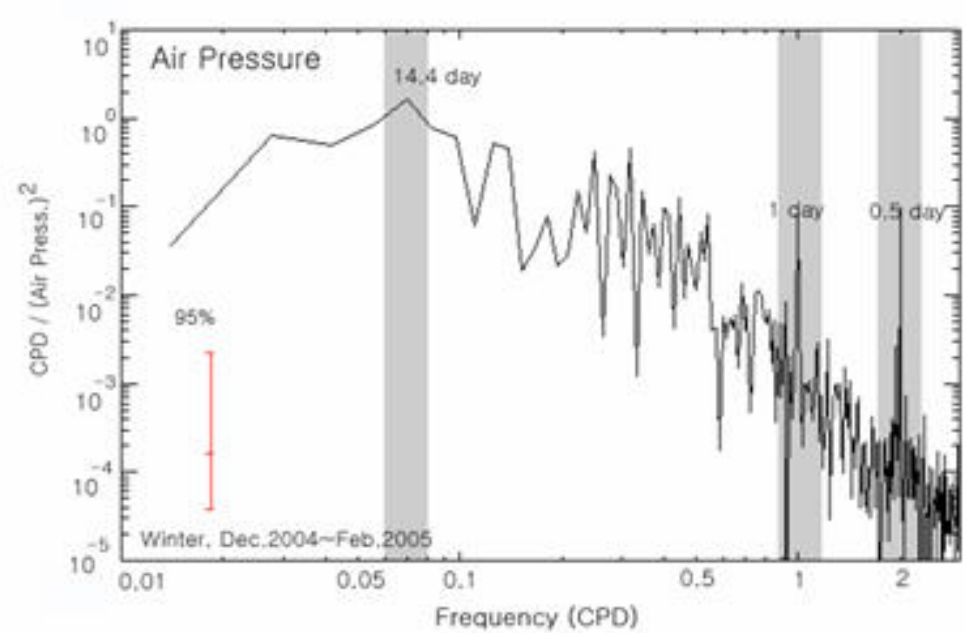
Summer



Winter







Meteor. Summary

Air Temp.

- Min. : −6.66 . (1. 17.), Max. : 38.49 . (7. 28.)
- Annual Mean : 14.4 .

Wind

- Mean : 4.97 m/sec
- Aug, Mean : 3.68 m/sec, Max : 16.6 m/sec
- Feb. Mean : 4.78 m/sec, Max : 15.9 m/sec

Pressure

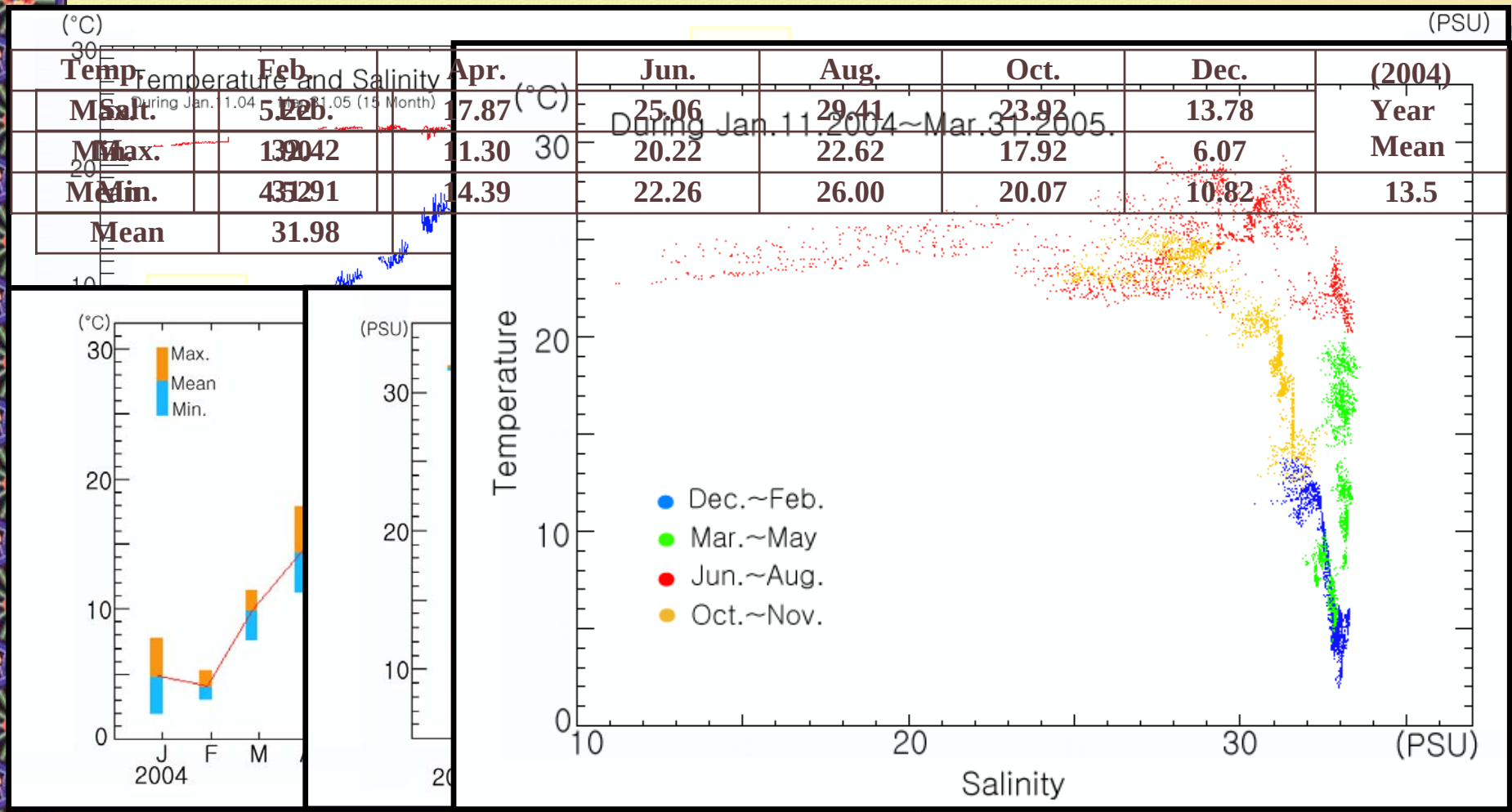
- Aug. . Min : 980.6 hPa, Max : 1013 hPa
- Feb. . Min : 1009.22 hPa, Max : 1032 hPa

Radiation

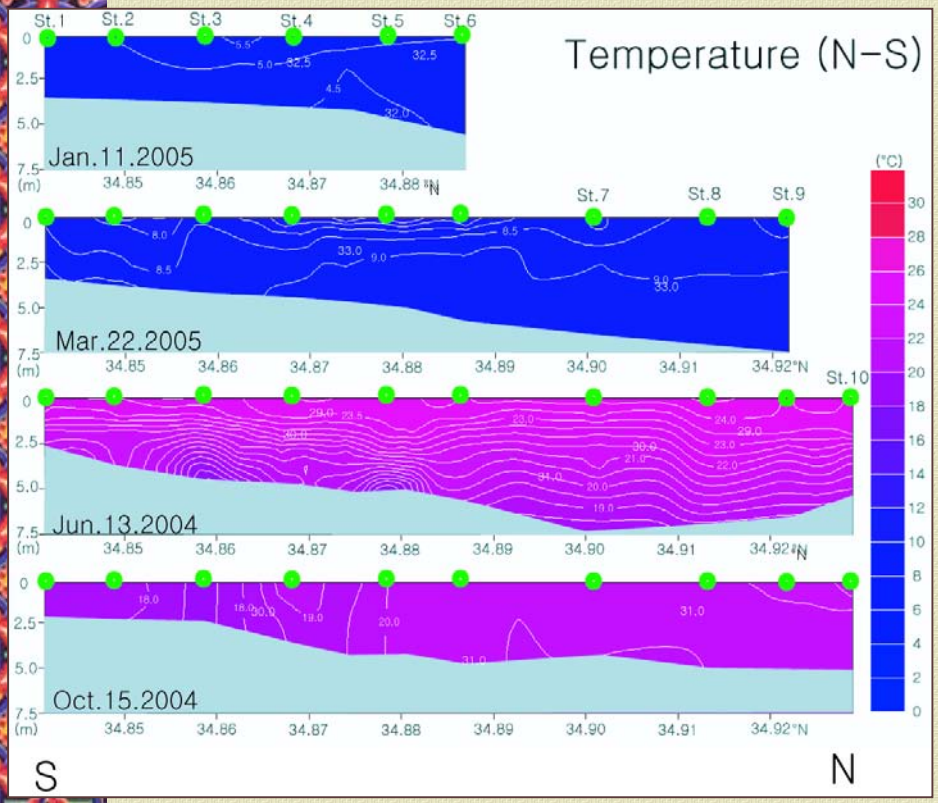
- Feb. : 230~270 W/m^2, Winter : 110~180 W/m^2
- Aug. .. : 1255 W/m^2, Feb. Min. : −13.6 W/m^2

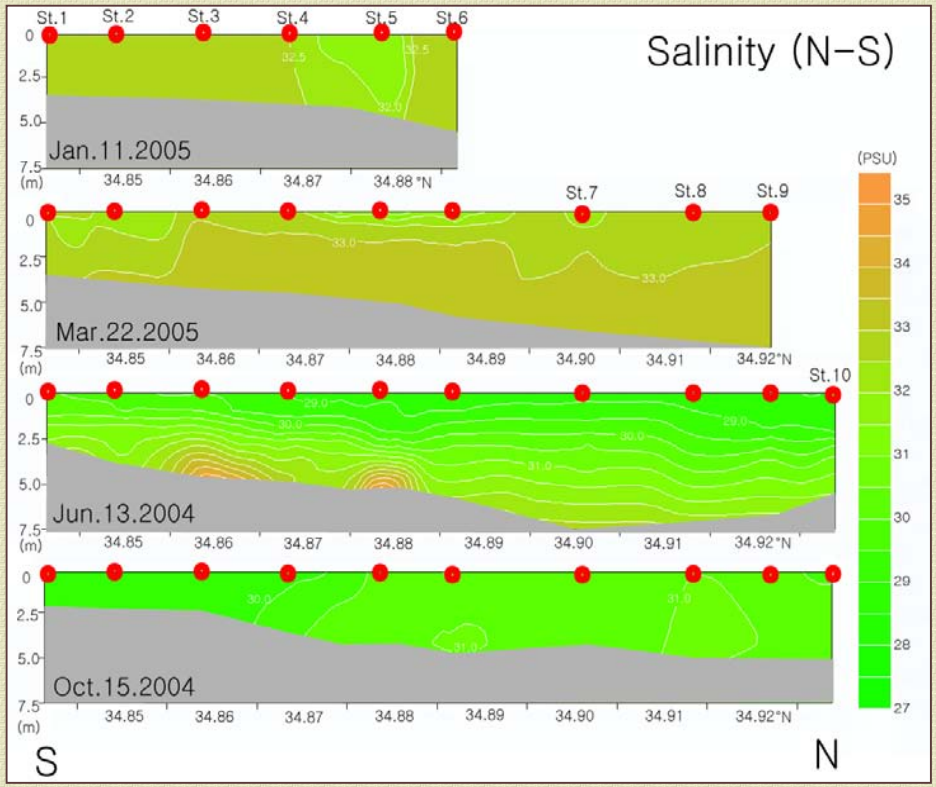
Seasonal Variation of Water Temp & Salinity

Temp.	Feb.	Apr.	Jun.	Aug.	Oct.	Dec.	(2004)
Max.	13.42	11.30	20.22	22.62	17.92	6.07	Year Mean
Min.	4.91	4.39	22.26	26.00	20.07	10.82	13.5
Mean	31.98						

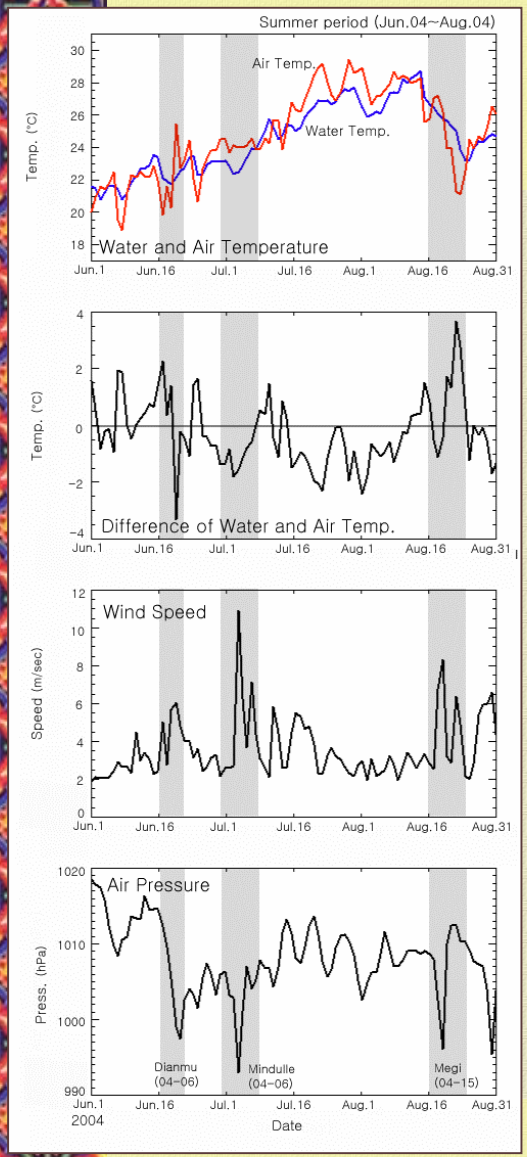


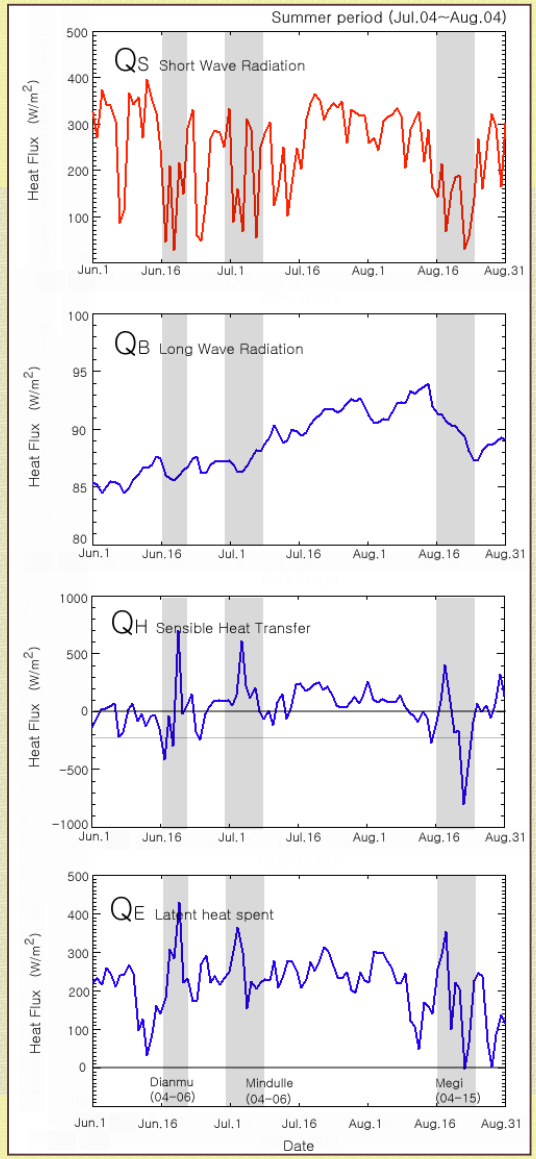
Vertical Structure of Temp. & Salinity

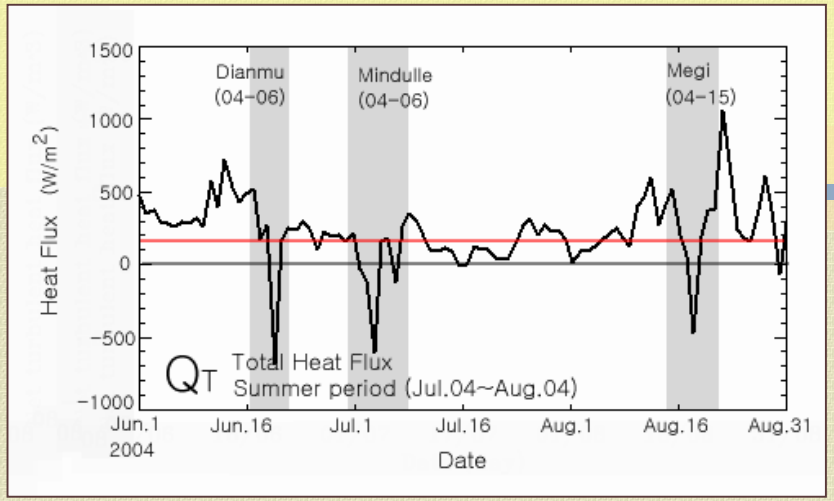




Water Temp. in Summer and Heat Flux

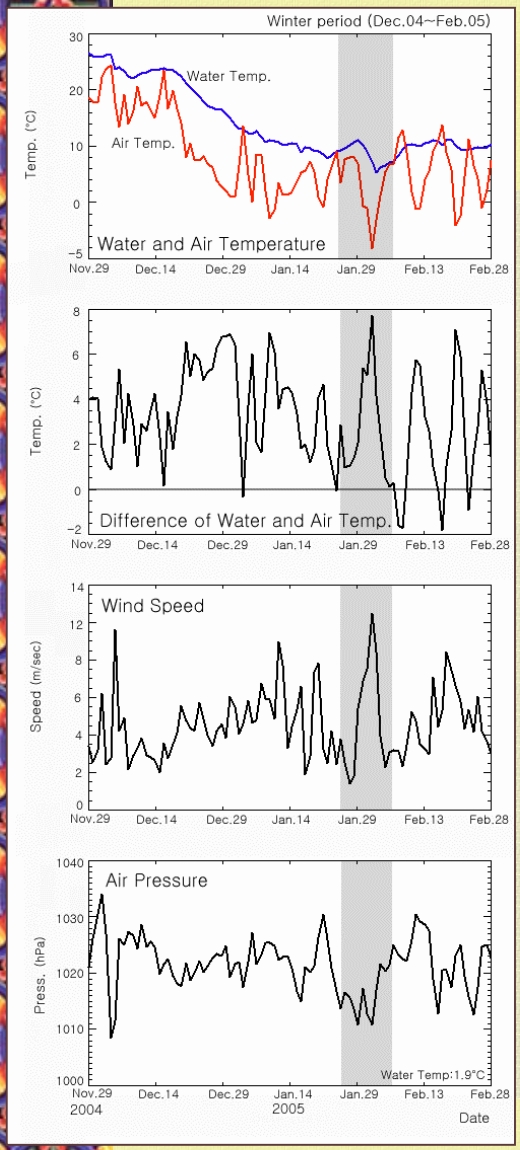


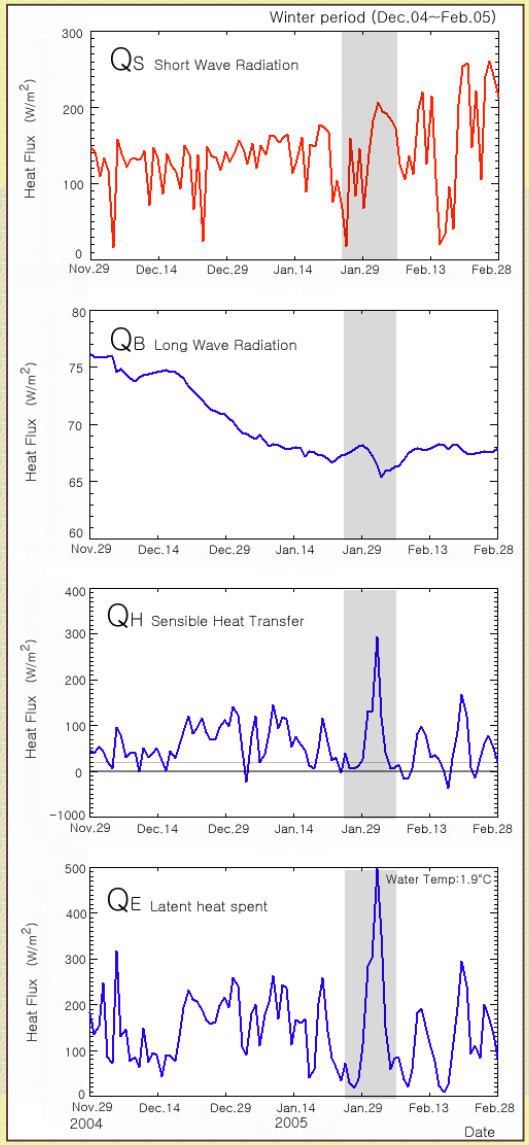


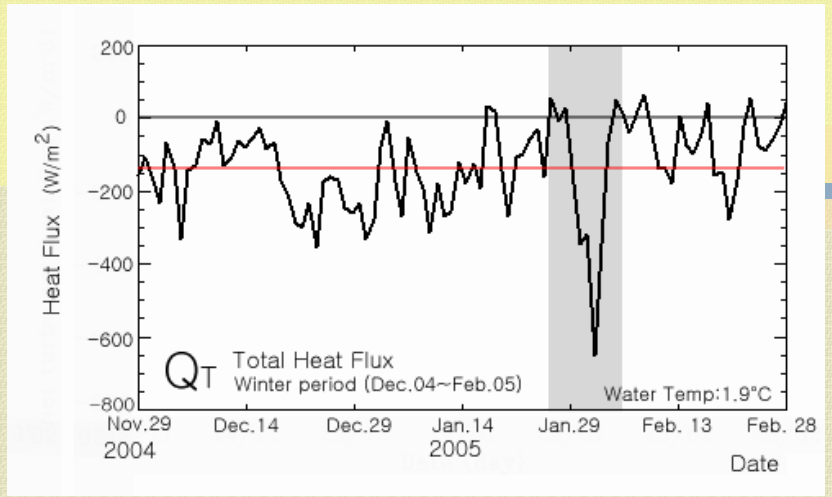


Summer	Qt	Qs	Qb	Qh	Qe
Dianmu	−88.6	142.5	86.0	161.6	296.7
Mindulle	−134.2	190.6	86.6	299.1	537.3
Megi	−69.8	151.0	90.7	203.4	333.5
Mean of Typhoon Period	−97.6	161.4	87.8	218.0	389.2
Mean of Summer Period	127.2	258.7	88.7	13.8	29.0

Water Temp. in Winter and Heat Flux







Winter	Qt	Qs	Qb	Qh	Qe
Mean of Cold Episode Period	−202.9	174.9	66.8	90.3	220.7
Mean of Winter Period	−132.7	138.7	69.8	56.8	144.7

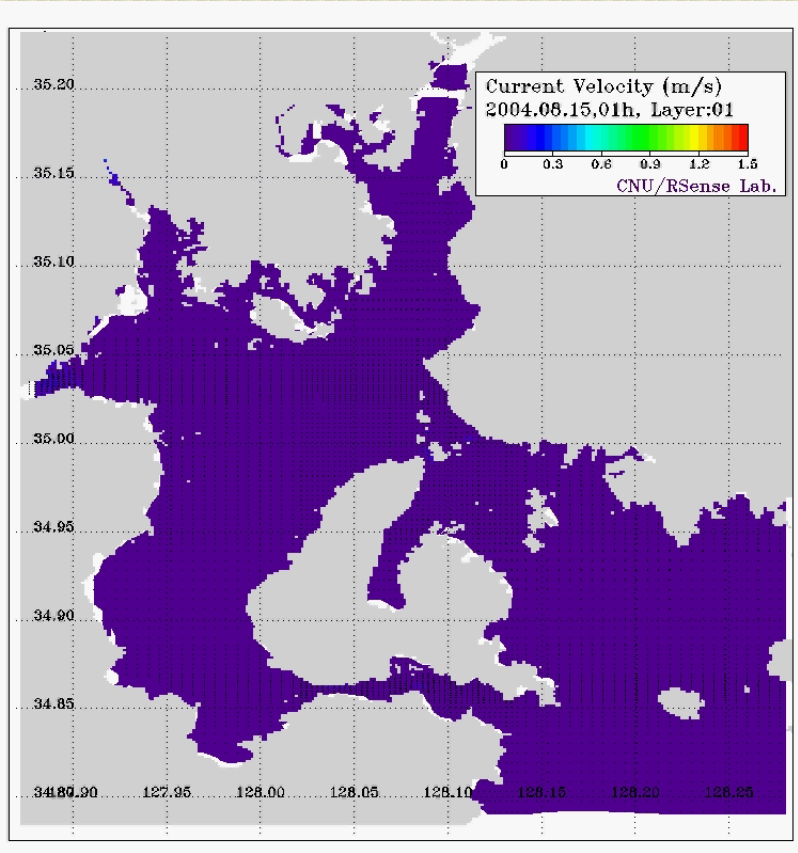
Summary for Temp & Salinity

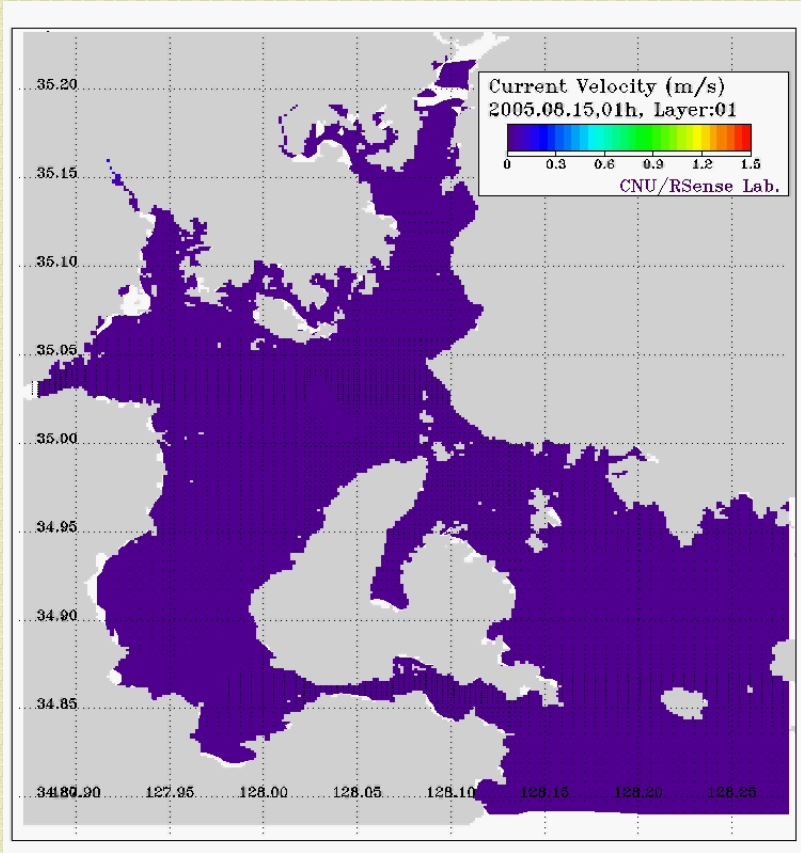
- Temp. Variation
  - 2004 1 , 2005 2 1.8˚C
  - 2004 8 29.4˚C
  - 27.3˚C, 21˚C
  - 4.5˚C/
- Salinity Variation
  - 8 10.63 PSU
  - 32 PSU, 4 33 PSU
  - 20 PSU

Tidal and Mixing Model

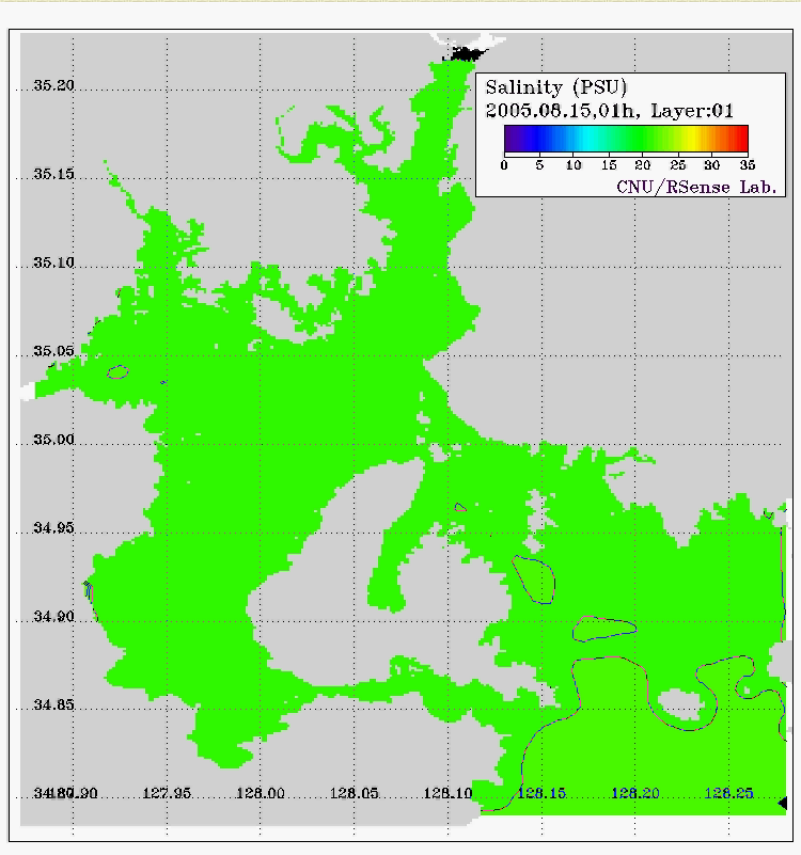
- .. .. ..
  - ... .
- DO Profile Conceptual Model

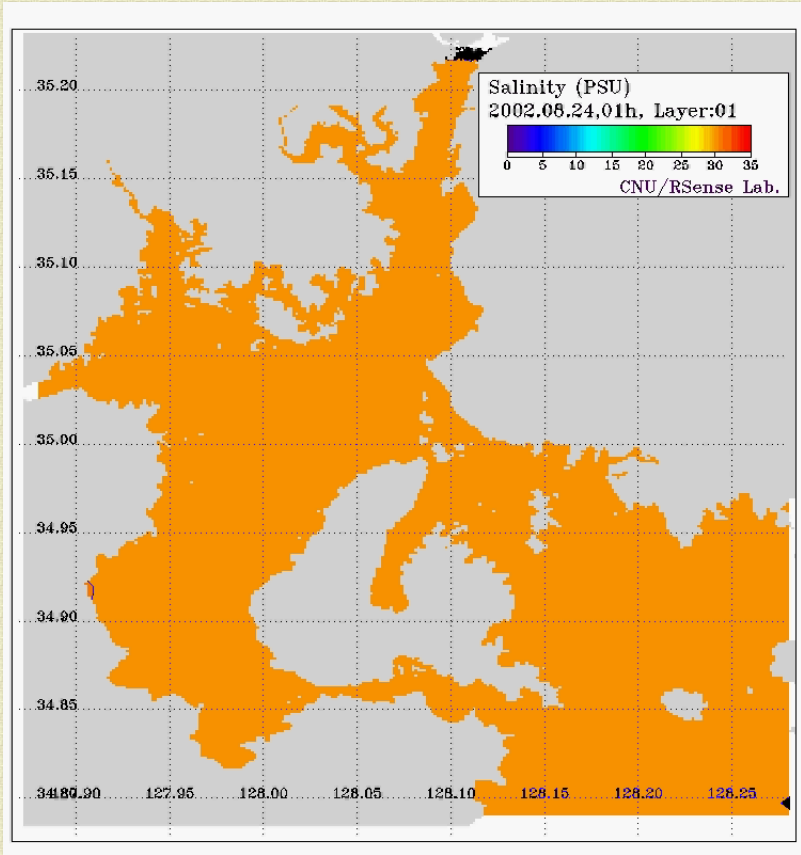
Animation : Tidal Current





Animation : Salinity





Discussion

- Variability of the hydrographic and hydrodynamic condition is so huge that the components of the KB ecosystem are exposed to such extreme condition. In shallow bottom, the water temperature in the KB is controlled by the seasonal solar radiation in summer as well as by the latent heat loss in winter time due to very cold and dry wind. It results in the huge range of 27.5 .. On the other hand, salinity in the KB also plays a critical role in the ecosystem associated with the mass death of the shell-fish. It is under direct influence of the river runoff in the summer season.
- Another critical factor in the ecosystem of the KB is dissolved oxygen. It is undergoing very complicated ecological processes such as photo-synthesis and respiration of animal along with abiotic physical and geochemical processes such as mixing and aeration in the surface layer and organic sediment consumption at the benthic boundary. These processes are investigated in other paper (Ro, 2005) in detail with the numerical modeling approach.

Thank You for Your Attentions