Technical Design and Operation of Far Sea Observing Network in the Yellow Sea

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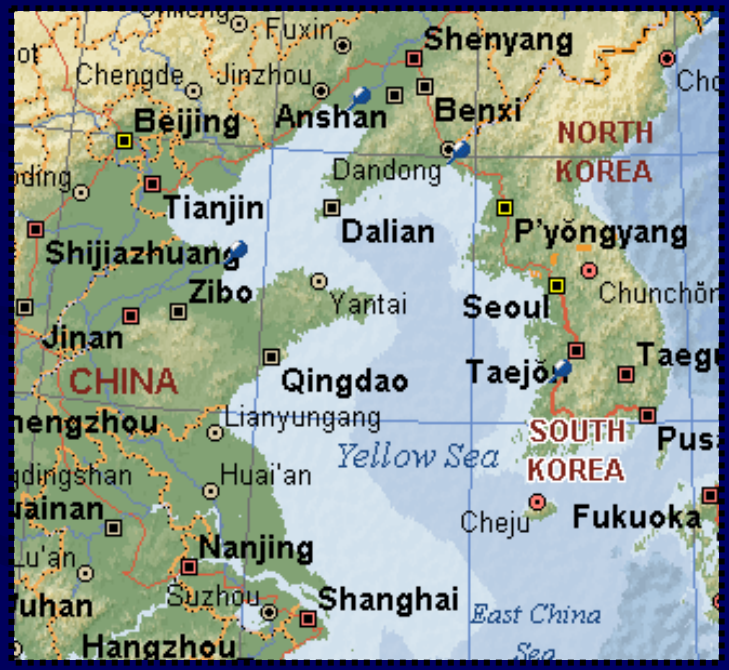
and M. Li et al.

Preface

- Semi-closed, shallow continent-typed sea.
- Large population (600 million)
- Important economic region with a highly development
- Growing industrialization and urbanization



→A big challenge to ocean science

Necessity

- Provide basic information for the ocean industries, environment protection, disaster mitigation and protection, and ocean development management

Nowcast and forecast of ocean status

- coverage
- high-resolution
- Long-term
- continuous
- (near) real-time

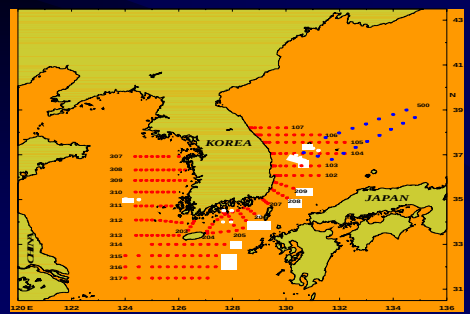
+

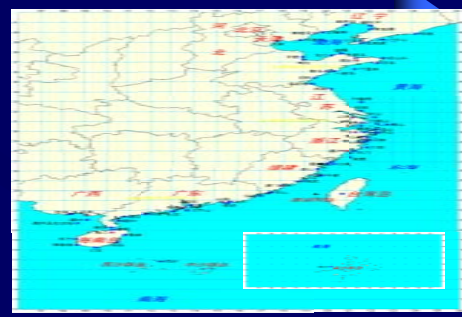
Especially in-situ data in the far sea without the land impact almost.

Monitoring Network

- Coastal station
- R/V, VOS
- Platform
- Satellite

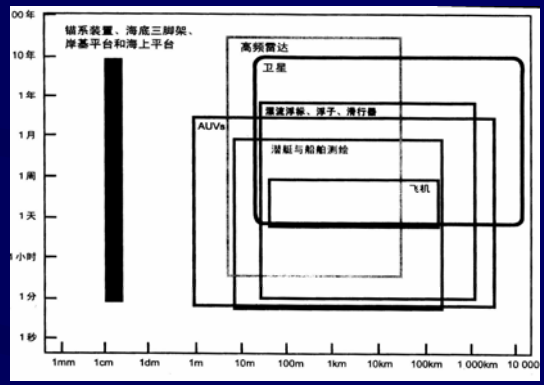
- Costal station, more accurate；
- R/V，less typical and less accurate;
- Remote Sensing，cover more space and continuously, quickly transmission; measuring was affected greatly by variation of mediums, not timely, limited variables
- Platform: high accuracy, good continues, used for bad environmental conditions

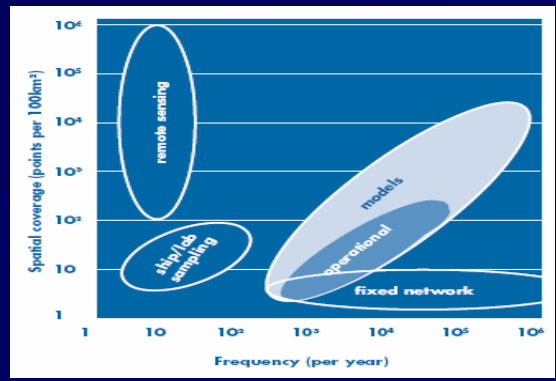




Fix-point Network

- More accurate predictions of extreme marine weather.
- Improved nowcasts and forecasts of wind and air pressure fields that can be used to drive hydro-dynamic models.
- Detection of transient events and subsurface features that would be missed by discrete sampling or remote sensing.
- More rigorous calibration and validation of satellite remote sensing and continuity of data on cloudy days.
- An expanded database of ocean variability which will improve our understanding of how the coastal ocean works, including ecosystem dynamics, and accelerate the development and validation of predictive models.





Other applications of fixed-point timeseries observations

- ground-truthing/verification of remote-sensing, modelling, forecasting
- geophysical (seismic etc) and bottom pressure (incl. tsunamis) data
- acoustic observations (tomography, biology)
- pollution monitoring
- testbeds for new instrumentation

Unique methodological benefits of fixed-point timeseries

- high vertical and temporal resolution from atmospheric boundary layer to abyss, on timescales from minutes to years
- large suite of sensors possible, giving many linked variables at one place
- fixed-point systems are required in regions of large currents and small spatial scales (e.g. boundary currents).
- only fixed-point autonomous systems can be combined with *in-situ* (ship) sampling programs (laboratory procedures)
- Fixed autonomous instrumentation allows post-calibration (or during ship visits) ⇨ reference/calibration for floats, remote sensing, ...
- Moored observatories are ideal for developing/testing new instrumentation

Initiating

Concept design and feasibility study (2003 – 2004)

2005.5, government approve

Technical design and action plan (2005)

2006.1, implementation agreement

Approve of technical design

Development Strategy

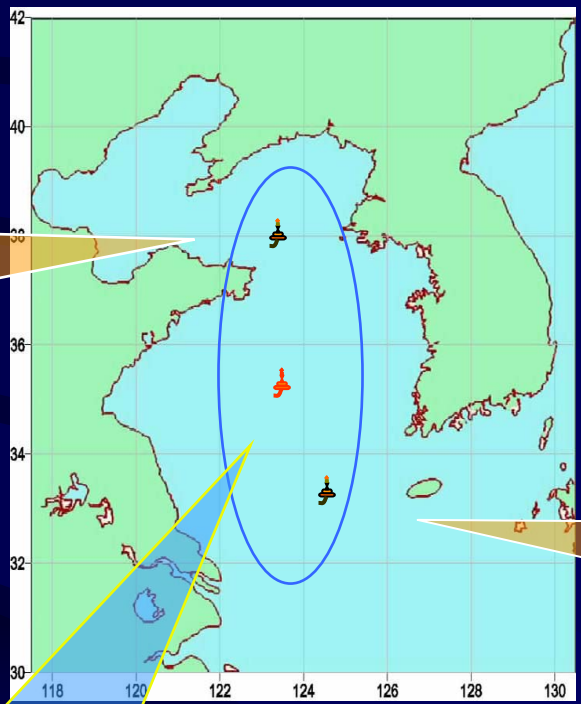
- Cooperation
- Integrated existed system
- Operational
- GOOS demand

Plan for the Far Sea Platform in YS

Name: No. 15 Buoy

Location: 38˚N, 123.5ºE

Agency: NCSFC/NCSB

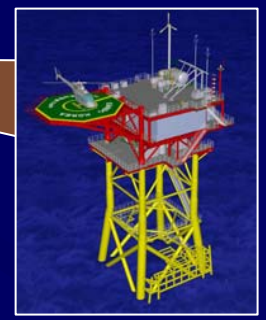


C-K Joint Buoy: 35 ˚N,124E ˚b

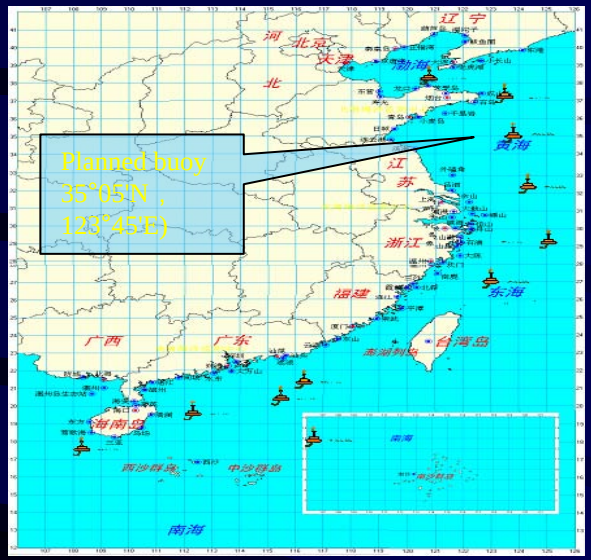
Name: Ieodo Ocean Station

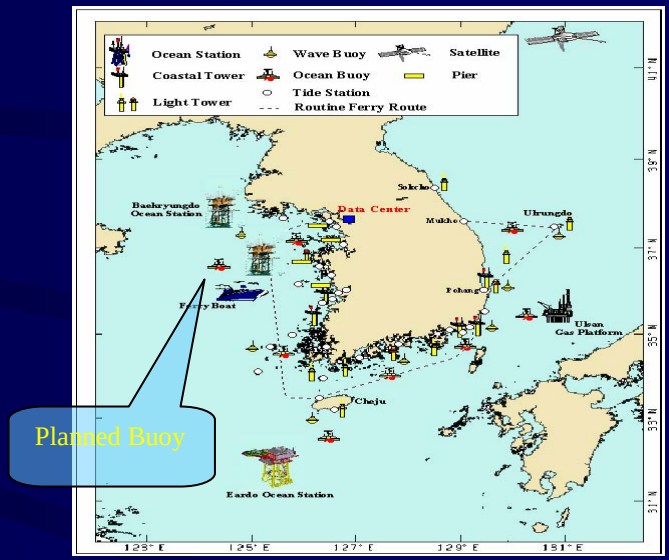
Location: 32 ˚ 07′22.63″N, 125 ˚10 ′56.81 ″E

Agency: KORDI



Feasibility



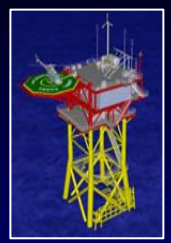


- Sustainable, Cost-effective, Risk protection

Observed Objects

Items	No. 15 Buoy	Ieodo Ocean Sta.	New Buopy
Air speed & dir.	×	×	×
Air pressure	×	×	×
Air temp.	×	×	×
Humidity	×	×	×
Wave	×	×	×
SST	×	×	×
SSS	—	×	×
Surface current	×	×	×
PH	—	×	×
DO	—	×	×
Turbidity	—	×	×
Chlorophyll	—	×	×
Current profile	×	×	×

Data Flow



NCSFC

NCSB

KORDI

Real-time DB

Historic DB

Backup DB

Real-time DB

Historic DB

Multi Users

Multi Users

Data Policy

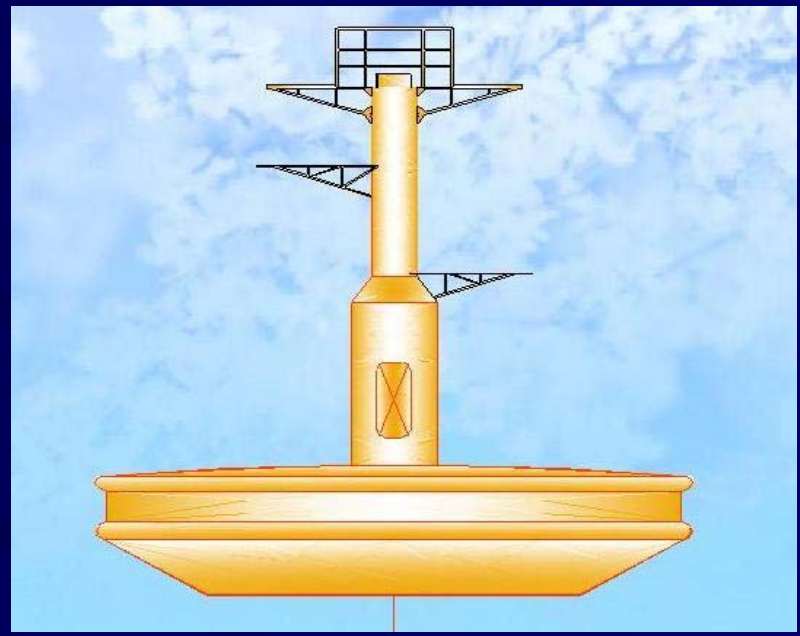
- C-K Buoy
  - Real-time exchange
- No. 15 Buoy / Ieodo Ocean Station
  - 8 times/day
  - WMO standard time

- Focal Point
  - Dr. Tao YAN
    - NCSFC
    - Tel: ＋86-532-85646037
    - E-mail: mfcenter@public.qd.sd.cn
  - Dr. Kwan-Soon Park
    - KORDI
    - +82-31-400-6343
    - E-mail: kspark@kordi.re.kr

C-K Buoy Design

- Three main concern:
  - operational experiences
  - manly attack
  - atrocious environment

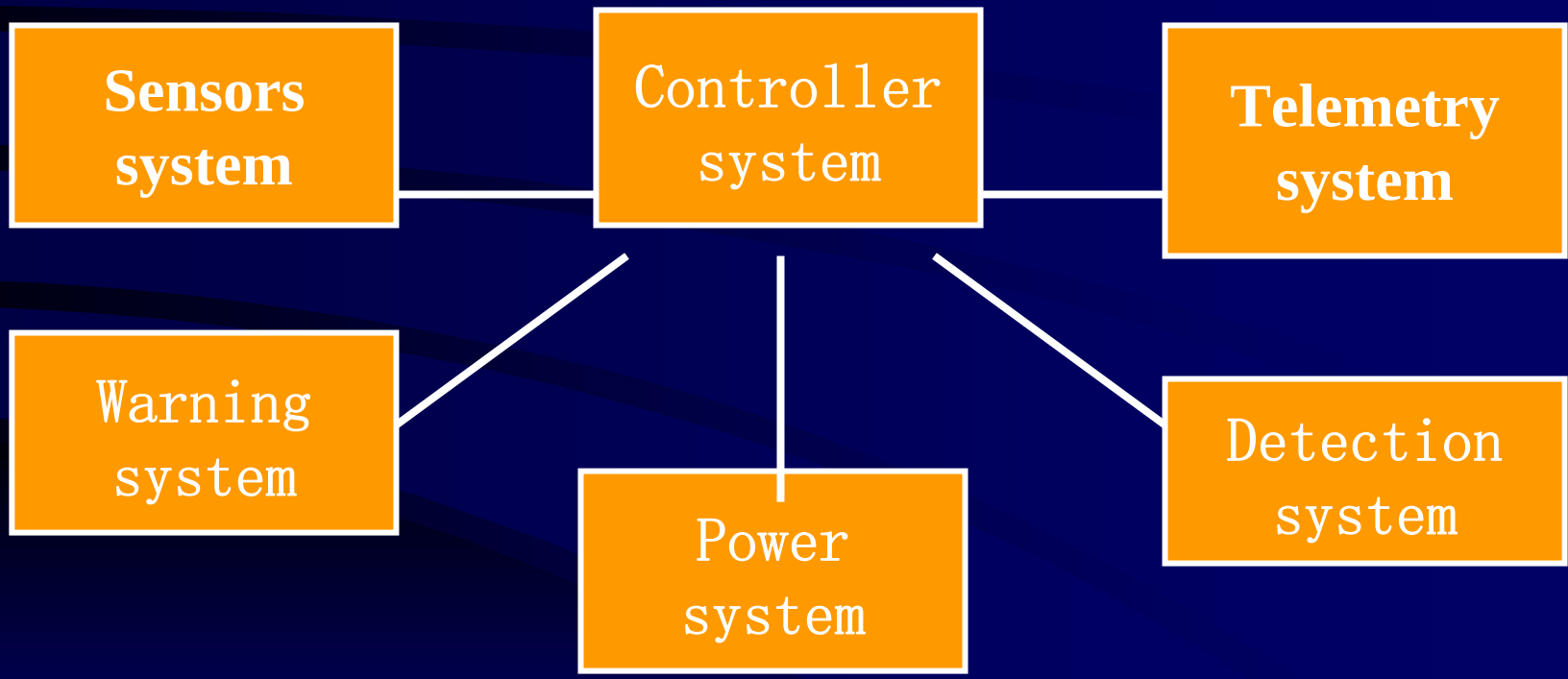
- 10m Disc Hull



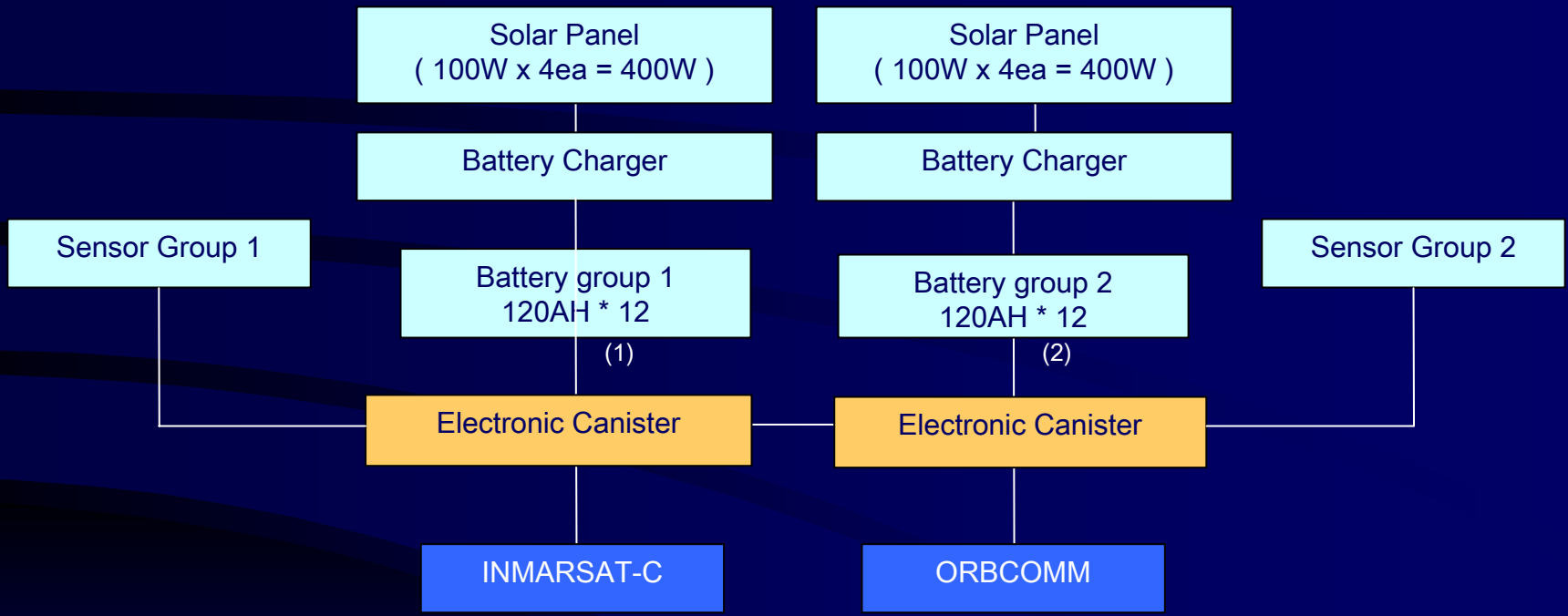
Technical Design

Parameters	range	accuracy	resolution
Wave	height：0.5m～25m period：3s～30s	±(0.3+H*10%)m	0.1m
Wind speed	0.3m/s ～ 80m/s	±(0.5+0.05×V)m/s	0.1m/s
Wind dir.	0° ～360°	±5°	±3°
air temp.	-50℃～+50℃	±0.2℃	
Air pressure	850hpa ～ 1050hpa	±0.5hpa	±0.1
SST	-3℃～+35℃	±0.1℃	
Wave dir.	0° ～360°	±5°	1°
Humidity	0 ～100%	5%	1%
方 位	0° ～360°	±5°	
Current	0.05～2.55m/s	±5%	
Flow dir.	0° ～360°	±10 °	
surface salinity	0～40	±0.05	±0.01
DO	0～50mg/L	0.2	0.01
pH	0～14	±0.2	0.01
Conductivity	100mS/cm	±5%	
turbidity	0～1000NTU	±5%	0.1NTU
Chl.	0～200μg/l	5%	1 μg/l

Framework


Sensors system
Controller system
Telemetry system
Warning system
Power system
Detection system

Technical Design Proposal



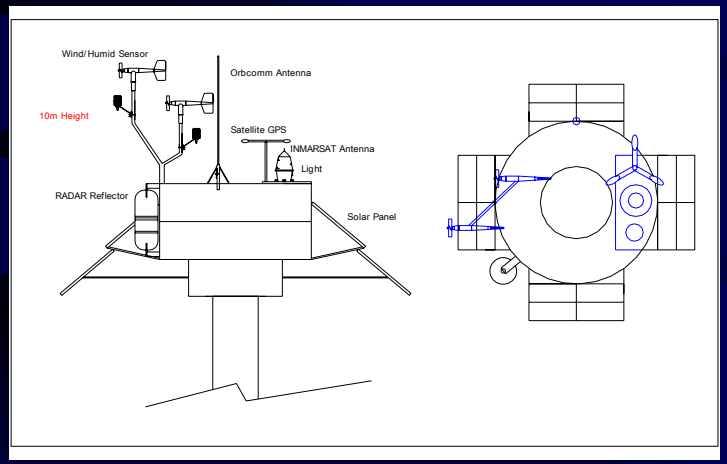
- Separated to two groups to prepare power failure
- Dual Sensor, Dual Power, Dual Transmission System

Components Overview

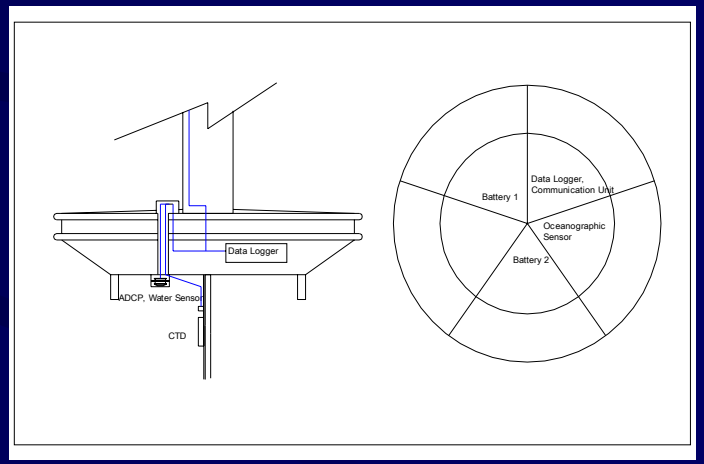
Device		Manufacturer	Model
Meteorological Sensors	Wind Sensor	R.M.YOUNG	05106
	Temp./Humid Sensor	VAISALA	HMP45A
	Barometer	VAISALA	PTB100A
	Wave Sensor	Datawell	Hippy 40
Oceanographic Sensors	Water Temp. Salinity	SBE	SBE 37-IM
	Current Profiler	RDI	Workhorse Monitor -300
	Turbidity Sensor	ALEC	AAQ1183
	DO Sensor	ALEC	AAQ1183
Positioning Sensors	DGPS	Furono	SC110
	Gyro Compass	NAVICO	HS8000
Controller, Transmitter	Data Logger	OTRONIX	OBDL-2000
	Transmitter	Stellar	ST-2500
Power supply	Solar Panel	Haesung	HSLTF-100W
	Battery	VOLTA	VT12120
	Battery charger	OTRONIX	BC-01
ETC	Signal Lantern	TIDELAND	ML-140 MaxLumina
	Radar Reflector	FIRDELL	210-7

Installation

Meteorological Sensor

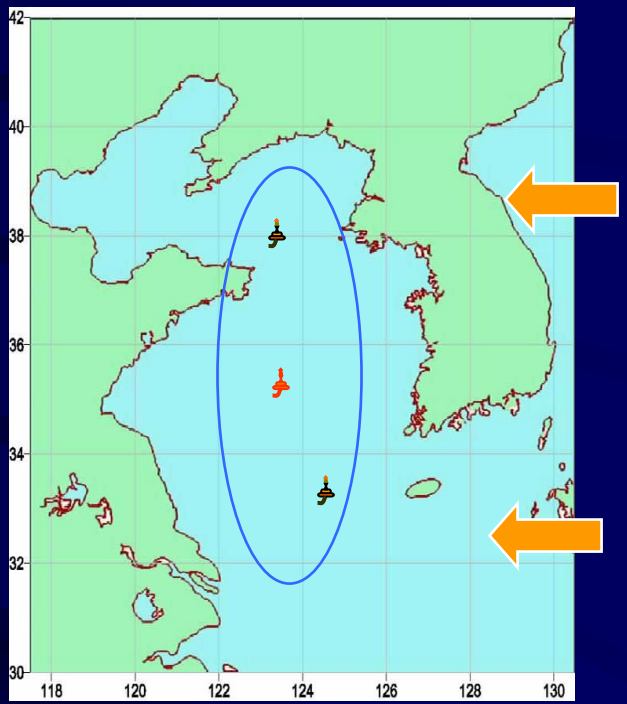


Oceanographic Sensor



Maintenance

- Regular maintenance
- Emergency maintenance
- Patrol: airplane, vessel



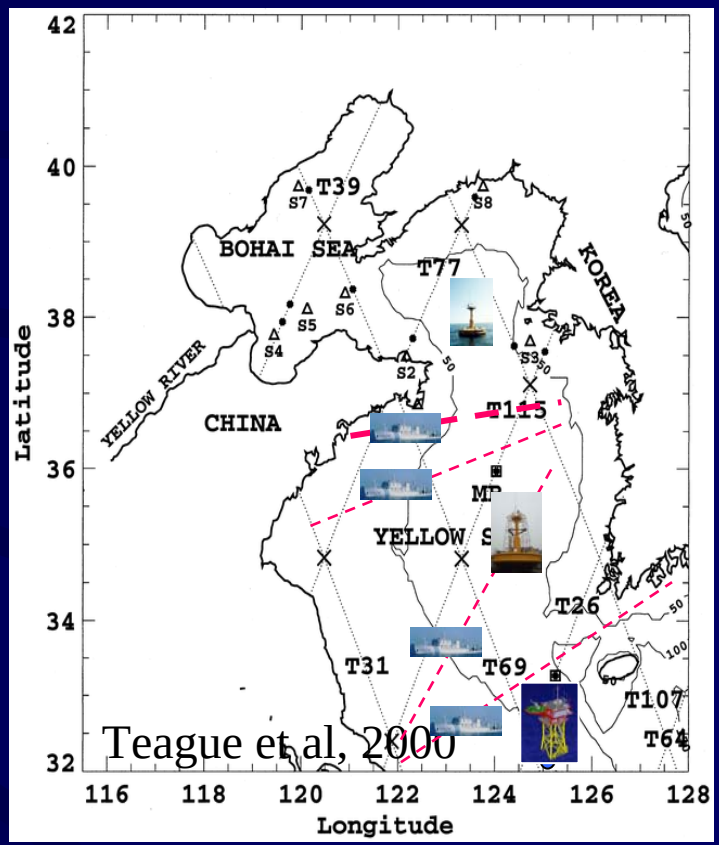
Buoy-operated Vessel

- Length: 74m
- Width: 10m
- Weight: 1,200 tonnages
- Speed: 16 knots
- Voyage: 4,000 miles

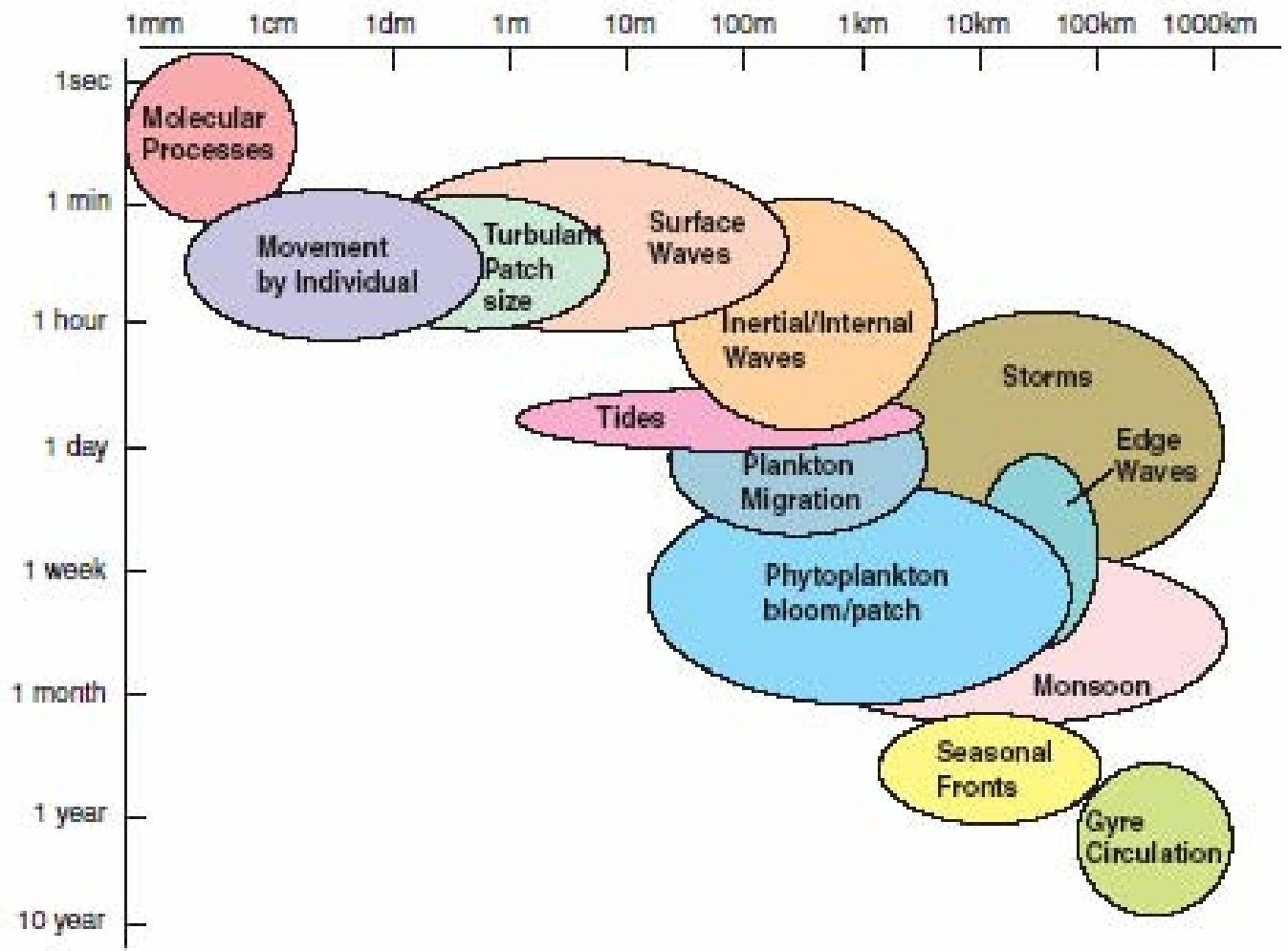

Buoy berth
Buoy experimental station

Experimental Station at sea

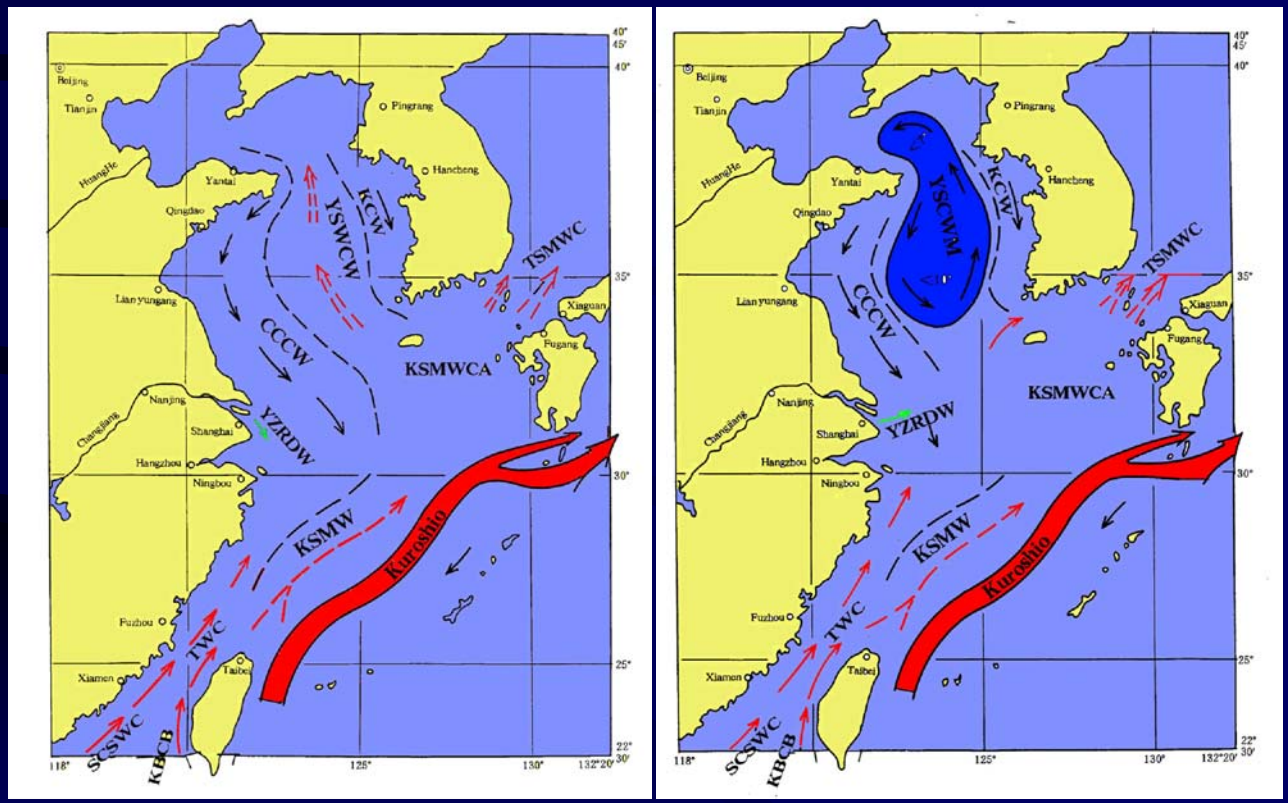
Discussion and Conclusion



Teague et al, 2000


1mm
1cm
1dm
1m
10m
100m
1km
10km
100km
1000km
1sec
1 min
1 hour
1 day
1 week
1 month
1 year
10 year
Molecular Processes
Movement by Individual
Turbulent Patch size
Surface Waves
Inertial/Internal Waves
Storms
Tides
Edge Waves
Plankton Migration
Phytoplankton bloom/patch
Monsoon
Seasonal Fronts
Gyre Circulation

YSWC and YS-CWM



Thanks for your attention!