5.14 Continuous monitoring of surface seawater

(1) Personnel

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(2) Objective

Our purpose is to obtain temperature, salinity, dissolved oxygen, and fluorescence data continuously in near-sea surface water.

(3) Instruments and Methods

The Continuous Sea Surface Water Monitoring System (Marine Works Japan Co. Ltd.) has five sensors and automatically measures temperature, salinity, dissolved oxygen and fluorescence in near-sea surface water every one minute. This system is located in the "*sea surface monitoring laboratory*" and connected to shipboard LAN-system. Measured data, time, and location of the ship were stored in a data management PC. The near-surface water was continuously pumped up to the laboratory from about 4.5 m water depth and flowed into the system through a vinyl-chloride pipe. The flow rate of the surface seawater was adjusted to be 10 dm³ min⁻¹.

- Software

Seamoni-kun Ver.1.50

- Sensors

Specifications of the each sensor in this system are listed below.

a) Temperature and Conductivity sensor

Model:	SBE-45, SEA-BIRD ELECTRONICS, INC.
Serial number:	4552788-0264
Measurement range:	Temperature -5 to +35 °C
	Conductivity 0 to 7 S m ⁻¹
Initial accuracy:	Temperature 0.002 °C
	Conductivity 0.0003 S m ⁻¹
Typical stability (per m	nonth):
	Temperature 0.0002 °C
	Conductivity 0.0003 S m ⁻¹
Resolution:	Temperatures 0.0001 °C
	Conductivity 0.00001 S m ⁻¹

b) Bottom of ship thermometer

Model:	SBE 38, SEA-BIRD ELECTRONICS, INC.	
Serial number:	3852788-0457	
Measurement range:	-5 to +35 °C	
Initial accuracy:	±0.001 °C	
Typical stability (per 6 month): 0.001 °C		
Resolution:	0.00025 °C	

c) Dissolved oxygen sensor

Model:	OPTODE 3835, AANDERAA Instruments.	
Serial number:	1915	
Measuring range:	0 - 500 μmol dm ⁻³	
Resolution:	$< 1 \ \mu mol \ dm^{-3}$	
Accuracy:	$< 8 \ \mu mol \ dm^{-3}$ or 5 % whichever is greater	
Settling time:	< 25 s	

d) Dissolved oxygen sensor

RINKO II, JFE ADVANTECH CO. LTD.	
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0 - 540 μmol dm ⁻³	
$< 0.1 \ \mu mol \ dm^{-3}$	
or 0.1 % of reading whichever is greater	
$< 1 \ \mu mol \ dm^{-3}$	
or 5 % of reading whichever is greater	

e) Fluorescence & Turbidity sensor

Model:	C3, TURNER DESIGNS
Serial number:	2300384
Measuring range:	Turbidity 0 - 3000 NTU
Minimum Detection Limit:	Turbidity 0.05 NTU

(4) Observation log

Periods of measurement, maintenance, and problems during MR15-04 are listed in Table 5.14.

System Date	System Time	Events	Remarks
[UTC]	[UTC]		
2015/11/06	08:41	All the measurements started and data	Start observation
		was available.	
2015/11/13	16:33	All the measurements stopped.	Enter to Philippine
			EEZ
2015/11/15	03:00	All the measurements started.	Observation
			permitted from
			Indonesian
			Security Officer
2015/11/23	19:02	All the measurements stopped.	Maintenance
2015/11/23	19:52	All the measurements started.	Logging restart
2015/11/26	21:34	All the measurements stopped.	Maintenance
2015/11/26	21:40	All the measurements started.	Logging restart
2015/11/30	19:01	All the measurements stopped.	Maintenance
2015/11/30	19:55	All the measurements started.	Logging restart
2015/12/07	19:01	All the measurements stopped.	Maintenance
2015/12/07	19:48	All the measurements started.	Logging restart
2015/12/14	19:02	All the measurements stopped.	Maintenance
2015/12/14	19:49	All the measurements started.	Logging restart
2015/12/19	00:05	All the measurements stopped.	End observation

Table 5.14: Events list of the Sea surface water monitoring during MR15-04

We took the surface water samples once a day to compare sensor data with bottle data of salinity, dissolved oxygen and chlorophyll *a*. The results are shown in Fig. 5.14-2-1 ~ 5.14-2-3. All the salinity samples were analyzed by the Guideline 8400B "AUTOSAL" (see 5.17), and dissolved oxygen samples were analyzed by Winkler method (see 5.18), chlorophyll *a* were analyzed by 10-AU (see 5.20).



Figure 5.14-1: Spatial and temporal distribution of (a) temperature [$^{\circ}$ C], (b) salinity [PSU], (c) dissolved oxygen [µmol kg⁻¹], (d) fluorescence, and (e) turbidity [NTU] in MR15-04 cruise.