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R/V MIRAI Cruise Report

MR17-01

R/V Mirai Performance check test

Off Kiisuido,Off Shikoku,Around Amami Plateau

May.12,2017-May.18,2017

Japan Agency for Marine-Earth Science and Technology

(JAMSTEC)

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1. Cruise Information

Cruise ID：MR17-01

Name of vessel：R/V　Mirai

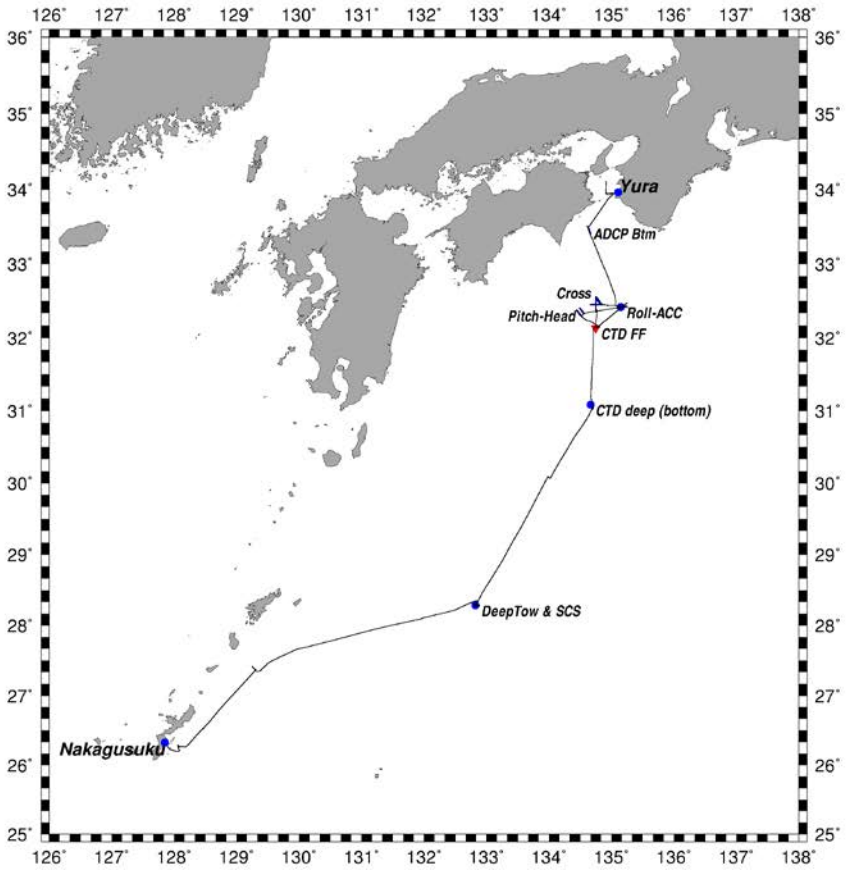
Title of the cruise：R/V　Mirai　Performance check test

Cruise period：May.12,2017-May.18,2017

Ports of departure / call / arrival：Ura/Nakagusuku

Research area：Off Kiisuido,Off Shikoku,Around Amami Plateau

Research Map



2. Researchers

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Onboard Researchers

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Senior Technical Scientist	Hiroshi Uchida	Senior Technical Scientist ,JAMSTEC
Senior Scientist	Fumikazu Taketani	Senior Scientist ,JAMSTEC
Engineer(Ⅱ)	Yosaku Maeda	Engineer(Ⅱ),JAMSTEC
Scientist	Saki Kato	Student,the Univ.Fukuoka
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Marine Technician	Shinya Okumura	N ippon Marine Enterprises,Ltd
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Marine Technician	Kazuho Yoshida	Nippon Marine Enterprises,Ltd
Marine Technician	Ryo Oyama	Nippon Marine Enterprises,Ltd
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Marine Technician	Hiroyuki Hayashi	N ippon Marine Enterprises,Ltd
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Marine Technician	Rei Ito	Marine Works Japan,Ltd.
Marine Technician	Sonoka Tanihara	Marine Works Japan,Ltd.
Marine Technician	Keisuke Takeda	Marine Works Japan,Ltd.
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Marine Technician	Yasuhiro Arii	Marine Works Japan,Ltd.
Marine Technician	Hiroyasu Sato	Marine Works Japan,Ltd.
Marine Technician	Hiroshi Hoshino	Marine Works Japan,Ltd.

Marine Technician	Nagisa Fujiki	Marine Works Japan,Ltd.
Marine Technician	Misato Kuwahara	Marine Works Japan,Ltd.
Marine Technician	Masahiro Orui	Marine Works Japan,Ltd.
Marine Technician	Emi Deguchi	Marine Works Japan,Ltd.
Marine Technician	Atsushi Ono	Marine Works Japan,Ltd.
Marine Technician	Keitarou Matsumoto	Marine Works Japan,Ltd.
Marine Technician	Katsunori Sagishima	Marine Works Japan,Ltd.
Marine Technician	Y uusuke Sato	Marine Works Japan,Ltd.
Marine Technician	Yukihiko Nakano	Marine Works Japan,Ltd.
Marine Technician	Y uki Miyajima	Marine Works Japan,Ltd.
Marine Technician	Takehiro Kanii	Marine Works Japan,Ltd.

3. Observation

3.1 Total dissolved gas and related measurements

(1) Objectives

To test a newly introduced dissolved gas sensor for the surface water measurements of the surface water monitoring system and the CTD/water sampling system.

(2) Instruments

Total gas sensor:

HGTD-Pro, model 0-30 PSI, serial number 37-394-10, Pro Oceanus Systems Inc.

Thermosalinograph:

Temperature and conductivity sensor: SBE 45, serial number 4563325-0362, Sea-Bird Electronics Inc.

Bottom of ship thermometer: SBE 38, serial number 3857820-0540, Sea-Bird Electronics Inc.

Dissolved oxygen sensor: RINKO-II, serial number 0035, JFE Advantech Co. Ltd.

Fluorescence sensor: C3, serial number 2300123, Turner Designs

CTD:

SBE 9plus, serial number 0677-79511, Sea-Bird Electronics Inc.

Temperature, serial number 03P4418 (primary) and 03P4421 (secondary), Sea-Bird Electronics Inc.

Conductivity, serial number 042240 (primary) and 043063 (secondary), Sea-Bird Electronics Inc.

Fluorometer, serial number 3700 (primary) and 3618 (secondary), Seapoint Sensors Inc.

Turbidity meter, serial number 14953, Seapoint Sensors Inc.

PAR, serial number 1025, Biospherical Instruments Inc.

Altimeter, serial number 1100, Teledyne Benthos Inc.

Salinometer:
AUTOSAL 8400B, serial number 62827, Guildline Instruments Ltd.
Standardization, IAPSO Standard Seawater batch P160, Ocean Scientific International Ltd.

Dissolved oxygen titlator:
DOT-01X, serial number 138558002 and 138558003, Kimoto Electronics Co. Ltd.
Reference material for iodometry, lot no. K1605D07, Marine Works Japan Ltd.

Fluorometer for measurement of chlorophyll-*a*:
10-AU-005, serial number 0134-LRXX and 1100349, Turner Designs
Reference material, a pure chlorophyll-*a*, Sigma-Aldrich Co. LLC
Filter to be used, Whatman GF/F filter (diameter 25 mm)
Method to be used, Fluorometric "Non-acidification method" (Welschmeyer, 1994)

Atmospheric pressure:
Barometer, model 370, Setra Systems (Mirai surface meteorological observation system)
Location, Captain deck (21 m from surface)
Compensation for altitude from sea surface was applied for the barometer reading.

(3) Data processing and quality control

Data from the Continuous Sea Surface Water Monitoring System were obtained at 1-minute intervals. These data were processed as follows. Spikes in the temperature and salinity data were removed using a median filter with a window of 3 scans (3 minutes) when difference between the original data and the median filtered data was larger than 0.1ºC for temperature and 0.5 for salinity. Data gaps were linearly interpolated when the gap was ≤ 13 minutes. Fluoromete and turbidity data were low-pass filtered using a median filter with a window of 3 scans (3 minutes) to remove spikes. Raw data from the RINKO oxygen sensor, fluorometer and turbidity data were low-pass filtered using a Hamming filter with a window of 15 scans (15 minutes).

Salinity (S [PSU]), dissolved oxygen (O [µmol/kg]), and fluorescence (Fl [RFU]) data were corrected using the water sampled data. Corrected salinity (Scor), dissolved oxygen (Ocor), and estimated chlorophyll a (Chl-a) were calculated from following equations

$$Scor\ [PSU] = c0 + S$$

$$Ocor\ [\mu mol/kg] = c0 + O + c1\ t$$

$$Chl\text{-}a\ [\mu g/L] = c0 + c1\ Fl$$

where S is practical salinity, t is days from a reference time (2017/05/13 01:40 [UTC]), T is temperature in ºC. The best fit sets of calibration coefficients were determined by a least square technique to minimize the deviation from the water sampled data. The calibration coefficients were listed in Table 3.1.1. Comparisons between the Continuous Sea Surface Water Monitoring System data and water sampled data are shown in Figs. 3.1.1, 3.1.2 and 3.1.3.

(4) Preliminary results

Total dissolved gas pressure was measured at 5 m depths during the first CTD cast and in the Continuous Sea Surface Water Monitoring System during the second CTD cast at same location of the first cast, and the results were compared (Fig. 3.1.4). Nitrogen saturation can be estimated from the oxygen saturation measured by the RINKO oxygen sensor and the total gas pressure (Fig. 3.1.5).

Table 3.1.1. Calibration coefficients for the salinity, dissolved oxygen, and chlorophyll *a*.

Parameter	c_0	c_1	Note
Salinity	–6.860000e–3		
Dissolved oxygen	0.7672915	–1.680803	
Chlorophyll a	0.0	0.2350651	(for Fl < 1.319)
	6.256373e–2	0.2275293	(for Fl >= 1.319)

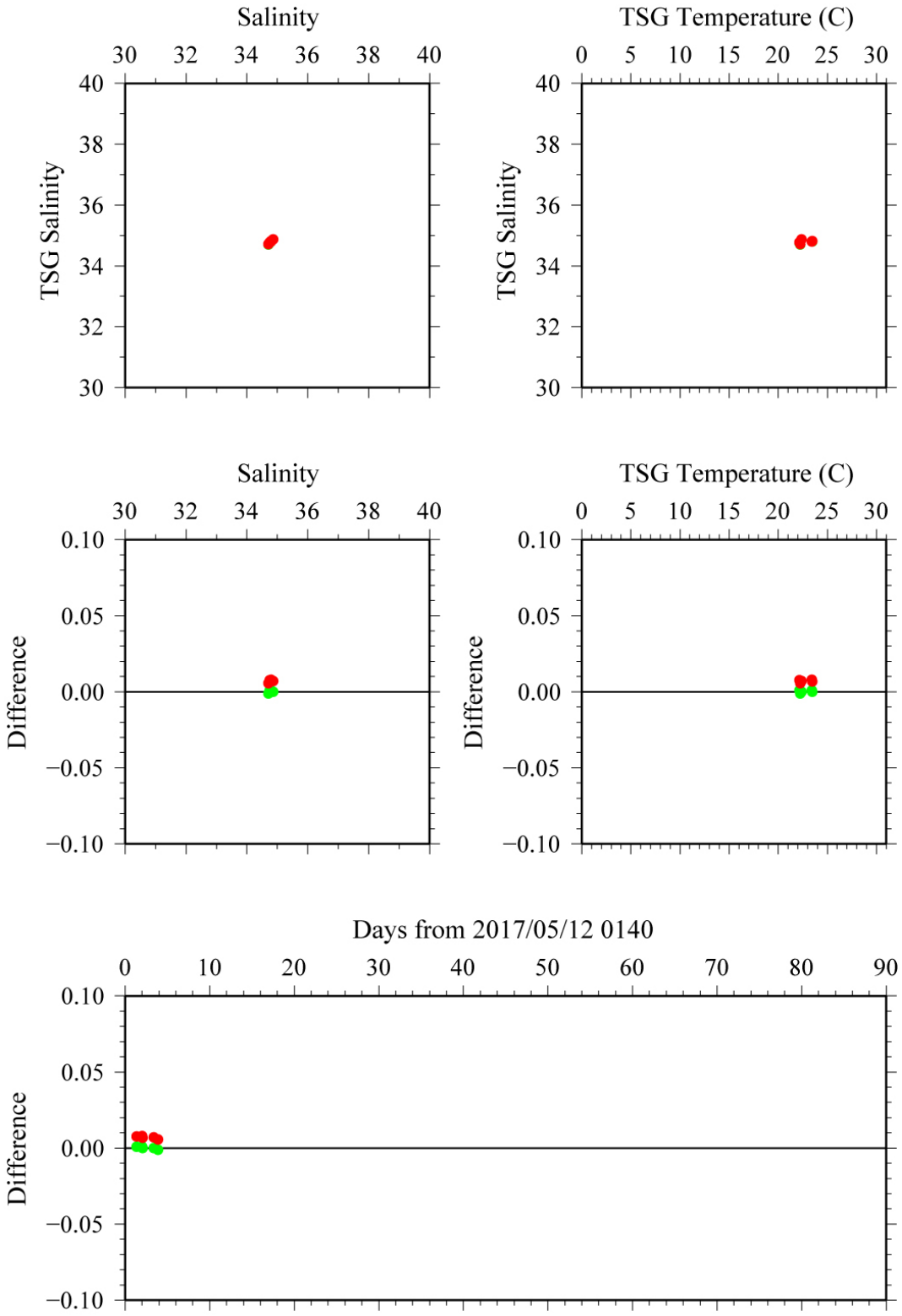

Figure 3.1.1. Comparison between TSG salinity (red: before correction, green: after correction) and sampled salinity.

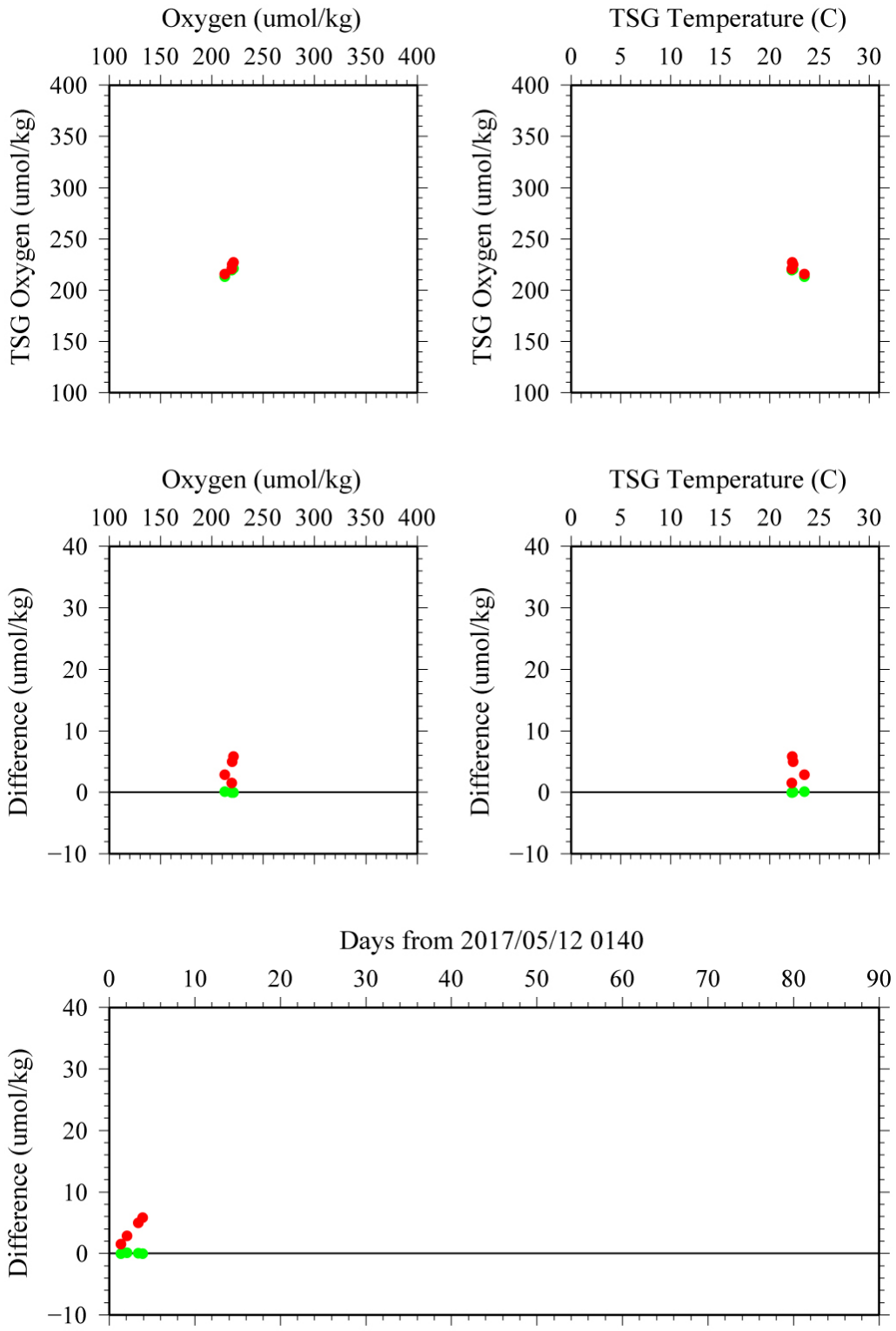

Figure 3.1.2. Comparison between TSG oxygen (red: before correction, green: after correction) and sampled oxygen.

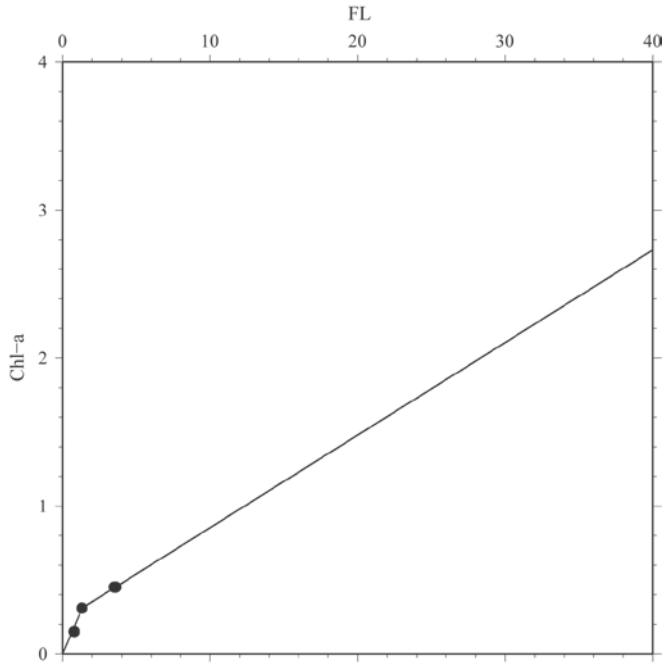

Figure 3.1.3. Comparison between TSG fluorescence and sampled chlorophyll-a. Open dots show that PAR data were greater than 50 □E/(m^2 sec). Calibration functions are also shown as lines.

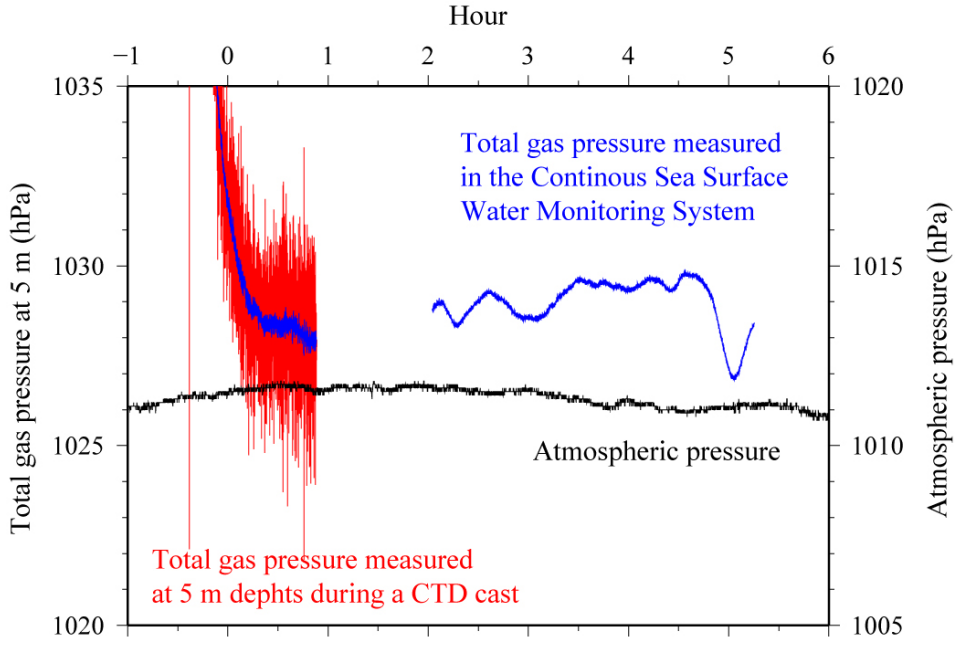

Figure 3.1.4. Comparison of total gas pressure readings obtained at 5 m depths during the first CTD cast and in the Continuous Sea Surface Water Monitoring System during the second CTD cast at same location of the first cast. For the total gas pressure data obtained during the first CTD cast, low-pass-filtered data (blue line) by a box-car filter with a window of about 20 seconds was also shown.

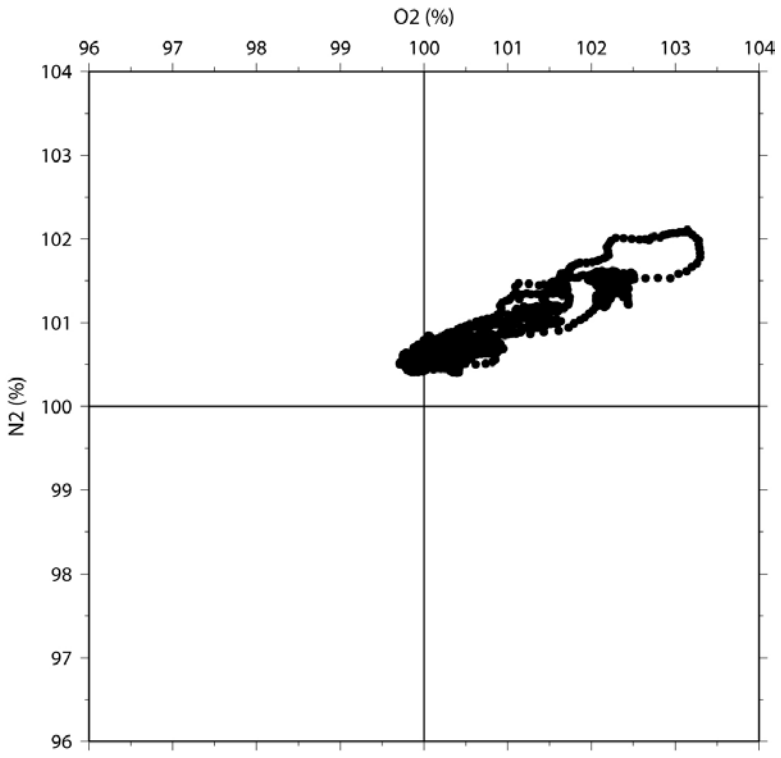

Figure 3.1.5. Comparison between oxygen saturation and nitrogen saturation obtained by the Continuous Sea Surface Water Monitoring System. Oxygen saturation is measured by the RINKO oxygen sensor and nitrogen saturation is estimated from the total gas pressure and the oxygen saturation.

● 4. Notice on Using

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