

README for Chemical Analysis (R/V MIRAI MR11-07 CINDY Cruise) as of June 7, 2013

*** Note. Revised from the version of August 2, 2012 ***

Chemical analysis data are stored as one ASCII file (mr11-07_seafile_rev.csv).

Data contain parameters obtained by (a) continuous measurement sensors with CTD system, and (b) analyses for sampled water.

--- < Sensor Information > ---

CTD system

(1) Temperature sensor

Primary sensor : SBE3-4/F, Sea-Bird Electronics, Inc. S/N 031524 calibrated on 29 July 2011
Secondary sensor : SBE3-4/F, Sea-Bird Electronics, Inc. S/N 031464 calibrated on 02 March 2011
Measurement range : -5.0 to +35 degC
Accuracy : 0.001 degC
Resolution : 0.0002 degC

(2) Conductivity sensor

Primary Sensor : SBE4-4/0, Sea-Bird Electronics, Inc. S/N 041206 calibrated on 14 June 2011
Secondary sensor : SBE4C, Sea-Bird Electronics, Inc. S/N 042240 calibrated on 08 June 2011
Measurement range : 0.0 to 7 S/m
Accuracy : 0.0003 S/m
Resolution : 0.00004 S/m

(3) Pressure sensor

Model : SBE9plus, Sea-Bird Electronics, Inc. S/N 09P27443-0677
calibrated on 11 May 2011
Measurement range : up to 10500 m
Accuracy : 0.015 % F.S.
Resolution : 0.001 % F.S.

(4) Dissolved Oxygen

Model : SBE43, Sea-Bird Electronics, Inc. S/N 430330 calibrated on 22 July 2011
Measurement range : 0-15 ml/l (120% of surface saturation)
Accuracy : 0.1 ml/l (2% of saturation)
Resolution : 0.01 ml/l

(5) Fluorescence

Model : Chlorophyll Fluorometer, Seapoint Sensors, Inc. S/N 3054
Gain setting : 30X, 0 - 5 µg/l
Offset : 0.000

(6) Carousel water sampler

Model : SBE32, Sea-Bird Electronics, Inc.
S/N 3221746-0278 used during 09Z 28 Sept. - 00Z 06 Nov. 2011
S/N 3227443-0391 used during 03Z 06 Nov. - 06Z 29 Nov. 2011

Chemical and Biological sampling

1. Dissolved Oxygen

- (1) Instrument : Burette - APB-620 (Kyoto Electronic Co. Ltd., Japan)
Detector - Automatic photometric titrator (DOT-01X),
(Kimoto Electronic Co. Ltd., Japan)
Software - DOT Terminal (ver. 1.2.0)
- (2) Method : Winkler titration (WHP Operations and Methods by Dickson, A. G., 1996)
- (3) Precision : 0.15 μ mol/kg

2. Salinity

- (1) Instrument : Autosal salinometer (Model 8400B, Guildline Instruments, Ltd.)
- (2) Precision : 0.0004 +/- 0.0002 PSU for Leg-1
0.0003 +/- 0.0003 PSU for Leg-2

3. Silicate

- (1) Instrument : QuAAtro 2-HR (BL Tec K.K., Japan)
- (2) Standard solution : Silicon standard solution SiO₂ in NaOH 0.5 mol/l CertiPUR(R)
(Merck, CAS No.1310-73-2)
- (3) Precision : Median Mean CV 0.15% / 0.11% for Leg-1 / Leg-2

4. Nitrate

- (1) Instrument : QuAAtro 2-HR (BL Tec K.K., Japan)
- (2) Standard solution : Potassium nitrate 99.995 Suprapur(R) (Merck, CAS No.7757-91-1)
- (3) Precision : Median Mean CV 0.14% / 0.09% for Leg-1 / Leg-2

5. Nitrite

- (1) Instruments : QuAAtro 2-HR (BL Tec K.K., Japan)
- (2) Standard solution : Sodium nitrate (Wako, CAS No.7632-00-0)
- (3) Precision : Median Mean CV 0.22% / 0.11% for Leg-1 / Leg-2

6. Phosphate

- (1) Instruments : QuAAtro 2-HR (BL Tec K.K., Japan)
- (2) Standard solution : Potassium dihydrogen phosphate anhydrous 99.995 Suprapur(R)
(Merck, CAS No. 7778-77-0)
- (3) Precision : Median Mean CV 0.25% / 0.17% for Leg-1 / leg-2

7. pH

- (1) Instruments : PHM240 pH/Ion meter (Radiometer Analytical, France)
- (2) Methods : Potentiometric method at 25degC
- (3) Precision : The mean difference of replicate measurements at 2 layers (80m, 200m)
is 0.001 pH unit.

8. Chlorophyll-a

- (1) Instrument : Spectorophotometer UV-2400PC (Shimadzu Corp., Japan)
Fluorometer 10-AU-005 (Turner Designs, Inc., USA)
- (2) Method : Acidification method (Holme-Hansen et al. 1965)
- (3) Precision : Relative standard deviation 4.8% / 3.2% for Leg-1 (97 samples) / Leg-2 (114)

--- < Data Format > ---

Following parameters are stored as comma-separated values.

Column No.	Column Heading Mnemonic	Units	Comments
1	EXPCODE		Expedition code
2	STNNBR		Station number
3	CASTNO		Cast number
4	SAMPNO		Sample number
5	DATE		Cast date (UTC)
6	TIME	UTC	Cast time (UTC)
7	LATITUDE	deg	LATITUDE
8	LONGITUDE	deg	LONGITUDE
9	DEPTH	m	Reported depth to bottom
10	BTLNBR		Bottle identification number
11	CTDPRS	dbar	Pressure
12	CTDDPT	m	CTD Depth
13	CTDTMP	ITS-90	CTD Temperature, primary
14	1CTDTMP	ITS-90	CTD Temperature, secondary
15	CTDSAL	PSS-78	CTD Salinity, primary
16	1CTDSAL	PSS-78	CTD Salinity, secondary
17	CTDCND	S/m	CTD Conductivity, primary
18	1CTDCND	S/m	CTD Conductivity, secondary
19	CTDOXY	μ mol/kg	CTD Oxygen
20	CTDOXV	V	CTD Oxygen Voltage
21	THETA	degC	Potential temperature, primary
22	1THETA	degC	Potential temperature, secondary
23	SIG0	KG/CUM	Density, primary
24	1SIG0	KG/CUM	Density, secondary
25	FLUOR	μ g/l	Fluorescence
26	SALNTY	PSS-78	Salinity, first
27	1SALNTY	PSS-78	Salinity, second
28	OXYGEN	μ mol/kg	Oxygen, first
29	1OXYGEN	μ mol/kg	Oxygen, second
30	SILCAT	μ mol/kg	Silicate, first
31	1SILCAT	μ mol/kg	Silicate, second
32	NITRAT	μ mol/kg	Nitrate, first
33	1NITRAT	μ mol/kg	Nitrate, second
34	NITRIT	μ mol/kg	Nitrite, first
35	1NITRIT	μ mol/kg	Nitrite, second
36	PHSPHT	μ mol/kg	Phosphate, first
37	1PHSPHT	μ mol/kg	Phosphate, second
38	PH	-	pH, first
39	1PH	-	pH, second
40	CHLHOL	μ g/l	Chlorophyll a, first
41	1CHLHOL	μ g/l	Chlorophyll a, second
42	BTLNBR_FLAG_W		Quality flag for CTD data
43	CTDPRS_FLAG_W		Quality flag for CTD pressure
44	CTDTMP_FLAG_W		Quality flag for CTD temperature, primary

45	1CTDTMP_FLAG_W	Quality flag for CTD temperature, secondary
46	CTDSAL_FLAG_W	Quality flag for CTD salinity, primary
47	1CTDSAL_FLAG_W	Quality flag for CTD salinity, secondary
48	CTDOXY_FLAG_W	Quality flag for CTD oxygen
49	SIGO_FLAG_W	Quality flag for density, primary
50	1SIGO_FLAG_W	Quality flag for density, secondary
51	FLUOR_FLAG_W	Quality flag for fluorescence
52	SALNTY_FLAG_W	Quality flag for salinity, first
53	1SALNTY_FLAG_W	Quality flag for salinity, second
54	OXYGEN_FLAG_W	Quality flag for oxygen, first
55	1OXYGEN_FLAG_W	Quality flag for oxygen, second
56	SILCAT_FLAG_W	Quality flag for silicate, first
57	1SILCAT_FLAG_W	Quality flag for silicate, second
58	NITRAT_FLAG_W	Quality flag for nitrate, first
59	1NITRAT_FLAG_W	Quality flag for nitrate, second
60	NITRIT_FLAG_W	Quality flag for nitrite, first
61	1NITRIT_FLAG_W	Quality flag for nitrite, second
62	PHSPHT_FLAG_W	Quality flag for phosphate, first
63	1PHSPHT_FLAG_W	Quality flag for phosphate, second
64	PH_FLAG_W	Quality flag for pH, first
65	1PH_FLAG_W	Quality flag for pH, second
66	CHLHOL_FLAG_W	Quality flag for chlorophyll-a, first
67	1CHLHOL_FLAG_W	Quality flag for chlorophyll-a, second

--- < Quality Flags (Definition) > ---

For Bottle

- 1 = Bottle information unavailable.
- 2 = No problems noted.
- 3 = Leaking.
- 4 = Did not trip correctly.
- 5 = Not reported.
- 7 = Unknown problem.
- 9 = Samples not drawn from this bottle.

For water samples

- 1 = Sample for this measurement was drawn from water bottle but analysis not received.
- 2 = Acceptable measurement.
- 3 = Questionable measurement.
- 4 = Bad measurement.
- 5 = Not reported.
- 6 = Mean of replicate measurements.
- 9 = Sample not drawn for this measurement from this bottle.

For CTD data

- 1 = Not calibrated.
- 2 = Acceptable measurement.
- 3 = Questionable measurement.
- 4 = Bad measurement.

- 5 = Not reported.
- 6 = Interpolated over >1 dbar interval.
- 7 = Despiked.
- 9 = Not sampled.

--- < Remarks > ---

For the first version of this seafloor data set which was released since August 2, 2012, we noticed that the four parameters (Silicate, Nitrate, Nitrite, and Phosphate) were produced using wrong temperature values. Thus, we stopped to release data on April 23, 2013. Newly calculated data have been released since June 7, 2013. Note that although our calculation procedure was incorrect for the first version, we also noticed that such effect onto the recalculation was very small (almost negligible). The difference between previous wrong results and the current version is smaller than the instrument error.

ex. The maximum differences before/after the recalculation are 0.05 $\mu\text{mol/kg}$ ($\sim 0.17\%$) for nitrate, 0.05 $\mu\text{mol/kg}$ ($\sim 0.14\%$) for silicate, and 0.004 $\mu\text{mol/kg}$ ($\sim 0.19\%$) for phosphate. For nitrite, significant difference could not be confirmed.

--- < Contact Point > ---

Kunio Yoneyama / JAMSTEC (yoneyamak [at] jamstec.go.jp)

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