

## Data Paper

Ryosuke Makabe, Shintaro Takao, Tsuneo Odate. Chlorophyll a and macro-nutrient concentrations and photosynthetically active radiation during the training vessel Umitaka-maru cruises of the 58th Japanese Antarctic Research Expedition in January 2017. *Polar Data Journal*. 2019, 3, p. 46-58. <https://doi.org/10.20575/00000009>

(Received 12/20/2018; Accepted 6/10/2019)

---

## 1st submission

Editor Start Date: 12/20/2018

Editor Stop Date: 3/26/2019

Reviewer #1 (PDJ-D-18-00007-3/3/2019)

Reviewer #2 (PDJ-D-18-00007-3/1/2019)

## Editor Comments to the Author:

Both reviewers are suggesting that your paper is worthwhile and should be published. In addition, reviewers made very useful and constructive comments to improve the manuscripts. I would like to ask you to revise your manuscripts according to the comments and prepare necessary responses to the questions.

## Reviewer #1: Swadling Kerrie

This paper presents a useful dataset of chlorophyll a and macro-nutrients collected during the regular summer transect of Umitaka-maru. It is good that the data are being made available in an open forum; as this dataset develops it will be very useful for tracking change in the Indian Sector of the Southern Ocean. I have made several grammatical suggestions that I hope will be helpful.

## Abstract

L18: change 'basically' to 'fundamentally'

L19: change 'fundamental' to 'basic'

L23: do you mean that the measurements on Fuji and Shirase have been made since 1972/73 and 1965/66, or only in those seasons? It is not clear.

L24: change 'have' to 'has'

L26: change 'determined' to 'collected'

## Background & Summary

L31: The phytoplankton community is the main primary producer in oceanic ecosystems.

L32 & 33: remove both 'ons'

L35: In 'the' Indian Sector

L36: changes in chlorophyll a were evident on a cycle of less than 10 years

L41: (JARE), which were renamed to "Marine Ecosystem Monitoring" from JARE-38.

L43: concentrations have been OR concentration has been

L44: under routine monitoring observations

L44&45: Chlorophyll a concentration has been closely related to

L46: ...phosphate), which has been

L49: were terminated on Shirase from JARE-51

L52: delete 'Then'

L53: on JARE-55

L55: 200 m, measured

L61; have been published

#### Study sites

L65: Field sampling was conducted

L66: from the underway pump, whose inlet was located at 5 m

L67: delete 'basically'; change to 'were generally sampled twice a day'

L68: located along the 110°E meridian from

#### Materials and methods

L75: delete 'basically'

L78: of the water column

L79: delete 'using'

L79: delete first ','

L80: a 24-position

L81: On all occasions water samples were collected from two dark bottles, and filtered onto glass-fiber filters (Whatman, GF/F), while size-fractionated samples were collected onto membrane filters

L85: were extracted for more than

L91: are shown

L92: was higher

#### Nutrients

L100: in the coefficient of variation

L101: phosphate was, (note: was relates back to precision)

PAR

L105: at the sea surface

L106: mounted on the

L110: in vertical and surface waters are shown in

L112: PAR at the sea surface are shown

Data Records

L134: the depth of water collection

L135: at the sea surface

Author contribution

L140: in the land laboratory

Usage notes

L154: can be referred to as Shimada et al.

Figure legends

L185: Location of

L185&186: Open squares and blue circles show vertical and underway sampling stations, respectively.

L191&L194: be consistent in use of Chlorophyll or chlorophyll

L200: at the surface during the cruise.

Figures

Fig. 2: the fitted line is influenced by the high value; it would be interesting to see some intermediate values

Figs 4 and 5: I think it would be better to show the latitude range rather than use the terms first half and second half

Reviewer #2: Hashihama Fuminori

The data in this report are fundamental, but very important for part of long-term monitoring of the Southern Ocean biogeochemistry. I recommend publication on Polar Data Journal after addressing specific comments below.

Specific comments:

Title

“Chlorophyll a and macro-nutrients concentrations”

Should change to “Concentrations of chlorophyll a and macro-nutrients” or “Chlorophyll a and macro-nutrient concentrations.”

In addition, this paper presents PAR data. I think it is necessary to include “photosynthetically active radiation” into the title, together with “chlorophyll a” and “macro-nutrients”.

#### Abstract

L20-26: The large part of the present abstract is a history of JARE. This is not informative in abstract. The authors should describe data characteristic of chlorophyll a, macro-nutrients, and PAR here (sampling location, analytical methods, data reliability, brief distribution pattern, etc.).

#### Background & Summary

There is no background and summary for macro-nutrients and PAR in this section. Should describe why macro-nutrients and PAR data were collected, because this paper presents not only chlorophyll a but also macro-nutrients and PAR.

L40: ““Biological Oceanography” was one of the routine observations”

“Biological oceanography” is a research field. I think this term does not mean a kind of observations. Please reconsider usage of this term.

L41: “(JARE)”

Need a period, “(JARE).”

L47-48: “routine observations, “Physical Oceanography” and “Chemical Oceanography””

Also, reconsider usage of these terms.

#### Materials and methods

L82-83: “size fractionated measurements using membrane filters (pore size:”

Why did the authors address the size-fractionated analysis of chlorophyll a? The purpose of this should be described in Background and Summary section. Further, it is necessary to describe information on the membrane filter (company, type, etc.) in addition to pore size.

L85: “extracted more than 24 hours”

This is unclear. Change to “extracted for xx-xx hours” Duration is important for extraction, because long extraction of >24 h (e.g. 1 week or 1 month) probably decomposes chlorophyll a.

L92-93: “Fluorescence of all.....the calibration”

I’m sorry. I cannot understand this sentence. Is it essential?

L95: “Nutrients”

Change to “Macro-nutrients”

L96: “Surface seawater”

Change to “Surface seawater for macro-nutrient analysis”

L98: “Shimada et al., 2018”

This paper is not listed in References section. If Shimada et al. (2018) reported detailed information on macro-nutrient data, the authors do not need to report macro-nutrient data in this paper. By the way, why did the authors present surface nutrient data only? Is there vertical nutrient data? If you have the surface and vertical data, both the data should be present in one paper.

L100: “Precision in Coefficient of Variation”

Why did the authors show CV for macro-nutrient data only? As for CV of chlorophyll data? Further, the authors did not show calibration data for nutrient analysis, although that for chlorophyll a analysis is shown in 3.1. section. I think it need to show calibration data for nutrients as well as chlorophyll one. Moreover, because there are low concentrations of nutrient data (e.g. 0.01 uM for nitrite), the authors need to describe detection limits for individual nutrients.

L101: “silicate”

Dissolved inorganic Si in seawater generally appears in the form of  $\text{Si(OH)}_4$  that is not ion (Sarmiento and Gruber, 2006, Chapter 7 silicate cycle (p270) in Ocean Biogeochemical Dynamics, Princeton Univ. Press). Therefore, in place of “silicate”, a term, “silicic acid”, is appropriate.

L106: “a Pocket-size PAR logger (DEFI2-L”

It is better the authors present calibration information (date, factor, etc.) of this sensor, provided by the JFE Advantech. Further, because there are 0 values in data sheet (probably PAR during night), the authors should describe detection limit of this sensor.

Data Record

L111: “And”

Should delete.

L121-123: “date”

Delete.

L124: “date time”

Change to “hour”

L125: “date time”

Change to “minute”

L127-129: “composition”

Change to “percentage” or “proportion”, because the unit is %.

L132: “silicate”

“silicic acid” is better.

Author contribution

L140: “nutrients analysis”

Change to “macro-nutrient analysis”

Figure legends

L185: “location”

Change to “Location”

L185: “Open square and blue circle shows.....sampling station”

Change to “Open squares and blue circles show.....sampling stations”

L188: “Fluorescence”

Change to “fluorescence”

L191, L194: “Chlorophyll a”

Change to “chlorophyll a”

L198: “silicate”

“silicic acid” is better.

---

Authors Response:

To Reviewer #1

Abstract

L18: change 'basically' to 'fundamentally'

L19: change 'fundamental' to 'basic'

Change accordingly.

L23: do you mean that the measurements on Fuji and Shirase have been made since 1972/73 and 1965/66, or only in those seasons? It is not clear.

It was changed to “...Fuji and Shirase since JARE-14 (1972/73 season) and JARE-7 (1965/66 season), respectively.”

L24: change 'have' to 'has'

L26: change 'determined' to 'collected'

Change accordingly.

Background & Summary

L31: The phytoplankton community is the main primary producer in oceanic ecosystems.

L32 & 33: remove both 'ons'

L35: In 'the' Indian Sector

L36: changes in chlorophyll a were evident on a cycle of less than 10 years

L41: (JARE), which were renamed to "Marine Ecosystem Monitoring" from JARE-38.

L43: concentrations have been OR concentration has been  
L44: under routine monitoring observations  
L44&45: Chlorophyll a concentration has been closely related to  
L46: ...phosphate), which has been  
L49: were terminated on Shirase from JARE-51  
L52: delete 'Then'  
L53: on JARE-55  
L55: 200 m, measured  
L61; have been published

Corrected according to above comments

#### Study sites

L65: Field sampling was conducted  
L66: from the underway pump, whose inlet was located at 5 m  
L67: delete 'basically'; change to 'were generally sampled twice a day'  
L68: located along the 110oE meridian from

Corrected according to above comments

#### Materials and methods

L75: delete 'basically'  
L78: of the water column  
L79: delete 'using'  
L79: delete first ','  
L80: a 24-position  
L81: On all occasions water samples were collected from two dark bottles, and filtered onto glass-fiber filters (Whatman, GF/F), while size-fractionated samples were collected onto membrane filters L85: were extracted for more than  
L91: are shown  
L92: was higher

Corrected according to above comments

#### Nutrients

L100: in the coefficient of variation  
L101: phosphate was, (note: was relates back to precision)

Corrected according to above comments

#### PAR

L105: at the sea surface

L106: mounted on the

Corrected according to above comments

#### Data Records

L110: in vertical and surface waters are shown in

L112: PAR at the sea surface are shown

L134: the depth of water collection

L135: at the sea surface

Corrected according to above comments

#### Author contribution

L140: in the land laboratory

Corrected accordingly

#### Usage notes

L154: can be referred to as Shimada et al.

Corrected accordingly

#### Figure legends

L185: Location of

L185&186: Open squares and blue circles show vertical and underway sampling stations, respectively.

Corrected according to above comments

L191&L194: be consistent in use of Chlorophyll or chlorophyll

Changed 'Chlorophyll' to 'chlorophyll'

L200: at the surface during the cruise.

#### Figures

Fig. 2: the fitted line is influenced by the high value; it would be interesting to see some intermediate values

In case removing highest value, R2 of the equation is 0.9999. So it is not strongly biased only by the highest value.

Figs 4 and 5: I think it would be better to show the latitude range rather than use the terms first half and second half

X axis of the graphs is latitude. We divided the data into two durations because sampling locations during the first half was along 110°E meridian but those during the second half was not so.

To Reviewer #2

The data in this report are fundamental, but very important for part of long-term monitoring of the Southern Ocean biogeochemistry. I recommend publication on Polar Data Journal after addressing specific comments below.

Specific comments:

Title

“Chlorophyll a and macro-nutrients concentrations”

Should change to “Concentrations of chlorophyll a and macro-nutrients” or “Chlorophyll a and macro-nutrient concentrations.”

In addition, this paper presents PAR data. I think it is necessary to include “photosynthetically active radiation” into the title, together with “chlorophyll a” and “macro-nutrients”.

The title has changed as “Chlorophyll a and macro-nutrient concentrations and photosynthetically active radiation...”

Abstract

L20-26: The large part of the present abstract is a history of JARE. This is not informative in abstract. The authors should describe data characteristic of chlorophyll a, macro-nutrients, and PAR here (sampling location, analytical methods, data reliability, brief distribution pattern, etc.).

We added following sentences in abstract:

“The course of the Umitaka-maru is almost same every year; leave from Fremantle, goes down to ice edge (ca. 65°S) along 110°E meridian and back to Hobart. During water sampling from underway pump for chlorophyll a and macro-nutrient concentrations are obtained twice a day, and Photosynthetically Active Radiation is continuously measured by a sensor mounted on the navigation bridge deck of the ship. The vertical water sampling for chlorophyll a concentration were conducted at 6 station along 110°E meridian, although macro-nutrients concentration at the same stations were determined by the another monitoring program.”

Background & Summary

There is no background and summary for macro-nutrients and PAR in this section. Should describe why macro-nutrients and PAR data were collected, because this paper presents not only chlorophyll a but also macro-nutrients and PAR.

We added “Macro-nutrients and photosynthetically active radiation, which would also varied with climate changes in surface mixed layer, are essentials for phytoplankton growth. A model study, for example, suggested that dominant factors affecting predicted changes in phytoplankton biomass and the structure from 1980 to 2100 are nutrients and temperature in the equator to mid latitude regions and light and temperature in the marginal sea-ice to subpolar regions, respectively (Marinov et al., 2010). Therefore, these measurements with chlorophyll a concentration and the size composition enable us better understand of spatio-temporal variability in phytoplankton biomass.” to end of the first paragraph.

L40: ““Biological Oceanography” was one of the routine observations”

“Biological oceanography” is a research field. I think this term does not mean a kind of observations. Please reconsider usage of this term. L41: “(JARE)”

Need a period, “(JARE).”

L47-48: “routine observations, “Physical Oceanography” and “Chemical Oceanography””

Also, reconsider usage of these terms.

These are names of monitoring program, so we cannot change the name. We changed the sentence using the word “program”, e.g. “One of the routine observation program of the Japanese Antarctic Research Expedition (JARE), named “Biological Oceanography”, which was renamed to...”

Materials and methods

L82-83: “size fractionated measurements using membrane filters (pore size:”

Why did the authors address the size-fractionated analysis of chlorophyll a? The purpose of this should be described in Background and Summary section. Further, it is necessary to describe information on the membrane filter (company, type, etc.) in addition to pore size.

We added “n such phytoplankton observation, size fractionated chlorophyll a measurements are important, because both global warming and changes in sea ice dynamics affect on phytoplankton size spectrum (Montes-Hugo et al., 2008; Daufresne et al., 2009; Moran et al, 2010).” To end of the first paragraph. And, the details of membrane filters have been added.

L85: “extracted more than 24 hours”

This is unclear. Change to “extracted for xx-xx hours” Duration is important for extraction, because long extraction of >24 h (e.g. 1 week or 1 month) probably decomposes chlorophyll a.

Changed to “extracted for 1-20 days”. Chl. a extracted by DMF stored at dark condition in a freezer is relatively stable (no significant decomposition occurs within a few month) than that extracted by Acetone.

L92-93: “Fluorescence of all.....the calibration”

I’m sorry. I cannot understand this sentence. Is it essential?

This means that all chl. a measurements during the cruise were within calibration range of the fluorometer.

L95: “Nutrients”

Change to “Macro-nutrients”

Corrected accordingly.

L96: “Surface seawater”

Change to “Surface seawater for macro-nutrient analysis”

Corrected accordingly.

L98: “Shimada et al., 2018”

This paper is not listed in References section. If Shimada et al. (2018) reported detailed information on macro-nutrient data, the authors do not need to report macro-nutrient data in this paper. By the way, why did the authors present surface nutrient data only? Is there vertical nutrient data? If you have the surface and vertical data, both the data should be present in one paper.

Sorry for confusing descriptions. Shimada et al. was submitted to Polar Data Journal Dec. 2018. We added it to reference list. Vertical nutrient data are included in Shimada et al.

L100: “Precision in Coefficient of Variation”

Why did the authors show CV for macro-nutrient data only? As for CV of chlorophyll data? Further, the authors did not show calibration data for nutrient analysis, although that for chlorophyll a analysis is shown in 3.1. section. I think it need to show calibration data for nutrients as well as chlorophyll one. Moreover, because there are low concentrations of nutrient data (e.g. 0.01 uM for nitrite), the authors need to describe detection limits for individual nutrients.

In case measuring chlorophyll a by using a fluorometer, no standard is commonly used. So we have no replicates of chlorophyll standard. And this is why result of fluorometer calibration is needed to show. On the other hand, CV and the detection limit of each nutrient are enough to confirm the data reliability. We added detection limit of each nutrient after the description of the CV.

L101: “silicate”

Dissolved inorganic Si in seawater generally appears in the form of  $\text{Si}(\text{OH})_4$  that is not ion (Sarmiento and Gruber, 2006, Chapter 7 silicate cycle (p270) in Ocean Biogeochemical Dynamics, Princeton Univ. Press). Therefore, in place of “silicate”, a term, “silicic acid”, is appropriate.

We have changed it to “silicic acid” throughout the MS, figures and data tables.

L106: “a Pocket-size PAR logger (DEFI2-L”

It is better the authors present calibration information (date, factor, etc.) of this sensor, provided by the JFE Advantech. Further, because there are 0 values in data sheet (probably PAR during night), the authors should describe detection limit of this sensor.

We added the detection limit and the accuracy of the logger.

Data Record L111: “And”

Should delete. L121-123: “date”

Delete. L124: “date time”

Change to “hour” L125: “date time”

Change to “minute” L127-129: “composition”

Change to “percentage” or “proportion”, because the unit is %. L132: “silicate”

“silicic acid” is better.

Author contribution L140: “nutrients analysis”

Change to “macro-nutrient analysis”

Figure legends L185: “location”

Change to “Location”

L185: “Open square and blue circle shows.....sampling station”

Change to “Open squares and blue circles show.....sampling stations” L188: “Fluorescence”

Change to “fluorescence” L191, L194: “Chlorophyll a” Change to “chlorophyll a” L198: “silicate”

“silicic acid” is better.

Corrected according to above comments

---

2nd submission

Editor Start Date: 4/9/2019

Editor Stop Date: 6/10/2019

Reviewer #1 (PDJ-D-18-00007-3/1/2019)

Reviewer #2 (PDJ-D-18-00007-3/8/2019)

Editor Comments to the Author:

Reviewer #2: Hashihama Fuminori

The revised manuscript is suitable for the acceptance after addressing few points below.

L30 chlorophyll a: change to italic a.

L77 This report documents: change to This report mainly documents.

L125 Shimada et al., 2018 : change to Shimada et al., submitted to Polar Data Journal.

L131-132 umol l-1: change to  $\mu\text{mol kg}^{-1}$ .

Silicate in ADS should be changed to silicic acid.

---

Authors Response:

To Reviewer #2

The revised manuscript is suitable for the acceptance after addressing few points below.

L30 chlorophyll a: change to italic a.

L77 This report documents: change to This report mainly documents.

L125 Shimada et al., 2018 : change to Shimada et al., submitted to Polar Data Journal.

L131-132 umol l-1: change to  $\mu\text{mol kg}^{-1}$ .

Silicate in ADS should be changed to silicic acid

Corrected according to above comments

---

Editorial Office's note

Calculate checksum date: 9/30/2019

Algorithm:SHA256

Hash:8389c140533e5e62d0a08622ea65d4f5c8fe36580a0de0ba24398501b44d6d94

Path:<https://ads.nipr.ac.jp/portal/kiwa/ProductsSelect.action?referer=summary&downloadList=ADS%3AA20181220-002%3A1.00#>

Original Data

Ryosuke, M., Shintaro, T., Tsuneo, O. Chlorophyll a and macro-nutrient concentrations and photosynthetically active radiation during the training vessel Umitaka-maru cruises of the 58th Japanese Antarctic Research Expedition in January 2017 1.00, Arctic Data archive System (ADS), Japan, 2018. <https://doi.org/10.17592/001.2018122002>

Postscript by editorial office,

The above Path had been not available. (accessed 2020-10-12)

Please refer instead: <http://id.nii.ac.jp/1434/00000009>