Data Paper

Ryosuke Makabe, Shintaro Takao, Kunio T. Takahashi and Tsuneo Odate. Chlorophyll a and macronutrient concentrations during the icebreaker Shirase cruise of the 60th Japanese Antarctic Research Expedition. Polar Data Journal. 2021, 5, p.47–53. http://doi.org/10.20575/00000025.

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1st submission

Editor Start Date: 9/2/2020

Editor Stop Date: 12/10/2020

Reviewer #1 (9/11/2020–9/22/2020)

Reviewer #2 (12/2/2020–12/10/2020)

Reviewer #1: Anonymous

This manuscript reports environmental parameters such as chlorophyll and nutrient concentrations during the Shirase cruise in 2018/19. Due to the characteristics of this journal, I have no choice to reject this manuscript. However, the authors should revise this manuscript very carefully before publication. There are so many repetition and unnecessary wording as pointed out below. I strongly recommend English proofreading before publication.

Abstract

L24: remove "with climate change"

1. Background & Summary

L34: Phytoplankton is the major primary producer

L37: Change "in various coastal and oceanic regions" to "in the ocean"

L37-38: In the Indian Sector of the Southern Ocean, surface chlorophyll a varied inter-annually (Hirawake et al., 2015)

L39: This means that frequent observations of chlorophyll a are needed. I don't understand the logical connection with the prior sentence.

L43-45: I don't understand these sentences.

L48-50: Need citation

L53-57: Unnecessary information

2. Study site

L60-61: Field sampling was performed from Fremantle to Sydney in the Indian Sector of the Southern Ocean (Fig.

1)

3. Materials and methods

L74: the same surface water

L75-76: delete "during boreal summer"

L75-76: at total 10 stations

L82: during the last boreal summer

Which year did you perform the calibration? I don't think that season is important information.

L87: from the surface water pumped up from the ship bottom

L88: Surface seawater was also collected

L89-90: Seawater samples were collected vertically over the upper 100 m depth with Niskin bottles.

L91-94: Samples for chlorophyll a measurement were collected in two 300 mL dark bottles, and for bulk measurement were filtered onto glass-fiber filter (Whatman, GF/F). Samples for size-fraction measurement were sequentially filtered onto 10- and 2 μm membrane filters and GF/F filter.

L95-96: and stored at -18 °C more than 24 hours for extraction.

L99: calibrated with a chlorophyll-a standard (Fujifilm…) at onshore laboratory before the cruise using a spectrophotometer (Fig.2).

L102-103: Remove these two sentences.

3.3. Macro-nutrients

Information on what bottles were sampled and which parameters were measured is needed. Further, the author should show the detection limit of each parameter.

L106-107: Samples for macro-nutrient analysis were collected in XXX as the same time as samples for chlorophyll a.

L108-109: The details of the analytical procedure were as described previously (Shimada et al., 2020).

3.4. Photosynthetically active radiation

Write how often the data was aquired.

L114: Surface photosynthetically active radiation (PAR) was measured using …

4. Data records

This section is like saying nothing. All descriptions are written in the figure caption.

Figure

All the figures are drawn in raster format and the resolution is rough. They should be drawn in vector format. Further, the authors should add station numbers in all figures.

Figure 1: Should add station number in the map.

Figure 3: Temperature and Salinity should be combined in a single graph.

Figure 4: Change "Composition" to "Size composition"

Figure 5-8: Nitrate, nitrite, silicic acid, phosphate should be combined in a single graph.

Reviewer #2: Tomomi Takamura

The authors reported fundamental biological oceanographic data obtained by the JARE60. These data complements valuable data sets that accumulated over 60 years, and should be open to the public. I recommended that this paper to be accepted in Polar Data Journal after minor revision.

My comments are as follows:

Line 28-29 and 46-47: This description seems to be incorrect or incomplete.

The icebreakers Shirase and Fuji were conducted from JARE-25 (1983/84 season) and JARE-7 (1965/66 season), respectively.

What is the JARE-14 for?

Line 65 and 194: According to Table 1, twice CTD casts were conducted at L01.

Line 86-89: It reads as if you sampled surface seawater from underway pump using the plastic bucket at vertical sampling station.

If this is not true, it would be better to make clear that the surface seawater at vertical sampling stations were not taken from underway pump but directly from ocean surface.

Line 132: The unit of conductivity should be "S/m" (capital S).

Line 117, 154 and Figures 9-12(d): The unit of PAR should be "µmol photons m^-2 s^-1"

Figures 10 and 11: The horizontal axis should be "Longitude (°E)"

Authors Response:

We revised the MS according to reviewer's comments as followings (in red).

Response to reviewer #1;

This manuscript reports environmental parameters such as chlorophyll and nutrient concentrations during the Shirase cruise in 2018/19. Due to the characteristics of this journal, I have no choice to reject this manuscript.

However, the authors should revise this manuscript very carefully before publication. There are so many repetition and unnecessary wording as pointed out below. I strongly recommend English proofreading before publication.

Abstract

L24 remove "with climate change"

Removed.

1. Background & Summary

L34: Phytoplankton is the major primary producer

Corrected accordingly

L37: Change "in various coastal and oceanic regions" to "in the ocean"

Corrected accordingly

L37-38: In the Indian Sector of the Southern Ocean, surface chlorophyll a varied inter-annually (Hirawake et al., 2015)

L39: This means that frequent observations of chlorophyll a are needed. I don't understand the logical connection with the prior sentence.

Inter-annual changes reported by Hirawake et al. (2005) occurred with short time scale (within 10 year). We mean here that frequent observation can detect such a short term variation is needed for understanding ecosystem responses to longterm climate changes. We revised the sentences as "In the Indian Sector of the Southern Ocean, surface chlorophyll a varied inter-annually with a few years cycle (Hirawake et al., 2005). This means that frequent observations of chlorophyll a, can detected such a variation with shorter time scale, are needed to understand the ecosystem responses to…."

L43-45: I don't understand these sentences.

We changed the sentences as "The ecosystem monitoring program named "Biological Oceanography" was a part of the routine observations of the Japanese Antarctic Research Expedition (JARE). These routine observations have been renamed "Marine Ecosystem Monitoring" since JARE-38."

L48-50: Need citation

This sentence, meaning "phytoplankton biomass is basically regulated by such physical and chemical conditions", is truism. Therefore, we believe no references is needed here.

L53-57: Unnecessary information

Deleted.

2. Study site

L60-61: Field sampling was performed from Fremantle to Sydney in the Indian Sector of the Southern Ocean (Fig. 1)

Corrected accordingly

3. Materials and methods

L74: the same surface water

Corrected accordingly

L75-76: delete "during boreal summer"

Deleted.

L75-76: at total 10 stations

Corrected accordingly

L82: during the last boreal summer

Which year did you perform the calibration? I don't think that season is important information.

We changed the words to “in 2018”

L87: from the surface water pumped up from the ship bottom

Corrected accordingly

L88: Surface seawater was also collected

Corrected accordingly

L89-90: Seawater samples were collected vertically over the upper 100 m depth with Niskin bottles.

We changed the sentence as “Seawater samples were collected vertically over the upper 100 m depth with Niskin bottles attached to the water sampler.”

L91-94: Samples for chlorophyll a measurement were collected in two 300 mL dark bottles, and for bulk measurement were filtered onto glass-fiber filter (Whatman, GF/F). Samples for size-fraction measurement were sequentially filtered onto 10- and 2 μm membrane filters and GF/F filter.

Corrected accordingly

L95-96: and stored at -18 °C more than 24 hours for extraction.

Corrected accordingly

L99: calibrated with a chlorophyll-a standard (Fujifilm…) at onshore laboratory before the cruise using a spectrophotometer (Fig.2).

Corrected accordingly, but we added “according to Porra et al. (1989)” to the end of the sentence.

L102-103: Remove these two sentences.

The latter sentence includes important information related to data quality. We changed the latter sentence as “Fluorescence of all samples presented in this MS was within range validated by calibration (0.286−678).”

3.3. Macro-nutrients

Information on what bottles were sampled and which parameters were measured is needed. Further, the author should show the detection limit of each parameter.

We also added the detection limit of each parameter in this session.

L106-107: Samples for macro-nutrient analysis were collected in XXX as the same time as samples for chlorophyll a.

We changed this part as “Seawater samples for macro-nutrient analysis were collected as the same time as samples for chlorophyll a. And, waters form 200 and 400 m depths were also collected at vertical sampling stations.”.

L108-109: The details of the analytical procedure were as described previously (Shimada et al., 2020).

Corrected accordingly

3.4. Photosynthetically active radiation

Write how often the data was aquired.

We have added the sentence “The data was recorded at every minute.”

L114: Surface photosynthetically active radiation (PAR) was measured using …

Corrected accordingly

4. Data records

This section is like saying nothing. All descriptions are written in the figure caption.

Deleted other than description of data files. Also we changed the description as “All measurements are presented in 13 CSV files, named “JARE60_CTD_LXX (L01-L10)”, “JARE60_Chl&Nuts_BtlSample”, “JARE60_Chl&Nuts_Underway”, “JARE60_Underway_Fremantle to Syowa” and “JARE60_Underway_Syowa to Sydney”.”

Figure

All the figures are drawn in raster format and the resolution is rough. They should be drawn in vector format. Further, the authors should add station numbers in all figures.

We added station numbers in Fig. 1. But did not so for the other figure where station numbers were shown in the each caption.

Figure 1: Should add station number in the map.

Added.

Figure 3: Temperature and Salinity should be combined in a single graph.

Corrected accordingly.

Figure 4: Change "Composition" to "Size composition"

Corrected accordingly. Figs. 13-16 were also corrected.

Figure 5-8: Nitrate, nitrite, silicic acid, phosphate should be combined in a single graph.

We did not combine these figures, because this change makes figure axis to be quite complicated.

Reponse to reviewer #2;

The authors reported fundamental biological oceanographic data obtained by the JARE60. These data complements valuable data sets that accumulated over 60 years, and should be open to the public. I recommended that this paper to be accepted in Polar Data Journal after minor revision.

My comments are as follows:

Line 28-29 and 46-47: This description seems to be incorrect or incomplete.

The icebreakers Shirase and Fuji were conducted from JARE-25 (1983/84 season) and JARE-7 (1965/66 season),

respectively.

What is the JARE-14 for?

Thank you and sorry for confusing description. JARE14 is the season zooplankton monitoring started. We changed the sentensec as "…..have been measured onboard the icebreakers Fuji and Shirase by JARE-7 during the 1965/66 season and by JARE-25 during the 1983/84 season, respectively." and "Chlorophyll a concentrations have been measured onboard the icebreakers Fuji and Shirase by JARE-7 during the 1965/66 season and by JARE-25 during the 1983/84 season, respectively, as part of routine observations. Macro-nutrients, had been measured by another monitoring program named "Physical and Chemical Oceanography", and surface photosynthetically active radiation (PAR) have been measured by this program since JARE52 during the 2010/11 season."

Line 65 and 194: According to Table 1, twice CTD casts were conducted at L01.

Thank you. L01 is correct. It has been corrected.

Line 86-89: It reads as if you sampled surface seawater from underway pump using the plastic bucket at vertical sampling station.

If this is not true, it would be better to make clear that the surface seawater at vertical sampling stations were not taken from underway pump but directly from ocean surface.

We corrected these sentences as "Surface seawater was collected twice daily (day and night without the midnight sun) during the cruise from the surface water pumped up from the ship bottom. At the vertical sampling stations, seawater samples were collected vertically over the upper 100 m depth with Niskin bottles attached to the water sampler, and surface water was also collected using a plastic bucket."

Line 132: The unit of conductivity should be "S/m" (capital S).

Corrected accordingly

Line 117, 154 and Figures 9-12(d): The unit of PAR should be "µmol photons m^-2 s^-1"

Corrected accordingly

Figures 10 and 11: The horizontal axis should be "Longitude (°E)"

Corrected accordingly

2nd submission

Editor Start Date: 1/5/2021

Editor Stop Date: 1/24/2021

Reviewer #1 (1/8/2021–1/24/2021)

Reviewer #1: Anonymous

The manuscript has been improved from the initial version. However, I still found several issues present in the revised manuscript. The authors should respond more carefully to the reviewers' comments. For example, I pointed out that the resolution of the figures is poor, but there is no correction for that. I recommend to add station numbers in all figures, but this has not been corrected. Furthermore, I recommend that nitrate, nitrite, silicic acid, and phosphate should be combined in a single graph, but the authors ignored this recommendation.

L23: But you mentioned that chlorophyll a was also closely related to water column structure.

L23-25: Therefore, long-term monitoring…

I don't think this is a necessary statement. Please delete.

L27-29: … have been determined since 1965.

L37-42: I still don't understand the logic of these sentences. If the authors want to capture the interannual variability of surface chlorophyll a, satellite monitoring is sufficient. Please explain the significance of the shipboard observation more carefully.

L43-53: Chlorophyll a concentration is closely related to water column structure (e.g., temperature and salinity) and macronutrients (nitrate, nitrite, silicic acid, and phosphate). Chlorophyll a has been measured by the research program "Marine Ecosystem Monitoring" (renamed from "Biological Oceanography" since JARE-38) as the routine observations of the Japanese Antarctic Research Expedition (JARE). It was also measured onboard the icebreakers Fuji and Shirase by JARE-7 during the 1965-1966 season and by JARE-25 during the 1983-1984 season, respectively. Macronutrients have been measured by another monitoring program, "Physical and Chemical Oceanography", since JARE-XX. Surface photosynthetically active radiation (PAR) has been measured since JARE-52.

L54: Delete "phytoplankton"

L94: Delete "onboard"

L101: I commented earlier to write which container the sample was collected, but that has not been addressed.

L105: Please change the word from onland to onshore

Fig. 5-8: Make a single graph with nitrate and phosphate on the same axis and nitrite and silicic acid on different axes.

Authors Response:

We revised the MS according to reviewer's comments as followings (in red).

Response to reviewer #1;

The manuscript has been improved from the initial version. However, I still found several issues present in the revised manuscript. The authors should respond more carefully to the reviewers' comments. For example, I pointed out that the resolution of the figures is poor, but there is no correction for that. I recommend to add station numbers in all figures, but this has not been corrected. Furthermore, I recommend that nitrate, nitrite, silicic acid, and phosphate should be combined in a single graph, but the authors ignored this recommendation.

The resolution of figures, you can download from the link located top of each figure, is enough. Station name had already been shown in each caption (added to Fig.1). Four nutrients did not combine to avoid confusing label of the axis.

L23: But you mentioned that chlorophyll a was also closely related to water column structure.

We has changed the sentence as "Chlorophyll a concentration is the most common indicator of phytoplankton biomass, basically regulated by physicochemical properties such as temperature, salinity, macronutrients and light intensity."

L23-25: Therefore, long-term monitoring…

I don't think this is a necessary statement. Please delete.

Deleted.

L27-29: … have been determined since 1965.

Changed accordingly.

L37-42: I still don't understand the logic of these sentences. If the authors want to capture the interannual variability of surface chlorophyll a, satellite monitoring is sufficient. Please explain the significance of the shipboard observation more carefully.

Satellite monitoring cannot covered salinity and nutrients, therefore, field observation is needed to know factor control the phytoplankton biomass.

We changed the sentences as "In the Indian Sector of the Southern Ocean, surface chlorophyll a varies interannually with a cycle of a few years (Hirawake et al., 2005). The abundance of chlorophyll a was closely related to water column structure (e.g., temperature and salinity) and macronutrients (nitrate, nitrite, silicic acid, and phosphate). Thus, frequent observations of chlorophyll a with the environmental parameters are required, to capture interannual variation that will allow us to understand ecosystem responses to long-term climate changes (e.g., global warming) and decadal environmental changes (e.g., El Niño and Southern Annular Mode)."

L43-53: Chlorophyll a concentration is closely related to water column structure (e.g., temperature and salinity) and macronutrients (nitrate, nitrite, silicic acid, and phosphate). Chlorophyll a has been measured by the research program "Marine Ecosystem Monitoring" (renamed from "Biological Oceanography" since JARE38) as the routine observations of the Japanese Antarctic Research Expedition (JARE). It was also measured onboard the icebreakers Fuji and Shirase

by JARE-7 during the 1965-1966 season and by JARE-25 during the 1983-1984 season, respectively. Macronutrients have been measured by another monitoring program, "Physical and Chemical Oceanography", since JARE-XX. Surface photosynthetically active radiation (PAR) has been measured since JARE-52.

We changed the sentences as “Chlorophyll a has been measured by the research program "Marine Ecosystem Monitoring" (renamed from "Biological Oceanography" since JARE-38) as the routine observations of the Japanese Antarctic Research Expedition (JARE). It was also measured onboard the icebreakers Fuji and Shirase by JARE-7 during the 1965-1966 season and by JARE-25 during the 1983-1984 season, respectively. Macronutrients have been measured by another monitoring program, "Physical and Chemical Oceanography", since JARE-7. Since the program have been carried out during cruise of the training and research vessel Umitaka Maru, which belongs to the Tokyo University of Marine Science and Technology (TUMSAT), since JARE52, macronutrients measurements have been measured under the Marine Ecosystem Monitoring during Shirase cruise. Surface photosynthetically active radiation (PAR) has been measured since JARE-52.”, basically according to your suggestion.

L54: Delete "phytoplankton"

Corrected accordingly.

L94: Delete "onboard"

Corrected accordingly.

L101: I commented earlier to write which container the sample was collected, but that has not been addressed.

Sorry. We added information of container as “The sampled water in a plastic spitz tube was stored at –18°C until analysis in an onshore laboratory.”

L105: Please change the word from onland to onshore

Corrected accordingly.

Fig. 5-8: Make a single graph with nitrate and phosphate on the same axis and nitrite and silicic acid on different axes.

Four nutrients did not combine to avoid confusing label of the axis.

3rd submission

Editor Start Date: 2/9/2021

Editor Stop Date: 2/21/2021

Reviewer #3 (2/19/2021–2/21/2021)

Reviewer #3: Naomi Harada

I confirmed that the manuscript was revised according to the reviewer #1's comments. The manuscript looks for ready to publish in this journal as a whole. But, I suggest that authors check about the minor comments as follows before publication:

Line 46: Fuji and Shirase, might be changed in italic?

Line 154: "Land" should be changed in "offshore"

Authors Response:

We revised the MS according to the 3rd reviewer's comments.

4th submission

Editor Start Date: 2/24/2021

Editor Stop Date: 2/24/2021

Editorial Office's note

Calculate checksum date: 3/4/2021

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