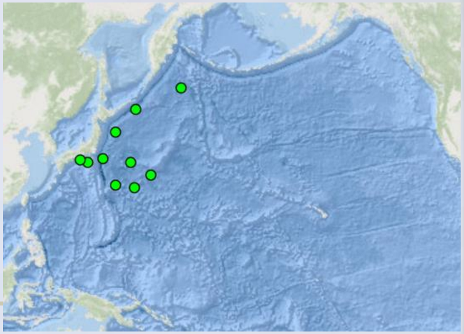
Japan BGC-Argo report 2022

- **Float deployment** [including Deep floats (O_2)]
  (2005 – 2021) 110 BGC floats @ North Pacific, Indian Ocean & Southern Ocean
  (2022) 2 BGC floats @ North Pacific
  1 Navis (O_2 Chl b_{bp} pH), 1 Apex (O_2)
  (2023 plan) 5 BGC floats @ North Pacific & Southern Ocean
  1 Navis (O_2 Chl b_{bp} NO_3 pH), 1 Navis (O_2 Chl b_{bp} NO_3),
  1 Navis (O_2 Chl b_{bp} pH), 2 DeepNINJA (O_2)

- **Operational floats** (as of Mar 2023) 11 BGC floats
  North Pacific: 1 Navis (O_2 Chl b_{bp} pH), 2 Apex (O_2 pH), 7 Apex (O_2)
  Southern Ocean : 1 Deep (O_2)



Location map of operational BGC floats deployed by Japan

- **Ongoing programs**
  "Hotspot2 project" by Japan Society for the Promotion of Science
  14 BGC floats [4 Apex (O_2 pH), 10 Apex (O_2)] were deployed in 2021 and 2022 to examine the mechanisms on formation and dissipation of O_2 max. and O_2 min. layers in the subtropical western North Pacific.
  "Development of BGC NINJA floats" by JAMSTEC, T.S.K and TUMSAT
  We are developing BGC NINJA floats with a fast repetition rate fluorometer (FRRF, for phytoplankton productivity) and pH/CO_2 sensor.

- **Submitted budget proposal** 2 BGC (4 para) and 2 Deep (O_2) floats [JAMSTEC project]

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- **Data management organization**

  DAC & RTQC: Japan Meteorological Agency (JMA)

  DMQC: Japan Agency for Marine-Earth Science and Technology (JAMSTEC)

- **Current status of data processing**
  - JMA has been developing a program for RTQC of each parameter and conducted RTQC for O_2 with adjustments based on WOA in August 2022.
  - JAMSTEC is currently developing a program for DMQC of O_2 and plans to submit BD files with O_2-adjusted values soon.
  - Additionally, JAMSTEC is testing whether NO_3 and pH observed by BGC floats in the North Pacific can be effectively corrected by the SAGE.

- **Japan BGC-Argo publications in 2022**

Fujiki, T., Hosoda, S., Harada, N. (2022) Phytoplankton blooms in summer and autumn in the northwestern subarctic Pacific detected by the mooring and float systems. *J Oceanogr* 78: 63-72

Sukigara, C., Inoue, R., Sato, K., Mino, Y., Nagai, T., Fassbender, A. J., Takeshita, Y., Bishop, S., Oka, E. (2022). Observing intermittent biological productivity and vertical carbon transports during the spring transition with BGC Argo floats in the western North Pacific. *Biogeosci Discuss* DOI: 10.5194/bg-2022-9

Performance evaluation of oxygen sensor (RINKO-FT)

Dr. Kanako Sato will give a detailed presentation this afternoon!

- **Storage drift of RINKO-FT in laboratory**

  within -1 % for first 100 days, at oxygen concentration of 100 % air saturation and T=20 °C

- **Comparison of RINKO-FT with bottle data at float deployment (Fig. 1)**
  - Offset of RINKO-FT: -8 to -3 μmol/kg
  - Difference in O_2 between RINKO-FTs and bottle data shows a linear relationship with bottle data.

  ⇒ O_2 measurements of RINKO-FTs can be corrected using the linear relationship.

- **Time drift of RINKO-FT (Fig. 2)** (using the method described by Bittig et al. 2018)
  - Time series of oxygen slopes ($1/m_i$) : -0.02 to 0.01 %/yr ⇒ excellent stability
  - Carry-over slope (*c*) : >0.5 (about half of floats)

  ⇒ RINKO-FTs on floats may not have accurately measured O_2 concentrations in air.

RINKO-FT (ARO-FT/AROD-FT), produced by JFE Advantech

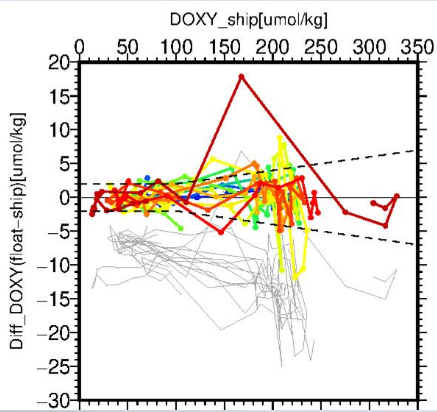


Fig. 1. Comparison of RINKO-FT with bottle data. Grey lines show RINKO-FT O_2 before correction

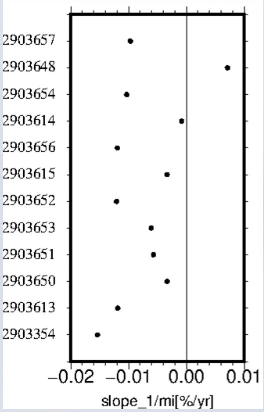


Fig. 2. Time drift of RINKO-FT

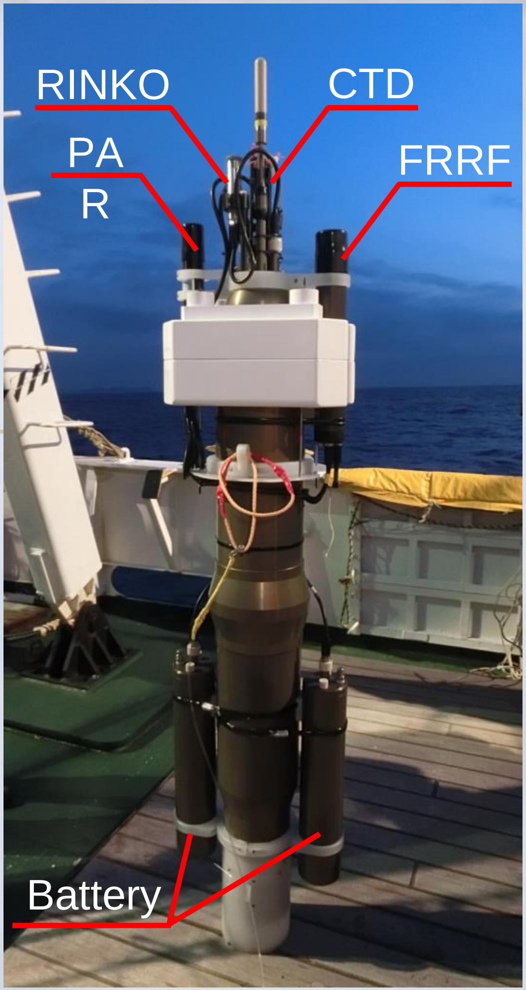
Development of BGC NINJA equipped with FRRF

- FRRF can measure a single turnover fluorescence induction curve in photosystem II (PSII) of phytoplankton (Kolber et al. 1998). The PSII parameters derived from the fluorescence induction curve provide information on the physiological state related to photosynthesis and can be used to estimate primary productivity.

- The utility of FRRF in measuring phytoplankton productivity *in situ* has been repeatedly documented (e.g., Schuback et al. 2021 and references cited therein).

- By incorporating FRRF in autonomous observation platforms, it is possible to estimate phytoplankton productivity with high spatial and temporal resolution.

- We have been developing NINJA float equipped with FRRF since 2021, and started conducting sea trials from 2023.



(Photo of Feb. 6, 2023)