29th, May,2023

Tool to assist planning Argo floats deployment, developed by JAMSTEC

1. Introduction

Argo program has achieved to deploy over 3,000 active Argo floats as a global ocean observing system. And strongly required to maintain the observing network. The global spread of COVID-19 has reduced the opportunities to deploy floats, and the maintenance of the float observation network is required more than ever before. We JAMSTEC have developed a tool to determine where to deploy floats effectively to achieve this.

2. Data and design

As cycle time and parking pressure of most floats in the Argo GDAC monthly snapshots at May 2020 is 10 days and 1,000 dbar in the North Pacific (shown in Appendix), we performed particle tracking from location of the currently active float to estimate the location of 360, 720, 1,080 days up to 1,080 days from now, by using G-YoMaHa dataset (https://www.jamstec.go.jp/argo_research/dataset/gyomaha/gyomaha_en.html), which is velocity climatology at 1,000 dbar using YoMaHa'07. The tool then calculates and illustrates the sufficiency ratio of 360, 720, 1,080 days to Argo2020 on the 3-degree grid.

The locations of the active floats are extracted from the GDAC index file (ar_index_global_prof.txt), which is downloaded when the program is run. An active float is defined as the latest profile obtained within three months prior to the date of downloading the file.

In addition, for each active float, particle tracking is performed only during the difference between the number of active days and the average lifetime of the active float at the time the tool was run, assuming that the average lifetime is 2,450 days (about 6.7 years). This average lifetime is the average lifetime calculated from inactive floats in the Argo GDAC snapshot at May 2020 plus its standard deviation, as described in the Appendix. The reason is that the average lifetime is expected to be longer for current active floats than for the inactive floats at that time.

The time interval of particle tracking is 1day.

3. Results of this tool

These figures show the results of this tool run at 9th May, 2023.

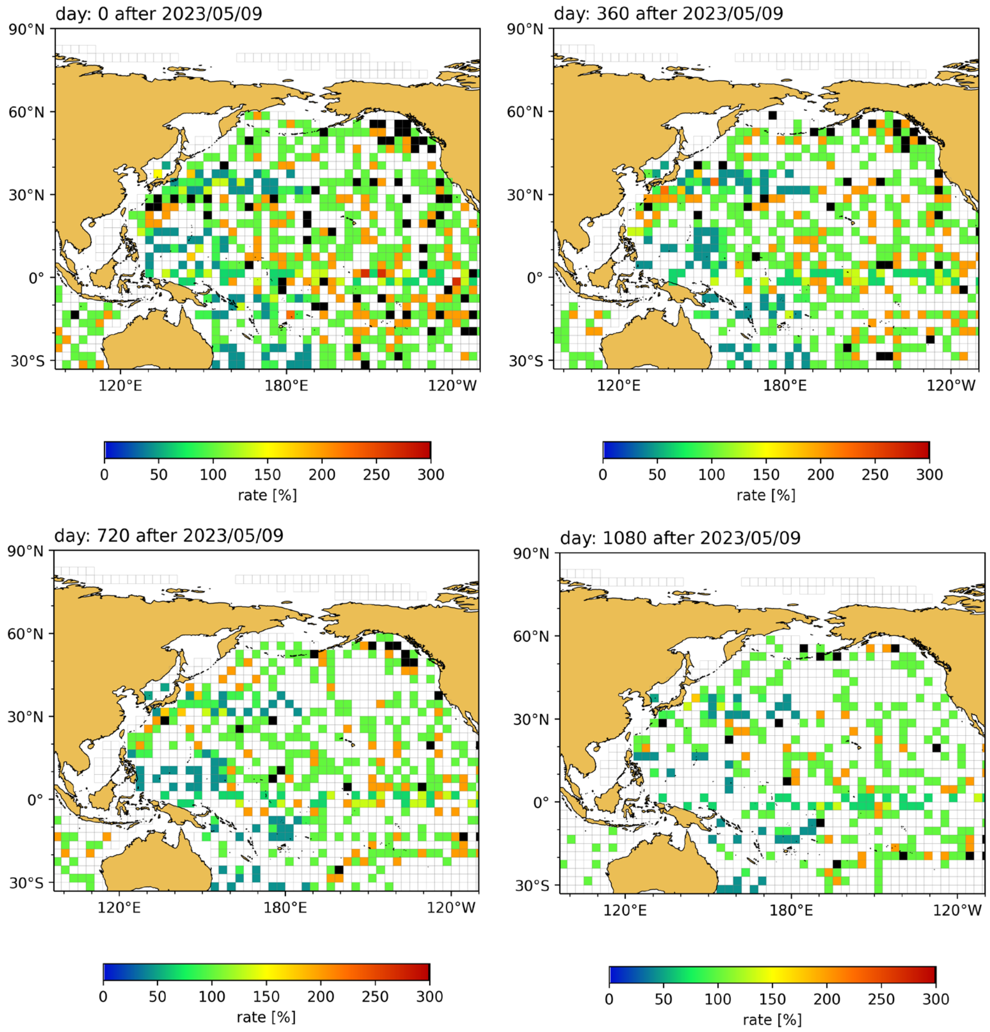

Fig.1 the sufficiency ratio of now (upper left), 360 days (upper right), 720 days (bottom left), and 1,080 days (bottom right) to Argo 2020.

4. Recommendation of implementation environment

The environment must meet or exceed the following conditions.

Processor	Intel Core i7-8565U CPU 1.80GHz 1.99GHz
RAM	16GB
System type	16bit Operation System
OS	Windows 10 & Windows Sybsystem for Linux Or Ubuntu 18.4
Python	3.9.1

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Appendix: Results of average Argo float's lifetime and Argo floats' configuration

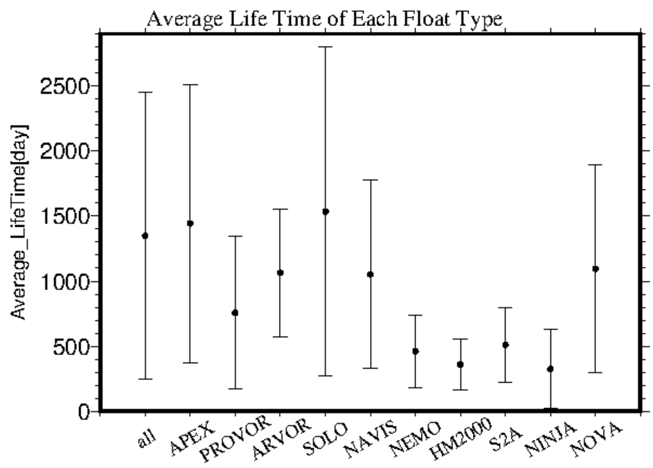
1. Data

We use Argo GDAC monthly snapshots at May 2020 (http://doi.org/10.17882/42182#73395) in the North Pacific; 0-55N, 110E-100W. Deep floats are excluded from the analysis.

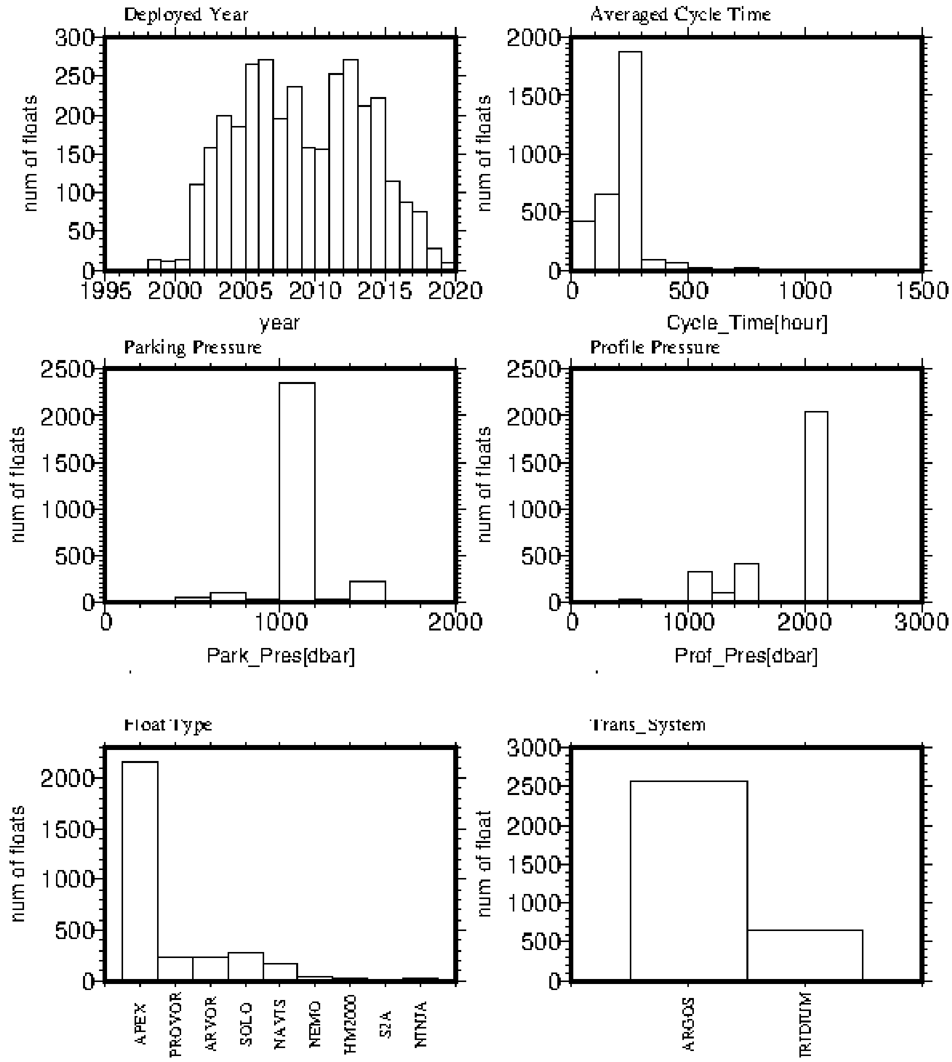
2. Results

We defined the active and inactive floats as follows: active floats are floats with the latest communication date of 3 months before May 1, 2020 or later, and inactive floats are all other floats. The number of inactive floats in the target area described above is 3,246 in the Argo GDAC monthly snapshots at May 2020.

The average lifetime for all types of floats was calculated from these communication disruption floats to be 1,348±1,102 days. Its standard deviation is large due to the large variation in the average lifetime for the float types with the largest number of floats, i.e., APEX, ARVOR, PROVOR, SOLO and Navis.

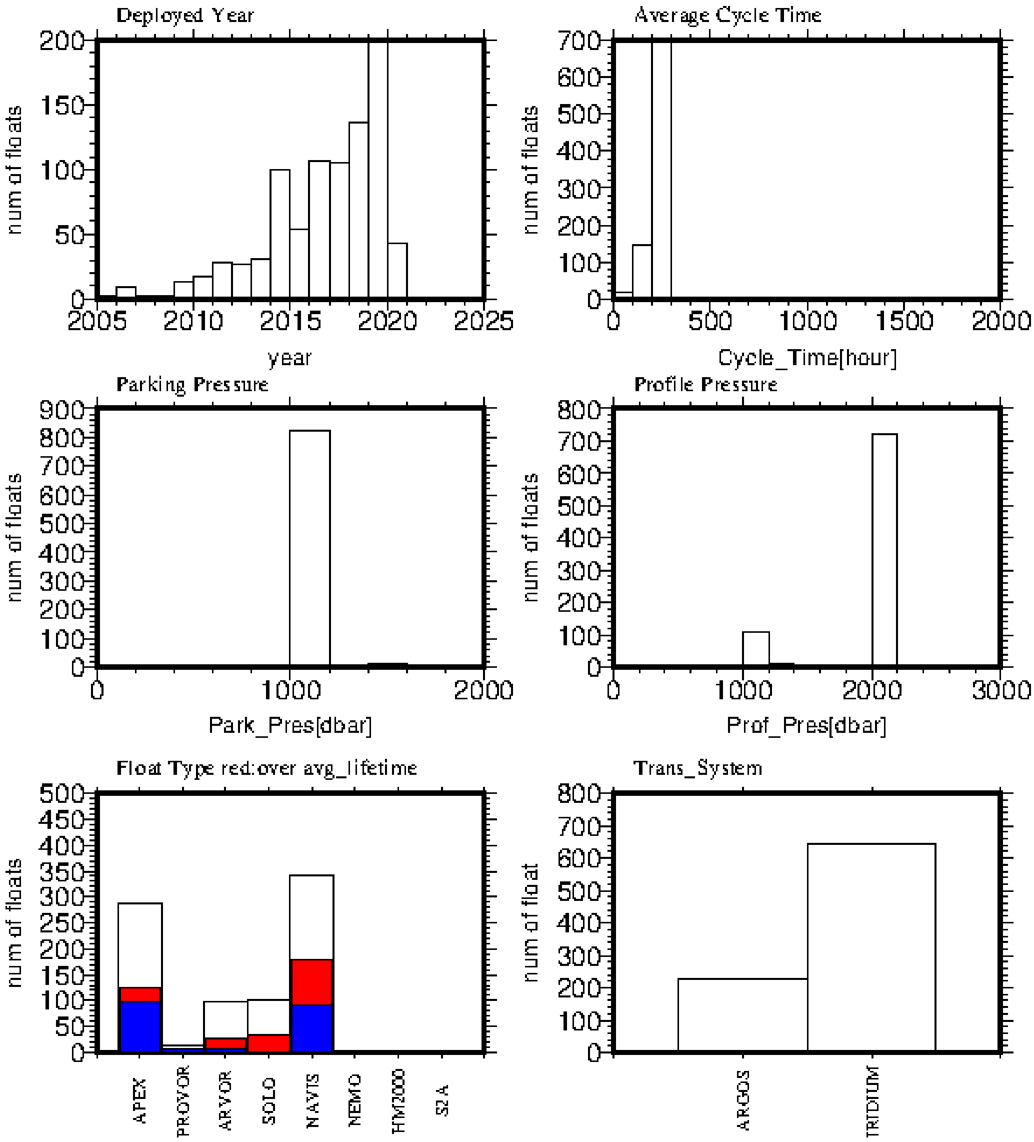


A-fig.1: Average lifetime of inactive floats by float type. The leftmost panel shows the average lifetime for Argo floats calculated regardless of float type.



A-fig.2: Histogram of inactive floats configuration; (upper left) deployment year, (upper right) average cycle time, (middle left) parking pressure, (middle right) profile pressure, (bottom left) float type, and (bottom right) transmission system.

The average lifetime for all types of floats, 1,348±1,102 days, is the average lifetime of floats with cycle time=10days, parking pressure=1000dbar, profile pressure=2000dbar, and ARGOS transmission system, deployed from 2003 and 2015.



A-fig.3: Same as A-fig.2, but active floats configuration; (upper left) deployment year, (upper right) average cycle time, (middle left) parking pressure, (middle right) profile pressure, (bottom left) float type, and (bottom right) transmission system. White in the bottom light panel indicates the number of floats with fewer operating days than the average lifetime for each float type, red indicates floats with more operating days than the average lifetime, and blue indicates floats with more operating days than the average lifetime + standard deviation.

Although cycle time, parking pressure, and profile pressure of active floats are same as inactive floats, many active floats have iridium transmission system. It is expected that the average lifetime of active floats is longer than that of inactive floats.