Argo Operational Status
AST#20

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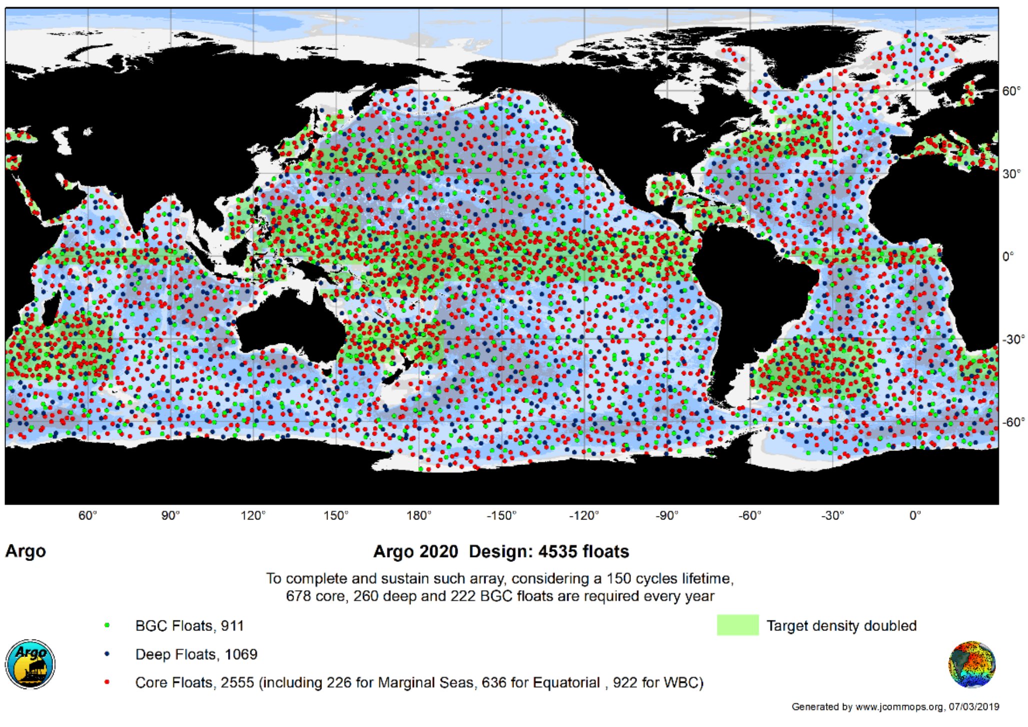


Contents

Executive summary

This report provides elements for information and discussion on the implementation status of the Argo program, in its current Global Design, and on the expanded and fully integrated Argo 2020 vision.

Here are the highlights of the report or lessons learnt in analyzing the many monitoring tools, map and indicators available on argo.jcommops.org:

- ⇨ Argo2020 integrated, would require 678 core floats, 260 deep and 222 BGC floats per year to be sustained at the current float reliability target (150 cycles). This would require tripling national Argo budgets.
- ⇨ The Core Argo is 15% underfunded, extras contributions (equivalent, BGC, deep), and float reliability improvement just allow to sustain the global array.
- ⇨ BGC Argo is stable (35%) and Deep Argo is growing (7%).
- ⇨ Argo has been sustained around 4000 operational units for the last 3 years, but intensity of deployment is on decrease.
- ⇨ At the current float mortality rate, the array is going to decay if we don't deploy more floats or improve float reliability up to 175 cycles (achieved by 55% of floats today).
- ⇨ Global spatial coverage is still improving and rather good everywhere, but the Southern Ocean seasonal ice zone is challenging (50%).
- ⇨ Alarm is raised for the Indian Ocean (south) where the continuous deficits in deployments will start to show gaps. 200 floats are required in 2019. Planning for 2019 is reassuring.
- ⇨ Major gaps are also being developed in the South East Pacific, and North/North East.
- ⇨ The North Atlantic has a year of implementation in advance and 2019 deployments should target the South (< 45°), the Caribbean Sea and Gulf Stream.
- ⇨ Marginal Seas are implemented at 60% (mainly by US Navy) and further support from coastal states and new implementers is required.
- ⇨ A few WBC regions start to be well implemented according to Argo2020 targets (Gulf Stream, East Australian Current, Solomon Sea).
- ⇨ The instruments reliability offers some optimistic perspectives. Overall, reliability of main float models keeps improving year after year, and the performance of the SOLO_II by Scripps is excellent followed up by S2A, ARVOR and NAVIS_EBR. The APEX must progress in the early cycles, and the ARVOR for late cycles. If these two improve, we can reach the 175 cycles and then save up about 150 units every year.

In time of stretched resources, every single float deployment is precious and should be carefully planned to fill up gaps and not oversample areas using classical R/V routes.
Improving float reliability is a priority to secure the global array, and decrease dramatically the resources required every year. For these two reasons, investing in low-cost ship time to optimize deployments and recover some floats with lower performance for engineering investigations seems important. The recovery is in practice very challenging, even with Iridium telemetry. The use of an AIS transmitter on board the float might help ships to recover floats when needed or just identify them when they are at surface.
There might be some interesting solutions in the future such as saildrones deploying floats automatically in gaps.
The ratio cost-benefit for the environment is clear for Argo, and the legal aspects as well. This does not prevent us to do efforts to maximize the value of each single float.
Finally, how can we communicate efficiently on the Argo2020 vision to deciders. This needs an unprecedented effort and investment and probably some help from experts. The cycling strategy for BGC floats will have to be optimized considering the cost of each unit.

Argo CHINA

Since the 20th session of the AST will be held in China, this report provides some brief highlights on China contribution to the Argo array.

Argo China operational floats (~100) were deployed mainly in the West Pacific and North Indian Ocean (Fig. 4,5). They are operated 50/50 by the national Argo program and by equivalent contributions from various national research initiatives (Fig. 3). Through its history 433 floats were deployed, with more than 20 units deployed each year recently and a commitment of 35 floats for 2019, including 22 BGC and 3 deep floats.
Floats deployed in 2018 were manufactured by TWR (USA), NKE (FR) and HSOE (CH).
Argo China stopped deploying floats using Argos telemetry and has been testing Beidou and Iridium alternatives on APEX, ARVOR and HM2000 floats in the last two years. A third of the floats deployed in 2018 were equipped with BGC sensors. Argo China has also started to contribute to the Deep Argo extension in the West Pacific and Southern oceans. (Fig. 1, 2).

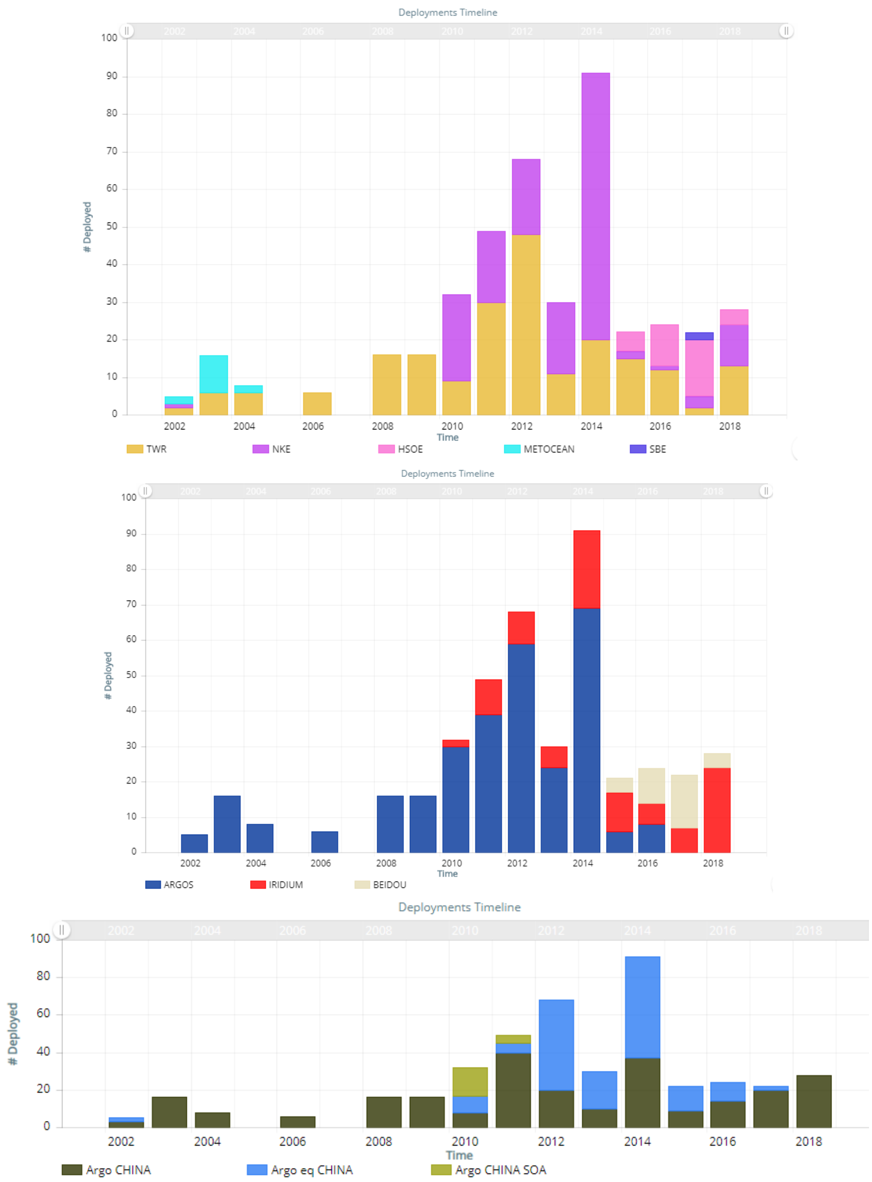
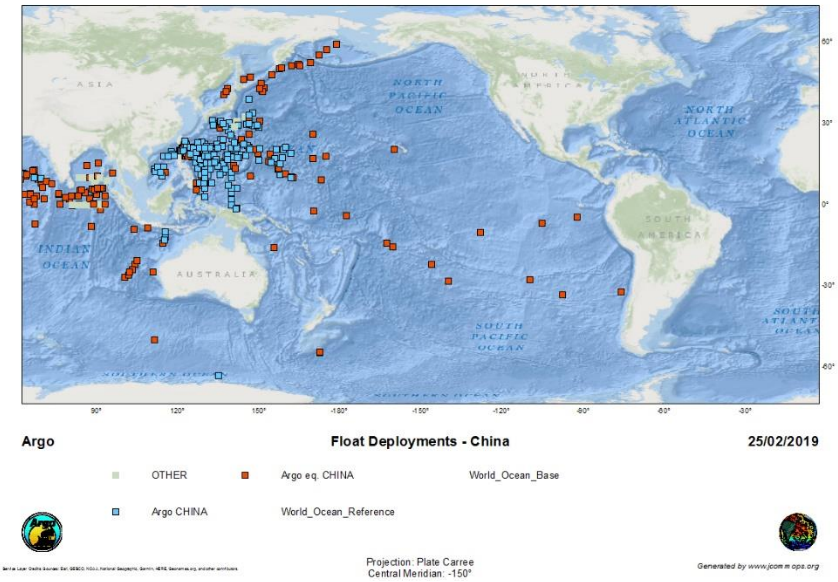


Fig. 1,2,3: Argo China deployment by manufacturers, telemetry, implementer.



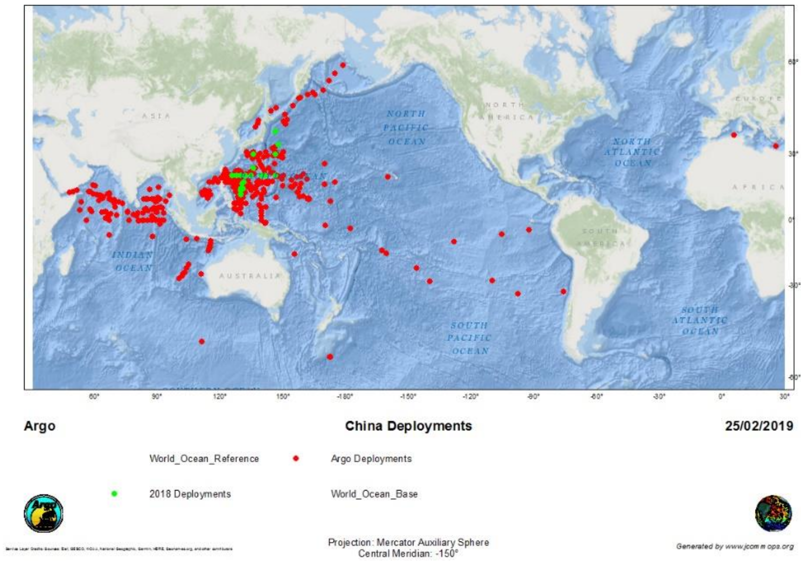


Fig. 4,5: Argo China historical deployments (by program, 2018 highlighted)

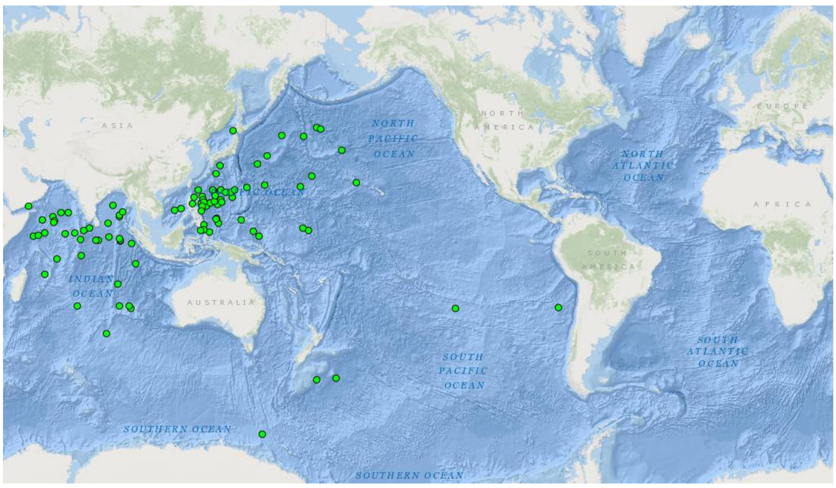


Fig. 6: Location of China operational floats as of Feb. 2019.

Fig. 7: Float data distributed at GDACs by program.

China has also recently deployed a COPEX float manufactured by the national Ocean Technology Centre (NOTC) in Tianjin.

To keep optimizing the global network coverage, deployments in the South China Sea and further east in the Pacific Ocean (135°-170°) might be considered in 2019 (Fig. 8)

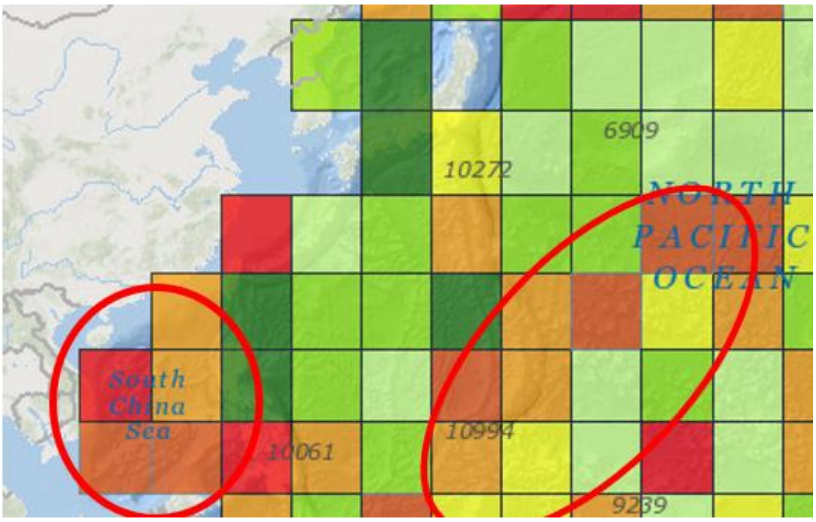


Fig. 8: Current Argo density and suggested deployment areas.

⇨ Argo China has been a continuous supporter of the Argo program since its early years, including financial support to the JCOMMOPS infrastructure, and is supporting the Argo2020 extensions with ambitious plans for its BGC component.

Design

All numbers and indicators provided in this section are largely based on the network designs defined through 3°x3° grids after many iterations with AST (see previous reports).
In practice these are polygons (GIS layers), with different density targets in each grid cell, and different filters such as basin, sub basins, extensions, etc.
This representation is not perfect, and none would be, but very useful to analyze the array performance through many different perspectives.
Any update on such designs means a major recalculation of many indicators, maps, timeseries, web site elements, etc.
Update are however encouraged on a yearly basis following up on AST feedback to improve the accuracy of our monitoring and planning.

Argo Global

As reviewed at AST#19 the current global Argo design (3756 floats) includes most of the marginal seas (with a double density) and high latitudes (Fig. 9).

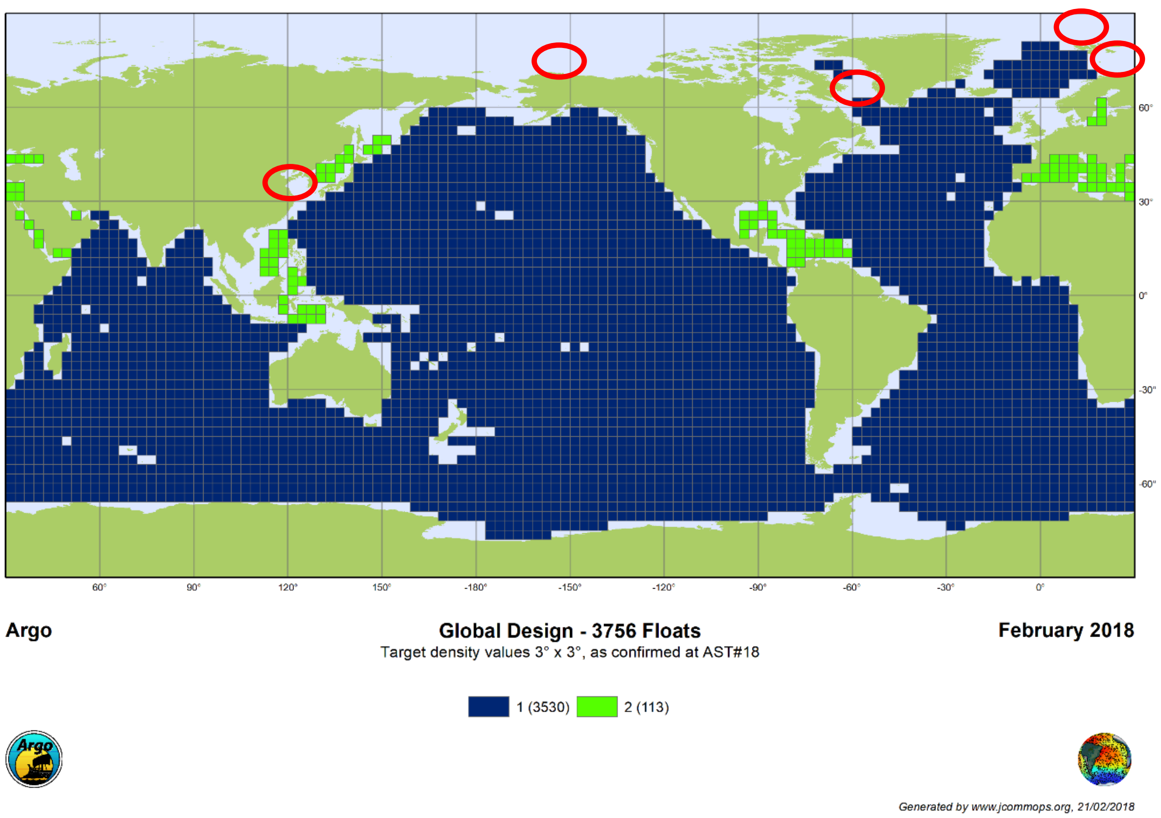


Fig. 9: Global Argo Design

The deployment practices in 2018 show that some floats were deployed in the Yellow Sea, in the Beaufort Sea, Davis Straight, Queen Victoria Sea and Barents Sea (highlighted in Fig. 9).
Implementers might confirm if such areas should be added to the Argo design, and with which cycling or density specifications.

The Arctic ocean shows anyway some floats with shorter cycle time, and consequently a yearly mortality rate twice above the standard (>50%)

⇨ **Action:** Refine targets for the Arctic Ocean (space, density, cycle)

This design needs 226 floats for Marginals Seas and 3530 for other basins. To be sustained, based on a 150 cycles target (4.1 years) and double cycling in Marginal seas, we need an intensity of 970 floats per year.

Improvements on float reliability have a dramatical impact on the yearly Argo budget required to sustain the array. To sustain “Global Argo” we seem short of 100 floats per year, but a light improvement of float performance, which is somehow anticipated, could allow to meet the target.

The table 1. below provides a few simulations of the requirements based on float reliability.

Argo Global	High Seas	Marginal seas	Total
Total array	3530	226	3756
Intensity (150)	860	110	970
Intensity (175)	736	94	831
Intensity (200)	644	82	727
Intensity (250)	515	66	581
2016-2018 avg	814	70	884

Table 1.: Requirements for Global Argo

⇨ Global Argo is sustainable today, provided efforts in deployments are addressing the design and not oversampling areas not identified, and float reliability lightly improved up to 175 cycles.

Argo 2020

A first evaluation of the requirements in floats for a future Argo design was made on the Argo2020 design below. The WBC and equatorial extensions (suggested at OceanObs’09 and including recently TPOS2020 report) are included. This design would require an increase of 200 new floats per year.

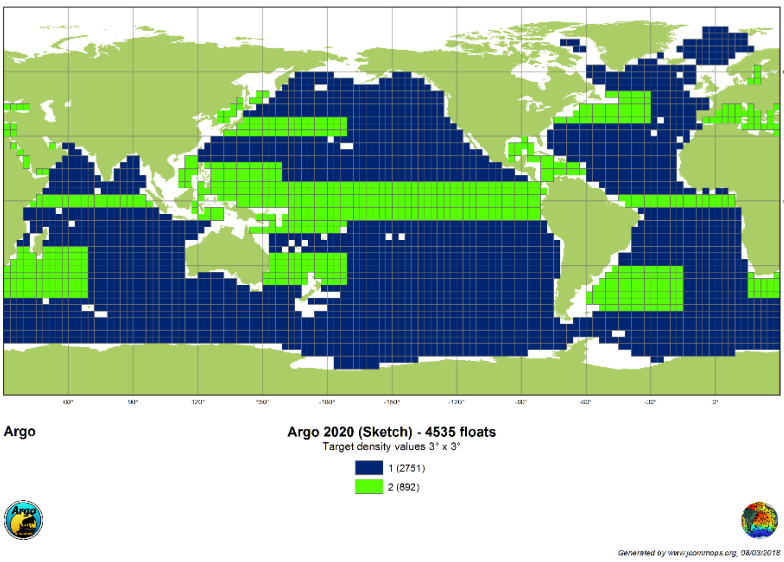


Fig. 10: Argo2020 Design

We can run the same simulations than above:

Argo 2020	**core**	**Marginal seas**	**total**
Total array	4309	226	4535
Intensity (150)	1050	110	1160
Intensity (175)	899	94	993
Intensity (200)	786	82	869
Intensity (250)	629	66	695
2016-2018 avg	814	70	884

Table 2: Requirements for Argo2020

⇨ Argo2020 is sustainable today with 100 new floats per year, and float reliability lightly improved up to 175 cycles, or with 200 new floats.

Numbers for Equatorial and WBC extensions are provided further in this report.

Argo 2020 integrated

Following up on the 6th Argo Science Workshop (Oct. 2018), the future of Argo design was drafted with a fully integrated perspective. It assumes that deep and BGC floats will contribute to the core Argo mission.

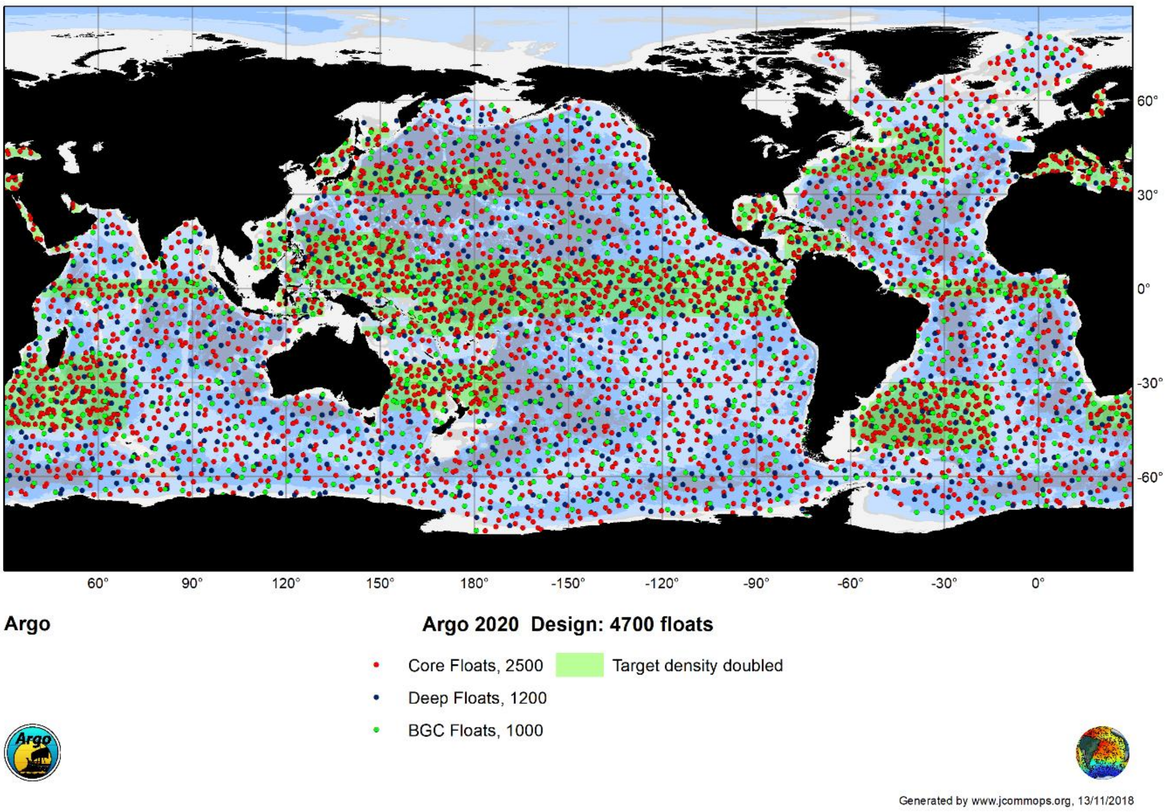


Fig. 11: Argo2020 integrated design

The number provided on the above map (Fig. 11) can be refined, according to the deep and BGC design estimations calculated at JCOMMOPS, and with same simulations on floats performance:

Argo2020 integrated	total	deep	bio	core	marginal. seas
Total array	**4535**	**1069**	**911**	**2329**	**226**
Intensity (150)	**1160**	**260**	**222**	**568**	**110**
Intensity (175)	993	223	190	486	94
Intensity (200)	866	195	166	425	82
Intensity (250)	693	156	133	340	66
2016-2018 avg	884	36	131	717	70

Table 3.: Requirements for Argo2020

However, the current practices with BGC floats (higher cycling frequency on half of BGC floats– see section reliability) will increase the number of BGC floats to be deployed each year, potentially by a factor 2.

- ⇨ Argo2020 integrated, would require 678 core floats, 260 deep and 222 BGC floats per year to be sustained at the current float reliability target (150 cycles). The cycling strategy of BGC floats remains a question mark to refine this estimation.
  If core floats are still funded at the same level, and deep/bgc extensions funded, the dependency on extras floats (e.g. "Argo Equivalent") won't be critical.

Projection

Using the existing operational status (3907 floats), the current mortality rate (26%), we can project the network status in the future. The Argo array is going to decay substantially (~3500 in 2020) if we don't improve float reliability or deploy more floats.

Fig. 12, 13: Projections at current intensity and two mortality rates (0.26 and 0.2)

The inflation rate will emphasis this decay on the long run but doesn't weight much in the first years. Note that simulator can be used to project the status of any basin adapting the starting number of floats, projected deployments and mortality rate.

Roadmap - National budgets

While Argo is preparing its future 2020 design, we need to have an idea of budgets increase for communication to funding agencies. A simplistic approach would be to say that we need to triple the yearly budget for floats, including ½ core ¼ deep and ¼ BGC, and grow the overall infrastructure accordingly (data processing, logistics for deployments, etc).

Considering "A" as the price of a standard float, 3A is roughly the price for a deep float and 4A for a BGC float (potentially 5A for a full 6 variables BGC float).
The Argo2020 integrated design will need 678 core floats, 260 deep and 222 bgc floats per year for a total cost of "2346A" while the original "Argo 3000" budget was "750A".

The requirement for funding agencies is to triple the yearly Argo budget vs what they committed in 2000 for the implementation of Argo. Some AST member countries should be already in between.

Based on the last 3 years of Argo operations (2016-2018), and on the average yearly contribution by each AST member country (i.e. % of the global array), we can define the float numbers that would be needed to implement Argo2020 proportionally for each member.

	2016-2018 practices								Argo2025 yearly requirements			
COUNTRY	**2016**	**2017**	**2018**	**avg**	**%**	**core**	**deep**	**bgc**	**Argo2025**	**CORE**	**DEEP**	**BGC**
∑	**891**	**929**	**830**	**884**	**100**	**717**	**36**	**131**	**1155**	**673**	**260**	**222**
United States	442	441	359	414	47	340	18	56	**541**	318	122	104
France	57	69	85	71	8	39	5	27	**92**	54	21	18
Japan	51	74	55	60	7	51	5	4	**78**	46	18	15
Australia	75	35	43	51	6	47	0	4	**67**	39	15	13
Germany	39	50	51	47	5	46	0	1	**61**	36	14	12
European Union	36	57	40	44	5	37	2	5	**58**	34	13	11
United Kingdom	34	53	33	40	5	30	3	7	**52**	31	12	10
Canada	34	33	39	35	4	30	0	5	**46**	27	10	9
Italy	30	26	29	28	3	20	1	8	**37**	22	8	7
India	29	32	15	25	3	17	0	8	**33**	19	7	6
China	24	15	26	22	2	18	1	3	**28**	17	6	5
Korea (Rep. of)	16	12	11	13	1	13	0	0	**17**	10	4	3
Netherlands	3	12	3	6	1	6	0	0	**8**	5	2	2
Spain	1	3	14	6	1	6	0	0	**8**	5	2	2
Finland	3	5	4	4	0	2	0	2	**5**	3	1	1
Poland	3	3	6	4	0	3	0	1	**5**	3	1	1
Greece	3	3	4	3	0	2	0	1	**4**	3	1	1
Ireland	3	3	4	3	0	3	0	0	**4**	3	1	1
Norway	2	0	6	3	0	2	0	1	**3**	2	1	1
New Zealand	2	2	2	2	0	2	0	0	**3**	2	1	1
Peru	4	0	0	1	0	1	0	0	**2**	1	0	0
Indonesia	0	1	1	1	0	1	0	0	**1**	1	0	0

Table 4: practices, and requirement for Argo2020 integrated

⇨ The national strategies to implement Argo2020 might be different and it would be good to have an idea of the trends if they are different from the proposed scheme (1/2,1/4,1/4).

Networks

Networks are defined as follow:

Argo Core:	float funded under a national Argo program (without BGC sensors, not deep)
Argo Equivalent:	float not funded under Argo (data and international procedures shared).
Argo BGC:	any float with any BGC sensor
Argo Deep:	any deep float
Argo 2020:	extra floats deployed in WBC, Equatorial and TPOS extensions
Non-Argo:	float data shared with Argo, but not international procedures (e.g. Navy)

There can be overlap between equivalent, deep, 2020 and BGC floats.

Argo Global = Argo Core + (Argo Equivalent OR Argo BGC OR Argo Deep OR Argo2020) + Non-Argo

At the time of writing this report (Feb. 2019), on the 3909 operational units, 3308 are Argo Core, 336 Argo BGC, 119 Argo Equivalent, 91 Non-Argo, 74 Argo Deep and 16 Argo 2020.
Only about 44 units are overlapping between networks.

The other networks are other grouping of floats either geographical AtlantOS, TPOS (-30°/30°), or based on national contributions (EuroArgo).

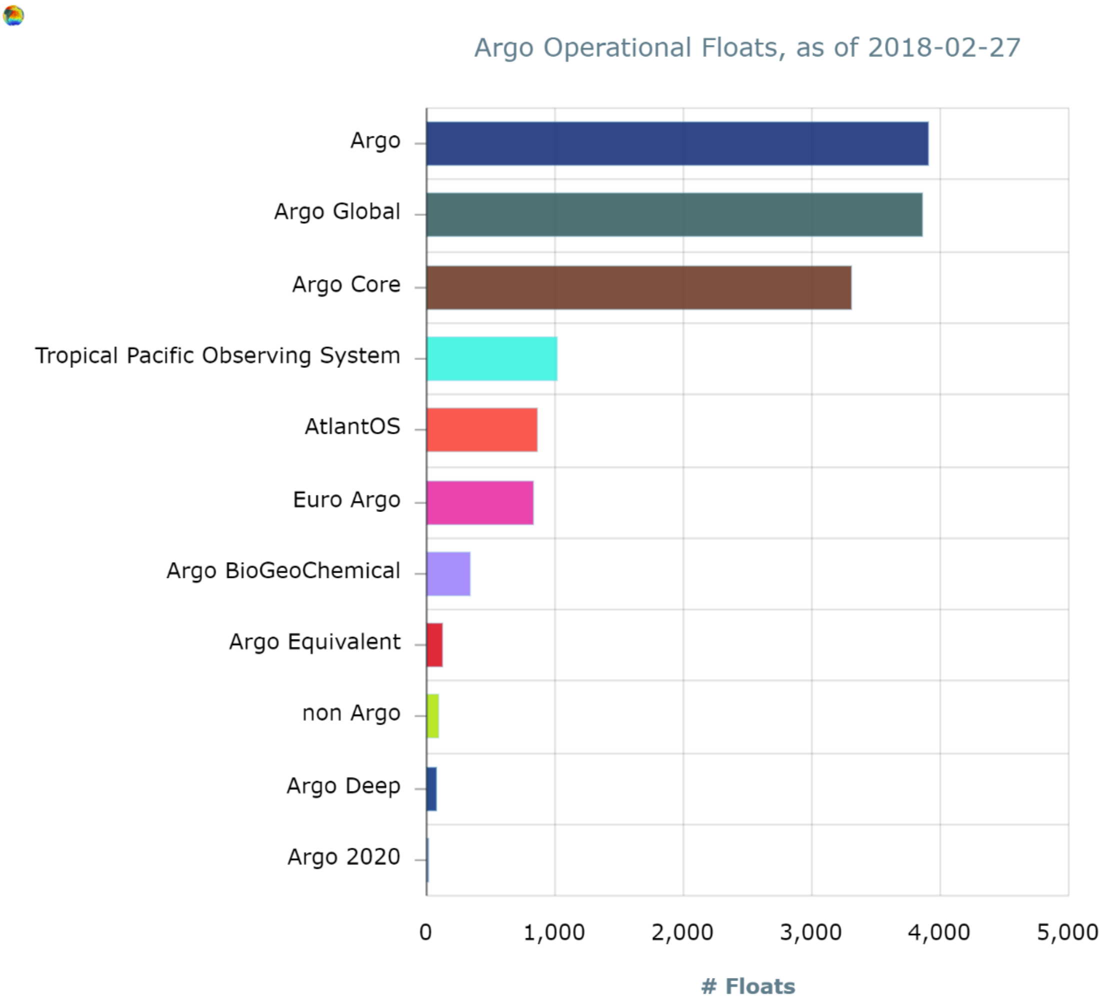


Fig. 14: Argo networks status

The "Argo" network tag is used in the JCOMMOPS integrated perspective (can be ignored here).
A few deep floats sampling on descent were initially excluded from the Global Argo label and can be added back so that "Argo" = "Global Argo".

- ⇨ The AST is invited to provide further criterion for integration into the "Global Argo" network.
- ⇨ The question of "non-Argo" floats should be discussed during AST

Implementation Status

Activity

The activity indicator tracks the floats officially registered at JCOMMOPS, and operating[1] within the design, vs the target.

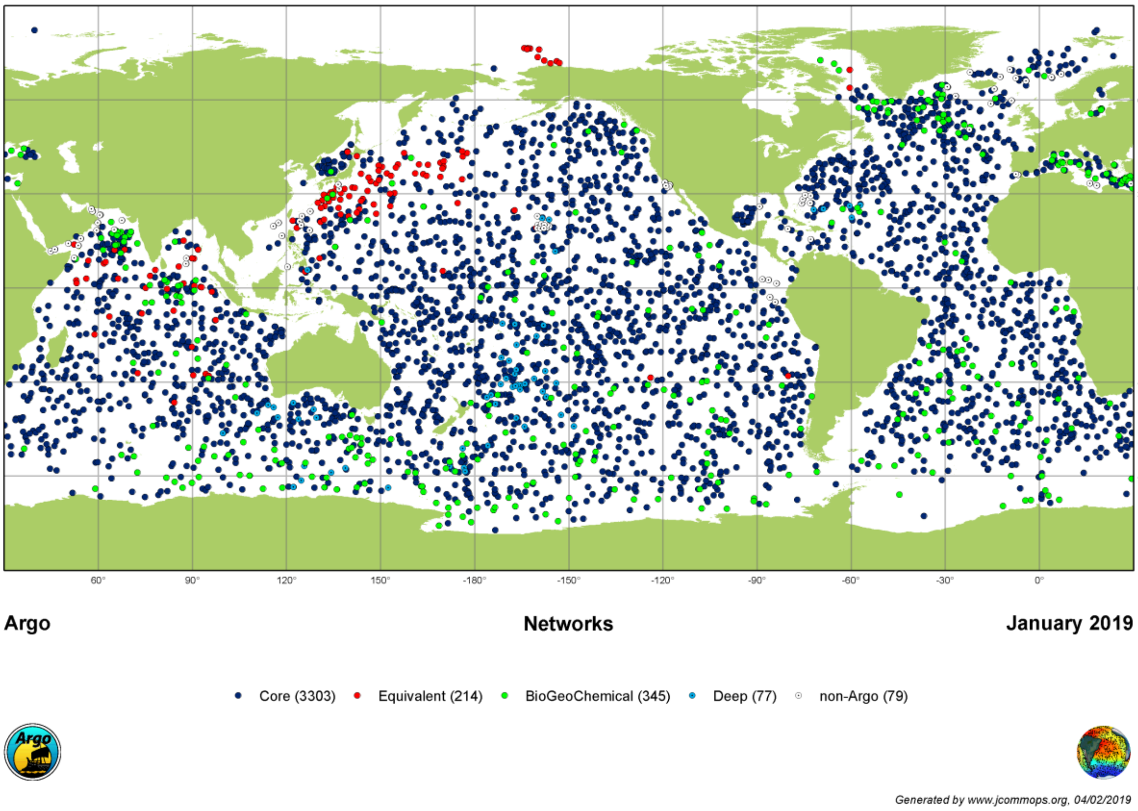


Fig. 15: Argo operational networks

The array has an appropriate number of operating units to maintain its global design.
The 4000 operational floats milestone was reached during a few hours (real-time view) in October 2018 before dropping below.

But if we look to the GDAC archives (Fig. 16), where data can arrive with long delay, the 4000 floats milestone (distinct floats providing data for a given month) was passed several times around December/January in 2016, 2017 and 2018, when Southern Ocean iced over floats are back on line.

[1] Operational = one observation distributed in the last X days, where X is the activity criteria set by default to 30 days, or 365 days in ice covered regions – set automatically by the system when location enter the monthly ice extent polygon.

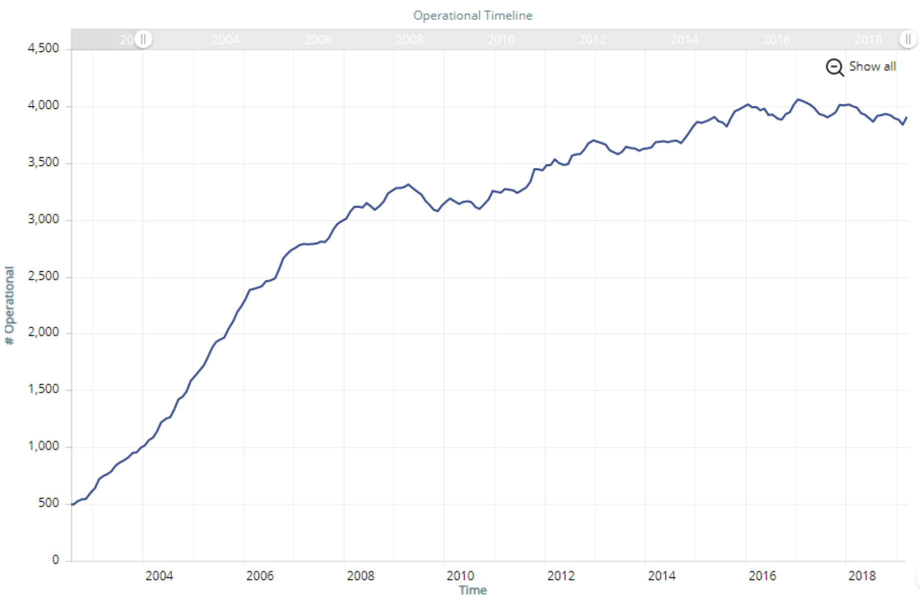


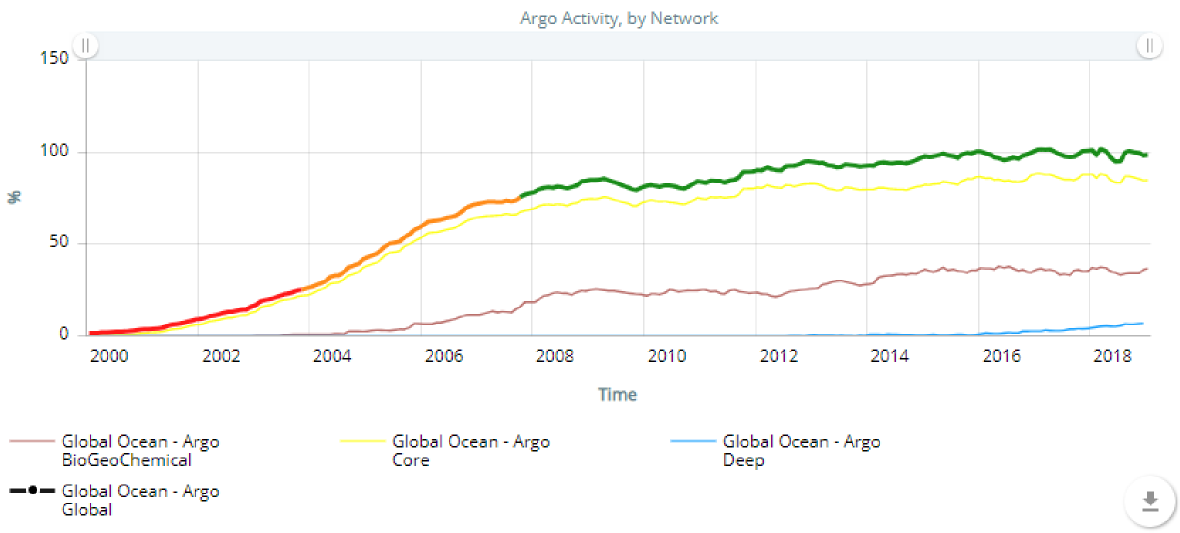
Fig. 16: Number of floats that provide data at GDACs (monthly), as of Feb. 2019.

Note that we still have about 100 floats that have been deployed but data are not showing up.

⇨ Argo has been sustained around 4000 units for the last 3 years.

# of operational units in the design vs target (Global Argo)

Target: 3756 >=75 25 to 75 <=25



Implementation

Activity Argo BioGeoChemical	36.62% 1/2019 ↘	334 Raw count	912 Target	# of operational units in the design vs target (BGC-Argo)
Activity Argo Core	84.64% 1/2019 ↘	3179 Raw count	3756 Target	# of operational units in the design vs target (Core Argo)
Activity Argo Deep	6.74% 12/2018 ↗	72 Raw count	1069 Target	# of operational units in the design vs target (Argo Deep)
Activity Argo Global	98.51% 1/2019 ↘	3700 Raw count	3756 Target	# of operational units in the design vs target (Global Argo)

Fig.,17, 18: Activity Indicators, by Network

We can check on these activity plots (Fig. 17, 18) that the Global Argo design can't be sustained without extras contributions. Core Argo is still short by 15%.

The BGC network activity is stable (35% vs its target) with about 330 operational units and Deep Argo is starting to grow (7%, 72 units).
A view by variable (Fig. 19) provide us with more details on BGC sensors evolution; most of BGC floats carry oxygen (321), Backscatter & chlorophyll (199), Nitrate (128), pH (118).

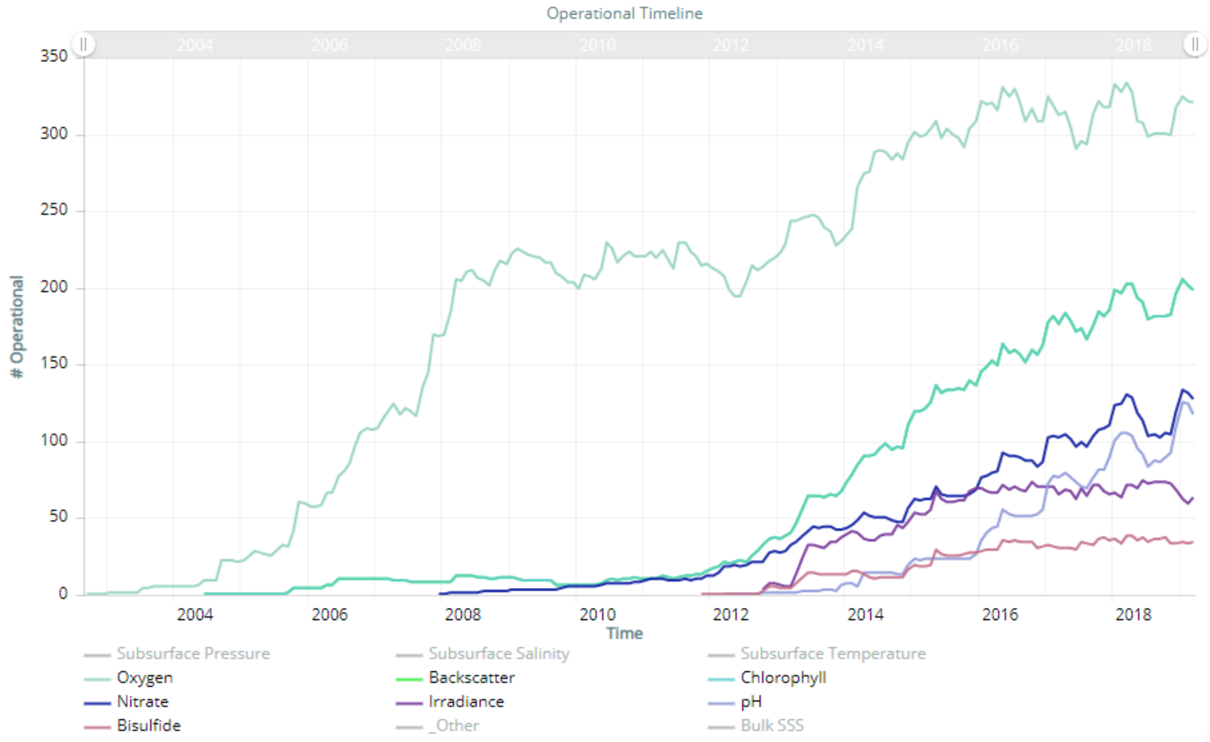


Fig. 19: BGC Argo evolution by variable, at GDACs

A view by ocean basin highlights the gaps in Marginal Seas (65%, showing seas not implemented), and Southern Ocean seasonal ice zone (slow and regular increase, but still 46%). There is a clear seasonal trend with a drop of the SO activity by 10-20% around August/September each year.
The North Atlantic has an excess of 110 floats.
The South West Pacific shows a little excess due to the deep float pilots in the region.
The Indian Ocean has lost its reserve of floats after 2 years of slow and continuous decrease.

Activity	% (1/2019)	Raw count	Target
Activity Argo Global - Atlantic Ocean	114.5% 1/2019 ↘	908	793
Activity Argo Global - Pacific Ocean	106.27% 1/2019 ↘	1695	1595
Activity Argo Global - Indian Ocean	100.72% 1/2019 ↘	702	697
Activity Argo Global - Southern Ocean	46.28% 1/2019 ↗	174	376
Activity Argo Global - Mediterranean Sea	98.44% 1/2019 ↗	63	64
Activity Argo Global - Arctic Ocean	107.25% 1/2019 ↘	74	69
Activity Argo Global - Marginal Seas	65.04% 1/2019 ↘	147	226
Activity Argo Global - Pacific Ocean - North West	97.19% 1/2019 ↘	277	285
Activity Argo Global - Pacific Ocean - North East	105.01% 1/2019 ↘	461	439
Activity Argo Global - Pacific Ocean - South West	119.53% 1/2019 ↘	508	425
Activity Argo Global - Pacific Ocean - South East	100.67% 1/2019 ↘	449	446
Activity Argo Global - Atlantic Ocean - North	132.36% 1/2019 ↗	454	343
Activity Argo Global - Atlantic Ocean - South	100.89% 1/2019 ↘	454	450

Fig. 20: Activity by ocean basin.

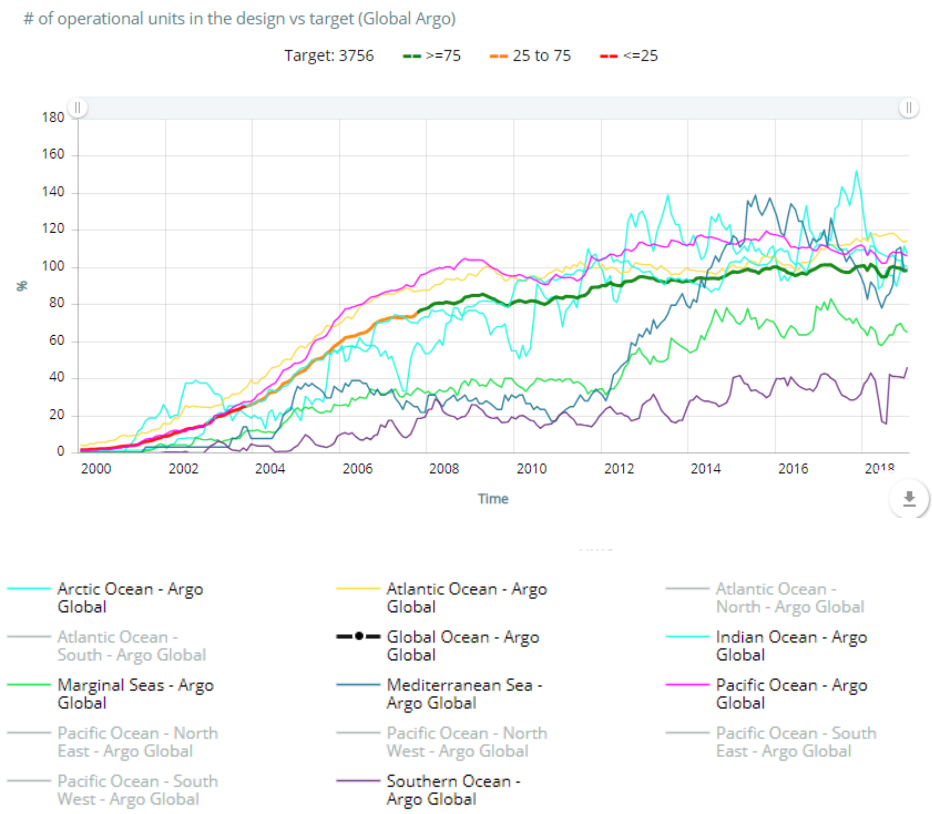
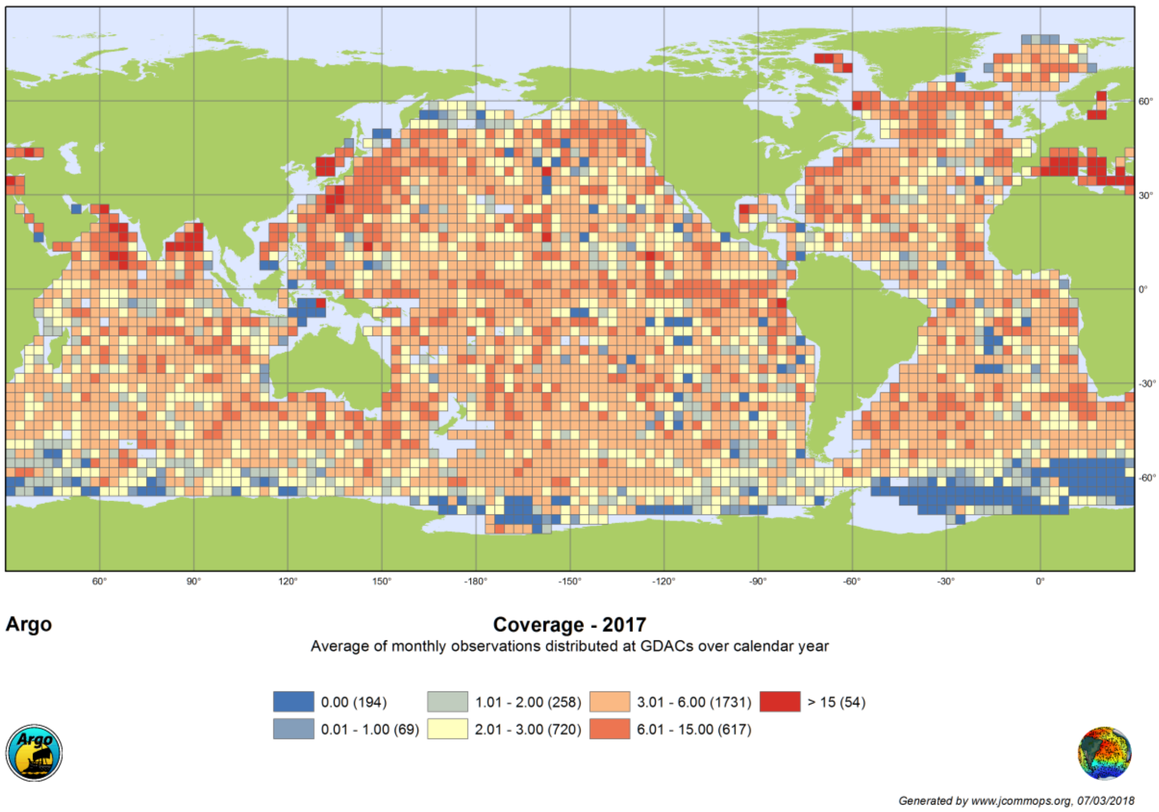
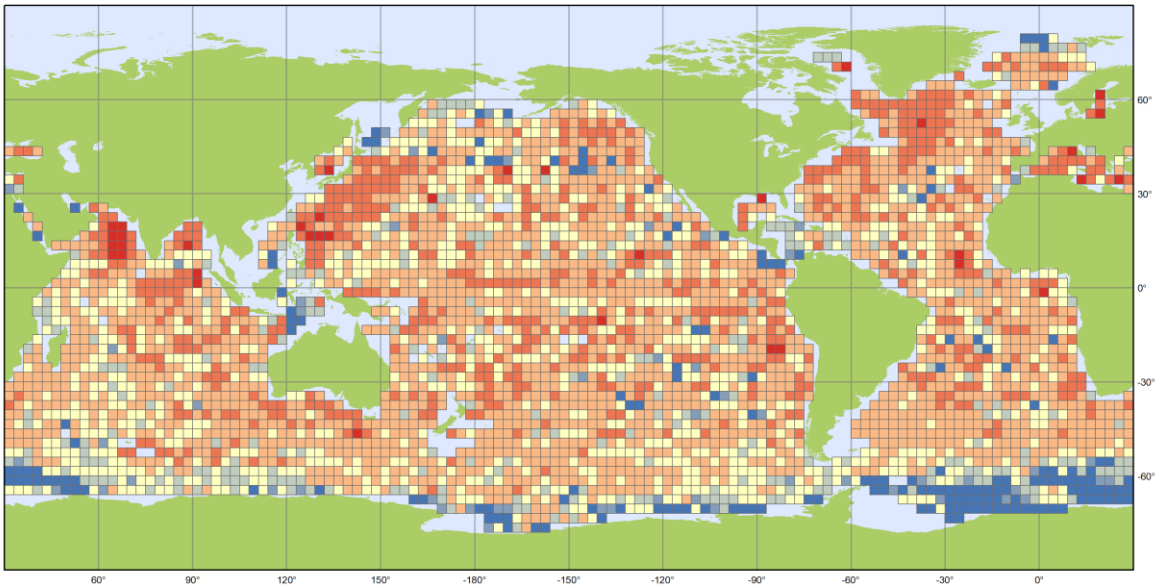


Fig. 21: Activity indicator as of January 2019 and time series, by basin

Coverage

The coverage indicator is representing the spatio-temporal distribution of data available at GDACs, normalized to the target (e.g. double density in marginal seas), and averaged over a year. It represents the share of the array that is perfectly sampled according to the design.
Other calculations are available on the web site with monthly values, or with the sum of partially implemented grid cells considered.





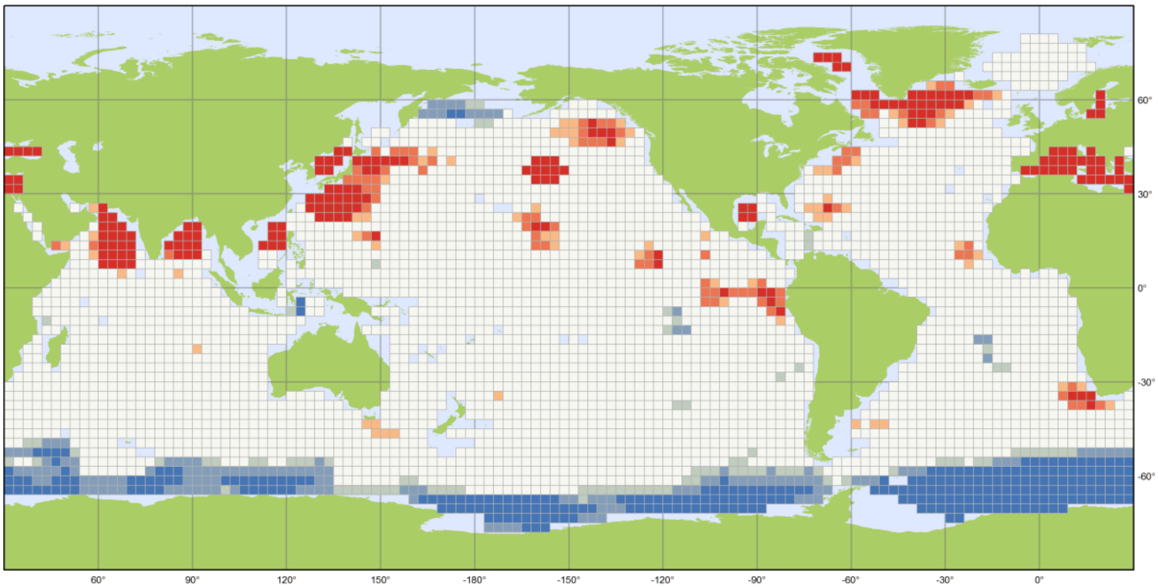
Argo

Coverage - 2018

Average of monthly observations distributed at GDACs over calendar year,
normalized on Argo Global Design targets (double density in marginal seas)

0.00 | 1.01 - 2.00 | 3.01 - 6.00 | > 15
0.01 - 1.00 | 2.01 - 3.00 | 6.01 - 15.00

Generated by www.jcommops.org, 19/02/2019



Argo

Coverage 2017 - Hot Spot Analysis

For each float a spatial weight on age is calculated according to neighbours to identify spatial clusters of hot/cold spots.
To be statistically significant, the hot/cold spot will have a high/low value and be surrounded by other features with high/low values. (Getis-Ord Method)

Cold Spot - 99% Confidence (276) | Hot Spot - 90% Confidence (67)
Cold Spot - 95% Confidence (140) | Hot Spot - 95% Confidence (78)
Cold Spot - 90% Confidence (89) | Hot Spot - 99% Confidence (182)
Not Significant (2811)

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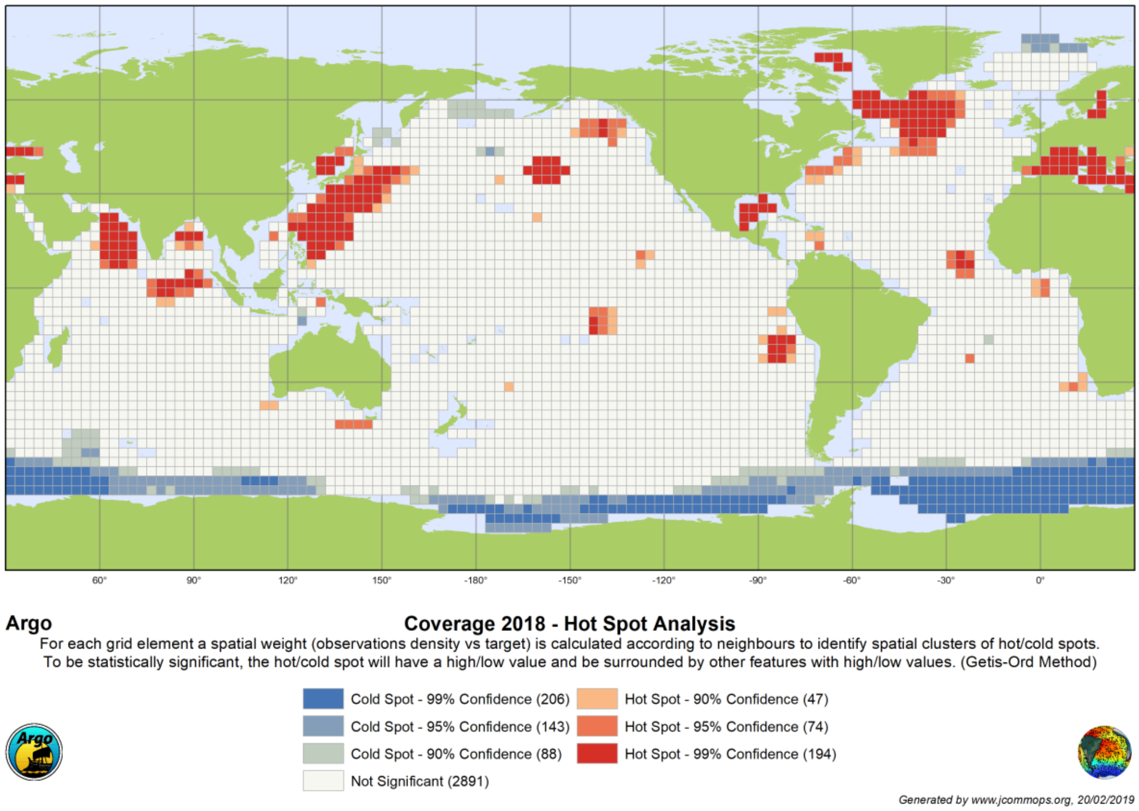


Fig. 22-24: Coverage 2017/2018 and hot spots analysis

Figures 22-24 show that small gaps identified in 2017 have been addressed in 2018 and larger gaps are remaining in the Southern Ocean even if its boundary has shifted a little further south.

A number of areas are still oversampled (vs the design) and call for an update of the design or for a rebalancing of deployments beyond classical R/V routes or observatories.

The coverage keeps improving lightly for the global array and has reached a plateau where 67% of the array is perfectly sampled. We can say that Argo is continuously optimizing its spatial coverage, and it could even do better through a refined deployment strategy.

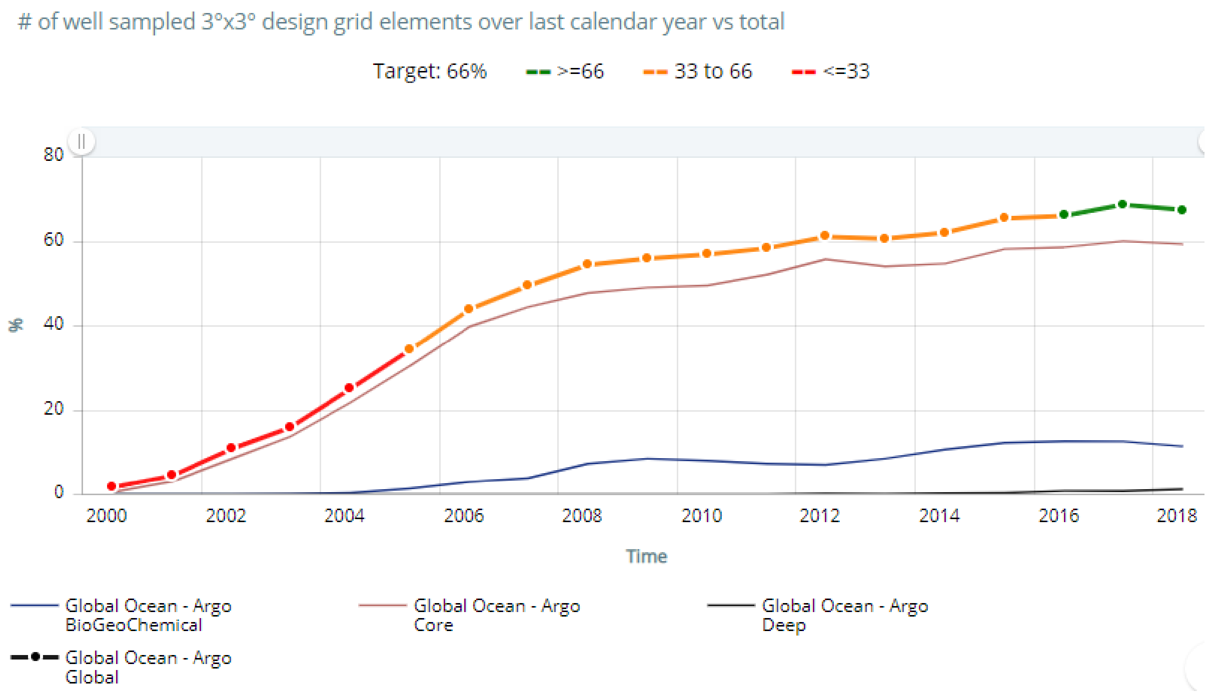


Fig. 25: Global Argo yearly coverage evolution

Fig. 25 shows the contribution of BGC and in less extent deep floats to the overall coverage target. BGC floats participate to the coverage by 10% and explain the difference between core and global, with a very small overlap.

Coverage (Yearly) Argo Global - Pacific Ocean	72.35% 2018 ↘	72 Raw count
Coverage (Yearly) Argo Global - Atlantic Ocean	77.81% 2018 ↗	77 Raw count
Coverage (Yearly) Argo Global - Indian Ocean	68.58% 2018 ↘	68 Raw count
Coverage (Yearly) Argo Global - Southern Ocean	25.8% 2018 ↘	25 Raw count
Coverage (Yearly) Argo Global - Mediterranean Sea	71.88% 2018 ↘	71 Raw count
Coverage (Yearly) Argo Global - Arctic Ocean	68.12% 2018 ↘	68 Raw count
Coverage (Yearly) Argo Global - Marginal Seas	42.48% 2018 →	42 Raw count
Coverage (Yearly) Argo Global - Pacific Ocean - North West	68.77% 2018 ↘	68 Raw count
Coverage (Yearly) Argo Global - Pacific Ocean - North East	70.61% 2018 ↘	70 Raw count
Coverage (Yearly) Argo Global - Pacific Ocean - South West	79.29% 2018 ↘	79 Raw count
Coverage (Yearly) Argo Global - Pacific Ocean - South East	69.73% 2018 ↗	69 Raw count
Coverage (Yearly) Argo Global - Atlantic Ocean - North	83.97% 2018 ↗	83 Raw count
Coverage (Yearly) Argo Global - Atlantic Ocean - South	73.11% 2018 ↗	73 Raw count

Fig. 26: Coverage Indicators by basin

With regard to the ocean basin view Fig. 26:

- It is appropriate in the 3 main basins, and very good in the Pacific Ocean (72%) and Atlantic Ocean (78 %).
- The Southern Ocean coverage is decreasing and has lost 10% in a year, despite the stable activity (deployment strategy, accumulations areas ?)
- Overall coverage in Marginal Seas could be improved by implementing new areas and avoid oversampling in some others.

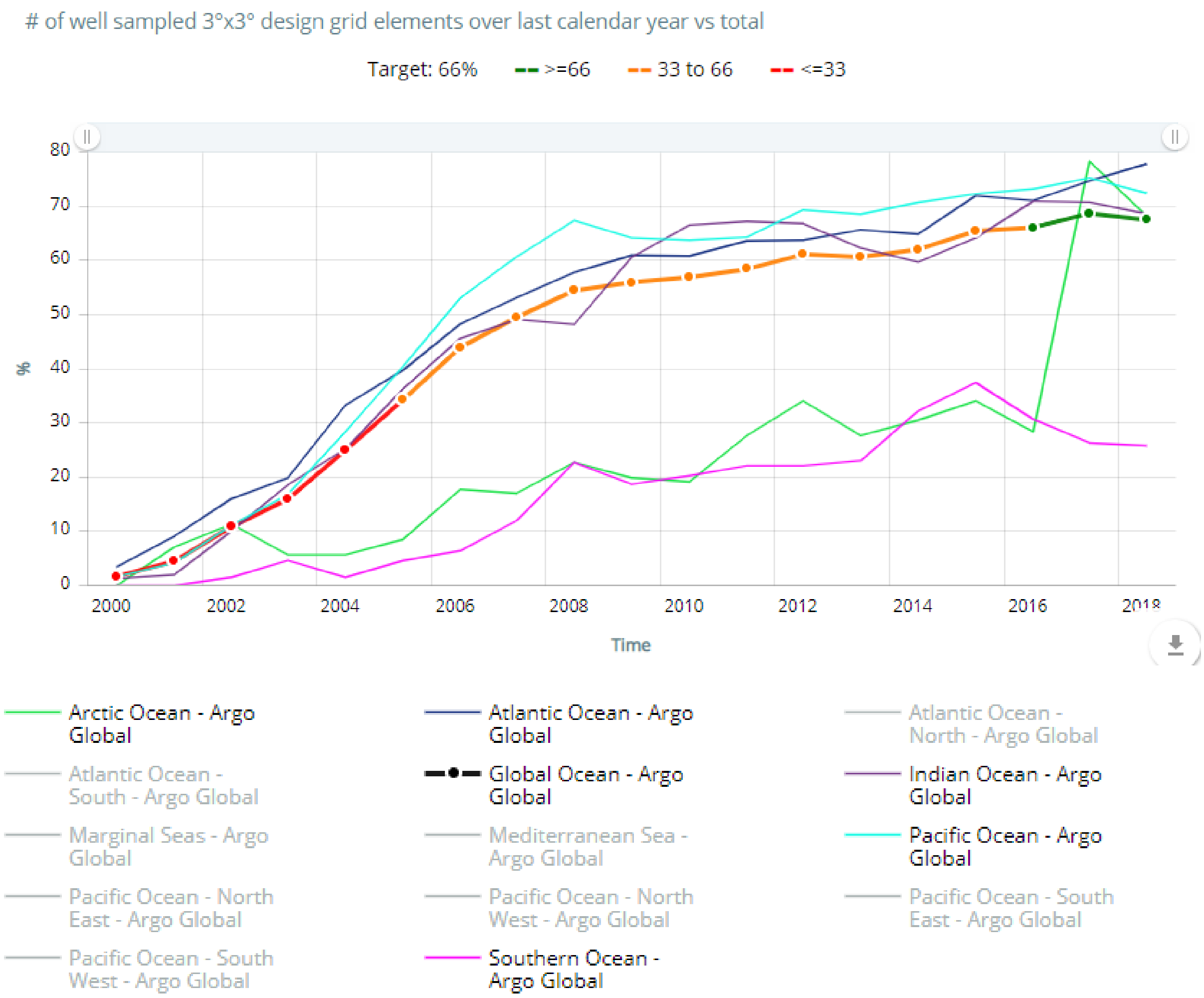


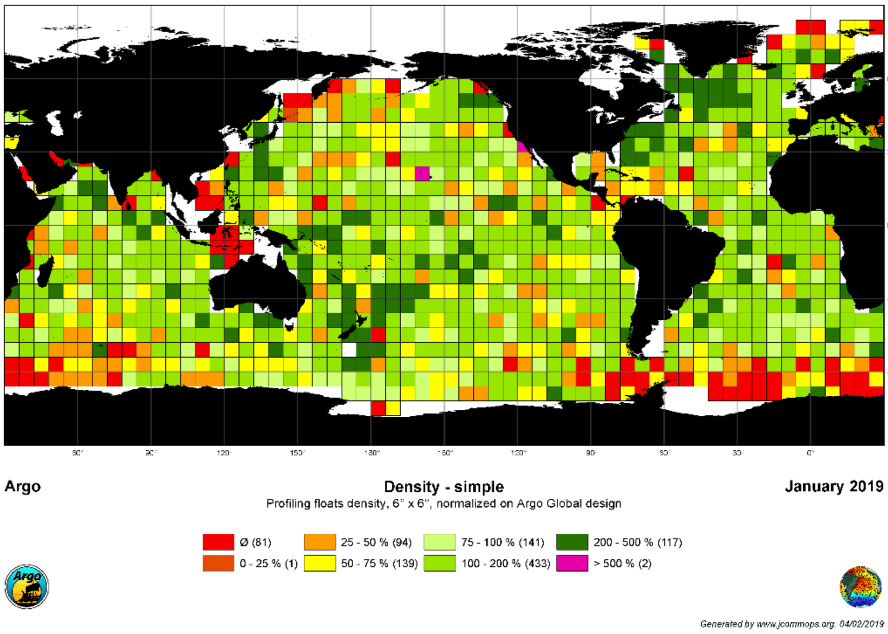
Fig. 27: yearly coverage time series

The North Atlantic is on continuous improvement and show a very high coverage value (84%) but for a high cost in floats. The oversampled area has grown up since 2017 through deployments by France, Canada and Germany, but not much toward the Gulf Stream or other Argo2020 extensions areas.

The North Indian ocean is showing a new oversampled area along the equator meaning that the Argo2020 equatorial expansion is being considered.

⇨ North West Atlantic deployment strategy or targets need to be reviewed and call for more cooperation between Canada and EuroArgo partners.

The density maps may be more appropriate to highlight remaining gaps and provide recommendations for 2018 deployments.



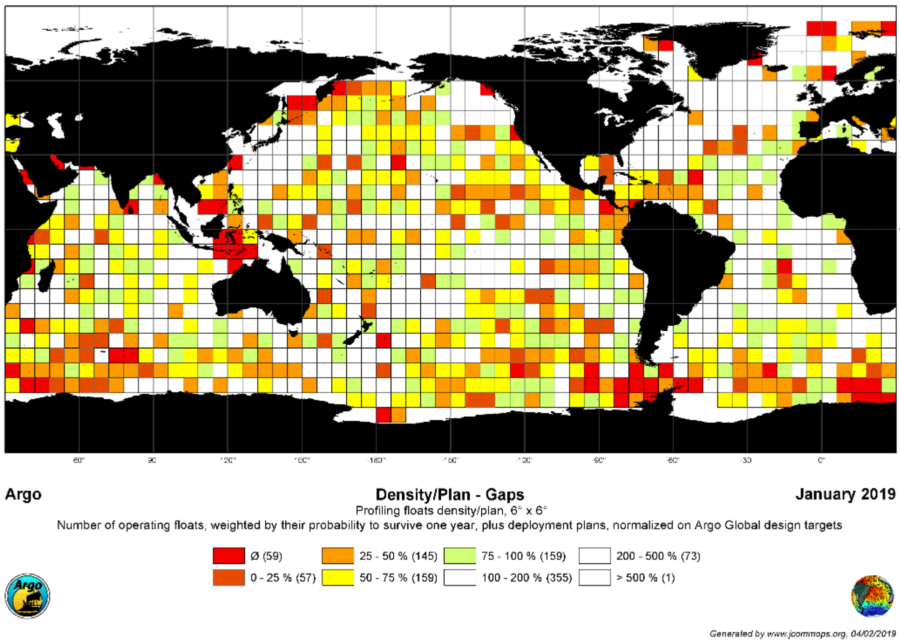


Fig. 28,29: Argo density maps

Major gaps are being developed in the south west of Indian Ocean, north and north east of the Pacific Ocean and around 60°south in the east.

We can formulate a few recommendations for 2019 planning in each basin:

- Atlantic: redirect north west deployment in gulf stream or tropical west part including Caribbean and below 45° south.
- Indian: prioritize deployments below 30°S and along 60°S.

- Pacific: South East between 30°S and 60°S, North East between equator and 45°, North West from 100° toward west.

Intensity

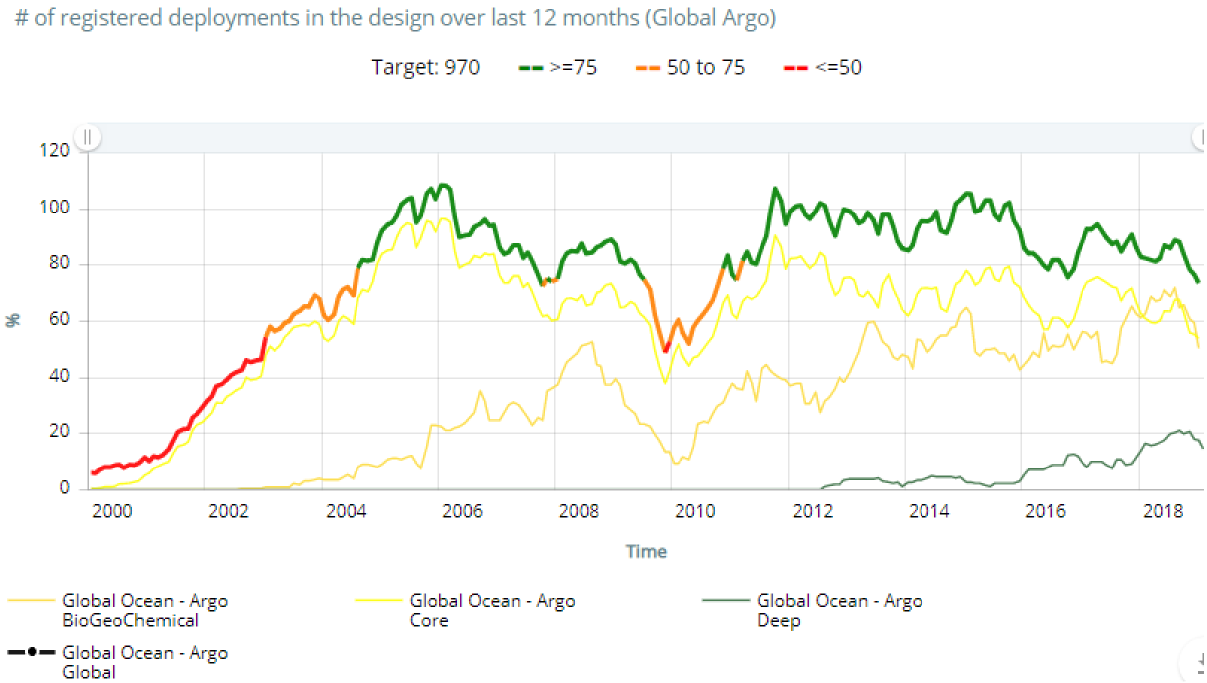
The intensity indicators show the yearly efforts in deployments required to sustain the array. It's is based on a 150 cycles target (or 4.1 years) and doubled in marginal seas where cycling frequency is generally doubled. It is calculated on a 12-months moving window.

The intensity has been on a clear decreasing trend for the last few years to reach 73%. In 2018 we have been deploying 100 floats less than in 2017 (see section on international issues).

This fact calls for a careful optimization of deployments as if every float would make a difference filling up a gap. BGC and Deep extensions are slowly progressing, but they need to increase their effort and do not compensate the overall decrease.
Is it a sign of core mission decreasing because of extensions (higher cost) development?

Implementation			
Intensity Argo BioGeoChemical	50.45% 1/2019 ↘	112 Raw count	222 Target
Intensity Argo Core	54.02% 1/2019 ↘	524 Raw count	970 Target
Intensity Argo Deep	14.62% 2/2019 ↘	38 Raw count	260 Target
Intensity Argo Global	73.71% 1/2019 ↘	715 Raw count	970 Target

Fig. 30: Intensity Indicator, by Network



Intensity Argo Global - Atlantic Ocean	102.07% 1/2019 ↘	197 Raw count	193 Target
Intensity Argo Global - Pacific Ocean	79.12% 1/2019 ↘	307 Raw count	388 Target
Intensity Argo Global - Indian Ocean	47.65% 1/2019 ↘	81 Raw count	170 Target
Intensity Argo Global - Southern Ocean	60.76% 1/2019 ↗	48 Raw count	79 Target
Intensity Argo Global - Mediterranean Sea	122.58% 1/2019 ↗	38 Raw count	31 Target
Intensity Argo Global - Arctic Ocean	47.06% 1/2019 ↘	16 Raw count	34 Target
Intensity Argo Global - Marginal Seas	60% 1/2019 ↗	66 Raw count	110 Target
Intensity Argo Global - Pacific Ocean - North West	118.84% 1/2019 ↗	82 Raw count	69 Target
Intensity Argo Global - Pacific Ocean - North East	81.31% 1/2019 ↗	87 Raw count	107 Target
Intensity Argo Global - Pacific Ocean - South West	90.29% 1/2019 ↗	93 Raw count	103 Target
Intensity Argo Global - Pacific Ocean - South East	41.28% 1/2019 ↘	45 Raw count	109 Target
Intensity Argo Global - Atlantic Ocean - North	145.78% 1/2019 ↘	121 Raw count	83 Target
Intensity Argo Global - Atlantic Ocean - South	70% 1/2019 ↘	77 Raw count	110 Target

Fig. 31,32: Argo Global Intensity, by ocean basin

With regard to the ocean basin intensity (Fig. 31,32), the alarm is raised for the Indian Ocean (as noted in last year report) where we missed 90 floats in 2018. This deficit should be addressed in 2019, and at least 200 units should be deployed.

The South East Pacific (41%) shows a deficit of 64 floats in 2018 and will need about 150 floats in 2019 to be balanced.
The North West Pacific has a high intensity due to the WBC implementation. The South Atlantic (70%) will need about 140 floats in 2019 to be balanced.
The North Atlantic had an excess of 40 floats deployed in 2018 leading to an overall excess of more than 100 units (a year of deployments). Deployments could be basically skipped in 2019 or limited to filling up remaining small gaps, while majority of planned floats could support the South, the Caribbean, or the Gulf Stream.
Actually, the North Atlantic has one year of reserve.

The Southern Ocean intensity is still too low (60%) to reach a full coverage; 100 floats will be needed in 2019.
The Arctic ocean is also suffering from a low intensity of deployments (47%) ;50 floats for 2019 would be ideal.

Deployments could be relieved in the Med. Sea. (122%) at the benefit of other marginal seas and 20 floats would be enough in 2019.

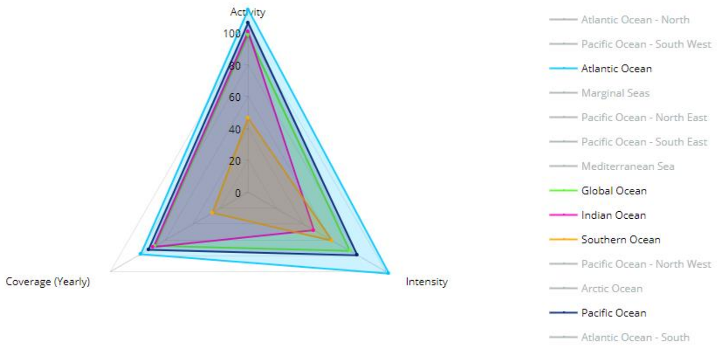
Implementation

Intensity Argo BioGeoChemical	50.45% 1/2019 ↘	112 Raw count	222 Target
Intensity Argo BioGeoChemical - Pacific Ocean - North West	70.59% 1/2019 ↗	12 Raw count	17 Target
Intensity Argo BioGeoChemical - Pacific Ocean - North East	33.33% 1/2019 ↗	9 Raw count	27 Target
Intensity Argo BioGeoChemical - Pacific Ocean - South West	26.92% 1/2019 ↗	7 Raw count	26 Target
Intensity Argo BioGeoChemical - Pacific Ocean - South East	7.41% 1/2019 ↗	2 Raw count	27 Target
Intensity Argo BioGeoChemical - Mediterranean Sea	362.5% 2/2019 ↗	29 Raw count	8 Target
Intensity Argo BioGeoChemical - Arctic Ocean	48.31% 2/2019 ↘	2 Raw count	4.14 Target
Intensity Argo BioGeoChemical - Atlantic Ocean	58.12% 2/2019 ↘	28 Raw count	48.18 Target
Intensity Argo BioGeoChemical - Pacific Ocean	29.87% 2/2019 ↗	29 Raw count	97.08 Target
Intensity Argo BioGeoChemical - Indian Ocean	14.17% 2/2019 ↘	6 Raw count	42.34 Target
Intensity Argo BioGeoChemical - Southern Ocean	52.47% 2/2019 ↘	12 Raw count	22.87 Target

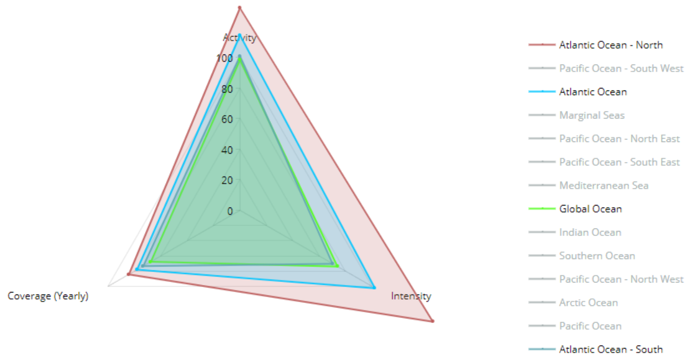
Fig. 33: Argo BGC Intensity, by ocean basin

29 BGC floats were deployed in the Mediterranean Sea in the last 12 months which is an intensity of 300% vs the current design (Fig. 33).
The intensity of BGC Argo in the North West Pacific is rather good (70%) and should improve further given the commitments (e.g. China).

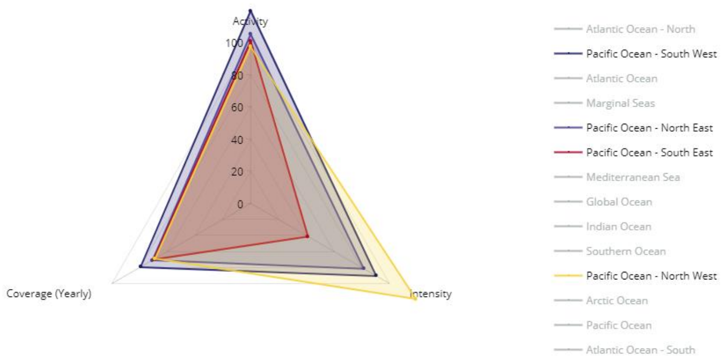
Summary



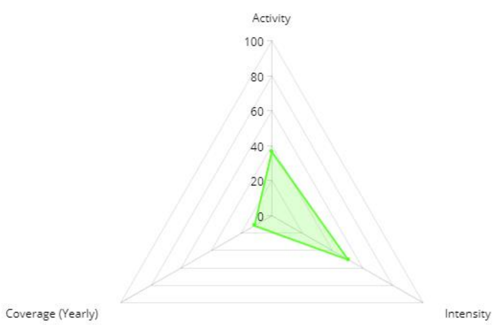
Argo Global KPIs Overview



Argo Global KPIs Overview



Argo BioGeoChemical KPIs Overview



Marginal Seas

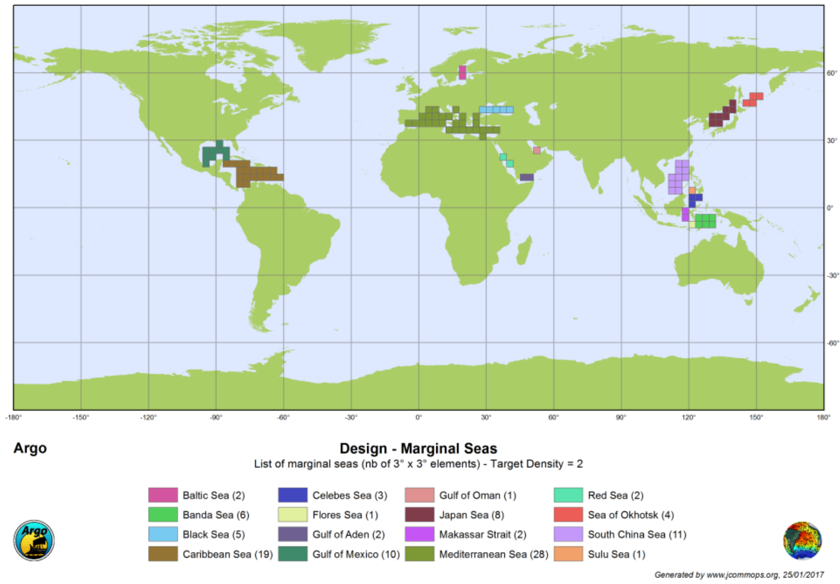


Fig. 41 Argo Design for Marginal Seas for a total of (105 x 2) floats

	Activity target	Activity status	Intensity target	2018 Deployments	Intensity status %
Med. Sea	56	110%	27	41	150
Caribbean Sea	38	45%	19	4	22
South China Sea	22	27%	11	0	0
Gulf Of Mexico	20	90%	10	8	82
Japan Sea	16	181%	8	7	90
Banda Sea	12	17%	6	1	17
Black Sea	10	80%	5	1	21
Baltic Sea	8	100%	4	7	179
Red Sea	8	0%	4	0	0
Sea of Okhotsk	8	0%	4	0	0
Celebes Sea	6	33%	3	0	0
Gulf of Aden	4	100%	2	1	51
Makassar Strait	4	0%	2	0	0
Gulf of Oman	2	0%	1	0	0
Flores Sea	2	0%	1	0	0
Sulu Sea	2	0%	1	0	0

Table 5: Activity, Intensity, Coverage, old floats proportion for main Marginal Seas

The Mediterranean Sea, the Gulf of Mexico, the Black Sea and Baltic Sea are well implemented.
Deployments in the Japan Sea could be slow down.
Deployments in Caribbean Sea and South China Sea should be increased to complete the array in that

areas.
All other Marginal Seas need commitments by coastal countries and are certainly challenging to address. However, the requirements in floats/year are very low and should not be an issue for some of these countries.
There are some interesting developments around the Gulf countries that requested implementation plans details to JCOMMOPS via WMO, and with Indonesia that is hosting the next JCOMM Observation Coordination Group Meeting (April 2019). Some countries are starting to prepare the implementation of a complete regional observing system with an integrated perspective.

TPOS

TPOS region as defined in the JCOMMOPS system is covering the Pacific Ocean zone from 30°N to 30°S. It shows good performance indicators. The activity and intensity are over 100% which shows that the area is well considered and the TPOS2020 (double density in the equatorial region) might have started. (see next section).
The area has lost about 200 floats in the last couple of years (as expected in previous reports) due to the age of floats in the area.

Implementation

Activity Tropical Pacific Observing System - Pacific Ocean	111.86% 1/2019 ↗	1000 Raw count	894 Target
Intensity Tropical Pacific Observing System - Pacific Ocean	105.96% 1/2019 ↗	231 Raw count	218 Target

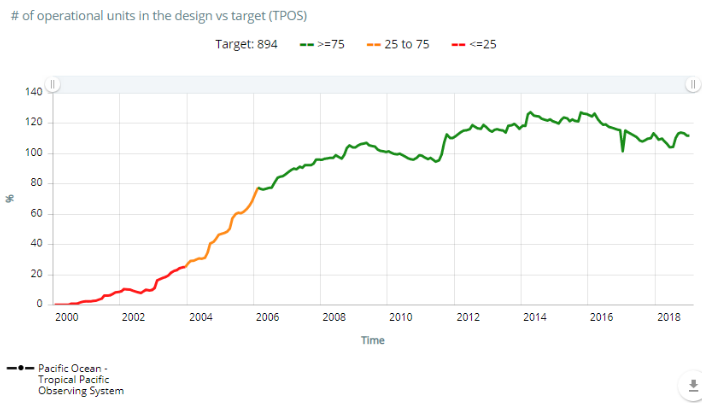
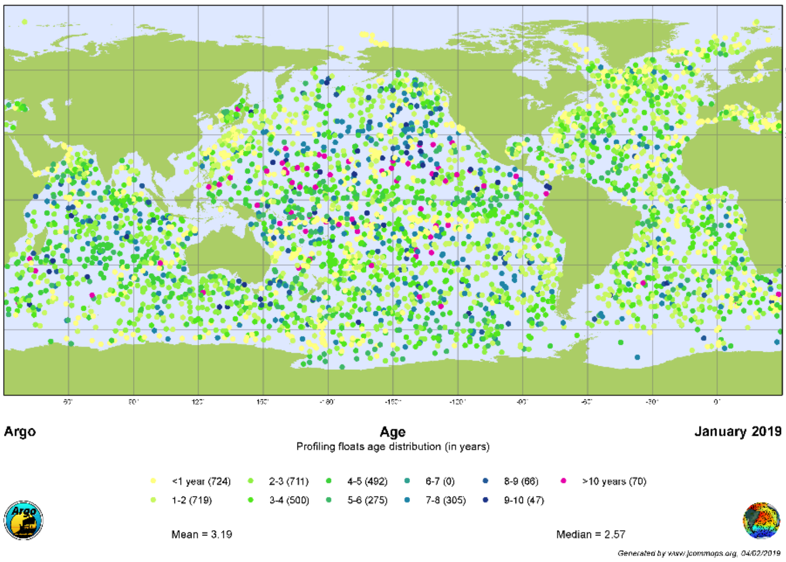


Fig. 42, 43, 44: TPOS indicators - activity/intensity



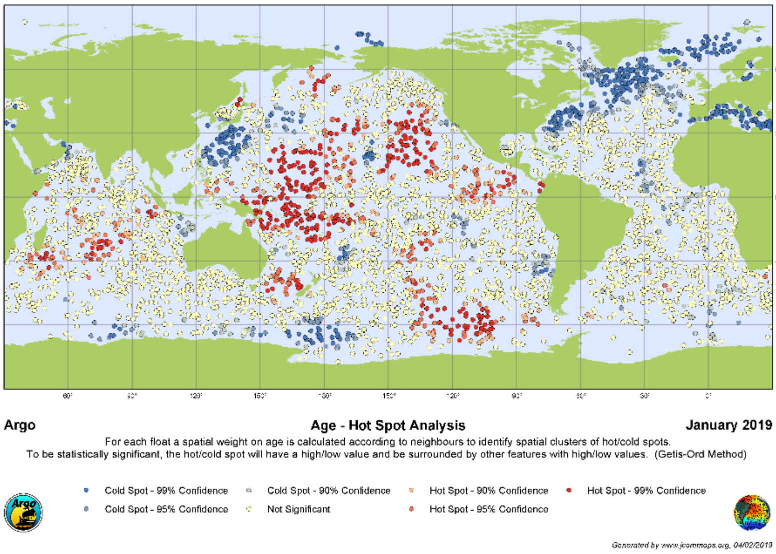


Fig. 45, 46: Analysis of young/old float; spatial clusters

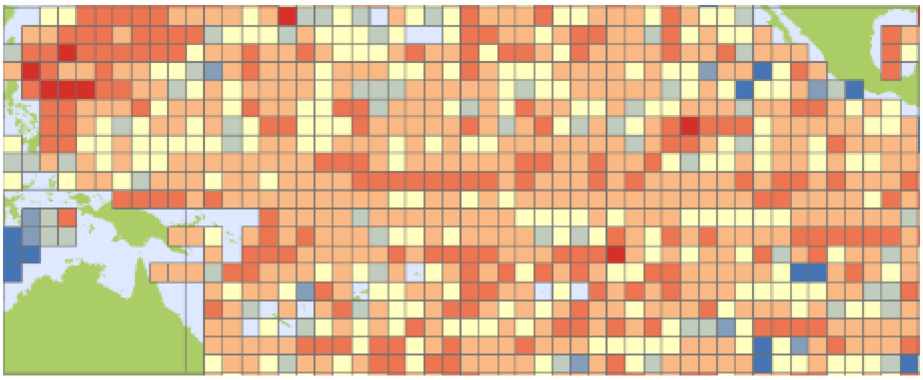


Fig. 47: Yearly coverage in TPOS area

In the West part, many floats are getting old and we can expect a drop of the activity rather soon so the intensity of deployment should be sustained and lightly increased to absorb the anticipated loss

of 200 more units in the West and North parts.
The yearly coverage doesn't show up any major gaps.

⇨ TPOS area is well implemented.

Extensions – Argo2020

Targets

Target for Argo2020 expansions areas are provided for information in Table 6 below.
They have been reviewed in depth but rounding up methods can make the numbers varying very lightly between this report and web site KPIs.

	Argo Global		Argo 2020 (x2)		Extra cost/year
	Activity	Intensity	Activity	Intensity	
Equatorial	**318**	**77**	**636**	**155**	**77**
Eq. Atlantic Ocean	35	**9**	**70**	**17**	**9**
Eq. Indian Ocean	36	**9**	**72**	**18**	**9**
Eq. Pacific Ocean*	247	**60**	**494**	**120**	**60**
WBC	**461**	**112**	**922**	**224**	**112**
WBC - Agulhas	113	28	226	55	28
WBC - East Australian	59	14	118	29	14
WBC - Gulf Stream	50	12	100	24	12
WBC - Kuroshio	52	13	104	25	13
WBC - Malvinas/Falklands	93	23	186	45	23
WBC - Mindanao	56	14	112	27	14
WBC - Solomon Sea	38	9	76	18	9
TOTAL	779	190	1558	379	190

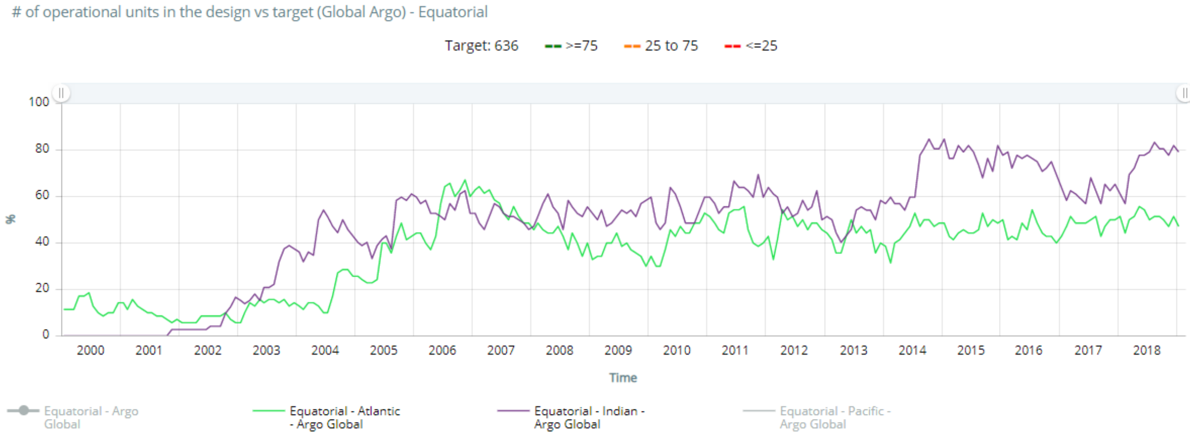
Table 6: Targets for extension areas

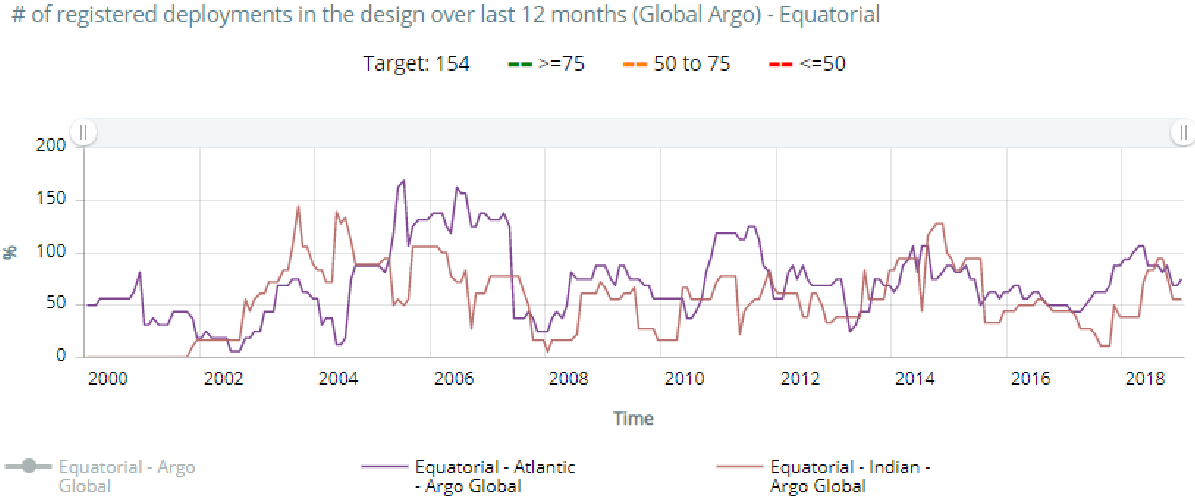
(*) The Pacific Ocean equatorial extension was reviewed to include TPOS2020 requirements (here double density between -9° /9°), and all indicators recalculated accordingly. This extension does not overlap with WBC regions in the West Pacific. See Fig. below.

Implementing such extensions at no cost would mean to double float lifetime up to 300 cycles…

At the time of writing this report the Equatorial Pacific indicators (and overall Equatorial) are being recalculated.

Equatorial





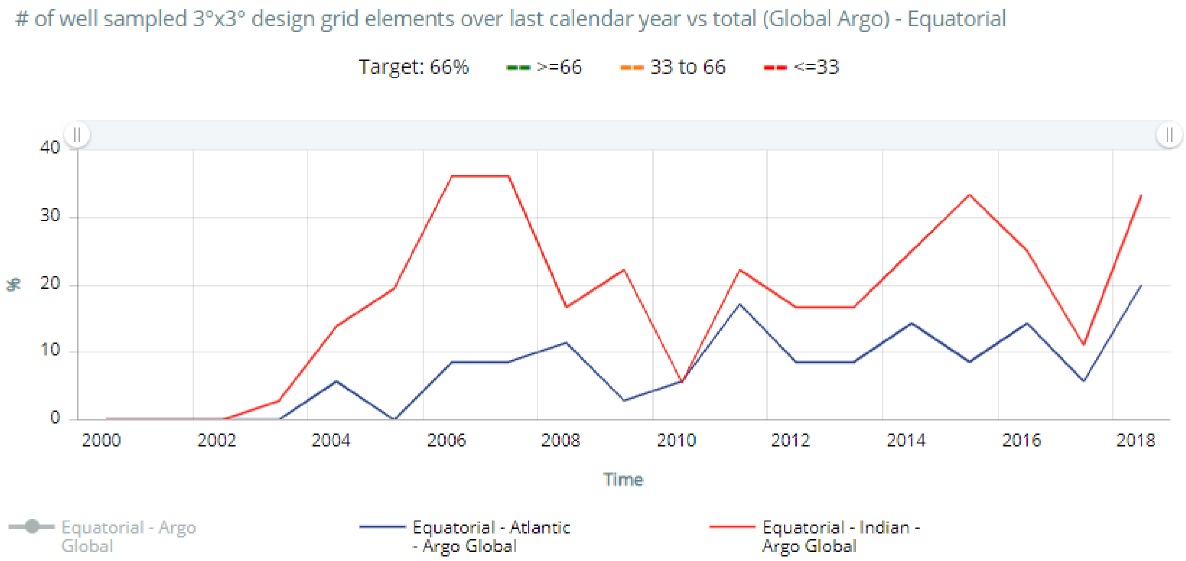


Fig. 48,49,50: Activity, Intensity, Coverage KPIs for equatorial band.

The Indian Ocean equatorial expansion has a good activity (80%) but intensity should be increased to sustain it and complete the coverage in the west part. The equatorial Atlantic is not yet considered at double density (50%).

WBC

The overall activity indicator for WBC extensions (Argo2020) has lost 10% in the last couple of years to reach 57% but the recent trend seems to be rising again.
The Gulf Stream and Solomon Sea WBC show good stats (80%), and East Australian current as well (70%). All the others are around 50% showing that the double density is not reached.
As expected in previous reports, the Kuroshio region stats have decreased still to a reasonable level but show a beginning of improvement.

Implementation		
Activity (2020) Argo Global - WBC	57.3% 1/2019 ↘	526 Raw count
Coverage (Yearly) (2020) Argo Global - WBC	22.99% 2018 ↘	22 Raw count
Intensity (2020) Argo Global - WBC	51.34% 1/2019 ↘	115 Raw count

Fig.51: Indicators for WBC Argo 2020 extensions

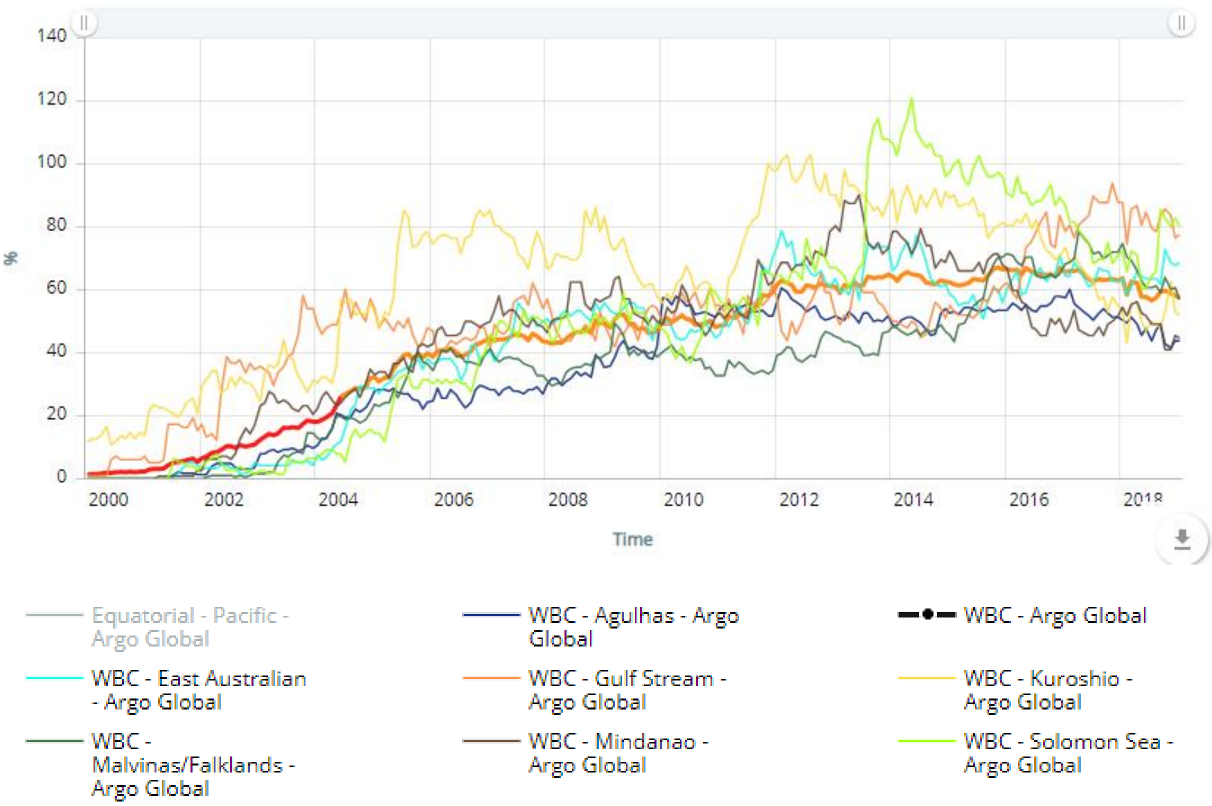


Fig. 52: WBC Activity

The WBC coverage is stable, but the Gulf Stream shows a very good progress to approach the target. This result from a very high intensity of deployments (150%) a couple of years ago.

After a continuous decrease the Kuroshio region starts to improve but the coverage is still pretty good.
The Solomon Sea coverage has dropped because there were no deployments for two years but should improve soon. All others WBC are not adequately covered.

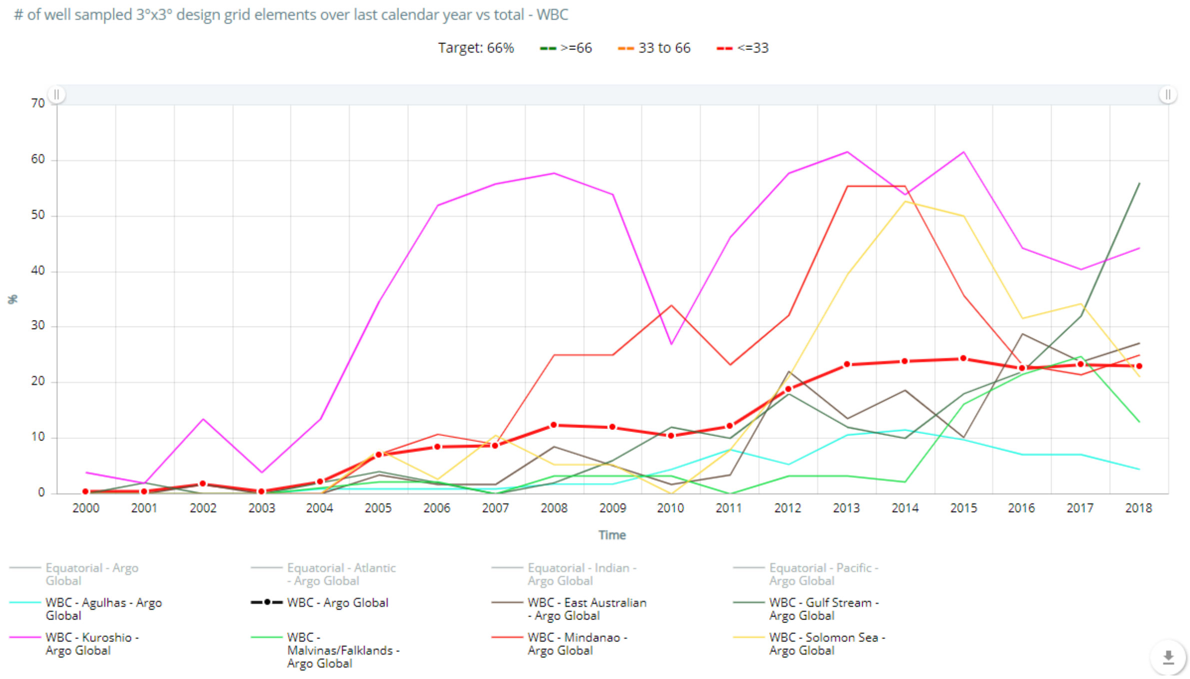


Fig. 53: WBC Yearly Coverage

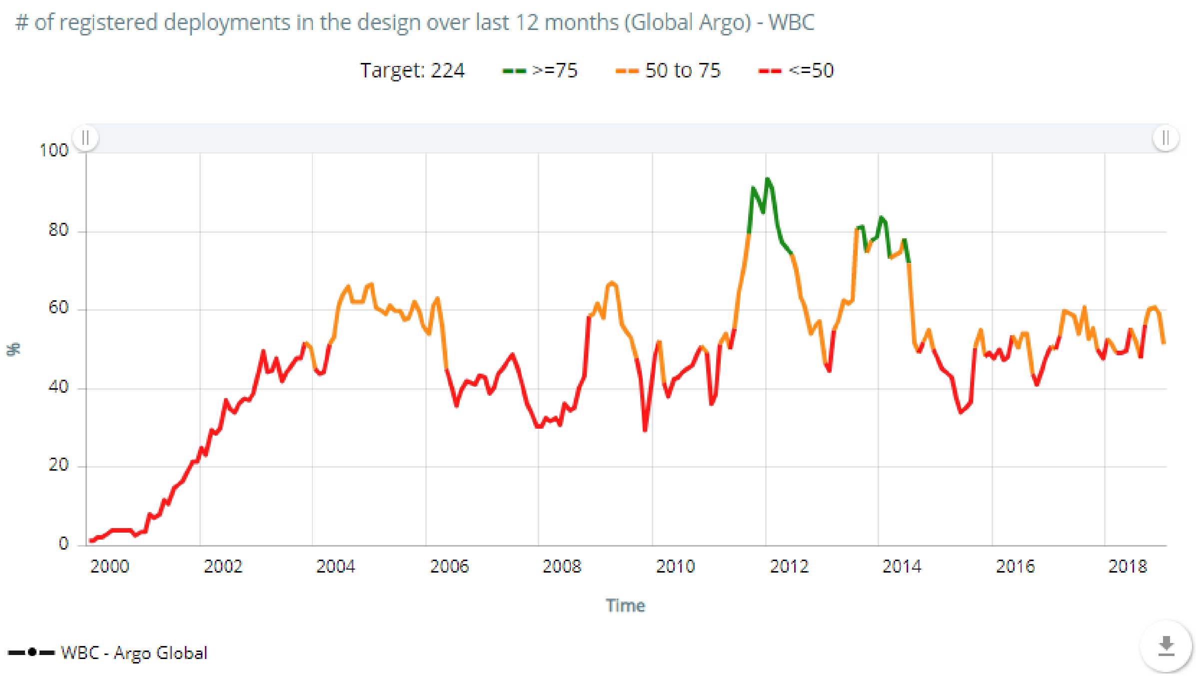


Fig. 54: WBC Intensity

Intensity of deployments needs to be doubled in WBC to meet the target. However, the Gulf Stream has an appropriate intensity which means that its status is likely to be sustained in the next years. The Agulhas region has 20% intensity and is even too low to maintain the basic Argo target.
In the Pacific all WBC regions show an intensity close to the requirements and announce a good coverage. The Mindanao region is implemented at the Argo basic target (50%).

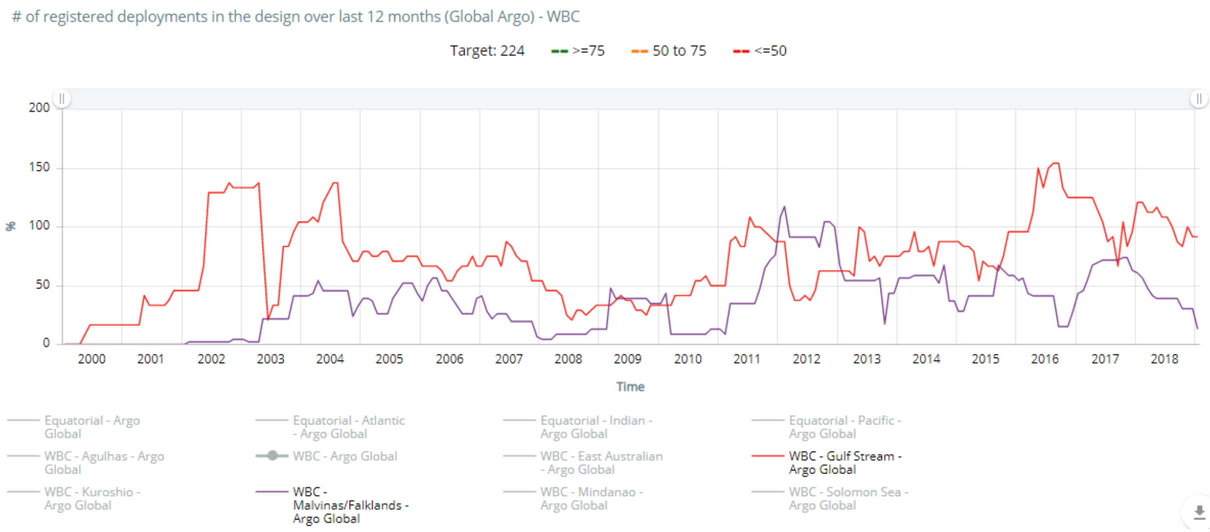


Fig. 55: WBC Intensity (Atlantic)

Fig. 56: WBC Intensity (Indian)

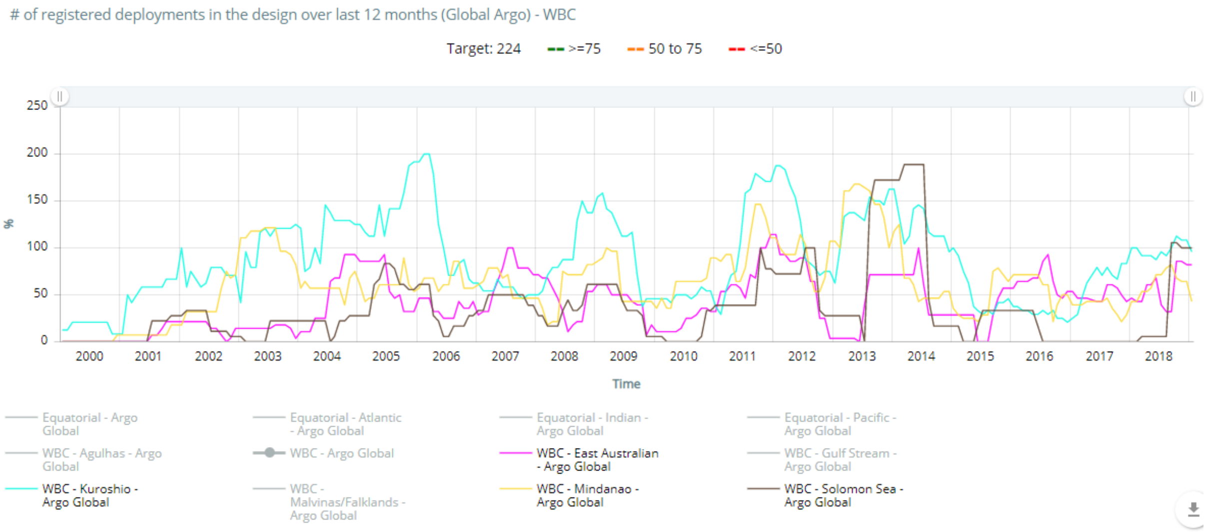


Fig. 57: WBC Intensity (Pacific)

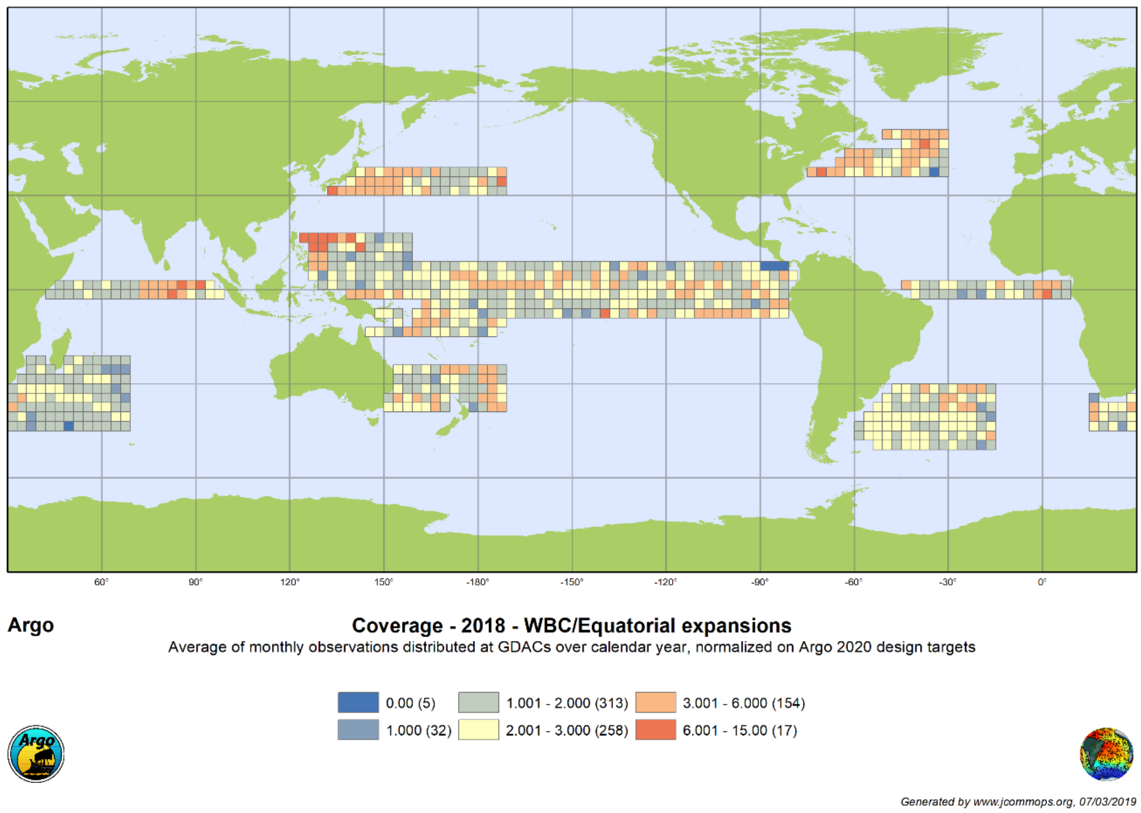
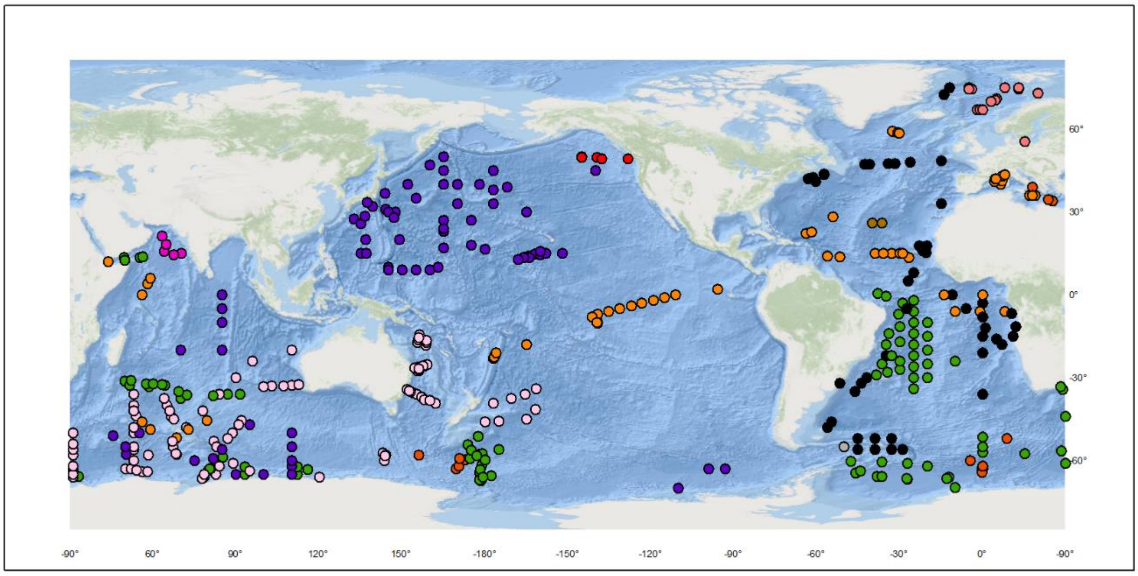


Fig. 58: 2018 Coverage in Argo 2020 extensions

Planning

At the time of finishing this report the planning for the year counts 445 units, including some already operational. The Indian ocean (mainly south) counts about 100 units which is reassuring. The South Atlantic shows some good planning as well.



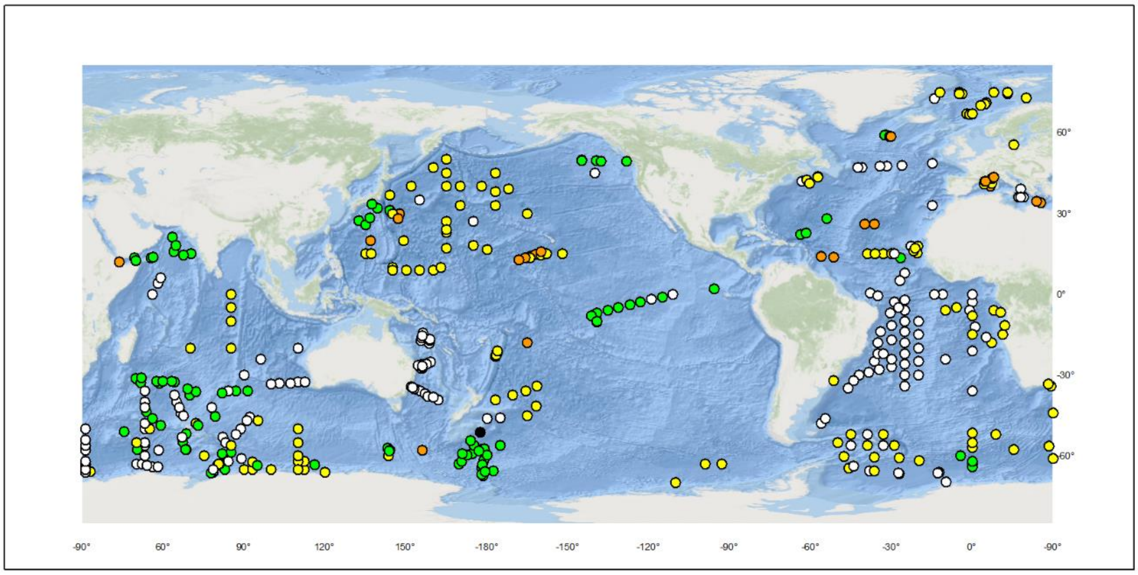
Argo **2019 Deployments** **07/03/2019**

AUSTRALIA	INDIA	NORWAY
CANADA	ITALY	POLAND
FRANCE	JAPAN	UK
GERMANY	NETHERLANDS	USA

Service Layer Credits: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Projection: Plate Carree
Central Meridian: -150°

Generated by www.jcommops.org



Argo **2019 Deployments** **07/03/2019**

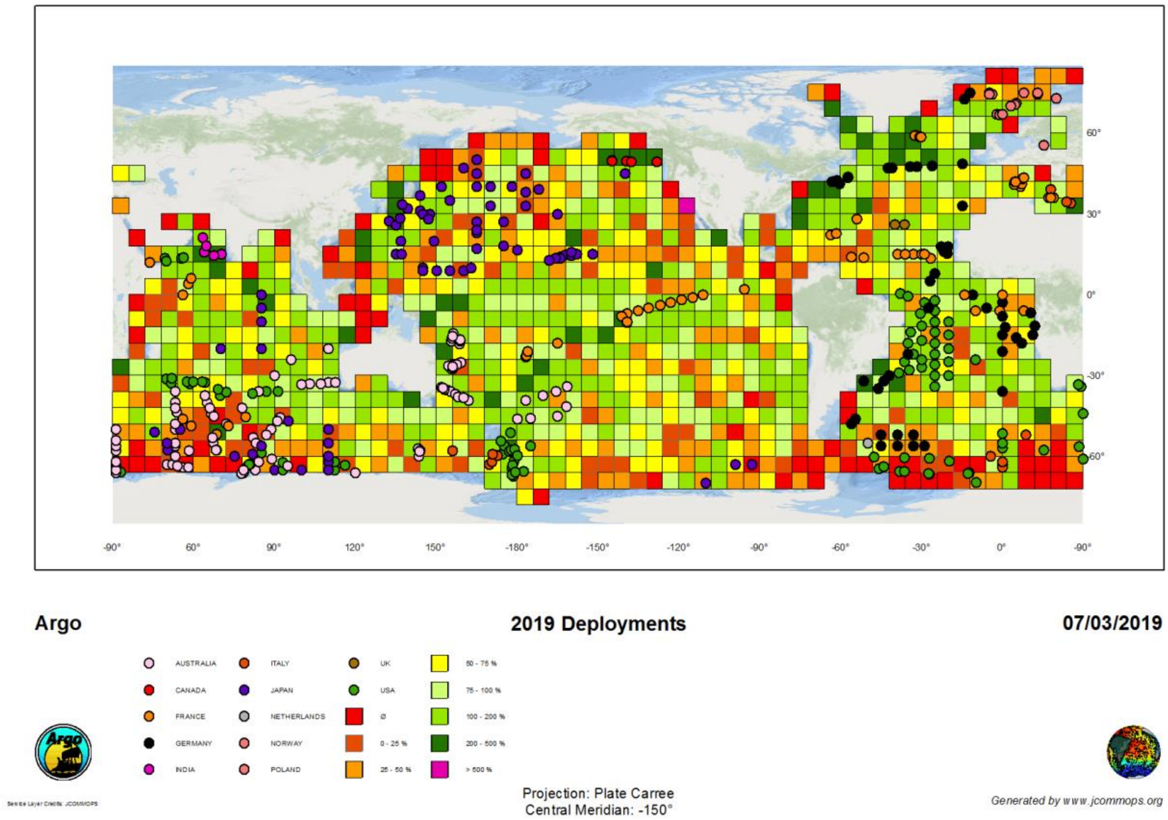
by status

PROBABLE	REGISTERED	CLOSED
CONFIRMED	OPERATIONAL	

Service Layer Credits: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Projection: Plate Carree
Central Meridian: -150°

Generated by www.jcommops.org



Instrumentation:

The annex of this report provides further stats on float reliability.
Our 150 cycles target is reached by 60% of the fleet with a little improvement to reach the reliability we had in 2010. After 150 cycles we have really a drop and 36% of floats reach 200 cycles.

The average age of failures is however improving up to 4 years and mortality rate is rather stable around 26 %.
Mortality rate is rather high in Med. Sea and Arctic Ocean probably because cycling frequency is doubled.

Float life expectancy (for a deployment in 2018) is 5.5 years, and 2 years for BGC floats (due to cycling frequency). It is 6.1 years in the Pacific Ocean, 5.5 in the Indian Ocean, 5.3 in Atlantic ocean, 4.26 in Southern ocean, 2.6 in Med Sea.

Fleet half-life is stable at 1511 days (980 for BGC floats).

The survival plots show a continuous progress for each float generation, and each float model.
The SOLO_II assembled by Scripps shows the best reliability stats, then come the S2A, ARVOR and NAVIS_EBR.
SOLO_II and S2A are qualified (by 86% and 75% respectively) to go beyond 175 cycles and 50 % passed 200 cycles. 35% of ARVOR reach 175 cycles but then only 9 % reach 200.

We need to wait a little more for the NAVIS_EBR.
The APEX model seems to perform less at 150 cycles, at the average of the Argo fleet (60%), but keep this level for 175 cycles, and is rather good at 200 cycles (45%).
PROVOR and PROVOR_III reach 200 cycles by 50%.

The split of ARVOR and ARVOR_L (less battery), and NAVIS_A and NAVIS_EBR (engineering issues fixed) in metadata shows some very good perspectives for these two float models.

Annex 1: AST#19 Action Items

Action 2: Think about better ways to show collaboration between BGC and core floats in order to track global coverage:

- ⇨ A new indicator has been calculated to show the contribution of BGC and deep to the overall spatial distribution.

Action 22: Make Deep Argo float label.

- ⇨ Samples sent to Scripps for testing. A model designed for spherical surface drifters might fit or the standard one could as well. Waiting feedback before production.
  The addition of a clear message in red "do not disturb" might be useful.

Action 23: Add WBC and Equatorial Region columns to the commitments table.

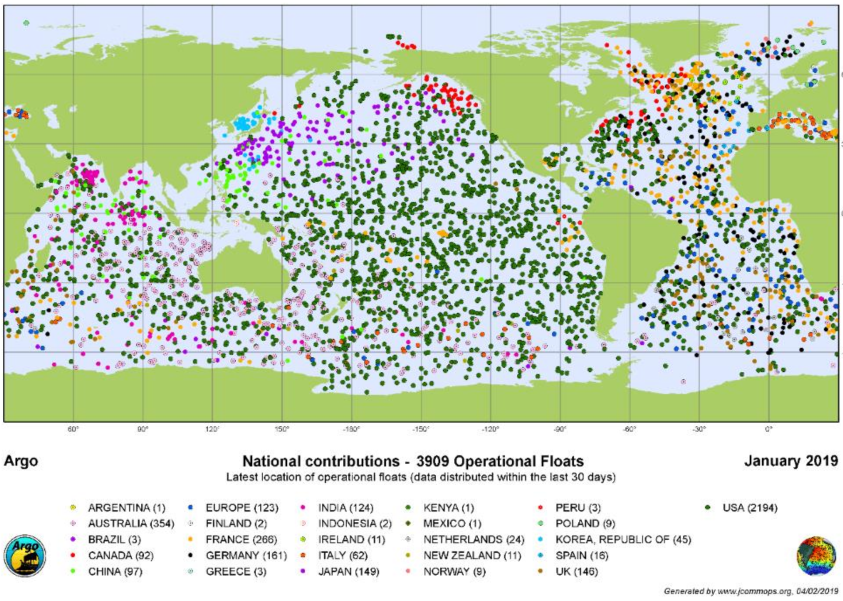
- ⇨ New column for Argo2020 commitments added. And view by basin allows to fill up number for any extension.

Action 24: Modify Future Argo/Argo 2020 map and tables to highlight how many more floats are needed to satisfy the extensions.

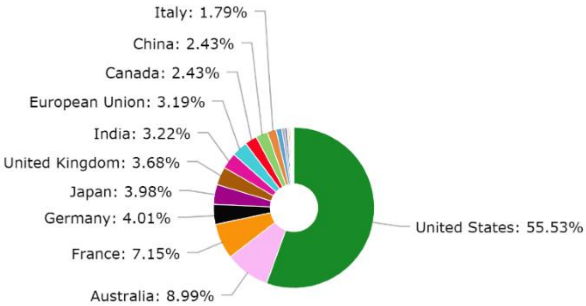
- ⇨ Done. See cover page of the report and tables.

Annex 2: Statistics & Maps

Operational Floats

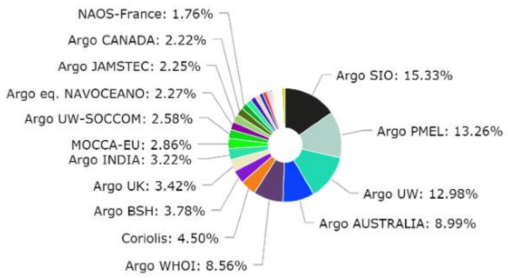


<u>*Operational Floats, by country, as of January 2019*</u>



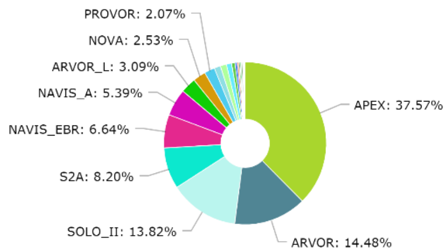
United States	2,174	Australia	352
France	280	Germany	157
Japan	156	United Kingdom	144
India	126	European Union	125
Canada	95	China	95
Italy	70	Korea (Republic Of)	45
Netherlands	24	Spain	16
Ireland	11	New Zealand	11
Norway	9	Poland	8
Brazil	3	Peru	3
Finland	3	Greece	3
Indonesia	2	Kenya	1
Mexico	1	Argentina	1

<u>*Operational Floats, by country, as of January 2019*</u>



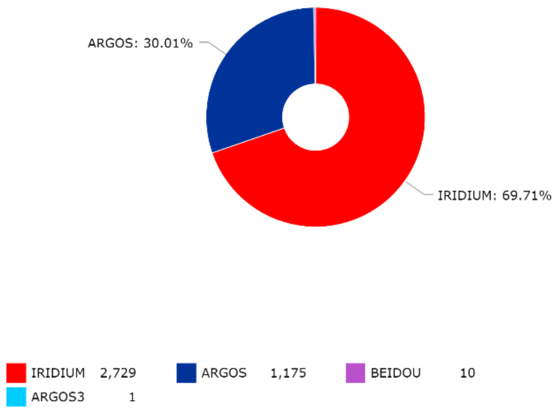
Argo SIO	600	Argo PMEL	519
Argo UW	508	Argo AUSTRALIA	352
Argo WHOI	335	Coriolis	176
Argo BSH	148	Argo UK	134
Argo INDIA	126	MOCCA-EU	112
Argo UW-SOCCOM	101	Argo eq. NAVOCEANO	89
Argo JAMSTEC	88	Argo CANADA	87
NAOS-France	69	Argo ITALY	66
Argo eq. JMA	56	Argo CHINA	49
Argo eq. CHINA	46	Argo NIMS/KMA	41
Argo SPAIN	16	MOCCA-NETH	14
Coriolis-BIOArgo	13	AtlantOS_H2020	12
Argo IRELAND	11	Argo NEW ZEALAND	11
Argo NETHERLANDS	10	Argo UK Bio	10
Argo UW-MBARI	10	Coriolis-OVIDE	9
MOCCA-GER	9	Argo NORWAY	9
Argo eq. JAMSTEC	8	Argo CANADA eq.	7
Argo UW-TPOS eq.	7	Argo POLAND	5
Argo WHOI-SODA eq.	5	Coriolis-remOcean	4
MOCCA-IT	4	Argo eq. OIST	4
Other programs	35		

Operational Floats, by program, as of January 2019

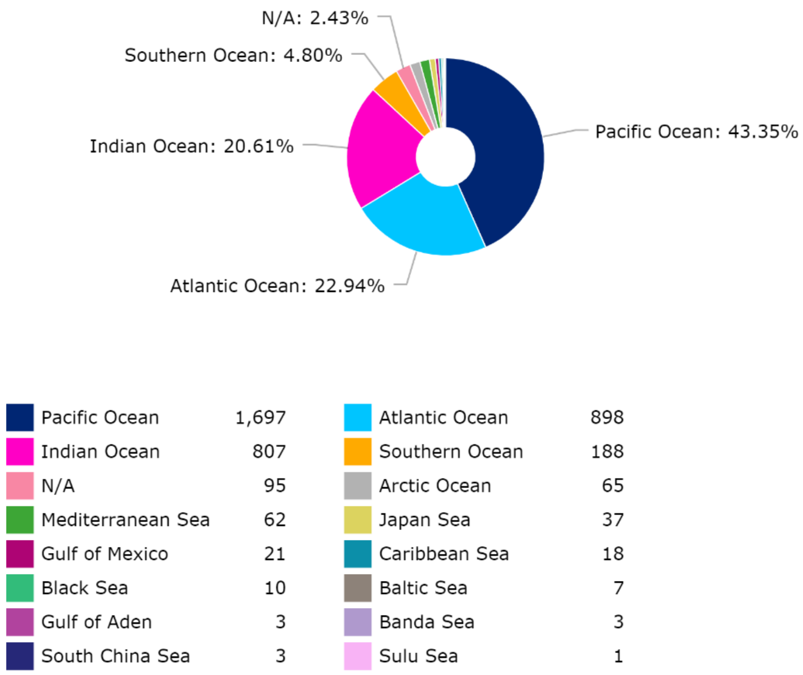


APEX	1,471	ARVOR	567	SOLO_II	541
S2A	321	NAVIS_EBR	260	NAVIS_A	211
ARVOR_L	121	NOVA	99	PROVOR	81
PROVOR_III	50	SOLO_D	48	S2X	40
SOLO	26	ARVOR_D	17	ALTO	13
HM2000	10	PROVOR_IV	9	SOLO_W	9
PROVOR_II	5	FLOAT	4	NEMO	4
APEX_D	3	SOLO_D_MRV	3	NINJA_D	2

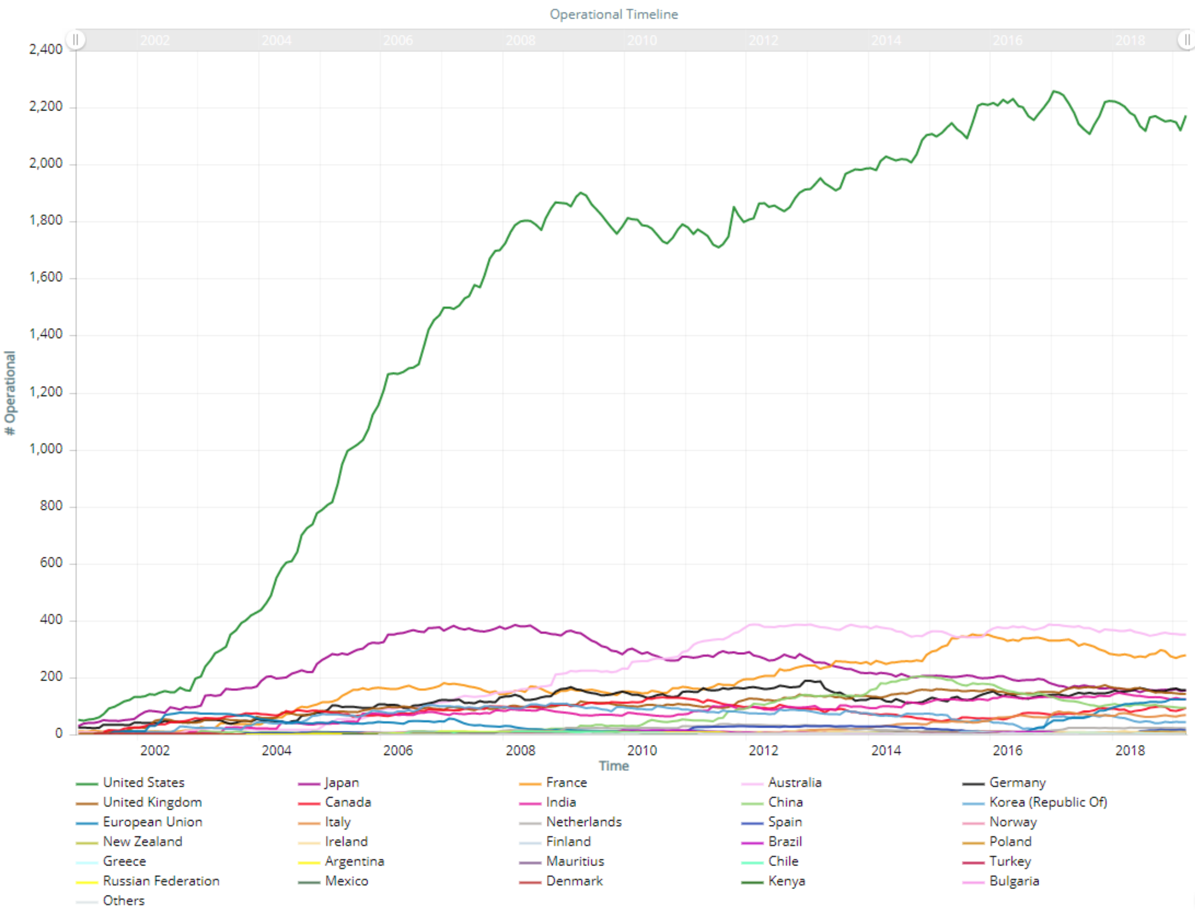
Operational Floats, by model, as of January 2019



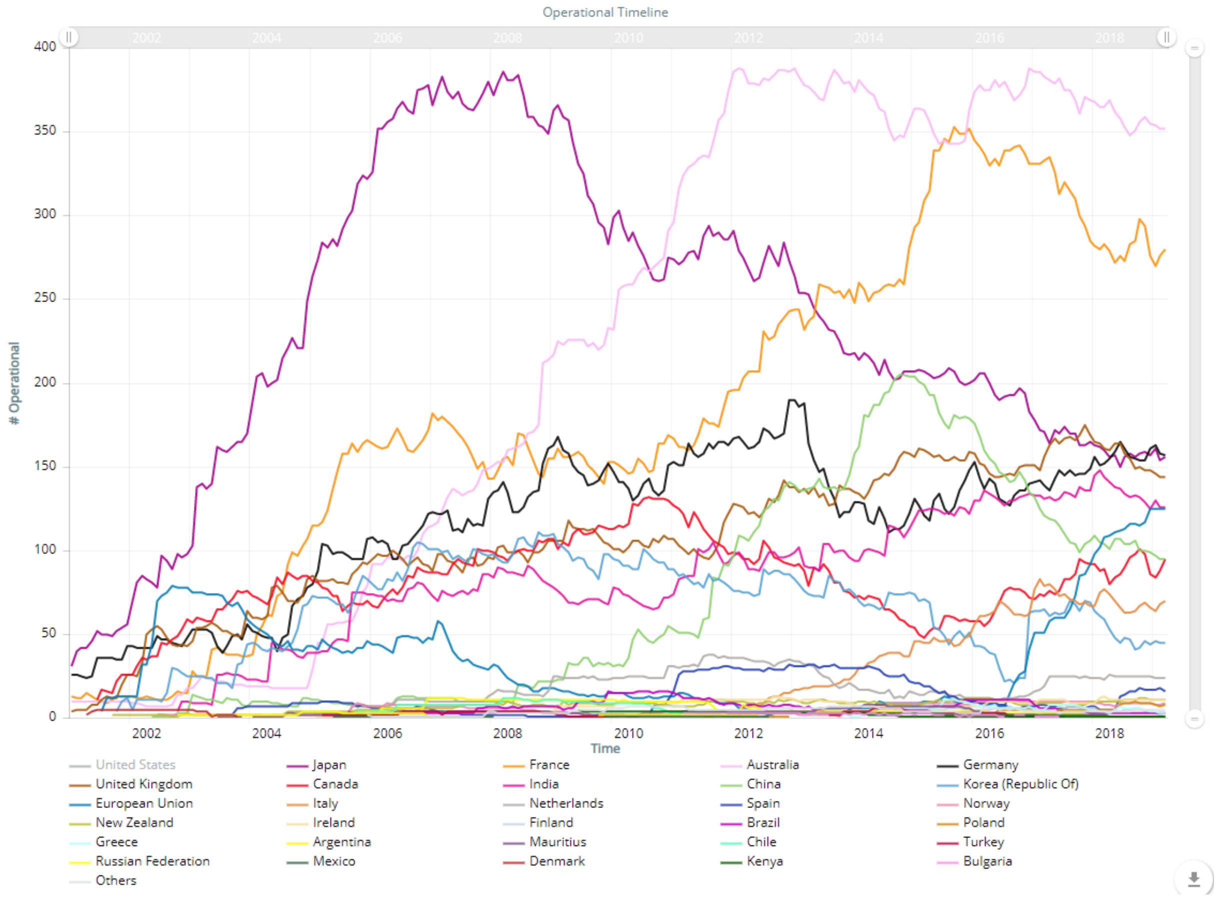
Operational Floats, by telecommunication type, as of January 2019



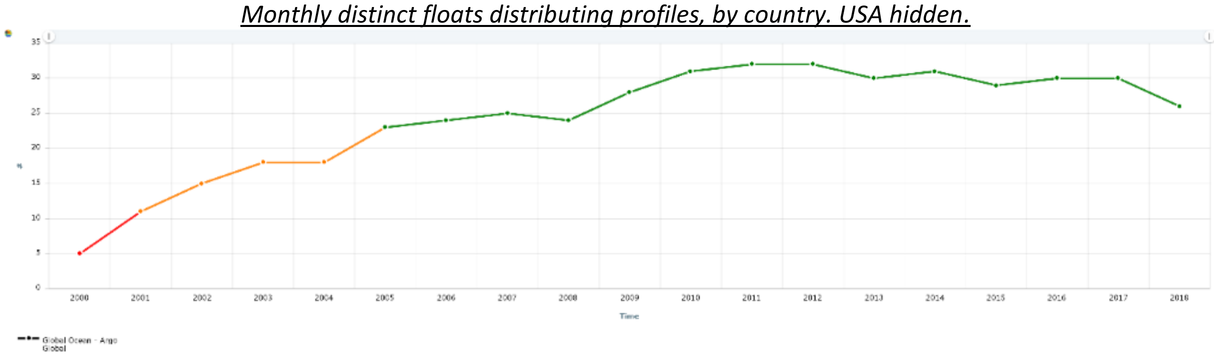
Operational Floats, by basin, as of January 2019



Monthly distinct floats distributing profiles at GDACs, by country



Monthly distinct floats distributing profiles, by country. USA hidden.



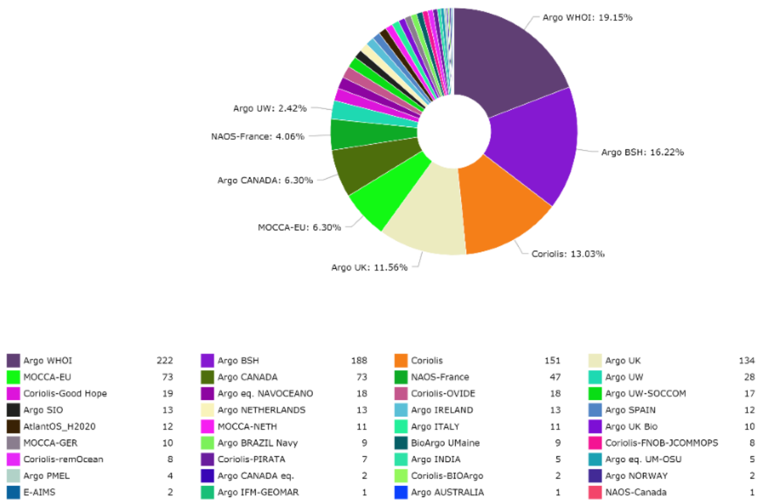
Active Countries (deploying floats the considered year)

Deployments

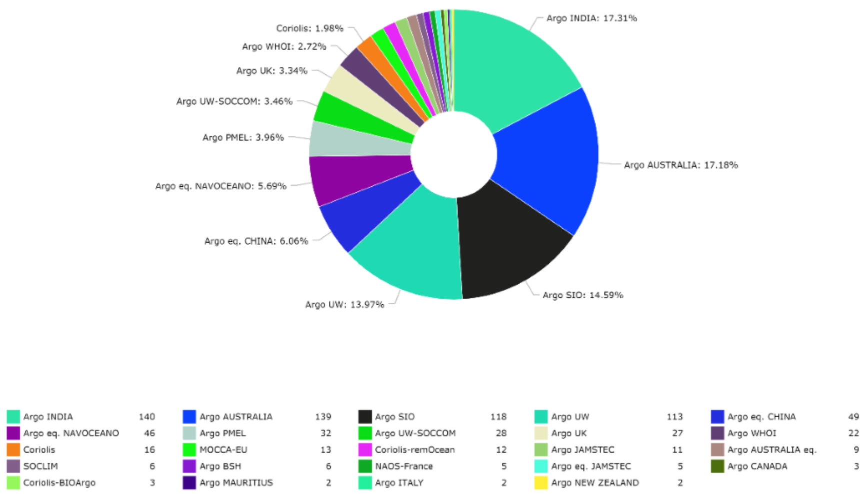
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
- Total -	**297**	**454**	**673**	**866**	**1016**	**932**	**752**	**900**	**541**	**837**	**949**	**1029**	**885**	**1058**	**925**	**891**	**929**	**830**
United States	129	150	315	442	513	517	424	434	246	389	373	467	415	466	440	442	441	359
Japan	40	76	128	118	108	116	102	92	74	90	132	103	88	96	41	51	74	55
France	9	8	34	85	89	51	36	90	35	59	64	105	89	108	131	57	69	85
Australia	0	12	8	4	63	46	43	76	35	79	120	49	64	45	52	75	35	43
Germany	21	14	28	42	57	36	35	71	33	62	54	76	45	61	76	39	50	51
United Kingdom	29	38	37	45	28	24	33	29	20	25	39	38	35	47	32	34	53	33
Canada	30	38	31	30	28	38	18	25	23	28	17	27	33	10	30	34	33	39

India	1	11	23	30	45	15	31	15	7	23	44	34	27	45	27	29	32	15
China	0	5	16	8	0	6	0	16	16	32	49	68	30	91	22	24	15	26
Korea (Republic Of)	16	25	33	31	38	33	9	29	17	12	14	14	17	15	17	16	12	11
European Union	15	70	4	20	27	20	8	0	0	0	2	0	5	9	5	36	57	40
Italy	0	0	0	0	0	0	0	0	0	2	2	19	13	24	26	30	26	29
Netherlands	0	0	0	3	4	4	4	13	4	9	7	7	4	8	2	3	12	3
Spain	0	0	7	2	1	1	0	0	0	12	18	9	2	6	1	1	3	14
New Zealand	2	2	0	2	1	3	2	2	2	2	2	2	2	0	4	2	2	2
Ireland	0	0	2	0	0	0	0	4	4	3	3	2	1	2	2	3	3	4
Norway	0	3	6	0	0	2	0	0	0	4	0	0	2	6	0	2	0	6
Finland	0	0	0	0	0	0	0	0	0	2	2	3	4	5	2	3	5	4
Brazil	0	0	0	0	4	0	4	0	10	0	0	0	0	2	7	0	0	0
Greece	0	0	0	0	0	0	0	0	0	1	0	0	1	5	5	3	3	4
Poland	0	0	0	0	0	0	0	0	2	2	0	1	0	0	3	3	3	6
Argentina	0	0	0	0	0	12	0	0	0	0	0	4	0	0	0	0	0	0
Mauritius	0	0	1	2	0	2	0	0	0	0	4	0	2	2	0	0	0	0
Chile	0	0	0	0	4	4	0	4	0	0	0	0	0	0	0	0	0	0
Turkey	0	0	0	0	2	2	0	0	0	0	0	0	4	2	0	0	0	0
Mexico	0	0	0	0	2	0	0	0	1	0	0	0	0	3	0	0	0	0
Russian Federation	0	2	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0
Denmark	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kenya	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0
Bulgaria	0	0	0	0	0	0	0	0	0	0	3	0	1	0	0	0	0	0
Peru	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0
Ecuador	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0
Gabon	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0
Costa Rica	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Indonesia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
South Africa	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
Lebanon	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Saudi Arabia	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Sri Lanka	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0

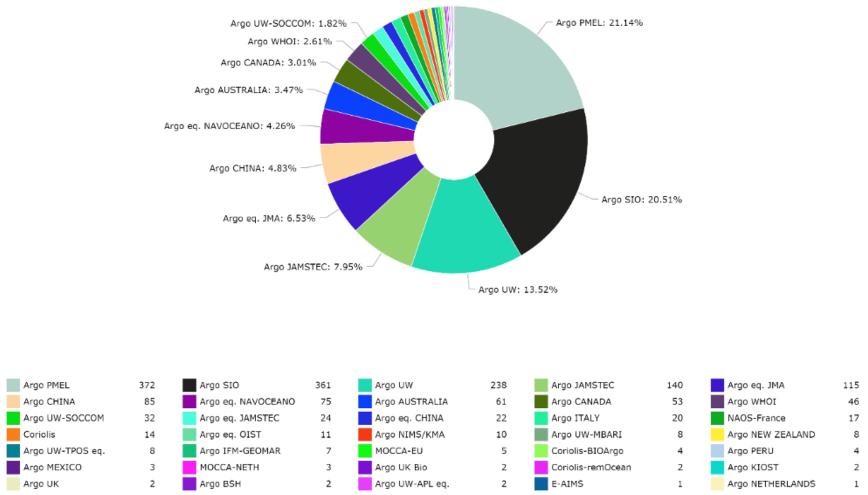
Yearly deployments per country



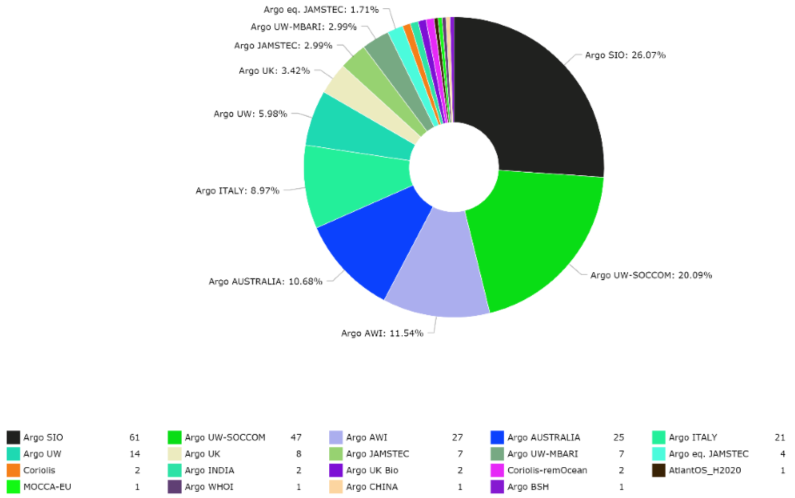
Deployments in Atlantic Ocean 2014-2018, by national programme.



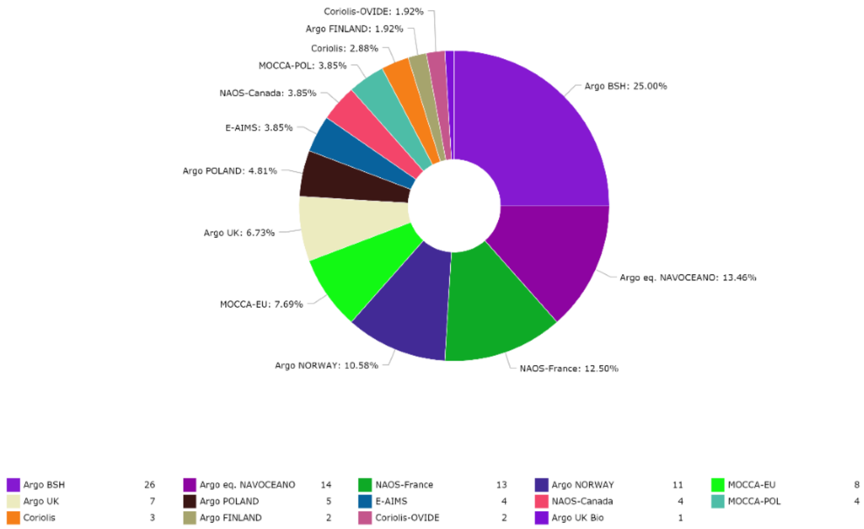
Deployments in Indian Ocean 2014-2018, by national programme.



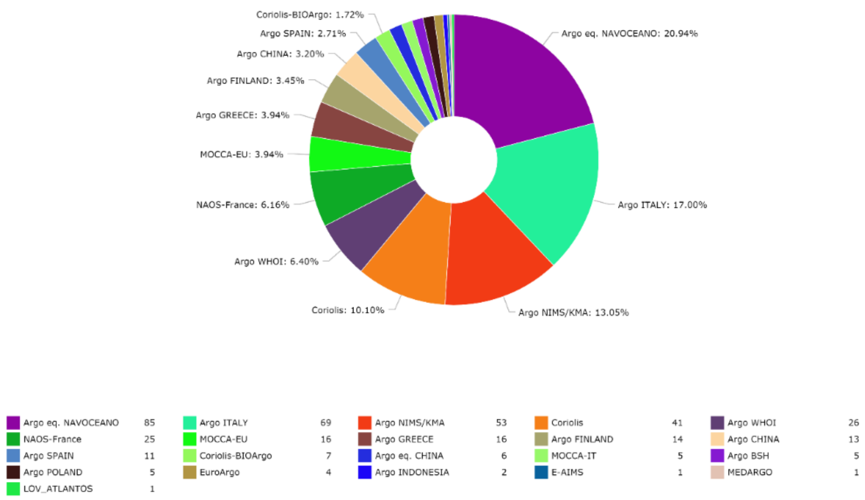
Deployments in Pacific Ocean 2014-2018, by national programme.



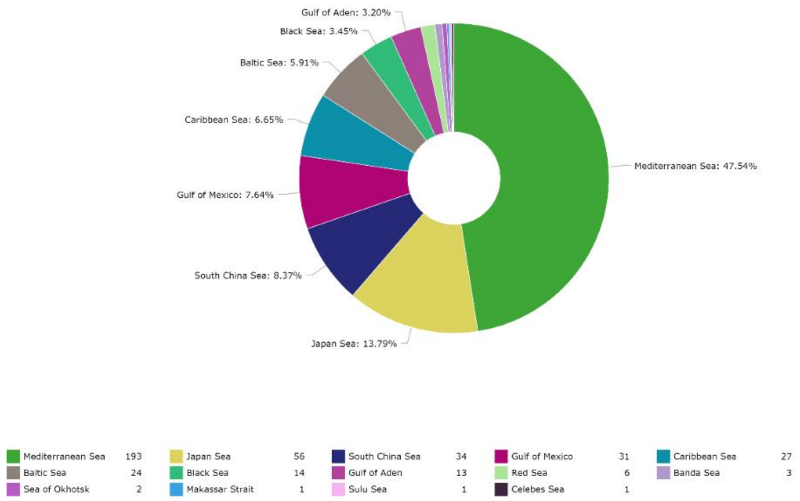
Deployments in Southern Ocean 2014-2018, by national programme.



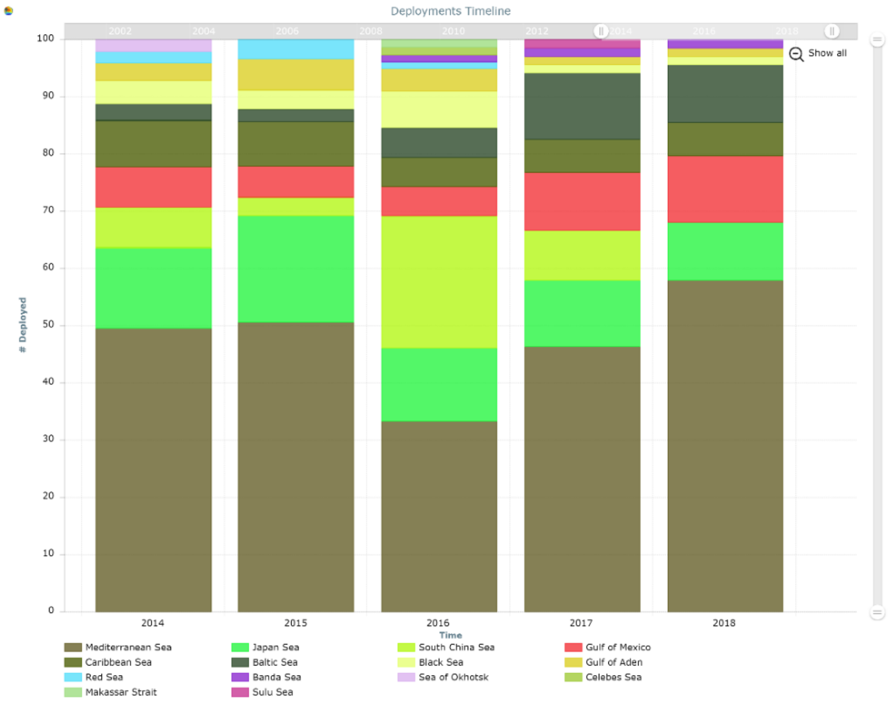
Deployments in Arctic Ocean 2014-2018, by national programme.



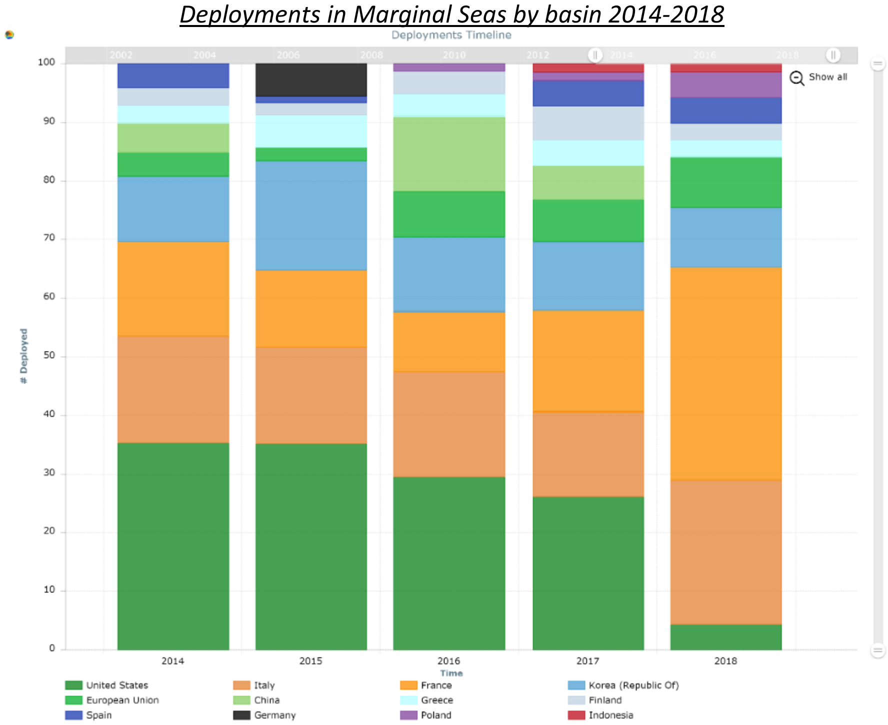
Deployments in Marginal Seas 2014-2018, by national programme.



Deployments in Marginal Seas 2014-2018



__Deployments in Marginal Seas by basin 2014-2018__



__Deployments in Marginal Seas by country 2014-2018__

Ship	Type	Argo
- Total -		4109
KAHAROA (ICES Code: 61LY)	Research Vessels	606
RONALD H. BROWN (ICES Code: 33RO)	Research Vessels	204
NATHANIEL B. PALMER (ICES Code: 3206)	Research Vessels	185
INVESTIGATOR (ICES Code: 096U)	Research Vessels	115
BLUE FIN (ICES Code: 331I)	Support vessels	110
JAMES CLARK ROSS (ICES Code: 74JC)	Research Vessels	106
POLARSTERN (ICES Code: 06AQ)	Research Vessels	103
S.A. AGULHAS II (ICES Code: 91AH)	Research Vessels	99
ATALANTE (ICES Code: 35A3)	Research Vessels	87
HUDSON (ICES Code: 18HU)	Coastguard	82
RYOFU MARU (ICES Code: 49UP)	Research Vessels	77
METEOR (ICES Code: 06M3)	Research Vessels	69
ATLANTIS (ICES Code: 33AT)	Research Vessels	67
ROGER REVELLE (ICES Code: 33RR)	Research Vessels	66
MARIA S. MERIAN (ICES Code: 06M2)	Research Vessels	62
THOMAS G. THOMPSON (ICES Code: 3250)	Research Vessels	62
THALASSA (ICES Code: 35HT)	Research Vessels	57
SAGAR NIDHI	Research Vessels	56
KILO MOANA (ICES Code: 33KB)	Research Vessels	55
MAERSK VILNIUS (ICES Code: SIMV)	Unknown	52
AURORA AUSTRALIS (ICES Code: 09AR)	Research Vessels	49
INVESTIGATOR	Sailing Vessels	48
MIRAI (ICES Code: 49NZ)	Research Vessels	48
US Navy	Military ships	45
KEIFU MARU (ICES Code: 49UF)	Research Vessels	42
DISCOVERY (ICES Code: 74EQ)	Research Vessels	41
KEIFU MARU	Unknown	41
C-130 AIRCRAFT	Unknown	39
POURQUOI PAS? (ICES Code: 35PK)	Research Vessels	38
PLANCIUS	Passenger ferries	34
SIKULIAQ (ICES Code: 33BI)	Research Vessels	32
JAMES COOK (ICES Code: 740H)	Research Vessels	31
Ke Xue Yi Hao (ICES Code: 76SC)	Research Vessels	29
JOHN P. TULLY (ICES Code: 18DD)	Coastguard	27
SIR WILFRID LAURIER (ICES Code: 18LU)	Coastguard	27
S.A. AGULHAS (ICES Code: 91AA)	Unknown	26
SARMIENTO DE GAMBOA (ICES Code: 29AH)	Research Vessels	26
ARAON	Icebreaking vessels	25
DONG FANG HONG II	Unknown	25
HAKUHO MARU (ICES Code: 49HH)	Research Vessels	25
MARCUS G. LANGSETH (ICES Code: 33H3)	Research Vessels	25
MARION DUFRESNE (ICES Code: 35MV)	Research Vessels	24
SAGAR KANYA	Research Vessels	23
SAGAR SAMPADA (ICES Code: 41SS)	Research Vessels	23
TETHYS II (ICES Code: 35TT)	Research Vessels	23
Angeles Alvarino (ICES Code: 29AJ)	Research Vessels	22
GOLDEN BEAR	Passenger Ships	22
TANGAROA (ICES Code: 61TG)	Research Vessels	22
AEGAEO (ICES Code: 36AE)	Research Vessels	20
HESPERIDES (ICES Code: 29HE)	Research Vessels	19
Sagar Nidhi (ICES Code: 41SN)	Research Vessels	19
DISCOVERY (ICES Code: 74E3)	Unknown	18
KNORR (ICES Code: 316N)	Research Vessels	18
BRAVEHEART	Research Vessels	17
NEIL ARMSTRONG	Research Vessels	17
NEW HORIZON (ICES Code: 32NM)	Research Vessels	17
OCEANIA (ICES Code: 67CE)	Research Vessels	17
ALGOA (ICES Code: 91AL)	Unknown	15
Falkor (ICES Code: CIFR)	Research Vessels	15
ROBERT C. SEAMANS (ICES Code: 33GY)	Yachts and pleasure craft	15
BEAUTEMPS-BEAUPRE (ICES Code: 35B5)	Research Vessels	14
Celtic Explorer (ICES Code: 45CE)	Research Vessels	14
MARY SEARS	Military ships	14
OKEANOS EXPLORER (ICES Code: 334A)	Research Vessels	14
Sagar Kanya (ICES Code: 41SG)	Research Vessels	13
HAAKON MOSBY (ICES Code: 58AA)	Research Vessels	12
HESPERIDES	Unknown	12
LE SUROIT (ICES Code: 35LU)	Research Vessels	12
METEOR (ICES Code: 06MT)	Research Vessels	12
PELAGIA (ICES Code: 64PE)	Research Vessels	12
SEWARD JOHNSON II (ICES Code: 33S2)	Research Vessels	12
SHIRASE (ICES Code: 49ZS)	Unknown	12
SHONAN MARU	Unknown	12
TANGAROA (ICES Code: 61TN)	Research Vessels	12
ZIMIC	Military ships	12
AMUNDSEN (ICES Code: 18SZ)	Coastguard	11

…

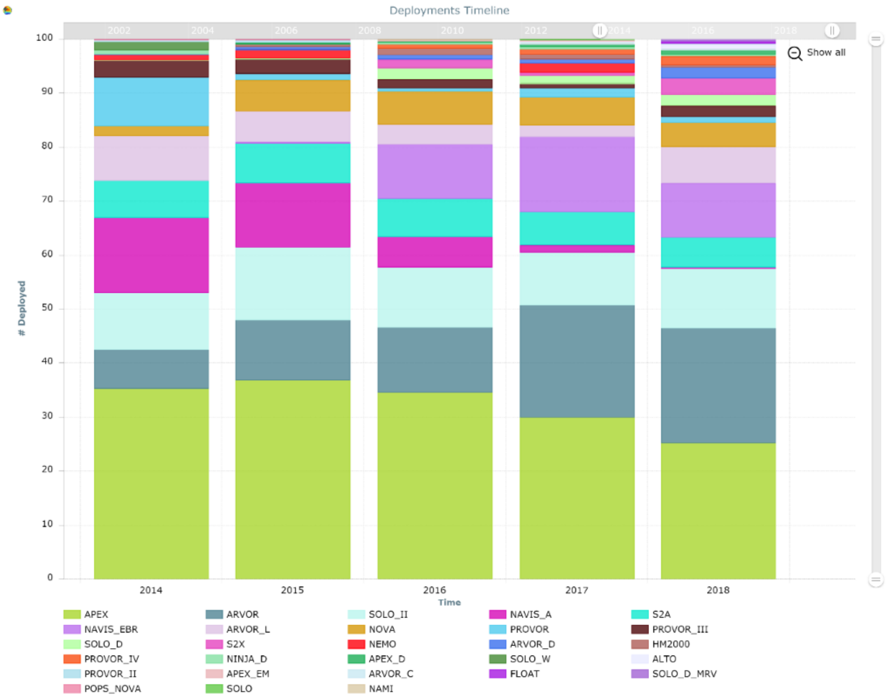
Key 2014-2018 ships, #Deployments.

Ship	Type	Argo
- Total -		856
KAHAROA (ICES Code: 61LY)	Research Vessels	106
POLARSTERN (ICES Code: 06AQ)	Research Vessels	40
RONALD H. BROWN (ICES Code: 33RO)	Research Vessels	40
THOMAS G. THOMPSON (ICES Code: 3250)	Research Vessels	34
INVESTIGATOR (ICES Code: 096U)	Research Vessels	33
BLUE FIN (ICES Code: 331I)	Support vessels	31
C-130 AIRCRAFT	Unknown	31
US Navy	Military ships	27
ATALANTE (ICES Code: 35A3)	Research Vessels	23
HUDSON (ICES Code: 18HU)	Coastguard	23
MARIA S. MERIAN (ICES Code: 06M2)	Research Vessels	22
S.A. AGULHAS II (ICES Code: 91AH)	Research Vessels	21
THALASSA (ICES Code: 35HT)	Research Vessels	20
NATHANIEL B. PALMER (ICES Code: 3206)	Research Vessels	16
RYOFU MARU (ICES Code: 49UP)	Research Vessels	16
Angeles Alvarino (ICES Code: 29AJ)	Research Vessels	15
JAMES COOK (ICES Code: 740H)	Research Vessels	15
JAMES CLARK ROSS (ICES Code: 74JC)	Research Vessels	12
TANGAROA (ICES Code: 61TN)	Research Vessels	12
HESPERIDES (ICES Code: 29HE)	Research Vessels	11
SIKULIAQ (ICES Code: 33BI)	Research Vessels	11
KILO MOANA (ICES Code: 33KB)	Research Vessels	10
S.A. AGULHAS (ICES Code: 91AA)	Unknown	10
GOLDEN BEAR	Passenger Ships	9
NEIL ARMSTRONG	Research Vessels	9
PLANCIUS	Passenger ferries	9
Ship	Type	Argo
XIANG YANG HONG 3 (ICES Code: 76T3)	Research Vessels	9
ATLANTIS (ICES Code: 33AT)	Research Vessels	8
JIAGENG HAO	Research Vessels	8
KEIFU MARU	Unknown	8
WHALE SONG (ICES Code: CK6F)	Research Vessels	8
GISANG 1 (ICES Code: 248K)	Research Vessels	7
SARMIENTO DE GAMBOA (ICES Code: 29AH)	Research Vessels	7
ALIS (ICES Code: 35AY)	Research Vessels	6
CABO DE HORNOS	Research Vessels	6
FGS HESSEN (ICES Code: 061L)	Military ships	6
JUSTO SIERRA	Research Vessels	6
KEIFU MARU (ICES Code: 49UF)	Research Vessels	6
METEOR (ICES Code: 06M3)	Research Vessels	6
OCEANIA (ICES Code: 67CE)	Research Vessels	6
Sagar Nidhi (ICES Code: 41SN)	Research Vessels	6
TETHYS II (ICES Code: 35TT)	Research Vessels	6
AEGAEO (ICES Code: 36AE)	Research Vessels	5
Falkor (ICES Code: CIFR)	Research Vessels	5
MAERSK ADVANCER (ICES Code: 26UH)	General Cargo	5
SAGAR NIDHI	Research Vessels	5
SHONAN MARU	Unknown	5
SIR WILFRID LAURIER (ICES Code: 18LU)	Coastguard	5
USCGC HEALY (ICES Code: 33HQ)	Icebreaking vessels	5
AMUNDSEN (ICES Code: 18SZ)	Coastguard	4
Celtic Explorer (ICES Code: 45CE)	Research Vessels	4
JOHAN HJORT (ICES Code: 58J3)	Research Vessels	4
JOHN P. TULLY (ICES Code: 18DD)	Coastguard	4
KAIYO MARU	Unknown	4
PELAGIA (ICES Code: 64PE)	Research Vessels	4
RENE DESCARTES	Cable ships	4
UMITAKA MARU (ICES Code: 49QB)	Unknown	4
UNKNOWN_KOREA	Unknown	4
XIANG YANG HONG 18 (ICES Code: 76OB)	Research Vessels	4
ARANDA (ICES Code: 34A3)	Research Vessels	3
BEAUTEMPS-BEAUPRE (ICES Code: 35B5)	Research Vessels	3
KAIWO MARU	Other	3
MIRAI (ICES Code: 49NZ)	Research Vessels	3
PIERRE DE FERMAT	Cable ships	3
POURQUOI PAS? (ICES Code: 35PK)	Research Vessels	3
SWAN RIVER BRIDGE (ICES Code: SISR)	Container ships	3
UNKNOWN	Passenger Ships	3
ALIZES II (ICES Code: 35X4)	Sailing Vessels	2
Alliance (ICES Code: 06A4)	Research Vessels	2
CARETTA	Sailing Vessels	2
CHANIK	Unknown	2
Coastguard	Coastguard	2
KAIMIKAI-O-KANALOA (ICES Code: 33KI)	Research Vessels	2
Ke Xue Yi Hao (ICES Code: 76SC)	Research Vessels	2
NYK DIANA	Container ships	2
OGS-EXPLORA (ICES Code: 48AZ)	Research Vessels	2
ROBERT C. SEAMANS (ICES Code: 33GY)	Yachts and pleasure craft	2
ROE	Yachts and pleasure craft	2

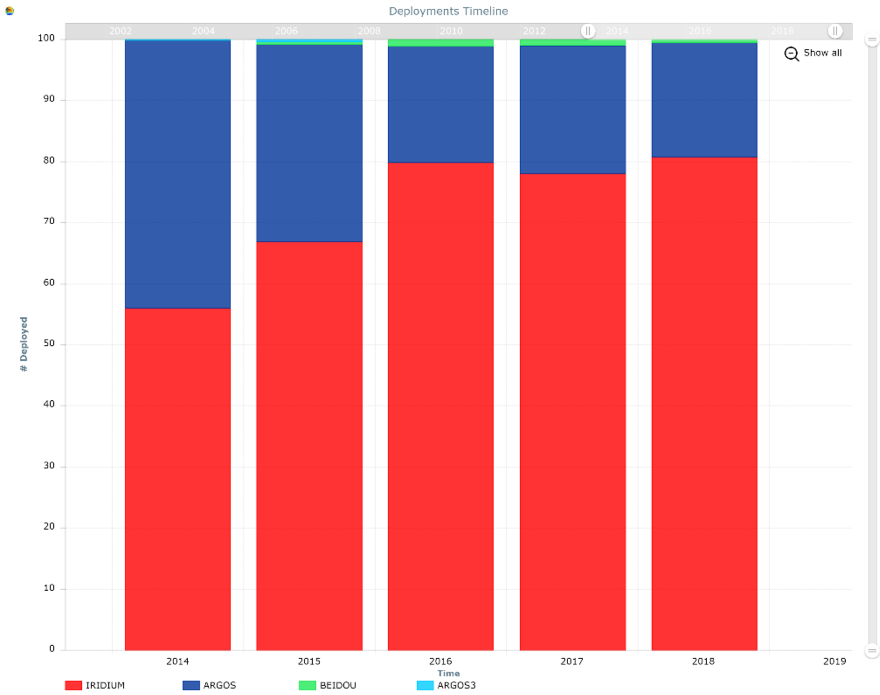
SHINSEI MARU (ICES Code: 49PI)	Research Vessels	2
UNKNOWN MILITARY US	Military ships	2
ATLANTIC EXPLORER	Unknown	1
G. DALLAPORTA (ICES Code: 48DP)	Research Vessels	1
KELLY OVAYUAK	Tugs	1
Kristine Bonnevie (ICES Code: 58UO)	Research Vessels	1
Kronprins Haakon (ICES Code: 58US)	Research Vessels	1
L'ASTROLABE (ICES Code: 353L)	Research Vessels	1
LEONARDO (ICES Code: 48LE)	Research Vessels	1
MARION DUFRESNE (ICES Code: 35MV)	Research Vessels	1
OSCAR DYSON (ICES Code: 33OA)	Research Vessels	1
Perintis IRAMA	Passenger Ships	1
R/V Akademik	Research Vessels	1
Sagar Kanya (ICES Code: 41SG)	Research Vessels	1
SALLY RIDE	Research Vessels	1
SEWARD JOHNSON II (ICES Code: 33S2)	Research Vessels	1
SONNE (ICES Code: 06SN)	Research Vessels	1
UNKNOWN IT NAVY	Military ships	1

2018 ships, #Deployments.

Instrumentation



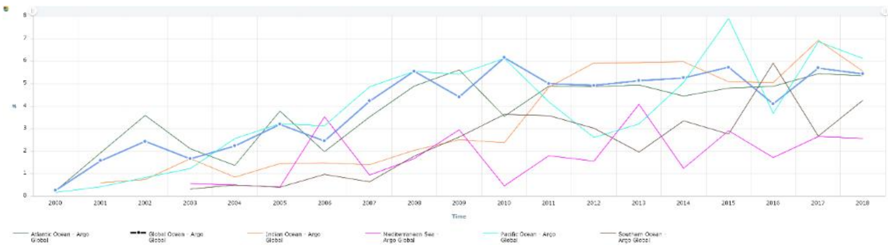
2014-2018 Deployments, float models (%)



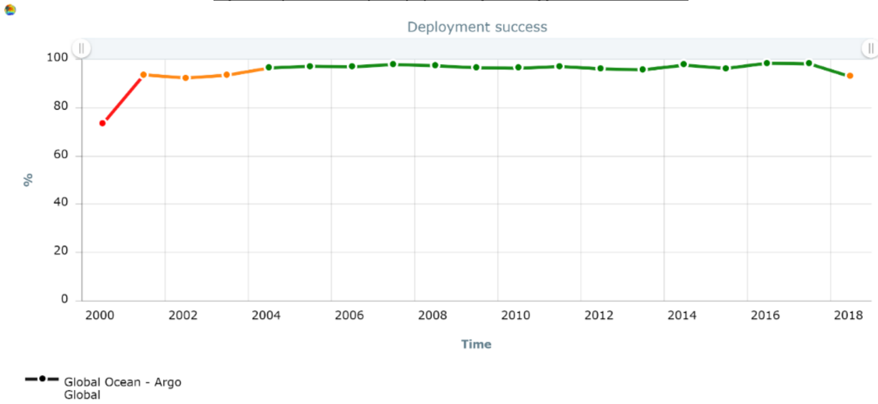
2014-2018 Deployments, telecom. types (%)

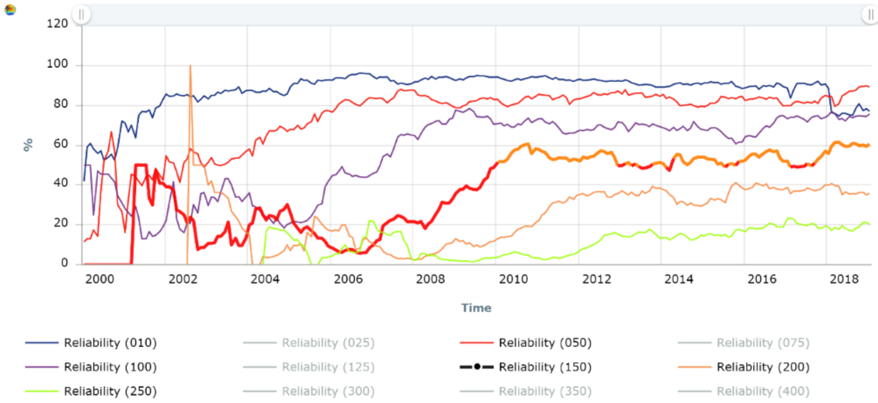
Reliability (200) Argo Global	35.89% 1/2019 ↘	342 Raw count	50% Target	% of deployment surviving 200 cycles (12 months moving window)
Reliability (250) Argo Global	20.4% 1/2019 ↗	206 Raw count	25% Target	% of deployment surviving 250 cycles (12 months moving window)
Reliability (300) Argo Global	6.17% 1/2019 ↘	41 Raw count	20% Target	% of deployment surviving 300 cycles (12 months moving window)
Reliability (350) Argo Global	4.99% 1/2019 ↗	41 Raw count	10% Target	% of deployment surviving 350 cycles (12 months moving window)
Reliability (400) Argo Global	1.09% 1/2019 ↘	8 Raw count	5% Target	% of deployment surviving 400 cycles (12 months moving window)
Instrumentation				
Age of failure Argo Global	4.25 2018 ↗	- Raw count	4.1 Target	Average age of failures (excluding launch failures)
Deployment Success Argo Global	92.82% 2018 ↘	698 Raw count	95% Target	% of deployment surviving one cycle over last calendar year deployments
Half Life Argo Global	1511.26 2014 ↗	1511 Raw count	- Target	Half Life in days (Global)
Life Expectancy Argo Global	5.43 2018 ↘	5 Raw count	- Target	Annual Life expectancy calculation based on demographic studies
Mortality Rate Argo Global	26.37% 2018 ↗	26 Raw count	- Target	The mortality rate, or death rate, is the ratio between the yearly failures and the average float population that year (arithmetic mean of monthly operational floats).
Reliability (010) Argo Global	76.99% 1/2019 ↘	783 Raw count	90% Target	% of deployment surviving 10 cycles (12 months moving window)
Reliability (025) Argo Global	79.78% 1/2019 ↘	738 Raw count	90% Target	% of deployment surviving 25 cycles (12 months moving window)
Reliability (050) Argo Global	89.23% 1/2019 ↗	787 Raw count	90% Target	% of deployment surviving 50 cycles (12 months moving window)
Reliability (075) Argo Global	79.25% 1/2019 ↗	672 Raw count	90% Target	% of deployment surviving 75 cycles (12 months moving window)
Reliability (100) Argo Global	75.67% 1/2019 ↗	650 Raw count	85% Target	% of deployment surviving 100 cycles (12 months moving window)
Reliability (125) Argo Global	69.17% 1/2019 ↗	682 Raw count	80% Target	% of deployment surviving 125 cycles (12 months moving window)
Reliability (150) Argo Global	60.56% 1/2019 ↗	611 Raw count	75% Target	% of deployment surviving 150 cycles (12 months moving window)

KPIs for Instrumentation



Life Expectancy, by year, for different basins

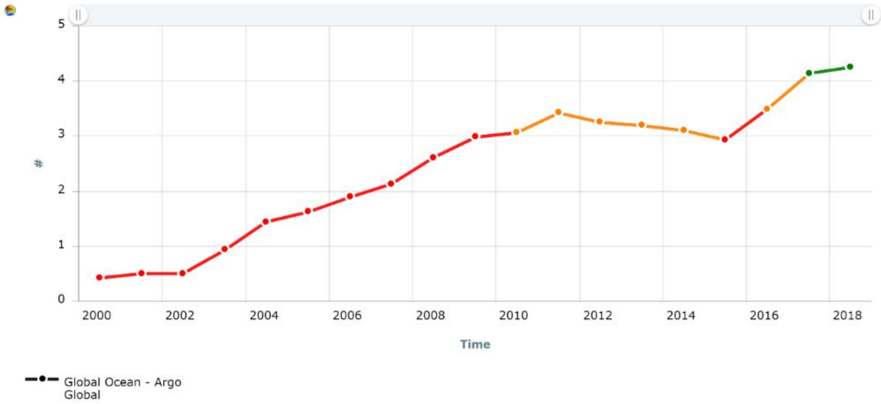




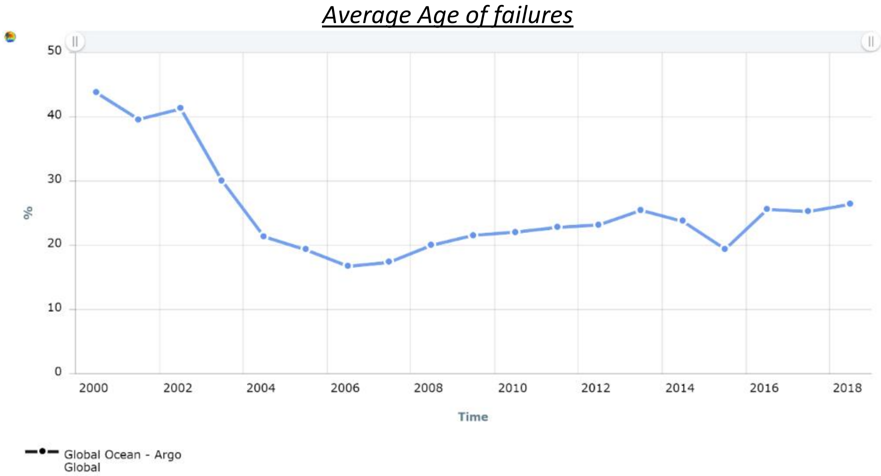
Floats reliability

# cycles	%
10	76.99
50	89.23
100	75.67
150	60.56
175	55.4% Manual: - TO IMPLEMENT INDICATOR
200	35.89
250	20.4

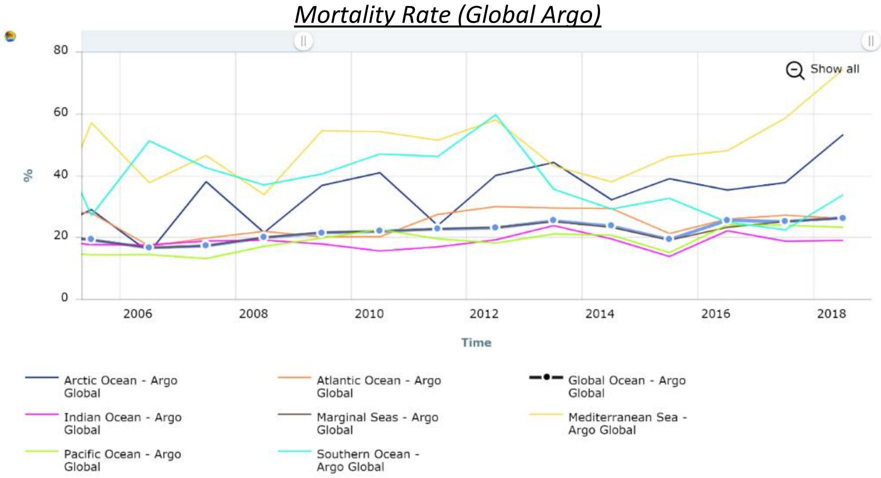
Floats reliability values (01/2019)



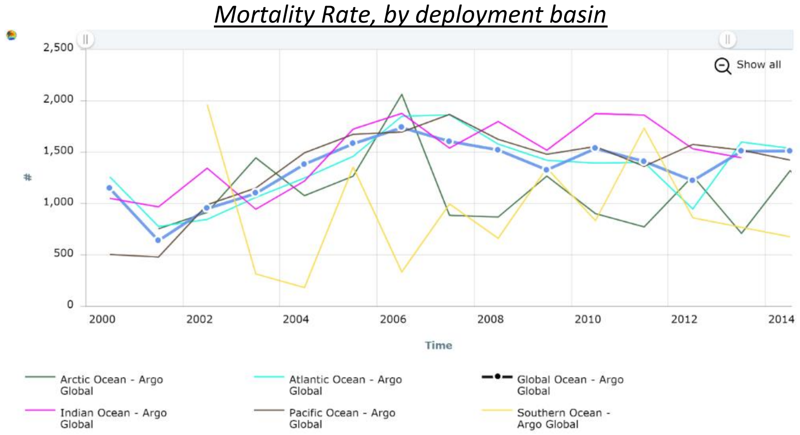
Average Age of failures



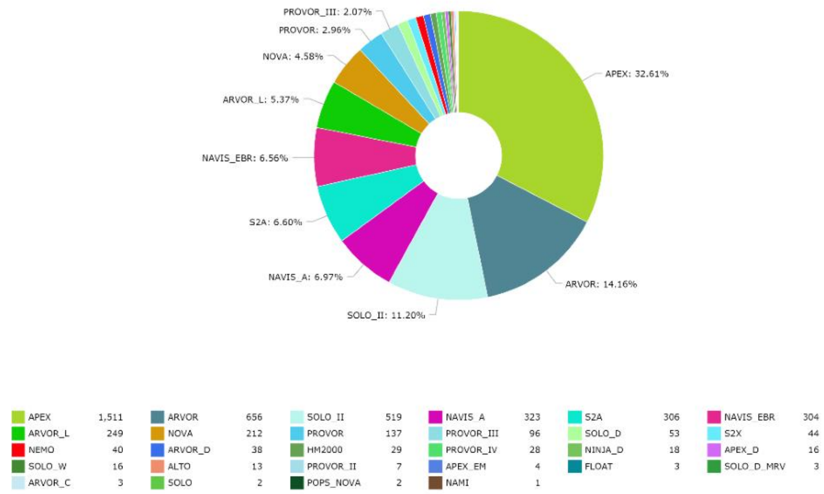
Mortality Rate (Global Argo)



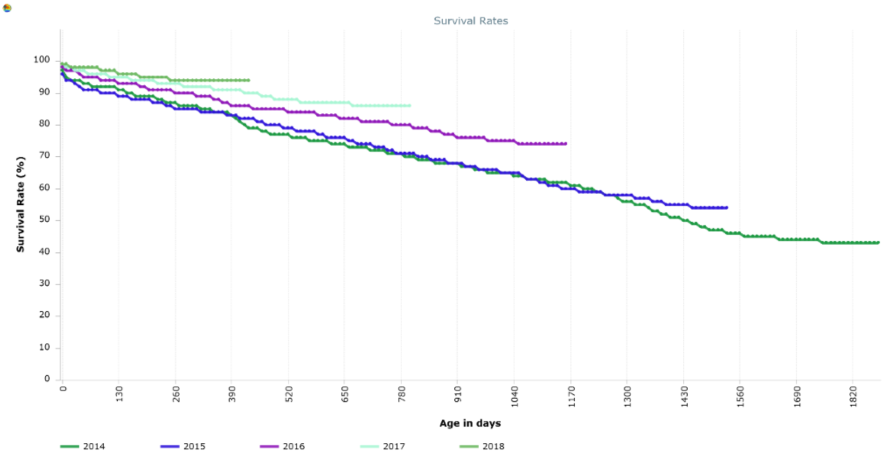
Mortality Rate, by deployment basin



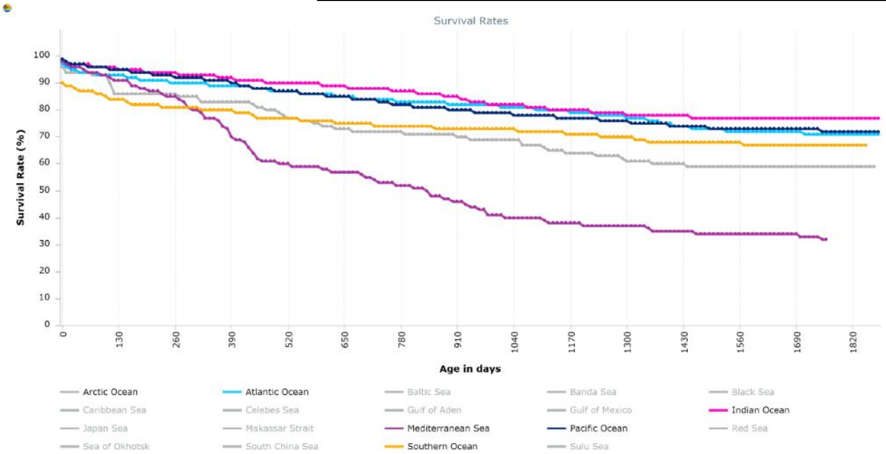
Half Life, by deployment basin



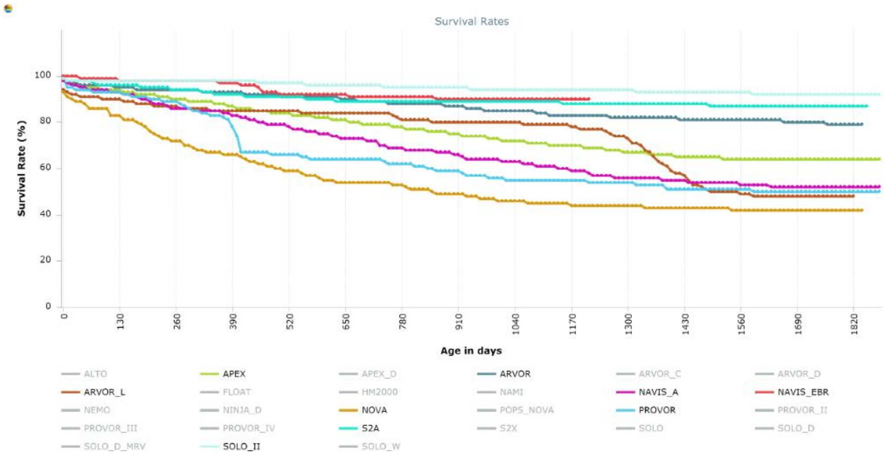
Deployments 2014-2018



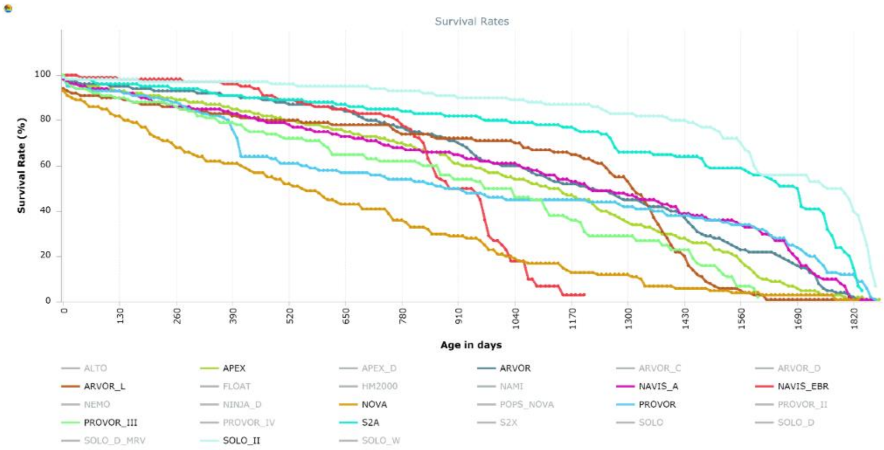
Deployments 2014-2018 Survival Rate, by generation



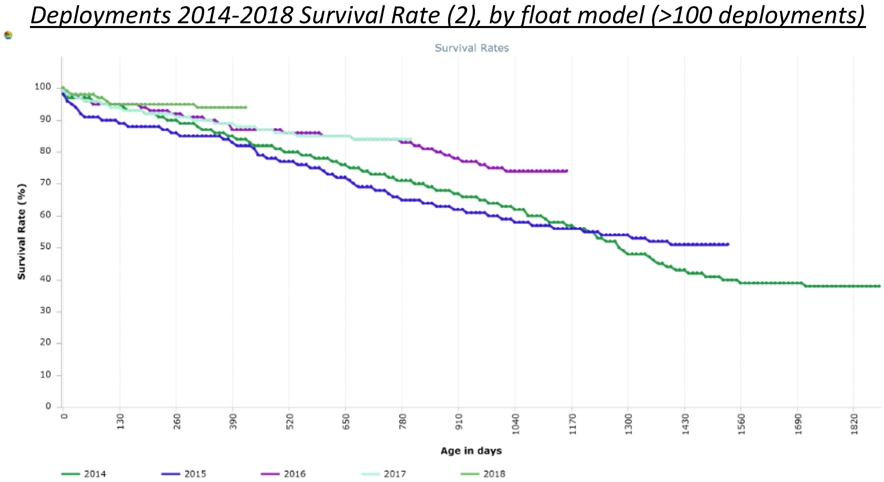
Deployments 2014-2018 Survival Rate, by deployment basin



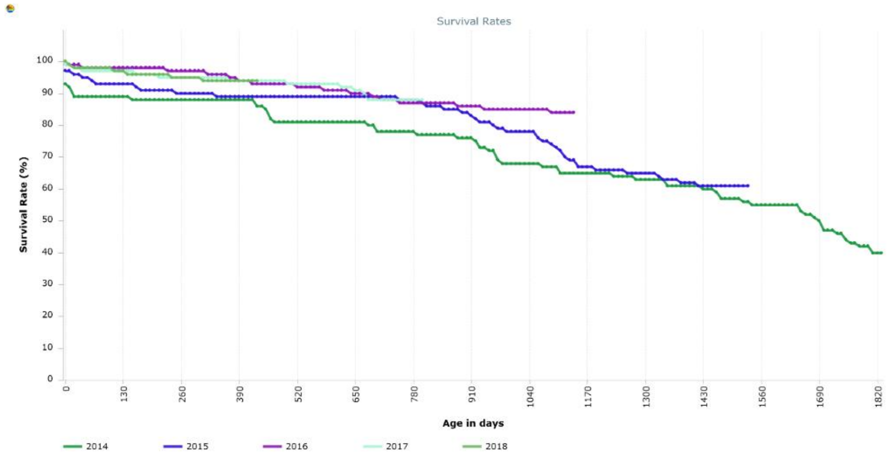
Deployments 2014-2018 Survival Rate, by float model (>100 deployments)



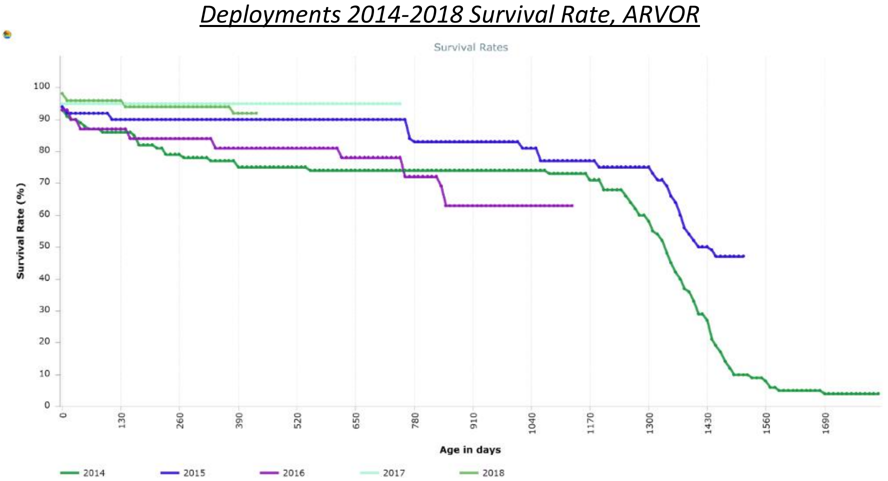
Deployments 2014-2018 Survival Rate (2), by float model (>100 deployments)



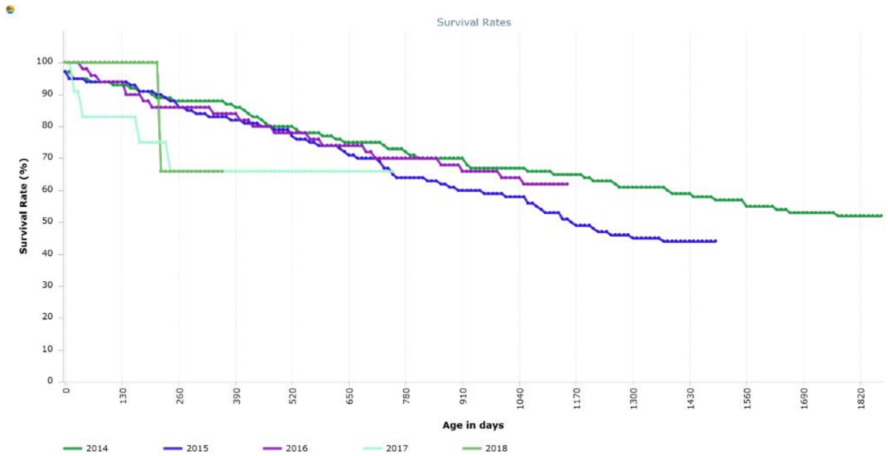
Deployments 2014-2018 Survival Rate, APEX



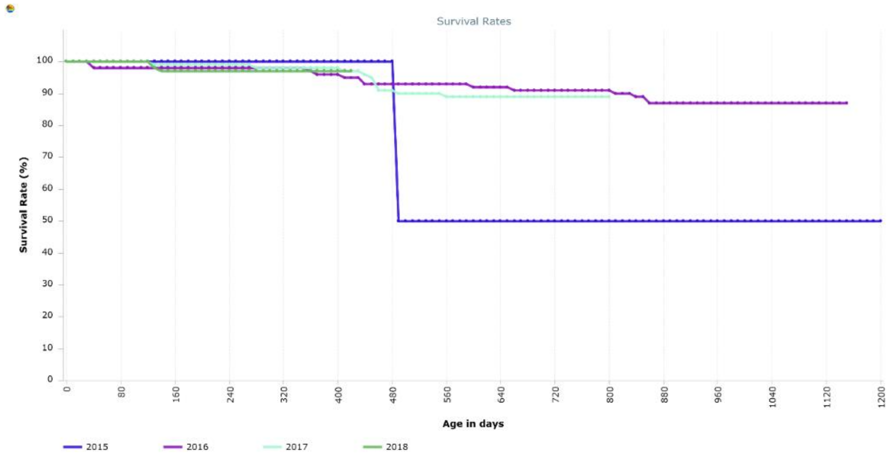
Deployments 2014-2018 Survival Rate, ARVOR



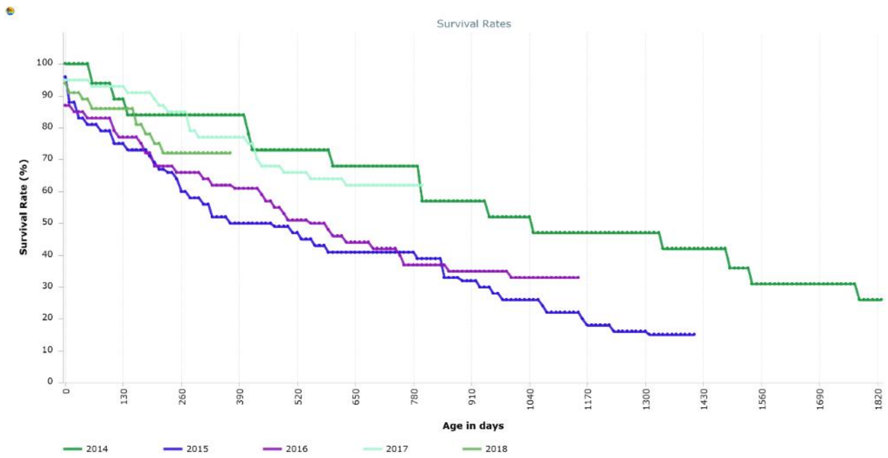
Deployments 2014-2018 Survival Rate, ARVOR_L



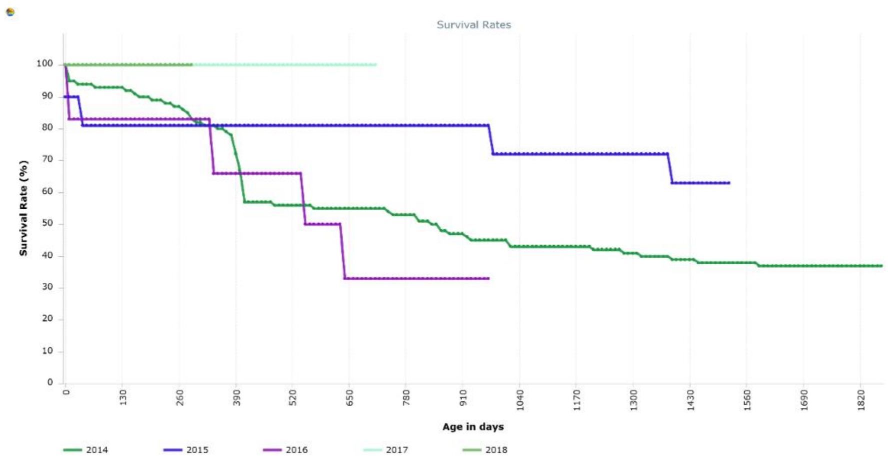
Deployments 2014-2018 Survival Rate, NAVIS_A



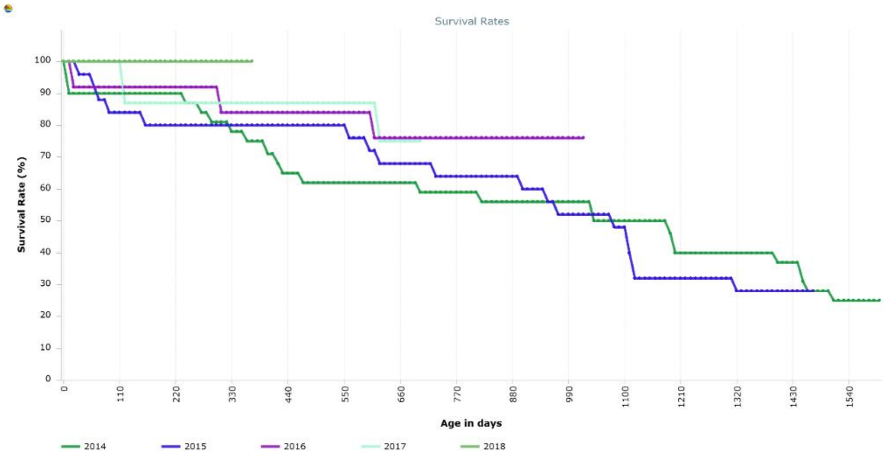
Deployments 2014-2018 Survival Rate, NAVIS_EBR



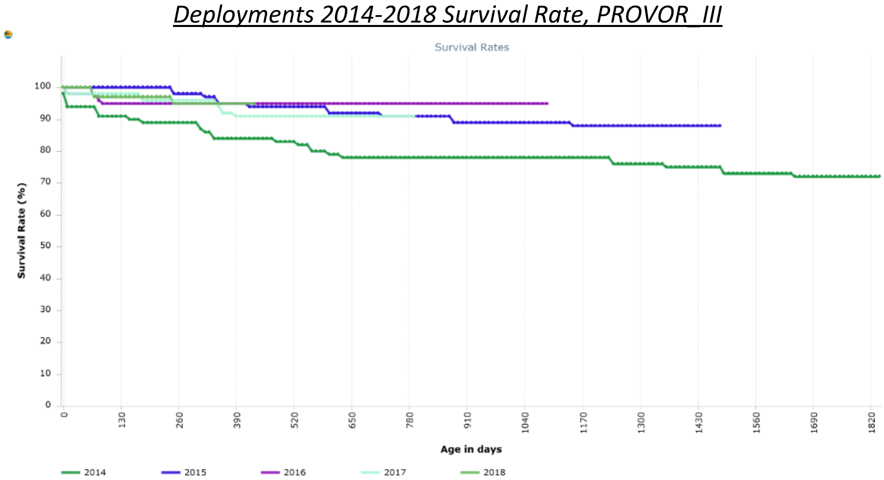
Deployments 2014-2018 Survival Rate, NOVA



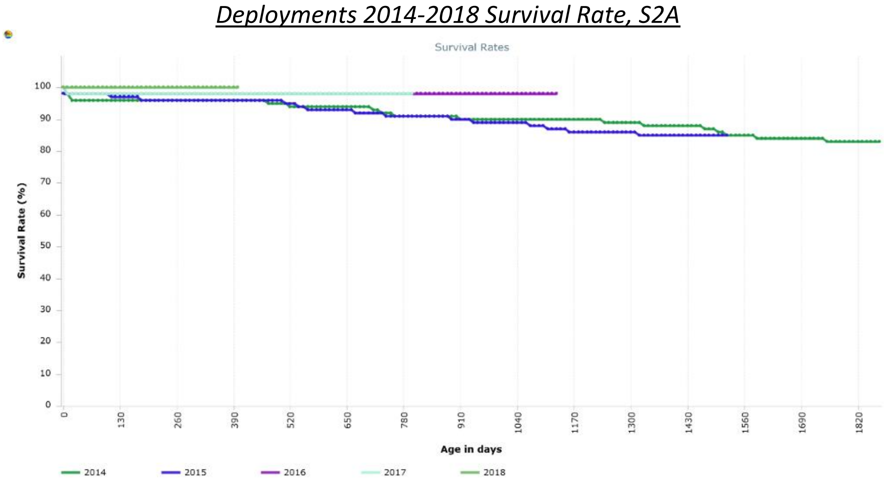
Deployments 2014-2018 Survival Rate, PROVOR



Deployments 2014-2018 Survival Rate, PROVOR_III



Deployments 2014-2018 Survival Rate, S2A

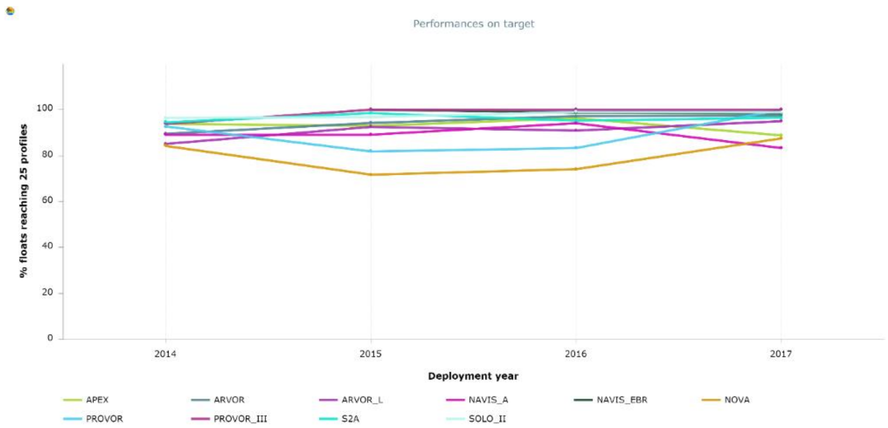


Deployments 2014-2018 Survival Rate, SOLO_II

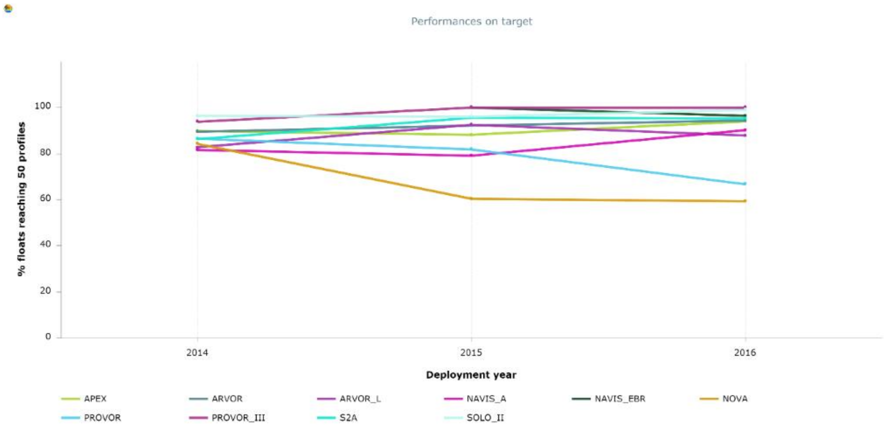
	10 profiles	25	50	75	100	125	150	175	200
ALL	96%	92.7	90.6	85.2	77.4	71.5	60.4	55	36.4
APEX	94	88.8	94	90	79.6	73.8	62.3	60	45
ARVOR	97.9	97.4	94.4	88.9	90.3	81.6	75	35	9
ARVO_L	95	95	87.9	81.8	92.5	65.5	11.5	-	-
NAVIS_A	100	83.3	90.2	82.4	62.7	64.6	58.5	51.2	51
NAVIS_EBR	100	98.4	96.4	92.8	100	-	-	-	-
NOVA	93.8	87.5	59.3	42.6	34	57.9	52.6	34	30
PROVOR	100	100	66.7	33.3	81.8	64.6	60.4	53	41
PROVOR_III	100	100	100	92.3	88	75	71.9	55	54
S2A	98.2	96.5	95.2	95.2	88.2	76.7	75.3	75	49
SOLO_II	98.9	98.9	99	99	90.4	91.1	90.2	86	54

Performance on target: % of distributing N profiles, most recent value.

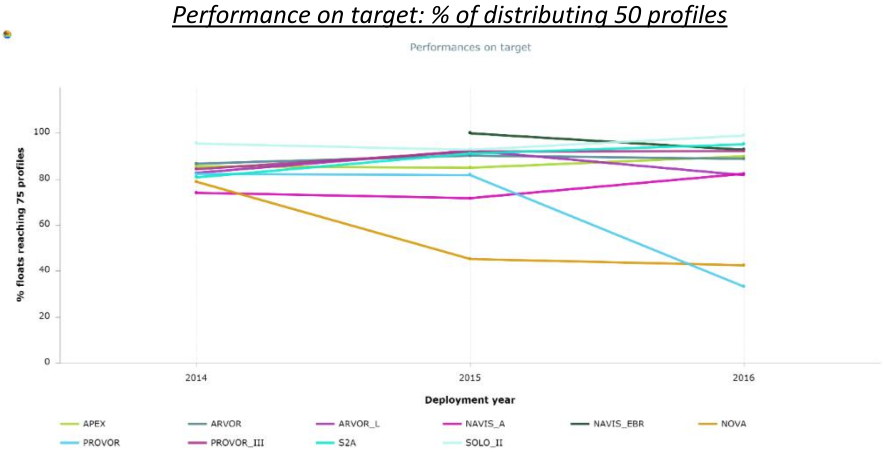
Float sample: floats deployed in 2014-2018
Performance on target: % of distributing 10 profiles



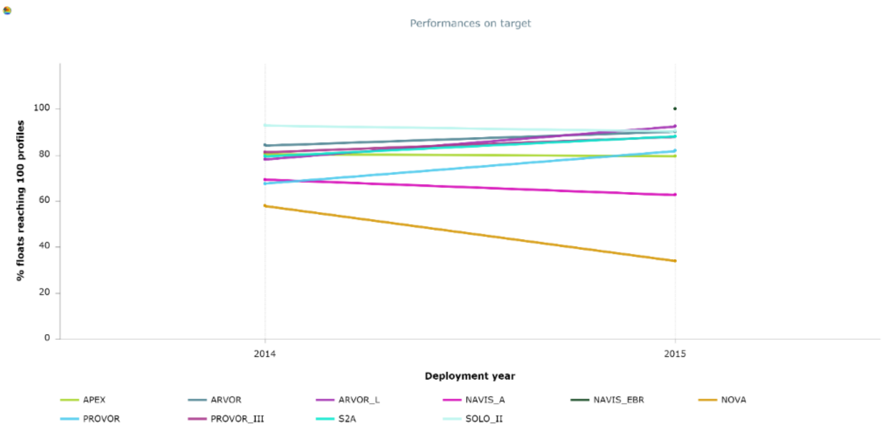
Float sample: floats deployed in 2014-2018
Performance on target: % of distributing 25 profiles



<u>Float sample: floats deployed in 2014-2018</u>
<u>Performance on target: % of distributing 50 profiles</u>



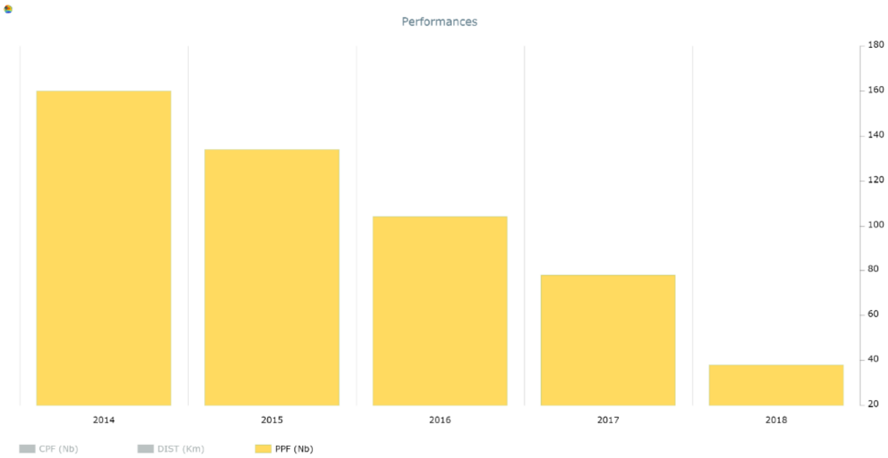
<u>Float sample: floats deployed in 2014-2018</u>
<u>Performance on target: % of distributing 75 profiles</u>



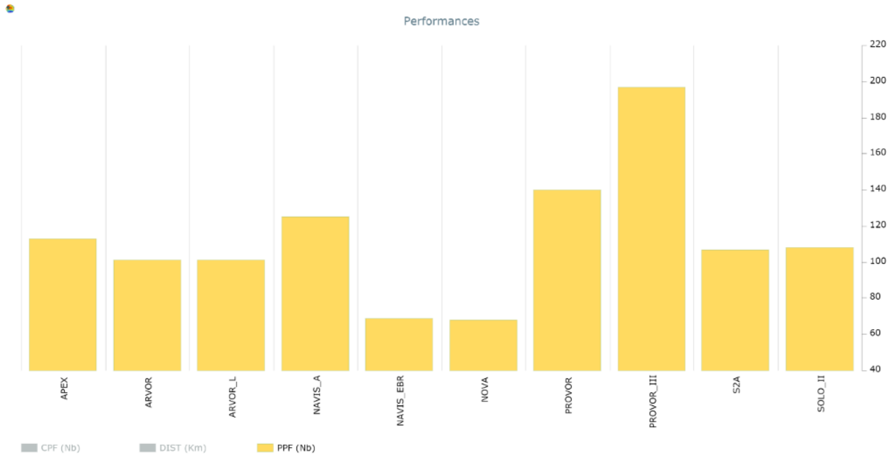
<u>Float sample: floats deployed in 2014-2018</u>
<u>Performance on target: % of distributing 100 profiles</u>

Float sample: floats deployed in 2014-2018
Performance on target: % of distributing 125 profiles

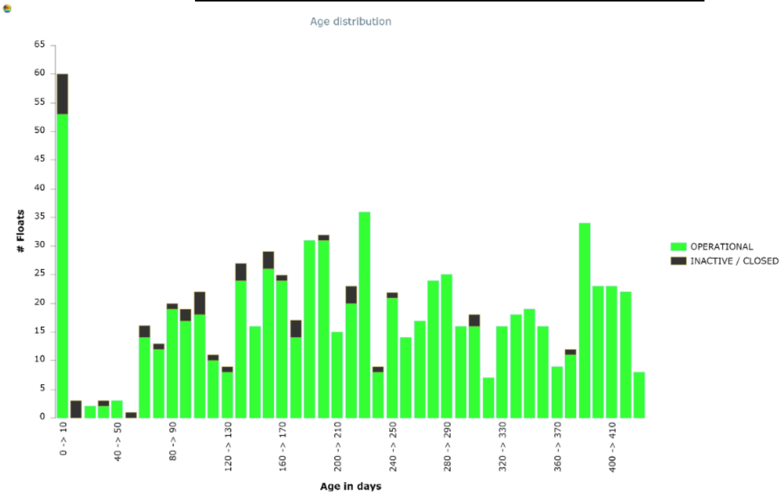
Float sample: floats deployed in 2014-2018
Performance on target: % of distributing 150 profiles



Float sample: floats deployed in 2014-2018
Average Profiles per float distributed, by generation

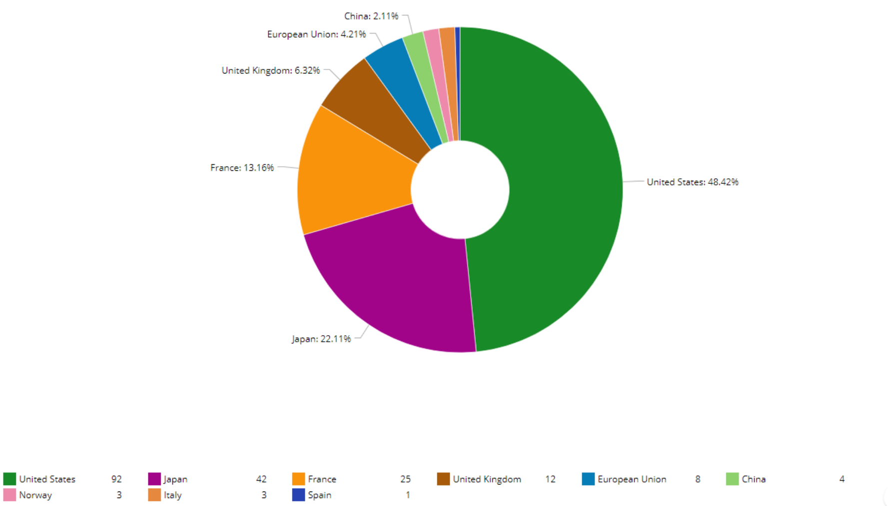


Float sample: floats deployed in 2014-2018
Average Profiles per float distributed, by model

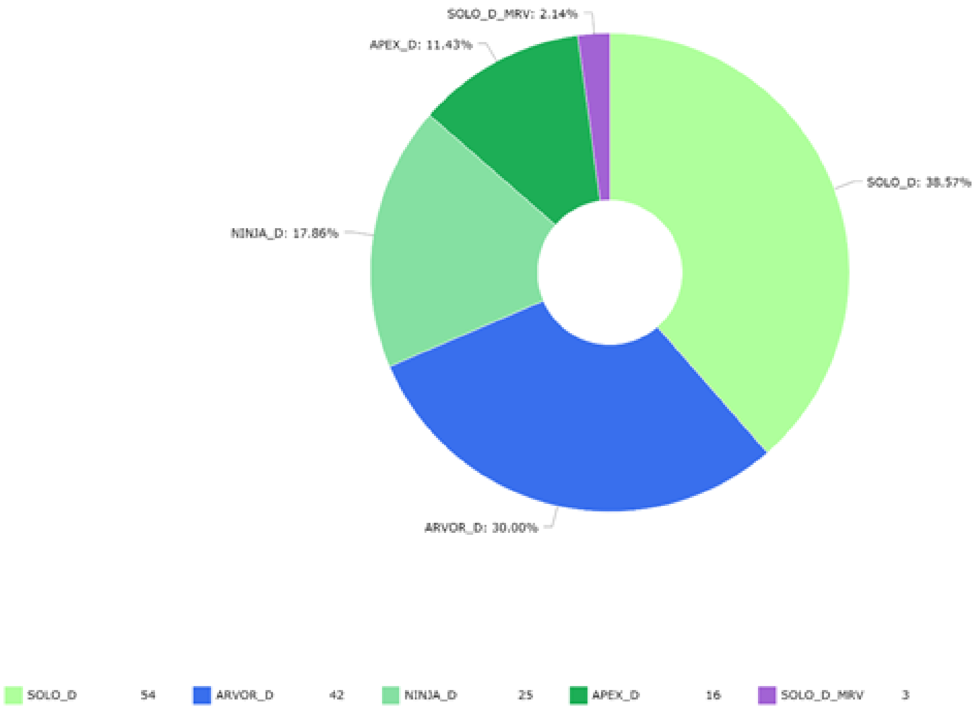


Age distribution of 2018 deployments

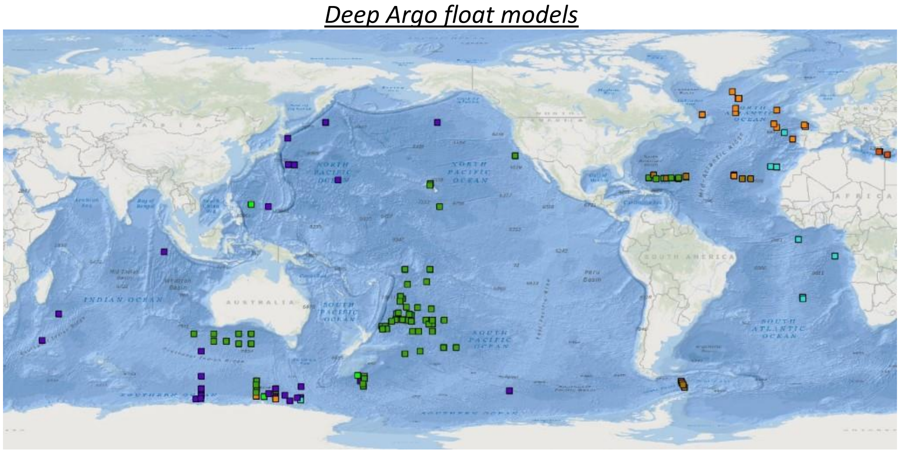
Deep Argo



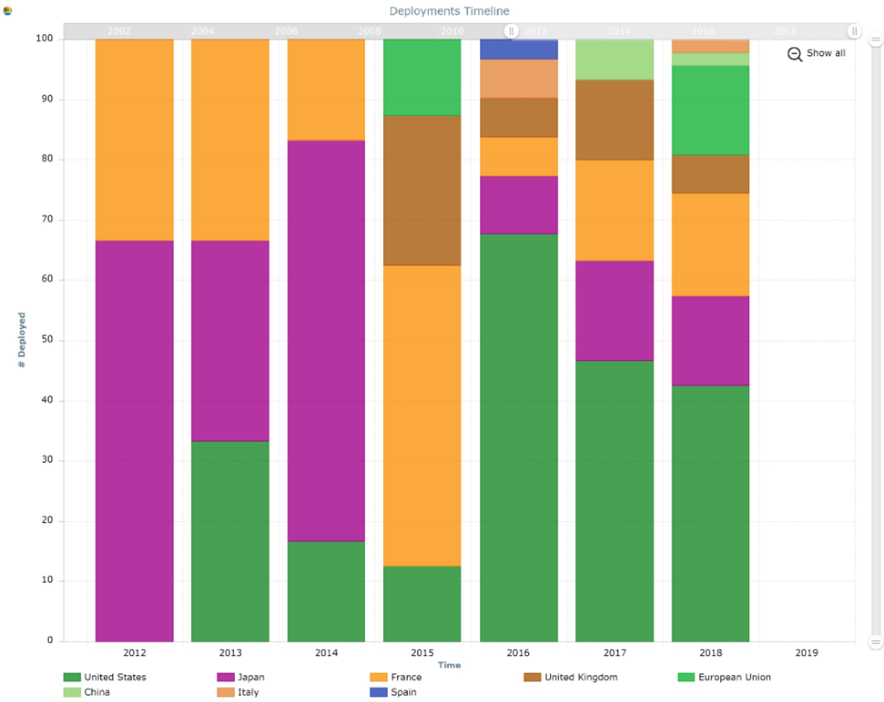
Deep Argo deploying countries



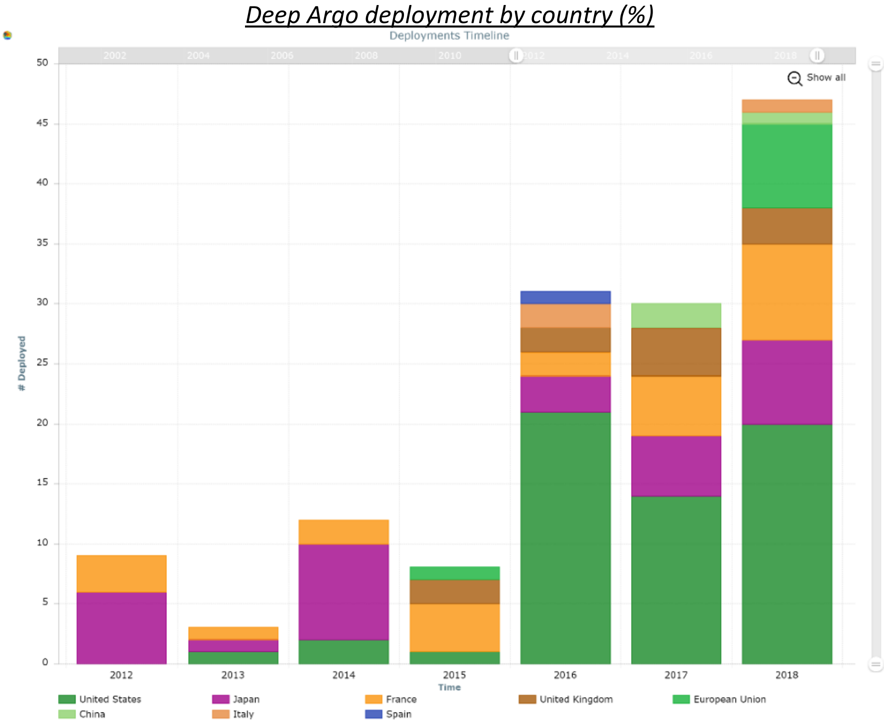
Deep Argo float models



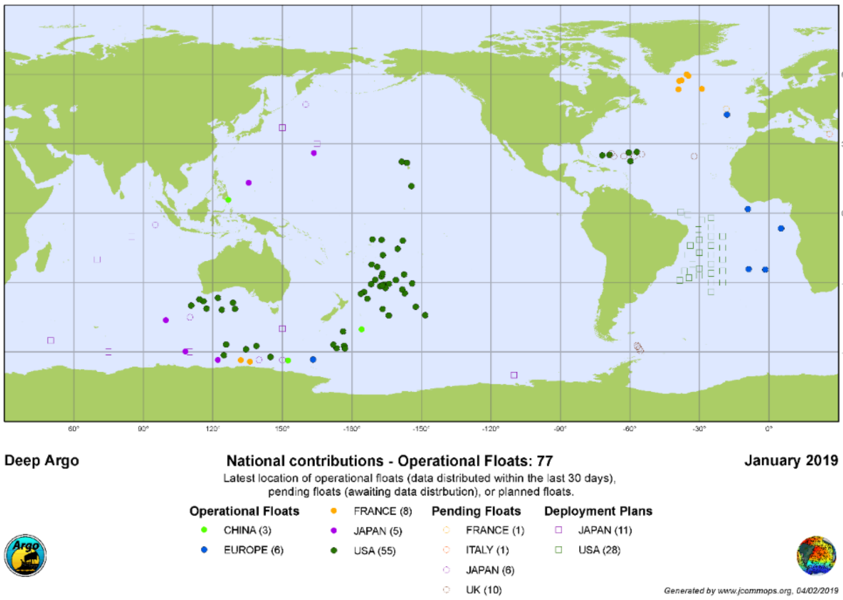
Deep Argo deployment locations, by country



Deep Argo deployment by country (%)

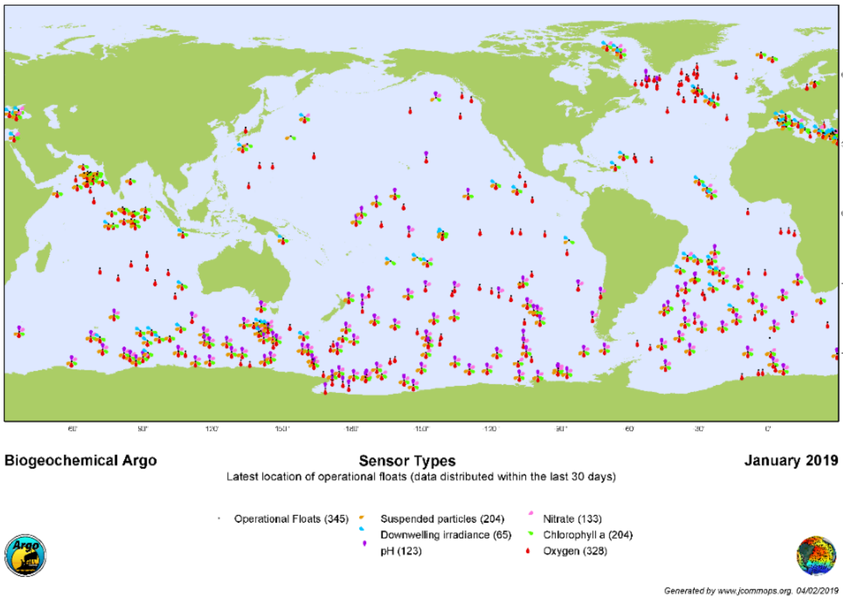


Deep Argo deployment by year (Nb)

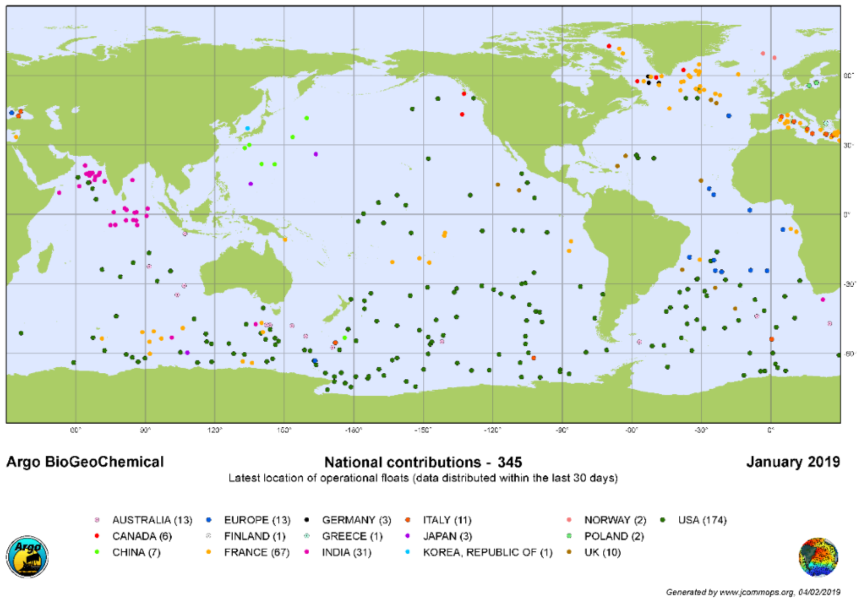


Deep Argo operational floats

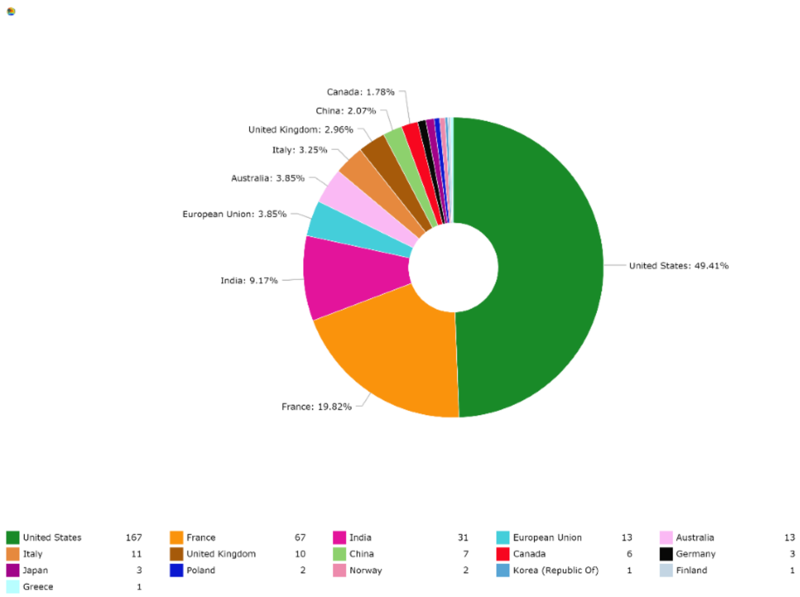
BGC Argo



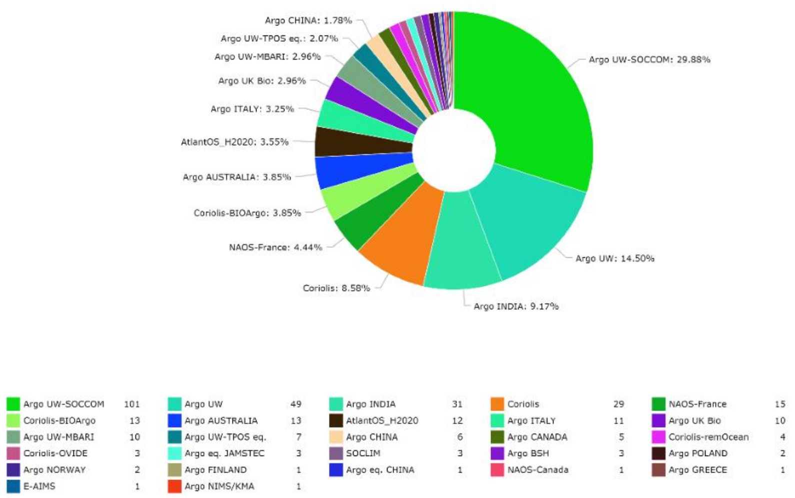
BGC Sensors, operational floats



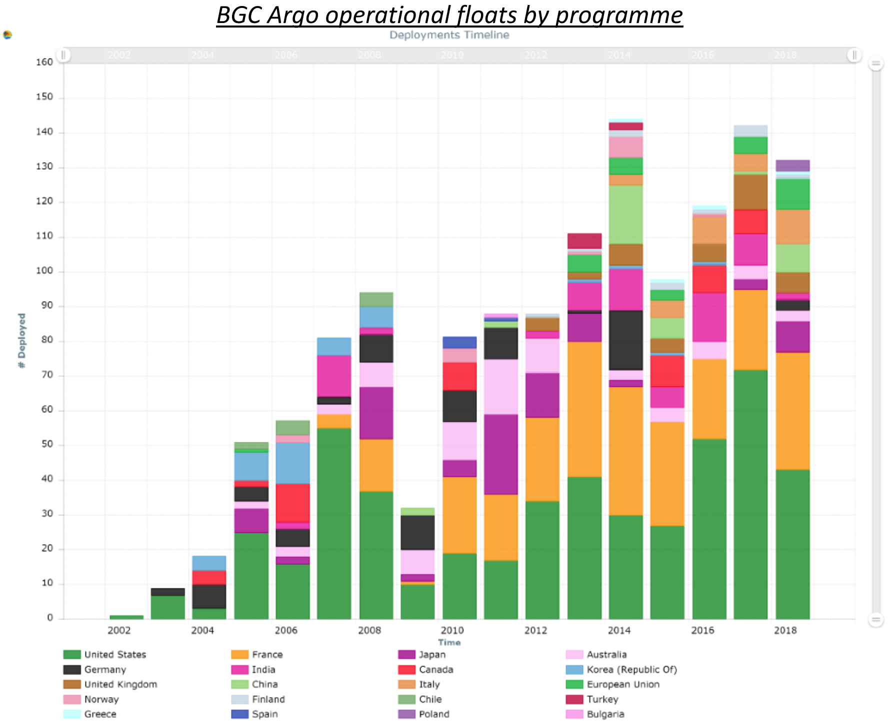
BGC National contributions, operational floats



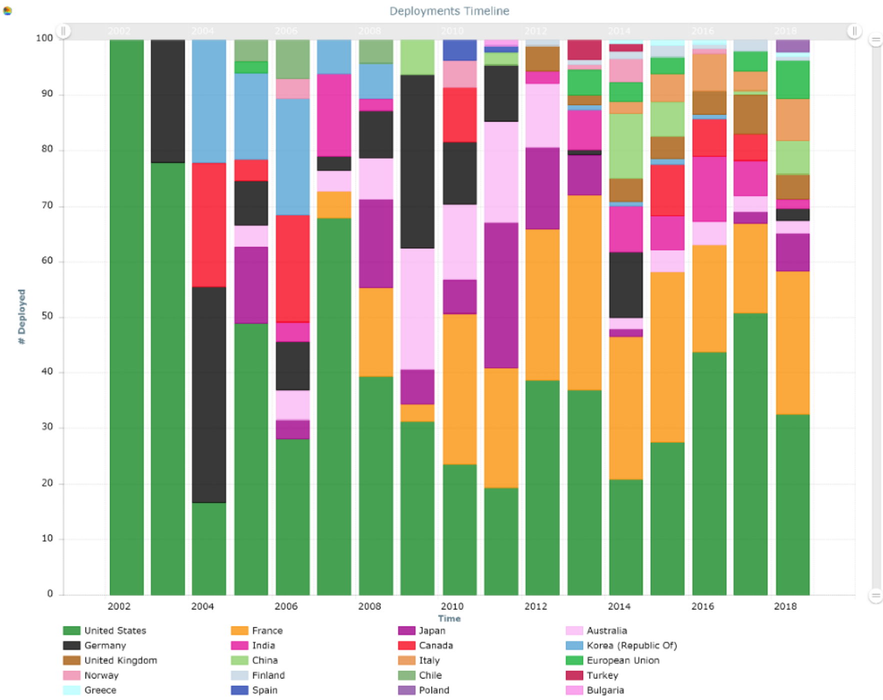
BGC Argo operational floats by country



BGC Argo operational floats by programme

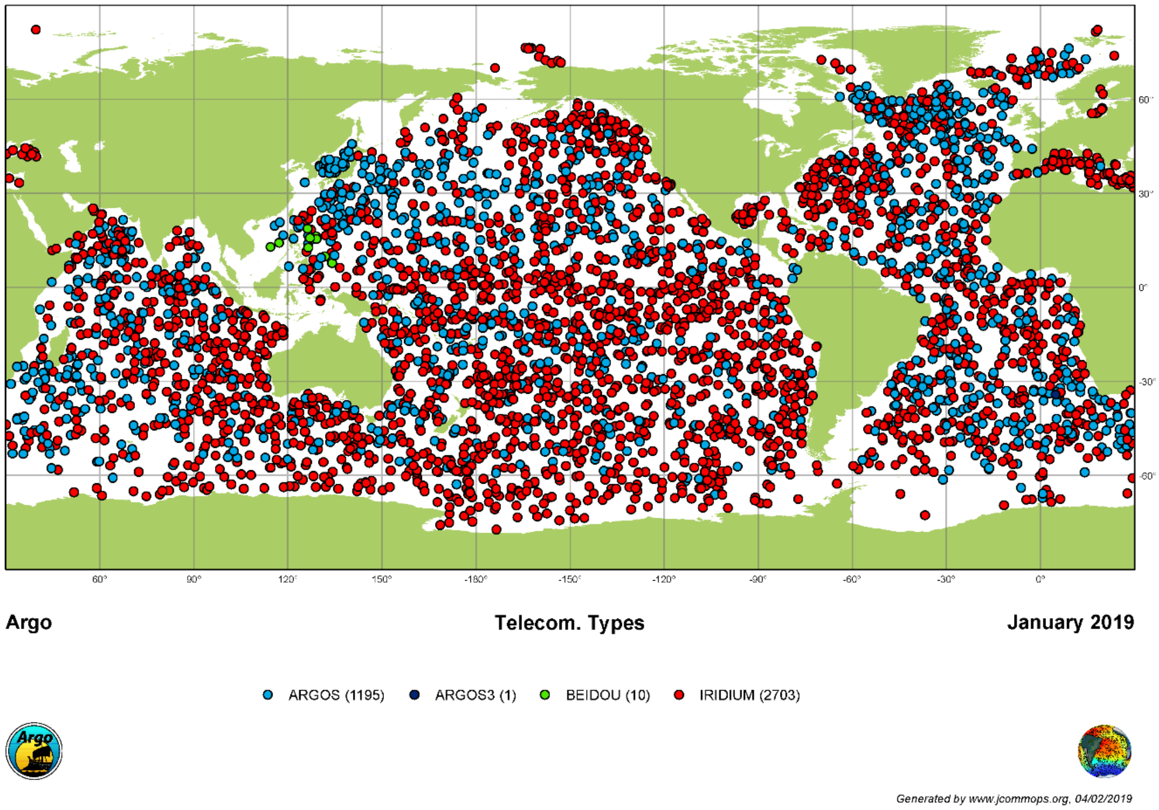


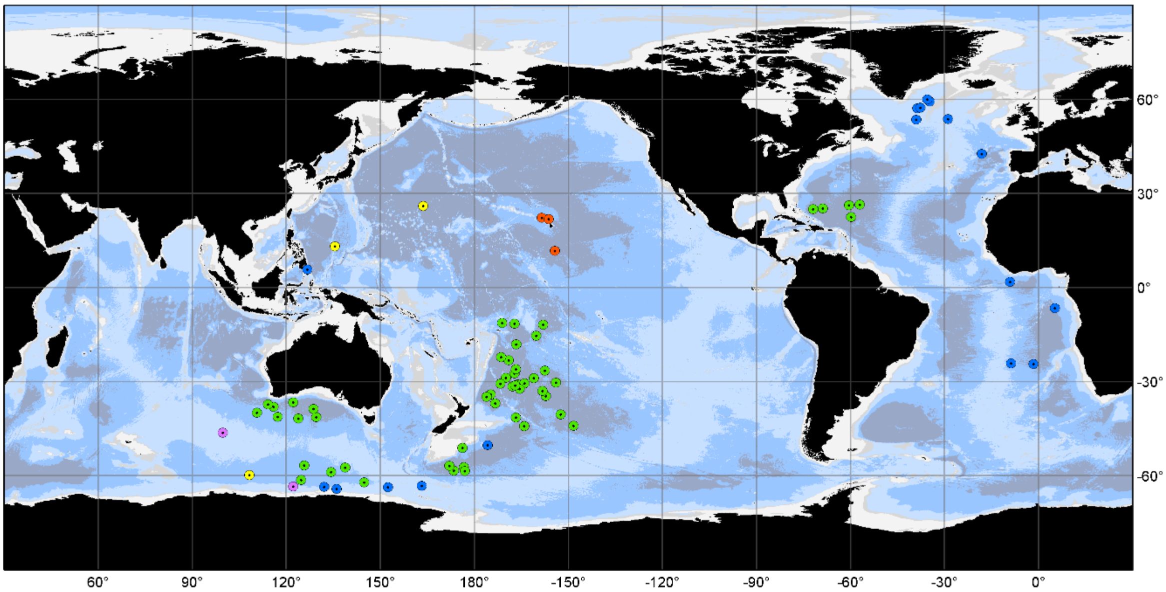
BGC float deployments, by country



BGC float deployments, % by country

More Maps ...





Argo | **Deep Float Models** | **January 2019**

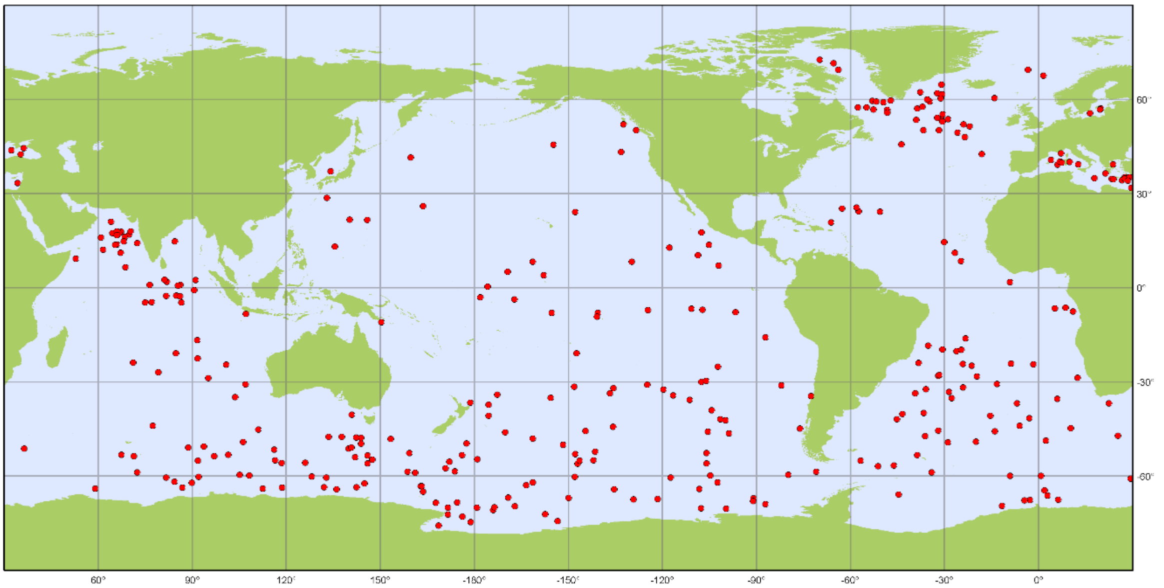
Latest location of operational floats (data distributed within the last 30 days),

- SOLO_D_MRV (3)
- NINJA_D (2)
- APEX_D (3)
- SOLO_D (52)
- ARVOR_D (17)

ETOPO2

- <-5000
- -5000 / -4000
- -4000 / -2000
- -2000 / -1000
- -1000 / 0

Generated by www.jcommops.org, 04/02/2019

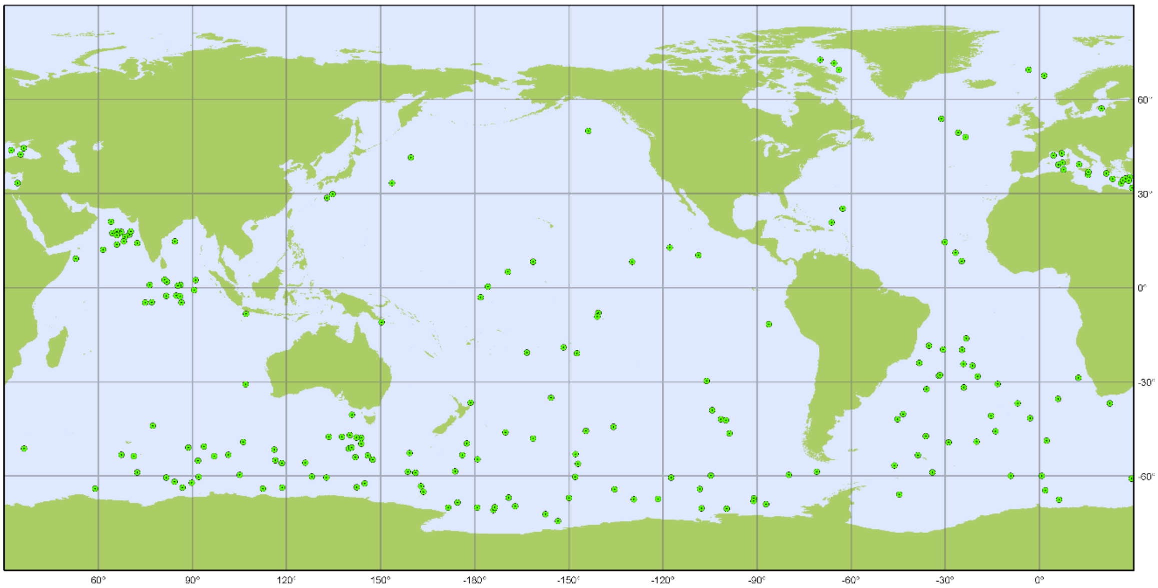


Argo | **BioGeoChemical Argo - Oxygen** | **January 2019**

Latest location of operational floats (data distributed within the last 30 days)

- IDO_DOXY (0)
- OPTODE_DOXY (328)

Generated by www.jcommops.org, 04/02/2019

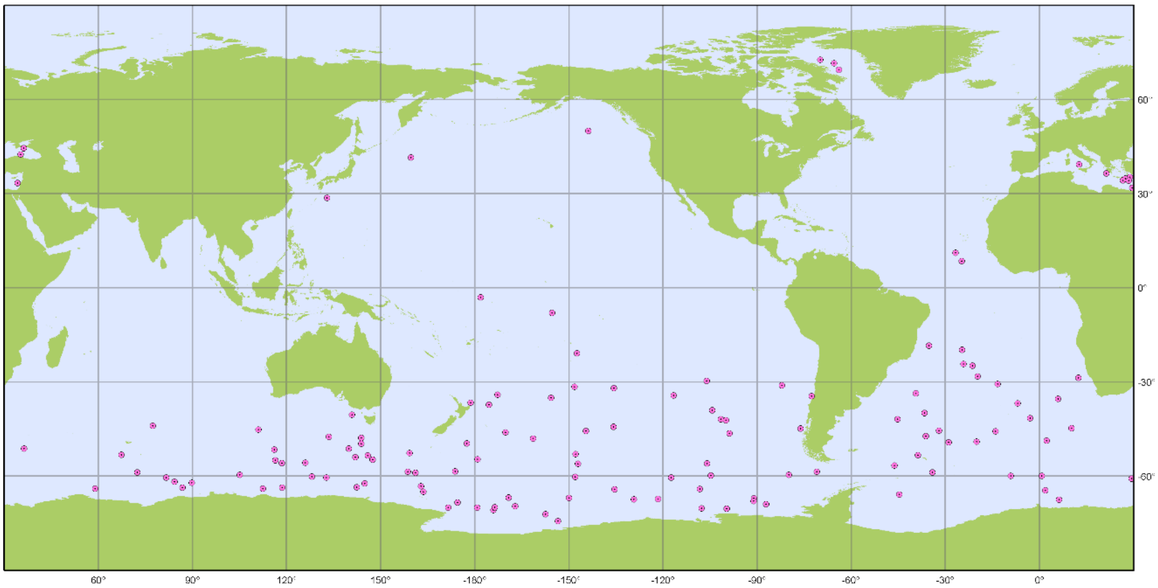


Argo **BioGeoChemical Argo - Chlorophyll a** **January 2019**

Latest location of operational floats (data distributed within the last 30 days)

FLUOROMETER_CHLA/CDOM (204)

Generated by www.jcommops.org, 04/02/2019

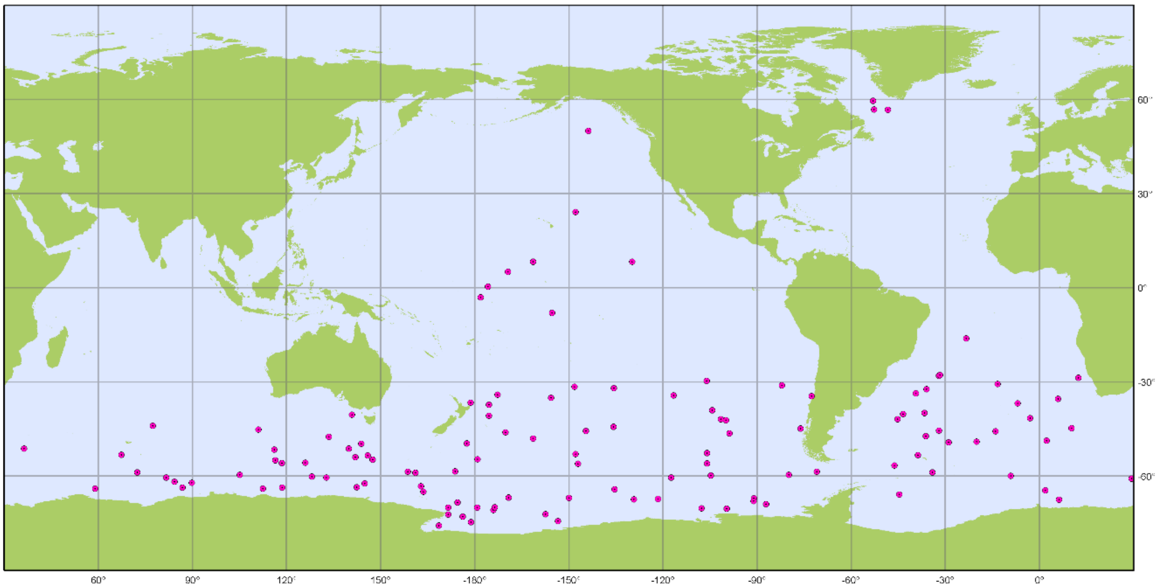


Argo **BioGeoChemical Argo - Nitrate** **January 2019**

Latest location of operational floats (data distributed within the last 30 days)

SPECTROPHOTOMETER_NITRATE/BISULFIDE (133)

Generated by www.jcommops.org, 04/02/2019

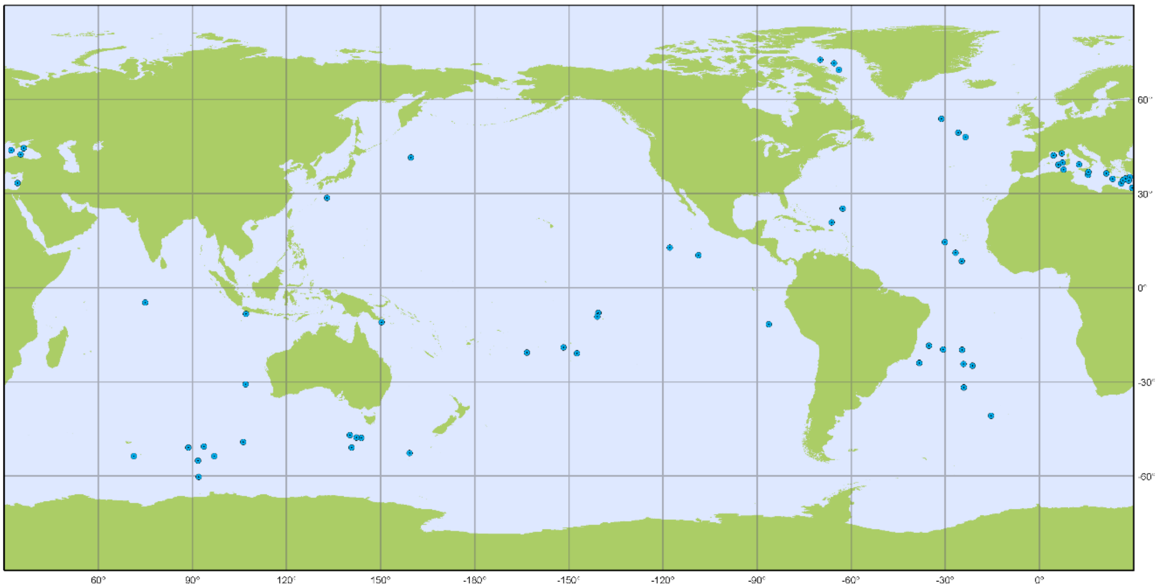


Argo **BioGeoChemical Argo - pH** **January 2019**

Latest location of operational floats (data distributed within the last 30 days)

TRANSISTOR_PH (123)

Generated by www.jcommops.org, 04/02/2019

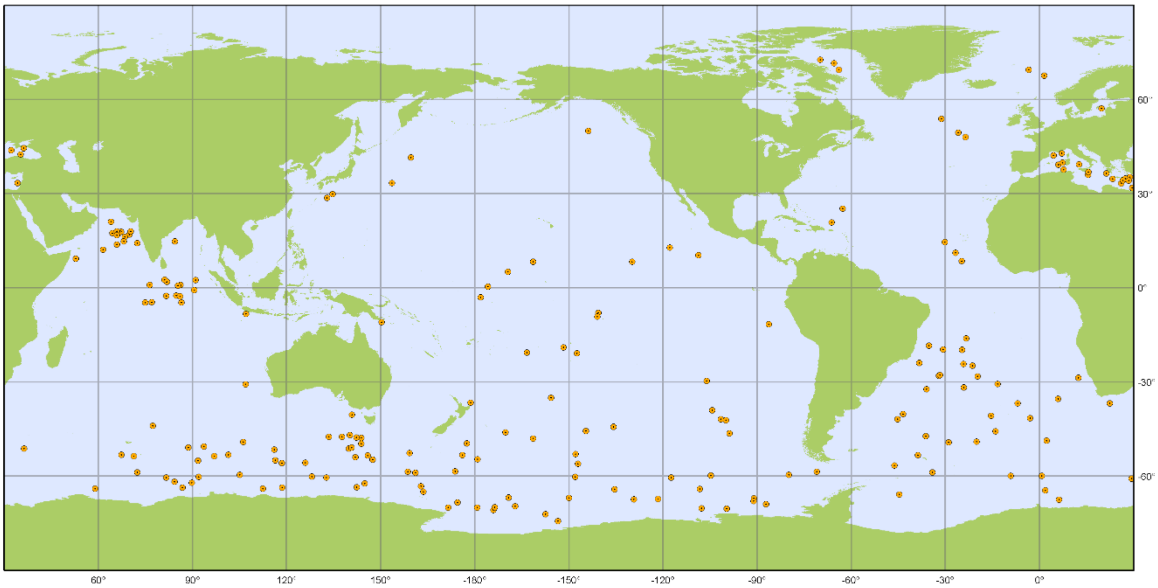


Argo **BioGeoChemical Argo - Downwelling irradiance** **January 2019**

Latest location of operational floats (data distributed within the last 30 days)

RADIOMETER (DOWN_IRR, PAR) (65)

Generated by www.jcommops.org, 04/02/2019

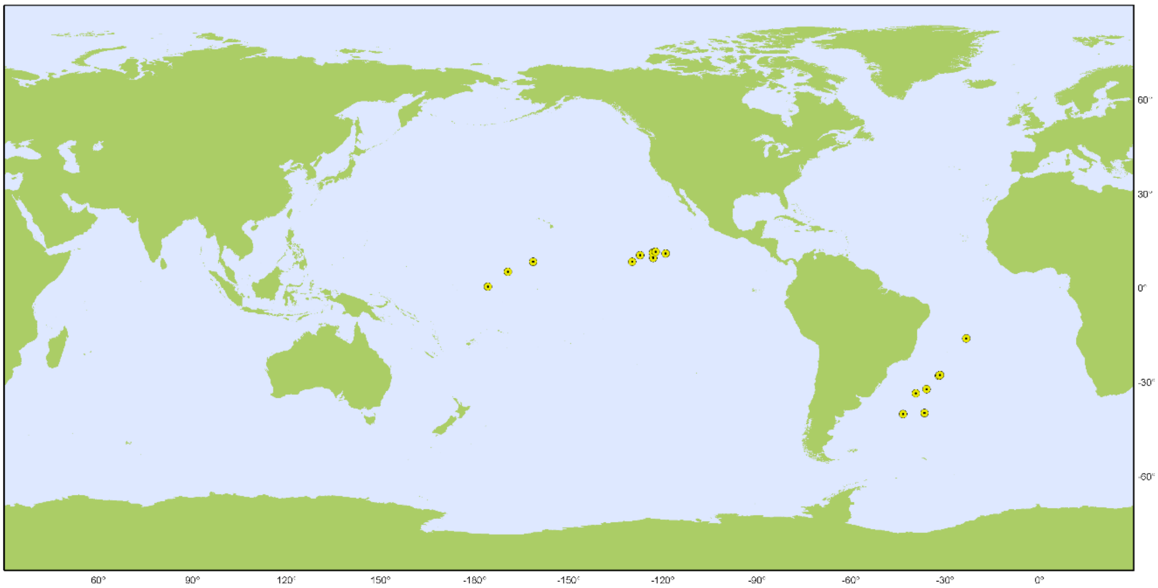


Argo **BioGeoChemical Argo - Suspended particles** **January 2019**

Latest location of operational floats (data distributed within the last 30 days)

BACKSCATTERINGMETER_BBP/TURBIDITY (204)

Generated by www.jcommops.org, 04/02/2019



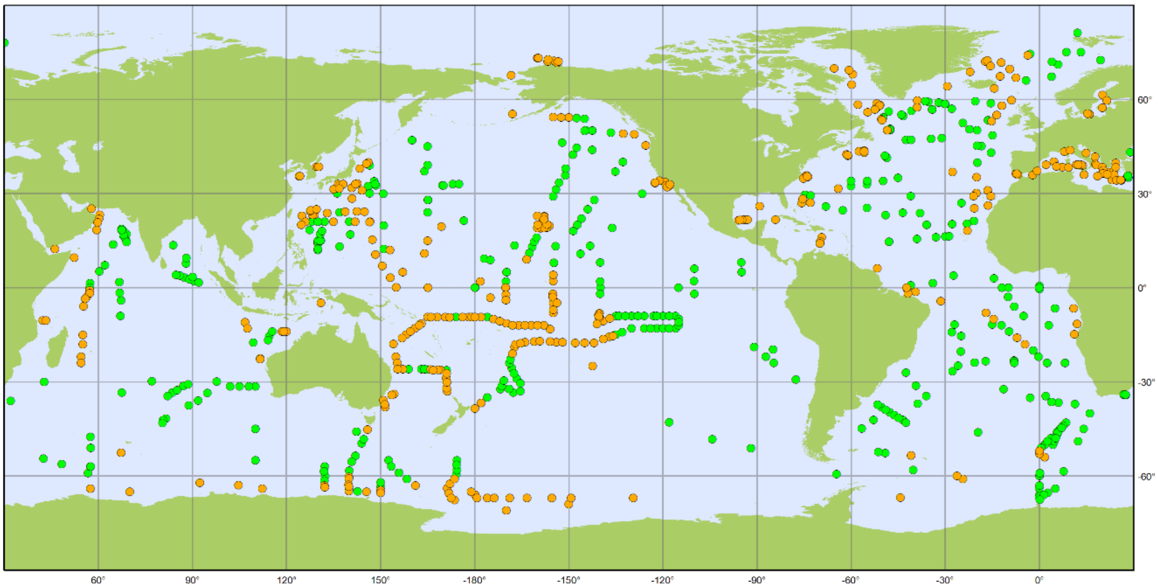
Argo **Argo - Misc. Sensors** **January 2019**

Latest location of operational floats (data distributed within the last 30 days)

PAL (16) *(Passive Acoustic Listener (Ambient sound field recording)*

RAFOS (0) *(Delayed-mode under-ice localization via acoustic receiver)*

Generated by www.jcommops.org, 04/02/2019



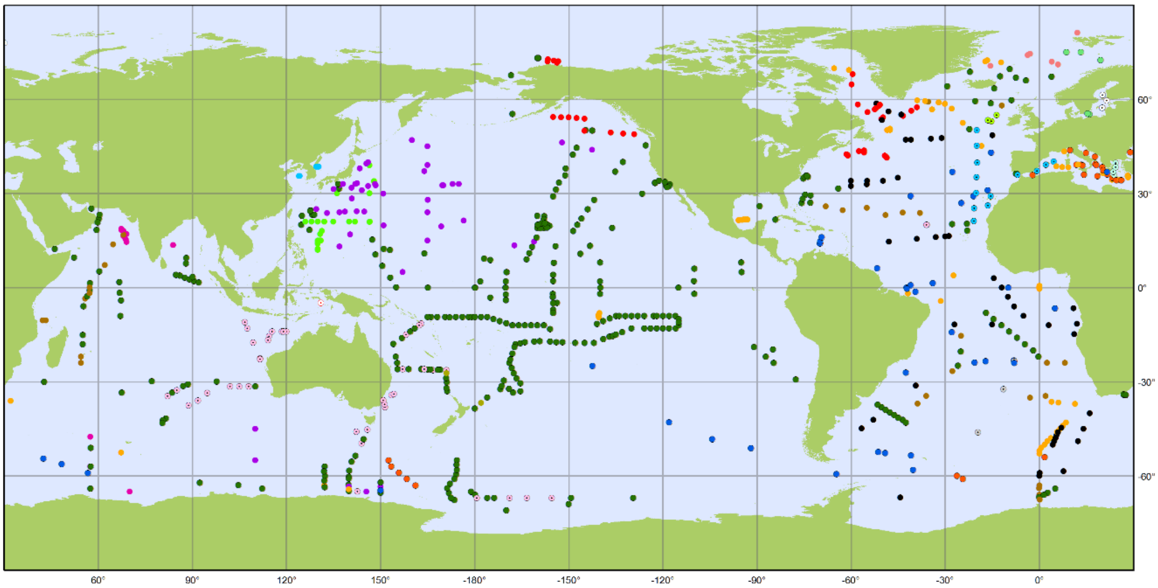
Argo

2018 Deployments

Launch location of all profiling floats deployed in 2018

Deployments outside high-seas (399) All 2018 (830)

Generated by www.jcommops.org, 25/02/2019



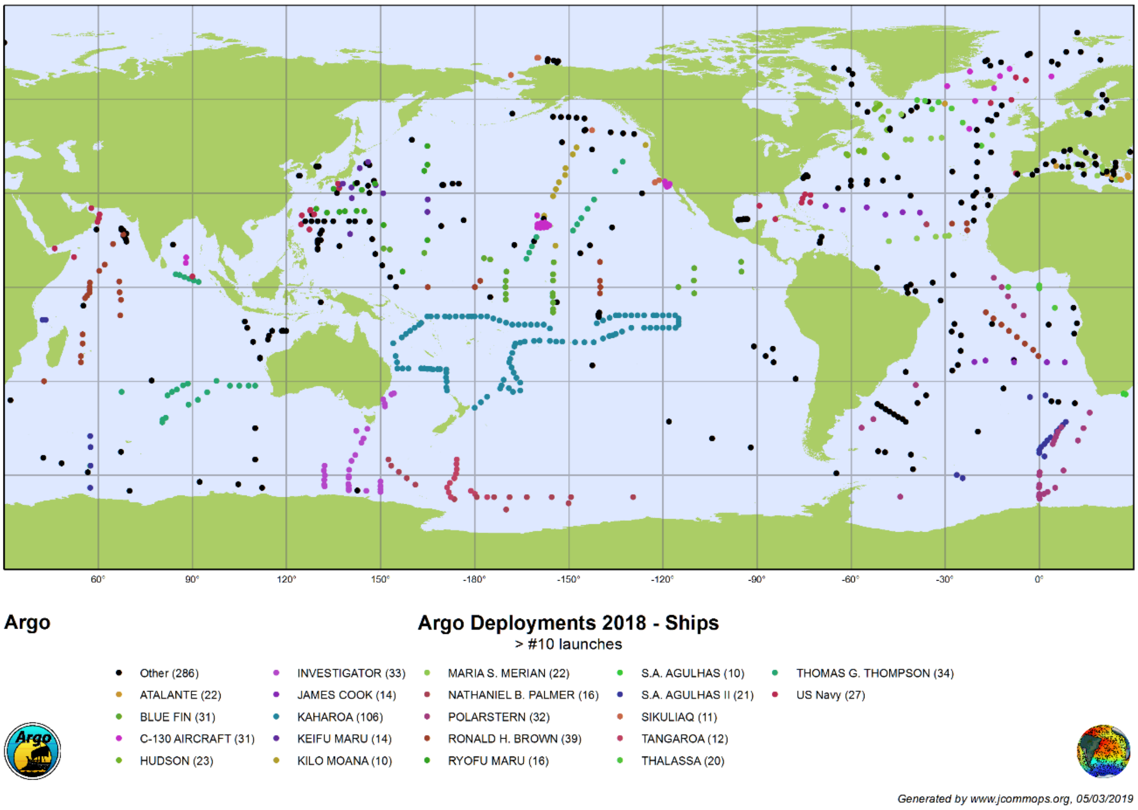
Argo

2018 Deployments

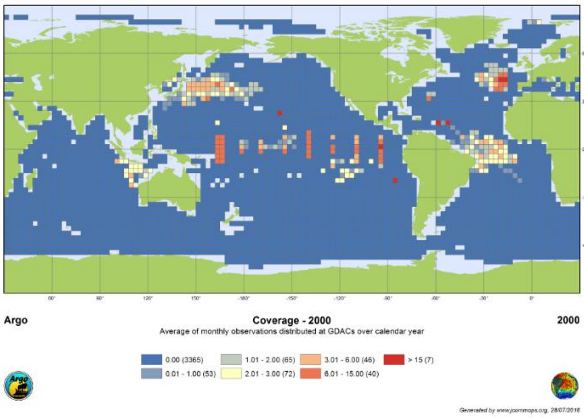
Launch location of all profiling floats deployed in calendar year

AUSTRALIA (43)
CANADA (39)
CHINA (26)
EUROPE (40)
FINLAND (4)
FRANCE (85)
GERMANY (51)
GREECE (4)
INDIA (15)
INDONESIA (1)
IRELAND (4)
ITALY (29)
JAPAN (55)
KOREA, REPUBLIC OF (11)
NETHERLANDS (3)
NEW ZEALAND (2)
NORWAY (6)
POLAND (6)
SPAIN (14)
UK (33)
USA (359)

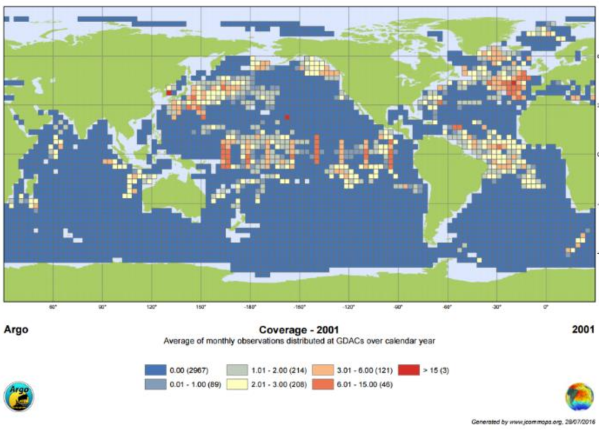
Generated by www.jcommops.org, 05/03/2019



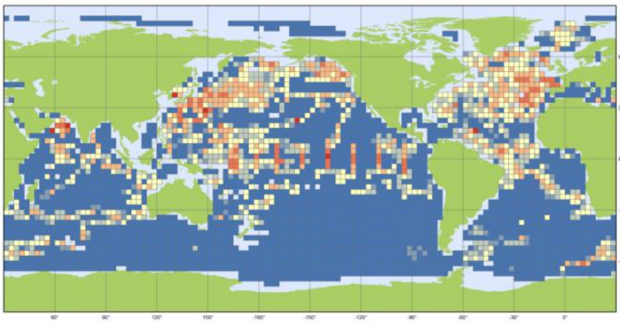
Argo
Argo Deployments 2018 - Ships
> #10 launches
Other (286)
ATALANTE (22)
BLUE FIN (31)
C-130 AIRCRAFT (31)
HUDSON (23)
INVESTIGATOR (33)
JAMES COOK (14)
KAHAROA (106)
KEIFU MARU (14)
KILO MOANA (10)
MARIA S. MERIAN (22)
NATHANIEL B. PALMER (16)
POLARSTERN (32)
RONALD H. BROWN (39)
RYOFU MARU (16)
S.A. AGULHAS (10)
S.A. AGULHAS II (21)
SIKULIAQ (11)
TANGAROA (12)
THALASSA (20)
THOMAS G. THOMPSON (34)
US Navy (27)
Generated by www.jcommops.org, 05/03/2019



Argo
Coverage - 2000
Average of monthly observations distributed at GDACs over calendar year
2000
0.00 (3365)
0.01 - 1.00 (53)
1.01 - 2.00 (65)
2.01 - 3.00 (72)
3.01 - 6.00 (46)
6.01 - 15.00 (40)
> 15 (7)



Argo
Coverage - 2001
Average of monthly observations distributed at GDACs over calendar year
2001
0.00 (2967)
0.01 - 1.00 (89)
1.01 - 2.00 (214)
2.01 - 3.00 (208)
3.01 - 6.00 (121)
6.01 - 15.00 (46)
> 15 (3)

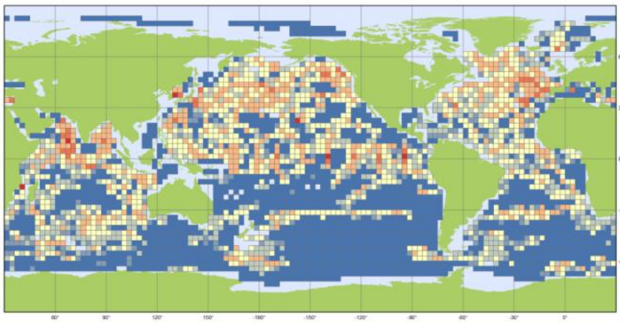


Argo **Coverage - 2002** 2002

Average of monthly observations distributed at GDACs over calendar year

0.00 (2449) | 0.01 - 1.00 (134) | 1.01 - 2.00 (318) | 2.01 - 3.00 (402) | 3.01 - 6.00 (273) | 6.01 - 15.00 (65) | > 15 (7)

Generated by www.jcommops.org, 26/07/2016

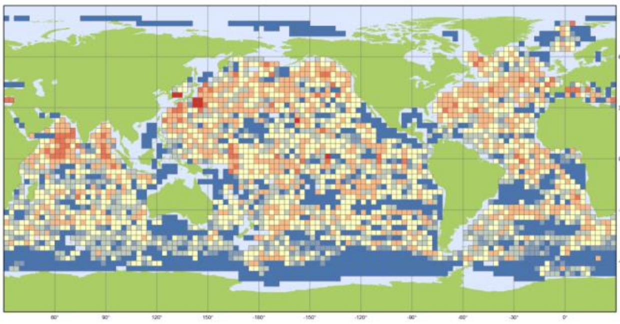


Argo **Coverage - 2003** 2003

Average of monthly observations distributed at GDACs over calendar year

0.00 (1728) | 0.01 - 1.00 (209) | 1.01 - 2.00 (518) | 2.01 - 3.00 (706) | 3.01 - 6.00 (436) | 6.01 - 15.00 (45) | > 15 (6)

Generated by www.jcommops.org, 26/07/2016

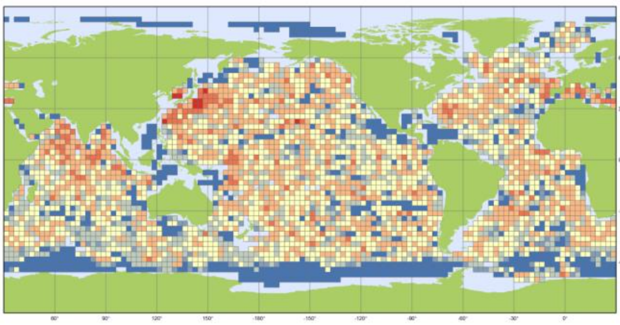


Argo **Coverage - 2004** 2004

Average of monthly observations distributed at GDACs over calendar year

0.00 (1078) | 0.01 - 1.00 (224) | 1.01 - 2.00 (645) | 2.01 - 3.00 (932) | 3.01 - 6.00 (685) | 6.01 - 15.00 (76) | > 15 (8)

Generated by www.jcommops.org, 26/07/2016

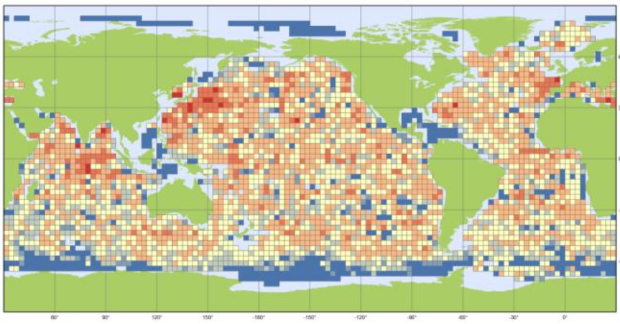


Argo **Coverage - 2005** 2005

Average of monthly observations distributed at GDACs over calendar year

0.00 (671) | 0.01 - 1.00 (129) | 1.01 - 2.00 (647) | 2.01 - 3.00 (1069) | 3.01 - 6.00 (975) | 6.01 - 15.00 (148) | > 15 (9)

Generated by www.jcommops.org, 26/07/2016

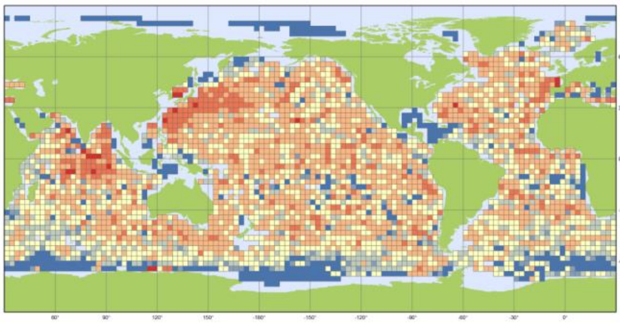


Argo **Coverage - 2006** **2006**

Average of monthly observations distributed at GDACs over calendar year

0.00 (486) | 1.01 - 2.00 (509) | 3.01 - 6.00 (1238) | > 15 (17)
0.01 - 1.00 (114) | 2.01 - 3.00 (1058) | 6.01 - 15.00 (226)

Generated by www.jcommops.org, 28/07/2016

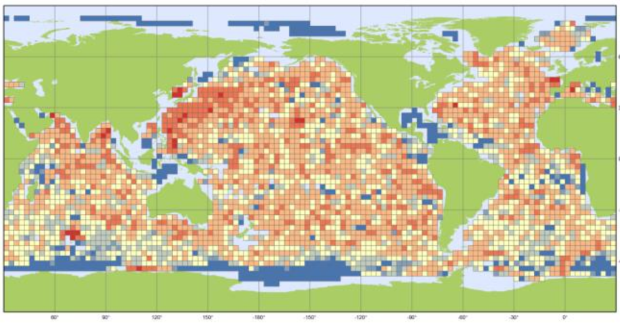


Argo **Coverage - 2007** **2007**

Average of monthly observations distributed at GDACs over calendar year

0.00 (432) | 1.01 - 2.00 (441) | 3.01 - 6.00 (1367) | > 15 (20)
0.01 - 1.00 (96) | 2.01 - 3.00 (987) | 6.01 - 15.00 (305)

Generated by www.jcommops.org, 27/07/2016

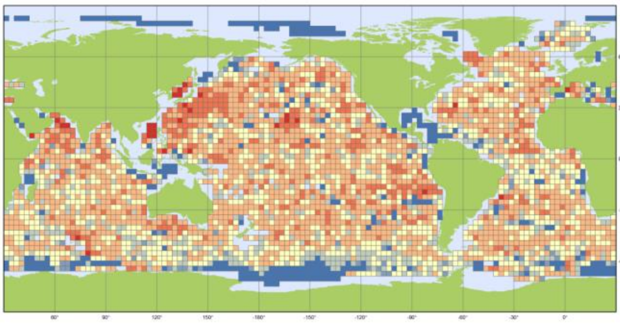


Argo **Coverage - 2008** **2008**

Average of monthly observations distributed at GDACs over calendar year

0.00 (388) | 1.01 - 2.00 (402) | 3.01 - 6.00 (1426) | > 15 (24)
0.01 - 1.00 (84) | 2.01 - 3.00 (915) | 6.01 - 15.00 (409)

Generated by www.jcommops.org, 27/07/2016

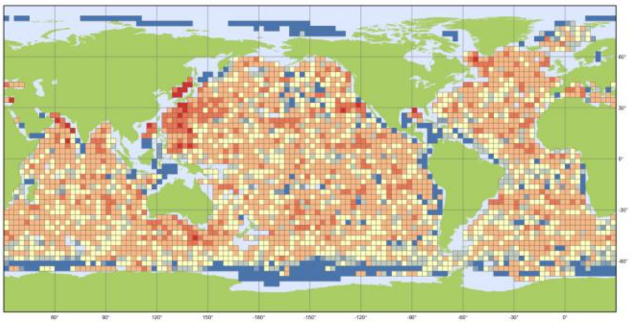


Argo **Coverage - 2009** **2009**

Average of monthly observations distributed at GDACs over calendar year

0.00 (352) | 1.01 - 2.00 (381) | 3.01 - 6.00 (1486) | > 15 (30)
0.01 - 1.00 (80) | 2.01 - 3.00 (912) | 6.01 - 15.00 (407)

Generated by www.jcommops.org, 27/07/2016

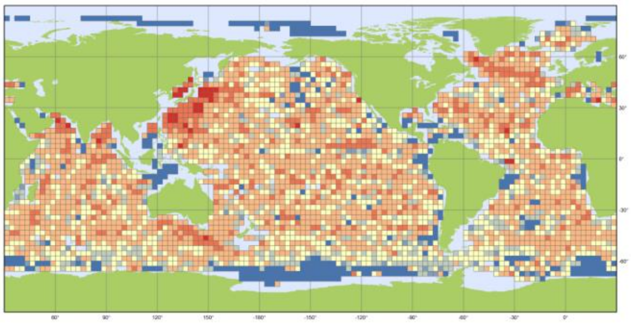


Argo **Coverage - 2010** **2010**

Average of monthly observations distributed at GDACs over calendar year

0.00 (369) | 1.01 - 2.00 (355) | 3.01 - 6.00 (1588) | > 15 (25)
0.01 - 1.00 (67) | 2.01 - 3.00 (919) | 6.01 - 15.00 (325)

Generated by www.jcommops.org, 29/07/2016

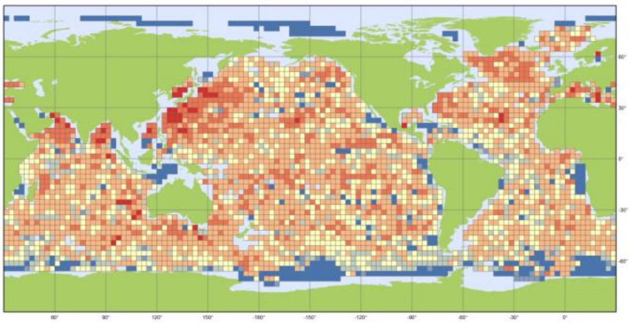


Argo **Coverage - 2011** **2011**

Average of monthly observations distributed at GDACs over calendar year

0.00 (379) | 1.01 - 2.00 (350) | 3.01 - 6.00 (1572) | > 15 (35)
0.01 - 1.00 (59) | 2.01 - 3.00 (875) | 6.01 - 15.00 (378)

Generated by www.jcommops.org, 29/07/2016

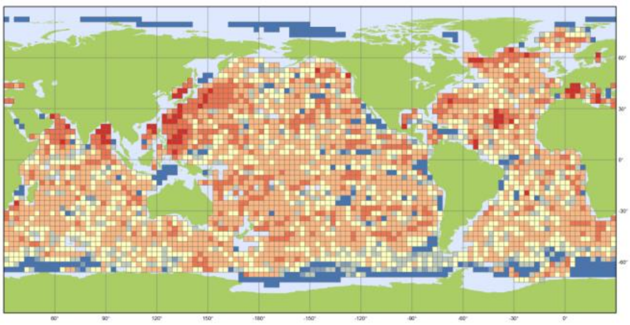


Argo **Coverage - 2012** **2012**

Average of monthly observations distributed at GDACs over calendar year

0.00 (340) | 1.01 - 2.00 (326) | 3.01 - 6.00 (1599) | > 15 (47)
0.01 - 1.00 (58) | 2.01 - 3.00 (796) | 6.01 - 15.00 (482)

Generated by www.jcommops.org, 29/07/2016

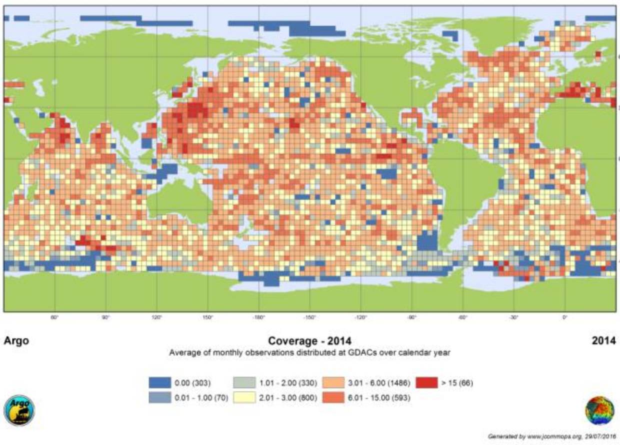


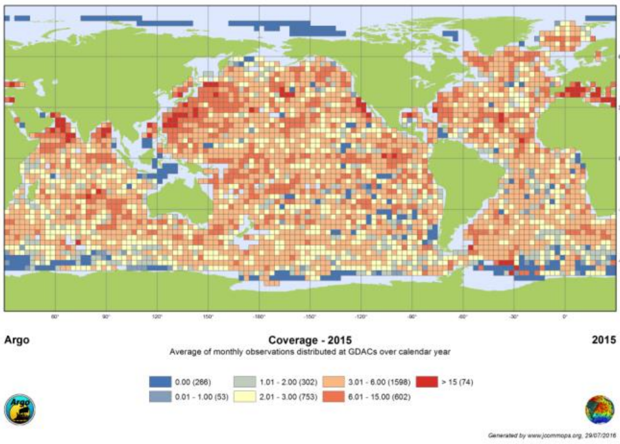
Argo **Coverage - 2013** **2013**

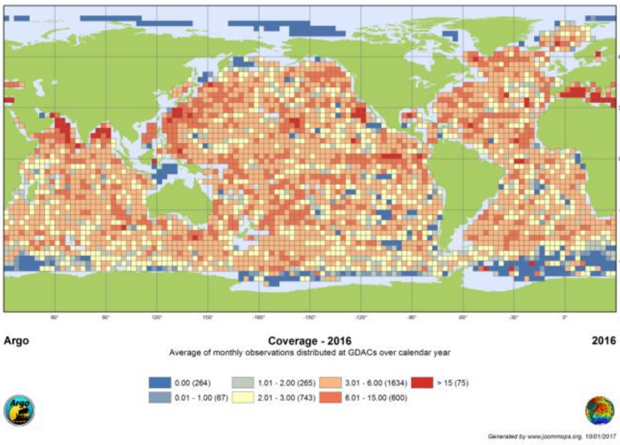
Average of monthly observations distributed at GDACs over calendar year

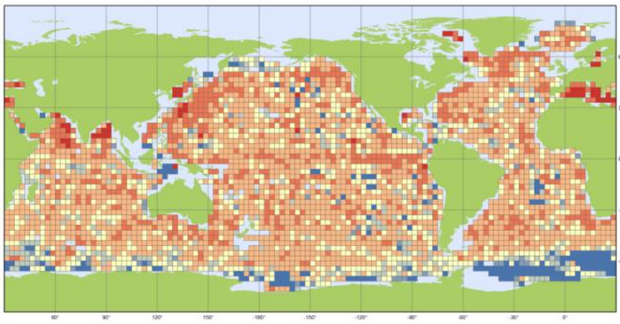
0.00 (343) | 1.01 - 2.00 (315) | 3.01 - 6.00 (1549) | > 15 (67)
0.01 - 1.00 (59) | 2.01 - 3.00 (819) | 6.01 - 15.00 (496)

Generated by www.jcommops.org, 29/07/2016


60°
90°
120°
150°
-180°
-150°
-120°
-90°
-60°
-30°
0°
60°
30°
0°
-30°
-60°
Argo
Coverage - 2014
2014
Average of monthly observations distributed at GDACs over calendar year
0.00 (303)
0.01 - 1.00 (70)
1.01 - 2.00 (330)
2.01 - 3.00 (800)
3.01 - 6.00 (1486)
6.01 - 15.00 (593)
> 15 (66)
Generated by www.jcommops.org, 29/07/2016


60°
90°
120°
150°
-180°
-150°
-120°
-90°
-60°
-30°
0°
60°
30°
0°
-30°
-60°
Argo
Coverage - 2015
2015
Average of monthly observations distributed at GDACs over calendar year
0.00 (266)
0.01 - 1.00 (53)
1.01 - 2.00 (302)
2.01 - 3.00 (753)
3.01 - 6.00 (1598)
6.01 - 15.00 (602)
> 15 (74)
Generated by www.jcommops.org, 29/07/2016


60°
90°
120°
150°
-180°
-150°
-120°
-90°
-60°
-30°
0°
60°
30°
0°
-30°
-60°
Argo
Coverage - 2016
2016
Average of monthly observations distributed at GDACs over calendar year
0.00 (264)
0.01 - 1.00 (67)
1.01 - 2.00 (265)
2.01 - 3.00 (743)
3.01 - 6.00 (1634)
6.01 - 15.00 (600)
> 15 (75)
Generated by www.jcommops.org, 10/01/2017

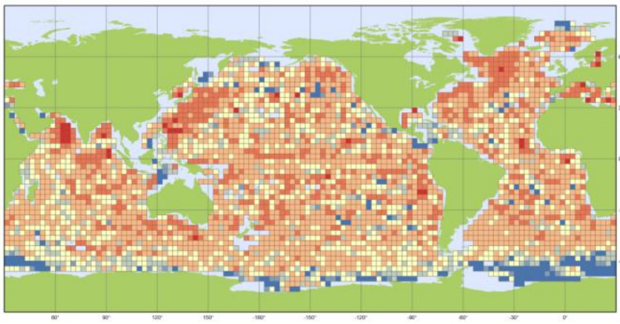


Argo **Coverage - 2017**

Average of monthly observations distributed at GDACs over calendar year

0.00 (194) | 0.01 - 1.00 (69) | 1.01 - 2.00 (258) | 2.01 - 3.00 (720) | 3.01 - 6.00 (1731) | 6.01 - 15.00 (617) | > 15 (54)

Generated by www.jcommops.org, 07/03/2018

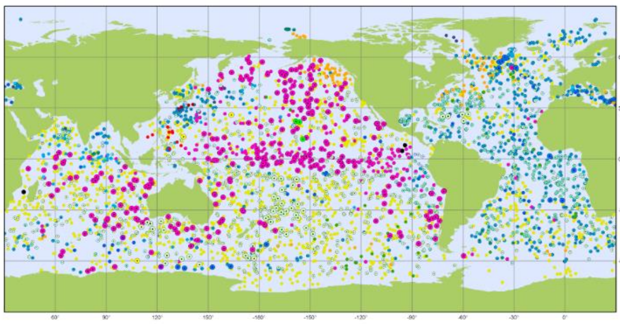


Argo **Coverage - 2018**

Average of monthly observations distributed at GDACs over calendar year, normalized on Argo Global Design targets (double density in marginal seas)

0.00 | 0.01 - 1.00 | 1.01 - 2.00 | 2.01 - 3.00 | 3.01 - 6.00 | 6.01 - 15.00 | > 15

Generated by www.jcommops.org, 19/02/2019

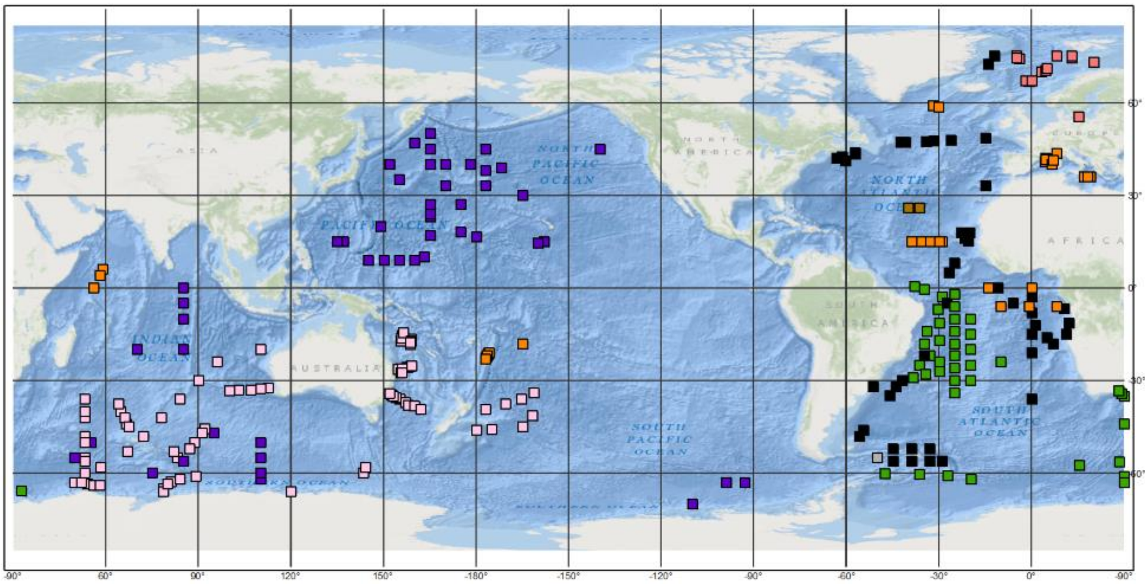


Argo **Models** **January 2019**

Latest location of operational floats (data distributed within the last 30 days),

FLOAT (3) | APEX_D (3) | APEX (1498) | PROVOR (81) | PROVOR_II (5) | PROVOR_III (51) | PROVOR_IV (9) | ARVOR (536) | ARVOR_L (126) | ARVOR_D (17) | NAVIS_A (214) | NAVIS_EBR (261) | NOVA (99) | NEMO (4) | NINJA_D (2) | SOLO (27) | SOLO_W (12) | SOLO_D (52) | SOLO_D_MRV (3) | S2A (325) | ALTO (13) | S2X (29) | SOLO_II (529) | HM2000 (10)

Generated by www.jcommops.org, 04/02/2019



Argo **National Deployment Plans** **07/03/2019**

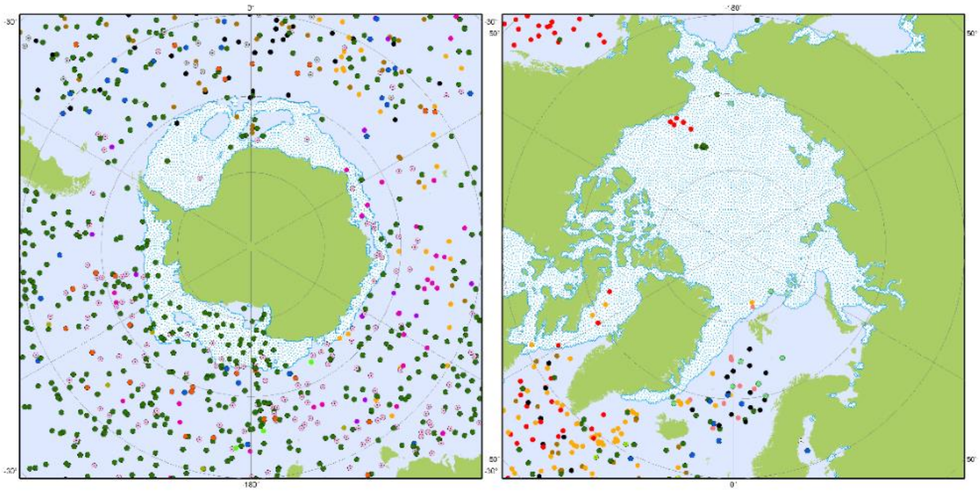
Deployment date > today

AUSTRALIA, FRANCE, GERMANY, JAPAN, NETHERLANDS, NORWAY, POLAND, UK, USA, 30° x 30°, World_Ocean_Reference, World_Ocean_Base

Projection: Plate Carree
Central Meridian: -150°

Basemap Layer Credits: Sources: Esri, GEBCO, NOAA, National Geographic, Garmin, HERE, Geonames.org, and other contributors

Generated by www.jcommops.org



Argo **National contributions** **January 2019**

Latest location of operational floats (data distributed within the last 30 days)

AUSTRALIA (148), BRAZIL (1), CHINA (3), EUROPE (29), FRANCE (31), GERMANY (35), INDIA (30), ITALY (29), JAPAN (12), NETHERLANDS (16), NEW ZEALAND (5), UK (38), USA (485)

CANADA (45), EUROPE (8), FINLAND (1), FRANCE (59), GERMANY (22), IRELAND (3), NORWAY (9), POLAND (7), UK (15), USA (37)

Generated by www.jcommops.org, 04/02/2019

Notes