



The Global Ocean Observing System
www.goosocean.org

Impact of the Covid-19 pandemic on the Global Ocean Observing System

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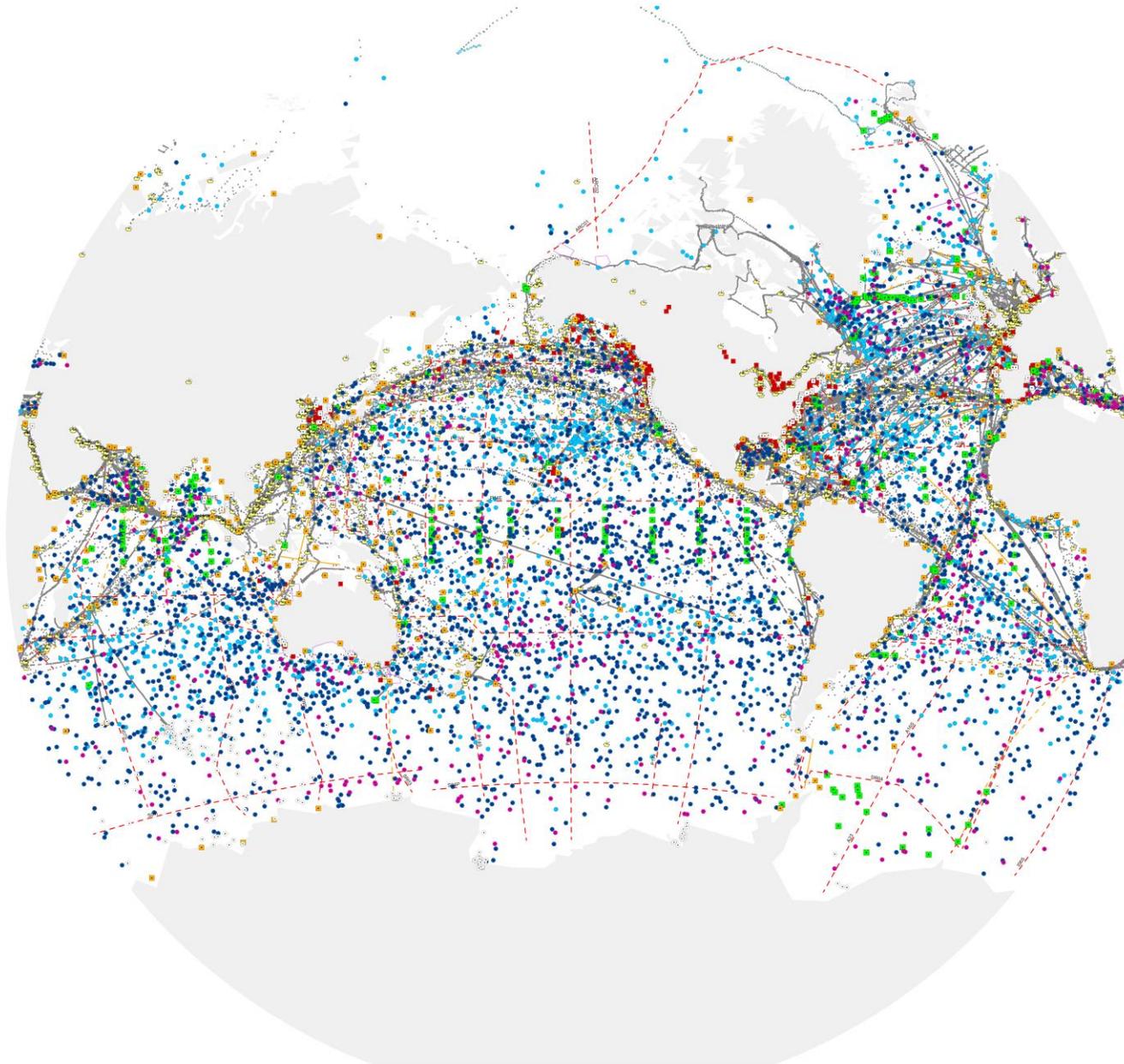
Programme Specialist GOOS Office, IOC/UNESCO

EMB Open Session on COVID-19 and Marine Science: 04 November 2020



One Ocean Observing System

In situ operational platforms monitored by OceanOPS

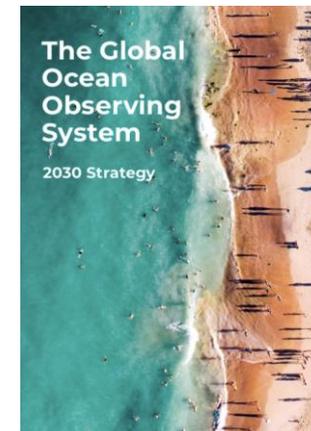


- 🌊 Ship based aerological measurements - SOT/ASAP
- 🌬️ Ship based meteorological measurements - SOT/VOS
- 🌐 Ship based meteorological measurements - SOT/VOS
- 🌊 Ship based aerological measurements - SOT/ASAP
- 📡 HF radars
- 🐼 Animal borne sensors
- 📏 Sea level gauge - GLOSS
- 🌊 Biogeochemical and deep floats - Argo
- 🌊 Profiling floats - Argo
- 🌊 Interdisciplinary moorings - OceanSITES
- 🌊 Drifting and polar buoys - DBCP
- 📏 Moored buoys - DBCP
- 🌊 Ship based oceanographic measurements - SOT/SOOP-XBT
- 🌊 Ship based oceanographic measurements - SOT/SOOP-XBT
- 📏 Repeated transect - GO-SHIP
- 🐼 OceanGliders

Dashed lines for GO-SHIP and SOOP have not been sampled after Covid-19 impact

Ocean Observing in 2020

- Established arrays (Argo, DBCP), new networks (gliders, HF Radar)
- 86 countries, 8,933 in situ observing platforms, 170 satellites
- Early focus was on climate and operational services - increasing ocean health and human impacts
- View of the 11 global ocean observing networks
- Working towards the – GOOS Vision



Generated by www.ocean-ops.org, 2020-10-09
Projection: Van der Grinten I (-150.0000°)

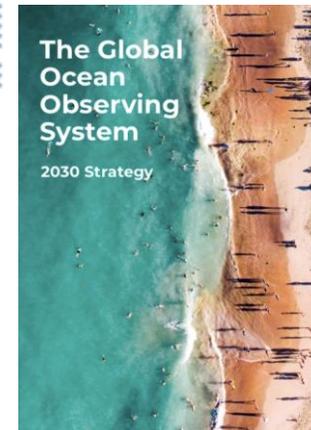
Ocean Observing Report Card 2020



GOOS <i>in situ</i> networks ¹	Implementation Status ²	Data & metadata			Best practices ⁶	GOOS delivery areas ⁷		
		Real time ³	Archived high quality ⁴	Meta-data ⁵		Operational services	Climate	Ocean health
Ship based meteorological measurements - SOT/VOS	★★★	★★★	★★★★	★★★★	★★★			
Ship based aerological measurements - SOT/ASAP	★★★	★★★	★★★	★★★★	★★★			
Ship based oceanographic measurements - SOT/SOOP	★★★	★★★★	★★★★	★★★★	★★★			
Sea level gauges - GLOSS	★★★★	★★★	★★★★	★★★	★★★			
Drifting and polar buoys - DBCP	★★★★	★★★	★★★	★★★★	★★★			
Moored buoys - DBCP	★★★	★★★★	★★★	★★★★	★★★			
Interdisciplinary moorings - OceanSITES	★★★	★★★	★★★	★★★★	★★★			
Profiling floats - Argo	★★★★	★★★★	★★★★	★★★★	★★★			
Repeated transects - GO-SHIP	★★★★	★★★	★★★★	★★★★	★★★★			
OceanGliders	Emerging	★★★	★★★	★★★★	★★★			
HF radars	Emerging	★★★★	★★★★	★★★	★★★★			
Biogeochemistry & Deep floats - Argo	Emerging	★★★★	★★★	★★★★	★★★			
Animal borne ocean sensors - AniBOS	Emerging	★★★★	★★★	★★★★	★★★			

Ocean Observing in 2020

- 203 active long-term biological observing programs*
- 10 BioEco Essential Ocean Variable (EOV) based observing networks
- Working towards the – GOOS Vision
- Coverage 6 -7% of the global ocean, based on surface area - 93% of the global surface ocean without known sustained observations



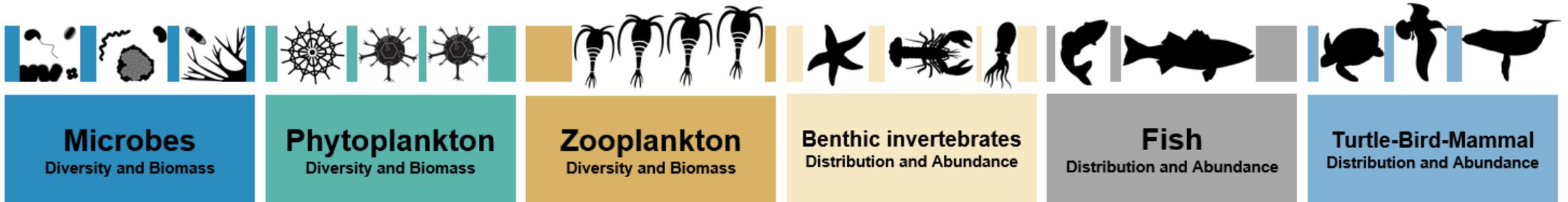
* Recent survey 643 observing entities identified, 371 responded, 203 programs were active, long-term (5 years or more) and sampled at least EOVs systematically but spatial data were only available for 192 observing programs (Satterthwaite et al. 2020 in prep)



BioEco Ocean Observing Networks

- A small proportion of ocean biodiversity is monitored, with bias toward developed countries
- This needs to increase for society to respond to the severe environmental challenges
- Important to make data more open, and to share best practices

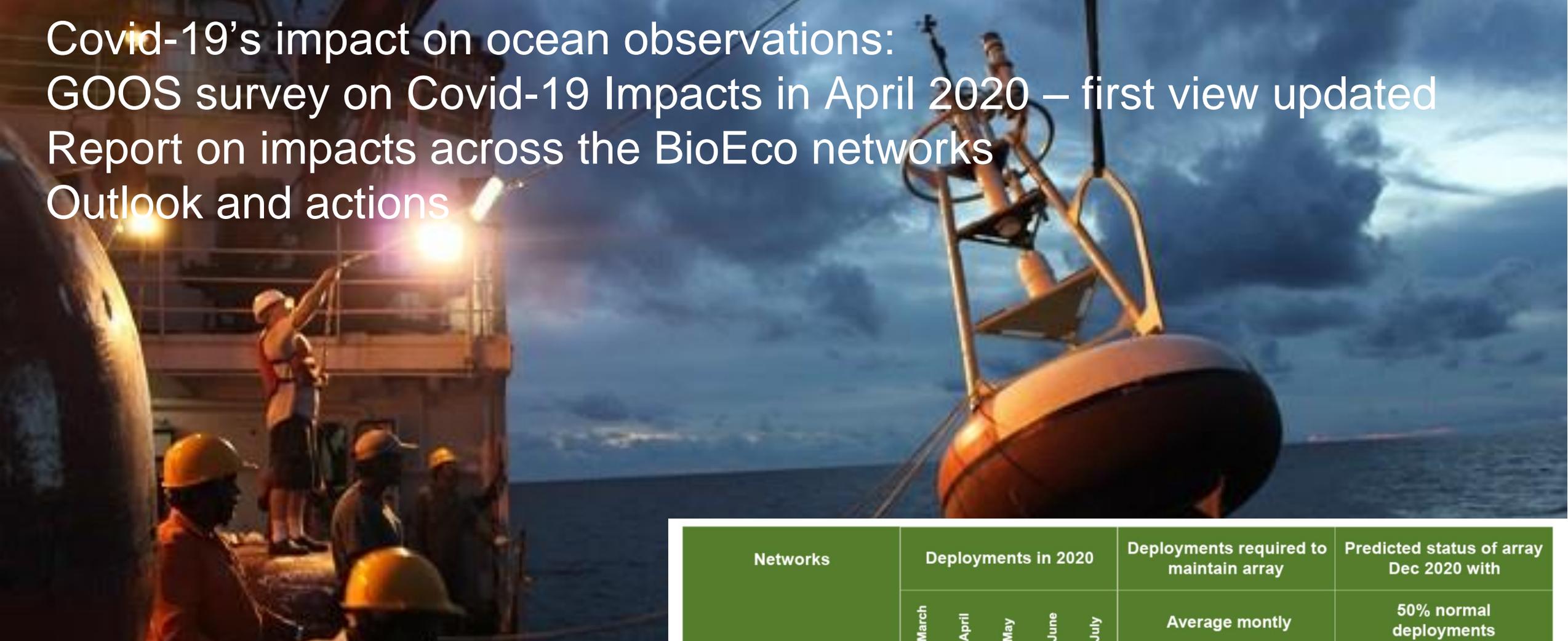
FUNCTIONAL GROUPS



HABITAT STATE



Covid-19's impact on ocean observations: GOOS survey on Covid-19 Impacts in April 2020 – first view updated Report on impacts across the BioEco networks Outlook and actions



Networks	Deployments in 2020					Deployments required to maintain array	Predicted status of array Dec 2020 with
	March	April	May	June	July	Average montly	50% normal deployments
 Global surface drifters	58	41	25	6	16	80	-20%
 Argo floats	51	21	10	34	192*	81	-10%
 Underwater gliders	10	1	5	20	23	20	-50%

UNITED IN SCIENCE

goosocean.org/covid-19

Covid-19 Survey – 11 global networks



Immediate Impacts - April 2020

- Almost all research vessels were recalled to home port
 - 4 decadal cruises cancelled
 - Surface carbon measurements effectively ceased
 - Maintenance cruises for mooring arrays cancelled
 - Re-seeding autonomous arrays interrupted
- Ships of Opportunity Programme (SOOP) lost 90% data flow as ship riders no longer could operate on vessels
- Deployment/recovery of gliders ceased
- Operational activities for calibration, replacement, maintenance of instruments halted or restricted – affected voluntary ships, HF Radar, tide-gauges

System resilience

- Use of autonomous instruments – delay in impact
- Commercial ships remain operational
- Strong effort by operators – working from home, monitoring data flow, work arounds for remote calibration, etc.
- Community collaboration, with ship operators, across networks, sharing information
- Identified as essential operations



Outlook - concerns

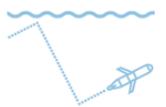
Networks		Deployments in 2020					Deployments required to maintain array	Predicted status of array Dec 2020 with 50% normal deployments
		Mar	Apr	May	Jun	Jul	Average monthly	50% normal deployments
	Global surface drifters	58	41	25	6	16	80	-20%
	Argo floats	51	21	10	34	192*	81	-10%
	Underwater gliders	10	1	5	20	23	20	-50%

Table 1. Data source, www.jcommops.org.

* 119 floats deployed from R/V Kaharoa (New Zealand) in Southern hemisphere (Indian and Southern Oceans).

GOMO asset	Routine ship that services this asset	Date last serviced	Q1	Q2	Q3	Q4	Associated risk (political, technical, data)	Notes
KEO	Bluefin	October 2019		Adrift		*if fixed in Q3	Data, technical	MAPCO2 System
PAPA	CCGS Tully Line P	April 2019					Data	MAPCO2 System
WHOTS	SETTE	June 2019					Data	MAPCO2 System
STRATUS	Cabo De Hornos	March 2019					Data, technical	MAPCO2 System
NTAS	Ron Brown	January 2020		Adrift			Data, political	
CCE1	Rueben Lasker	May 2019		Adrift			Data, technical	MAPCO2 System
SAM	N. Oc. Alpha-Crucis (Brazilian vessel)	June 2019					Data	
WBTS	Walton Smith	March 2020					Data	
MOVE	Ron Brown	June 2018					Data	
PNE	Ron Brown	> 1 year for 3 out of 4 moorings					Data	
PIRATA	Ron Brown	> 1.5 yrs for 7 of 8 U.S. PIRTA moorings					Data, political	
M2 (Bering Sea)	Oscar Dyson	>1 year					Data, technical	Q3: Spring Mooring Cruise cancelled. Possible that it will be serviced on DBO/EcoFOCI cruise or other chartered commercial vessel this year.
M8 (Bering Sea)	Oscar Dyson	> 1 year					Data, technical	Q3: Sediment trap and other instruments were supposed to be added. May be serviced on DBO/EcoFOCI cruise if it goes or some other commercial vessel, if chartered.

For Q1-Q4 (by FY), please use the color system:

- All is well, no immediate concerns
- Possible impact expected
- Immediate impact expected (e.g., batteries are going to die, cessation of data, drifting mooring)
- Distinction between assumed impact & actual impact

Action

- Communicate critical nature sustained observations for services
- Highlight maintenance needs deep sea moorings
- Increase connection with research vessel community
- Flexible operations, reseeding profile float and drifting buoy arrays, working with local operators, working with commercial sector

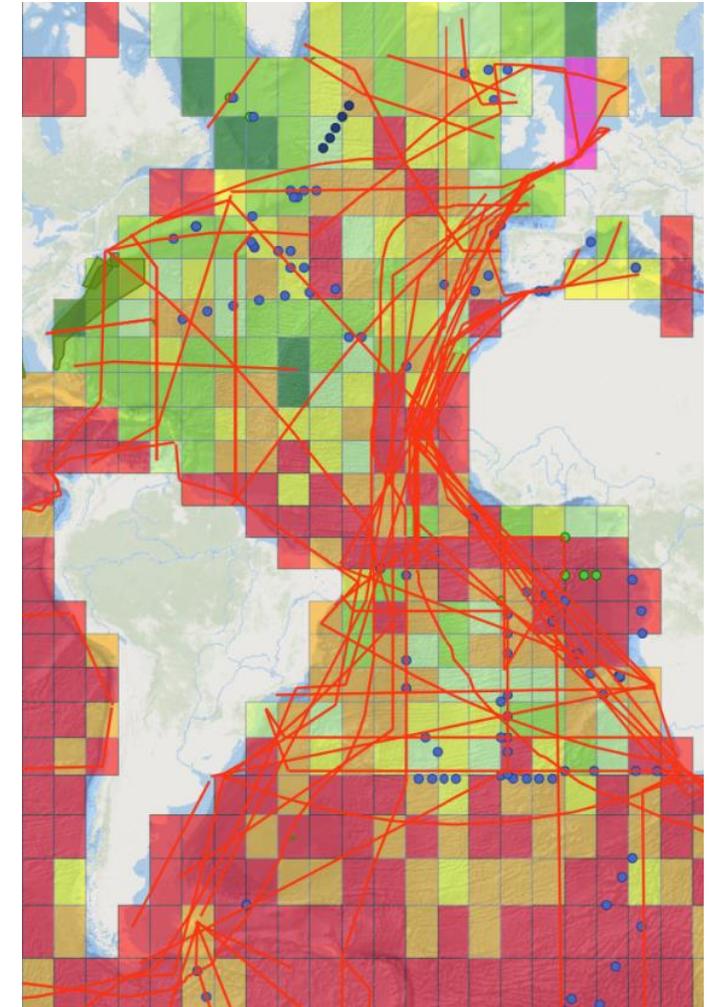


OCG Covid Tag-up / regional Calls – reporting/action



- OceanOPS has noticed a 10% decrease in the number of Argo profiles. This may be due to other effects (such as an aging array) than COVID19.
- Float deployment institutions will have a large inventory of floats.
- US deployments from both research vessels and VOS lines have been affected.
- US research vessels will be operating only out of US ports for at least the rest of this year. It is unknown when US VOS lines will start up.
- The Kaharoa cruise to the Indian Ocean has been delayed by 3 weeks to allow for delivery of floats.
- WHOI is looking for a charter vessel to deploy floats in the Atlantic. Canada and EuroArgo may contribute floats and possibly funds for this effort.
- Japanese research cruises are resuming. 70-80% of planned Argo deployments will be completed by the end of the year.
- EuroArgo has been significantly impacted and future cruises are still uncertain.

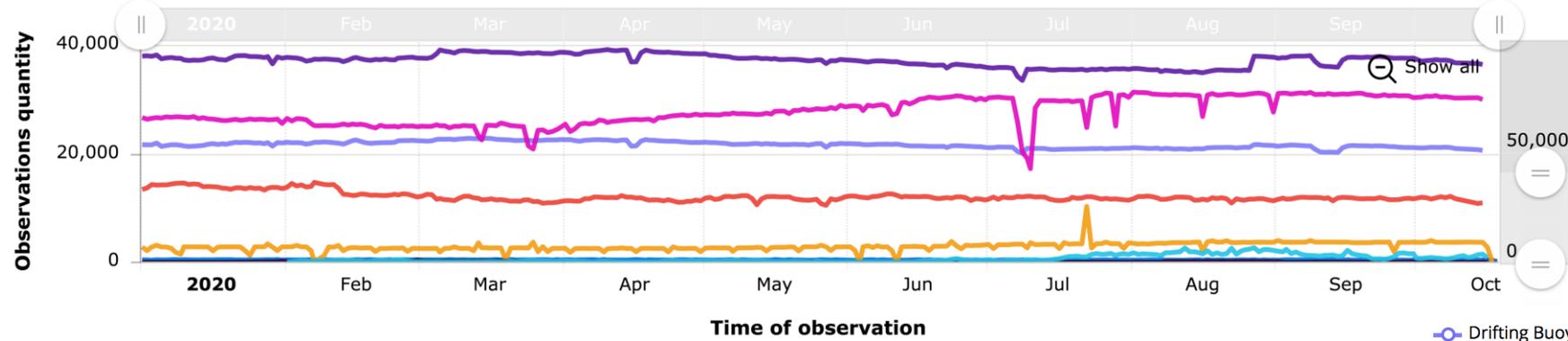
A view on the deployment opportunities, gaps and plans in the Atlantic @OceanOPS





Last updated: 2020-10-18 17:24:48 UTC

Daily observations



- Drifting Buoys with barometer - DBCP (source GTS MétéoFrance)
- Drifting buoys - DBCP (source GTS MétéoFrance)
- Moored buoys - DBCP (source GTS MétéoFrance)
- Profiling floats - Argo (source GDACs)
- Profiling floats - Argo (source GTS MétéoFrance)
- Total (source GTS MétéoFrance)
- Tsunameter buoys - DBCP (source GTS OSMC)
- Underwater gliders - OceanGliders (source GDAC Ifremer)
- Underwater gliders - OceanGliders (source GTS OSMC)
- VOS stations - SOT (source GTS MétéoFrance)

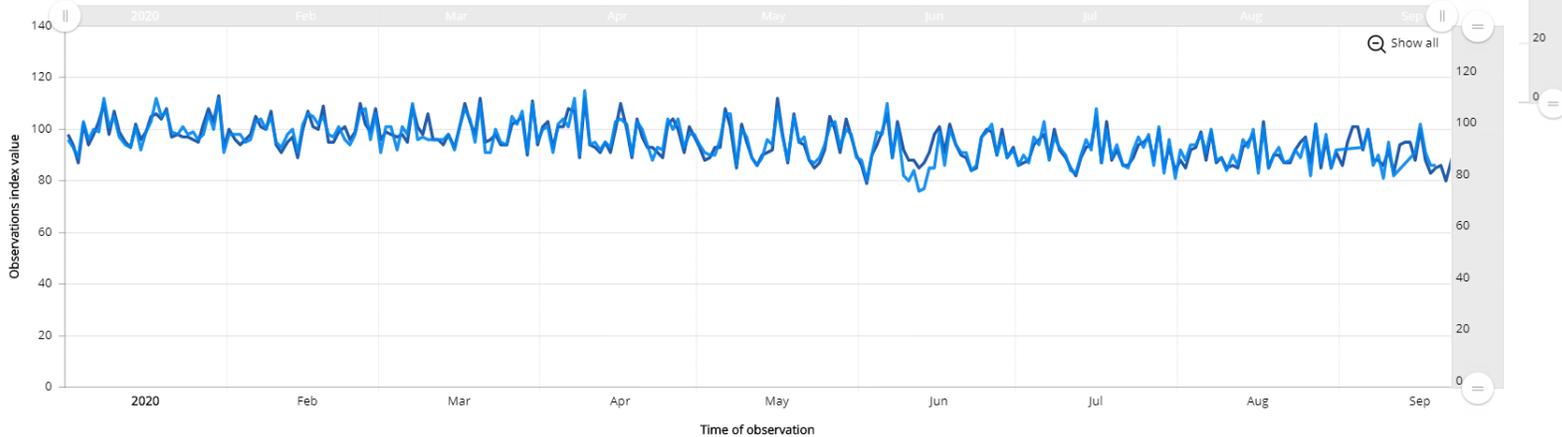
Last updated: 2020-09-23 14:26:47 UTC

Daily observations indexes (base 100: January 2020 average)

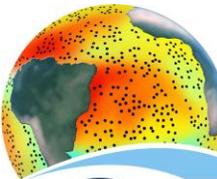


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Daily observations indexes (base 100: January 2020 average)



- Drifting Buoys with barometer - DBCP (source GTS MétéoFrance)
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- Profiling floats - Argo (source GDACs)
- Profiling floats - Argo (source GTS MétéoFrance)
- Total (source GTS MétéoFrance)



OceanOPS

In October 2020

- Work ongoing to re-seed autonomous arrays
 - Argo array down 10% to end 2020
 - Drifting buoys level OK, loss since start 2020 of approx.10%
 - Use charter vessels, increased cross network cooperation
- Research vessels re-commenced, BUT with restricted operations:
 - mooring maintenance priority – but some tropical moored buoys getting to the end life and may fall silent
 - missions still planned 2021 – GO-SHIP – but many missions to re-schedule
- Still impacted:
 - Ships of Opportunity Programme - ships crew trained however still only 5/32 lines operational - 15%
 - Animal Bourne Ocean Sensors - 50% fewer animals tagged Southern Ocean 2020/2021
- Local impacts can be higher
 - restrictions still inhibit servicing coastal buoys UK

GOOS <i>in situ</i> networks	Covid-19 impact	
	June 2020	Projected status December 2020
Ship based meteorological measurements	Minor	Minor
Ship based aerological measurements	Minor	Minor
Ship based oceanographic measurements (XBT)	Major	Major
Sea level gauges	Minor	Minor
Drifting and polar buoys	Minor	Minor
Moored buoys	Minor	Minor
Interdisciplinary moorings	Medium	Medium
Profiling floats	Minor	Minor
Repeated hydrographic transects	Major	Medium
OceanGliders	Medium	Minor
HF radars	Minor	Minor
Animal borne ocean sensors	Minor	Medium



BioEco network – Impacts

Specific examples: COVID-19 impacts on Biological sampling updated: October 2020

- **Reef fieldwork shut down in Australia**
- Arctic MBON research cruise ran later which may **impact comparability** of data
- Central California MBON suffered a **hiatus from March to late June**
- Gulf of Maine MBON - **4 month gap (Mar-June)** in monthly sampling of phytoplankton and micro and mesozooplankton abundance and species diversity. More interruptions expected
- Northern California Current (NCC) Ecosystem Survey **no samples collected in May, September 2020** cruise undertaken
- NOAA South Florida Program **cruises to the Florida Keys and Florida Bay cancelled** and resumed August with reduced personnel, processing samples remains impossible
- Southern California Bight MBON - **fieldwork was suspended for 3 months**, including kelp forest surveys and Plumes and Blooms cruises. **Moored instruments, however, were maintained as essential infrastructure.**
- Arctic Ocean Observing System (AOOS) - majority of **Arctic research cruises plus NOAA fishery surveys were cancelled. The ecosystem glider was deployed.**
- Southern California Coastal Ocean Observing System (SCCOOS)/West Coast HABs - **shut down ~20 year time series**, during an historic red tide, **if not for an operating mooring, initiation of the bloom would have been entirely missed.**



BioEco

Not a complete view, however indication:

- Biological sampling opportunities are being lost, a 4-6 month gap in data collection - March to June/Sept
- Management impacts e.g. harmful algal bloom
- Personal impacts, e.g. on PhD students with only 2 or 3 seasons to collect data
- Routine maintenance of physical oceanographic observing gear prioritized – also autonomous platforms providing ‘*at least collect a snapshot of the physical data when the ships couldn't go out*’
- Biological surveys often in smaller coastal vessels, diving has been particularly affected, ongoing difficulty with protocols



Impact users

“The weather forecasting systems will run off the rails if they don’t have the surface pressure information over the ocean to constrain them. We cannot do reliable forecasting without this piece of information coming straight from the ocean via these drifting buoys.” Lars Peter Riishojgaard, Director of the Earth System Branch at the **World Meteorological Organization (WMO)**

“A 10% drop of Argo could really hurt us in ocean analysis but also in our coupled ocean-atmosphere forecasting system” Hao Zuo, Senior Scientist at **European Centre Medium-range Weather Forecasts (ECMWF), UK.**

“In situ observations and ocean forecasts are vital information that we need to provide daily to our ports. This is saving lives and allowing us to avoid risky situations during storms.” Enrique Alvarez Fanjul, Head of Physical Oceanography, **Puertos del Estado, Spain**

- Data lost in initial months cannot be regained – includes sampling in areas undergoing rapid change
- Operational services are dependent ocean data – HABs, weather, ports, tsunami, seasonal forecasts...
- Operators need to maintain and calibrate their instruments – data quality – also critical



Pandemic 'stress test' – impulse for positive change

Pivoting through the Pandemic: A Global Problem with a Pacific Solution

Suva | 28 September 2020



- Reliance on research vessels – communication with research vessel operators organization (IRSO)
- Flexible operations considered, charter for remote locations, commercial, other vessels
- Increase use autonomous platforms
- International cooperation necessary – research vessels, cross-network deployment planning, basin scale information sharing, etc.
- Local solutions, accelerated capacity development
- Observing system operations should be viewed as critical



Strengthen the system, make more efficient

Communications – Covid-19's impact on ocean observations



- [GOOS Briefing Note](#)
- IOC/UNESCO news release [English](#) [French](#)
- [US National Public Radio Morning Edition](#)
- [Inside Climate News](#)
- [Copernicus Marine Service news](#)
- [UN's United in Science 2020](#) assessment of earth system
- [El Pais](#)
- [SPC: global problem with Pacific solution](#)
- CBC Canadian Broadcasting Corporation (underway)
- Twitter: 3x normal impressions / engagement rate @GOOSocean

Thank you



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