



The Global Ocean Observing System
www.goosocean.org

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

GOOS Office, IOC/UNESCO

*Information from the Observation Coordination Group (OCG), OceanOPS, BioEco
Panel, and the global ocean observing networks*

November 2020



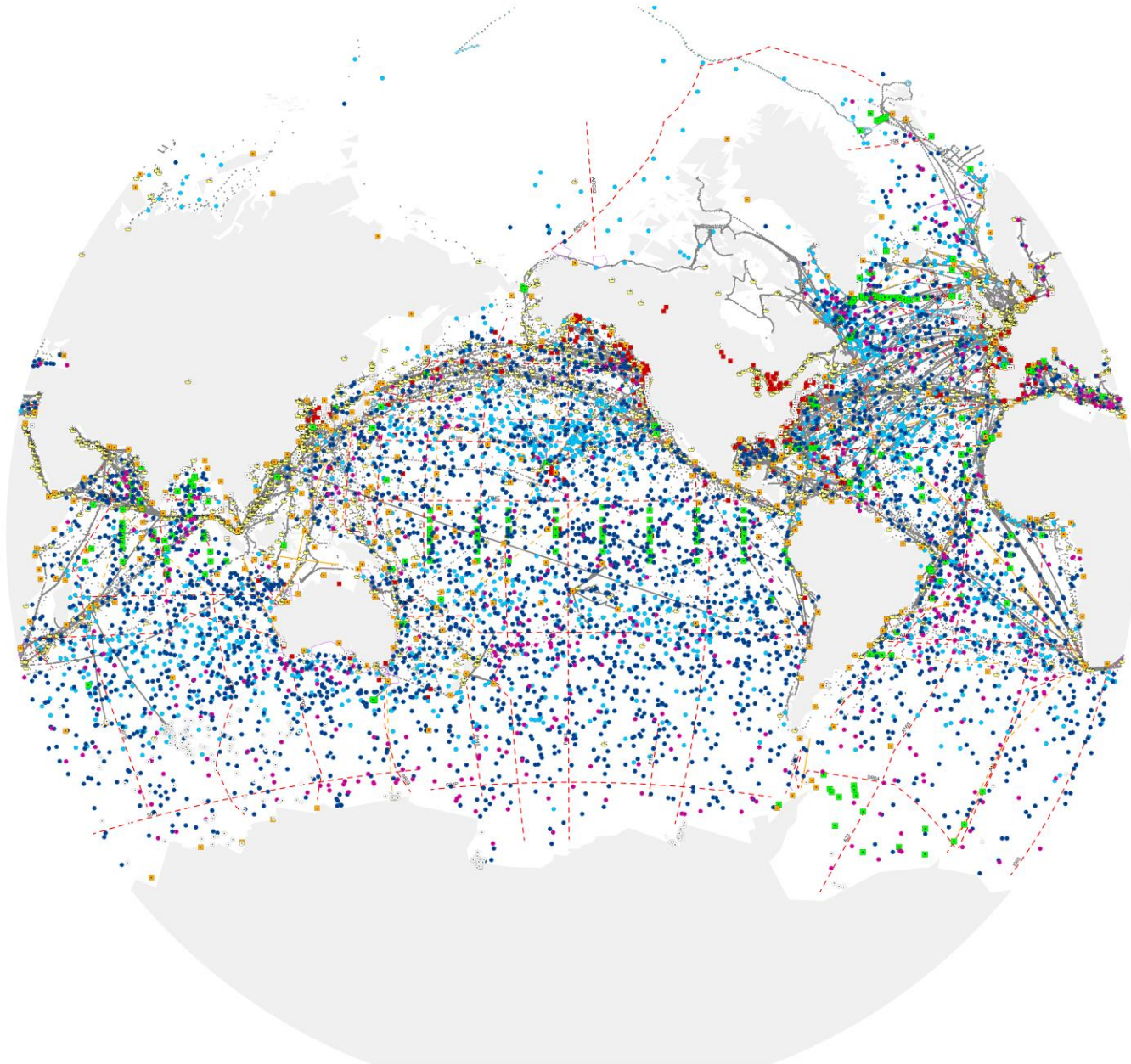
IOC



WMO



International
Science Council



One Ocean Observing System

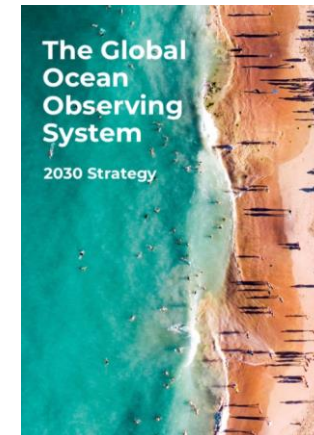
In situ operational platforms monitored by OceanOPS

- 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

- Global Ocean Observing System has come a long way in last 20 years
- 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 12 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	★★★★	★★★	★★★★	★★★			

GOOS survey on Covid-19 Impacts April 2020 -

- across 12 global ocean observing networks
- outlook updated during 2020



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%



Immediate Effects April – June 2020

- **Almost all Oceanographic Research vessels were recalled to home port – mid-march to July/Aug**
- Cancellation 4 decadal cruises - basin-scale, full-depth, multivariable, climate
- Surface carbon measurements effectively ceased
- Re-seeding autonomous arrays interrupted
- Ships of Opportunity Programme (SOOP) lost 90% data flow ocean temp profiling sections
- Operational activities for calibration, replacement, maintenance of instruments halted or restricted – affected voluntary ships, HF Radar, tide-gauges, ocean gliders
- **Autonomous observing components continued to send data**
- **Operators worked from home to ensure data flow**
- Many coastal biological sampling missions were cancelled, causing a March to June/Sept gap in data collection, again autonomous instruments continued sampling

Outlook – concern - action



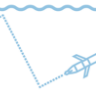
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	Underwater gliders	10	1	5	20	23	20	-50%

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	Ruben 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					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

- Outlook for vital autonomous profile float and drifting buoy arrays projected at initial pandemic deployment levels
- Red, yellow, green ‘traffic light’ table used to show critical timing for mooring recoveries
- Action:
 - Communicate critical nature sustained observations for services
 - Highlight maintenance needs deep sea moorings
 - Increase connection with research vessel community
 - Flexible solutions for reseeded autonomous arrays working with local operators, working with commercial sector



Ocean Observing System System resilience

- Use of autonomous instruments – delay in impact
- Commercial ships remained 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



Situation Nov 2020

- Continue tracking:
 - Argo array down 10% to end 2020
 - Drifting buoys network back up to operational levels
 - 50% fewer animals tagged Southern Ocean 2020/2021
 - Voluntary Observing Ships – approx. 5% reduction
 - Research vessels re-commenced with restricted operations
 - Locally and for specific datasets impacts can be higher
- Observing system adaptation:
 - Ships of Opportunity Programme trained commercial shipping partners crew – now 5/32 lines operational - 15%
 - Use of charter vessels and local vessels for re-seeding and mooring turnaround
 - Increased cross-network cooperation for operations
 - Training of local operators to undertake calibration work

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



Climate, operational and ocean health services

- Not yet able to assess amount of data 'lost' and impact on climate services – 3-6 month 'hole' in many ship based datasets – includes sampling in areas undergoing rapid change
- Operational services are dependent ocean data – data critical to HABs, weather, shipping, port operations, tsunami, seasonal forecasts - to date no major issues reported – delay due to use of autonomous observing platforms and critical action by the observing community
- Data showing the onset of harmful algal bloom (HABs) impacted through loss ship based monitoring, fortunately was visible from a mooring sensor

“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**



Pandemic 'stress test' – impulse for positive change

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

Suva | 28 September 2020



[SPC: global problem with Pacific solution](#)

- Understand system reliance on research vessels – forge stronger connections operators (e.g. IRSO)
- Increase use of autonomous platforms
- Consider flexibility in operations e.g. using charter, local vessels for remote locations
- Local solutions, accelerated capacity development
- Observing system operations should be viewed as critical
- Greater international cooperation across research vessels, cross-network, basin scale
- Consideration of redundancy in the system – multi-platform approach

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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