



## WMO OMM

World Meteorological Organization  
Organisation météorologique mondiale  
Organización Meteorológica Mundial  
Всемирная метеорологическая организация  
المنظمة العالمية للأرصاد الجوية  
世界气象组织

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Ref.: 00946/2021-19 S/DPS

Our ref.: 00946/2021/S/DPS

27 January 2021

Annex: 1 (available in English only)

Subject: COVID-19 Impacts Status Report

Action required: Respond to the COVID-19 Impacts Follow-up Survey

Dear Sir/Madam,

I wish to refer to my earlier correspondence dated 5 November 2020 (Ref. 20838/2020/S/DPS) by which a second survey on the impacts of the COVID-19 pandemic was shared with all Members as a follow-up to Executive Council discussions held in early October. As I indicated in that correspondence, a report detailing this analysis was prepared and it is my pleasure to share it with all Members as an annex to this letter.

I would like to thank those Members who have kindly provided their response to this second survey and also to encourage those who have not, to still consider providing their feedback. Assistance and/or further clarification may be sought from the WMO Secretariat COVID-19 Monitoring Team at [covid19@wmo.int](mailto:covid19@wmo.int)

I would like to take this opportunity to thank you for your professionalism and dedication throughout this difficult time. I wish to express my sincere condolences to those of you who have lost loved ones and/or colleagues.

Yours faithfully,

Prof. Petteri Taalas  
Secretary-General

To: Permanent Representatives of Members with WMO

cc: Hydrological Advisers

00946/2021/S/DPS, ANNEX

Ref.: 00945/2021-13 S/DPS

**COVID-19 pandemic**  
**WMO Survey of Members**  
**Initial Impact Report**



**WORLD  
METEOROLOGICAL  
ORGANIZATION**

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## Executive Summary

In March 2020 as the COVID-19 pandemic started to take hold, Members began to report a number of difficulties in maintaining “Business as Usual” operations.

In order to assess the full extent of the COVID-19 impact on Members, the WMO Secretary-General (SG) decided to implement a survey in April 2020 with the aim of developing a more thorough understanding of COVID-19 impacts across the WMO family.

The survey, issued in April, remained open until June with a total of 146 Members responding. Through the northern hemisphere summer, some of the initial impacts lessened with Members successfully adopting new ways of working and some even returning to near normal operations.

However, with the second wave leading to further impacts on Members, the WMO SG implemented a follow-up survey in October. This report summarizes the major findings from both surveys and underscores that, while Members continue to demonstrate total commitment, some impacts, in particular around observational supply and maintenance, have been felt. This is further highlighted in the recent United in Science 2020 Report<sup>1</sup>. The brief analysis from our aviation colleagues also concludes that some of the financial impacts may last well into next year, if not beyond.

In order to respect the confidentiality of Members’ responses, this report deliberately steers clear of comments or analysis in respect of impacts on individual Members.

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<sup>1</sup> [https://public.wmo.int/en/resources/united\\_in\\_science](https://public.wmo.int/en/resources/united_in_science)

## Overview

The WMO COVID-19 Monitoring Team in the Services Department conducted two impact surveys with Members from April to June 2020 and a follow-up survey from October 2020 (still pending returns). A brief glance at the provisional data suggests the two surveys highlight a similar level of impacts; however, a more detailed analysis indicates a gradual decrease in Members' resilience across many of the key functions of National Meteorological and Hydrological Services (NMHS).

### Initial COVID-19 Survey April – June 2020

The initial COVID-19 Survey was distributed to Members in April 2020, with **146** returns before the survey closed for entries at the end of June 2020. The regional breakdown was as follows:

- |                            |  |
|----------------------------|--|
| • Regional Association I   | 36   |
| • Regional Association II  | 21   |
| • Regional Association III | 10   |
| • Regional Association IV  | 11   |
| • Regional Association V   | 12   |
| • Regional Association VI  | 37   |
| • Non-members              | 2 <sup>2</sup>                                       |
| • Duplicate returns        | 17 (from agencies with a dual function) <sup>3</sup> |

In order to establish potential impacts in a relatively short space of time, the survey was designed to collect qualitative information from Members in respect of both current and predicted impacts, with specific questions divided into the following categories ([Annex A](#) provides a full list of survey questions):

- General assessment in respect of any COVID-19 impacts both immediately and in the future
- Teleworking capabilities
- Impacts on core NMHS functions, including observational and service delivery capabilities
- Impacts on regional and/or global commitments and cooperation

### Second COVID-19 Survey October – December 2020

The second survey issued in late October 2020 ([Annex B](#)) includes the same questions as the first survey. However, in order to provide greater clarity, Members were asked to identify the specific discipline to which their responses referred:

- Weather/Climate
- Hydrology
- Aviation

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<sup>2</sup> Such as Bermuda, where formal representation is through the UK Met Office

<sup>3</sup> Some Members completed two surveys to reflect impacts on both Meteorological and Hydrological Agencies

- Marine

By the date of publication of this report, 55 survey returns have been received by the Services Department COVID-19 Monitoring Team:

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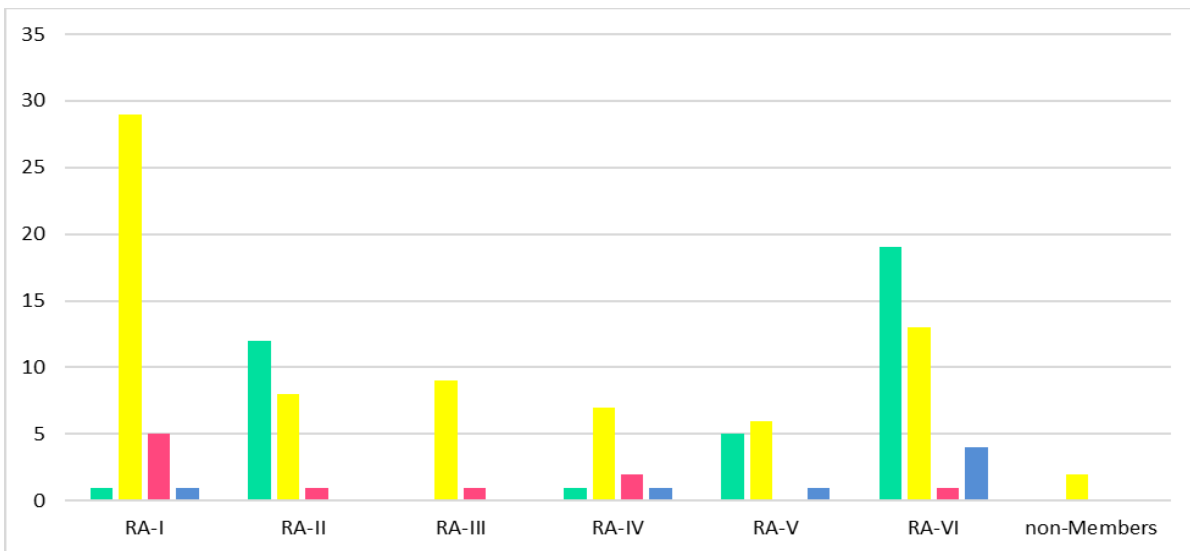
- Regional Association I 12
- Regional Association II 8
- Regional Association III 5
- Regional Association IV 3
- Regional Association V 12
- Regional Association VI 13
- Non-members 1

**Survey response summary – general assessment**

The general assessment section was designed to gather a very quick overview in respect of the possible COVID-19 impacts across the many functions of NMHSs. Therefore, the survey asked Members to respond to the following questions:

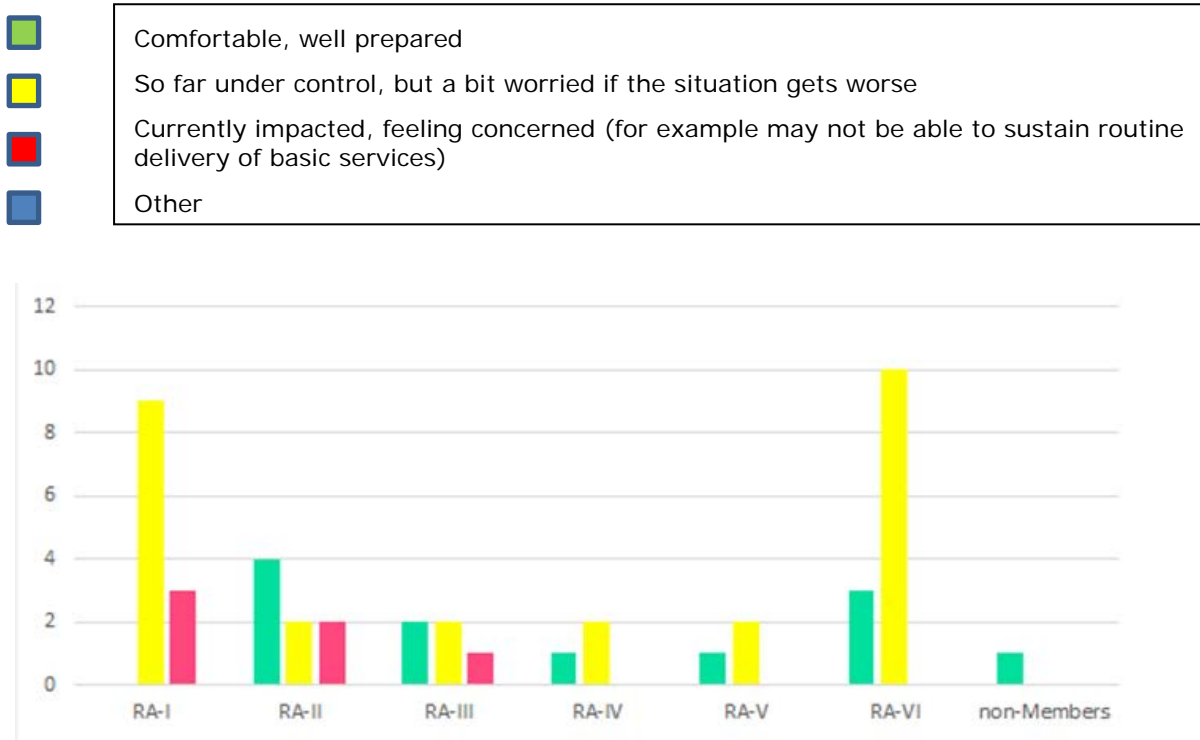
- Comfortable, well prepared
- So far under control, but a bit worried if the situation gets worse
- Currently impacted, feeling concerned (for example may not be able to sustain routine delivery of basic services)
- Other

Figure 1 provides a summary of these returns, with 11 Members advising of immediate impacts.



**Figure 1. Initial COVID-19 survey returns per region for the first survey in spring 2020**

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**Figure 2. Second COVID-19 survey returns per region for the second survey in autumn 2020**

Figure 2 shows the same as Figure 1, but for the second survey initialized in autumn 2020. The second survey is still active with 55 returns to date, however the number of Members registering impacts already numbers 6.

**Survey response detailed analysis**

In order to assess impacts associated with COVID-19 between the first and second surveys the following sections provide a direct comparison of responses between the 42 Members who have returned both surveys (Table 1).

RA-I	RA-II	RA-III	RA-IV	RA-V	RA-VI	non Members
Gambia	Nepal	Venezuela	Trinidad and Tobago	New Zealand	Netherlands	
Togo	Bahrain	Paraguay	British Caribbean Territories	Malaysia	Finland	
Guinea	Iraq	Brazil		Australia	Belarus	
Morocco	Hong Kong, China	Colombia			Croatia	
Lesotho	Kazakhstan	Chile			Bosnia and Herzegovina	
Algeria	China	Bolivia			Norway	
Tunisia	Thailand	Guyana			Switzerland	
Libya					Moldova	
Burkina Faso					Cyprus	
Guinea Bissau					Spain	
					Serbia	
					United Kingdom	
					Slovakia	

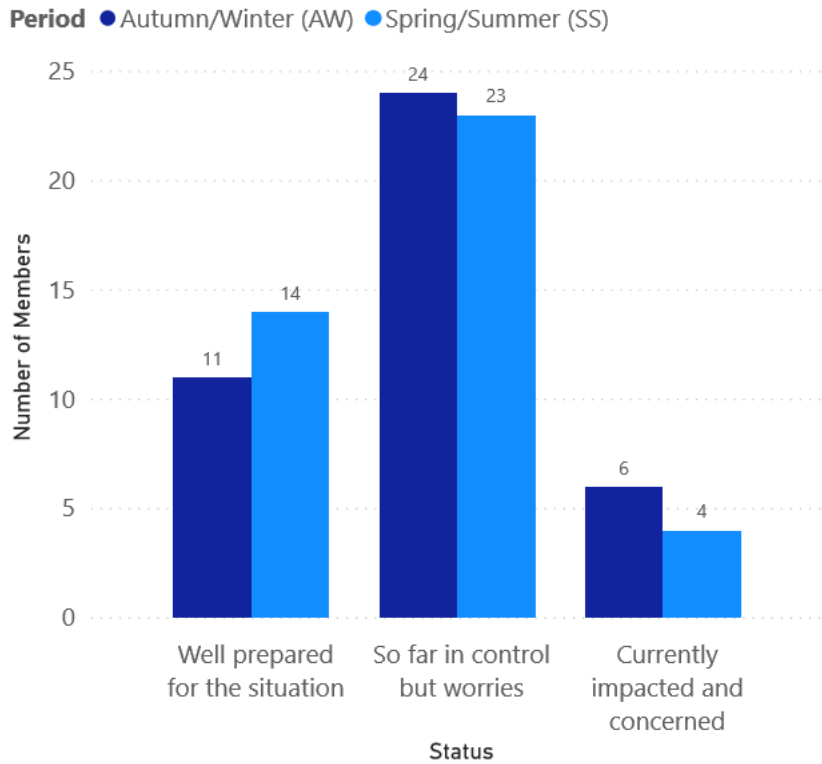
**Table 1. Members responding to both surveys (by WMO Region)**

While to date only 42 returns have been received, the second survey has been open for less time than the first survey and therefore more returns are expected.

**General assessment (survey section B)**

Figure 3 provides a comparison in respect of the general impact of the COVID-19 pandemic on the 42 Members who returned both surveys. While the general impact on Members remains fairly stable, there is an increase in those either experiencing impacts or concerned about potential future impacts. This is supported by the more detailed analysis discussed below.

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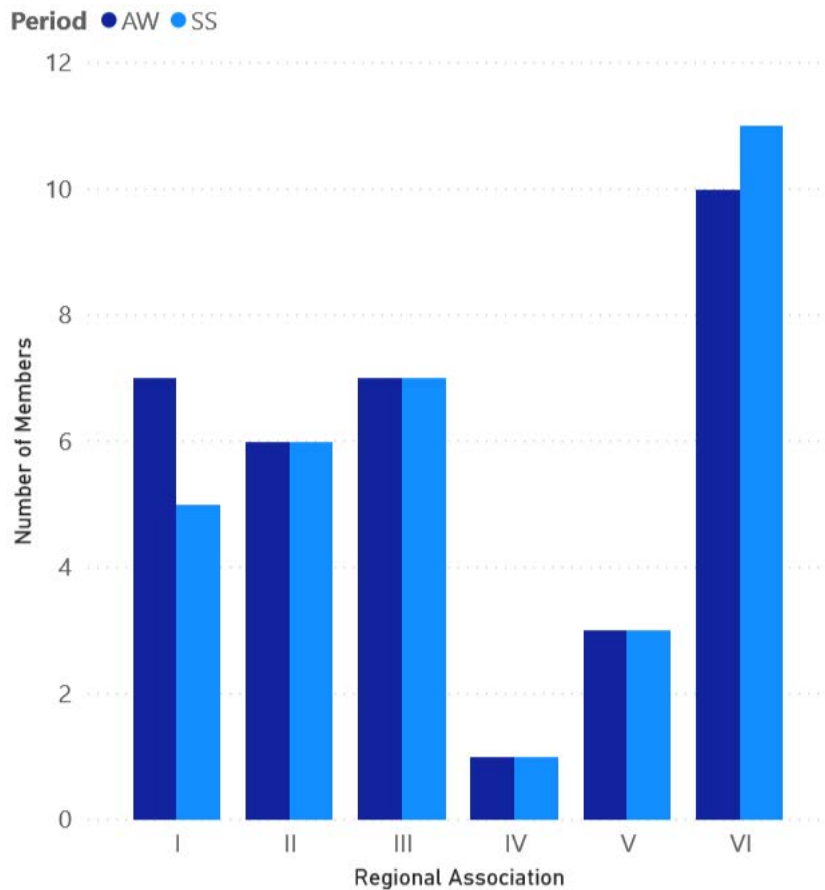


**Figure 3. General Assessment First Vs Second Survey Comparison**



### Teleworking capabilities (survey section C)

Figure 4 shows the results from the initial summary question of the teleworking section which asked Members to indicate if they had started teleworking in response to COVID-19 impacts. The numbers of those teleworking remained consistent between the two surveys with 34 Members advising of teleworking during the initial survey (**SS** – Spring/Summer), compared to 33 (**AW** – Autumn/Winter).



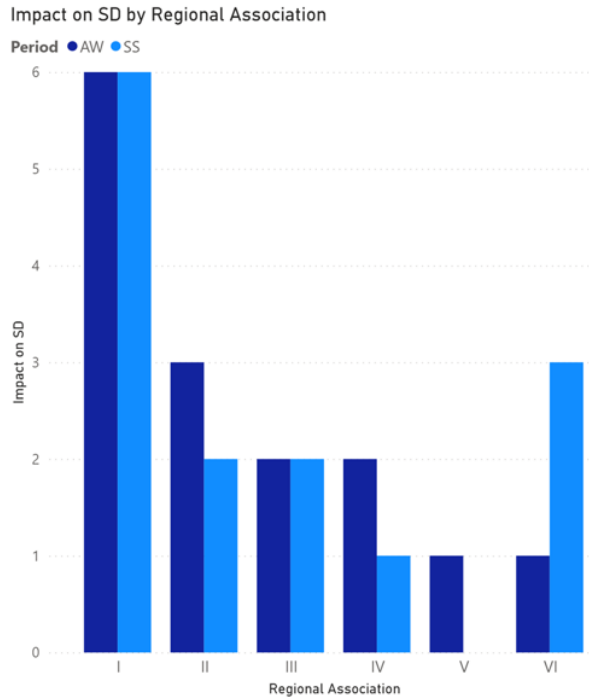
**Figure 4. Number of countries that report on teleworking for both surveys**

However, further feedback in relation to the availability of sufficient bandwidth and laptops to enable staff members to work remotely from NMHS premises suggests a further decline in resilience by the time of the second survey in November 2020.

### Impacts on NMHS core functions (survey section D) service delivery

Of the 42 Members who returned both surveys, the impact on the ability to deliver services remained stable (Figure 5) with 14 Members reporting impacts in the first survey compared to 15 reporting impacts during the second survey.

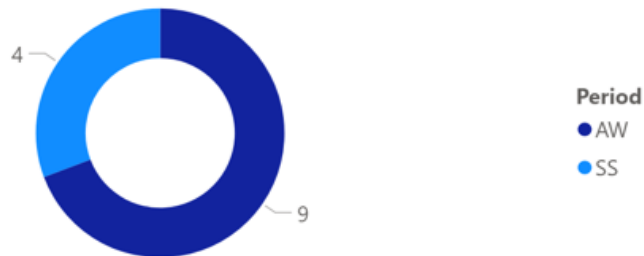
Ref.: 00946/2021-1.9 S/DPS



**Figure 5. Number of Members that report on impact of service delivery across all regions and divided between the two surveys**

However, a more detailed look at the response of the Members shows increasing specific impacts associated with the provision of the required forecast services (Figure 6) with more than twice the number of Members reporting impacts in the second survey when compared to the first.

**Difficulties in issuing forecasts**

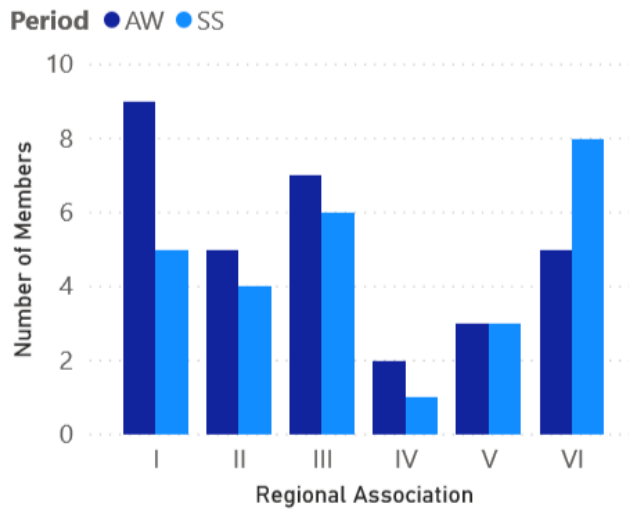


**Figure 6. Number of Members that report on Service Delivery and Forecast Production impacts across all regions and divided between the two surveys**

**Impacts on NMHS core functions (survey section D) observations**

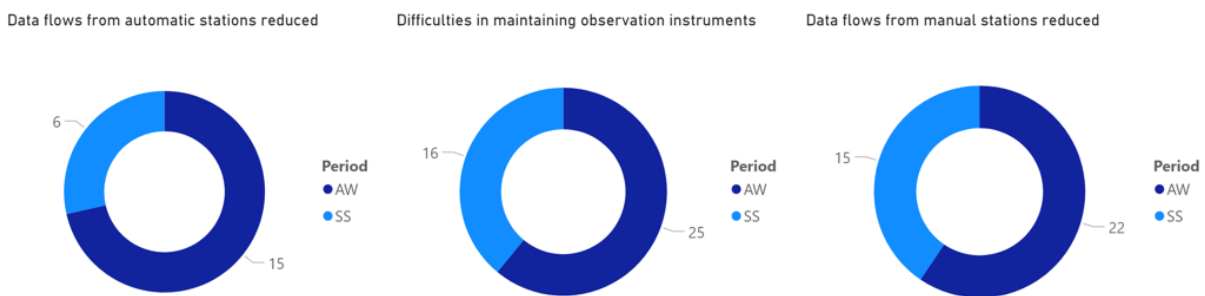
Figure 7 provides an overview in respect of the impact on Members’ observing capabilities.

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**Figure 7. Number of Members that report on impact on observational capability for both surveys**

27 Members registered impacts on observational capability during the first survey with 31 indicating impacts four months later. Looking at the results more closely, Figure 8 indicates a strong increase in impacts related to access to surface (land-based) observational data and also in the ability to maintain instrumentation; this is especially true from Members in Regional Association I. One point to consider in respect of the impacts on the observing network is that the difficulty in maintaining networks may be storing up a latent problem. A lack of maintenance may not have an immediate impact, but quality and operational issues may surface at a later stage.

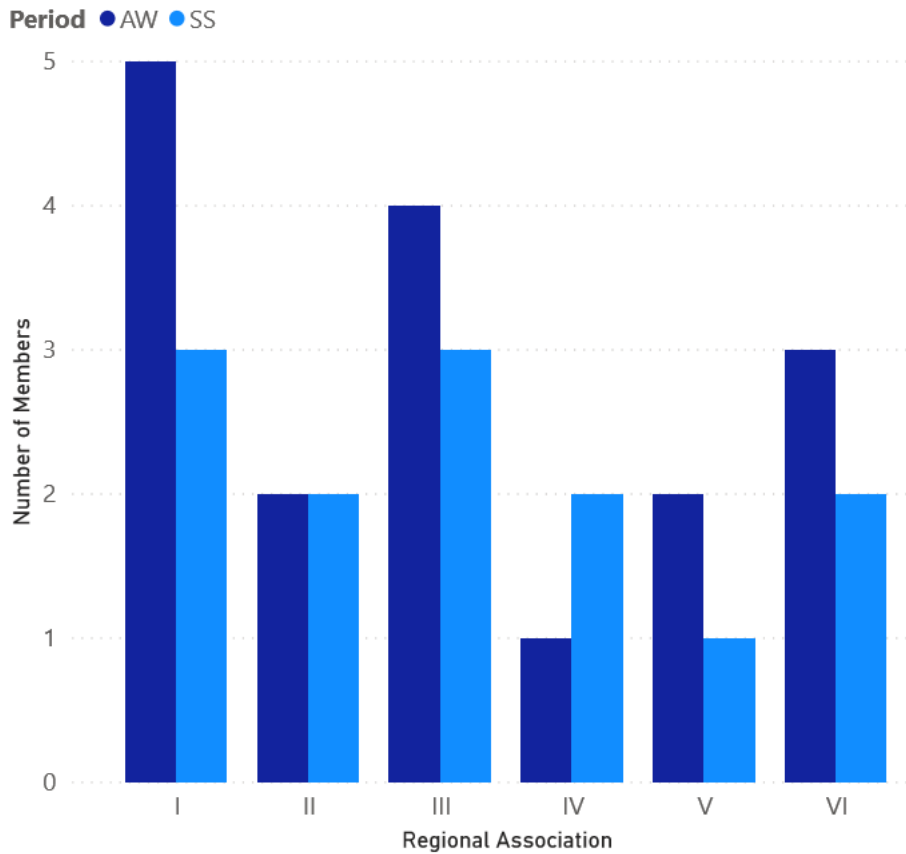


**Figure 8. Specific impacts on Surface Observational Capability**

**Impact on NMHS core functions (survey section D) underpinning infrastructure (IT/HPC)**

The survey questions also looked to gain an understanding of the impacts on underpinning IT and Numerical Weather Prediction (NWP) capability and the associated maintenance (Figure 9).

Ref.: 00946/2021-19 S/DPS

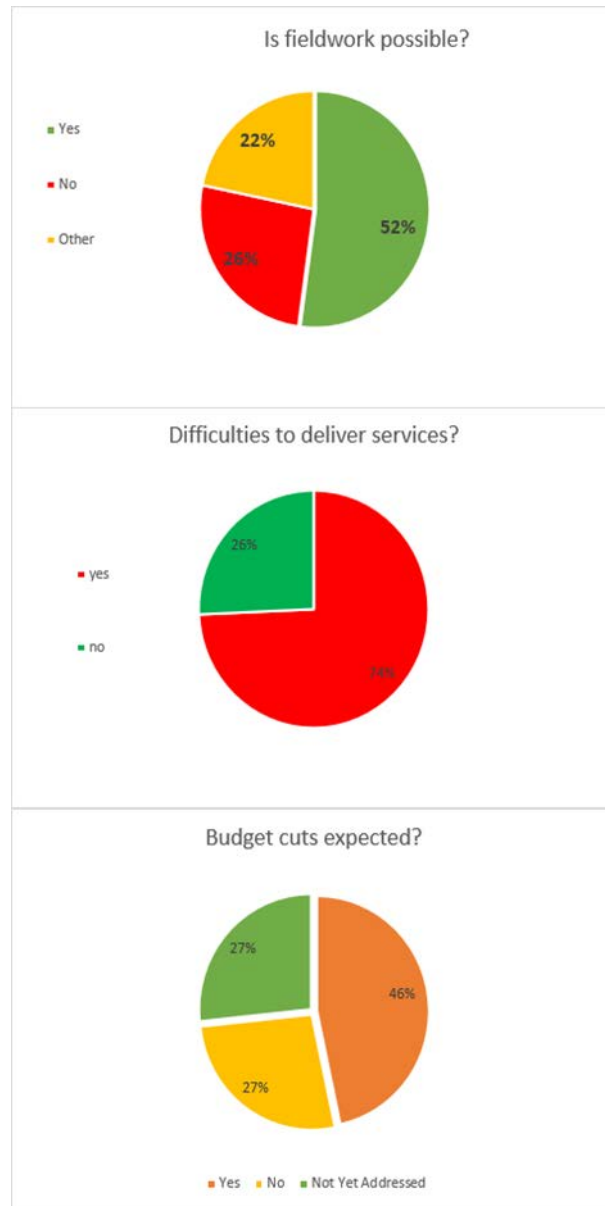


**Figure 9. Number of Members that report on IT/HPC impact across all regions and divided between the two surveys**

Analysis of the 42 Members who responded to both surveys indicated only a modest increase in respect of impacts on IT or HPC capacity with 13 Members reporting impacts in the first survey whereas 17 Members indicated problems in the second survey.

## Hydrological impacts

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**Figure 10. Hydrological impact, fieldwork, service delivery and budget impacts**

In September, the hydrology team, within the Services Department, conducted a specific survey (Figure 10) to which 46 Members responded<sup>4</sup>. Figure 10 details impacts in relation to capacity to undertake field work, deliver core services and whether budget cuts were anticipated.

<sup>4</sup> The hydrological survey was a separate activity which was aimed at Hydrological members only

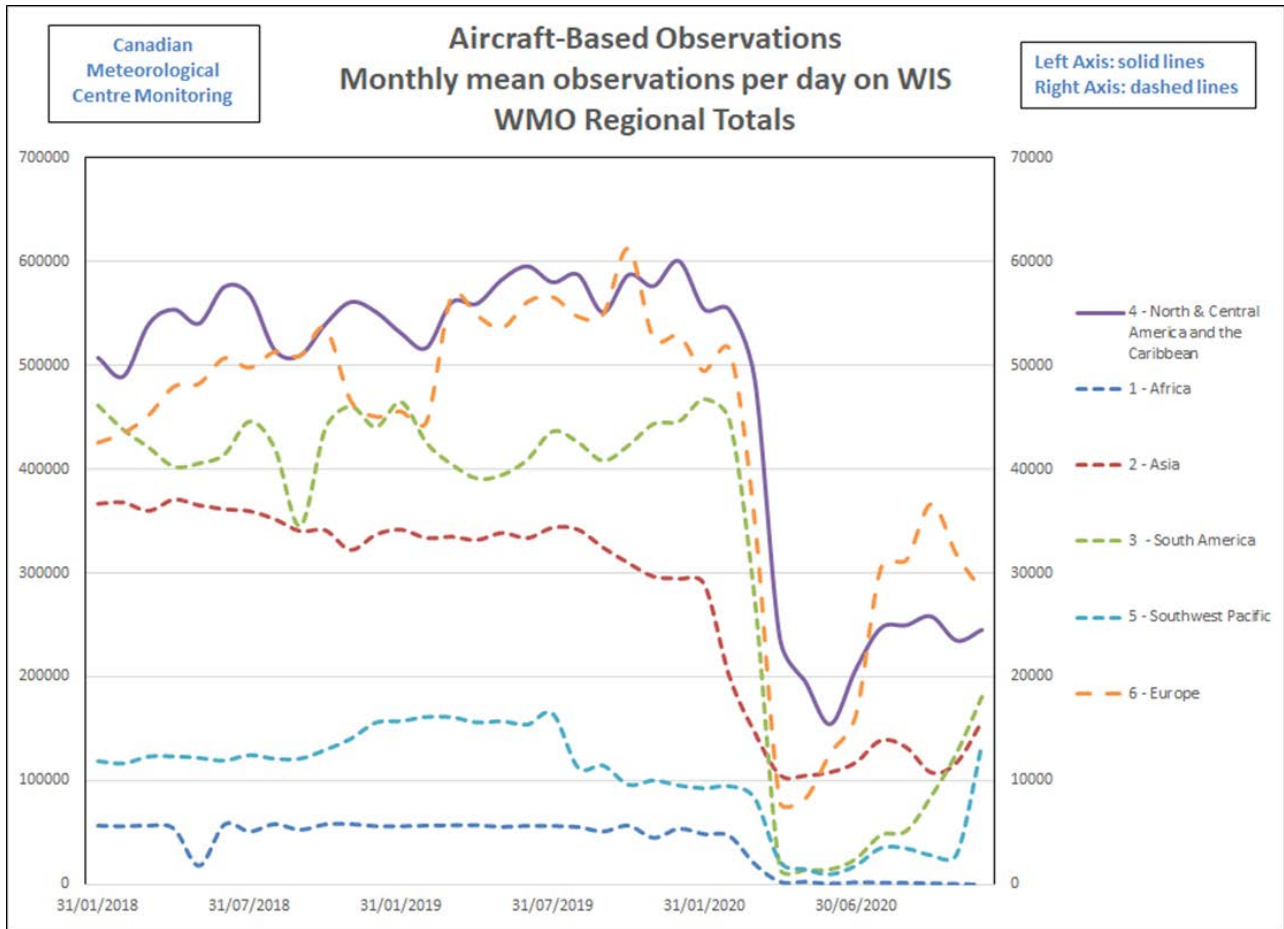
Of the respondents, 31 reported impacts in respect of maintaining service delivery, while 11 reported issues in undertaking specific fieldwork, with a similar number advising of expected budget cuts due to the COVID-19 pandemic.

Evidence also gathered through a number of virtual meetings indicated that some national hydrological services were not classed as ‘critical services’ unlike their meteorological agency counterparts. This meant additional challenges in operating within national lockdown restrictions including gaining access to office facilities and the associated IT infrastructure.

**Aviation observations**

At the start of the crisis a sudden reduction in the availability of Aircraft Meteorological Data Relay (AMDAR) observations was well documented (Figure 11).

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**Figure 11.**

**Monthly mean daily volume of aircraft-based observations in the WMO Information System (WIS) from 31.01.2018 until 30.11.2020 separated across the RAs. From levels of over 600 000 observations per day from several sources, including the WMO AMDAR programme, before the COVID-19 pandemic, data volume fell dramatically in March and April 2020. Please note that BUFR and AIREP/ADS-C and FM42 are different reporting formats for aircraft observation data.**

In June 2020, the European Centre for Medium-range Weather Forecasts (ECMWF) published a press article detailing potential impacts in respect of Global NWP<sup>5</sup>. In this article, ECMWF discussed how previous data denial experiments had indicated a 10% drop in the accuracy of the forecast 12-hour 200 – 250HPA pressure fields. However, at the time of publication of the report in June there was no evidence of any reduction in NWP quality which was attributed to the increase in observation from other sources such as satellite and radiosonde.

A wider look at the aviation arena shows global flight departures (excepting Asia and Africa) have plateaued following the slow but steady rises post-April 2020 with around 47% of the weekly number of flights compared with the same period in 2019. Given the international travel restrictions the recovery in flight numbers is, primarily, being led by an increase in domestic traffic.

Impacts on aviation sector revenues are expected to remain significant and are likely to remain so for some time to come. Revenues in 2021 are expected to be down around 50% compared with expectations pre-crisis (US Dollars 400 billion vs. US Dollars 800 billion forecast). Naturally this reduction may have an impact on the budget of aviation met service providers

Best case scenarios suggest a recovery of passenger air traffic to pre-COVID (2019) levels by around 2023/2024 with a worst-case scenario indicating a delay in the recovery to pre-COVID-19 levels until around 2029

### Marine observations

A number of impacts from the marine sector are similar to land-based colleagues in respect of limitations in the capacity to maintain and deploy observational equipment. Therefore, we may not see 'physical' impacts for some time as equipment quality is more likely to degrade over time<sup>6</sup>.

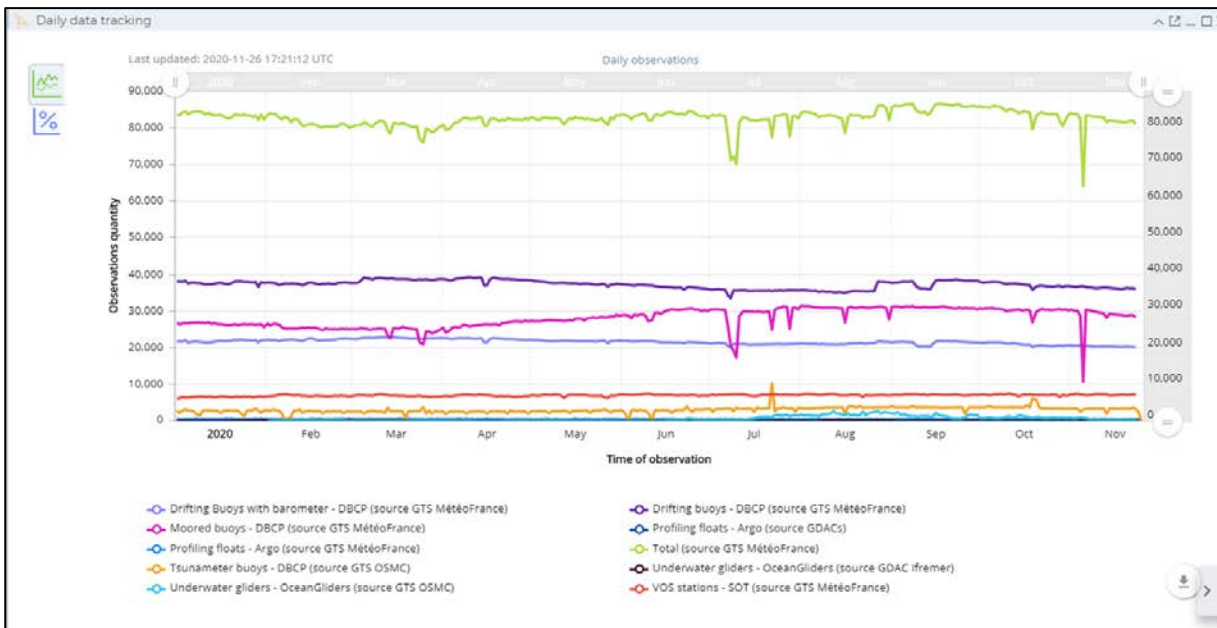


Figure 12. Impact on Oceanographic Observations

<sup>5</sup> <https://www.ecmwf.int/en/about/media-centre/news/2020/coordinated-response-mitigates-loss-aircraft-based-weather-data>

<sup>6</sup> [https://www.gooscean.org/index.php?option=com\\_content&view=article&id=245:covid-19-and-ocean-observations](https://www.gooscean.org/index.php?option=com_content&view=article&id=245:covid-19-and-ocean-observations)

Figure 12 highlights the availability of daily oceanographic observations since the beginning of 2020. An initial reduction in availability can be detected when the pandemic first took hold in March and April. Thereafter, apart from a few sharp reductions, the return of observations to date at least has remained fairly constant.

One possible issue may be in respect of quality of Voluntary Observing Ship (VOS) observations as the virtual cessation of the cruise market means some of the “highest quality” observations may no longer be available.

Mariners are identified as key ‘workers’ during the pandemic by many Members although COVID-19 still has a significant impact on mariners who are often not permitted to leave their respective vessels.

Outside of the oceanographic arena, as with the rest of the WMO community, meetings have been disrupted as the community has moved into the ‘virtual meeting’. However, while the International Ice Charting Working Group (IICWG-21) was held online from 21 through 25 September, it was noted that iceberg product information has been impacted due to restrictions for the patrols in the Arctic Region.

Research cruise restrictions have also been impacted due to the introduction of COVID-compliant health and safety procedures.

#### Further notes

While the impacts of COVID-19 have been significant, Members have continued to deliver safety critical services and, throughout the Caribbean Hurricane season, Members continued to deliver critical advice as did their colleagues in the Western Pacific, although social distancing means early action and response is now more challenging:

- A strong La Niña event is currently underway. Despite COVID-19 however, Members continue to provide critical advice to global and regional humanitarian stakeholders<sup>7</sup>
- First ever South-West Indian Ocean TC Miniforum provided effective seasonal advice to Members and humanitarian partners
- Members have embraced this new virtual world which has made a significant contribution to the successful delivery of a number of training courses and also allowed for numerous important procedural meetings to continue

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<sup>7</sup> <https://public.wmo.int/en/media/news/wmo-steps-action>



Ref.: 00946/2021-1.9 S/DPS


## Internal WMO Board of Directors reporting

From April through July 2020, the COVID-19 Monitoring Team were required to produce weekly impact reports for the Board of Directors. The report from 9 June 2020 is provided below for reference.



### COVID-19 Impacts on National Meteorological and Hydrological Services and WMO Systems

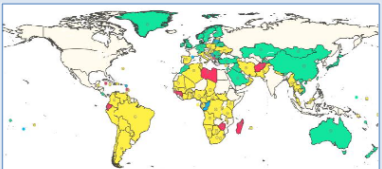
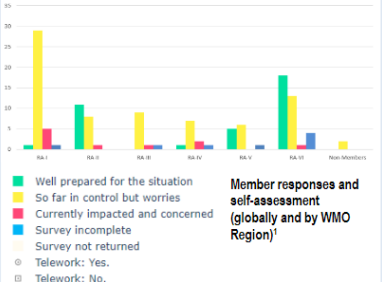
Report 10, 9 June 2020 – Page 1/2 (internal distribution only)



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#### Highlights

- 143 returned surveys (no new response since Report 9) from 124 Members & 2 Non-Members as of 17 CET 9 June<sup>1</sup>.
- 10 Members are already seeing significant impacts ranging from impacts on their observational systems through to ability to maintain key IT systems, with concerns in respect of ongoing operations<sup>1</sup>.
- 72 Members are currently in control but worry about future operations should the COVID-19 crisis continue.
- 34 Members reported financial issues, possibly impairing operations, project implementation and payment of their subscriptions<sup>1</sup>.
- Aviation continues to see a significant reduction in traffic with financial impacts on Members likely to be felt well into 2021. Current estimates indicate a return to pre-COVID-19 traffic levels are unlikely until 2021 or later<sup>2</sup>.
- The Turkish State Meteorological Service (TSMS), as the Regional Centre for South East Europe FFGS (9 countries) and Black Sea and Middle East FFGS (10 countries), is working on indicators to report on the dataflows, server operations and interface availability of FFGS infrastructures.<sup>3</sup>
- Some evidence from Members suggests a gradual relaxation of teleworking arrangements in some work areas.
- WMO colleagues provided extensive information to UN climate change negotiators on the impacts of COVID-19 on climate research, observations and assessments, as well as on the GHG concentrations and emissions (substantial reduction in urban areas) at an event convened by the Chairperson of the Subsidiary Body for Scientific and Technological Advice (SBSTA) of the UNFCCC<sup>4</sup>.

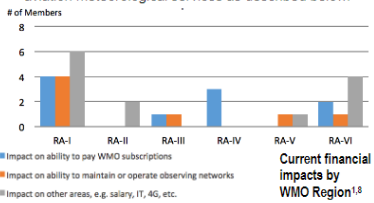



**Member responses and self-assessment (globally and by WMO Region)<sup>1</sup>**

- Well prepared for the situation
- So far in control but worries
- Currently impacted and concerned
- Survey incomplete
- Survey not returned
- Telework: Yes.
- Telework: No.

#### Impacts on NMHSs and potential Issues

- Sudden drops in surface observations reported in Malawi, Nepal, and Suriname during the last week → under investigation in coordination with WIGOS colleagues (see plots on page 2).<sup>5</sup>
- AMDAR observations are still at >30% of normal levels, despite a gradual and measurable increase since mid-May observations remain a long way off normal levels.<sup>6</sup>
- Almost no impact is visible in ocean observations, but this may change in the coming months as logistics chains have suffered.<sup>7</sup>
- Impacts of budget cuts and reduced revenue from aviation meteorological services as described below.<sup>1,8</sup>




**Current financial impacts by WMO Region<sup>1,8</sup>**

- Impact on ability to pay WMO subscriptions
- Impact on ability to maintain or operate observing networks
- Impact on other areas, e.g. salary, IT, 4G, etc.


#### Secretariat Actions

- Suggested production of bi-monthly reports on COVID-19 impacts from this week onward,
- Continued discussion on using the Community Platform for longer-term monitoring of NMHSs' capacities,
- Discussion of COVID-19 impacts during the upcoming RA I MG Meeting,
- Follow-ups (e.g. through INF & HWR colleagues) on specific issues reported, such as observations,
- Input for a chapter on COVID-19 impacts in the Progress Report on the Implementation of the UN Plan of Action on DRR for Resilience which will be presented at the Senior Leadership Group on DRR (SLG) on 17 July in New York.

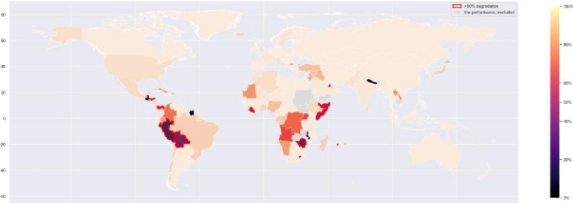


### COVID-19 Impacts on National Meteorological and Hydrological Services and WMO Systems

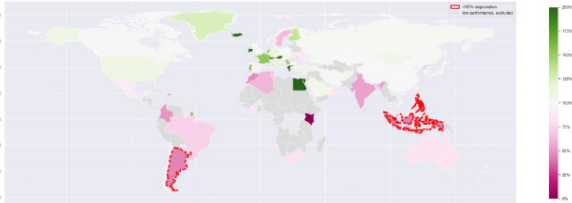
Report 10, 9 June 2020 – Page 2/2 (internal distribution only)



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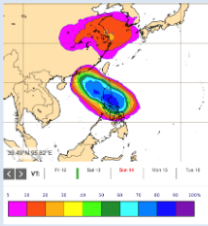
**Variability of surface observations (7d rolling vs January 2020)<sup>1</sup>.**  
Light Orange = 100%, Purple = 50%, Black = 0%

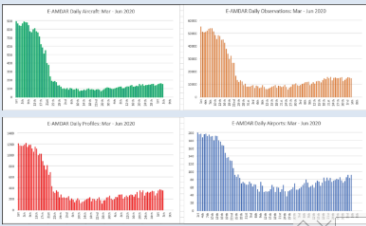


**Variability of upper air observations (7d rolling vs January 2020)<sup>1</sup>.**  
Green = 200%, White = 100%, Purple = 0%

#### Concurrent weather / climate risks

- Tropical Depression Cristobal is moving across Missouri, USA, with heavy rainfall continuing to spread northward across the middle and upper Mississippi Valley and the western Great Lakes on 9 June<sup>9</sup>.
- PAGASA advises that an area of low pressure may develop into a tropical depression close to the Philippines in the next 48 hours. ECMWF output indicates a 70% chance that it may develop into a tropical cyclone this weekend, although official RSMC warnings have not yet been issued. The system is expected to weaken and track towards southern China, close to Hong Kong and Macau by Monday<sup>10</sup>.





#### Details on aviation, AMDAR and GOOS

- In some parts of the world, as national restrictions on the movement of people start to ease, airlines, airports and the associated services (security, facilitation, maintenance, catering, etc.) are restarting their operations. At its worst in late April, global air traffic was reduced by around 95% compared with the same period last year, with only cargo and repatriation flights in the air. Since then, flights have increased by around 30% but given the level of decline it still means that the industry has a gap of well over 90% to cover<sup>2</sup>.
- In terms of observations from the global Aircraft Meteorological Data Relay (AMDAR) programme, there has been a decline from around the 2nd week of March and a gradual increase from around the 2nd week of May. While the increase is certainly measurable, data levels (see diagrams on the left) are still at >30% of normal/expected levels. The USA program (normally makes up around 60-70% of the total AMDAR output) also shows these signs of a small recovery in data volumes from participating passenger aircraft<sup>9</sup>.
- The Global Ocean Observing System (GOOS) does not show any impacts of COVID-19, and although some components of the system have suffered (Research Vessels, XBTs, etc.), most of the global networks remain operational. This is also thanks to the diversity of the system and the level of autonomy and automatization of its components which are key for its resilience. Just like the economy in general, the GOOS logistics chains have suffered which may impact the system in the medium term (i.e. a clear gap in a few months that will take time to be absorbed). However, international bodies such as WMO, IOC (incl. JCOMMOPS) are at work to develop international cooperation more than ever through a more multilateral and integrated approach<sup>7</sup>.

Ref.: 00946/2021-19 S/DPS

## Annex A

### Initial Survey Questions (SS – Spring Summer)



COVID 19 Spring  
Survey.pdf

## Annex B

### Follow-up Survey Questions (AW – Autumn Winter)



20838-2020-ANNEX\_  
en.pdf

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