On-line Survey Assessment of National Marine and Coastal Services

2019
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Acknowledgements

This report was prepared by combining the responses received by participating Members. The Marine Meteorology and Ocean Affairs Division (MMO) coordinated the data collection on behalf of WMO.

WMO wishes to express special thanks to respondent Members and the National Marine Services Focal Points.
Foreword

Covering some 70% of the Earth’s surface, the ocean is a major driver of the world’s weather and climate. As well, it is an instrumental facet of the global economy, carrying more than 90% of world trade and sustaining 40% of humanity living within 100 km of the coast. Recognizing this, national weather agencies and researchers regularly monitor the ocean, model how it affects the atmosphere and deliver marine services to support coastal management and safety at sea. Today, the growing impacts of climate change are making ocean observations, research and services more critical than ever before.

The World Meteorological Organization (WMO) provides standardized information, forecasts and warnings to ensure the safety of life and property at sea. It also supports the efforts of National Meteorological and Hydrological Services (NMHS) to deliver forecasts and warnings to protect coastal and inland communities from hazards such as ocean-generated storms and coastal flooding.

WMO, NMHS and other national entities support international efforts to monitor ocean variables – including ocean temperatures, currents and salinity – which are factors in understanding and predicting weather and climate. They also support coastal management and resilience, particularly for Small Island Developing States and other vulnerable regions.

Recognizing the importance of knowing the state-of-art of the marine and coastal services, WMO carried out an on-line survey assessment of National Marine and Coastal Services. The survey, whose results are presented in this report, was conducted between 5 November 2018 and 31 December 2018 with a response across all regions, informing the situation, interests, and needs of the respondent NMHS.

Gaps in marine and coastal services were evident from the survey, particularly related to lack of human resources, capacity development and training, funding and equipment. Members are also seeking to improve the infrastructures and services in order to decrease their vulnerability against adverse meteorological phenomena.

It also identified issues related to instrumentation availability, data application and interpretation of satellite images and priority areas that needed follow-up to sustain and improve the capacities of NMHSs to enable WMO to effectively implement the decisions of WMO policy-making organs and contribute to the UN Sustainable Development Goals, the Sendai Framework for Disaster Risk Reduction 2015–2030, the Paris Agreement and other international agreements such as the International Convention for Safety of Life At Sea.

I wish to express my appreciation to those Members who responded to the survey. I invite all interested stakeholders to use the highly valuable information contained in this report and I also take this opportunity to reiterate my commitment to work with all in addressing issues related to marine and coastal services, which was clearly expressed by Members at the Eighteenth World Meteorological Congress, as an important area of focus.

P. Taalas
Secretary-General, WMO
1. INTRODUCTION

The World Meteorological Organization (WMO) strives to ensure that its Members are capable of providing the standard and recommended practices for marine meteorological service delivery, as described in the WMO Technical Regulations.

At the end of 2018, a survey was conducted to collate this status report of Members capabilities in the provision of the marine and coastal services. The survey results presented in this report, will help WMO better understand Member's needs to take appropriate action to target and prioritize areas requiring assistance, especially in relation to capacity building and training support.

These results will guide WMO priorities and plans for future improvement of marine and coastal services. Future improvements will be coordinated by the WMO Marine Meteorology and Ocean Affairs Division (MMO), with technical assistance from the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM).

The survey was open from 5 November to 31 December 2018. All Members were requested to complete it. In addition to 152 coastline countries, some landlocked countries have lakes, therefore questions were relevant to these services. A total of 72 countries filled out the survey. The global participation percentage was 47% although some of the replies were incomplete. More than 50% of the countries of the Regional Associations (RA) II-Asia, III-South America and VI-Europe filled out the survey.


Figure 2. Survey and Regional Associations (RA)

More than 80% of the countries with appointed National Marine Services Focal Points (NMSFP) responded to the survey.

Table 1. Survey and National Marine Services Focal Points

<table>
<thead>
<tr>
<th>NMSFP</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>49 countries</td>
<td>11 countries</td>
</tr>
<tr>
<td>Yes</td>
<td>32%</td>
<td>7%</td>
</tr>
<tr>
<td>No</td>
<td>23 countries</td>
<td>71 countries</td>
</tr>
<tr>
<td></td>
<td>15%</td>
<td>46%</td>
</tr>
</tbody>
</table>

Figure 3. In green: countries which responded to the survey
In red: countries which did not respond to the survey
Yellow triangles: countries with appointed NMSFPs
Table 2. Countries have filled out the survey (72)

<table>
<thead>
<tr>
<th>RA I Africa (16)</th>
<th>RA II Asia (15)</th>
<th>RA III South America (6)</th>
<th>RA IV North America, Central (4)</th>
<th>RA V South-West Pacific (7)</th>
<th>RA VI Europe (24)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algeria</td>
<td>Bahrain</td>
<td>Argentina</td>
<td>Canada</td>
<td>Australia</td>
<td>Belarus</td>
</tr>
<tr>
<td>Burundi</td>
<td>China</td>
<td>Brazil</td>
<td>Honduras</td>
<td>Indonesia</td>
<td>Bulgaria</td>
</tr>
<tr>
<td>Cameroon</td>
<td>India</td>
<td>Chile</td>
<td>Trinidad and Tobago</td>
<td>Malaysia</td>
<td>Denmark</td>
</tr>
<tr>
<td>Comoros</td>
<td>Islamic Republic of Iran</td>
<td>Ecuador</td>
<td>USA</td>
<td>New Zealand</td>
<td>Finland</td>
</tr>
<tr>
<td>Congo</td>
<td>Japan</td>
<td>Guyana</td>
<td>Philippines</td>
<td>Germany</td>
<td></td>
</tr>
<tr>
<td>Côte d'Ivoire</td>
<td>Kuwait</td>
<td>Uruguay</td>
<td>Solomon Islands</td>
<td>Greece</td>
<td></td>
</tr>
<tr>
<td>Libya</td>
<td>Myanmar</td>
<td></td>
<td></td>
<td>Timor-Leste</td>
<td>Hungary</td>
</tr>
<tr>
<td>Morocco</td>
<td>Pakistan</td>
<td></td>
<td></td>
<td>Iceland</td>
<td></td>
</tr>
<tr>
<td>Nigeria</td>
<td>Qatar</td>
<td></td>
<td></td>
<td>Jordan</td>
<td>Kazakhstan</td>
</tr>
<tr>
<td>Senegal</td>
<td>Saudi Arabia</td>
<td></td>
<td></td>
<td>Latvia</td>
<td>Lithuania</td>
</tr>
<tr>
<td>Sierra Leone</td>
<td>Sri Lanka</td>
<td></td>
<td></td>
<td>Netherlands</td>
<td></td>
</tr>
<tr>
<td>South Africa</td>
<td>Thailand</td>
<td></td>
<td></td>
<td>Norway</td>
<td>Poland</td>
</tr>
<tr>
<td>Sudan</td>
<td>United Arab Emirates</td>
<td></td>
<td></td>
<td>Portugal</td>
<td></td>
</tr>
<tr>
<td>Togo</td>
<td>Vietnam</td>
<td></td>
<td></td>
<td>Russian Federation</td>
<td>Slovenia</td>
</tr>
<tr>
<td>Tunisia</td>
<td>Yemen</td>
<td></td>
<td></td>
<td>Spain</td>
<td>Sweden</td>
</tr>
<tr>
<td>United Republic of Tanzania</td>
<td></td>
<td></td>
<td></td>
<td>Switzerland</td>
<td>Turkey</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ukraine</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>United Kingdom and Northern Ireland</td>
<td></td>
</tr>
</tbody>
</table>

Throughout this report, the answers obtained in each survey’s question will be analysed:
2. RESULTS OF THE SURVEY

2.1. CURRENT STATUS OF SERVICE PROVISION

**Question 6.** Do you provide marine forecasts and warnings for ports, lakes and/or coastal waters within your national jurisdiction?

![Pie chart showing the results of Question 6](chart.png)

**Figure 4.** Marine forecasts and warning for ports, lakes and/or coastal waters

This question has been responded to, by 72 countries. More than 90% of the organizations (65 countries) that had filled out the survey provide marine forecasts and warning for ports, lakes and/or coastal waters.

The remaining 10% of countries (7 countries) are not providing marine forecasts and warnings for ports, lakes and/or coastal waters. Of these, countries 57% (4 countries) are from to RA-I (Africa).
2.2. MARINE SERVICE DELIVERY IN THE ORGANIZATIONS

The questions will provide some background on how marine services are delivered within each National Meteorological and Hydrological Service.

**Question 7.** Is the responsibility for providing marine meteorological services officially assigned by your government by decree or any other legal text, to your organization?

This question has been responded to, by 63 countries. 90% of organizations (57 countries) have a responsibility assigned by their government for providing marine meteorological services. From this 90%, 14 countries (25%) are assigned by a law, 10 countries (18%) by a decree, and the remainder by any other legal text.

**Figure 5.** Responsibility for providing marine meteorological services

**Question 8.** Do you have any forecasting staff involved in producing marine and coastal forecasts and warnings?

This question has been answered by 65 countries. 92% of them (60 countries) have forecasting staff involved in producing marine and coastal forecast and warnings. Figure 6 gives the number of countries depending on the number of marine forecasters. Four countries had responded this question “Yes” but the number of marine forecasters is not available.

**Figure 6.** Number of marine forecasters
**Question 9.** If you answered yes to question 8, have your staff been specifically trained in producing marine and coastal forecasts and warnings?

This question has been responded to, by 62 countries.

![Pie chart showing 74% Yes and 26% No for staff trained in marine and coastal forecast and warnings.](image)

**Figure 7.** Staff specifically trained in marine and coastal forecast and warnings

The staff of more than 70% of the organizations receive or have received specific training in producing marine and coastal forecast and warnings. In general, all marine desk forecasters have received training in applied marine meteorology.

26% of organizations (16 countries) have no specific training in marine and coastal warnings. Of these 16 countries, 5 countries are in RA I (Africa) and 5 countries are in RA II (Asia).
2.3. MARINE AND COASTAL SERVICE DELIVERY

The following questions relate to the provision of marine and coastal services for shipping, boating and coastal activities and communities.

**Question 10.** For Coastal Waters marine forecast and warning products, how many nautical miles from the coast do these products cover?

This question has been answered by 64 countries.

![Nautical miles from the coast](chart)

Figure 8. Nautical miles from the coast covered for coastal waters marine forecast and warning products

For the 25 countries that noted “other distance”, comments showed that some of these organizations had products that varied in coverage from less than 10NM and up to 400NM, depending on the district at the regional level.

**Question 11.** How many days ahead are covered by your marine text forecasts?

This question has been answered by 61 countries.

<table>
<thead>
<tr>
<th>DAYS AHEAD COVERED BY MARINE TEXT FORECASTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 day</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>20 countries 32%</td>
</tr>
</tbody>
</table>

Table 3. Days ahead covered by marine text forecasts
Question 12. Please provide answers to the following questions about your marine forecast and warning service.

Do you issue warnings when speeds are Beaufort 8 (34 knots) or greater
Total respondents: 64 countries

- No: 12.5%, 8 countries
- Yes: 87.5%, 56 countries

Do marine forecast products include information about wind speed and direction
Total respondents: 62 countries

- No: 5%, 3 countries
- Yes: 95%, 59 countries

Do marine forecast products include information about the sea state?
Total respondents: 62 countries

- No: 11%, 7 countries
- Yes: 89%, 55 countries

Do marine forecast products include information about reduced visibility?
Total respondents: 62 countries

- No: 21%, 13 countries
- Yes: 79%, 49 countries

Do you provide specific assistance to authorities responsible for Search and Rescue, when requested?
Total respondents: 62 countries

- No: 2%, 1 country
- Yes: 98%, 61 countries

Figure 9. Marine forecast and warning service
Question 13. Which communication channels do you provide marine forecasts and warnings on?

In this question it is possible to select multiple responses. It has been answered by 64 countries.

<table>
<thead>
<tr>
<th>Communication channels</th>
<th>Percentage</th>
<th>Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>HF email transmissions (Grib data files for display using software on-board a vessel)</td>
<td>11%, 7</td>
<td>7 countries</td>
</tr>
<tr>
<td>NAVTEX</td>
<td>45%, 29</td>
<td>29 countries</td>
</tr>
<tr>
<td>HF Narrow-Band Direct Printing</td>
<td>16%, 10</td>
<td>10 countries</td>
</tr>
<tr>
<td>HF radiofax (images)</td>
<td>20%, 13</td>
<td>13 countries</td>
</tr>
<tr>
<td>Internet website &quot;light file sizes&quot;</td>
<td>34%, 22</td>
<td>22 countries</td>
</tr>
<tr>
<td>Internet website</td>
<td>88%, 56</td>
<td>56 countries</td>
</tr>
<tr>
<td>HF marine radio (voice)</td>
<td>28%, 18</td>
<td>18 countries</td>
</tr>
<tr>
<td>VHF marine radio (voice)</td>
<td>42%, 27</td>
<td>27 countries</td>
</tr>
<tr>
<td>SafetyNET (Inmarsat satellite text broadcast)</td>
<td>27%, 17</td>
<td>17 countries</td>
</tr>
<tr>
<td>Others</td>
<td>61%, 39</td>
<td>39 countries</td>
</tr>
</tbody>
</table>

Figure 10. Communication channels to provide marine forecasts and warnings

39 countries have responded “Others” which included: media and social networks, mobile apps, radio, television, fax, email and SMS.
2.4 GRAPHICAL PRODUCTS

Graphical products may be offered to users as images, Geographic Information System (GIS) shape files, or as formats for ship navigation systems. They may be presented on a website, web map service feed, mobile app, or be available for download from a website.

**Question 14.** Do you provide graphical products (via the internet or otherwise) for mariners to access?

This question has been answered by 63 countries.

**Figure 11.** Graphical products
**Question 15.** Please indicate all the marine elements that you provide in graphical form? (tick all that apply)

The percentages of Figure 12 are based against the number of countries that answered Yes to question 14 (44 countries).

**Figure 12.** Marine elements provided in graphical form
2.5 WAVE MODEL

Wave models may provide forecasts of parameters such as wave height, wave period, wave direction, wave spectrum, wave energy. Wave models may provide geographic coverage from global to regional scales.

**Question 16.** Do you currently access forecast guidance from a wave model?

This question has been answered by 63 countries.

54 countries (86%), currently access forecast guidance from a wave model. 14% of countries surveyed (9 countries) had no current access to forecast guidance from a wave model. 4 of these are from RA II (Asia).

**Figure 13.** Organizations access forecast guidance from a wave model

**Question 17.** Which wave models do you have access to?

We have no data from 11 countries and 9 countries have responded “No” to question 16. The responses to this question in Figure 14 are from 52 countries.

**Figure 14.** Wave models provided in graphical form
For the countries that noted access to wave models, the source of the wave models varied (as noted in Figure 14). Wave models being used included the NOAA Wave Watch III, Simulating WAve Nearshore (SWAN) and ECMWF WAve Model (WAM).

Countries (14) that have access to both wave model guidance provided by another NMHS and a wave model operated within their own organization are showed in Table 4.

<table>
<thead>
<tr>
<th>Australia</th>
<th>Germany</th>
<th>New Zealand</th>
<th>Turkey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>Indonesia</td>
<td>Senegal</td>
<td>U.R. of Tanzania</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>Malaysia</td>
<td>Spain</td>
<td>Vietnam</td>
</tr>
<tr>
<td>Denmark</td>
<td>Netherlands</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 4.** Access wave model guidance provided by other NMHS and wave model operated within the organization
2.6 OCEAN MODEL

Ocean models may provide forecasts of parameters such as sea surface temperature, ocean currents, sea level height or anomaly, sub-surface information, and salinity. Ocean models may provide geographic coverage from global to regional scales.

**Question 18.** Do you currently access forecast guidance from an ocean model?

This question has been answered by 61 countries.

30% of respondents, 18 countries, noted that they have no access to a forecast guidance from an ocean model. Of this 30%, more than 30%, six countries, are in RA I (Africa), and approximately 25% are in RA VI (Europe).

The reasons for ‘no access’ are varied. These include: lack of training and knowledge in accessing and using forecast guidance from an ocean model; lack of oceanographers in the country; and lack of awareness about where the ocean models are located.

**Figure 15.** Organizations access forecast guidance from an ocean model

**Question 19.** Which ocean models do you have access to? (you can tick multiple)

This question has been answered by 46 countries.

The organizations that provide operational ocean model predictions are ECMWF, ROMS, NEMO and others.

The countries that operate both an ocean model provided by other NMHS and an ocean model within their organization include Brazil, Finland, Indonesia, Malaysia, Nigeria and Norway.

**Figure 16.** Ocean models
2.7 SEASONAL OCCURRENCE OF SEA-ICE

**Question 20.** Do the waters in your forecast areas experience any seasonal occurrence of ice accretion hazards to ships, or sea-ice formation (including icebergs)?

This question has been answered by 61 countries.

![Seasonal occurrence of ice accretion hazards to ships, or sea-ice formation](image)

**Figure 17.** Seasonal occurrence of ice accretion hazards to ships, or sea-ice formation (including icebergs)
2.8 SEA-ICE SERVICE STATUS

**Question 21.** Do you issue ice accretion warnings?

This question has been answered by 23 countries.

The 65% of survey respondents who issue Ice-Accretion include Canada, China, Denmark, Finland, Iceland, Latvia, Lithuania, New Zealand, Norway, Poland, Russian Federation, Sweden, Ukraine, United Kingdom of Great Britain and Northern Ireland, United States of America.

Some Members who answered ‘No’ to responsibilities for Ice-Accretion warnings, noted

**Figure 18.** Ice accretion warnings

<table>
<thead>
<tr>
<th>RA</th>
<th>Country</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>Argentina</td>
<td>We are in the process of introducing ice accretion warnings, but the implementation of improvements is being delayed by a lack of staff.</td>
</tr>
<tr>
<td>V</td>
<td>Australia</td>
<td>We await guidance from WMO on standard thresholds specified by IMO.</td>
</tr>
<tr>
<td>III</td>
<td>Chile</td>
<td>Neither the authorities nor the users have requested this service.</td>
</tr>
<tr>
<td>VI</td>
<td>Germany</td>
<td>no special warning bulletins issued, however, forecasts may include advice</td>
</tr>
<tr>
<td>VI</td>
<td>Netherlands</td>
<td>Ice accretion forecasts are incorporated in the text forecasts. No separate warnings are issued.</td>
</tr>
<tr>
<td>I</td>
<td>South Africa</td>
<td>Not necessary in the coastal areas. Only applicable for the high seas areas we are responsible for.</td>
</tr>
</tbody>
</table>

**Table 5.** Reasons why the countries are not responsibility for Ice-Accretion warnings
**Question 22.** Do your marine forecast products include information about sea-ice or icebergs?

This question has been answered by 23 countries.

**Figure 19.** Information about sea-ice or icebergs

- Yes: 74%, 17 countries
- No: 26%, 6 countries
2.9 COASTAL HAZARDS AND SERVICES

**Question 23.** Have you had any incidences of coastal inundation and/or storm surge (not including tsunami) that has damaged infrastructure and/or resulted in casualties?

This question has been answered by 62 countries.

![Incidence of coastal inundation or storm surge](chart)

**Figure 20.** Incidences of coastal inundation, storm surge that has damaged infrastructure and/or resulted in casualties

**Question 24.** Do you have relationships with government agencies in relation to the impacts of coastal hazards?

This question has been answered by 62 countries.

![Relationships with government](chart)

**Figure 21.** Relationship with government agencies in relation to the impact of coastal hazards
**Question 25.** Do you provide any services in relation to the impacts of coastal hazards?

This question has been answered by 62 countries.

Of the 68% of respondents who provide services for coastal hazards, it was noted that these hazards include: Coastal flood and storm surge forecasts, tsunami, rogue wave, sea ice, typhoon, rip current, algal bloom.

Of the 32% of respondents who do not provide any service in relation to the impacts of coastal hazards, there is a varied breakdown across all Regional Associations (RA I-Africa: 20%, RA II-Asia: 25%, RA III-South America: 20%, RA IV-North America, Central: 5%, RA V-South West Pacific: 10% and RA VI-Europe: 20%).

**Figure 22.** Services in relation to the impacts of coastal hazards

**Question 26.** Do you have any measures in place for educating the public about coastal hazards and related products?

This question has been answered by 62 countries.

48% of the organizations have measures in place for educating the public about coastal hazards and related products., the main ones being:

- Website, social media, social networks, blogs, TV and radio programs
- Public events: training courses, seminars, workshops and regular briefings open to the public
- Regular meetings with working groups of the Governments
- Science propaganda
- Awareness programs for schools
- Feedback from users and analyze the results

**Figure 23.** Measures in place for educating the public about coastal hazards and related products
2.10 SERVICE DELIVERY MANAGEMENT

The following questions relate to aspects of the WMO framework for service delivery, and quality management standards.

**Question 27.** What processes do you have in place for engaging with your users?

This question has been answered by 62 countries.

![Figure 24. Processes in place for engaging with users](image)

**Question 28.** Do you evaluate/verify the product accuracy of your marine services?

This question has been answered by 62 countries.

![Figure 25. Evaluation/verification of the product accuracy of the marine services](image)

The main barriers that prevent the organizations performing verification activities are:

- Lack of human resources
- Not enough real time data is available (few measurements to verify against)
- Lack of ability because there are no technical staff specialized in marine meteorology to do the verifications
- No appropriate tools for providing marine meteorological services.
**Question 29.** Do you assess user satisfaction with your services?

This question has been answered by 62 countries.

The main assessment activities and methods used are: questionnaires, user surveys, web analytics, web feedback forms, consultative meetings, direct contact with the forecasters and informal contacts with users, etc.

More than 50% of the organizations assess their user satisfaction. Of the 40% that do not assess user satisfaction with their services, 28% are from RA I-Africa, and 24% are from RA VI-Europe.

**Figure 26.** Assessment user satisfaction with the organizations services

**Question 30.** Do you have any backup or contingency planning procedures for the production and dissemination of marine services?

This question has been answered by 62 countries.

**Figure 27.** Backup or contingency planning procedures for the production and dissemination of marine services.
66% of organizations have contingency planning procedures for the production and dissemination of marine services. Those that do not have any plans or backup in place (34%) include RA I - Africa (33%) and RA VI - Europe (24%).

**Question 31.** Indicate which level of the *WMO Guide to the Implementation of Quality Management Systems for National Meteorological and Hydrological Services and Other Relevant Service Providers* (page 32, WMO-No.-1100) you have achieved for the production or management of marine services:

This question has been answered by 61 countries.

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**Figure 28.** Level of the WMO Quality Management implementation framework

Most of the organizations have not commenced any implementation of quality management for marine service.
**Question 32.** Indicate which implementation stage of the WMO Marine Forecaster Competency Framework, *Guide to Competency* (page 46, WMO-No. 1205) you have achieved for the production of marine services:

This question has been answered by 60 countries.

![WMO Marine Forecaster Competency Framework](image)

**Figure 29.** Implementation stage of the WMO Marine Forecaster Competency Framework

**Question 33.** What capability do you have in place to deliver marine service related training and education to your staff?

This question has been answered for 57 countries.

![Staff training and education](image)

**Figure 30.** Capacity to deliver marine service related training and education.
3. GAPS AND PRIORITIES

**Question 34.** What are your gaps and priorities for marine-related training packages during the next 3 years?

The responses to this question were open-ended, and are shown below, separated into ‘Gaps’ and ‘Priorities’:

**GAPS**

- Lack of human resources needed to offer a greater variety of marine services.
- Training/Capacity building:
  - Application of satellite data
  - In sea ice edge and ice accretion
  - Instrumentation
  - Prediction of sea surface temperature through satellite images
  - Prediction of tides, internal or swell waves, in lower and upper sea currents affecting the coasts, in deep or lower waves
  - Maritime safety
  - Use of wave spectra
  - Use and interpretation of ensemble
  - Radar information to marine forecasting
  - Interpretation of Numerical Weather Prediction data and Estimation of Sea State
  - Numerical prediction (storm surge models, pollution - oil spill...)
  - Marine extreme events and coastal hazards
  - Programming and the utilization of numerical models of waves
  - On the use of numerical observations of wind and rising waves detected by satellite
  - On how to develop a quality program for marine services
- Providing services for fog and reduced visibility
- More interaction with boundary METAREA Coordinators
- Study experiences of disseminating marine forecasts in other countries.
- Satellite data application. Interpretation of satellite images
- Ensure that the Marine Forecasting Service becomes operational
- Increase the number of seaborne meteorological instruments in national waters
- Put in place tools for sending and receiving weather information and warnings
- More validation and verification of the same increased use of models
- More oceanographic stations
- Modeling statistical analyzing methods
- Lack of funding
- Purchase the equipment and installed
PRIORITIES

- Keep contact with other METAREA Coordinators
- Continued cooperation with storm surge emergency management actors
- Manage financial resources for hiring and training staff.
- Develop marine services and increase the staff competency
- To groom more experts as many as possible
- Yearly test on knowledge/subjects, and if necessary training/schooling
- Yearly training day for maritime meteorologists
- Near/yearly simulation exercise for storm surge situations
- Improving and verifying wave models and marine observations network
**SUPPORT FOR IMPLEMENTING A MARINE SERVICE**

**Question 35.** Outline the reasons for not providing marine forecasts and warnings for your national jurisdiction:

Almost all organizations agree with the following reasons:

- Lack of equipment
- Lack of human resources
- Lack of training
- Lack of information (observational data and marine forecasting and warning models)
4. COMMENTS

**Question 36.** Please indicate any other information about your marine and coastal services that you wish WMO to be aware of.

The responses to this question were open-ended, and are shown below, per country:

**Argentina:** improvements will be made to the marine meteorology service during the first half of 2019. For example, wind warnings will be issued as a separate product, which will be notified together with the corresponding documentation to WMO.

**Australia:** in 2019-2020 Australia intends to review and amend the service overlap with METAREAs VIII and XI so that services boundaries align with METAREA boundaries.

**Canada:** ECCC is currently involved in a joint initiative with the Canadian Coast Guard to identify any duplication in the broadcast of marine weather information. The goal of this initiative is to mitigate such duplication between the ECCC Weather-radio broadcast and coast guard Continuous Marine Broadcast, and consolidating broadcast services if and where possible. This initiative is restricted to coastal VHF broadcast services.

**Chile:** SERVIMET produces the relevant information for METAREA XV (in English and Spanish). It has five weather centres, around a hundred automatic stations and some voluntary observing ships (VOS). It provides navigation support in Antarctic waters and is a member of the National Oceanographic Committee (CONA), along with state bodies and educational institutions in the field of marine sciences. Recent years have seen an increase in the occurrence of extreme marine weather events, attributable to climate change. These include greater frequency and intensity of storms, storm surges and waterspouts as well as prolonged periods of drought.

**China:** we also provide other marine forecasting products regarding ocean currents, sea temperature, El Niño, beach forecasting, oil spills, sea level, polar environment and marine weather, and also undertakes duties such as establishing the China marine meteorological and environmental forecasting operational development plan, collecting and distributing real-time observation data, and providing related support for public and emergency management to organize significant marine disaster investigation and assessment.

**Comoros:** update management’s policy for delineating national waters. Support the department until it is functioning satisfactorily. Increase the number of coastal weather stations and the number of buoys in each strategic sea area. Set up instruments and telecommunication equipment to facilitate links within the same sea area.

**Congo:** our department has a shortage of trained, qualified marine meteorology staff and lacks equipment (a marine forecasting station). We thank you for all support that will help us to enable our department to develop.

**Côte D’Ivoire:** the national meteorological organization sorely needs a station for marine matters, among other equipment (current meter, tide gauge, waver recorder etc.) along the Ivorian coast to better understand and forecast episodes of strong wind, dangerous swell and coastal erosion. In addition, we would like to acquire an ocean model, as well as the keys to wave products on the Synergie operating system. All that would enable an improvement in meteorological support to marine activities.
**Denmark:** we would like WMO to Work for the abolishment of requirements to communicate marine warnings and forecasts over coastal radio. As ships have satellite-based internet the use of voice comms over coastal radio seems obsolete, but is extremely expensive.

**Germany:** we provide worldwide ship routeing, meteorological consultancy on-board German research vessels and flight weather forecasts for the DROMLAN community in Antarctica.

**India:** ocean state forecast is provided by India National Centre for Ocean Services INCOIS Hyderabad

**Indonesia:** to be able to give warning forecast within our national territory

**Kuwait:** we aspire to develop marine and coastal services and are among the objectives of our national service for the coming years

**Morocco:** the National Meteorology Directorate provides meteorological support to search and rescue operations and operations to combat marine pollution

**Myanmar:** especially for Marine training, B Sc, M Sc, PhD

**New Zealand:** METAREA XIV has a preparation service for their "Islands" region. With the marine competencies coming on line in the near future, further clarification is needed as to whether the issuing service is accountable or the preparation service. Increased broadcast costs as a result of the INMARSAT migration and new satellite providers coming online

**Nigeria:** NiMet as an Agency of the Federal Government is expected to generate revenue from the services she renders to the various sectors of the Nigerian economy. Replicating the success she has recorded in this regard in the Aviation sector is proving to be very difficult. It will be highly appreciated if WMO can give us any idea on how to go about it or share the success story of NHMSs that have overcome this challenge in their country(ies).

**Norway:** prepare and issue services for METAREA XIX

**Pakistan:** training and equipment required

**Philippines:** to be able to produce the Ocean Wave Chart in our Area of Responsibility. These include wave height and direction. To be able to issue Small Sea Vessels Advisory for strong winds (below Gale Force wind). To be able to issue Route Forecast to every major city in the Philippines

**Portugal:** as national focal point I would like to receive from WMO/IOC and IMO, notifications on future developments plans at international level, in this area of marine meteorology and oceanography

**Qatar:** interested in hosting Marine weather Demonstration Research Project similar to Aviation

**Russian Federation:** Roshydromet is responsible for preparing hydrometeorological information in the Russian Federation; the Russian Ministry of Transport is responsible for raising awareness about that information among users. The Roshydromet research institutes (the Arctic and Antarctic Research Institute, the Hydrometeorological Centre of Russia, the
National Oceanographic Institute, and the Far East Research Institute for Hydrometeorological Information) prepare the information in partnership with the territorial water departments of the hydrometeorological service for the three METAREAs that Russia is responsible for and the waters of the Baltic, Black, Azov and Caspian seas, including distant offshore waters of the north-west Pacific and Arctic oceans, with a lack of information needed for marine forecasting verification.

**Senegal**: roving awareness-raising and training workshops for fishermen and journalists on using meteorological information.

**Sierra Leone**: coastal erosion and sea level rise

**Slovenia**: Slovenian territorial waters are placed in the northern part of the Adriatic Sea and do not include open waters. Therefore extreme sea conditions as can be seen on more open waters are relatively rare and this is probably the main reason for not getting enough employees to work only for the marine services.

**South Africa**: we recently a 10 year master plan was approved by the board of the South African Weather Service. This master plan includes the establishment of a marine unit in Cape Town including researchers and forecasters to enhance the current service. We are also in the process of implementing a storm surge model and a high resolution wave model. We are planning on doing a full gap analysis on our marine service and will work on filling these gaps over the next year or so.

**Sudan**: training for 8 observers in marine observation stations training for 2 senior forecaster to put plan for the national marine service provide modern instruments for marine service and obtain the funding to build the regional marine forecast center.

**Timor-Leste**: need access to WMO marine ocean forecast and provide assistant to develop our marine forecast and also give opportunity to have more training for our staff.

**Togo**: activate all marine forecasting models in the PUMA 2015 system in Togo, acquire a regional marine forecasting model that is specific to Togo and based on the Thai model and train marine users in how to use meteorological services. Cost: US$ 7 000

**Trinidad and Tobago**: the limited marine meteorological services provided reach end users indirectly via the coastal radio station. The TTMS does not have the infrastructure nor regulatory arrangements in place to communicate via HF radio, NAVTEX, or otherwise.

**United Republic of Tanzania**: Transporters, Fishers, Oil and Gas explorers, Researchers, Tourism, Sports, Rescue Operations.

**Uruguay**: We would like to take up every opportunity in terms of both staff training and tools (ocean models, coastal models, etc.) and techniques for issuing marine warnings, as we are in the process of establishing this area.

**Vietnam**: the marine observation in Vietnam is very poor. Most of the information based on numerical model. It is difficulty to validate the model in ocean.

**Yemen**: We need a naval model with training (capacity building).
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