Technical Memo

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876

Floods, droughts, fire and beyond… Are existing forecasts enough?

8th Global Dialogue Platform session summary

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Abstract

This document describes ECMWF's involvement in the Anticipation Hub, a network to promote and enhance Forecast-based-Financing activities, and summarises key user-driven for high-impact environmental forecasts and services to aid agencies and the wider FbF network obtained during an interactive virtual session at the 8th Global Dialogue Platform annual meeting, in December 2020.

1. Introduction

High impact weather and environment forecast products, beyond the traditional weather forecasts, are now produced routinely globally. They are made available to users in the form of data (e.g. time series showing the temporal evolution of a variable for a given point) and products (e.g. maps highlighting areas where values crossing a pre-defined threshold are expected), often through web platforms and data services. ECMWF has been a provider of weather forecasts for over 4 decades, enhanced and complemented by more specific and targeted environmental products in more recent years, with an ever-increasing portfolio of data and products related to environmental forecasting developed and delivered through its contribution to the Copernicus programmes, especially the Copernicus Emergency Management Service, but also through the data services of the Copernicus Climate Change Services.

To ensure that the forecasts produced and the services provided are fit-for-purpose, it is important to understand the landscape of users from a range of sectors and with them, regularly review the offering to shape the future evolution of the services. ECMWF has a long experience in users' engagement, for example through its 'Using ECMWF's Forecast' annual workshop and through its outreach activities organised under the umbrella of Copernicus Climate Change Service, Copernicus Atmospheric Monitoring Service and Copernicus Emergency Management Service, as well as other activities such as the Global Flood Partnership.

One important sector for global high impact environmental forecasts is the humanitarian sector, which aims to reduce the devastating impact of environmental disasters through better preparedness and response. The Anticipation Hub, launched in December 2020, as the initiative of a number of Red Cross/ Red Crescent organisations, serves as a knowledge and exchange platform for humanitarian action, with a mission to develop a network of users to exchange and to act as key stakeholders for future development. As part of its continuous effort to reach out to different communities in their own platform, ECMWF is a partner of the Anticipation Hub and has been hosting a virtual interactive session to the 8th Global Dialogue Platform on Anticipatory Humanitarian in December 2020.

This report provides a brief description of the Anticipation Hub and dialogue platform, ECMWF's contribution to this initiative and the main findings of the ECMWF-led session on high-impact environmental forecasts at the 8th Global Dialogue Platform.

2. Forecast-based-Financing and the Anticipation Hub and Dialogue Platform

2.1. Forecast-based Financing

Traditionally, humanitarian actions are triggered following a crisis. Forecast-based-Financing (FbF) is a mechanism put in place so that funding to support humanitarian actions is released before the crisis starts, based on forecast information and risk analysis. Such disaster anticipation aims to prevent as

much as possible the impact of the crisis, hence reducing suffering and losses. It relies on the definition of high-impact weather forecast triggers that inform the potential release of resources and implementation of early actions.

FbF is now one of the instruments for 'early warning early actions' used by the Red Cross and Red Crescent Centre (RCRCC). It was trialled in November 2015, when the Uganda Red Cross (URC) activated a humanitarian action triggered by a scientific forecast of flood risk, based on the Global Flood Awareness Systems (GloFAS) forecasts[1], a service of the Copernicus Emergency Management Service operated by ECMWF. Since then, FbF has been piloted in different regions, with a guidance document published in 2020 aiming to describe how to develop impact-based forecasts and warnings (Harrowsmith et al., 2020, URL1).

2.2. Anticipation Hub

The Anticipation Hub is an exchange and collaborative online platform for the global anticipation community seeking to engage practitioners, scientists and policymakers with interest in FbF. Key activities include technical support & advice, stimulating innovation, learning & exchange, and promoting lasting change through sustained policy & advocacy efforts (Figure 2.1). It is a cooperation with the International Federation of Red Cross and Red Crescent Societies (IFRC) and the Red Cross Red/Crescent Climate Centre (Climate Centre), the German Red Cross (GRC) with support of the German Federal Foreign Office.

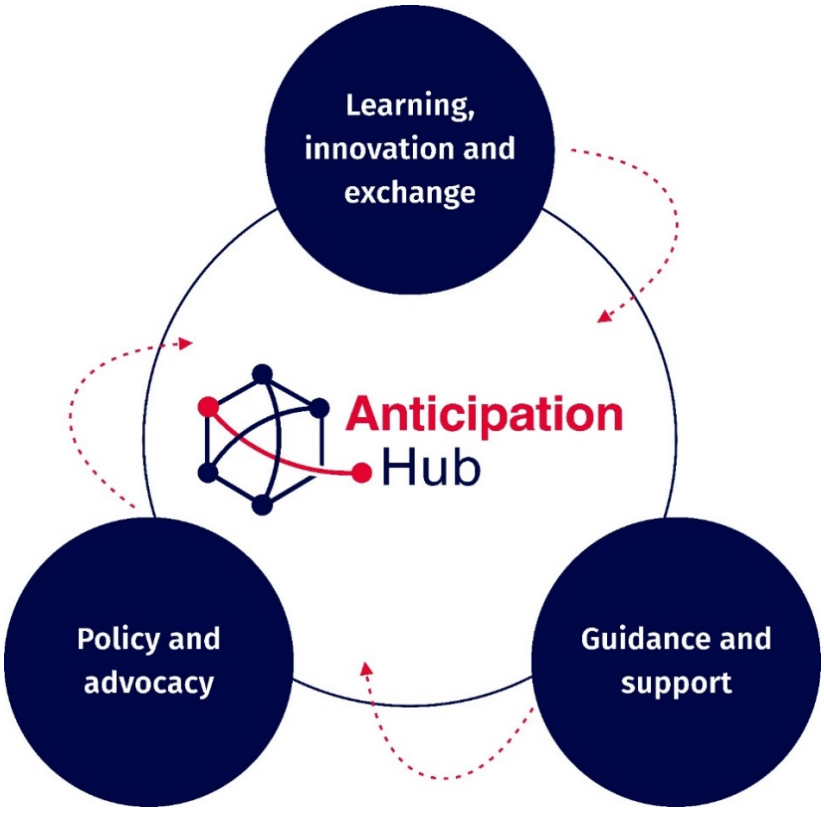

Figure 2.1. Key activities of the Anticipation Hub. Source: URL2.

[1] https://understandrisk.org/forecast-based-financing/

The Anticipation Hub online platform was launched the 8 December 2020 during the 8th Dialogue Platform virtual meeting. It aims to feature webinars, guidance material, tools, case studies, a twitter channel, and other collaborative tools to foster and empower a network of actors with interest in Forecast-based-Financing.

More information on the Anticipation Hub can be found in URL2.

2.3. Dialogue Platform

The Dialogue Platform is an initiative from the International Federation of Red Cross and Red Crescent Societies (IFR), German Red Cross (GRC) and the Red Cross Red Crescent Climate Centre which started in 2015. It aims to develop a methodology for FbF through exchange between participants to help and enable the implementation of FbF in pilot countries.

Since its onset in 2015, the Global Dialogue Platform has taken place annually in Berlin, with additional Regional Dialogue Platforms held in Africa, Asia and Latin America. The last meeting (8th Global Dialogue Platform) took place virtually the 8-10 December 2020.

More information on the Dialogue Platform can be found in URL3.

2.4. ECMWF's role in the Anticipation Hub

In October 2020, ECMWF was invited to become a partner of the Anticipation Hub. Its contribution focuses in two mechanisms:

- sharing knowledge, capability and experience, specifically in the context of GloFAS flood forecasts access and interpretation. This includes support of global flood forecasting training activities within the framework of GloFAS
- supporting activities of the Anticipation Hub. This includes contributions to new knowledge content disseminated through the online exchange platform and Working Groups, and identification of opportunities to align efforts on science, policy and practice for enhancing anticipatory action.

As part of the launch of the Anticipation Hub in 2020, ECMWF led a session at the 8th Global Dialogue Platform on Anticipatory Humanitarian Action on the 10th December 2020. This was an opportunity for ECMWF to reach out and gather information on the use of environmental forecasts in the wider aid community.

3. Interactive session 'Flood, drought, Fire and beyond: are existing forecasts enough?' at the 8th Dialogue Platform

The 8th Global Dialogue Platform was held virtually the 8 to 10 December 2020 due to the restrictions in place over Europe and the world regarding people gathering during the pandemic of COVID-19.

More than 42 interactive sessions were organized during the 3-day event. ECMWF hosted a session entitled 'Flood, droughts, fire and beyond: are existing forecasts enough?'. The session aimed to get feedback and insight from a range of forecast users on their current and ideal forecasting systems, with a particular focus on the usefulness of existing high-impact environmental forecasts products and services, and suggestions for desired service components. It gathered 17 participants. Due to privacy laws, not information on participants was available.

The 50-minute session was structured using three key themes: 'What?', 'How?', and 'When?'. Each theme was introduced with a combination of short presentations, demonstrative videos, and Padlet interactive idea board, a free online tool that can be used simultaneously by many to post notes on a common page (https://padlet.com). For each theme, the participants had 10 minutes to answer and rate a set of pre-prepared direct and open questions. More than one entry per participant was possible for any question, but not all participants contributed to all questions.

Two main sectors were represented by the participants, who listed the following use of environmental forecasts:

- humanitarian actions: early warning/ early action (national and local scale) and horizon scanning, identification of lead-time for activation / instigating humanitarian action, mobilising people to take precautionary measure and trigger design
- re/insurance: setup and monitor of flood triggers, risk financing/parametric insurance, infrastructure damage assessment

In the background, the team worked to extract the key messages emerging from the responses in the Padlets, enabling the 17 participants to be provided with an initial overview of the outcomes at the end of the session, presented in the last 10 minutes of the session.

The next sections list the main suggestions received from the participants for each of the three themes.

4. What

This session aimed to better understand the type of high-impact environmental forecast products required by users, through three direct questions and five open questions. A screenshot of the board used in the session is given in Figure 4.1 and can be accessed at URL4.

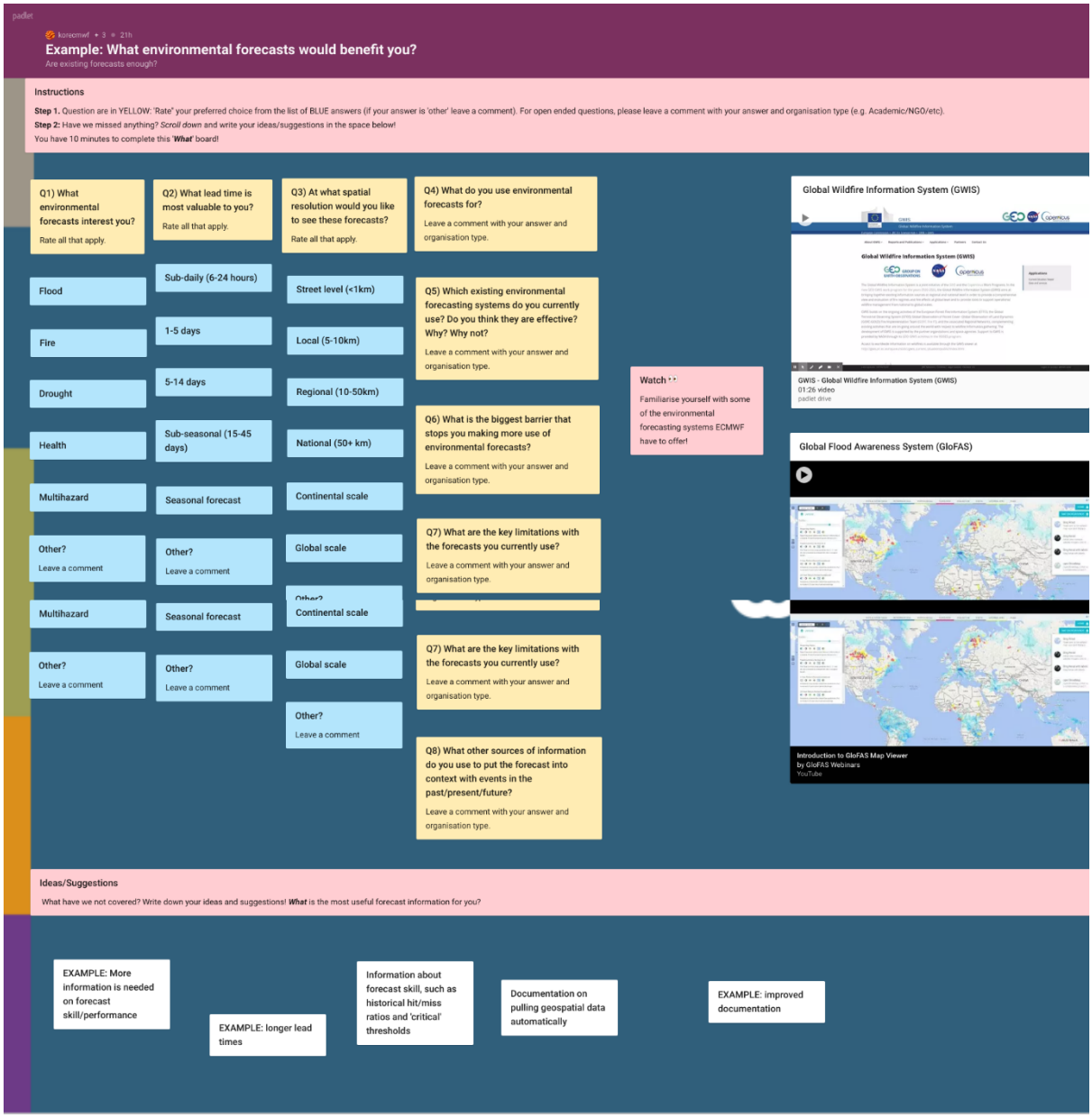

Figure 4.1. The 'What' padlet board

4.1. Headline messages

- Greatest interest in flood forecasts followed by drought and multi-hazard forecasts
- Interest in all forecast ranges, with medium range (5-14days) scoring highest, preferred lead time depending on hazard and country; Seasonal forecasts mentioned for drought forecasting
- Sub-daily forecasts scored lowest, as early actions require more lead time for decisions to be made
- Probabilistic forecasts provided for different lead-times critical for decision makers
- Forecasts at regional (10-50km), local (5-10km) and street level (<1km) scales ranked in that order

- GloFAS used by 80% of participants naming their current forecasting system; one key aspect of interest is its global coverage and information provision in areas where no other data is available
- Key barrier of use of forecasts: disconnect between forecast providers / hazard warning generators and on-the-ground users / response actors (unprepared, not trusting/ understanding forecasts)
- Key limitation of existing forecast systems: Too coarse spatial resolution/scale, errors in forecast timing, balancing lead time and forecast probability; for seasonal forecasts: low forecast skill and too infrequent release (note: no comment was received regarding the sub-seasonal range, nor the preferred update frequency)
- Forecasts contextualised with information on historic events, gauged data, and real-time impact reports from in-situ and earth observations

4.2. Direct questions

Summary graphs of the response to the direct questions are shown in Figure 4.2 to Figure 4.4.

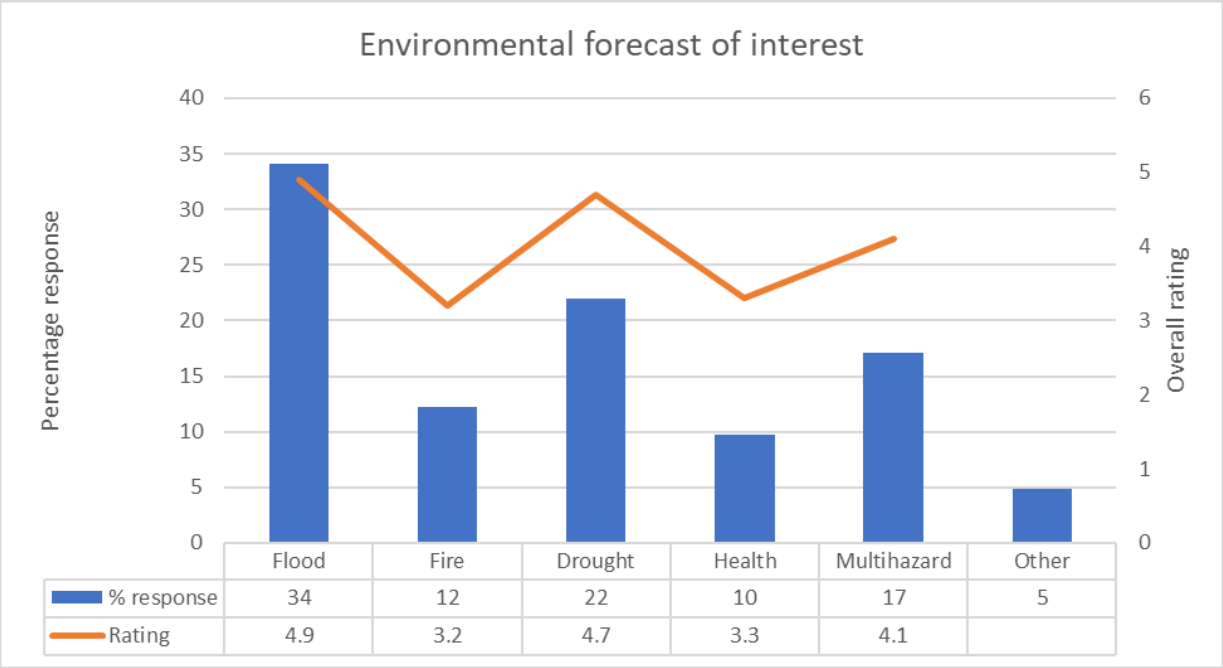

Figure 4.2. Responses to the question 'What environmental forecasts interest you? A total of 41 responses were received

Other environmental forecasts listed by participants include coastal floods, heatwaves and coldwaves.

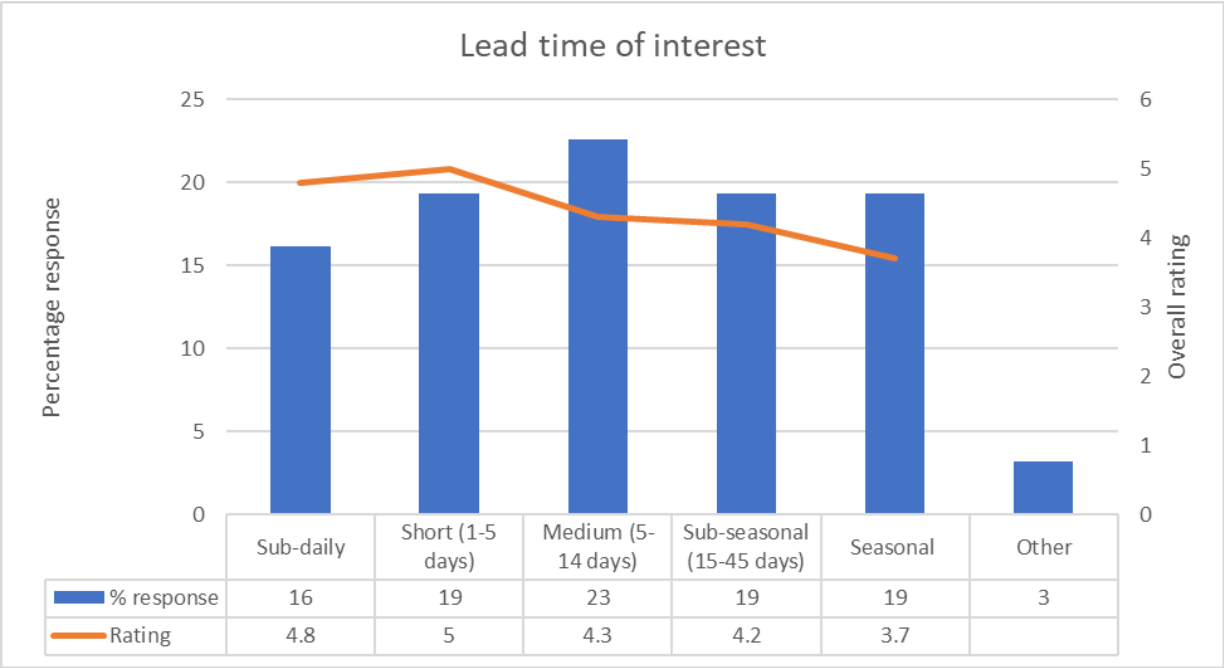

Figure 4.3. Responses to the question 'What lead time is most valuable to you?'. A total of 31 responses received

Seasonal range was highlighted for drought forecasting (no-regret option). The possibility to have forecasts provided for different leadtimes (from medium to seasonal) was mentioned as critical for decision makers as this covers different decision making processes.

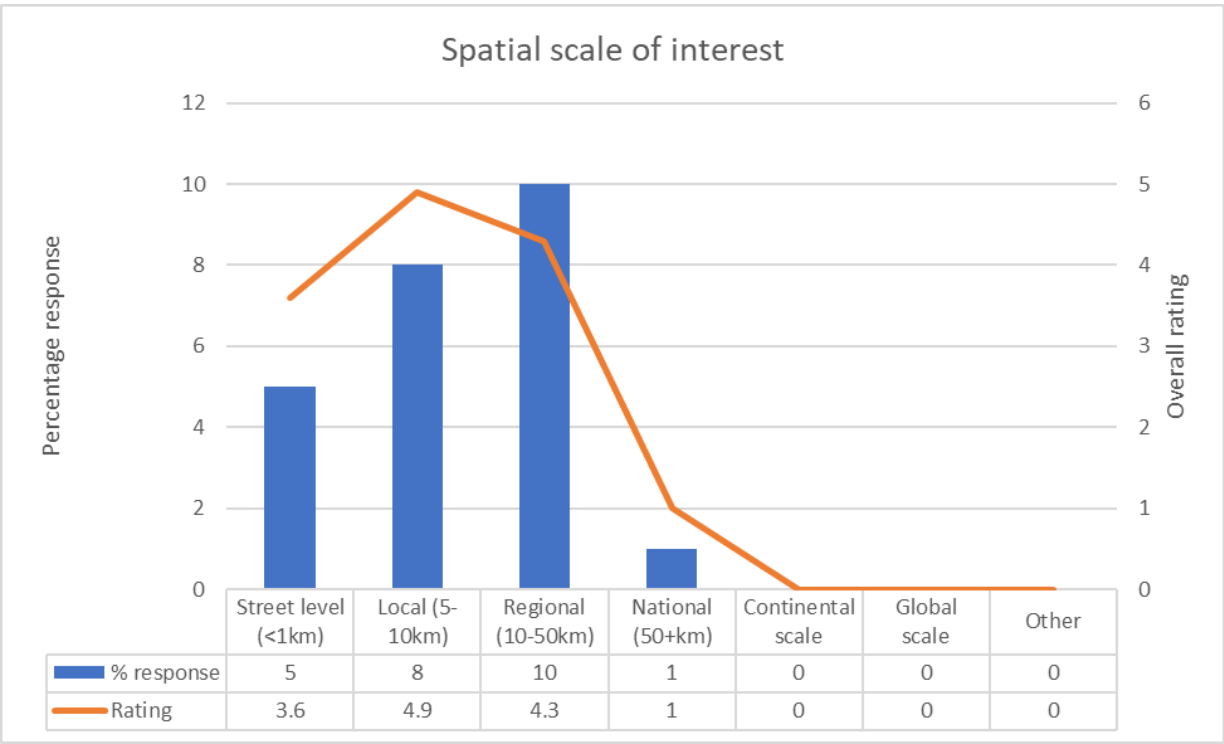

Figure 4.4. Responses to the question 'At what spatial resolution would you like to see these forecasts?'. A total of 24 responses received

4.3. Open questions

Theme	Detail
Use of forecasts	• Humanitarian purposes • Early warning • Insurance / Risk Financing • Forecasting / Anticipate triggers • Decision making • Consultancy
Systems used	• GloFAS only with more than one entry (80% of respondent) • 20 systems listed[2]
Feedback on GloFAS	• Positive: global coverage; information where no other data is available • Negative: no information on forecast evaluation
Barriers to use of forecasts[3]	• Limited technical capacity of users • Critical gap between forecast providers and disaster responders/ decision making process • Un-prepared users with limited response capacities • Forecasts not understood, not trusted for local early action
Limitation of existing forecast system	• Resolution/Scale (3 responses) • Timing of forecast release (3 responses) • Skill associated with the forecasts (2 responses).
Additional information source	• Historical events (2 responses) • Gauged data (2 responses) • Remote sensing (1 response) • Twitter/ real-time impact report (1 response)
Suggestions	• Unknown confidence in forecasts but without any suggestion regarding the attributes of the forecasts (e.g. uncertainty and/or skill) that should be provided • Forecasts skills expressed as historical hit/miss ratios and 'critical' thresholds

[2] Listed forecasting systems: EFFIS, NOAA, IRI, FEWSNET, FAO, ECHO, PAGASA, GEOGLAM, IFRC, WFP. IPC, FAOSWALIM, AHA. Institute of Hydrometeorological and Environmental Pacific Disaster Centre, HEWN, National Museum of Natural History Global Volcanism Program, PAHOFSNAU, WMO, Mekong River Commission, UK Met

[3] Comments only from 2 participants

5. How

5.1. Aim of the question

This session aimed to better understand the way high-impact environmental forecast information should be delivered, through two direct questions and seven open questions. A screenshot of the board used in the session is given in Figure 5.1 and can be accessed at URL5.

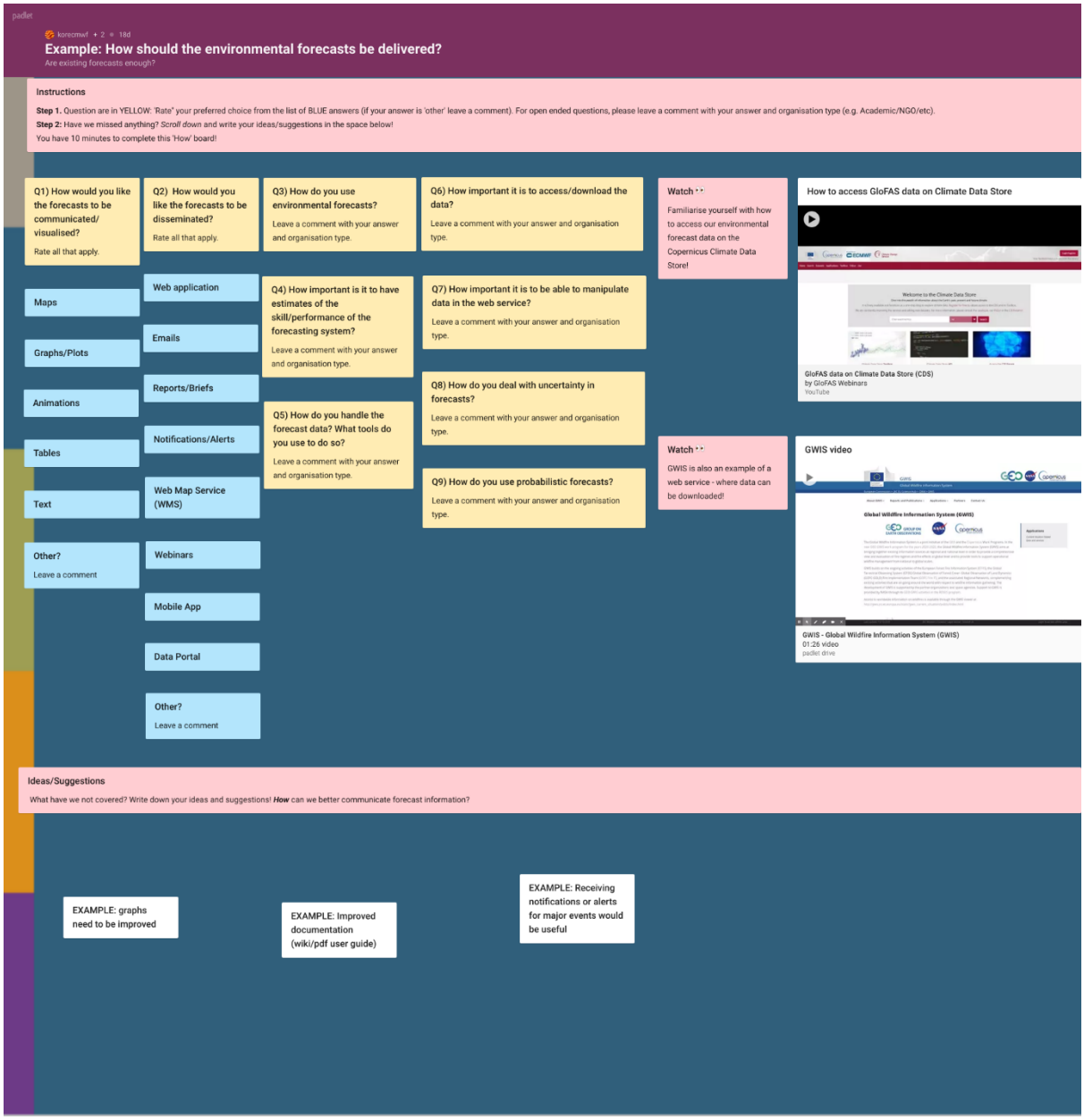

Figure 5.1. The 'How' padlet board

5.2. Headline messages

- Products preferred as maps, graphs and plots
- Products to be disseminated through data portal, notifications/alerts, and web services

- Forecasts/ raw data used as entry of users' system (e.g. through APIs), comparison with other systems, and further analysis
- Forecast skill/ performance important to 1) compare forecasts; 2) build confidence in system
- Performance information should not overshadow the forecast itself
- Python, (Q)GIS, and R used programmatically to handle forecast data.
- Ability to download/access the forecast data
- No need for data manipulation functionality within the web service
- Uncertainty assessed by users from own evaluation against other data (other forecasts and past events)
- Uncertainty communicated to decision makers to weigh up uncertainty vs risk
- Probabilistic forecasts not yet used, but considered by some for future applications

5.3. Direct questions

Summary graphs of the responses to the direct questions are shown in Figure 5.2 to Figure 5.3.

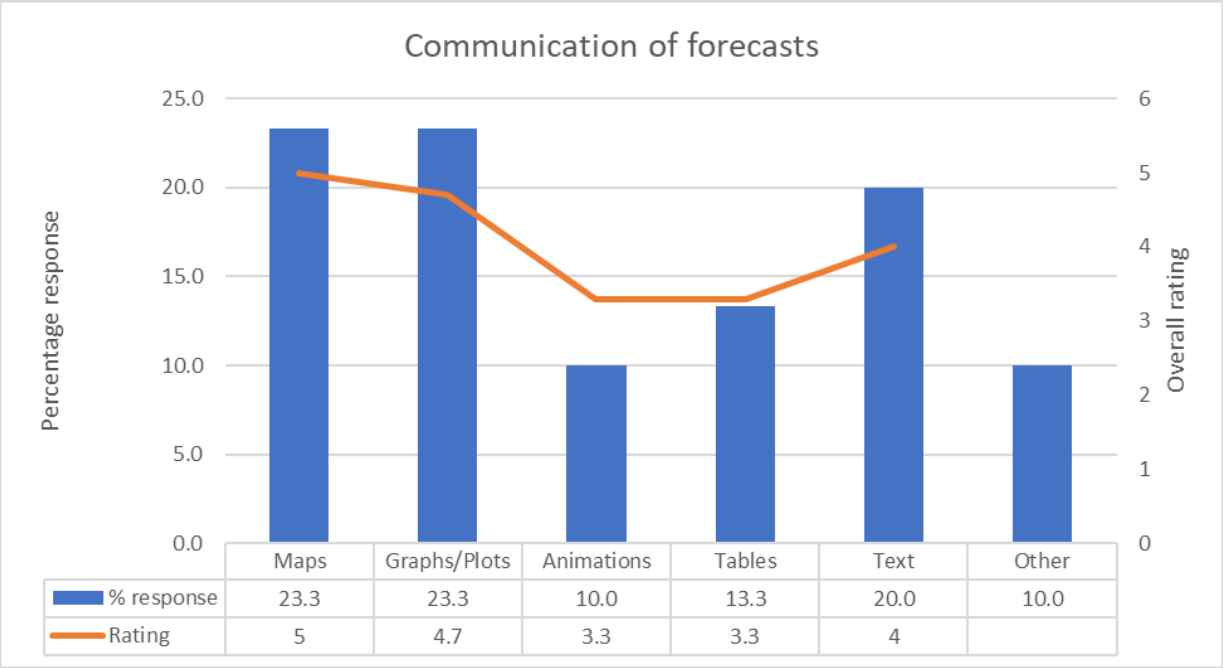

Figure 5.2. Response to the question 'How would you like the forecasts to be communicated/visualised?'. In total 30 responses were received

Raw geospatial data suggested as other form of communication.

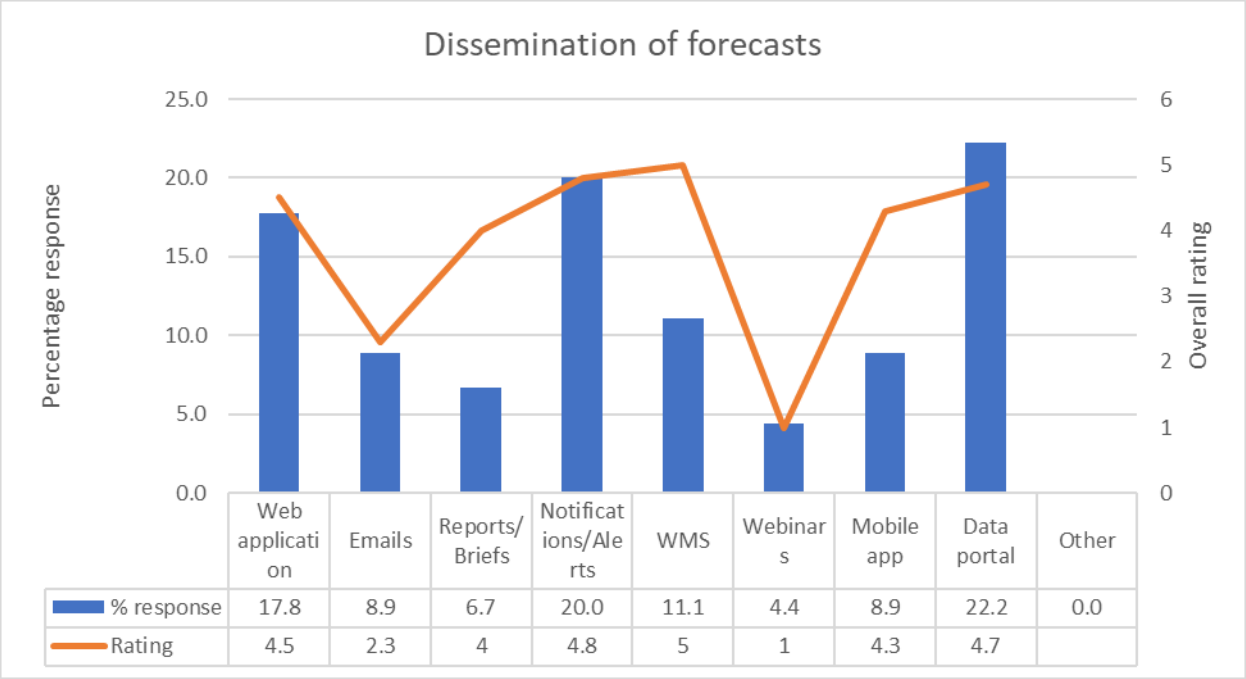

Figure 5.3. Response to the question 'How would you like the forecasts to be disseminated?'. In total 45 responses were received

Reports and briefs should be in an easy/ accessible language and include infographics and analysis of potential on-the-ground impact.

5.4. Open questions

Theme	Detail
How forecasts are used	• Data feed into own system for additional pre-analysis, multi-purposes downstream applications (insurance, infrastructure alert, humanitarian actions), own anticipatory action triggering (3 responses)) • Complementary information to other sources
Skill and uncertainty	• Important aspect (7 responses, 4.6/5 rate) • Gives users confidence in the results they deliver to clients, and helps answer clients' questions about the system • Helpful when comparing forecasts from different sources • Careful communication to avoid confusion (e.g. avoid mixing skill information with forecasts) • Some users trust providers and don't feel the need for a skill assessment
Data download facility	• Important (6 responses, 4.2/5 rate) • Enables post-processing • Web and data services (e.g. ftp) used

Post-processing tools	• Python and GIS for 66% of responses • R for 50% of responses	
Web data manipulation	• High score, low response (3 responses, 4.2/5 rate)	
Uncertainty in forecasts	• Question understood regarding skill, not associated with forecast likelihood • Own local evaluation based on local data and/or alternative forecasts (4 responses) • Communication of uncertainty to decision makers (2 responses) • Range-dependent decision making, with higher uncertainty/ low probabilities accepted for longer lead time	
Use of probabilistic forecasts	**Yes (2 responses)** • For longer term projections • To enable informed decision making in uncertain situations	**No (3 responses)** • Not yet, but consideration for cyclone path and windspeed forecasts • Not yet, but consideration to understand uncertainty of an event • Prefer the deterministic approach

6. When

6.1. Aim of the question

This session aimed to better understand the frequency of use of high-impact environmental forecast and factors influencing when to use a system or not, through three direct questions and three open questions. A screenshot of the board used in the session is given in Figure 6.1 and can be accessed at URL6.

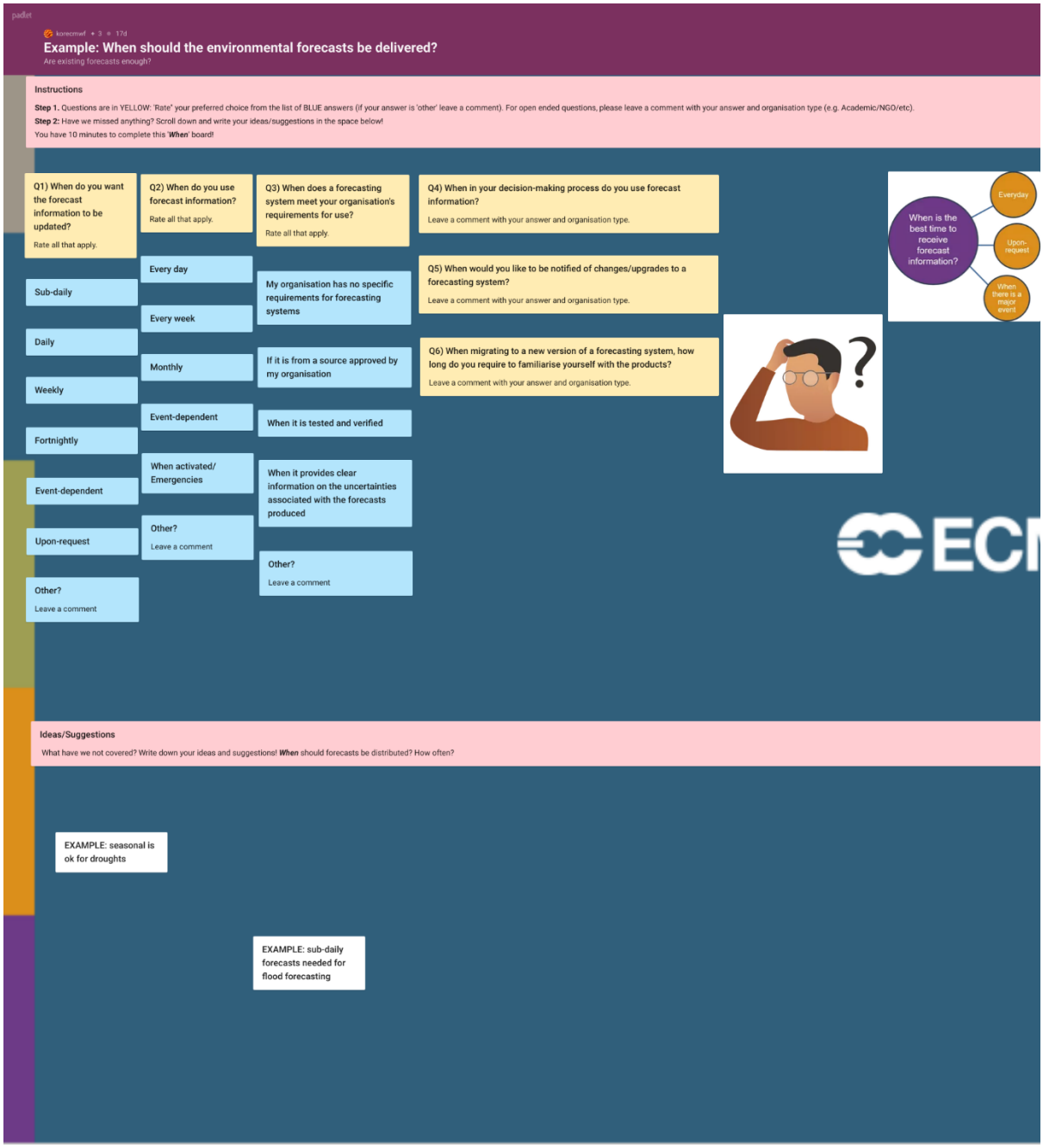

Figure 6.1. The 'When' padlet board

6.2. Headline message

- Daily or sub-daily updates preferred; and during a very active event
- Use of forecast information daily (50% of responses) or event-dependant/ on activation (20% of responses)
- Use of forecast information throughout the different phases of the decision-making process (monitoring/ horizon scanning, acting, planning). Post-event analysis important
- Use of forecast system when

  - Information on forecast uncertainty provided,
  - System is rigorously tested and verified,
  - Sufficient, transparent documentation on forecast production is provided
- When changes are made in the system, users want:
  - Automatic transfer to new operational system
  - Advance notice (as soon as possible) to ease transitions in own workflow and inform downstream users
  - Adequate documentation on changes
  - Training material (on new services)

6.3. Direct questions

Summary graphs of the responses to the direct questions are shown in Figure 6.2 to Figure 6.4Figure 5.3.

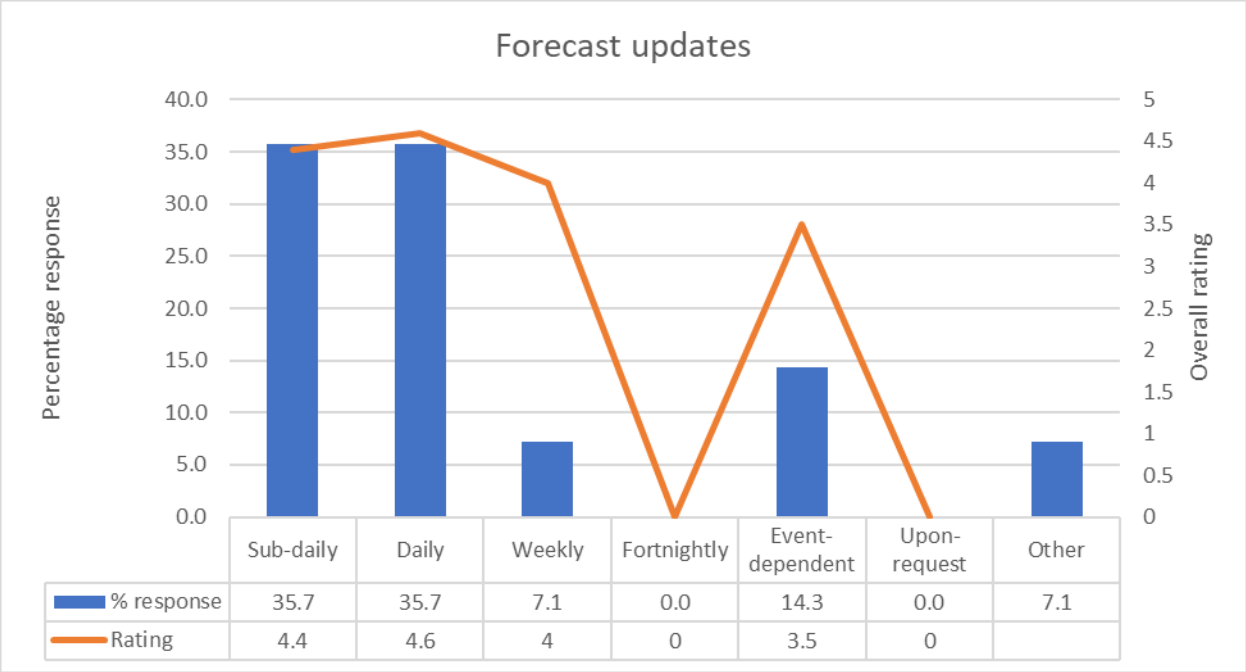

Figure 6.2. Response to the question 'When do you want the forecast information to be updated?' In total 14 responses received

Forecast updates during the monitoring season or during an event were also suggested.

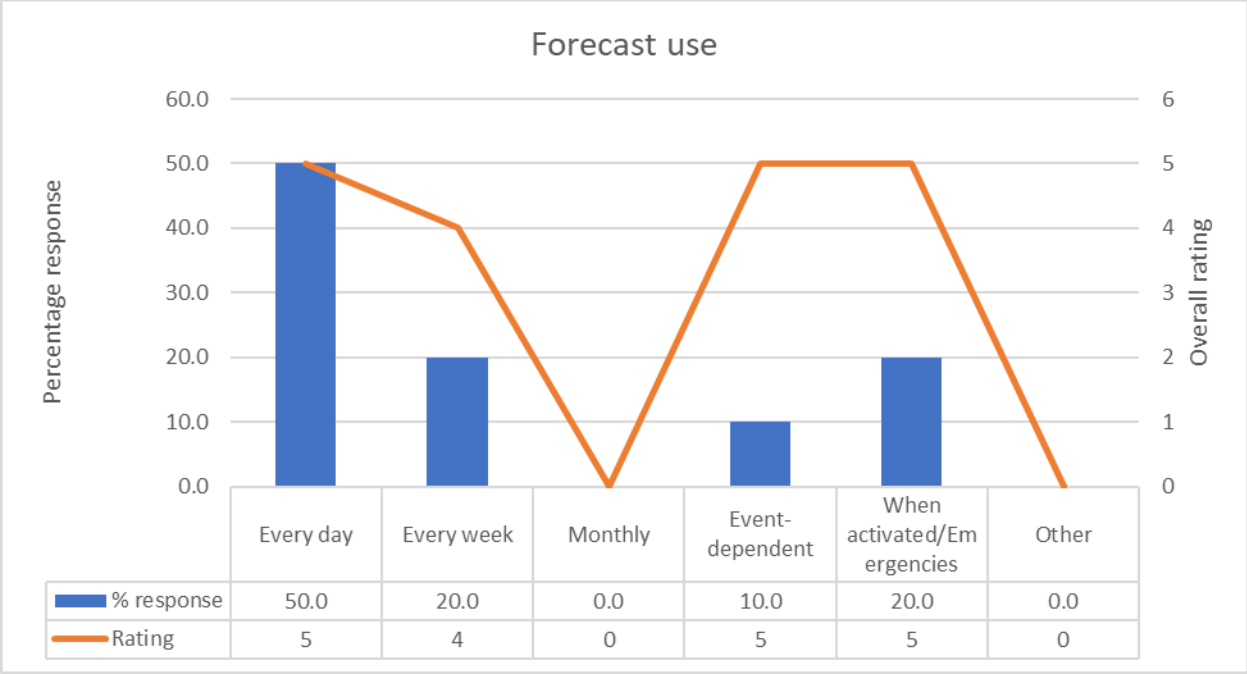

Figure 6.3. Response to the question 'When do you use forecast information?'. In total 10 responses were received

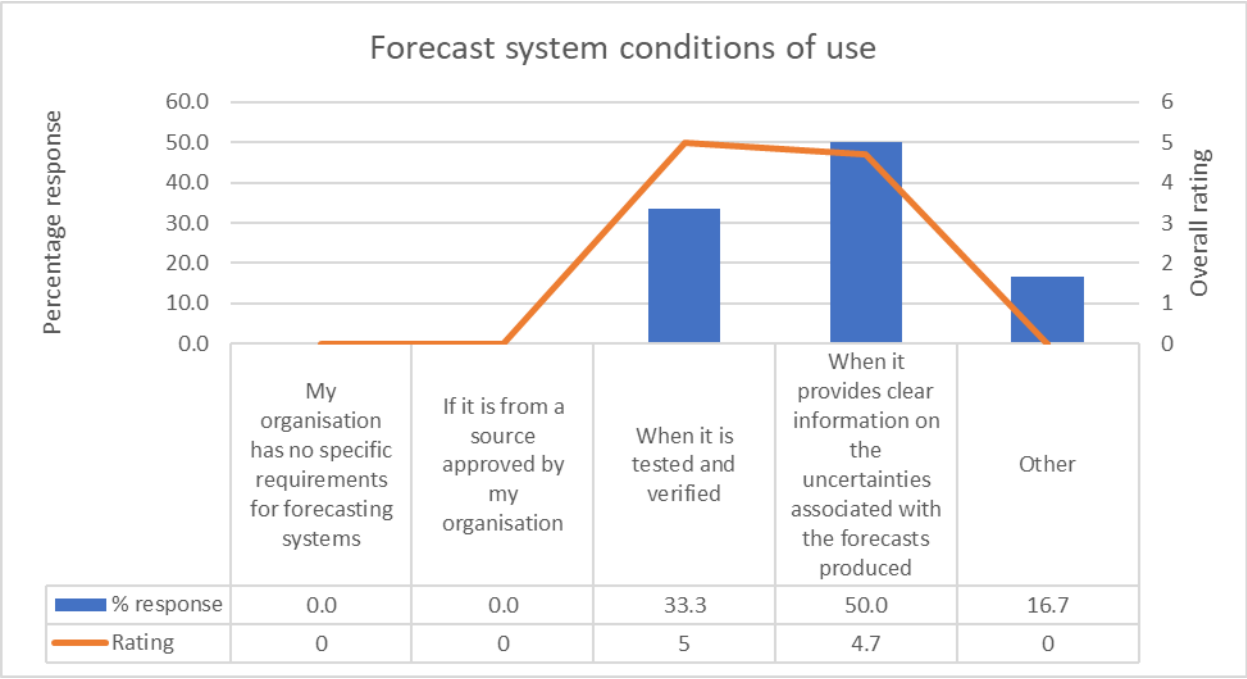

Figure 6.4. Response to the question 'When does a forecasting system meet your organisation's requirements for use?'. In total 12 responses were received

Conditions of use also included openly available forecasts, and clear and accessible documentation on how forecasts are produced.

6.4. Open questions

Theme	Detail
When forecasts used in decision making	• Horizon scanning: monitoring events to determine if and when alert should be raised (4 responses) • Acting: decide if pre-defined thresholds/ triggers are met (4 responses) • Planning: definition of action triggers
When notified of changes	• As far in advance as possible to allow for changes in workflow, inform downstream users of changes, communicate possible consequences • Seamless transition with latest forecast available automatically provided
Time needed to implement a new system	Dependent on: • Level of changes • Availability of documentation and training material

7. Conclusions and ways forward

An interactive session, in collaboration with the Anticipation Hub, was conducted to gain insights on the usefulness of ECMWF's environmental forecasts and services to aid agencies and the wider FbF network. The three key themes of 'What?', 'How?', and 'When?' guided the session to discern what users regard as critical components of environmental forecasts they currently use and what they consider to be 'ideal' forecasting systems and services. Questions regarding these themes were asked to aid our understanding of users' needs from the forecasting systems they currently employ. A combination of direct and open-ended questions was posed to determine how different agencies integrate environmental forecasts into their workflows. Analysis conducted on the survey responses from the 17 participants who contributed to the session is discussed and summarised in detail in this Technical Memo.

Overall, the Anticipation Hub acted as a beneficial mechanism for interacting with users of ECMWF's environmental forecasts. It facilitated the exchange of information between service providers and end-users regarding their requirements of current environmental forecasts. The session revealed many useful suggestions, presenting new insights and opportunities to align future forecast products and services with end users to strengthen anticipatory action globally.

References

Harrowsmith M, Nielsen M, Jaime C, Coughlan de Perez E, Uprety M, Johnson C, van den Homberg M, Tijssen A, Mulvihill Page E, Lux S, Comment T, 2020. The future of forecasts: impact-based for early action. https://www.climatecentre.org/downloads/files/Impact%20based%20forecasting%20Guide_Final.pdf, 82pp, accessed 4 January 2021

URL1: https://www.climatecentre.org/downloads/files/Standalone_Impact%20based%20forecasting%20guide%202020.pdf, accessed 4 January 2021

URL2: https://www.forecast-based-financing.org/anticipation-hub/, accessed 4 January 2021

URL3: https://www.forecast-based-financing.org/dialogue/

URL4: https://padlet.com/korecmwf/ECMWF_GDP_example_what, accessed 4 January 2021

ULR5: https://padlet.com/korecmwf/ECMWF_GDP_example_how, accessed 4 January 2021

ULR6: https://padlet.com/korecmwf/ECMWF_GDP_example_when, accessed 4 January 2021

Useful links

GloFAS, the Global Flood Awareness System of the Copernicus Emergency Management Service. www.globalfloods.eu, accessed 4 January 2021

GloFFIS, the Global Flood Forecast of Deltares. https://www.globalfloodforecast.com/glossis/index.htm, accessed 4 January 2021

World-Wide Hype, 1-10 day forecast world wide of SMHI. https://hypeweb.smhi.se/explore-water/forecasts/short-medium-range-forecast-world-wide/ accessed 4 January 2021

GWIS, the Global Wildfire Information System. https://gwis.jrc.ec.europa.eu/, access 4 January 2021

ECMWF real time product catalogue. https://www.ecmwf.int/en/forecasts/datasets/catalogue-ecmwf-real-time-products