Roundtable on Forecast Use in Atlantic Canada

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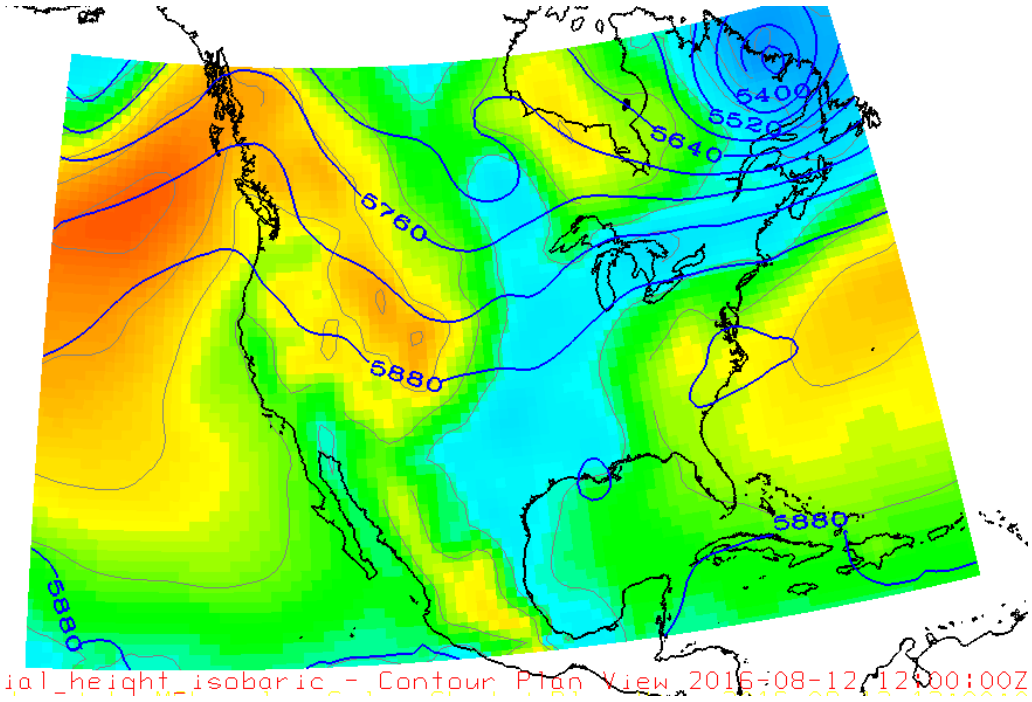

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MARINE ENVIRONMENTAL OBSERVATION PREDICTION & RESPONSE NETWORK

Table of Contents

Introduction

Organized by researchers from Memorial University, with the kind assistance of the Newfoundland & Labrador Fish Harvesting Safety Association (NL-FHSA), the roundtable on forecast use in Atlantic Canada brought together a varied group of forecast users and producers. The goal of the meeting was to explore approaches to using and communicating forecast information, and identify needs of different stakeholder groups. Attitudes towards forecasts (their usefulness, accuracy, etc.) were also explored. The meeting served as an exploratory first step into proposed research on cross-sector forecast practices, and responses are being used to design an interview schedule for future in-depth investigation.

The following questions were addressed during the meeting:

1) What, if any, forecast products are you currently using, and for what purposes?
2) How are you using these forecasts to inform operational decision-making?
3) What makes a forecast effective?
4) What would you like to see in forecasts that is not currently available?

Participants

The Roundtable consisted of 20 invited participants, including a mix of professional forecasters (or meteorologists) (5), stakeholders who reference forecasts frequently in their work (7), and workplace health and safety representatives (8). For convenience, this report groups participants into the following categories: 1) professional forecasters, both with government (Environment and Climate Change Canada; ECCC) and the private sector (AMEC Foster Wheeler); 2) casual forecast users, who do not require weather data for their day-to-day work, and 3) active users, who include weather forecasts in their workplace decision-making (e.g. fish harvesters, aviation, Coast Guard). In some cases, (e.g. aviation sector) active users have access to specialized meteorologists, hired or contracted by a given company or government agency (a common practice in transportation, aviation, and courier services, and the military). Other active users (e.g. most fish harvesters) rely exclusively on publicly available information, other harvesters and local knowledge, and may have little or no direct contact with forecasters.

Results

Accessing and Interpreting Forecast Data

While the quantity and detail of weather information used differs across professions, producers and active users of weather forecasts reported some common practices and approaches to interpreting the information available to them. All reported accessing many information sources, which were then interpreted through an ongoing discussion with peers. Common topics include comparisons of different (and sometimes contradictory) forecasts, comparisons of the forecast against observed weather, and evolving hazardous conditions. While different forecast producers and active users focus on different aspects of weather and may frame the

conversation differently, weather (including meteorology and sea state) was identified as a prominent workplace discussion concern for all but casual forecast users.

In the case of forecasters themselves, the multiple sources of forecast data accessed include results from many models, run multiple times, and often from a variety of modelling centres (national and international). The latest model runs are compared to prior runs, as well as available observations (climate stations, RADAR, satellite images), in an ongoing attempt to identify current sources of uncertainty. For example, many model runs will be compared as a storm approaches, in order to assess confidence in predicted storm position, area of impact, and intensity. The challenge for forecasters is to merge this information into an easy-to-use 'best guess' of future weather for their target audience. In the case of the ECCC, this is a diverse audience with differing concerns and familiarity with weather and forecasting practices, while private forecasters have the luxury of tailoring reports to clients with well-defined needs. Meteorologist participants stressed that this process is something of an art, and that the final reports are a blend of forecaster intuition, experience, and collegial consultation, as well as available science and technology. A key aspect of forecasting is the ongoing discussion among meteorologists, in an effort to best interpret all available information.

The practices of active users closely mirror those of the forecasters themselves. All active users reported accessing many forecast sources, as well as observational data, in their effort to best inform decision-making. Depending on the user, these might include weather model output, weather maps, climate station & buoy data, RADAR & satellite images, or summaries from forecast agencies (online, radio, or television reports). Users also engage in ongoing weather discussion with colleagues, mirroring the practice of forecasters. In sectors with access to in-house meteorologists (e.g. aviation), some of this discussion may take place in regularly scheduled weather briefings. Typically led by a meteorologist, these meetings outline current conditions and developing concerns. One participant emphasized the importance of these briefings in giving a forecast context (confidence in a given forecast, biggest uncertainties, reasons for current conditions etc.), as well as being a valuable way to learn about weather in general. Another participant stressed that these briefings were not meant to dictate operational decisions, such as whether scheduled flights should proceed; these decisions remain the responsibility of pilots, ship captains, etc. Rather, they offer an opportunity to strategize and assess risks ahead of any decision. They further provide a focus for ongoing monitoring and re-evaluation of weather conditions between briefings. In particular, Coast Guard and aviation participants spoke of the need to frequently compare forecasts against observations (sometimes called 'actuals'). In general, actuals are given greater weight in decision-making than near-term forecasts. However, in situations where no actuals are available (e.g. the site of a Search and Rescue operation), forecasts are particularly valuable.

Although they are much less likely than aviation or the Coast Guard to have direct access to meteorologists, fish harvesters use a similar approach as other active users: they monitor multiple forecast sources (radio and online sources were listed by participants), and continually compare forecasts against actuals. Harvesters indicated that weather and sea state are among the most common topics of discussion between harvesters, both at the wharf and over the

radio. These comparisons and discussions form an ongoing, informal approximation of the weather briefings that happen in other sectors, covering developing hazardous conditions, accuracy of the current forecast, and differences observed at various locations. Harvesters have access to less detailed forecast information than forecasters or active users with in-house meteorologists, and less information on forecast confidence. However, harvesters have the advantage of experience operating in specific areas, and those in the roundtable appear to be comfortable translating marine forecasts into likely weather outcomes on their fishing grounds (e.g. know which forecast areas best represent their grounds, even when geography does not align, or where forecast accuracy is relatively low/high). They are also able to monitor conditions through radio contact with the wider fishing fleet, providing an overall 'snapshot' of actuals. Several participants also praised the meteorological training harvesters receive as part of certification, comparing it to the training required to become a Master Mariner. As a result, fish harvesters can be considered informed/educated (in addition to experienced) forecast users. This is reflected in the range and detail of weather information harvesters report using, including weather maps and radar, in addition to ECCC's marine forecasts, radio broadcasts, and online forecasts. Due to training and experience, harvesters are often considered a good source of weather information by casual forecast users, and several participants named harvesters (usually in their immediate family) as their preferred source of forecast information.

Quality of Forecasts

When asked what makes a good forecast, forecasters listed consistency ('no big swings' from one forecast to the next), accuracy (what is predicted is what occurs), and utility (able to be used by stakeholders, actionable) as important criteria. Recognizing that all forecasts are imperfect, one forecaster suggested their goal was to report the 'least wrong' possible information, and pointed out that this is difficult to do when reporting for large areas and a broad audience. It was also noted that marine forecasts do not currently include uncertainty estimates or much detail on likely ranges (probability), and forecasters acknowledged that this can make them less useful to many experienced users. Again, private forecasters have an advantage here, as they can discuss risk tolerance with their clients and build suitable uncertainty estimates into their reports. Lacking this interaction with stakeholders, and serving a much broader audience, ECCC participants raised concerns that forecasting can become an 'academic exercise', focused on small gains in accuracy rather than potentially more useful increases in utility (e.g. by improving communication or moving toward probabilistic marine forecasts). It was recognized that utility improvements could be more difficult to achieve, and would require cooperation with stakeholders and experts outside the ECCC.

Stakeholders are also interested in forecast accuracy, but assess this accuracy in different terms. This leads to different impressions of quality, which were reflected in discussion around the relative difficulty of predicting weather in Newfoundland. Several stakeholders had heard that Newfoundland was one of the hardest places to predict in Canada, with a few connecting this difficulty to clashing ocean currents. One stakeholder felt forecasts for their area were so inaccurate they couldn't be effectively used; their response was to largely ignore the forecast and 'just work' whenever current conditions allow. By contrast, forecasters suggested Newfoundland was a 'busy' place to forecast (with frequent weather events), but that these

events were not necessarily more difficult to forecast than in other areas. Their assessments of forecast accuracy were also more generous than many stakeholders. Much of the difference here is due to scale. Forecasters are more likely to measure success in terms of a weather event's total lifespan and evolution; for example, they want to know when a storm is coming, and know it's path, size, and strength. Stakeholders are more interested in the storm's impacts on their specific area of operation, which are more difficult to both i) predict and ii) effectively communicate for all areas in a storm's path. Forecasters are therefore often measuring accuracy in terms of the 'big picture' of a weather event, while stakeholders measure it in terms of a small slice (spatial/temporal) of the overall event. Stakeholders recognize this difference, and that the limits of accuracy in their particular area are a function of large forecast areas (e.g. marine forecast zones) in many of the forecast products they use. Fisheries workers also reported higher forecast accuracy in some areas than others, and highlighted the differences in conditions they observe in relatively short distances (e.g. two parts of a forecast zone can be like 'different countries').

Active forecast users also suggested that the length of the forecast period is an important consideration when choosing forecast sources. Fisheries workers in particular highlighted their interest in longer forecast periods (beyond 3 days). All recognized that uncertainty in these long term forecasts could become high, but suggested that some form of probabilistic forecast (e.g. 'chance of waves as high as 5m') would be useful.

Casual forecast users also highlighted accessibility and rapid updates as important qualities. Several pointed to smartphone apps and websites as key sources, preferring immediate access to waiting for scheduled radio or television broadcasts. Casual users also expressed distrust of extended forecasts (more than a day or two into the future), but were less likely to need or use this information. Instead, they tended to rely on forecasts for short-term planning (daily driving, anticipating cancelled flights, etc.). Not only are forecast failures less likely in this situation, the impacts of an inaccurate forecast are also small relative to those for most active users.

Needs and Areas for Improvement

Participants shared a common interest in getting access to more forecast information. One suggested that there could 'never be enough' information, as long as it is presented clearly. Forecasters and some users (Coast Guard) expressed an interest in collecting more observations, particularly in the open ocean. This could be used to produce better forecasts (by giving a more accurate starting point for model runs), inform ocean operations (e.g. ocean transport, SAR), and assess forecast accuracy. Cooperative efforts by the offshore oil industry and private forecasters to extend the ocean buoy network and enhance the observational capacity of offshore oil rigs were mentioned as one means of doing this. Several participants also suggested that more fishing vessels should be equipped to automatically collect and distribute weather observations. There was also discussion of reviving or extending ship observation programs, in which crew members were trained and required to log standard weather conditions at regular intervals (e.g. the MANMAR observation program).

Harvesters were most interested in increasing the detail and duration of marine forecasts, and wanted to see forecasts well beyond the current 3-day forecast period, reported over smaller marine forecast areas. They felt this would make the information more relevant to their needs, particularly for users with long travel times from port to fishing grounds. The smaller forecast regions would reduce the need to generalize information, and better highlight sub-regions with the highest probability of hazardous conditions. Several participants (forecasters and users) suggested there should be a role for harvesters in this process, and that harvesters' experience would be useful in redrawing effective forecast area boundaries. This type of collaboration was favorably compared to the positive interactions between private forecasters and their clients. ECCC participants were very interested in increasing cooperation with users, and it was noted that interaction with forecast users was more common before recent ECCC reorganization.

Harvesters also expressed an interest in probabilistic ('chances' of a range of outcomes), rather than deterministic (single most likely outcome) marine forecasts. This would better reflect the modern forecasting process, as well as the ways forecasters think about their predictions. It would, however, also greatly increase the amount of information being delivered, making it difficult to efficiently deliver. Radio broadcasts were cited as a particular concern, as ECCC's marine forecasts are required to fit a set on-air duration and format. Changing these requirements would be difficult, and may not be in the best interest of many casual users; but recognizing that harvesters are already looking beyond radio reports to the internet, it was suggested that a more sophisticated and interactive website could be designed to fill probabilistic forecasting needs.

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