Analysis of Probabilistic Products Across all NCEP Centers

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Introduction

The NOAA National Centers for Environmental Prediction (NCEP) produce and maintain over **100 probabilistic forecast products** for a variety of different hazards, time scales, and audiences. There have been recommendations from some areas of the community to **standardize the presentation of these products**. An in-depth analysis and visualization of NCEP probabilistic products can help NCEP and the weather community understand these products before any attempt to standardize them is made. This evaluation reveals that **a subset of Centers**, the Climate Prediction Center (CPC), Weather Prediction Center (WPC), and Storm Prediction Center (SPC), **issue a majority of products**. Products issued are often targeted at a specific audience of "severe weather monitors", which are **a combination of forecasters, emergency managers, governmental agencies and other core partners**. A majority of products communicate **precipitation, temperature and their related hazards** (heat index, flooding, etc.). Additionally, organizing products into forecast funnels for different hazards provides a cross-center timeline for product issuance.

Methodology

To start this project, important characteristics to document were identified, and then the products were cataloged using these set characteristics. There were 17 total characteristics identified. These characteristics can be grouped into 5 main categories:

(1) Basic Information (product name with link to an example, Center name, whether it is forecaster issued or model output, and what the probability being communicated is)

(2) Hazard Description (number and type of hazards being communicated, and the type of severity descriptor used)

(3) Release Information (forecast area size, whether the release is routine or episodic, the range of the forecast, and the update frequency)

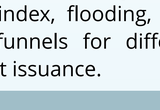
(4) Visual Data Description (whether the product is text, graphic, or both, what color scheme is used, how many attributes on each product, and how many data classes per attribute)

(5) Audience Information (purpose and intended users)

In order to ensure that the characterization is complete and accurate, members of Center leadership were sent sections of the spreadsheet with their respective Center's data for feedback. The two sections of the survey provided a space for respondents to discuss their experience with product creation and provide feedback on the catalogue in its current state. The spreadsheet was then revised and analyzed with the feedback received in mind.

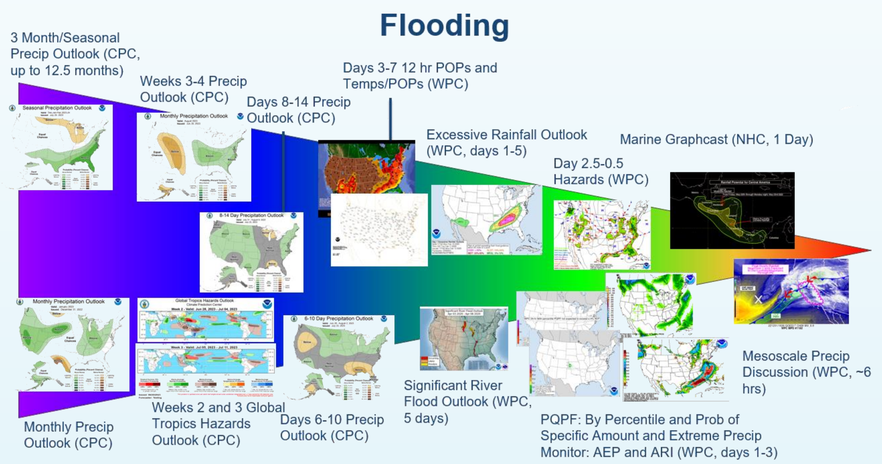
Example: SPC Categorical Convective Outlook (Day 1)

Basic Information	Hazard Description	Release Information	Visual Data Description	Audience Information
Convective Outlook SPC Forecaster Issued Likelihood of achieving some specific combination of coverage and hazard intensity	Multiple Hazards T-Storm, Tornado, Wind, Hail Multi-Level	100k mi² Area Routine 1-8 days 1-5x Daily	Graphic and Text Qualitative Fill 1 Attribute Displayed 2-6 Data Classes per Attribute	Show Severe Weather Threat for CONUS Public, Emergency Managers, Core Partners, Forecasters

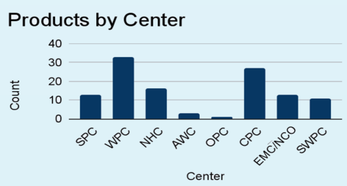


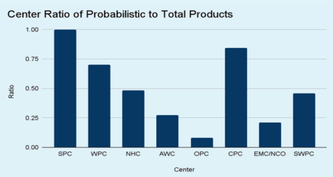
Results

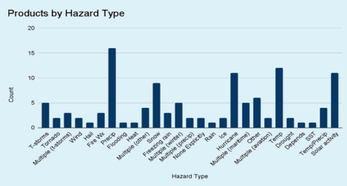
To show the variety of probabilistic products that exist, "forecast funnels" for a number of different weather events were created only using NCEP probabilistic products. These funnels showed the range of products that existed at different points in time, who was issuing them, and if they were being updated. The weather events chosen were extreme heat, tropical cyclones, severe convection, winter weather, and flooding. The data was also analyzed to identify potential trends in center type, hazard type, and audience type.

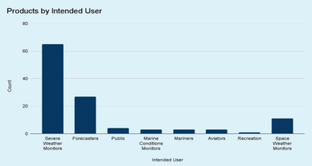


Scan QR code to view all five forecast funnels (google slides link)









Conclusion

In each funnel, CPC was responsible for longer term forecasts, with another Center assuming the main responsibility for forecasting the hazard at about day 7. Multiple Centers were represented in each funnel, with the WPC being represented in all funnels. Combined with data analysis, these funnels show that temperature, precipitation, and their related hazards (flooding, heat index, blizzard, etc.) are the most popular hazards to communicate probabilistically. An examination of the audiences of NCEP's probabilistic products revealed that a large majority of products are created for an audience of "severe weather monitors", which includes varying combinations of governmental agencies, emergency response teams, forecasters, and other core partners. When examining which Centers create the most probabilistic products, CPC and WPC seem to have a significant lead over any other center, but both Centers issue more total products than many other centers. The amount of probabilistic products a Center issued was also analyzed as a ratio to account for the difference in total products issued. After this analysis, both CPC's ratio (≈0.84) and WPC's ratio (≈0.70) showed that they issue a significant proportion of probabilistic products, but their ratio was not the highest. The Storm Prediction Center's (SPC) ratio was 1.0. Even though they only issue 13 products, all 13 are probabilistic.

Future Work

A few challenges presented themselves in the data collection phase of this project. Sections of Center websites were difficult to navigate, and product archive data and product description documents (PDDs) were not always easily available. This resulted in some uncertainty about certain characteristics documented that are frequently included in PDDs, such as update frequency, purpose, and intended audience, as well as for many episodic or winter weather products without archives. These challenges could be mitigated for users through work to update and improve Center website navigation and design. Despite uncertainties, this research has potential to be used in future research across the National Weather Service (NWS). It can be used to inform future social science research regarding probabilistic products at NCEP or NWS as a whole. Additionally, it can be used as an internal reference for NCEP employees looking at probabilistic products outside of their specialty. Finally, it can be used as a basis for any future efforts to standardize the methods of communicating probabilistic information across NCEP.

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