

PRODUCT DESCRIPTION DOCUMENT

Probability of Exceedance Forecast for Precipitation and Snowfall

Recommendation for Experimental Status

APPROVED BY:  DATE: January 30, 2012

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NATIONAL WEATHER SERVICE

PRODUCT DESCRIPTION DOCUMENT (PDD)

TYPE: Experimental Forecast Product

DATE: JANUARY 30, 2012

Experimental Forecast Product – Probability of Exceedance Forecast for Precipitation and Snowfall

Feedback Period: February 1, 2012 – May 1, 2012

Part I - Mission Connection

- A. Product / Service Description:** The NWS Multi-Format Forecast information Web Page provides for a customer-based approach in delivering NWS high resolution (5 km grid) forecast information in a variety of formats on demand. One of these formats is the Hourly Weather Graph which provides a time-series graph of forecast elements so the user can see how the weather changes with time. This service enhancement adds the probability of exceedance for specific rainfall amount thresholds (0.10, 0.25, 0.50 and 1.00 inch) and snowfall amount thresholds (0.1, 1, 3, 6 and 12 inches) to the list of selectable elements for display by the user.
- B. Purpose/Intended Use:** Enhancement of the Hourly Weather Graph format to provide access to forecast probabilities for rainfall and snowfall exceeding specific thresholds. The NWS has historically provided the probability of precipitation (PoP) for 12 hour time periods which is the chance that the occurrence of rainfall will equal or exceed 0.01 inch or more at the selected location. This service enhancement provides the probability that rainfall or snowfall will exceed additional (higher) threshold amounts. Potential users of this enhancement would be in construction, agriculture, water management, outdoor planning, media, academia and the general public. For example, workers pouring concrete often need to know what is the chance of rainfall exceeding 0.10 inches, since rainfall above 0.10 would hamper or damage their work. Therefore, they would be able to display the probability of rainfall above the threshold of 0.10.
- C. Audience:** The current audience for the forecast information web page consists of the customers and partners in the areas of emergency management, construction, agriculture, water management, outdoor planning, media, academia, and many others.

Part II – Technical Description

A. Format and Science Basis

Format: New experimental probabilistic quantitative precipitation forecasts (PQPF) probability of exceedance forecasts are available for the following thresholds: 0.10, 0.25, 0.50 and 1.00. Thresholds are derived from the probability of precipitation and quantitative precipitation forecast elements with exceedance values available for 3, 6, 12 and/or 24-hour periods. Users can select which forecast weather elements to display on the graphic by clicking on/off the check box next to the element label.

A sample of the hourly weather graphic web display can be found at:

<http://forecast.weather.gov/MapClick.php?site=eax&zmx=1&zmy=1&map.x=127&map.y=148&FcstType=graphical> .

Science Basis: Probabilistic quantitative precipitation forecasts (PQPF) and quantitative snowfall (PSnow) provide our best estimate of the chance that any given location will receive an amount of rain/snow that exceeds a certain threshold value. Our regular "probability of precipitation" (PoP) forecast is the unconditional probability that a location will receive an amount of rain/melted snow that equals or exceeds 0.01 inches. The PQPF/PSnow is similar, except it is computed for the probability to exceed higher amounts (e.g., 1.00 inches of rain or 6.0 inches of snow).

The PQPF/PSnow is derived from the probability of precipitation (PoP) forecasts and our quantitative precipitation/snowfall forecast (QPF/SnowAmt). For the purpose of the calculations, the standard QPF/SnowAmt, which is an unconditional value, is converted to a conditional value by dividing it by the PoP. The resulting QPF/SnowAmt is then an amount that is conditional upon the occurrence of rain/snow at any specific location. Although this seems to be a subtle difference, it is very important.

The PQPF/PSnow is based on the climatological distribution of precipitation, which very closely matches a linear combination of low order gamma distributions. Generally speaking, this combined distribution indicates that the probability of receiving larger rainfall/snowfall amounts decreases nearly exponentially as the amounts get larger.

The probability density function is:

$$f(x,a,b) = C(a=1) \cdot (1/b) \cdot e^{-x/b} + C(a=2) \cdot (x/b^2) \cdot e^{-x/b} + C(a=3) \cdot (x^2/2b^3) \cdot e^{-x/b}$$

where $b=\mu/a$, μ is the conditional QPF/SnowAmt, or mean expected rainfall/snowfall amount given that precipitation occurs at the specified location, a is the gamma order and $C(\text{PoP},a)$ is a weighting function .

- B. **Availability:** Updates to grid point forecasts are made once an hour from the existing GFE database. These updates are generally available at quarter past every hour.
- C. **Additional information:** These results are very similar to those of Donald L. Jorgensen, William H. Klein, and Charles F. Roberts, *Conditional Probabilities of Precipitation Amounts in the Conterminous United States*, ESSA Technical Memorandum WBTM TDL 18, Weather Bureau Office of Systems Development Techniques Development Laboratory, Silver Spring, MD., March 1969. Questions regarding this method may be directed to Steve Amburn, Science and Operations Officer (Steve.Amburn@noaa.gov) at the National Weather Service in Tulsa (918-832-4115).

APPENDIX G

Information Template

Product/Service Name: **Probability of Exceedance Forecast for Precipitation and Snowfall**

Type product/service: Experimental

Scope: Regional

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Parameters: PoP, QPF, Snowfall

SW Required: Web Browser for display

Data Type/Format: Digital/Graphic

Example: On website.

Product URL:

<http://forecast.weather.gov/MapClick.php?site=eax&zmx=1&zmy=1&map.x=127&map.y=148&FcstType=graphical>

PDD files name:

PDD_Experimental_Central_Region_Probabilistic_Hourly_Weather_Graph.docx

Dates of Comment Period: 01 February 2012 to 01 May 2012

Approved By: Lynn P. Maximuk, Regional Director, Central Region Headquarters

The above information is required to quickly link PDDs/SDDs to the National Catalogue of New or Enhanced NWS Products/Services