

Do you know your chance of succeeding with an operation that depends on no precipitation? Should you proceed if you have only one chance in two of succeeding without being interrupted by precipitation or should you wait until the chance is three out of four? The National Weather Service probability of precipitation (POP) forecast will help you make such decisions.

The National Weather Service has always been in the probability business, but the probability has been hidden in descriptive terms such as "clear to partly cloudy" or "general rain for the forecast area." It was found that expressing the likelihood of precipitation in words alone did not accurately convey the particular degree of risk since the words could be interpreted in different ways. Expressing the degree of certainty in numbers is believed to be a step towards making precipitation probabilities more useful to the public. Weather forecast wording, such as "rain likely," carries a rather specific probability wording and is still available in the forecast for those who prefer it (Table 1).

Table 1: Relationship between POP values, expression of certainty and equivalent area qualifier words.

POP Statement Value (Percent)	Expression of Certainty	Equivalent Area Qualifier of Coverage
20	slight chance	widely scattered
30, 40	chance	scattered
50	chance (or good chance)	scattered
60, 70	likely	none used
80, 90, 100	none used	none used

The ideal would be for the forecast to resolve the precipitation into a "yes" or "no" category, either zero or 100%. However, to have such forecasts be correct, the forecaster must either have no precipitation occurring anywhere in the forecast area or have precipitation occurring over all the forecast area. This can rarely be done. The evidence for or against precipitation is usually inconclusive, and the forecaster must indicate probability values other than zero or 100%.

What is a Precipitation Occurrence?

What is a precipitation occurrence as far as the probability forecast is concerned? Does a sprinkle of rain or a few snowflakes in the air constitute a precipitation occurrence? The National Weather Service says "no," but it is recognized that at times a sprinkle of rain may be significant enough to slicken a street, affect a freshly-painted surface or interfere with agricultural spraying or dusting activities. However, generally, these amounts are insignificant to most forecast users. The precipitation must be a measurable amount of five thousandths of an inch or more (.005) recorded to the nearest hundredth of an inch (.01). Amounts less than this are recorded as "traces" (T). Snow is melted by the weather observer to determine if a measurable amount of "water" fell.

Since nearly 50% of the rain occurrences are recorded either as T or .01, you can recognize the difficulty of deciding which amount to forecast. However, the percentage probability (POP) forecast is for the occurrence of at least a measurable amount of .01 of an inch or more. The occasional forecast of snow flurries or drizzle is mentioned in the main body of the forecast, but with very low probability for measurable amounts.

Forecast Periods

It is customary for the National Weather Service forecasts to use 12-hour time periods generally divided at 6 a.m. and 6 p.m. local standard time. This arbitrary division is fairly well-related to man's activities and is also convenient for verification of forecasts. However, those fixed-time periods usually do not coincide with the life of weather-producing systems. The approximate issue times and forecast periods used are as follows

At 6 a.m.	Today, tonight and tomorrow
At 12 noon	This afternoon (a 6-hour period), tonight and tomorrow
At 6 p.m.	Tonight, tomorrow and tomorrow night
At 10 p.m.	Rest of tonight (a 6-hour period), tomorrow, tomorrow night and the day-after-tomorrow

In some sections of the United States, there is a distinct day and night difference in the climatic probability of precipitation, but in most sections the difference is slight. However, the use of fixed time periods sometimes adversely affects the probability forecasts from the meteorological standpoint. For instance, occasionally there may be an approaching precipitation-producing weather system that will take about three hours to pass a given point. The timing indicates that it should reach the forecast point about 6 p.m., the breaking point between two periods. If it should accelerate, it might reach the point before 6 p.m. If it stays on schedule, it will be raining both before and after 6 p.m. Here we have a case of two chances out of three of rain before 6 p.m. This means the forecaster may indicate periods when there is a 100% probability of rain in the 12-hour period of noon to midnight. This is generally handled by using "late this afternoon" and "early evening" on the worded portion of the forecast.

Probability of Precipitation

The forecast pertains to your location--your garden, your north 40, your concrete job or wherever you may be. Along with the expression of certainty and the area of coverage, the POP gives you the chance for precipitation at that point. If you are going from place to place, you increase your chance of getting precipitation.

If a 40% probability is forecast, measurable precipitation should be received at your location four times out of ten. The 40% probability also implies precipitation will occur over 40% of the forecast area. If precipitation occurs one day in five in July, then the climatological probability of precipitation on any one day in July is 20%. If the frequency of precipitation is four days out of ten in January, the probability is 40% in January for any one day. It is the forecaster's job to improve on the climatological probability of a forecast. The further he can depart accurately from this probability, the more useful the forecast becomes.

The weather forecaster must make these decisions based upon insufficient evidence. Precipitation probabilities are based on several factors, such as: available moisture, stability of the air mass, upper air circulations, winds at upper and lower levels, speed of the disturbance, and acceleration and deceleration of weather systems in the region. The first decision the forecaster makes is: Is it going to rain in my local area of concern? He must figure the percent chance that precipitation will occur for the forecast period. The closer to the time of the expected precipitation, the more evidence is available. This means that probabilities of near zero or near 100% may be used in the first 12 hours of the forecast, but are rarely or never used in the last 12 hours of a 36 hour forecast period.

The second decision that the forecaster must make is: How much of the area will receive precipitation if it does occur? As we know, it does not rain everywhere at the same time nor over the whole area every time it rains. This is particularly true under showery conditions in the summer months. The forecaster may be quite sure that showers will occur somewhere in the state, with less than 30% of the local area receiving precipitation. The POP, the expression of certainty and the area of coverage are used to provide you a point POP for your location--in text as a qualifier word or numerically in the probability statement.

As expressions of certainty cannot be combined with other qualifier terms, such phrases as "chance of scattered showers" will not be used in the National Weather Service forecast. Also, since the POP and expression of certainty compliment each other, the National Weather Service will not use the wording: "90% chance of widely scattered showers." Why? Because the 90% value and the term "widely scattered" do not compliment each other according to National Weather Service definition. The 90% POP implies precipitation will occur 9 times out of ten under those specific weather conditions during the forecast period, and "widely scattered" implies precipitation occurring in certain locales but not everywhere. According to current National Weather Service definition, if the POP is 90%, no equivalent area qualifier is stated: (for example, "Cloudy and cold with rain today.") If the term "widely scattered" is in the forecast, the POP should be 20% and the expression of certainty used will be "slight chance."

Verification of the Forecast

Every day National Weather Service personnel check the accuracy of the preceding day's forecast. This allows continuous improvement in understanding weather systems and verifying where and how much precipitation occurred. But it is also very important for us, as individuals, to understand precipitation probability forecasts and the point of verification.

Certain situations can occur which tend to make people believe the forecast was wrong, when, in actuality, the forecast was completely correct, yet a misunderstanding of forecast wording caused problems. Some of these situations are as follows:

1. When a small POP is forecasted but rain occurs in your area.
2. When a large POP is forecasted but no rain occurs in your area.
3. When a small POP is forecasted and heavy activity occurs for a short time.

Many people believe that 20% POP implies light activity, however, the POP does not convey intensity (light, moderate or heavy) of precipitation.

Summary

Understanding the meaning of the probability of precipitation (POP) forecast is the first step in effective use of weather forecasts. Forecasts are very specific in their meaning but misunderstanding still occurs. To increase the understanding of precipitation forecasts of measurable precipitation, the National Weather Service currently provides a precipitation probability forecast that also can be considered as the expected area coverage of the forecasted precipitation. It is also important to realize that the probability forecast does not imply the magnitude of intensity. A probability of 20% does not mean light, moderate or heavy activity. And, finally, due to the complexities of weather, we usually view weather forecasts in a negative manner. Remember, however, that low probabilities of rain also imply high chances for no rain.

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