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PROBABILITY OF PRECIPITATION

Improving the weather forecast with the aid of numbers

Weather is an incredibly complex phenomenon. Despite the use of computers, satellites and skilled forecasters, it is difficult to predict future precipitation. Rain or snow cannot always be forecast with a simple yes or no. However, the probability of precipitation helps to gain a better understanding of what the future weather holds. It offers us another way to view the precipitation forecast.

To a large extent, Environment Canada's weather service has always been in the probability business. Forecasters have, at times, qualified their predictions with subjective phrases like "scattered showers" or "possibility of snow tomorrow." Now, forecasters are expressing this type of probability by numbers, adding a probability of precipitation statement to regional forecasts.

What is probability of precipitation?

Probability forecasts are a subjective numerical estimate of your chances of encountering measurable precipitation at some time during the forecast period. For example, a 40% probability of rain today means there are 4 chances in 10 of your getting wet today.

Basically, probability of precipitation forecasts allow the forecaster to express his/her degree of belief in the likelihood of precipitation occurring using percentages. In the regular forecast he/she might say "one or two showers today," but in the probability of precipitation he/she might predict 20 percent probability of precipitation. Again, if the public forecast says "there is a good chance of precipitation tomorrow," the forecaster might follow this by adding: 80 percent probability of precipitation.

Probability of precipitation and the weather forecast

ISOLATED SHOWERS THIS MORNING. CLOUDY THIS AFTERNOON. A FEW SHOWERS TONIGHT. RAIN TOMORROW.

PROBABILITY OF PRECIPITATION 30 PERCENT TODAY, 60 PERCENT TONIGHT, 90 PERCENT TOMORROW.

As the above example shows, probability forecasts are part of the regional forecasts for up to three specific periods: today, tonight and tomorrow. Today refers to the time period 6 am to 6 pm; tonight refers to the time period 6 pm to 6 am and tomorrow refers to the time period 6 am to midnight the following day.

Probabilities are given in 10% increments ranging from 0-100%. However, most forecasts tend to stay within the 10-90% range since forecasts cannot always be certain that precipitation will not or will occur due to the very complex nature of the atmosphere.

How is the probability forecast determined for a particular region? The forecaster studies the current weather situation, including wind and moisture patterns and determines how these patters will change with time. Factored into this is the effect of terrain, long-term weather statistics and the character of the precipitation (showery or continuous). In the case of showers, it is unlikely that precipitation will occur at all points in the region, whereas continuous rain is likely to be more widespread.

The procedures for producing a probability forecast do not radically differ from those employed in producing a regular forecast, but the forecaster does spend more time checking more points in a region before determining the possibility of precipitation.

The limitations of probability forecasts

Probability forecasts cannot be used to predict when, where or how much precipitation will occur. For example, a 60% probability of snow today does not mean it will snow during 60% of the day. However, the probability figure does mean that there is a 60% chance of a measurable amount of snow falling at that location.

A ROUGH AND READY USER'S GUIDE TO PROBABILITY OF PRECIPITATION

Probabilities	
0%	No precipitation even though it may be cloudy.
10%	Dry weather with only one chance in ten of snow or rain falling.
20%	Dry weather still expected.
30%	Go ahead with your picnic, boating or ski plans but you may have to take shelter.
40%	An umbrella is recommended. Make alternate plans for outdoor activities that are susceptible to rain. Not a good day to pave the driveway. Keep your fingers crossed!
50%	It's even Steven on whether it snows or not. Be prepared for all eventualities.
60%	Want to water your lawn? The odds are favourable that Mother Nature might give you some help.
70%	Suggest cancellation of outside events. The chances for dry weather have shrunk to three in ten.
80%	Wet weather likely. Make appropriate plans.
90%	The occurrence of precipitation is a near certainty. Venture out if you enjoy walking in the rain or playing in the snow.
100%	Precipitation is a certainty.

A person who did not encounter precipitation during the period would be tempted to say that forecast probability should have been zero, while the individual who did have precipitation during the same period would say the probability should have been 100%. Statistically, one cannot determine the accuracy of a single probability forecast. The accuracy can only be verified after a number of forecasts. A 30% probability of precipitation forecast is accurate if the same forecast was made on one hundred occasions and if it rained on 30 of those occasions.

The weather office forecasts a probability of precipitation for your region based on the information available at the time the forecast is issued. As the time of the event nears and more information becomes available, the forecaster is more accurate in predicting the probability of precipitation.

It should be emphasized that probability forecasts are not meant to replace regular weather forecasts. They simply supply a useful numerical addition to the existing forecasts.

The utility of probability forecasts

Probability forecasts are more than a novelty or an interesting variation on existing forecasts. They have considerable practical value and should allow many people to make more rational decisions about weather sensitive activities.

For example, a contractor might use probability of precipitation forecasts to decide whether or not to cure a concrete pad. He/she might juggle a 40 percent probability of rain forecast with such factors as actual dollor loss (due to rain) and expected loss based on the contractor's probable loss over time if the probability is accurate.

Probability forecasts are also useful to farmers making crop decisions, to promoters organizing outdoor sporting events and to your own personal picnics or skiing trips.

Generally, probability of precipitation forecasts aim to establish better communictions between the weather service and the public. Adding numbers to supplement the existing forecasts provides Canadians with more useful weather forecasts.

(*continued overleaf*)

The article EM9213 reprinted overleaf (with*out* its four illustrations) is used, together with EM9117 and EM9013, in Figure 7.2 of the STAT 220 Course Materials.

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