STOCHASTIC METHODS IN LONG-RANGE FORECASTING

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Armed with knowledge of the basic climatology of an area, it is possible to generate long-range forecasts using purely random processes. Such forecasts may demonstrate apparent accuracy and, as such, may be offered at the marketplace to the unwary.

In the following example, Newark, New Jersey is used and approximations to the climatic normals are taken for purposes of simplification. For the 31 days of January, climatology indicates that measurable precipitation will be observed on 10 days (2). Given a precipitation event in January at Newark, the conditional probability that 0.1 of an inch of snow will occur is 0.45 (3). This number is multiplied by 31, rounded off, and indicates that 5 of the January days with precipitation will include at least 0.1 inch of snow. Now, if we were to allow the numbers 1 through 5 to represent a snow event, 6-10 to represent rain, and 11 through 31 to represent no precipitation, we have a basis upon which to develop our forecast.

Utilizing a table of random units (4), we select and record from any two-digit column the occurrence, in order of appearance, of only those numbers between 01 and 31 for a total of 31 numbers (including duplicates). These 31 selections represent each day of January, while the specific number will indicate the type of precipitation, if any, on that day. By this method, a January precipitation forecast has been generated for 1, 5, 10 years in advance (your choice). Table 1 presents the daily precipitation forecast and the forecast verification using data from Newark, New Jersey for January 1982.

To misquote a big city mayor, let's ask the question, "How did we do?" Precipitation was forecast on 13 days of the month, and there were 13 such events. Quite good! Of these 13 events, 5 were forecast to be snow, while snow occurred on 9 days. While this may not be very good, the clever long-range forecaster could easily call for snow or rain on a January day with expected precipitation and change a mediocre forecast to one of excellence. On 15 of the 31 days, the forecast correctly indicated whether precipitation would occur, as well as precipitation type. If the forecaster is not satisfied with these results, one need only acknowledge that long-range forecasting is an inexact science, and consider a forecast of precipitation one day off to be essentially correct. Is this not reasonable, since the forecast is being made a year or more in advance? Accepting this premise, now 22 of the 31 days have been forecast correctly. Not bad!

Table 1. Random two digit units, resultant precipitation forecast (see text) and verification using Newark, New Jersey January 1982 data

Day	Random Unit	Expected Precipitation	Actual Precipitation
1	10	rain	rain
2	22	none	none
3	24	none	rain
4	28	none	rain
5	09	rain	none
6	10	rain	none
7	07	rain	rain
8	02	snow	none
9	01	snow	snow
10	07	rain	none
11	29	none	none
12	02	snow	none
13	29	none	snow
14	05	snow	snow
15	25	none	snow
16	09	rain	snow
17	17	none	none
18	14	none	none
19	08	rain	snow
20	15	none	snow
21	16	none	snow
22	18	none	none
23	16	none	snow
24	03	snow	none
25	09	rain	none
26	16	none	none
27	21	none	none
28	21	none	none
29	27	none	none
30	11	none	none
31	30	none	none

More sophisticated verification techniques could be applied and would likely show apparent skill. While forecasts of this type have long appeared in almanacs and on calendars, they occasionally surface on television and other media. Most disturbing is the likelihood that long-range economic decisions may be made on the basis of forecasts whose scientific sophistication does not exceed that presented here. The user of long-range forecast products should be wary of claims of accuracy, and reject forecasts based on methodologies not subject to peer review in scientific and technical publications.

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REFERENCES AND FOOTNOTES

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2. National Climatic Center, NOAA, EDS, February 1978: Climatography of the United States, No. 90, Airport Climatological Summary, Newark, New Jersey International Airport.

3. Shulman, M.D. and E.F. McCarthy, 1976; A Rain-Snow Climatology of New Jersey. Bull., N.J. Acad. Sci., 21, No. 1.

4. Standard Mathematical Tables, C.R.C., 1961: 12th Edition, Chemical Rubber Publishing Co., Cleveland, OH.

TO FOLKLORE ENTHUSIASTS

Red Sky Night, Sailor's Delight
Red Sky Morning, Sailors Take Warning.....

Mare's Tails and Mackerel Sky
Bring Roaring Gales, and Rain is Nigh.....

These old weather adages are rapidly becoming the province of old sea salts and retired farmers, and the art of natural weather prediction is falling by the wayside of a climate-controlled society. The ever-expanding computer age speaks a different tongue, and these gems of weather wisdom should be preserved before they are lost. Certainly some of these legends and quips of lore can be disproved, but just as many are as true as the day they were coined.

Have you a favorite quote or rhyme? Do you know of one but can't prove it wrong or right? Perhaps we can even help the viewer, listener, and reader to better understand meteorology and the atmosphere by collecting some of these proven true clues to forecasting the weather. Send your favorites along to me to include in a new corner of the Digest, and we'll try to keep a part of forecasting's roots from withering on the vine.

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