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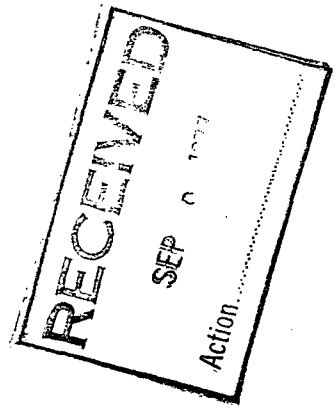
Technical Memoranda

EXPERIMENTAL ALGORITHM FOR AUTOMATED EXTENDED PERIOD FORECASTS

by

R.L. Raddatz and J.M. Bullas



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4905 Dufferin Street
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ABSTRACT

A simple algorithm has been developed which automatically translates the extended period forecast for Southern Manitoba into a form suitable for public distribution. Automation of "outlooks" was found to be feasible due to the limited input and standard output. Use of a simple algorithm leads to consistent wording of forecasts and uniform interpretation of guidance material.

ALGORITHME EXPÉRIMENTAL POUR PRÉVISIONS À PÉRIODE PROLONGÉE AUTOMATISÉES

pour

R. L. Raddatz et J. M. Bullas

RÉSUMÉ

On a mis au point un algorithme simple qui traduit automatiquement la prévision à période prolongée pour le sud du Manitoba pour la rendre sous une forme adaptée à la diffusion au public. On a trouvé que l'automatisation des aperçus est possible en raison du nombre limité de données à l'entrée et des résultats standardisés. L'utilisation d'un algorithme simple permet d'obtenir des prévisions à terminologie uniforme et une interprétation uniforme des documents.

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(Manuscript received February 7, 1977)

1. Introduction

Canadian forecast offices routinely issue extended period forecasts or outlooks for days 3, 4, and 5. These forecasts are based on numerical guidance statistically derived from the Spectral Model output by the Canadian Meteorological Centre. A local-use algorithm has been developed which automatically translates the numerical precipitation probability and temperature forecasts into words. The rationale for attempting to automate the extended period forecast was:

1) Outlooks have a simple, standard format. They are worded in broad general terms related to precipitation and temperature. The problem was, therefore, straightforward and served as an initial step towards the ultimate automation of more complex forecasts.

2) Local subjective input to extended period forecasts is of questionable value.

3) Automation would free the forecaster from the clerical task of converting the guidance from numbers to words.

4) Use of a simple algorithm would lead to consistent phraseology for the forecasts as well as a uniform interpretation of the guidance material.

Glahn (1970, 1976), Smith (1974, 1976), and Faulkner (1974) among others, have developed computer programs which compose worded forecasts based on objectively produced forecasts. The technique of Model Output Statistics (MOS) is generally used to derive forecasts of individual weather elements from the output of dynamic prediction models, then an algorithm converts the numerical forecasts into words.

The CMC MOS guidance for the extended period forecast consists of a bulletin (FMCN 3) transmitted via teletype daily at 0720 GMT plus a triple panel facsimile chart transmitted at 0628 GMT. The teletype guidance material, the main guidance considered in this paper, includes maximum (MX) and minimum (MN) temperature forecasts, and the probability of precipitation (POP) for each of days 3, 4 and 5 for a selected list of stations.

Example:

YWG 3/-10/35 -3/-15/25 6/-6/75

i.e. YWG $MX_i/MN_i/POP_i$ $i = 3, 4, 5$

The algorithm, using this guidance as input, automatically composes the extended period forecast. The numerical precipitation and temperature forecasts are translated into a form suitable for direct distribution to the public.

It was conceived that the preparation of extended period forecasts would be completely automated with the exception of a scrutinization of the output by the public forecaster. Therefore, control over the final wording of the forecast would remain with the forecaster.

2. Assumption

The following assumptions are implicit in the algorithm for automating an extended period forecast:

1) A single station forecast is representative of the larger geographical area containing the station.

2) Only a small amount of information is conveyed by the 3-panel version of the extended period forecast that is not already inherent in the FM bulletin.

3) The sky condition forecast is implicitly contained in the precipitation forecast.

4) There is a relationship between the probability of precipitation and its frequency of occurrence (i.e. showery or continuous precipitation).

5) A precipitation probability of less than 50% implies some cloudiness possible, but the absence of precipitation, i.e. fair weather (Manpub 1966).

6) Temperature and precipitation forecasts of moderate skill are possible for days 3 through 5 (AMS policy statement, 1973) however, in the absence of precipitation, sky condition cannot be forecast with any skill for an extended period.

3. Procedure

The steps in automatically preparing the extended period forecasts were:

1) Abstract the necessary parameters received in the FM bulletin and stored by a computer.

2) Derive the date and day of the week (DY) from the internal computer time register, then calculate the days of the week corresponding to days 3, 4 and 5.

3) Abstract the normal daily maximum temperature for day three as stored in a computer disc file.

4) Code the outlooks using standard phraseology.

5) Output the complete forecast, including the header, to the line printer or CRT and to the paper tape punch.

6) Check the "hard" copy, and if approved by the public forecaster, transmit via teletype using the paper tape output.

4. Phraseology

The Central Region directive covering extended period forecasts indicates that the outlooks "will provide information on precipitation, sky condition (if no precipitation) and temperature." Therefore, the elements to be forecast are completely covered by the FM bulletin received daily at 0720 GMT. For day three the forecast maximum temperature was compared with the normal maximum. The public extended period forecast then specified whether the temperature

was expected to be above, near or below normal. The temperature forecast for day 4 indicated cooling, no change or warming from day 3, while the forecast for day 5 specified the trend from day 4. The temperature modifiers were adjusted on a seasonal basis. The probability of precipitation was interpreted to imply three classes of weather: (a) fair weather, (b) showers and/or snowflurries, or (c) rain and/or snow. The forecast minimum temperature was taken into account in determining the type of precipitation (i.e. liquid, solid or mixed). The descriptive terms derived from the C.M.C. guidance are outlined in detail in the block diagram, Appendix I. Sample forecasts are given in Appendix II.

5. Conclusions

The automation of extended period forecasts is feasible due to the limited input and standard output. Automation is desirable for it leads to consistent wording of forecasts and uniform interpretation of guidance material. It is hoped that this experiment has addressed some of the problems that must be overcome before the automation of complex forecast can be achieved.

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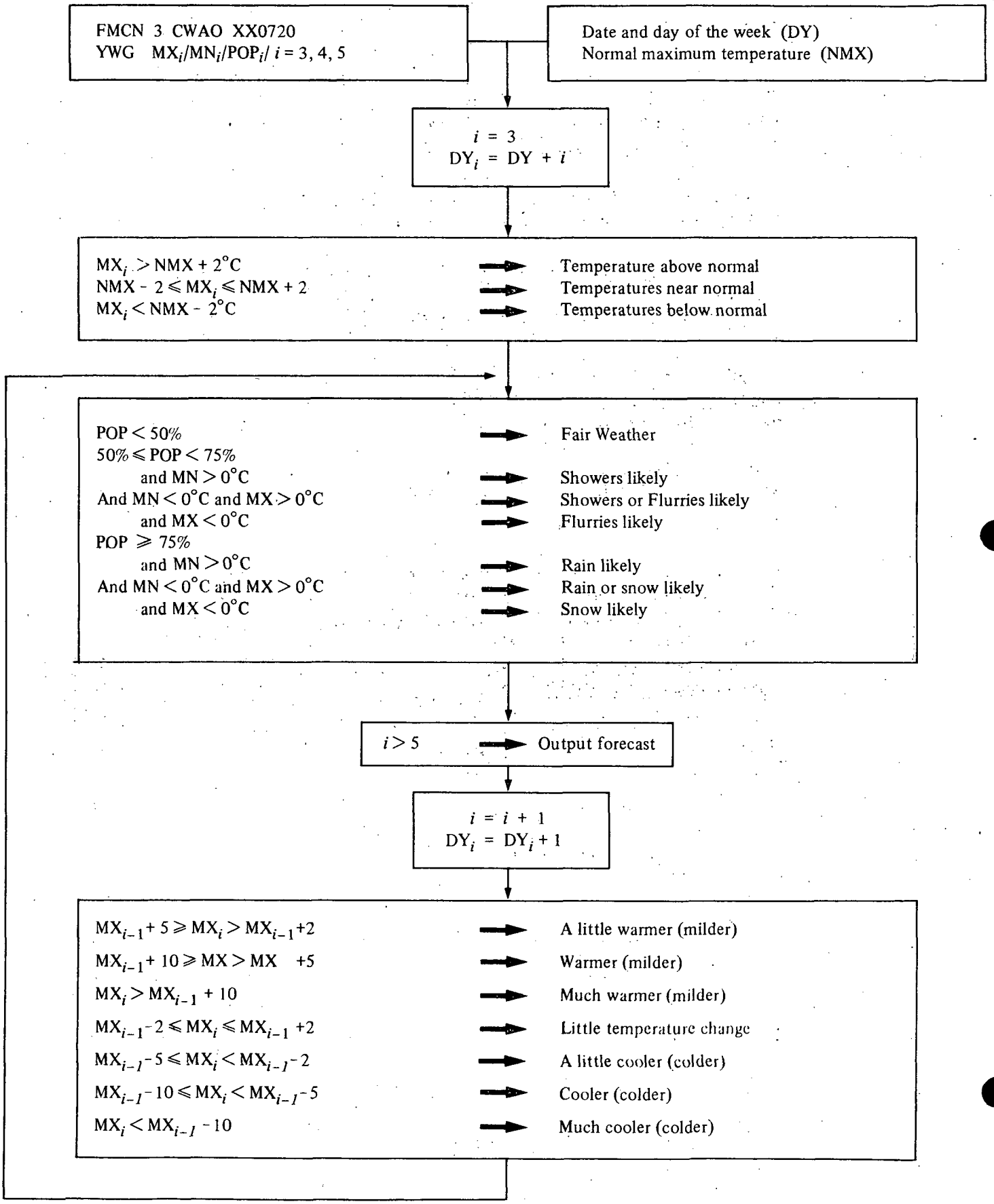
APPENDIX I

BLOCK DIAGRAM



Appendix II

Sample Forecasts

A.

FMCN 3 CWAO 4 300720

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.

YWG -07/-18/25 -01/-07/75 -04/-13/50*

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.

FPCN 52 CYWG 301320

WEATHER OUTLOOK FOR THURSDAY FRIDAY AND SATURDAY
FOR SOUTHERN MANITOBA ISSUED BY ENVIRONMENT CANADA
AT 7:30 AM CST TUESDAY NOVEMBER 30 1976

THURSDAY
FAIR WEATHER
TEMPERATURES NEAR NORMAL

FRIDAY
SNOW LIKELY
MILDER

SATURDAY
SNOWFLURRIES LIKELY
A LITTLE COLDER

---

* Simulated data

Sample Forecasts (cont'd)

B.

FMCN 3 CWAO 4 050720

.
.
.

YWG 18/12/80 15/06/55 21/11/30 *

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.
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FPCN52 CYWG 051130

WEATHER OUTLOOK FOR MONDAY TUESDAY AND WEDNESDAY
FOR SOUTHERN MANITOBA ISSUED BY ENVIRONMENT CANADA
AT 6:30 AM CDT SATURDAY JUNE 12 1976

MONDAY
RAIN LIKELY
TEMPERATURES BELOW NORMAL

TUESDAY
A FEW SHOWERS LIKELY
A LITTLE COOLER

WEDNESDAY
FAIR WEATHER
WARMER

---

* Simulated data

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