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MESO-SCALE FORECAST GUIDANCE AT THE VICTORIAN REGIONAL OFFICE

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1. Introduction

The purpose of this paper is to present an account of progress which has taken place towards providing meso-scale forecast guidance at the Victorian Regional Office (VRO) of the Bureau of Meteorology.The broad aim of the project is to develop statistical techniques for the interpretation of the output of synoptic-scale prognoses in terms of meso-scale distributions of local weather.This represents a realistic alternative to numerical - dynamical methods.

2. Method

The strategy for development has been to design the statistical techniques on the FACOM and then to use the results to design a forecast guidance package for the TANDEM computer in order to achieve the optimum impact on the operational environment.This strategy was adopted because the TANDEM does not have the capacity to support the ANALOGUE STATISTICS method for a large number of stations (the ANALOGUE STATISTICS method is a currently available forecast guidance package ,which develops its guidance by statistically analysing data associated with analogues to numerical and manual prognoses of the next day's circulation).

3. Current Status

Some forecast guidance for country centres ,including those for which fire weather predictions are requiresd ,is now available operationally in Victoria.At present ,the guidance is only available for the prediction of maximum temperature.

4. The FACOM Model

The FACOM model which generates the temperature forecast guidance is now described:

(a) The operator enters the following data:

- MSL pressure data extracted from 9 locations on the next day's 0000 GMT prognosis(Melbourne ,Mt Gambier ,Gabo Is, Smithton ,Hay ,Adelaide ,Nowra ,Maatsuyker Is ,Forrest);

- 850 hPa temperature data extracted from 5 grid points on the next day's 0000 GMT prognosis (32.5S/137.5E,32.5S/147.5E,37.5S/132.5E,37.5S/142.5E,37.5S/152.5E);

- 3 pm temperature data for 5 locations for the current day (Mt Gambier ,Wagga ,Mildura ,Sale ,Melbourne);

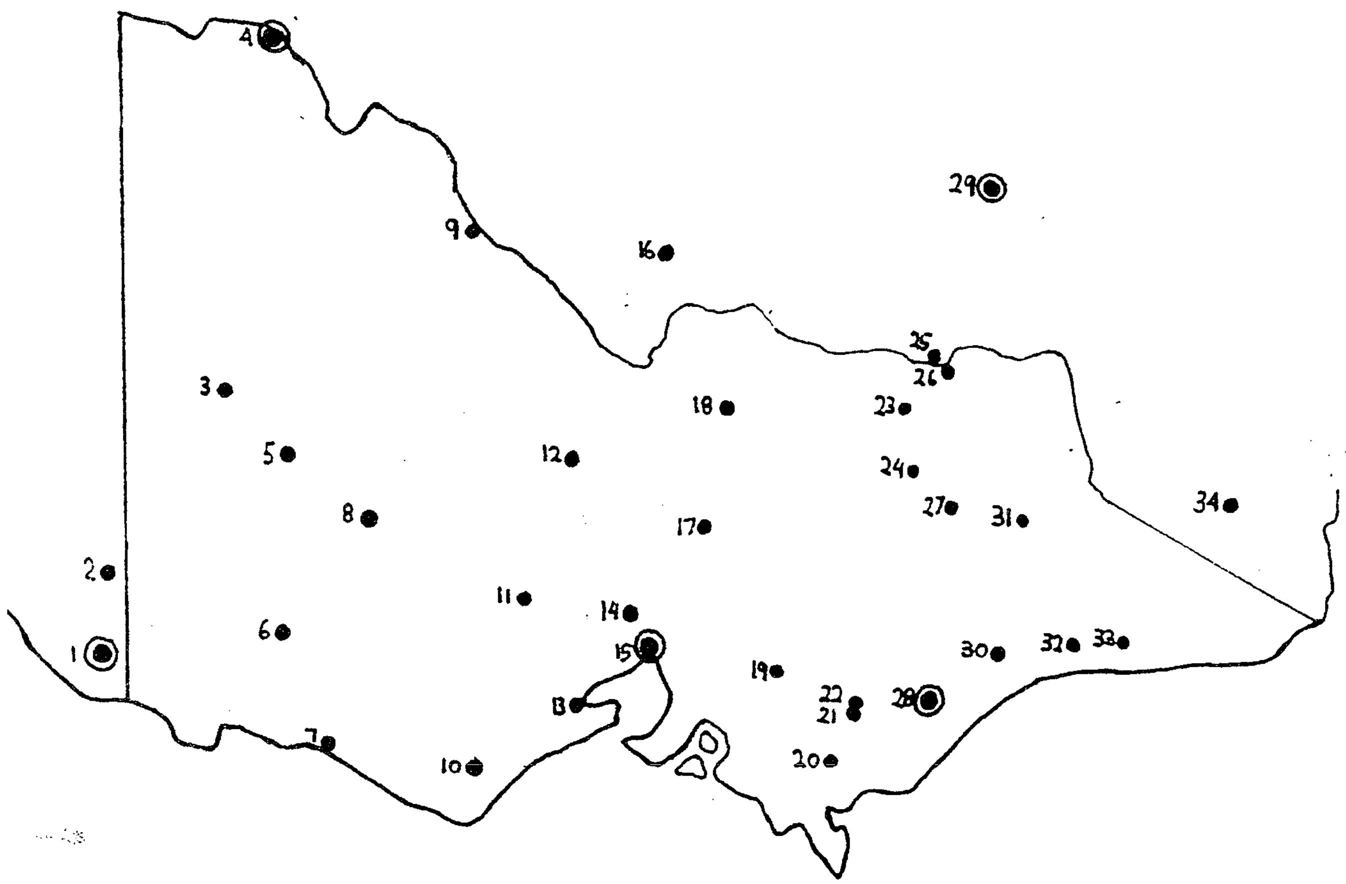
- the date for which the prognosis is issued.

(b) The output provides guidance for the prediction of maximum temperature at 34 locations in southeast South Australia ,southern New South Wales and Victoria (see FIG.1)

Figure 1.

Locations for which forecast guidance has been developed. Each spot represents a location. Key locations are represented by a spot surrounded by a circle.

1 = Mt Gambier, 2 = Penola, 3 = Nhill, 4 = Mildura, 5 = Horsham, 6 = Hamilton, 7 = Warrnambool, 8 = Stawell, 9 = Swan Hill, 10 = Weeaproinah, 11 = Ballarat, 12 = Bendigo, 13 = Geelong, 14 = Melbourne Airport, 15 = Melbourne, 16 = Deniliquin, 17 = Mangalore, 18 = Shepparton, 19 = Noojee, 20 = Olsens Bridge, 21 = Latrobe Valley, 22 = Yallourn, 23 = Beechworth, 24 = Mt Buffalo, 25 = Albury, 26 = Bonegilla, 27 = Mt Hotham, 28 = Sale, 29 = Wagga, 30 = Bainrsdale, 31 = Omeo, 32 = Nowa Nowa, 33 = Orbost, 34 = Bombala.



(c) The guidance is developed thus:

- Predictions for 5 locations (Mt Gambier ,Wagga ,Mildura Sale ,Melbourne)are derived by substituting data into regression equations of the form:

  MAX = f (combinations of sin day of year ,cos day of year 3 pm temperature ,850 hPa temperature ,northerly component of MSL flow ,cyclonicity).

  For each location a regression equation has been derived for each of 25 synoptic types and the model uses the MSL pressure data to establish the synoptic type ,and hence selects the appropriate 5 regression equations to be applied.

- Predictions for the other 29 locations are derived by substituting data into regression equations of the form:

  MAX = f(sin day of year ,cos day of year ,Mt Gambier MAX Wagga MAX ,Mildura MAX ,Melbourne MAX),the 5 MAX's being those derived in the first step above.

For all but 3 of the 29 locations (Mt Hotham ,Latrobe ,Weeaproinah) regression equations have been derived for each of the 25 synoptic types derived in the first step above.Furthermore ,Hazelwood data is used for the Latrobe regression equation.

5. The TANDEM Variation

The TANDEM variation of the model differs from the FACOM model in that predictions for the 5 locations (Mt Gambier ,Wagga ,Mildura ,Sale ,Melbourne) are those output by the ANALOGUE STATISTICS FORECAST GUIDANCE model.

6. Verification

To date only a very limited verification has been carried out.This verification has been performed using synoptic parameters forecast by the Australian Region Primitive Equation (ARPE) + 24 hours numerical model.The verification has been limited to the 30 days of April 1985 ,to the output of the FACOM model and to the 12 stations which make up the Victorian Regional Office's "Country City Maximum Temperature Verification" study namely:Mildura ,Swan Hill ,Horsham ,Bendigo ,Shepparton ,Ballarat Geelong ,Warrnambool ,Sale ,Latrobe Valley ,Orbost and Melbourne.

Table 1 summarizes the performance of the FACOM model predictions compared with that of the official forecasts.The table suggests that overall ,the official forecasts outperformed those of the model.

Figure 2 compares the performance of the model with the official performance ,on a daily basis.It may be noted that ,on most occasions the MODEL and official RMS errors were close to each other.

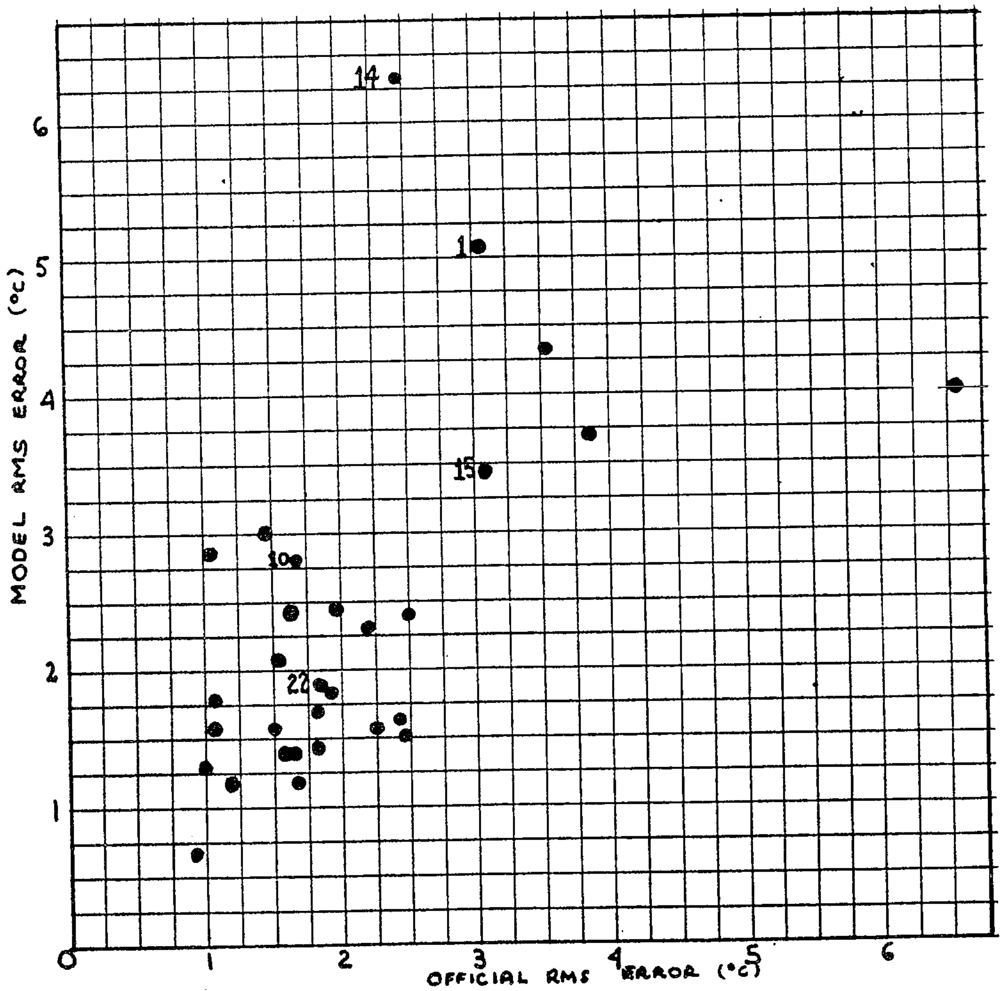
TABLE 1

Root mean square (RMS) errors (^{o}C) of the FACOM model predictions compared with those of the official forecasts, during April 1985.

City	Model RMS Error (^{o}C)	Official RMS Error (^{o}C)
Mildura	2.85	2.36
Swan Hill	2.85	2.08
Horsham	3.09	2.48
Bendigo	2.41	2.18
Shepparton	2.68	2.72
Ballarat	2.81	2.51
Geelong	2.59	2.52
Warrnambool	2.60	2.64
Sale	2.76	2.17
Latrobe Valley	2.69	2.23
Orbost	2.07	1.74
Melbourne	2.59	2.63
All	2.70	2.37

Figure 2.

Plots of root mean square (RMS) error (^{o}C) of the daily sets of official forecasts of maximum temperature (horizontal axis) versus the RMS error (^{o}C) of the corresponding daily set of model forecasts (vertical axis). The thirty plots are for each day of April 1985. Plots associated with the 1st, 10th, 14th, 15th and 22nd are indicated.



It was considered that the model's performance might be strongly related to the accuracy of the ARPE numerical prediction of the synoptic parameters.The thirty April 1985 ARPE products were ranked using a ranking coefficient RC where:

RC = f(850 hPa temperature prediction errors ,skill score of MSL pressure gradient)

The worst five ARPE model performances ,on this basis ,proved to be those of the 1st ,15th ,14th ,10th and 22nd.Figure 2 shows that ,in each of these cases ,the official forecasts were better than those of the FACOM model.In fact ,if one eliminates these five days from the verification ,the difference between the performance of the FACOM model and the official forecasts becomes negligible i.e overall RMS error for the FACOM model 2.26 degrees c.f' 2.34 degrees for the official forecasts.What is being suggested here is that forecasters are identifying situations when the ARPE model is likely to fail ,and taking this into account when preparing their forecasts.

7. Concluding remarks

An account of work carried out ,towards the development of statistically based meso-scale forecast guidance ,has been presented.Preliminary verification figures are based on too small a sample to allow solid conclusions to be drawn and it is proposed to carry out a more extensive verification.

Further work planned includes:

(a) To extend the guidance to other elements included in weather forecasts using a similar approach to that used for maximum temperature guidance;

(b) To study its accuracy in frontal situations ,in particular;

(c) To establish the viability of the statistical approach to the prediction of meso-scale distributions of weather elements;

(d) To use the predicted weather elements to derive prognostic fields of variables relevant to agricultural and other authorities (e.g.frost ,fire weather ,sheep grazier's alert ,etc).

8. Acknowledgements

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