Correspondence

Further testing of Stern's (1980) system for automated forecasting guidance

Stern (1980) described a pilot system for automated forecasting guidance and discussed the results of a trial of the system which was conducted during the spring of 1979. Dahni (1981) repeated this test during the spring of 1980. The additional testing suggests that Stern (1980) may have understated the skill of the model in writing that it was 'capable of providing guidance of skill not significantly different from that of the current official product'. The purpose of this note is to discuss verification data from the 1980 test and from the two tests combined (Tables 1 and 2).

The temperature forecast verification data for the two springs were analysed in order to assess the model's performance in unusual situations. Regression relationships of the form

$$E = C_0 + C_1 D \qquad \ldots 1$$

where E is the modulus of the forecast error, D is the modulus of the departure of the observed value from the long-term monthly mean, and C_0 and C_1 are constants, were derived employing the data associated with each of the four sets of forecasts (model maximum, Bureau maximum, model minimum, Bureau minimum). The relationships so derived are depicted in Fig. 1. Fig. 1 suggests that:

(a) the magnitude of the forecast error increases with increasing departure of the observed value from the monthly mean in all four cases;

(b) the magnitude increases at a greater rate for Bureau minimum temperature forecasts than for model minimum temperature forecasts;

(c) the magnitude increases at about the same rate for Bureau and model maximum temperature forecasts.

Table 1. A summary of the model's performance during the spring of 1980

Verification parameter	*Combined data for Sempember, October and November (91 cases)*			*Data specifically for October (31 cases)*		
	Model	*Bureau*	*Persistence*	*Model*	*Bureau*	*Persistence*
r.m.s. error of maximum temperature forecasts (°C)	3.28 [−0.48]	3.51 [−0.12]	5.25	2.93 [−0.94]	3.18 [+0.58]	4.63
r.m.s. error of minimum temperature forecasts (°C)	1.89 [−0.13]	2.43 [−0.56]	4.75	1.97 [+0.32]	2.63 [−0.16]	5.96
r.m.s. error of quantitative precipitation forecasts (Ranges)	0.98 (47)	0.90 1.05	1.37	1.02 (18)	0.93 1.16	1.81
Skill score	6.18	6.34	4.81	6.52	6.13	4.45

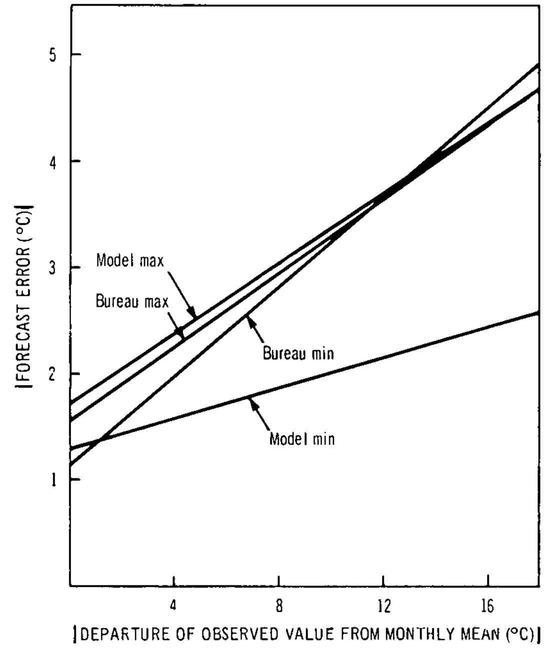
Note: 1. Two values are given for the r.m.s. error of the Bureau's quantitative precipitation forecasts. The first one given is for the 18-hour estimate; the second one given is for the 24-hour estimate.
2. Number of rain days (midnight to midnight period) are given in round brackets below the r.m.s. error for model forecasts.
3. Mean biases (forecast minus observed) of the temperature forecasts are given in square brackets below the respective r.m.s. errors.

Table 2. A summary of the model's performance during the two springs

Verification parameter	*Combined data for September, October and November (91 cases)*			*Data specifically for October (31 cases)*		
	Model	*Bureau*	*Persistence*	*Model*	*Bureau*	*Persistence*
r.m.s. error of maximum temperature forecasts (°C)	3.03 [−0.08]	3.02 [+0.01]	4.95	2.63 [−0.27]	2.84 [+0.34]	4.72
r.m.s. error of minimum temperature forecasts (°C)	1.87 [−0.28]	2.24 [−0.51]	4.09	1.81 [+0.04]	2.26 [−0.16]	4.79
r.m.s. error of quantitative precipitation forecasts (Ranges)	1.04 (99)	1.00 1.07	1.45	1.15 (37)	1.14 1.19	1.76
Skill score	6.44	6.65	4.87	6.55	6.44	4.61

Note: The r.m.s. errors of the model's minimum temperature forecasts — for the springs (182 cases), and for the Octobers (62 cases) — are significantly smaller (at the 5% level) than corresponding Bureau r.m.s. errors.

Fig. 1 Regression relationships (Eqn 1) between the magnitude of the forecast error and the magnitude of the departure of the observed value from the monthly mean.



Significance tests on the four C_1 (at the 5 per cent level) verified the above.

The additional data provide further support for Stern's (1980) proposition that the man-machine forecast be obtained by a consensus approach. Table 3 summarises the official temperature errors that would have occurred had predictions during the two trial periods been obtained by simply averaging the man's estimate and the machine's estimate. The averaging procedure is a simplified version of an objective method to optimally combine two forecasts (Stern 1981) in a regression equation of the form

$$T = C_2 + C_3E_1 + C_4E_2 \qquad \ldots 2$$

where T is the observed value, E_1 and E_2 are the estimates, and the constants C_2, C_3, and C_4 are derived on the basis of a large number of prior trials.

References

Dahni, R. R. 1981. Unpublished data available from the Department of Meteorology, University of Melbourne.

Stern, H. 1980. A system for automated forecasting guidance. *Aust. Met. Mag.*, *28*, *3*, 141-54.

Stern, H. 1981. Automation and operational meteorology — a review. *Tech. Rep. 34*, Bur. Met., Australia.

Table 3. A comparison between r.m.s. errors of official (manual) temperature predictions, and r.m.s. errors that would have occurred had official predictions been derived by the consensus approach described above.

Verification parameter	*Spring 1979 and 1980 combined (182 cases)*	*October 1979 and 1980 combined (62 cases)*
r.m.s. error of Bureau maximum temperature forecasts (°C)	3.02	2.84
r.m.s. error of consensus maximum temperature forecasts (°C)	2.73	2.48
r.m.s. error of Bureau minimum temperature forecasts (°C)	2.24	2.26
r.m.s. error of consensus minimum temperature forecasts (°C)	1.84	1.78

25 March 1981

H. Stern
Bureau of Meteorology
Box 1289K
Melbourne, Vic., 3001
Australia.

R. R. Dahni
Department of Meteorology
University of Melbourne
Parkville, Vic., 3052
Australia.