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Numerical prediction model performance summary January to March 1996

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Introduction

This summary continues the series comparing the performances of numerical weather prediction (NWP) models for a three-monthly period.

Models and methods

Explanations of the National Meteorological Centre (NMC), Melbourne, NWP models and global models from other operational centres, together with Australian verification methods, can be found in a previous article (Skinner 1995). The three models considered from NMC, Melbourne, are: RASP (Regional Assimilation and Prognosis), TAPS (Tropical Analysis and Prediction System) and GASP (Global Assimilation and Prediction). Overseas global models included in the comparisons are: ECSP (European Centre for Medium Range Weather Forecasts (ECMWF) Spectral Assimilation), USAVM (National Center for Environmental Prediction (NCEP) Washington Spectral model for aviation) and UKGC (UK Meteorological Office Grid PE model).

All verification statistics have been calculated within NMC Melbourne, and models were verified against their own analyses. Quoted results apply to the irregular Australian verification area only. RASP and TAPS models were run several hours earlier than GASP and this premature data cut-off, particularly for satellite information, adversely affected their measured skill against GASP.

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Note that the Australian region analysis verification grid has southerly points which are outside the TAPS grid and are therefore missing from the statistics presented in these summaries.

Notes on NWP systems

ECMWF

A new analysis scheme was implemented on 30 January 1996. The new scheme, known as 3D-VAR, is a three-dimensional variational analysis scheme in which observations of all types for the globe are analysed simultaneously. The new analyses have demonstrated positive impact on medium-range predictions, with the clearest advantage in the southern hemisphere (Andersson et al. 1995). Minor changes to the forecast model were implemented at the same time.

UK

On 26 January 1996 the 3rd Climate Version (3CV) physics parametrisations were implemented in the operational Global Model. The package contained changes to the formulation of mixed cloud, a correction to saturation vapour pressure, a revised parametrisation for the radius of water drops and small modifications to the precipition scheme. The changes have a largely neutral effect on the model operational performance (nwp Gazette).

TAPS

A new version of the tropical analysis and prediction system (TAPS) was implemented in NMC Melbourne from the 0000 UTC run on 24 January

1996. The new version should improve tropical cyclone track prediction and reduce overdevelopment of convectively active situations. The domain has been increased from 37°N to 45°S and 85°E to 176°E and is now 41°N to 45°S and 70°E to 184°E. The horizontal and vertical resolution are unaltered at 95 km and 19 levels respectively.

January to March 1996 intercomparisons

Local models: (RASP, TAPS, GASP)

Similar patterns to previous periods are apparent at MSLP with GASP scoring best and RASP worst (Fig 1. (a),(b)). The improvement of TAPS over

Fig. 1(a) Comparison for RASP/TAPS/GASP from January to March 1996. S1 skill scores at MSLP for combined base-times 0000 UTC/1200 UTC and intervals +12, +24, +36, +48 h over the irregular Australian verification grid.

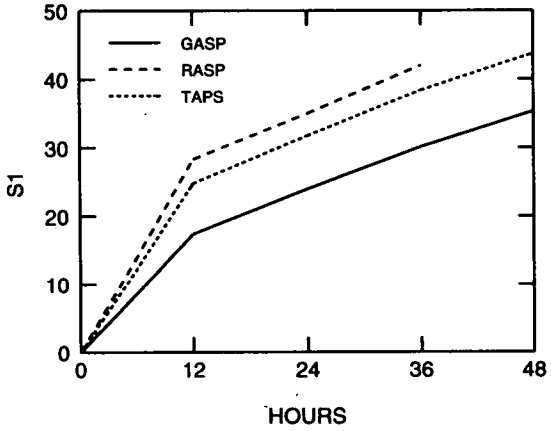


Fig. 1(b) Comparison for RASP/TAPS/GASP from January to March 1996. Root mean square errors (hPa) at MSLP for combined base-times 0000 UTC/1200 UTC and intervals +12, +24, +36, +48 h over the irregular Australian verification grid.

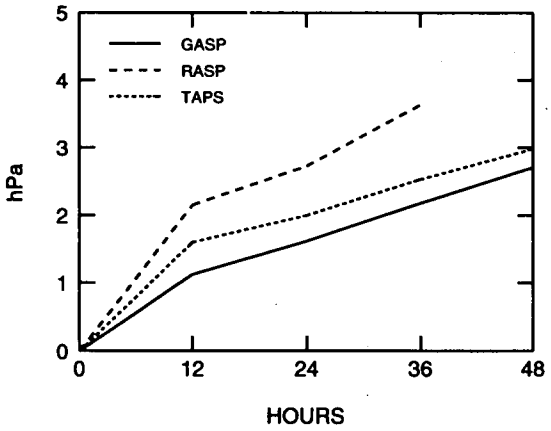


Fig. 1(c) Comparison for RASP/TAPS/GASP from January to March 1996. S1 skill scores at 500 hPa for combined base-times 0000 UTC/1200 UTC and intervals +12, +24, +36, +48 h over the irregular Australian verification grid.

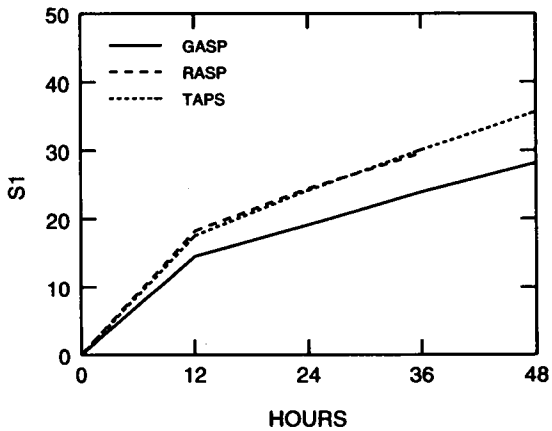
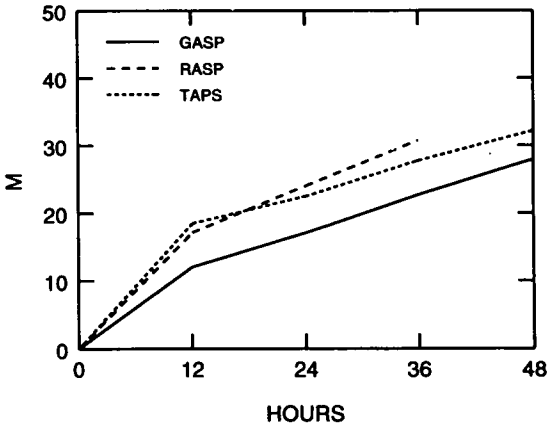


Fig. 1(d) Comparison for RASP/TAPS/GASP from January to March 1996. Root mean square errors (m) at 500 hPa for combined base-times 0000 UTC/1200 UTC and intervals +12, +24, +36, +48 h over the irregular Australian verification grid.



RASP is greatest during January (Fig. 3(a)). At 500 hPa, however, RASP and TAPS skill scores are very similar, with RASP having a slight edge up to +24h (Fig. 1(c)). The monthly split (Fig. 3(b)) shows this similarity to result from averaging. RASP scored better than TAPS in February and March but not in January. Root mean square errors show greater skill for RASP to +18h and for TAPS at longer periods (Fig 1.(d)).

Global models: (GASP, ECSP, UKGC, USAVM)

The most striking feature of the three months January to March 1996 was the improvement of

Fig. 2(a) Comparison for GASP/EC/US/UK from January to March 1996. S1 skill scores at MSLP for combined base-times 0000 UTC/1200 UTC and intervals +24 h to +168 h over the irregular Australian verification grid.

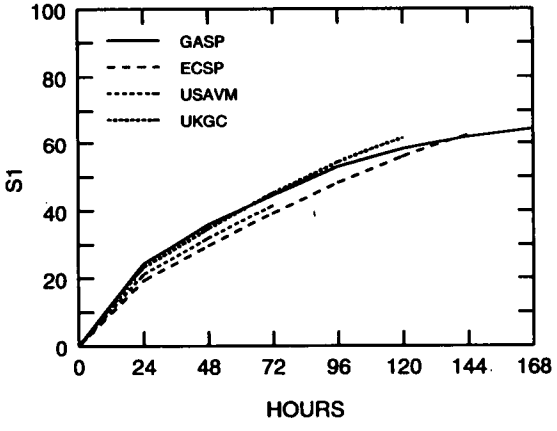


Fig. 2(c) Comparison for GASP/EC/US/UK from January to March 1996. S1 skill scores at 500 hPa for combined base-times 0000 UTC/1200 UTC and intervals +24 h to +168 h over the irregular Australian verification grid.

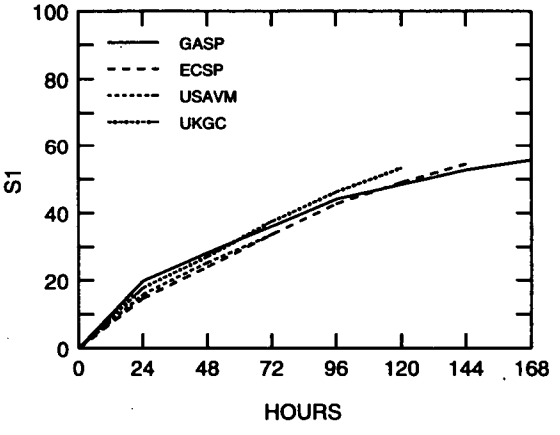


Fig .2(b) Comparison for GASP/EC/US/UK from January to March 1996. Root mean square errors at MSLP (hPa) for combined base-times 0000 UTC/1200 UTC and intervals +24h to +168 h over the irregular Australian verification grid.

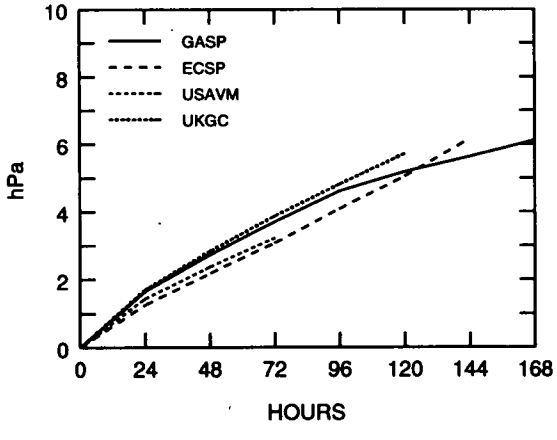


Fig. 2(d) Comparison for GASP/EC/US/UK from January to March 1996. Root mean square errors (m) at 500 hPa for combined base-times 0000 UTC/1200 UTC and intervals +24 h to +168 h over the irregular Australian verification grid.

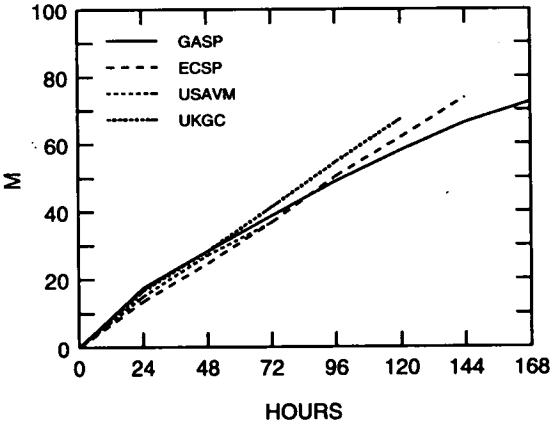


Fig. 3(a) Monthly S1 skill scores at MSLP for RASP/TAPS/GASP from January to March 1996 for base-time 1200 UTC and interval +24 h over the irregular Australian verification grid.

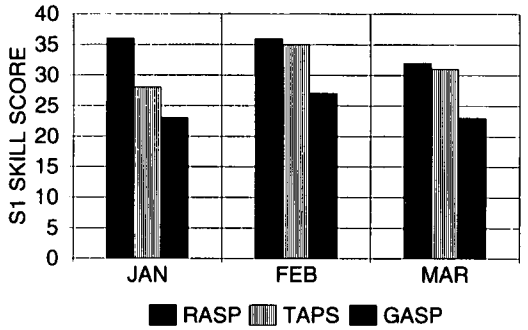


Fig. 3(b) Monthly S1 skill scores at 500 hPa for RASP/TAPS/GASP from January to March 1996 for base-time 1200 UTC and interval +24 h over the irregular Australian verification grid.

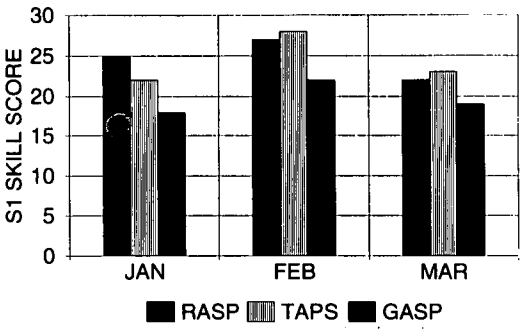


Fig. 3(c) Monthly S1 skill scores at MSLP for GASP/EC/UK/US from January to March 1996 for base-time 1200 UTC and interval +72 h over the irregular Australian verification grid.

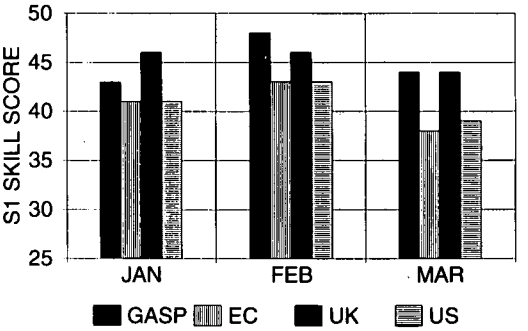
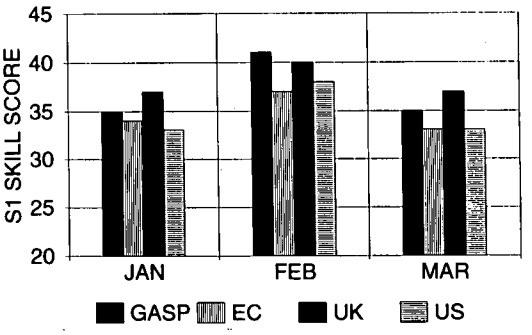


Fig. 3(d) Monthly S1 skill scores at 500 hPa for GASP/EC/UK/US from January to March 1996 for base-time 1200 UTC and interval +72 h over the irregular Australian verification grid.



the US model relative to the others. At both MSLP and 500 hPa, the US model was the closest rival to the EC (Fig. 2(a),(b),(c),(d),3(c),(d)). In January at 500 hPa and +72h, the US bettered the EC in skill-score assessment (Fig. 3(d)). For some tropical systems the EC showed intense systems in both analyses and prognoses and small errors in location gave large errors in verification for otherwise good forecasts. The US tended to show weaker tropical systems in both analyses and prognoses and hence produced smaller errors. The UK and GASP were more inclined than EC and US to overdevelop ridges and not to deepen low pressure systems enough. In the past at this time of year, GASP had a tendency to overdevelop tropical systems. This tendency is not apparent this year and can be attributed to the new version of GASP implemented in December 1995 (Skinner and Hart 1996). The replacement of the Kuo convection parametrisation by the Tiedtke mass flux scheme appears to have had the desired effect. There is some suggestion that the current GASP tropical predictions are too inert. Experiments on reducing the horizontal diffusion, while showing some beneficial aspects in development and intensity of lows, have reduced the overall skill.

GASP's tendency to overdevelop the trough over Western Australia continues.

References

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