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Numerical prediction model performance summary July to September 1995

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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 models considered are: three models from the National Meteorological Centre, Melbourne, RASP (regional), GASP (global) and TAPS (tropical) and global models; ECSP from the European Centre for Medium-range Weather Forecasting (ECMWF); USAVM from the National Meteorological Center (NMC) Washington; and UKGC from the UK Meteorological Office.

All verification entities are those calculated within NMC Melbourne and models are verified against their own analyses. Quoted results are over the irregular Australian verification area only.

RASP and TAPS models are run several hours earlier than GASP and this premature data cut-off, particularly for satellite information, adversely affects their measured skill against GASP.

July to September 1995 intercomparisons

A low zonal index regime, with cut-offs or complex low pressures in the Australian region, prevailed in July and early August. A more zonal regime (high zonal index), with strong ridging over the continent, followed and lasted until the last week in September when there was another series of cut-offs. The models often fail to capture the structure, evolution and development of cut-offs.

Local models (RASP, TAPS, GASP)

GASP continues to be a better forecast by at least 12 hours than RASP and TAPS for sea-level pressure and by a slightly smaller margin at 500 hPa (Fig. 1(a), (c)). Similar comparisons of root mean square (rms) errors show GASP to score as well or better at +48, +36 than RASP does at +36, +24 h (Fig. 1(b), (d)). The improvement is most evident at sea level (Fig. 1(b)). Whereas the skill scores for RASP and TAPS are very similar, the TAPS rms errors are significantly better than RASP's rms, although not as good as GASP (Fig. 1(b), (d)).

Sea-level pressure skill scores at +24 h for August were significantly lower than for July and September (Fig. 3(a)). All three models show improved skill during the period of zonality.

Global models (GASP, ECSP, UKGM, USAVM)

Skill scores continue to rank models from best to worst as ECSP, UKGM, USAVM and GASP at both sea level and 500 hPa (Fig. 2(a), (c)) although it is difficult to distinguish between the USAVM and UKGM prognoses at 500 hPa.

Rms errors show the USAVM model to be slightly less skillful than GASP, with GASP and the UKGM model having similar results. (Fig. 2(b), (d)).

As with the local models, the global models showed improved overall skill in August (Fig. 3(b)). At +72 h, the scores dropped 11 to 14 points reflecting the difficulty all models had with the low zonal index regime in July/early August and late September.

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Fig. 1(a) Comparison for RASP/TAPS/GASP from July to September 1995. S1 skill scores at MSLP for combined base times 0000UTC/1200UTC and intervals +12, +24, +36, +48 h over the irregular Australian verification grid.

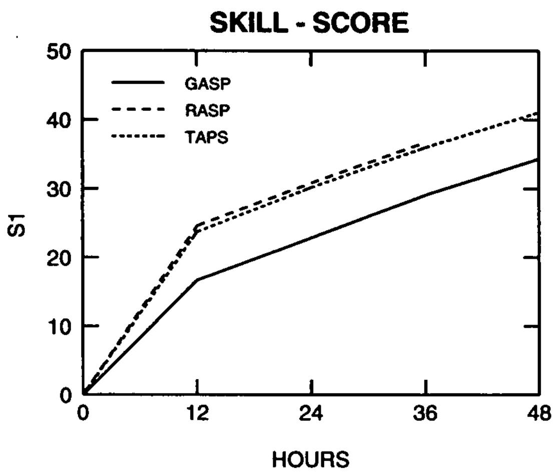


Fig. 1(b) Comparison for RASP/TAPS/GASP from July to September 1995. Rms errors at MSLP for combined base times 0000UTC/1200UTC and intervals +12, +24, +36, +48 h over the irregular Australian verification grid.

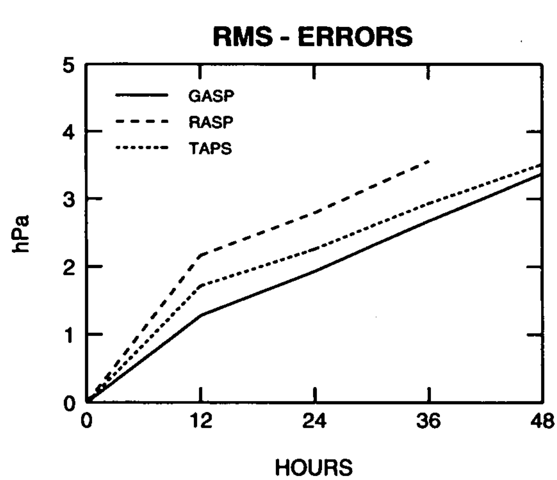


Fig. 1(c) Comparison for RASP/TAPS/GASP from July to September 1995. S1 skill scores at 500 hPa for combined base times 0000UTC/1200UTC and intervals +12, +24, +36, +48 h over the irregular Australian verification grid.

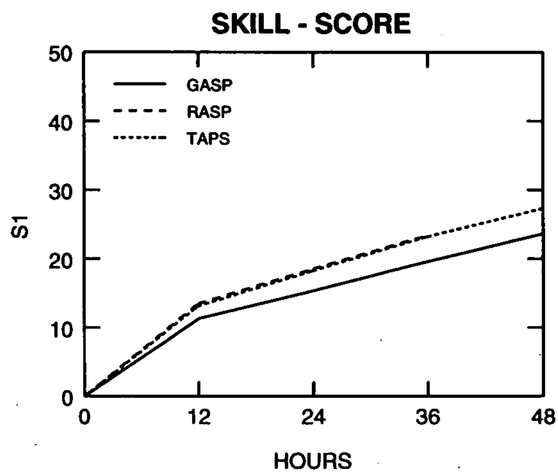


Fig. 1(d) Comparison for RASP/TAPS/GASP from July to September 1995. Rms errors at 500 hPa for combined base times 0000UTC/1200UTC and intervals, +12, +24, +36, +48 h over the irregular Australian verification grid.

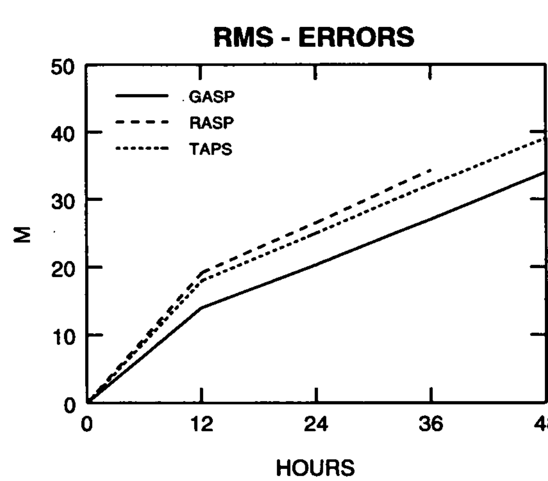


Fig. 2(a) **Comparison for GASP/EC/US/UK from July to September 1995. S1 skill scores at MSLP for combined base times 0000UTC/1200UTC and intervals +24 h to +168 h over the irregular Australian verification grid.**

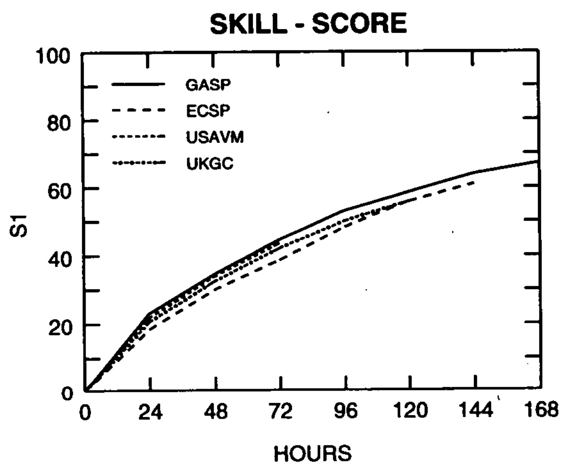


Fig. 2(c) **Comparison for GASP/EC/US/UK from July to September 1995. S1 skill scores at 500 hPa for combined base times 0000UTC/1200UTC and intervals +24 h to +168 h over the irregular Australian verification grid.**

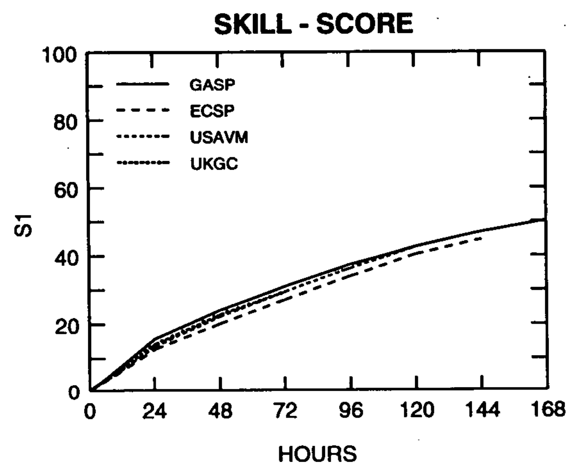


Fig. 2(b) **Comparison for GASP/EC/US/UK from July to September 1995. Rms errors at MSLP for combined base times 0000UTC/1200UTC and intervals +24 h to +168 h over the irregular Australian verification grid.**

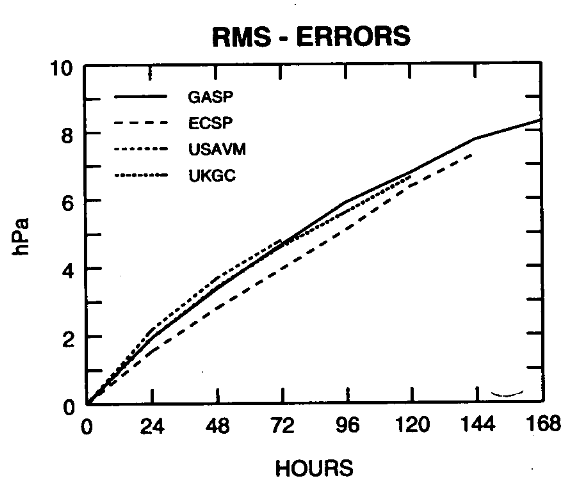


Fig. 2(d) **Comparison for GASP/EC/US/UK from July to September 1995. Rms errors at 500 hPA for combined base times 0000UTC/1200UTC and intervals +24 h to +168 h over the irregular Australian verification grid.**

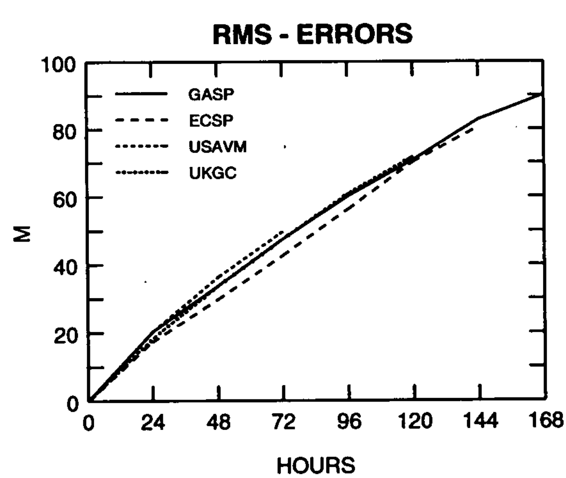


Fig. 3(a) **Monthly S1 skill scores at MSLP for RASP/TAPS/GASP from July to September 1995 for base time 1200UTC and interval +24 h over the irregular Australian verification grid.**

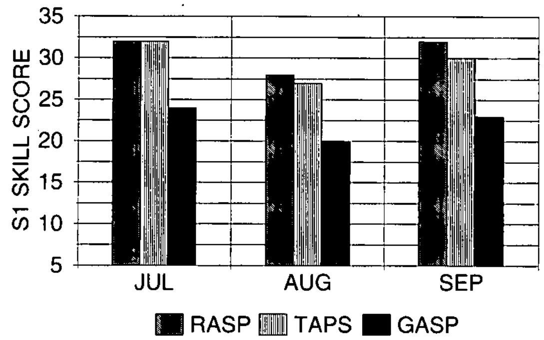
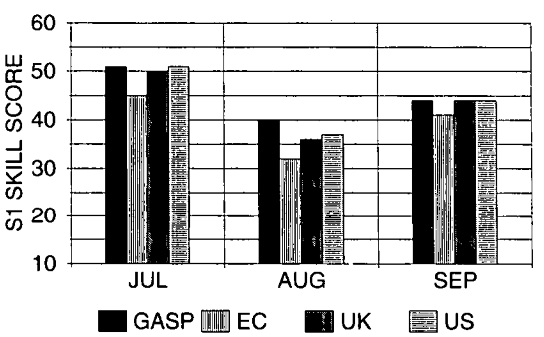


Fig. 3(b) **Monthly S1 skill scores at MSLP for GASP/EC/UK/US from July to September 1995 for base time 1200UTC and interval +72 h over the irregular Australian verification grid.**



Models tended to predict mobile troughs when a cut-off was in fact developing, and the USAVM and UKGM tended to retain the pattern too long and overdevelop it. ECMWF generally performed best and was the earliest to respond to changes.

The ECMWF system, and to a lesser degree the USAVM system, tend to generate spurious secondary centres especially at the northern apex of troughs. They tend to split large low pressure systems into several centres with a secondary centre located north of the verifying centre of the low. This mainly occurs well to the south of the continent but occasionally is within the verification area.

GASP shows a bias to weakening low pressure systems, particularly cut-off systems. It is also more prone to miss rapid developments, probably as a result of its lower resolution. The problem of over-developing the heat low region of northern Western Australia reappeared in September. This occasionally compromises its performance when this overdeveloped feature links with systems further south.

The USAVM system also showed a similar bias to GASP in lowering pressures over Western Australia in September. In contrast, the UKGC model shows a bias for too much ridging over the north of Western Australia and performs relatively weakly in predicting the developments of troughs in this reigon.

In the 30 to 40 degree South belt, UKGM high pressures are too high by 2 to 5 hPa. USAVM shows a similar but less marked tendency while GASP central pressures are generally too low by 2 to 3 hPa.

Acknowledgments

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References

Skinner, W. 1995 Numerical prediction model performance summary April to June 1995. *Aust. Met. Mag.*, *44*, 309–12.