

Numerical weather prediction model performance summary July to September 2003

Paul Stewart

National Meteorological and Oceanographic Centre, Bureau of Meteorology,
Australian

(Manuscript received January 2004)

Introduction

This summary, covering the three-month period July to September 2003, continues the series reporting on the performances of numerical weather prediction (NWP) models used operationally, in the Bureau of Meteorology.

NWP models verified

The models considered in this performance summary are from the NMOC (National Meteorological and Oceanographic Centre) in Melbourne, ECMWF (European Centre for Medium-range Weather Forecasts), NCEP (National Centers for Environmental Prediction, USA), UKMO (Met Office, United Kingdom) and JMA (Japan Meteorological Agency).

Three local models, from NMOC, are considered, *viz.*: LAPS (Limited Area Prediction System) – run over the Australian region on a 0.375° latitude/longitude grid, with 29 vertical levels, and using one-dimensional variational retrievals (1DVAR) and multivariate statistical interpolation in the assimilation; TLAPS (Tropical Limited Area Prediction System) – run over an extended tropical domain on a 0.375° latitude/longitude grid, with 29 vertical levels, and multivariate statistical interpolation in the analysis; and GASP (Global ASSimilation and Prediction) – run over a global domain at the Triangular spectral truncation resolution T239 in the horizontal, and 29 levels in the vertical, together with 1DVAR and multivariate statistical interpolation in the assimilation. These basic features have remained unchanged since the last summary (Stewart 2003).

The following four overseas global models are included in the comparisons (where the associated acronyms, used in the figures below, are shown in parentheses): ECMWF Assimilation and Spectral Model (ECSP) – run at the resolution: T511 and 60 levels, with a 4DVAR multivariate analysis procedure; NCEP Global Forecast System (USAVN) – run at T254 and 64 levels (for the forecast times processed below), with 3DVAR and a multivariate Spectral Statistical Interpolation analysis scheme; UK Meteorological Office Grid Point model (UKGC) – run on a 0.5555° latitude/0.8333° longitude grid and 38 levels, with a 3DVAR analysis scheme; and JMA Global Spectral Model (JMAGSM) – run at T213 and 40 levels, with a 3DVAR assimilation scheme.

Recent changes to the NWP models

Local models

The only significant change made to the local models during the July to September quarter was the incorporation of cloud-drift winds derived locally using GOES-9 (which had replaced GMS-5 earlier in the year) in LAPS and TLAPS.

Overseas models

Notes on operational upgrades and changes to the overseas models can be found on their respective web sites:

- ECMWF: <http://www.ecmwf.int/publications/newsletters>
- JMA: http://www.jma.go.jp/JMA_HP/jma/jma-eng/jma-center/nwp/nwp-top.htm

- NCEP: http://www.emc.ncep.noaa.gov/gmb/STATS/html/model_changes.html
- UKMO: <http://www.metoffice.com/research/nwp/publications>

Verification method

A description of the S1 skill-score, as applied in the National Meteorological and Oceanographic Centre (NMOC), can be found in an earlier article (Skinner 1995). All results have been calculated within NMOC Melbourne, where the models were verified against their own analyses. From the large number of objective verification results routinely produced, the statistics presented here cover only the 500 hPa geopotential height and mean sea-level pressure (MSLP) fields over the irregular Australian verification area (Miao 2003). It is noted that this particular verification grid has southerly points that are outside the TLAPS domain and, hence, the TLAPS scores are not strictly compatible with those from GASP and LAPS. The results for the 0000 and 1200 UTC base-times have been combined. The results are presented, at this stage, for forecast periods out to a maximum of 192 hours.

The NMOC limited area operational models are run several hours before GASP (for a given base date-time). This earlier data cut-off could affect their skill relative to GASP. Also, the US, UK and JMA models run with a short data cut-off time of about three hours, compared with seven hours for GASP and ten hours for ECMWF, which again makes the intercomparison not strictly compatible.

Review of performance – July to September 2003

Local models (GASP, TLAPS, LAPS)

The MSLP and 500 hPa geopotential height verification intercomparisons, between the local models for the July to September quarter (Fig. 1), show that GASP performed better than the limited area systems for forecast periods out to 48 hours.

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

For the July to September quarter (Fig. 2), the ECMWF (ECSP) continues to perform better than the other global systems, at least with respect to MSLP and 500 hPa geopotential height. Figure 3, which shows the anomaly correlation results for MSLP, again highlights the impressive performance of the ECMWF system relative to the other global systems.

Fig. 1(a) MSLP S1 skill-score comparison, for different forecast periods, between LAPS, TLAPS and GASP (July to September 2003).

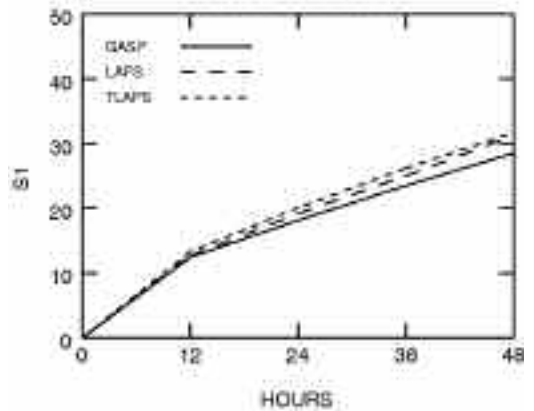
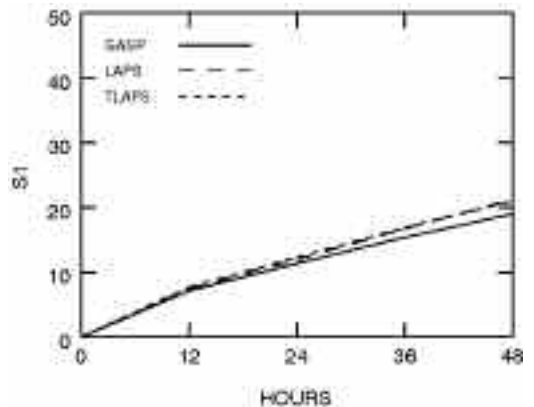


Fig. 1(b) 500 hPa geopotential height S1 skill-score comparison, for different forecast periods, between LAPS, TLAPS and GASP (July to September 2003).



(PERS refers to Persistence in Fig. 3.) Assuming the commonly used cut-off of 60 per cent as the criterion for useful forecasts, it is seen that, of the products processed, the ECMWF consistently produced useful guidance out to at least seven days, approximately one day more than the GASP and JMA systems.

References

- Miao, Y. 2003. Numerical prediction model performance summary July to September 2002. *Aust. Met. Mag.*, 52, 73-5.
- Skinner, W. 1995. Numerical prediction model performance summary April to June 1995. *Aust. Met. Mag.*, 44, 309-12.
- Stewart, P. 2003. Numerical weather prediction model performance summary January to June 2003. *Aust. Met. Mag.*, 52, 277-80.

Fig. 2(a) MSLP S1 skill-score comparison, for different forecast periods, between GASP, ECSP, USAVN, UKGC and JMAGSM (July to September 2003).

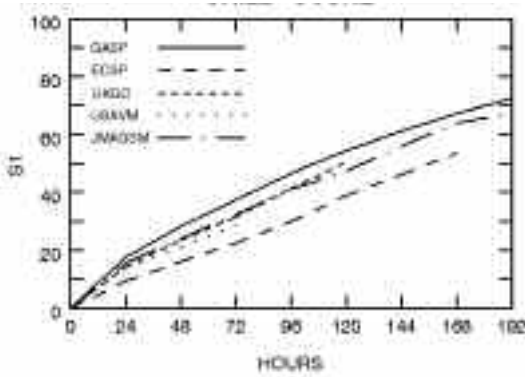


Fig. 2(b) 500 hPa geopotential height S1 skill-score comparison, for different forecast periods, between GASP, ECSP, USAVN, UKGC and JMAGSM (July to September 2003).

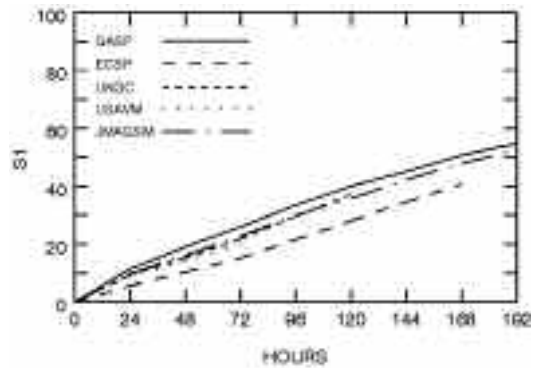


Fig. 3 Anomaly Correlation of MSLP comparison, for different forecast periods, between GASP, ECSP, USAVM, UKGC and JMAGSM (July to September 2003).

