

Quarterly numerical weather prediction model performance summary: January to March 2007

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Introduction

This summary, covering the three-month period from January to March 2007, continues the series reporting on the performances of numerical weather prediction (NWP) models used operationally in the Australian Bureau of Meteorology.

Verified NWP models and their upgrades during the January to March 2007 period

Local models

No significant changes have been reported for the Bureau's global model, GASP and the limited area models, LAPS_PT375 and TXLAPS_PT375 during this verification period.

Overseas models

Products from four global models run by overseas operational NWP centres are received in the National Meteorological and Oceanographic Centre (NMOC) and are verified in this article. For this article ECSP refers to the European Centre for Medium-range Weather Forecasts (ECMWF) system, UKGC to the Unified Model from the UK Met Office (UKMO), USAVN to the Global Forecast System (GFS) from the National Centers for Environmental Prediction (NCEP) and JMAGSM to the global assimilation and forecast model from the Japan Meteorological Agency (JMA).

During the January-March period JMA, which has been actively utilising more and more remotely sensed satellite data, started assimilation of GPS radio occultation refractivity measurements. No significant upgrades to their respective models were announced for the other centres during the period.

For further information on the improvements made to overseas NWP assimilation and forecast models refer to web references given below. Details on the configurations of the assimilation and forecast models are contained in an earlier summary (Lee 2005).

Verification method

A description of the S1 skill score, as applied in NMOC, can be found in an earlier article (Skinner 1995). All results have been calculated within NMOC Melbourne, where each of the models was verified against its own analyses. From the large number of objective verification results routinely produced, the statistics presented here cover only the mean sea-level pressure (MSLP) and 500 hPa geopotential height fields over the irregular Australian verification area (Miao 2003). It is noted that this particular verification grid has southerly points that are outside the TXLAPS_PT375 domain and, hence, the TXLAPS_PT375 scores are not strictly compatible with those from GASP and LAPS_PT375. Also, the results for the 0000 and 1200 UTC base-times have been combined. For the locally run, limited area models the verified forecast periods go out to a maximum of 72 hours and for the global models to a maximum of 192 hours.

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Local models (GASP, LAPS, TXLAPS)

The intercomparison of the S1 skill scores of the MSLP forecasts for the three local models is shown in Fig. 1(a). Figure 1(b) shows similar scores for 500 hPa geopotential height. The relative performance among the three models follows the long-term trend, the coarser resolution GASP generally outperforming the finer resolution limited area models. This result is partly due to the longer data cut-off of the GASP assimilation. It is also a result of the disadvantage suffered by the limited area models whereby their initial first guess and boundary conditions are obtained from earlier runs of GASP forecasts which tend to be poorer than forecasts produced from later runs. One other

contributing factor for the better-than-expected scores for GASP is the verification method used here, which disadvantages finer resolution models through ‘double penalty’ scoring. For example, a location error of a deep low pressure system from a more realistic high resolution forecast is counted once for misplacing the low where the verifying analysis does not have it and a second time for not placing it where the verifying analysis does. Care needs to be taken to filter out scales below which a verification method was not intended to measure if models which are run at different resolutions are to be objectively compared.

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

The Bureau of Meteorology’s operational global spectral model, GASP, and the four global models

Fig. 1(a) MSLP S1 skill score comparison, for different forecast periods, between GASP, LAPS_PT375, and TXLAPS_PT375 (January to March 2007).

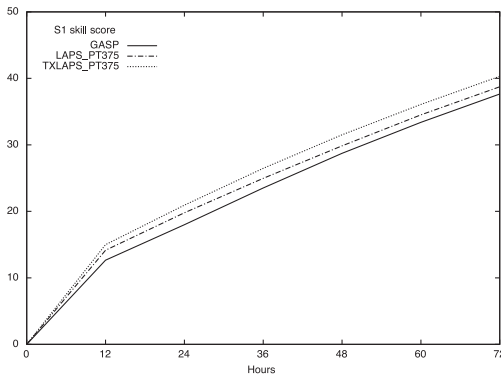


Fig. 1(b) 500 hPa geopotential height S1 skill score comparison, for different forecast periods, between GASP, LAPS_PT375, and TXLAPS_PT375 (January to March 2007).

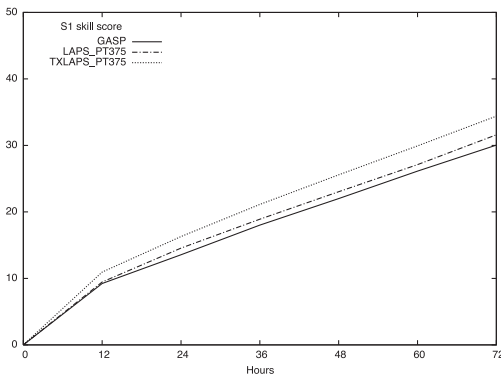


Fig. 2(a) MSLP S1 skill score comparison, for different forecast periods, between GASP, ECSP, UKGC, USAVN, and JMAGSM (January to March 2007).

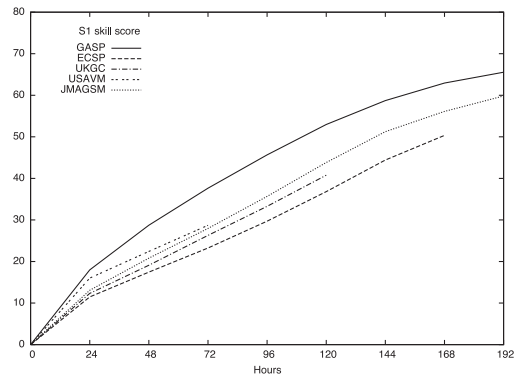
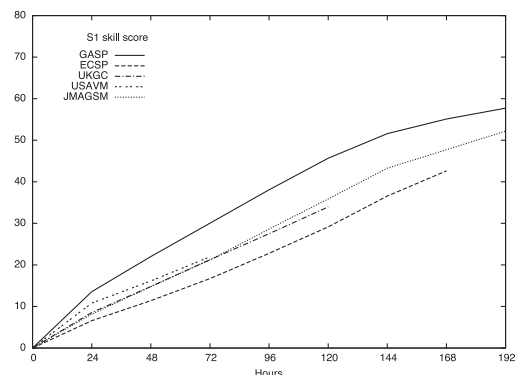


Fig. 2(b) 500 hPa geopotential height S1 skill score comparison, for different forecast periods, between GASP, ECSP, UKGC, USAVN and JMAGSM (January to March 2007).



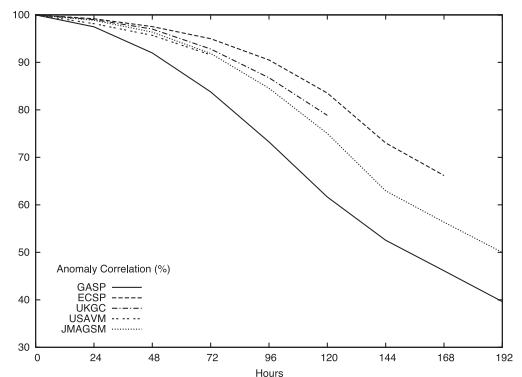
from overseas NWP centres are operationally used by forecasters. The outputs from the models are also post-processed to produce various objective guidance products used by users in and outside of the Bureau of Meteorology. Hence their forecast performance is of great interest to the forecasters and other users. The S1 skill scores for MSLP and 500 hPa geopotential height forecasts are presented in Figs 2(a) and 2(b). Anomaly correlations for the MSLP forecasts are shown in Fig. 3. All the global models are verified using a common 2.5° latitude/longitude grid except USAVN which is verified on a 2.5° latitude/ 5.0° longitude grid. However this use of coarser grid spacing for USAVN is not thought to have affected the inter-comparison.

In this quarter, the forecast performance of the global models follows the trend established in the past. JMAGSM forecast model continues to show relative skill improvement over other models. By some measures – for example, S1 skill score of 500 hPa geopotential height forecast shown in Fig. 2(b) – JMAGSM outperforms the Unified Model of the UK Met Office at short forecast lead times.

References

- Lee, J. 2005. Quarterly numerical weather prediction model performance summary – July 2005 to September 2005. *Aust. Met. Mag.*, 54, 253–61.
- 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.

Fig. 3 Anomaly correlation of MSLP comparison, for different forecast periods, between GASP, ECSP, UKGC, USAVN and JMAGSM (January to March 2007).



Web reference:

For ECMWF:

<http://www.ecmwf.int/publications/newsletters>

http://www.ecmwf.int/products/data/technical/model_id/index.html

For UKMO:

http://www.meto.gov.uk/research/nwp/publications/nwp_gazette/index.html

For NCEP:

http://www.emc.ncep.noaa.gov/gmb/STATS/html/model_changes.html

For JMA:

<http://ddb.kishou.go.jp>