Numerical weather prediction model performance summary - October to December 2005

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Introduction

This summary, covering the three-month period from October to December 2005, 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 October - December 2005 period

Local models

The observations blacklist used by the Bureau's Global ASsimilation and Prediction system (GASP) was replaced by a blacklist supplied by the European Centre for Medium-range Weather Forecasts (ECMWF). A short parallel trial showed a small positive impact on the GASP model forecasts. It was first implemented operationally in the GASP system for the 1200 UTC run on 21 November 2005.

Two of the Bureau's limited area models, LAPS_PT375 and TXLAPS_PT375 remained unchanged during this verification period.

Overseas models

Products from four global models run by overseas operational NWP centres are received in NMOC and are verified in this article. For this article ECSP refers to the ECMWF system, UKGC to the Unified Model from the UK Met Office, 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 Japan Meteorological Agency (JMA). During the period covered in this study the UK Met Office (UKMO) upgraded its global version of the Unified Model (UM) on 13 December 2005. The model's horizontal grid spacing changed from 0.56° latitude/0.83° longitude to 0.375° latitude/0.5625° longitude. The number of vertical levels increased from 38 to 50 with the majority of the extra levels in the stratosphere.

No significant changes were introduced to other overseas NWP models (see web reference 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 models the verified forecast periods go out to a maximum of 72 hours and for the global models to a maximum of 192 hours.

Fig. 1(a) MSLP S1 skill-score comparison, for different forecast periods, between GASP, LAPS_PT375, and TXLAPS_PT375 (October to December 2005).

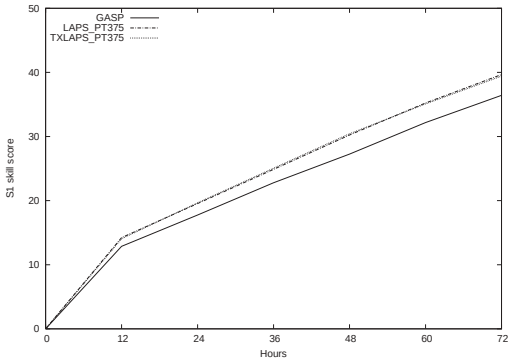


Fig. 2(a) MSLP S1 skill-score comparison, for different forecast periods, between GASP, ECSP, UKGC, USAVN, and JMAGSM (October to December 2005).

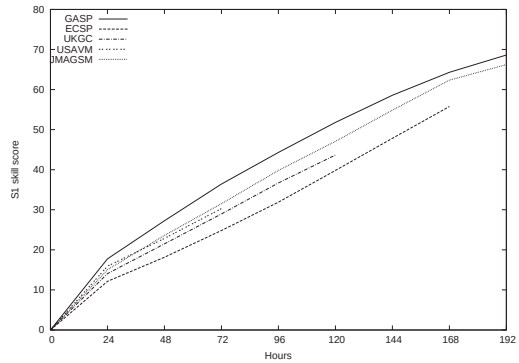


Fig. 1(b) 500 hPa geopotential height S1 skill-score comparison, for different forecast periods, between GASP, LAPS_PT375, and TXLAPS_PT375 (October to December 2005).

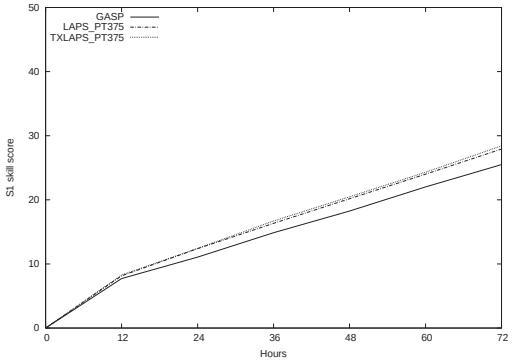
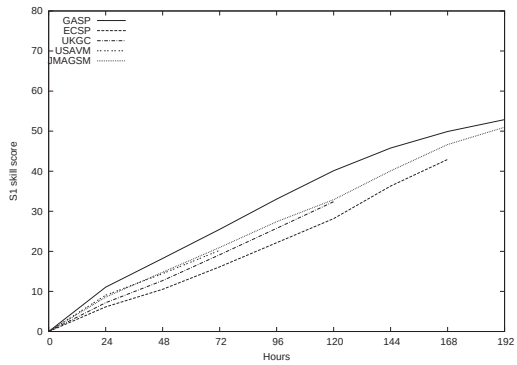


Fig. 2(b) 500 hPa geopotential height S1 skill-score comparison, for different forecast periods, between GASP, ECSP, UKGC, USAVN and JMAGSM (October to December 2005).



Review of performance – October 2005 to December 2005

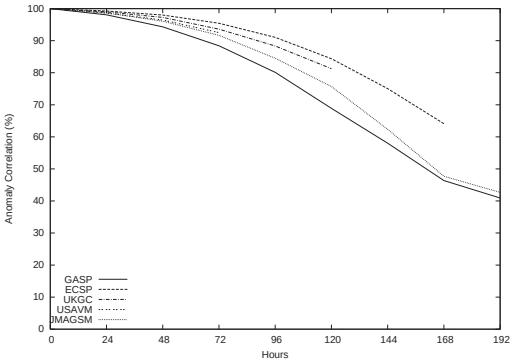
Local models (GASP, LAPS, TXLAPS)

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 outperforming the finer-resolution limited area models. As indicated in the previous summary (Lee 2005) this result is most likely due to different grid spacing at which the global and limited area models were verified: GASP was verified on a 2.5° latitude/longitude grid whereas the verification for LAPS_PT375 and TXLAPS_PT375 was carried out on a 0.75° latitude/longitude grid. This dependence of verification statistics on grid spacing can be overcome by using a common grid and the author anticipates that in the future this practice will most likely be adopted for intercomparison purposes.

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

The Bureau's own operational global spectral model, GASP, and the four global models from overseas NWP centres are operationally used by forecasters. The outputs from the models are also postprocessed to produce various objective guidance products used

Fig. 3 Anomaly correlation of MSLP comparison, for different forecast periods, between GASP, ECSP, UKGC, USAVN and JMAGSM (October to December 2005).



by users in and outside of the Bureau. 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 so that the results shown here can be viewed as a fair intercomparison.

In this quarter, a notable feature is a small but discernible improvement in the relative skill of UKGC over USAVN. This is a continuation of the past trend which began when UKMO implemented the 4DVAR data assimilation scheme in the UKGC model.

Acknowledgments

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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.

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