Quarterly numerical weather prediction model performance summary – April to June 2007

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Introduction

This summary, covering the three-month period from April to June 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 April to June 2007 period

Local models

The Bureau's Limited Area Prediction System (LAPS_PT375) provides initial and boundary conditions for a number of high-resolution models as well as providing inputs to numerous forecast guidance systems. The Australian Air Quality Forecasting System (AAQFS) uses the output from MESO_LAPS_PT050, which in turn is nested within LAPS_PT375, to drive its Chemical Transport Model (CTM). AAQFS commenced its operations in NMOC on 26 June 2007 and is expected to provide useful forecasts of pollutants in and around population centres.

MESO_LAPS_PT125 is a high-resolution NWP model nested within LAPS_PT375. The operational configuration was upgraded to produce two additional analysis and forecast cycles, providing forecast runs from base times of 0600 GMT and 1800 GMT in addition to the 0000 GMT and 1200 GMT runs. The more frequent update runs of MESO_LAPS_PT125 commenced on 11 July 2007 and will provide better and more timely forecast guidance.

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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 UK Met Office, USAVN to GFS from NCEP and JMAGSM to the global assimilation and forecast model from JMA.

During the April–June period ECMWF have reported a number of incremental improvements to their 4DVAR data assimilation and model physics as well as their Ensemble Prediction System (EPS). For the other centres no significant upgrades to their respective models were announced during the same period.

For further information on the improvements made to overseas NWP assimilation and forecast models refer to web reference 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.

Review of performance – April 2007 to June 2007

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 longer data cut-off of the GASP assimilation. It's also due to the disadvantage suffered by the limited area models which obtain their initial first guess and boundary conditions from earlier runs of GASP forecasts. Forecasts from earlier runs 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 the '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

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

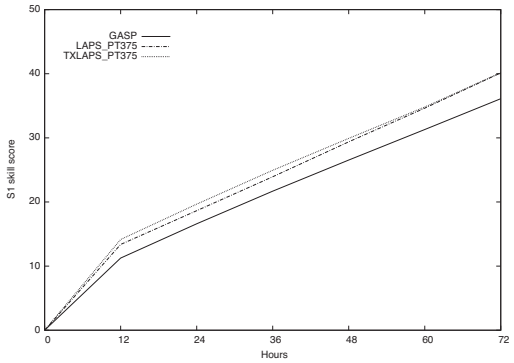


Fig. 1(b) 500 hPa geopotential height S1 skill score comparison, for different forecast periods, between GASP, LAPS_PT375, and TXLAPS_PT375 (April to June 2007).

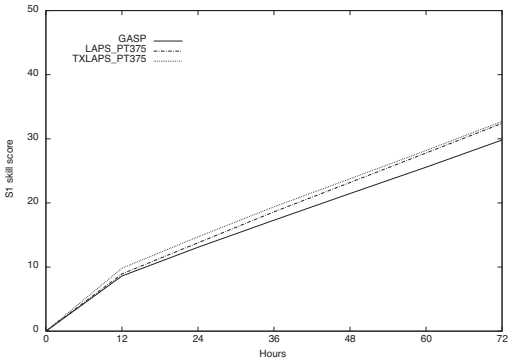


Fig. 2(a) MSLP S1 skill score comparison, for different forecast periods, between GASP, ECSP, UKGC, USAVN, and JMAGSM (April to June 2007).

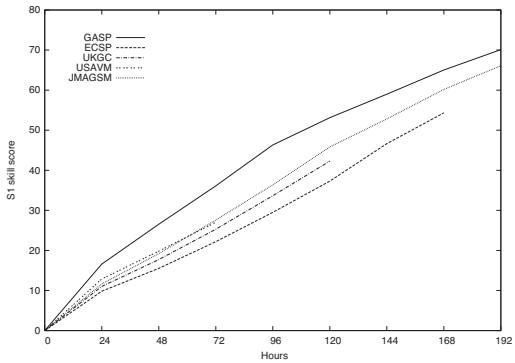


Fig. 2(b) 500 hPa geopotential height S1 skill score comparison, for different forecast periods, between GASP, ECSP, UKGC, USAVN and JMAGSM (April to June 2007).

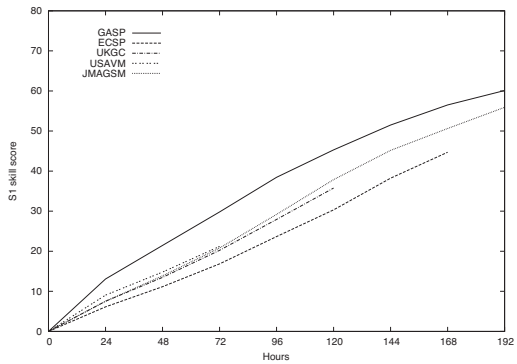
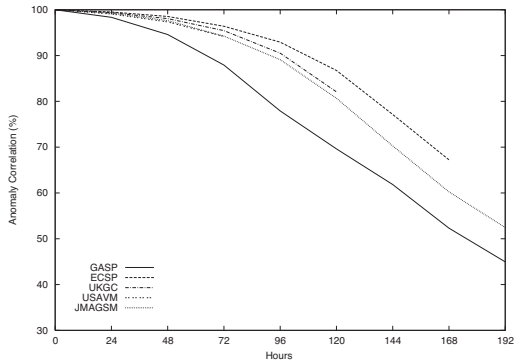


Fig. 3 Anomaly correlation of MSLP comparison, for different forecast periods, between GASP, ECSP, UKGC, USAVN and JMAGSM (April to June 2007).



have it and twice 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'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 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 (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 intercomparison.

In this quarter, the forecast performance of the global models follows the trend established in the past. ECSP leads the other models in all measures. UKGC continues to maintain the relative skill gain it has made recently.

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