Aust. Met. Mag. 57 (2008) 395-397

Quarterly numerical weather prediction model performance summary – July to September 2008

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(Manuscript received December 2008)

Introduction

This summary, covering the three-month period from July to September 2008, continues the series reporting on the performance of numerical weather prediction (NWP) models used operationally in the Australian Bureau of Meteorology.

Verified NWP models and their upgrades during the July to September 2008 period

Local models

There will be no further development for the existing local operational models. The current NWP work will be focused on the Australian Community Climate Earth-System Simulator (ACCESS), a joint initiative led by the Bureau of Meteorology and the Commonwealth Scientific and Industrial Research Organization (CSIRO) in cooperation with the university community of Australia. The initial version of ACCESS is largely based on the UKMO Unified Model assimilation and prediction code. ACCESS will replace the Bureau's Global ASsimilation and Prediction Model (GASP) and Limited Area Prediction System (LAPS) model and is expected to become operational next year. For more details about the ACCESS model, please refer to http://www.accessimulator.org.au/.

Overseas models

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

On 30 September 2008 ECMWF operationally implemented the new integrated forecast system (IFS) cycle 33r2. The main changes in the new cycle include implementing the high-resolution operational sea surface temperature and sea-ice analysis (OSTIA); a conserving interpolation scheme for trajectory fields in 4D-Var; new variational bias correction (VARBC) bias predictors to allow the correction of infrared short-wave channels affected by solar effects; cleaner cold-start of advance microwave sounding unit (AMSUA) channel 14 bias corrections; changes to physics for melting of falling snow, albedo of permanent snow cover, diurnal variation of sea-surface temperature and linear parametrisation schemes; convective contribution added to wind gusts in post-processing and the monitoring of medium-resolution imaging spectrometer (MERIS) total-column water vapour data.

On 27 August 2008 JMA introduced direct assimilation of clear-sky radiances of water vapour channels from geostationary satellites and the background errors of variational bias correction for radiance data were also revised.

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

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Verification method

A description of the S1 skill score, as applied in NMOC, can be found in the paper by Skinner (1995). All results have been calculated within NMOC Melbourne, where each of the models was verified against its own analysis. 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 comparable 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 – July to September 2008

Local models (GASP, LAPS, TXLAPS)

The intercomparison of the S1 skill scores of the MSLP forecasts for the three local models covering the period July to September 2008 is shown in Fig. 1(a). The S1 skill scores are averaged over the three-month period for various forecast periods ranging from 0 hour to 72 hours. S1 skill score comparison of the 500 hPa geopotential height forecasts is shown in Fig. 1(b). In general, the coarser-resolution GASP outperforms the finer-resolution limited area models. This result is partly due to the later data cut-off of the GASP assimilation. It is also due to the disadvantage suffered by the limited area models which obtain their initial first guess and boundary conditions from the earlier run of GASP forecasts. Forecasts from earlier runs tend to be poorer than forecasts 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 have it and again 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 that are run at different resolutions are to be objectively compared.

Fig. 1(a) MSLP S1 skill score comparison, for different forecast periods, between GASP, LAPS_PT375 and TXLAPS_PT375 (July to September 2008).

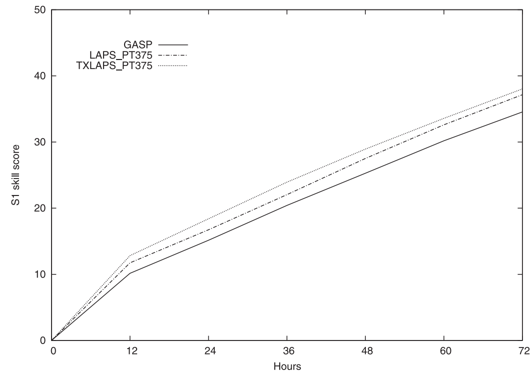
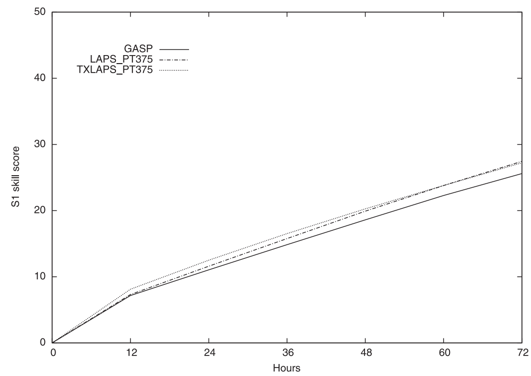


Fig. 1(b) 500 hPa geopotential height S1 skill score comparison, for different forecast periods, between GASP, LAPS_PT375, and TXLAPS_PT375 (July to September 2008).



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

The Bureau of Meteorology's operational global spectral model, GASP, and the four global models from overseas NWP centres are used operationally by forecasters. The outputs from the models are also post processed to produce various objective guidance products for users in and outside of the Bureau. Hence their forecast performance is of great interest to forecasters and other users. The S1 skill scores for MSLP and 500 hPa geopotential height forecasts for the period July to September are presented in Figures 2(a) and 2(b). Anomaly correlations for the MSLP forecasts are shown in Figure 3. All the global models are verified

Fig. 2(a) MSLP S1 skill score comparison, for different forecast periods, between GASP, ECSP, UKGC, USAVN and JMAGSM (July to September 2008).

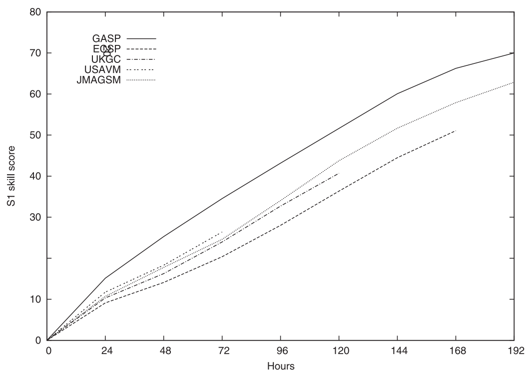
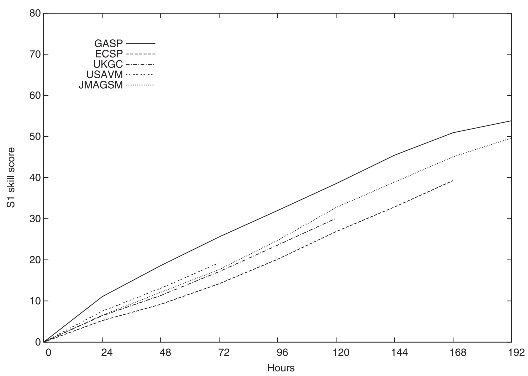


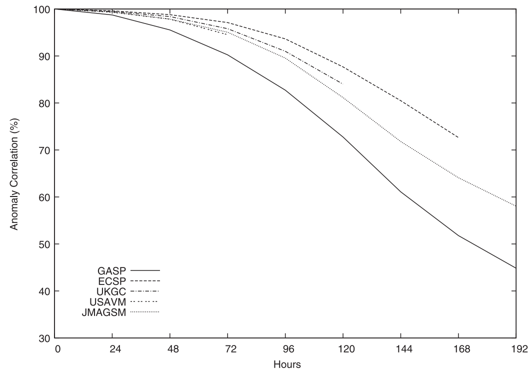
Fig. 2(b) 500 hPa geopotential height S1 skill score comparison, for different forecast periods, between GASP, ECSP, UKGC, USAVN and JMAGSM (July to September 2008).



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.

Assuming the commonly used cut-off of 60% as the criterion for useful forecasts (Murphy and Epstein 1989), the anomaly correlation scores for the ECMWF show useful skill to beyond seven days, JMA also shows useful skill to around seven days and GASP around six days. The UKGC is marginally better than JMA and USAVN at the shorter lead times but clearly better than JMA in the longer term up to five days.

Fig. 3 Anomaly correlation of MSLP comparison, for different forecast periods, between GASP, ECSP, UKGC, USAVN and JMAGSM (July to September 2008).



References

Lee, J. 2005. Quarterly numerical weather prediction model performance summary – July 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.

Murphy, A. and Epstein, E.S. 1989. Skill Scores and Correlation Coefficients in Model Verification. *Mon. Weath. Rev., 117*, 572-81.

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

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

For JMA: http://ddb.kishou.go.jp

For ACCESS: http://www.accessimulator.org.au/