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Quarterly Numerical Weather Prediction Model Performance Summary – October to December 2012

Xiaoxi Wu
National Meteorological and Oceanographic Centre, Bureau of Meteorology, Australia

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Introduction

This summary, covering the three-month period from October to December 2012, continues the series reporting on the performances of Numerical Weather Prediction (NWP) models used operationally in the Australian Bureau of Meteorology.

NWP models—October to December 2012

Local models

No changes have been reported for the Bureau's operational global model ACCESS-G and the limited area models ACCESS-R, ACCESS-T, ACCESS-A and ACCESS-TC during this verification period.

Details on the configurations of the Bureau's models are described in an earlier summary (Wu 2012). For more details about the ACCESS systems, please refer to http://www.bom.gov.au/australia/charts/bulletins/apob83.pdf, http://www.bom.gov.au/australia/charts/bulletins/apob90.pdf, http://www.bom.gov.au/australia/charts/bulletins/apob93.pdf and http://www.bom.gov.au/nmoc/access/NWPData.shtml.

Overseas models

The following four operational global models which are run by overseas forecast centres are verified 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 National Centers for Environmental Prediction (NCEP) and Japan Meteorological Agency Global Spectral Model (JMAGSM) to the global assimilation and forecast model from JMA.

On 18 December 2012 JMAGSM operationally implemented an improved stratocumulus cloud scheme and revised the usage of Global Navigation Satellite System – Radio Occultation (GNSS-RO) data.

Corresponding author address: Xiaoxi Wu, Bureau of Meteorology, GPO Box 1289, Melbourne VIC 3001. Email:x.wu@bom.gov.au

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 described in an earlier summary (Lee 2005).

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 ACCESS-T southern domain boundary and, hence, the ACCESS-T scores are not strictly comparable with those from ACCESS-G/R. 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—October to December 2012

Figures 1 to 3 are the plots covering the verifying period from October to December 2012.

Local models (ACCESS-G, ACCESS-R, ACCESS-T)

The intercomparisons of the S1 skill scores of the MSLP forecasts for the three local models covering the verifying period October to December 2012 are shown in Fig. 1(a). The S1 skill-scores are averaged over the three-month period for various forecast periods ranging from 0 to 72 hours. S1 skill-score comparisons of the 500 hPa geopotential height forecasts are shown in Fig. 1(b). In general, the coarser resolution global model outperforms the finer resolution

Fig. 1(a) MSLP S1 skill-score comparison, for different forecast periods, between ACCESS-G, ACCESS-R and ACCESS-T (October to December 2012).

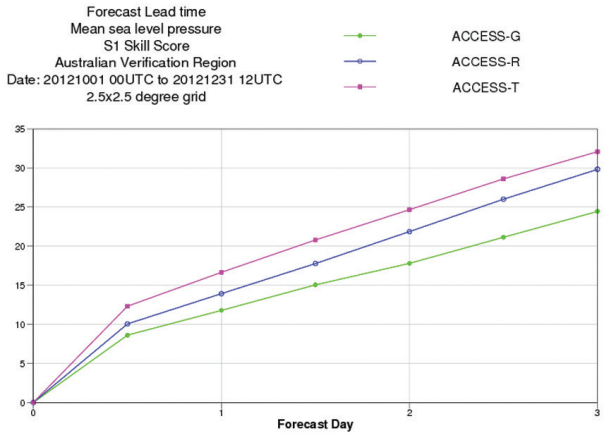
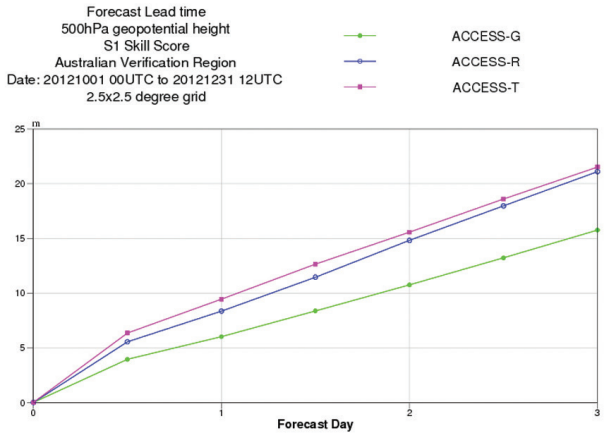


Fig. 1(b) 500 hPa geopotential height S1 skill-score comparison, for different forecast periods, between ACCESS-G, ACCESS-R and ACCESS-T (October to December 2012).



limited area models. This result is partly due to the later data cut-off of the assimilation for the global models. 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 the global model 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 the global models 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 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 that are run at different resolutions are to be objectively compared.

Fig. 2(a) MSLP S1 skill-score comparison, for different forecast periods, between ACCESS-G, ECSP, UKGC, USAVN, and JMAGSM (October to December 2012).

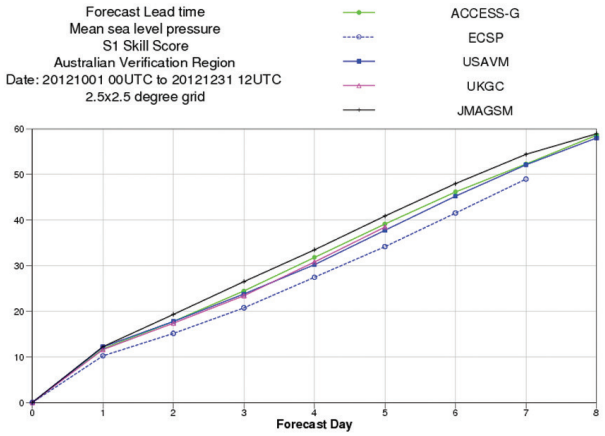
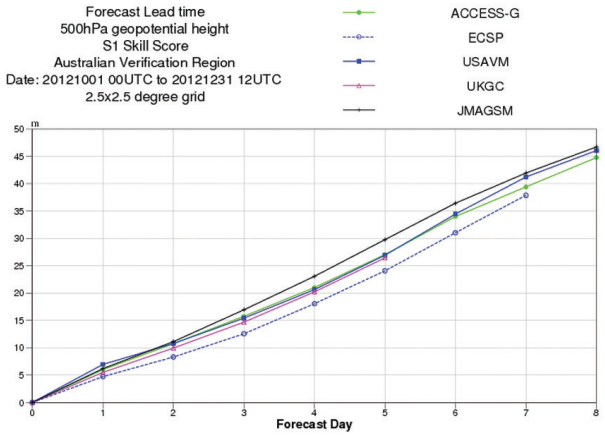


Fig. 2(b) 500 hPa geopotential height S1 skill-score comparison, for different forecast periods, between ACCESS-G, ECSP, UKGC, USAVN and JMAGSM (October to December 2012).

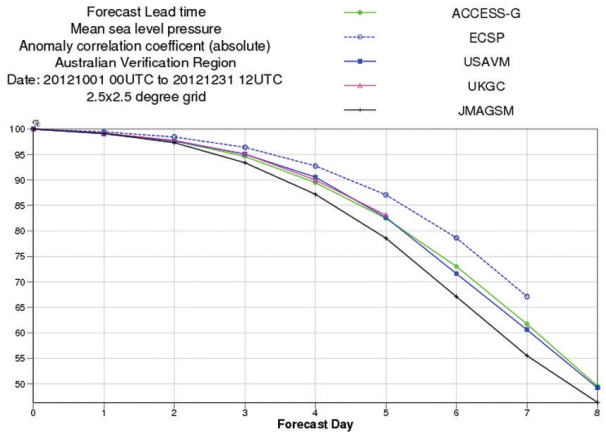


Global models (ACCESS-G, ECSP, UKGC, USAVN, JMAGSM)

The Bureau's new operational global spectral model ACCESS-G and the four global models 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 inside 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 for the period October to December 2012 are presented in Figs 2(a) and 2(b). Anomaly correlations for the MSLP forecasts are shown in Fig. 3.

Assuming the commonly used cut-off of 60 per cent as the criterion for useful forecasts (Murphy 1989), for the October to December 2012 period the anomaly correlation scores for the ACCESS-G, ECMWF and USAVN show useful skill to beyond seven days. ACCESS-G has the similar skill

Fig. 3. Anomaly correlation of MSLP comparison, for different forecast periods, between ACCESS-G, ECSP, UKGC, USAVN and JMAGSM (October to December 2012).



as UKGC and USAVM for the period up to five days, much more skillful than JMAGSM and marginally better than USAVM for the long period up to eight days, but less skillful than ECSP in the longer term.

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