

Quarterly numerical weather prediction model performance summary—January to March 2012

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Introduction

This summary, covering the three-month period from January to March 2012, continues the series reporting on the performances of numerical weather prediction (NWP) models used operationally in the Australian Bureau of Meteorology.

NWP models—January to March 2012

Local models

The Bureau's global model ACCESS-G was upgraded on 28 March 2012. The significant changes for this upgrade included: an increase in model horizontal resolution to approximately 40 km; an increase in the number of vertical

atmospheric levels from 50 to 70; assimilation of additional new satellite observation types; and use of more recent versions of the software that constitutes the UK Met Office's Unified Model/Variational Assimilation (UM/VAR) system upon which ACCESS is based. The forecast skill of the upgraded global model has improved greatly.

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

The configurations of the operational ACCESS systems are summarised in Table 1.

For more details about the ACCESS systems, please refer to <http://www.bom.gov.au/australia/charts/bulletins/apob83.pdf> and <http://www.bom.gov.au/nwp/doc/access/NWPData.shtml>

Table 1. Model domains and resolutions of the operational ACCESS systems

<i>NWP system</i>	<i>Domain</i>	<i>Type</i>	<i>Resolution</i>	<i>Domain limits S–N, W–E (lat. x long.)</i>	<i>Duration (hours)</i>	<i>Runs (UTC)</i>
ACCESS-G	Global	Assim + Forc	N320 (~40km) (0.375° x 0.5625°)	90.00°S to 90.00°N, 0.00°E to 359.44°E (0.16°W) (481 x 640)	+240 +72	00, 12 06, 18
ACCESS-R	Regional	Assim + Forc	0.375° (~37.5 km)	65.00°S to 17.125°N, 65.00°E to 184.625°E (175.375°W) (220 x 320)	+72	00, 06, 12, 18
ACCESS-T	Tropical	Assim + Forc	0.375° (~37.5 km)	45.00°S to 55.875°N, 60.00°E to 217.125°E (142.875°W) (270 x 420)	+72	00, 12
ACCESS-A	Australian	Assim + Forc	0.11° (~12 km)	55.00°S to 4.73°N, 95.00°E to 169.69°E (190.31°W) (680 x 544)	+48	00, 06, 12, 18
ACCESS-C	Brisbane	Forc	0.05° (~5 km)	31.00°S to 22.05°S, 148.00°E to 155.95°E (204.05°W) (180 x 160)	+36	00, 12
	Perth	Forc	0.05° (~5 km)	37.00°S to 28.05°S, 112.00°E to 119.95°E (240.05°W) (180 x 160)		
	Adelaide	Forc	0.05° (~5 km)	39.50°S to 30.55°S, 132.00°E to 141.95°E (218.05°W) (180 x 200)		
	VICTAS	Forc	0.05° (~5 km)	46.00°S to 34.05°S, 139.00°E to 150.95°E (209.05°W) (240 x 240)		
	Sydney	Forc	0.05° (~5 km)	38.00°S to 30.05°S, 147.00°E to 154.95°E (205.05°W) (160 x 160)		
ACCESS-TC	Tropical Cyclone	Assim + Forc	0.11° (~12 km)	Relocatable within the ACCESS-T domain: (300 x 300)	+72	00, 12

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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 (JMA GSM) to the global assimilation and forecast model from JMA.

No changes have been reported for the overseas models during this verification period.

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

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's 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—January to March 2012

Figures 1 to 3 are the plots covering the verifying period from January to March 2012.

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

The intercomparison of the S1 skill scores of the MSLP forecasts for the three local models covering the verifying period January to March 2012 is 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 comparison of the 500 hPa geopotential height forecasts is shown in Fig. 1(b). In general, the coarser-resolution global model outperforms the finer-resolution 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

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

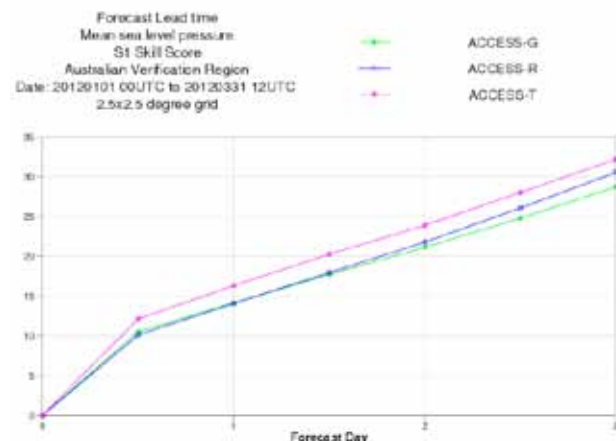
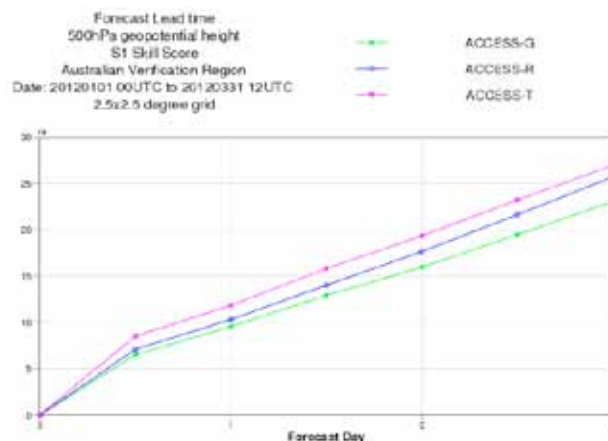


Fig. 1(b) 500 hPa geopotential height S1 skill-score comparison, for different forecast periods, between ACCESS-G, ACCESS-R and ACCESS-T (January to March 2012).



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.

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

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

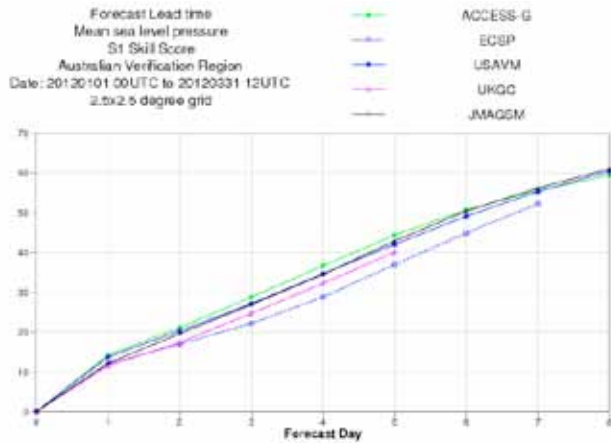
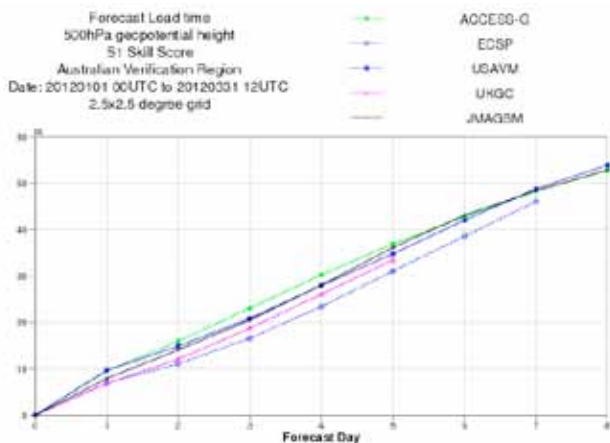


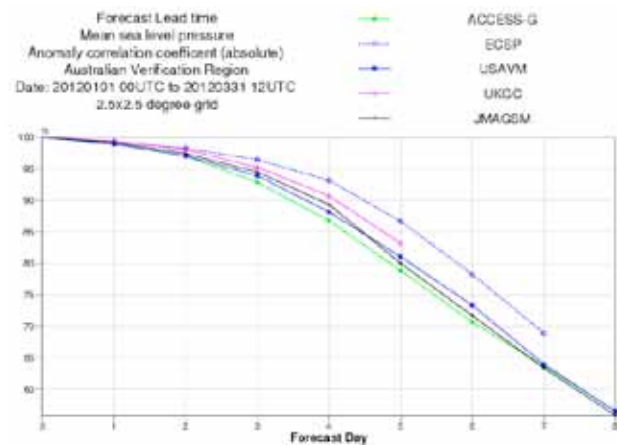
Fig. 2(b) 500 hPa geopotential height S1 skill-score comparison, for different forecast periods, between ACCESS-G, ECSP, UKGC, USAVN and JMAGSM (January to March 2012).



centres are operationally used by forecasters. The outputs from the models are also post-processed to produce various objective guidance products used 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 for the period January to March 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 January to March 2012 quarter the anomaly correlation scores for the ACCESS-G, ECMWF, JMAGSM and USAVN show useful skill to beyond seven days. ACCESS-G has similar skill as

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



JMAGSM and USAVN at the short term up to two days but becomes less skillful than those two models for the longer term up to six days, before showing similar skills again at day seven.

Acknowledgment

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