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Numerical weather prediction model performance summary July to September 2005

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Introduction

This summary, covering the three-month period from July to September 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 July-September 2005 period

Local models

A major upgrade to the Bureau's Global ASsimilation and Prediction system (GASP) became operational on 30 August 2005. Four additional vertical levels were added to both the assimilation and forecast components increasing the total number of levels from 29 to 33. The four extra levels were added to the boundary layer, thus allowing GASP to make use of scatterometer wind data. Soil moisture nudging was also introduced into GASP. Changes were also introduced to the model's physics package with the inclusion of the European Centre for Medium-range Weather Forecasts (ECMWF) land-surface scheme replacing the old 'bucket' scheme and the activation of middle-level convection.

The Bureau's two limited area models, LAPS_PT375 and TXLAPS_PT375 remained unchanged during this verification period.

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Overseas models

Products from four global models run by overseas operational NWP centres are received in the National Meteorological and Oceanographic Centre (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 GFS from the US National Centers for Environmental Prediction (NCEP) and JMAGSM to the global assimilation and forecast model from the Japan Meteorological Agency (JMA). During the period covered in this study no significant changes were introduced to the overseas NWP models (see web references below). For details on the configurations of the assimilation and forecast models refer to the previous 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.

Review of performance – July to September 2005

Local models (GASP, LAPS, TXLAPS)

The intercomparison of the S1 skill-scores of the MSLP forecasts for the 3 local models is shown in Fig. 1(a). Figure 1(b) shows similar scores for 500 hPa geopotential height. The relative performance among the 3 models follows the long-term trend, the coarser-resolution GASP outperforming the finer-resolution limited area models. This result may seem at first counter-intuitive and possible explanations are offered in the previous summary (Lee 2005). An extraneous factor that almost certainly affects the verification results is that the models are verified at different grid spacing. For this summary 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.

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

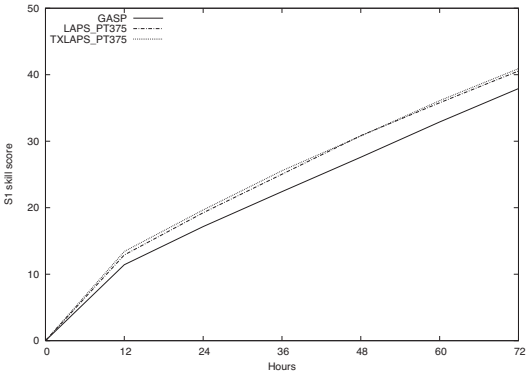


Fig. 1(b) 500 hPa geopotential height S1 skill-score comparison, for different forecast periods, between GASP, LAPS_PT375, and TXLAPS_PT375 (July to September 2005).

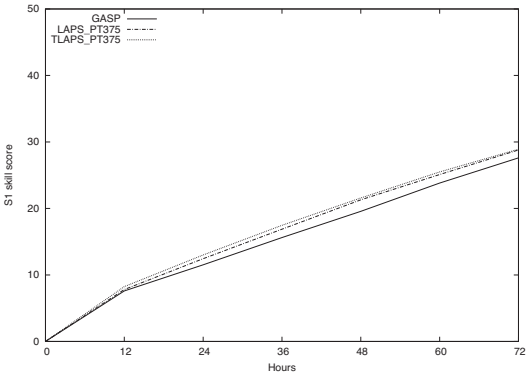


Fig. 2(a) MSLP S1 skill-score comparison, for different forecast periods, between GASP, ECSP, UKGC, USAVN, and JMAGSM (July to September 2005).

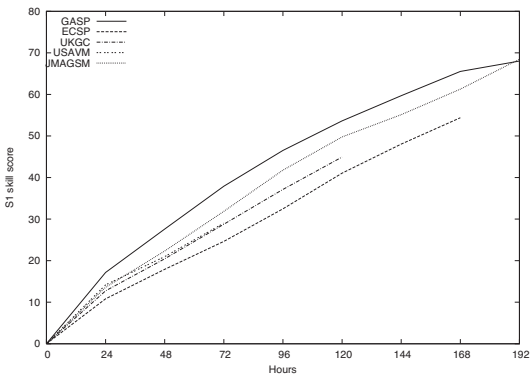


Fig. 2(b) 500 hPa geopotential height S1 skill-score comparison, for different forecast periods, between GASP, ECSP, UKGC, USAVN and JMAGSM (July to September 2005).

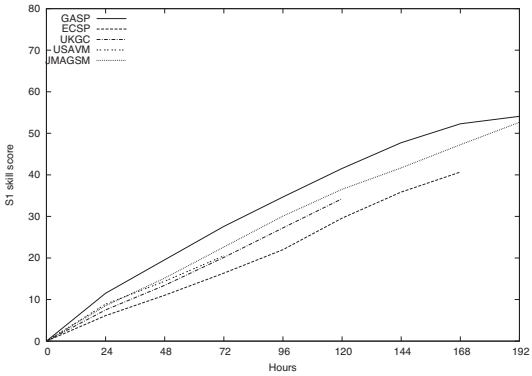
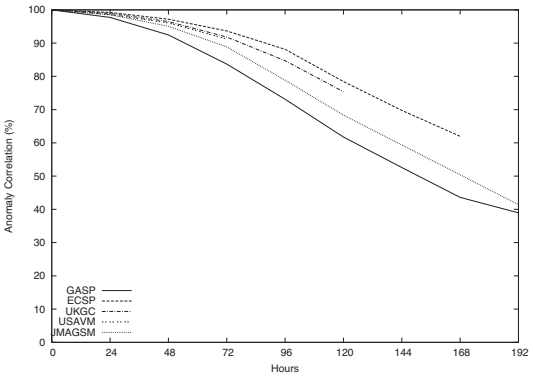


Fig. 3 Anomaly correlation of MSLP comparison, for different forecast periods, between GASP, ECSP, UKGC, USAVN and JMAGSM (July to September 2005).



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

The Australian 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 post-processed 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 others users. The S1 skill-scores for MSLP and 500 hPa geopotential height forecasts are presented in Figs 2(a) and 2(b). Anomaly correlation 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, the relative skill shown by JMAGSM for the shorter forecast period (up to 24 hours) continues the previous trend. Also evident is a small but discernible relative improvement made by UKGC over USAVN.

Acknowledgments

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