Numerical weather prediction model performance summary
October to December 2002

Paul Stewart
National Meteorological and Oceanographic Operations Centre,
Bureau of Meteorology, Australia

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Introduction

This summary continues the series reporting on the performances of numerical weather prediction (NWP) models used operationally in the Bureau of Meteorology.

NWP models verified

The models considered in this performance summary are from the NMOC (National Meteorological and Oceanographic Operations Centre) in Melbourne, ECMWF (European Centre for Medium-range Weather Forecasts), NCEP (National Centers for Environmental Prediction, USA), UKMO (Met Office, United Kingdom) and JMA (Japan Meteorological Agency).

Three local models, from NMOC, are considered, viz.: LAPS (Limited Area Prediction System) – run over the Australian region on a 0.375° latitude/longitude grid, with 29 vertical levels, and using one-dimensional variational retrievals (1DVAR) and multivariate statistical interpolation in the assimilation; TLAPS (Tropical Limited Area Prediction System) – run over an extended tropical domain on a 0.375° latitude/longitude grid, with 29 vertical levels, and multivariate statistical interpolation in the analysis; and GASP (Global ASSimilation and Prediction) – run over a global domain at the triangular spectral truncation resolution T239 in the horizontal, and 29 levels in the vertical, together with 1DVAR and multivariate statistical interpolation in the assimilation.

The following four overseas global models are included in the comparisons (where the associated acronyms, used in the figures below, are shown in parentheses): ECMWF Assimilation and Spectral Model (ECSP) – run at the resolution T511 and 60 levels, with a 4DVAR multivariate analysis procedure; NCEP Global Forecast System (UASGN) – run at T254 and 64 levels (for the forecast times processed below), with 3DVAR and a multivariate Spectral Statistical Interpolation (SSI) analysis scheme; UK Meteorological Office Grid Point model (UKGC) – run on a 0.56° latitude/0.833° longitude grid and 38 levels, with a 3DVAR analysis scheme; and JMA Global Spectral Model (JMA-MSM) – run at T213 and 40 levels, with a 3DVAR assimilation scheme.

Recent changes to the NWP models

Local models
A number of small changes, associated with improving the surface moisture, were made to the operational LAPS during the October to December 2002 quarter. Changes made to the operational TLAPS included a move to hourly radiation calculations, improved tropical cyclone bogussing and reduced atmospheric diffusion. No significant changes were made to GASP during the period.

Overseas models
Both the UK Met Office and ECMWF reported that NOAA-17 data was introduced into their respective assimilation schemes during the period (see: http://www.metoffice.com/research/nwp/publications/nwp_gazette/mar03/model.html and:}

Corresponding author address: Paul Stewart, National Meteorological and Oceanographic Operations Centre, Bureau of Meteorology, GPO Box 1289K, Melbourne, Vic. 3001, Australia.
http://www.ecmwf.int/publications/newsletters).

In addition, the UK Met Office also started using the Seawinds scatterometer data, and made changes to the analysis initialisation procedure. A summary of changes, to all the relevant overseas models during 2002, can be found at: http://www.wmo.ch/web/www/DPS/Annual-Tech-Progress/2002/a-front-page.html.

Verification method

A description of the S1 skill-score, as applied in the National Meteorological and Oceanographic Operations Centre (NMOC), can be found in an earlier article (Skinner 1995). All results have been calculated within NMOC Melbourne, where the models were verified against their own analyses. From the large number of objective verification results routinely produced, the statistics presented here cover only the 500 hPa geopotential height and mean sea-level pressure (MSLP) fields over the irregular Australian verification area (Miao 2003). It is noted that this particular verification grid has southerly points that are outside the TLAPS domain and, hence, the TLAPS scores are not strictly compatible with those from GASP and LAPS. The results for the 0000 and 1200 UTC base-times have been combined. The results are presented, at this stage, for forecast periods out to a maximum of 192 hours.

The NMOC limited area operational models are
run several hours before GASP (for a given base date-time). This earlier data cut-off could affect their skill relative to GASP. Also, the US, UK and JMA models run with a short data cut-off time of about three hours, compared with seven hours for GASP and ten hours for ECMWF, which again makes the intercomparison not strictly compatible.

**Review of performance - October to December 2002**

**Local models (GASP, TLAPS, LAPS)**

The verification using S1 skill-scores (Fig. 1) shows that GASP performs slightly better than the limited area forecasts for both the MSLP and 500 hpa geopotential height fields, throughout the 48-hour forecast period.

**Global models (GASP, ECSP, UKGC, USAVM, JMAGSM)**

The verification scores for the predictions from the global models (Fig. 2) continue to show the ECMWF predictions as the most skilful. The US system was the next best on average (at least out to 72 hours), followed by the UK model. The JMA model out-performed GASP for both MSLP and 500 hPa geopotential height.

The relative performance using the anomaly correlation (Fig. 3) is consistent with the S1 skill-score results. Taking the commonly used cut-off for useful forecasts as 60 per cent, the predictions provided useful guidance to around seven days for ECMWF, and approximately six days for GASP and JMAGSM.

**References**


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**Fig. 3** Anomaly correlation of MSLP comparison, for different forecast periods, between GASP, ECSP, USAVM, UKGC and JMAGSM (October to December 2002).