

NMOC Operations Bulletin No.78

Operational Upgrade to the Hourly OCF system 07 May 2009

1. Introduction

The Hourly OCF (Operational Consensus Forecasts) system is an extension of daily OCF which performs a statistical correction of model output at selected sites followed by a weighted average consensus on a daily basis. Hourly OCF generates forecasts of 2-m air temperature, dewpoint temperature, relative humidity, 10-m wind speed and direction, QNH and precipitation and produces hourly forecasts for up to 48 hours on a station-by station and hour-by-hour basis. This system was originally developed by Chermelle Engel (CAWCR, Centre for Australian Weather and Climate Research) and later upgraded by Wenming Lu and Frank Woodcock (CAWCR). It became operational in NMOC (National Meteorological and Oceanographic Centre) in October 2005 and was implemented by Jin Lee (CAWCR). This system was run twice a day in the NMOC Scheduler.

In 2008, two extra runs were requested to support the FDSS (Forecast Decision Support System for fog) being developed in CAWCR, initially for Perth and Melbourne airports, with future extension to other major airports. This system is based on the Hourly OCF and the forecast will be incorporated in the two most important Terminal Aerodrome Forecast (TAF) - 0612TAF and 1824TAF - which should be issued before 0530UTC and 1730UTC. The OCF forecasts based on 00Z and 12Z data are available too late for fog forecasting purposes, so the previous 12Z and 00Z were used instead. However, the forecast ranges of the two previous runs do not extend sufficiently to cover the 30 hour TAF period. As a result, two additional issues were developed to cover the 30 hour TAF forecast hours. On 7 May 2009 these two extra runs were implemented in the NMOC scheduler. The more frequent hourly OCF forecast runs are also expected to provide very useful guidance for Public, Aviation, Fire and Defence weather services.

2. Methodology

The Hourly OCF uses the same methodology as Daily OCF which is described in NMOC Operations Bulletin No 60 (<http://www.bom.gov.au/nmoc/bulletins/60/apob60.shtml>), but the bias correction and weighting strategies are applied on an hourly basis. DMO (Direct Model output) forecasts from the local and overseas models are derived at specific sites through interpolation from model's nearest grid values. Site-specific consensus forecasts are generated for sites throughout Australia using model forecast data which has been bias-corrected using the previous 30 days of model forecast data and the corresponding observations from that period.

As local and overseas NWP model guidance is available at varying spatial and temporal resolutions, a blending method is used in the consensus and this is done in two stages:

Stage1: Blend three and six hourly forecasts

Stage 2: Blend one and three hourly forecasts

The blending procedure is as follows:

1. Generate a consensus based on the largest number of models available and use this as “best guesses” or “fence posts,” available every 6 hours;
2. Generate a consensus based on a subset of models available every 3 hours;
3. Determine the *difference* between consensus forecasts at the fencepost hours;
4. Interpolate the differences to intervening hours;
5. Adjust intervening forecasts by the interpolated differences.

Repeat steps 1–5 blending from 3 to 1hour forecasts.

3. System descriptions

a. Observation data

The hourly OCF stations are a forecaster determined subset of the daily OCF station dictionary and updated every Tuesday. Currently around 380 stations are available in the hourly OCF system.

The system obtains METAR observation data which are derived from AWS (Automatic Weather Station) measurements of 2m air temperature and dewpoint temperature, 10m wind direction and speed and QNH. Relative Humidity values are calculated from air temperature and dewpoint temperature observations. The METAR data are derived twice a day at 00UTC and 12UTC base times in the NMOC scheduler. For the 00Z data file, the observations start from 00UTC and then progress 23hours and the 12Z data file starts from 12UTC.

b. Model configuration

In the current setup in NMOC, there are 10 component models whose forecasts are used in DMO form: Hires LAPS375, Lores LAPS375, Hires LAPS125, Lores LAPS125, LAPS050, MALAPS, GASP, ECSP, JMAGSM, UKGC, USAVM and CMCgem (refer to Section 4 for a definition of these models). As the models are available at varying resolution and fields, their descriptions are shown in Table 1.

Table 1. Configurations of the component models for the Hourly OCF system

Model	Spatial resolution (deg)	Temporal resolution (hrs)	Fields contribution
Hires LAPS375	0.375	1	air_temp, prcp, dwpt, wnd_ucmp, wnd_vcmp
Lores LAPS375	0.75	3	pres(surface), topg, rel_hum
Hires LAPS125	0.125	1	air_temp, prcp, dwpt, wnd_ucmp, wnd_vcmp
Lores LAPS125	0.25	3	pres(surface), topg, rel_hum
LAPS050	0.05	1	air_temp, prcp, dwpt, wnd_ucmp, wnd_vcmp, pres, wet, topg
MALAPS	0.10	1	air_temp, prcp, dwpt, wnd_ucmp, wnd_vcmp, rel_hum
GASP	1	3	air_temp, prcp, rel_hum, wnd_ucmp, wnd_vcmp
ECSP	0.5	6	air_temp, prcp, ttl_cld, dwpt, wnd_ucmp, wnd_vcmp
JMAGSM	1.25	6	air_temp, prcp, wnd_ucmp, wnd_vcmp, rel_hum
UKGC	1.25	6	air_temp, prcp, wnd_ucmp, wnd_vcmp, rel_hum
USAVM	0.5	3	air_temp, wnd_ucmp, wnd_vcmp, rel_hum
CMCGEM	0.6	3	air_temp, prcp, ttl_cld, dwpt, wnd_ucmp, wnd_vcmp

Where,

air_temp: 2m air temperature

dwpt: 2m dewpoint temperature

wnd_ucmp: 10m zonal wind

wnd_vcmp: 10m meridional wind

pres: barometric pressure

topg: topography

rel_hum: relative humidity

prcp: precipitation

The barometric pressure and topographic fields are used to generate QNH which is the mean sea level pressure derived from barometric pressure at the station location assuming a standard ICAO (International Civil Aviation Organization) atmosphere. Bias-correction and performance weighting of DMO (Direct Model Output) rainfall is not undertaken because rainfall is discontinuous. Instead the simple average of DMO rains is used.

Meridional and zonal wind components are combined to produce wind speed and direction forecasts. The bias corrections and weights are used to produce the wind speed field, while no bias corrections but only weights are used to produce the wind direction field.

It is also noted that hires LAPS375 and lores LAPS375 are the same models, but with different spatial and temporal resolutions of the forecast fields. It is likewise for hires and lores LAPS125.

c. Upgrades to Hourly OCF in NMOC

In the upgraded system, two extra early runs were implemented. The old 00Z and 12Z runs have been renamed as 06Z and 18Z, but still utilise the same dataset of the input models. The two extra early runs are named as 00Z and 12Z and are scheduled to run once most of the recent local limited-area models are available. The details of the 4 runs are summarised in Table 2.

Table 2. Description of the upgraded hourly OCF system

OCF runs	Component models	Issue times (UTC)	Deadlines (UTC) to run
00Z(New)	Current day 00Z LAPS375, LAPS125 and LAPS050 and previous day 12Z run for other models	04:50UTC	05:00UTC
06Z(Old 00Z)	Current day 00Z models	07:10 UTC	06:55 UTC
12Z(New)	Current day 12Z LAPS375, LAPS125 and LAPS050 and current day 00Z run for other models	16:50UTC	17:00UTC
18Z (Old 12Z)	Current day 12Z models	20:50UTC	23:25UTC

The start times of the hourly OCF processing depend on the availability of the NWP data, but will be no later than the aforementioned deadlines. The blending process takes about twenty minutes to run. The 4 runs usually complete at around the issue times given in Table 2, but if one of the expected models is not available and the deadline is reached, the suite will start to run and the issued times will be around 05:20UTC for 00Z, 07:15UTC for 06Z, 17:20UTC for 12Z and 23:45UTC for 18Z.

In the current composite scheme, if a desired model is not available when the composite starts to run, this model will be dropped from the forecast. For example, the 06Z OCF should blend with the latest 00Z models, if the 00Z USAVM is not available at the time of the composite job running, it will not be included in the blending scheme.

4. Output Products

As with the current system, the hourly OCF product is delivered to the Bureau's registered users' website. The temperature forecast from the 00Z hourly OCF system provides the frost risk guidance which is currently available at the Bureau's external website <http://www.bom.gov.au/jsp/watl/weather/frost.jsp>

5. Definition of the models

LAPS

Limited Area Prediction System (Australian Bureau of Meteorology)
LAPS375, LAPS125 and LAPS050 have different spatial and temporal resolutions

MALAPS

Mesoscale Assimilation Limited Prediction System (Australian Bureau of Meteorology)

GASP

Global Assimilation and Prediction Model (Australian Bureau of Meteorology)

ECSP

European Centre Spectral Prognosis (European Centre for Medium-Range Weather Forecasting)

JMAGSM

Japan Meteorological Agency Global Spectral Model (Japan Meteorological Agency)

UKGC

United Kingdom Grid Code (United Kingdom Met Office)

USAVM

United States Aviation Model (National Centers for Environmental Prediction (NCEP), USA)

CMCGEM

Canadian Meteorological Centre Global Environmental Multiscale model (Canadian Meteorological Centre)

6. Future Developments

Enhancements to the current operational configuration are expected in the near future. They include:

- Quality check for the input DMO data
- Replace the Australian models (GASP and LAPS) with the new ACCESS (Australian Community Climate Earth System Simulator) model, based on the UKMO Unified Model assimilation and prediction code.
- Incorporate more high resolution overseas models.
- GOCF (Gridded OCF) ozone/UV forecasts

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NMOC operations bulletin No 60 (OCF) –
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