International Civil Aviation Organization

SEVENTEENTH MEETING OF THE METEOROLOGY SUB-GROUP (MET SG/17) OF APANPIRG

Bangkok, Thailand, 13 – 16 May 2013

Agenda Item 4: World Area Forecast System (WAFS)

4.4) Gridded forecasts (icing, turbulence and CB) and visualization

USE OF WAFS GRIDDED CB, ICING AND TURBULENCE IN AUSTRALIA

(Presented by Australia)

SUMMARY

This paper presents some recent experiences Australia has had with using the WAFS CB cloud, icing and turbulence grids and highlights some benefits and areas requiring further refinement.

1. Introduction

1.1 The World Area Forecast System (WAFS) provides global gridded forecasts of wind, temperature, relative humidity, CB cloud, icing and turbulence. Whilst the wind, temperature and relative humidity grids have been operational for multiple decades, the CB cloud, icing and turbulence gridded forecasts are only relatively new and have only been available on a 'trial and evaluation' basis. These CB, icing and turbulence grids have been recommended by the WAFS Operations Group (WAFSOPSG) to become operational products effective from Amendment 76 to ICAO Annex 3 (effective November 2013).

1.2 There are likely to be 3 primary uses of these CB cloud, icing and turbulence grids, these being:

a) Automatic route optimization within flight planning systems;

b) Automatic generation of graphical guidance for use by pilots and flight planning personnel; and

c) Forecasting guidance for use by meteorologists.

1.3 This paper focuses on use c) above and reports on experience with the WAFS CB cloud, icing and turbulence datasets within the Australian region. The experience will also be relevant to all three uses mentioned above.

2. Use of WAFS Products in Australia

2.1 For many years Australia has been receiving WAFS wind, temperature and humidity gridded forecasts. These grids have been used by the Australian Bureau of Meteorology (Bureau) for the automatic generation of wind and temperature charts, grid point wind charts, route sector wind and temperature products. These grids are also used by Airservices (the Australian ANSP) and airlines for flight planning and route optimization purposes.

2.2 The Bureau Meteorology now also retrieves CB cloud, icing and turbulence data from both WAFC London (primary) and Washington (secondary). At this stage neither Airservices nor any airline are receiving this data operationally, but the Bureau's aviation forecasters within the National Meteorological Oceanographic Centre have access to this data.

2.3 Whilst the CB, icing and turbulence grids are yet to formally become part of the official forecast process, these grids are available to forecasters and the forecasters are encouraged to consider the guidance as part of the forecasting process. The usage of these grids varies between forecasters, however, generally the forecasters have found the guidance to be of benefit and have liked the way that data is available in 50hPA steps.

3. Review of specific datasets

3.1 This section is intended to provide a few examples of visualizations of WAFS forecasts and some general feedback from forecasters.

3.2 On a number of occasions, following the receipt of an AIREP, a review has indicated that the WAFS grids have highlighted a potential for such occurrences. One recent example of where the WAFS grids highlighted the potential for an occurrence which was not contained in a SIGMET is shown in Figure 1. An AIREP was received from aircraft travelling the flight path shown in blue which reported severe turbulence between FL250 and FL217. Whilst a SIGMET was issued for the appropriate geographic extents, its lowest limit stopped at FL240. The WAFS maximum potential guidance for FL240 (Figure 1) indicates a 12% potential for turbulence at a level centered at FL240 (+/- 25hPa). It could be inferred that the WAFS grids suggested severe turbulence down to 425hPA or about FL220, aligning well with the observation.

ARS JTE7042 85NM S YBBN 1758 F250 POODL 1812 SEV TURB F250 TO F217

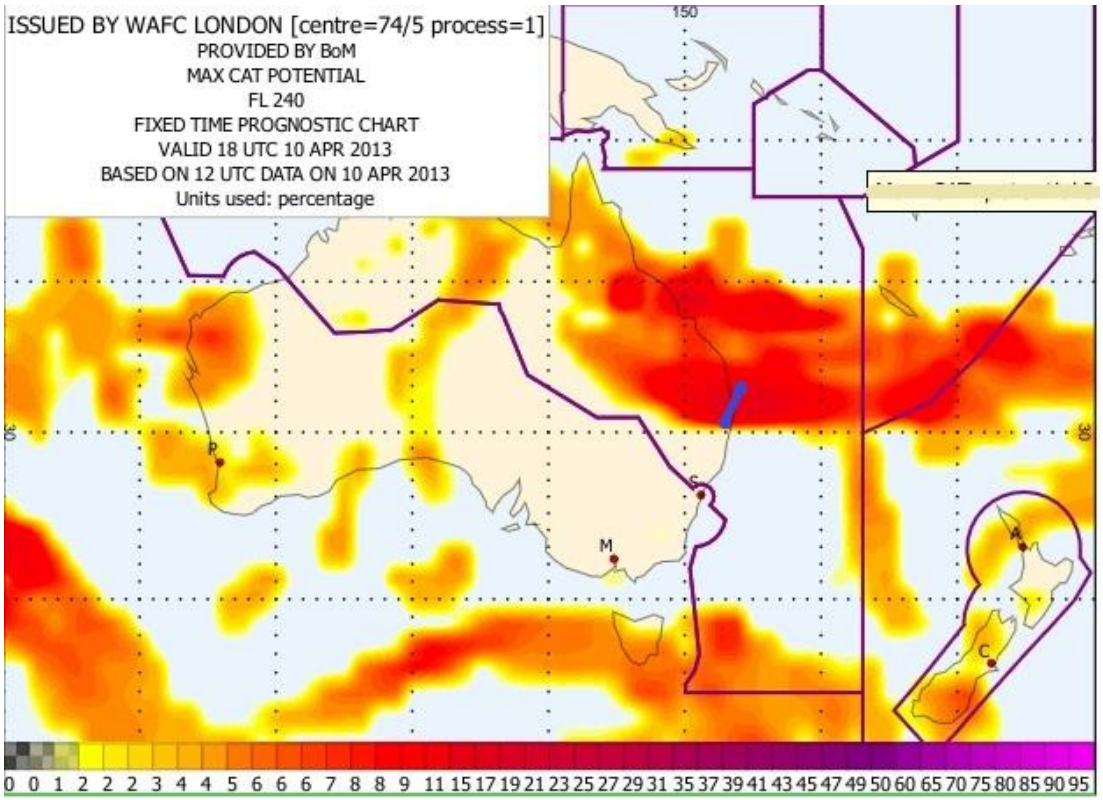

Figure 1. Max CAT potential where flight path is indicated by Blue Line

3.2 Occasionally, areas of anomalous CAT appear on the WAFS gridded forecast, such as the example given in Figure 2. Figure 2 shows an area indicated by both max (12%) and mean (5.1%) potentials to be favourable for moderate or greater CAT at about FL300. These anomalous CAT areas tend to be situated away from any upper level jets as demonstrated when comparing WAFS product with the Australian mid-level SIGWX analysis (Figure 3).

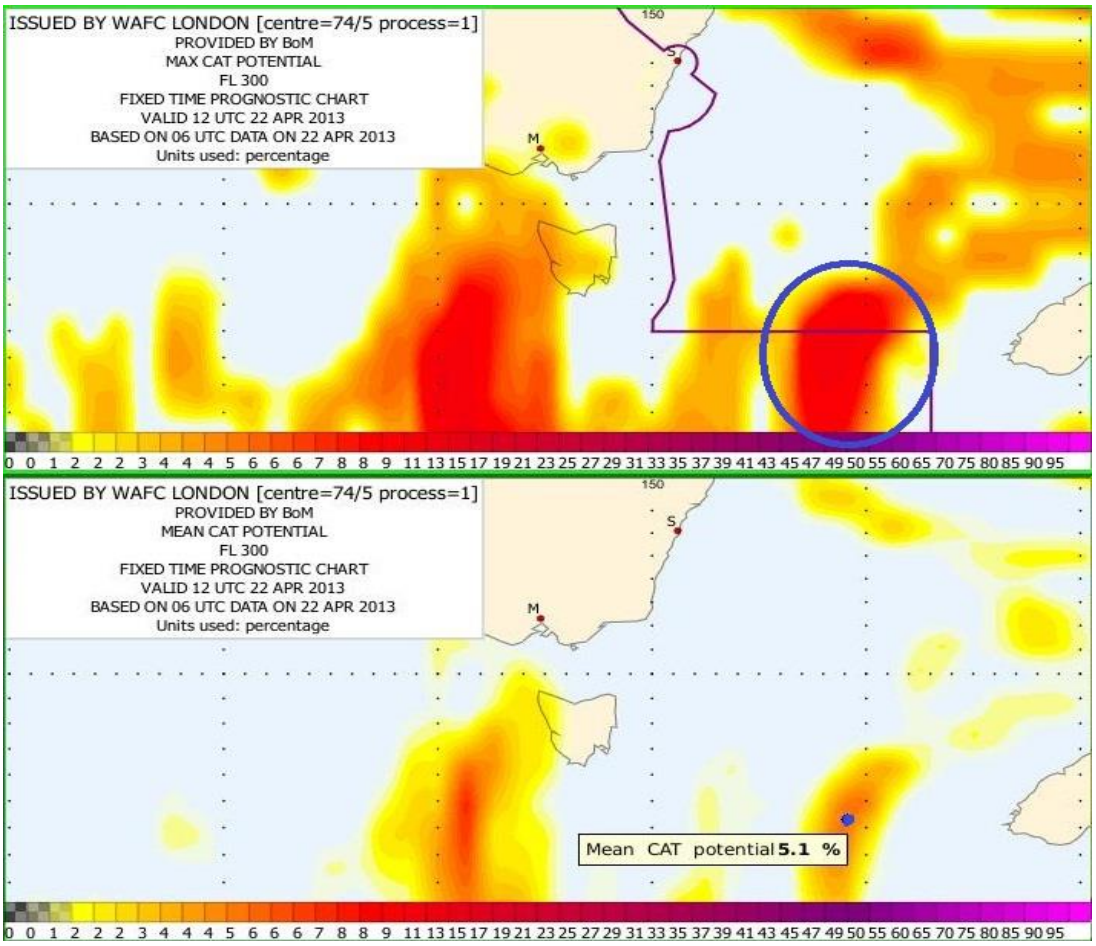

Figure 2. Anomalous area of maximum and mean CAT over southern Tasman Sea (12UTC 22nd April 2013)

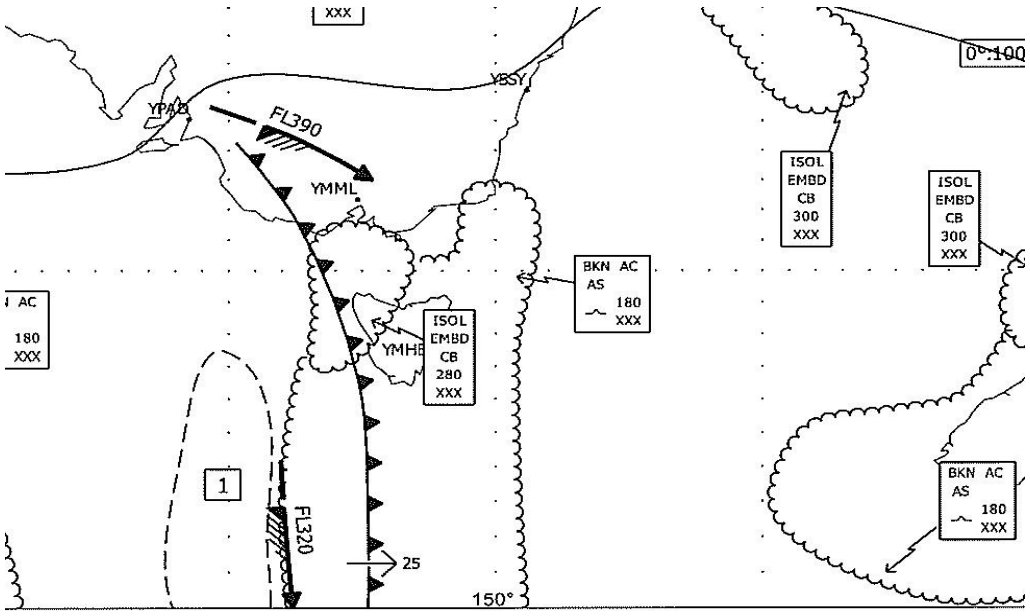

Figure 3. Australian SIGWX Analysis for the same time (12UTC 22nd April 2013**)**

3.3 The WAFCs have produced an updated guidance document (Guidance on the Harmonized WAFS Grids for Cumulonimbus Cloud, Icing and Turbulence Forecasts - 11 September 2012 available at http://www.icao.int/safety/meteorology/WAFSOPSG/Pages/GuidanceMaterial.aspx) which includes recommended thresholds for using these datasets. Having these recommended thresholds is a significant advance for users. For icing, a value of 0.1 is recommended for Extended Diversion Time Operations (EDTO) (formally known as ETOPS) purposes and 0.7 is considered representative of moderate icing on a SIGWX chart. At this stage no such value has been defined for determining areas severe icing. Figure 4 demonstrates the good correlation between WAFS gridded icing and Australian SIGMETs as well as the complexity in inferring severity from potential.

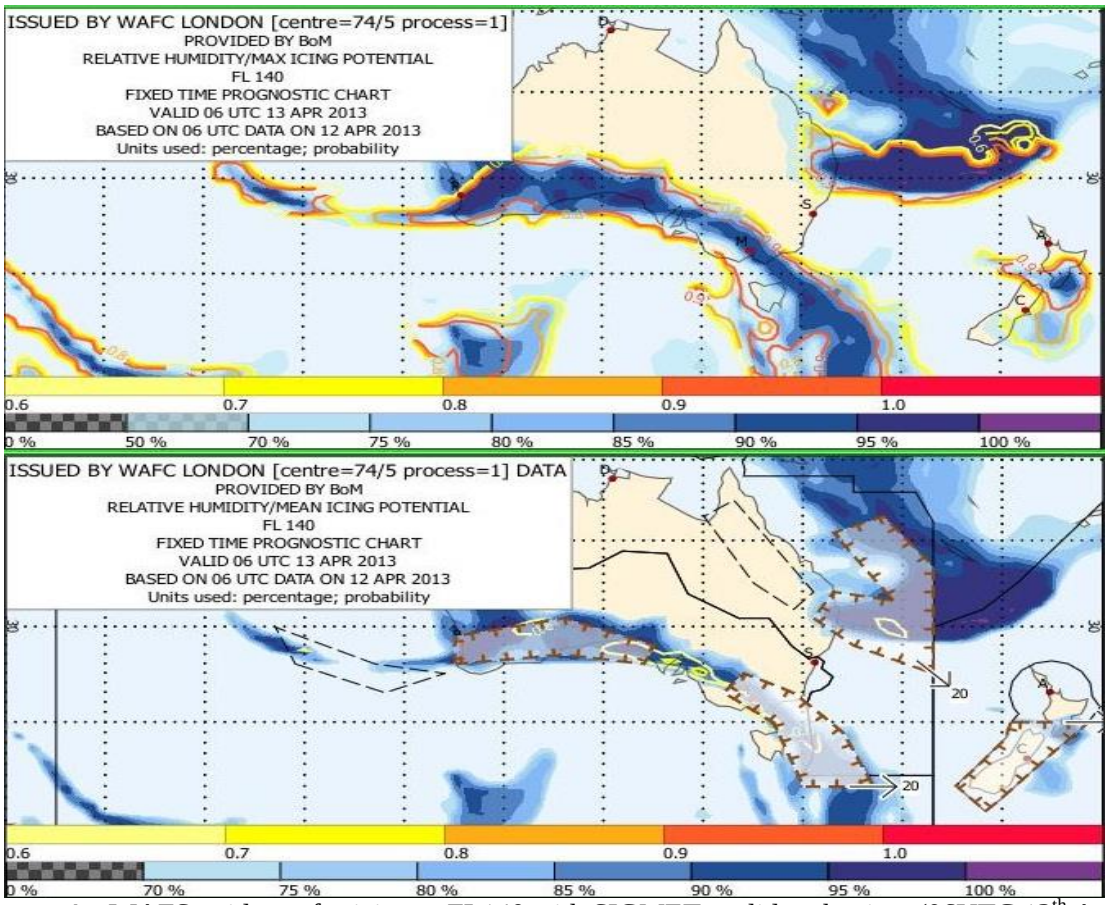

Figure 4. WAFS guidance for icing at FL140 with SIGMETs valid at the time (06UTC 13th April 2013)

3.4 Figure 5 provides an example of WAFS CB cloud horizontal extent whereby the gridded forecast has picked out areas of CB fairly well, in particular, over the west of New Zealand, west of Australia and in the tropics. In this example the model has failed to pick up the thunderstorms west of Sydney (highlighted in red circle). From our observations, the heights of CB bases and tops compare well with our policy for CB heights over the Australian region. Further work is generally required with CB performance in tropics but we recognize the complexity in producing accurate CB forecasts for this region.

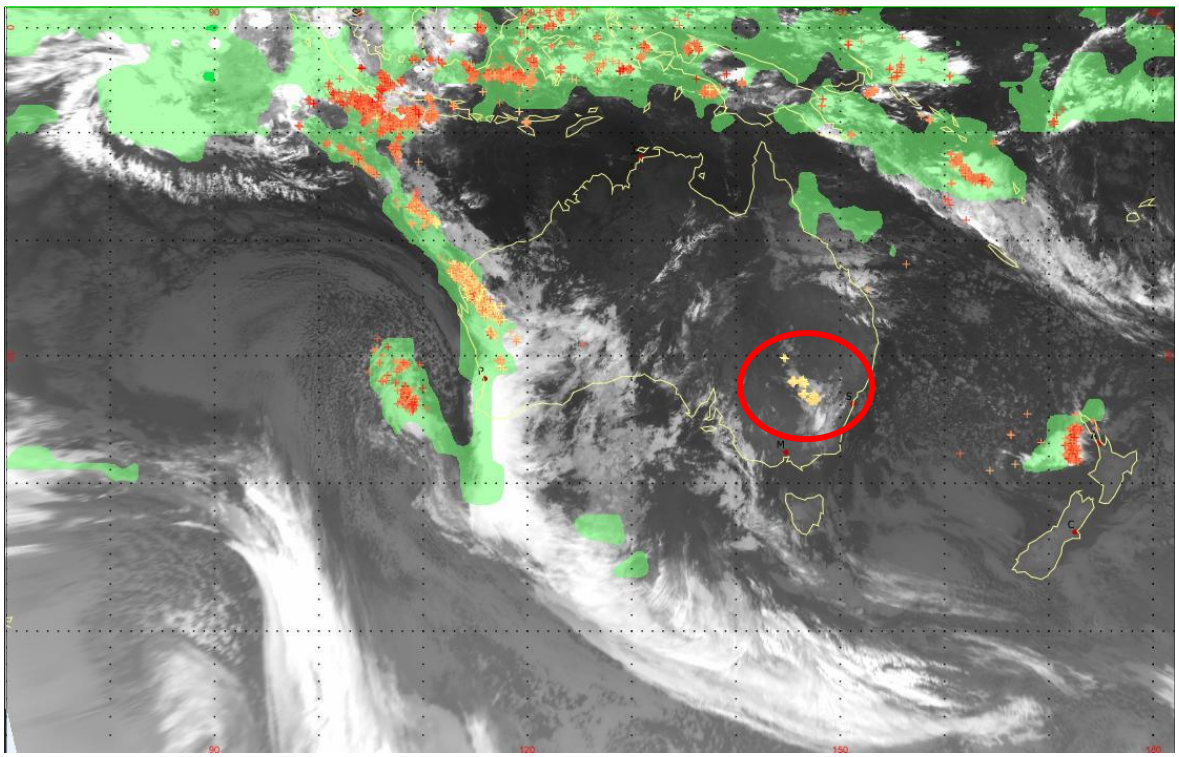

Figure 5. WAFS gridded CB cloud extents (green) with observed lightning (crosses) (valid 18UTC on 7 May 2013 based on 12UTC on 7th May 2013)

4. Summary

4.1 Whilst Australia is yet to automatically generate flight guidance off the new WAFS gridded CB, icing and turbulence forecasts due to issues determining appropriate thresholds and a current lack of user requirements, the grids are being used within the forecasting process. Forecasters have indicated that typically the icing and turbulence guidance matches the forecast policy relatively well although further work is required on CB forecasts near the tropics. Further refinement is also required in the calibration and adoption of appropriate thresholds to ascertain areas of moderate or severe conditions.

4.2 In summary, the WAFS gridded guidance offers a good additional resource for forecasters and users that are familiar with the meteorological factors. Australia highlights that the data does offer value in the forecasting process and encourages other States to utilize these forecasts.

4.3 Australia also plans to request, at the WAFSOPSG/8 Meeting, the WAFCs to perform verification of the CB cloud, icing and turbulence grids for the ASIA/PAC region.

5. Action by the Meeting

5.1 The meeting is invited to note the information contained in this paper.

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