International Civil Aviation Organization

METPWGMOG/7/IP/12
10/04/18

INFORMATION PAPER

MEETING OF THE METEOROLOGY PANEL (METP) WORKING GROUP MOG

SEVENTH MEETING

Frankfurt, Germany, 11 to 13 April 2018

Agenda Item **3.3 Work required in Support of WAFS Developments**
3.3.2 Matters related to gridded WAFS products

Improvements to the WAFS Hazard Grids in 2020

(Presented by the WAFC Provider States)

SUMMARY

This Information Paper describes the plan to increase the resolution of the WAFS Hazard Grids from 1.25 to 0.25 degrees in November 2020. Improved algorithms that will provide icing and turbulence severity will also be implemented.

1. INTRODUCTION

1.1 METP-WG/MOG/7 SN/12 describes the 10 year plan for the next generation of WAFS Hazard Grids, which are grids for turbulence, icing and cumulonimbus (Cb). Currently, these grids are provided at 1.25 degree resolution, for select vertical levels. The information consists of values for the potential of any icing and turbulence, plus the horizontal extent and tops and bases of Cb. In-cloud turbulence potential is also provided.

1.2 The 2014 ICAO/WMO Meteorological Divisional Meeting set requirements for the WAFCs to replace the potential of icing and turbulence with a forecast of the severity of icing and turbulence. The Meeting also required the WAFCs to increase the resolution of the grids, and then the METPMOG/4 agreed to set the new horizontal resolution at 0.25 degrees.

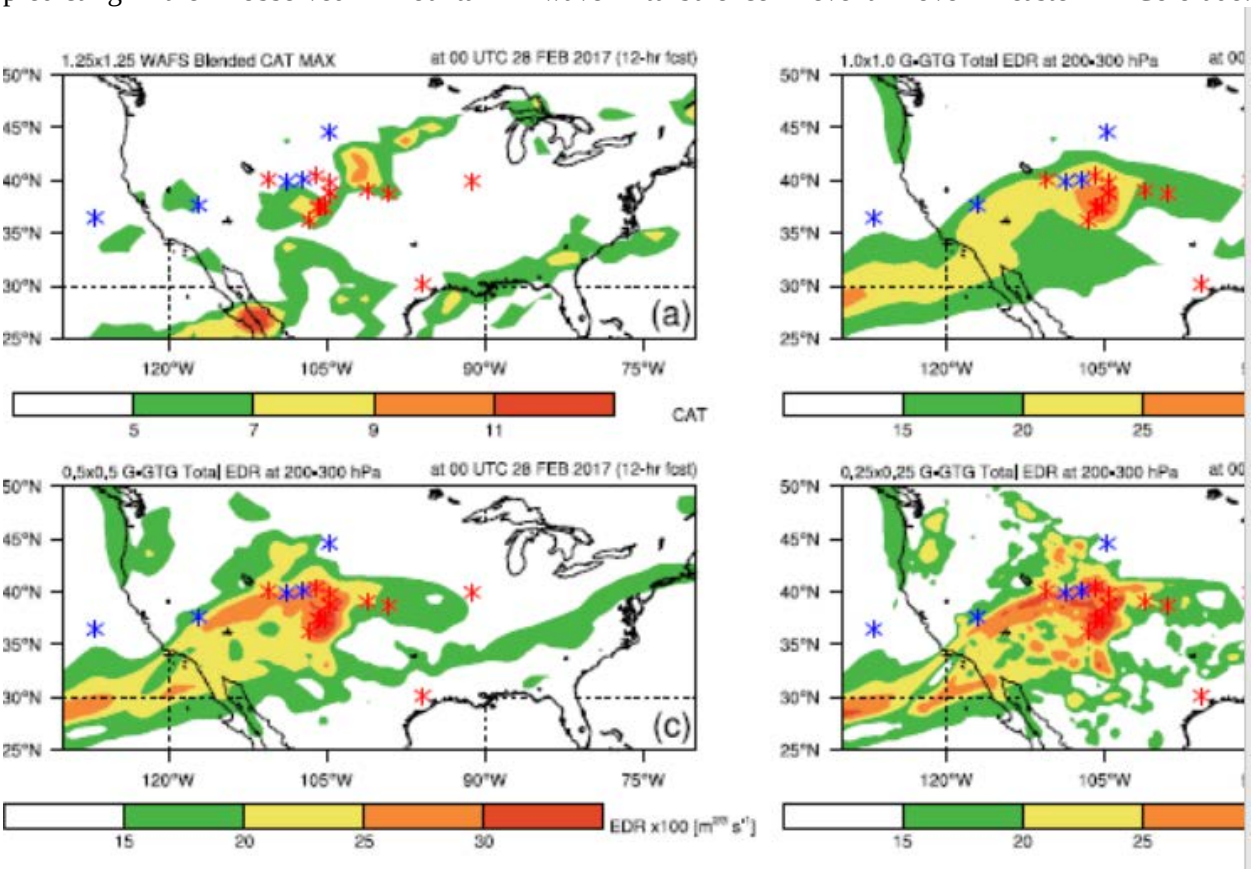
1.3 This paper describes the timeline and provides some rationale for making the initial round of improvements for the WAFC grids.

DISCUSSION

2. When the WAFS hazard grids were first introduced in 2010 and deemed operational in 2013, the resolution of WAFS grids was set at 1.25 degrees. This kept the file size low enough for

transmission on the old satellite downlink dissemination systems. Today's internet based dissemination systems can handle the larger file sizes associated with the higher resolution grids.

2.1 Studies were done by the WAFCs to determine a resolution that balanced increased file sizes with improved detection of hazards. An example of one such study is shown in the figure below, which shows how the 0.25 degree resolution is the best for detecting moderate or greater (MOG) turbulence. The current 1.25 degree WAFS grid in the top left is compared with the new WAFS Graphical Turbulence Guidance (GTG) algorithm at 1.0, 0.5 and 0.25 degrees. The 0.25 degree in the bottom right is best at predicting the observed mountain wave turbulence event over eastern Colorado.



2.2 The increased horizontal resolution will cause an increase in file size from around 540 kilobytes per forecast time step to around 14 megabytes per forecast time step. This 20 fold increase is without adding any additional time steps or flight levels. An improved WAFS dissemination system, discussed in IP11 will be necessary before additional time steps or flight levels are considered.

2.3 Turbulence severity will replace turbulence potential in the turbulence grid. Severity will be provided in units of Eddy Dissipation Rate (EDR), which is an aircraft independent measurement of turbulence. In other words, a large commercial jet and a small private plane will both report the same EDR value for a given area of turbulence. The small plane may be greatly affected by the turbulence, whereas the large jet may barely notice it. This means that operators can select an aircraft specific EDR threshold to avoid. The large jet will not need to avoid the lower values of EDR that a small aircraft will want to avoid.

2.4 Icing severity will replace icing potential in the icing grid. The severity will be provided categorically, as either none, light, moderate or severe icing. These categories represent the average reported icing severity for the forecast condition, and will be represented numerically, where 0 = none, 1 = light, 2 = moderate and 3 = severe.

2.5 The Cb grid will continue to provide a forecast of area coverage of the grid space. This will be upgraded to Cb probability in November 2022.

2.6 In-cloud turbulence will be retired, in favor of extending the new turbulence grid downward to FL100, FL140 and FL180. These new turbulence levels, when used in combination with the Cb grid, will provide more scientifically sound turbulence information than the outgoing in-cloud turbulence algorithm.

2.7 The below table provides an easy to read timeline of the changes discussed above.

Parameter	Discussion	Expected changes in November 2020
Turbulence	The current turbulence potential does not provide any severity information, nor is it calibrated to probability. It is just a simple index.	Potential is replaced by EDR, a direct measure of severity. Resolution increased to 0.25 degrees.
Icing	The current icing potential does not provide severity information, nor is it calibrated to probability. It is just a simple index.	Potential is replaced by categorical severity. Resolution increased to 0.25 degrees.
Cumulonimbus	The current Cb grids provide information about Cb top, base and horizontal extent.	No changes, other than resolution increased to 0.25 degrees.
In-cloud Turbulence	The current In-Cloud Turbulence grid is redundant with the Cb grid and the improved turbulence grid.	Retired. Replaced by lower flight levels in the WAFS Turbulence grid.

3. ACTION BY THE METP-WG/MOG

a) The METP-WG/MOG is invited to note the information contained in this paper