International Civil Aviation Organization

METP-WG/MOG/3-SN/10
03/6/16

STUDY NOTE

MEETING OF THE METEOROLOGY PANEL (METP) WORKING GROUP MOG

Third MEETING

Gatwick, London, United Kingdom, 13 to 16 June 2016

Agenda Item 6: Matters relating to WAFS
6.3.5 Long Term Planning of WAFS

DEVELOPMENT OF WAFS GRIDDED GLOBAL FORECASTS OF CUMULONIMBUS (CB) CLOUDS, ICING AND TURBULENCE

(Presented by the WAFC Provider States)

SUMMARY

This Study Note apprises the group of the progress in meeting the ASBU schedule for improvements to WAFS Turbulence, Icing and Cumulonimbus Cloud (Cb) grids.

1. INTRODUCTION

1.1 The group will recall that the 2014 Meteorology Divisional Meeting set forth a schedule of improvements to WAFS Turbulence, Icing and Cb grids. The schedule was linked to ICAO's Aviation System Block Upgrade (ASBU) schedule. The schedule can be found in Appendix A of this Paper.

1.2 This Information Paper apprises the group of the progress against the ASBU linked schedule for improvements to WAFS grids.

1.3 This paper also discusses issues related to the increase in file size that will be seen as horizontal and vertical grid resolution increases. An example is given that shows how this could be mitigated.

2. DISCUSSION

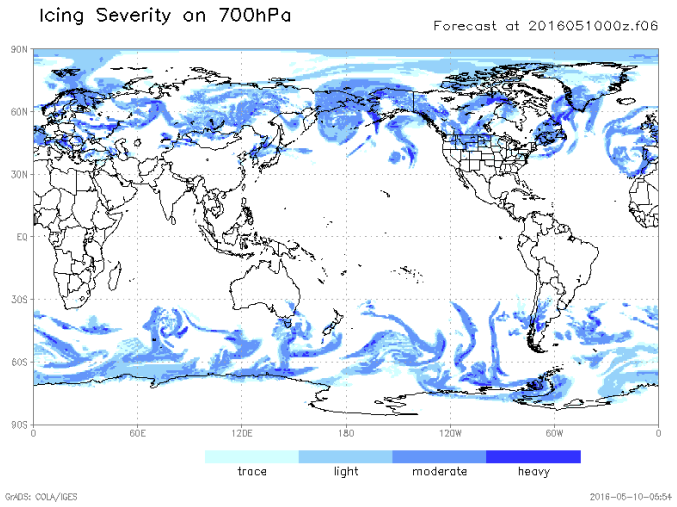
2.1 The WAFCs have made significant progress towards providing icing and turbulence severity grids, which are due in 2018. Some of the data is available on a trial basis now, or will become available very soon.

2.2 As a proxy for an eventual WAFS product, WAFC Washington is currently making a global icing severity grid operationally available via its NOAA Operational Model Archive and Distribution System (NOMADS). The icing severity data is available at 0.25 degrees in the horizontal in in one hour time increments. The data is operationally supported and can be found at http://nomads.ncep.noaa.gov/cgi-bin/filter_gfs_0p25.pl

It is notable that this increase in horizontal resolution to 0.25 degrees increases the file size up to 25 times the current 1.25 degree WAFS grid. This increase is before changing from three hour to one hour time steps, or adding additional flight levels. Fortunately, a system such as NOMADS will allow users to select specific levels, times and even areas of the world, so that the entire global grid does not need to be downloaded. The following example demonstrates how programmers can make such selections by replacing f024 with the forecast hour desired, 2016051206 with the desired forecast cycle, etc. Users can contact Matt.Strahan@noaa.gov with any questions.

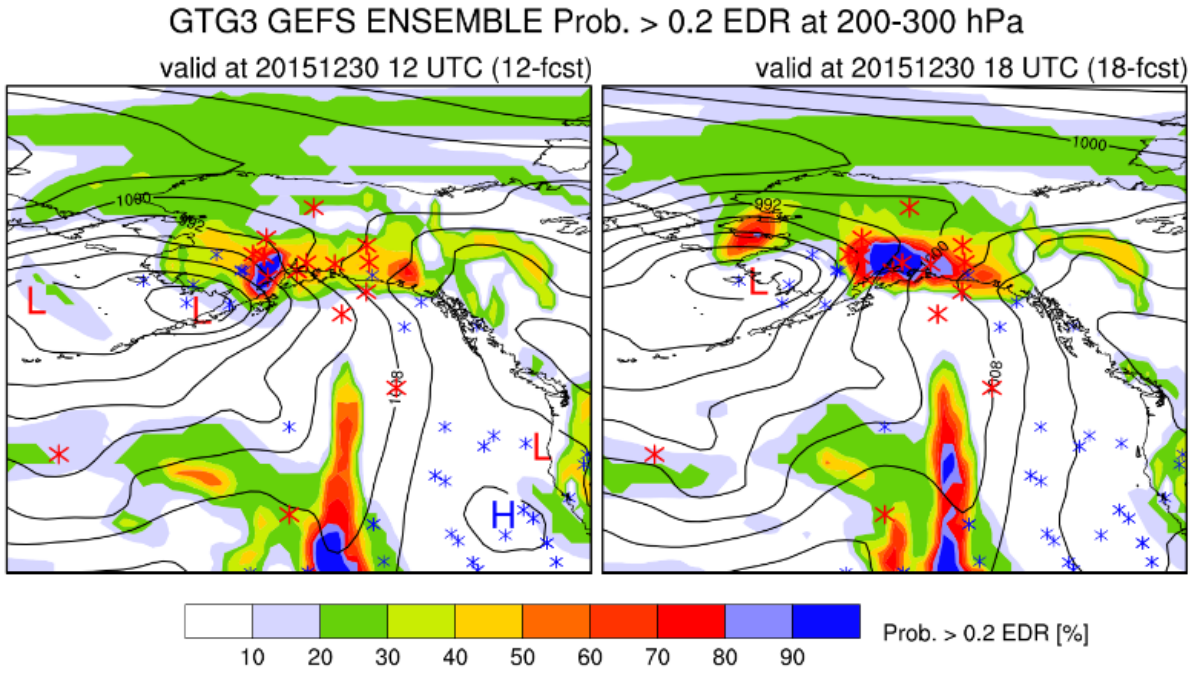
http://nomads.ncep.noaa.gov/cgi-bin/filter_gfs_0p25.pl?file=gfs.t06z.pgrb2.0p25.f024&lev_700_mb=on&var_ICSEV=on&subregion=&leftlon=-10&rightlon=60&toplat=20&bottomlat=-30&dir=%2Fgfs.2016051206

2.3 Below is a visualisation of 0.25 degree icing severity data.



2.4 The WAFCs are also working to deploy an advanced turbulence algorithm on the U.K.'s MOGREPS ensemble and the U.S.'s GEFS ensemble. This algorithm produces turbulence severity output in units of Eddy Dissipation Rate (EDR), and can differentiate between Clear Air Turbulence and Mountain Wave Turbulence. The use of the ensembles will enable probabilistic predictions. A proxy for the eventual WAFS turbulence severity grid should be made available on NOMADS by December, 2016.

2.5 Below is a visualization of the probability of turbulence exceeding an EDR of 0.2. The red asterisk are aircraft reports of Moderate or Greater (MOG) turbulence, and the blue asterisks are aircraft reports below that level.



2.6 The WAFCs have also developed an algorithm for probabilistic cumulonimbus cloud forecasts from a multi-center ensemble system. Initial experiments indicate improvements are made by including ensemble data from up to four global ensemble systems. The algorithm uses a combination of convective precipitation rate and stability parameters. There is some difficulty in that it must be tuned regionally and seasonally for maximum effectiveness.

2.7 Significant coordination is taking place between the two WAFCs to share algorithms and verification methods. For example, five U.S. scientists will spend one week at WAFC London to work with the U.K. scientists, and a U.K. scientist will spend the month of July 2016 working at WAFC Washington.

3. ACTION BY THE METP-WG/MOG

3.1 The METP-WG/MOG is invited to:

a) note the information contained in this information paper.

Appendix A

Roadmap for the **World Area Forecast System (WAFS)** in support of the Aviation System Block Upgrades (ASBU)	**Block 0** (through 2018)	**Block 1** (2018-2023)	**Block 2** (2023-2028)	**Block 3** (2028 and beyond)
Implement improved turbulence algorithms including the replacement of turbulence potential with turbulence severity (i.e. EDR)	X			
Implement improved icing algorithms including the replacement of icing potential with icing severity	X			
Global and regional verification of WAFS forecasts by utilizing data provided by States and user organizations	X			
Implement cumulonimbus cloud ensemble based prediction system		X		
Implement turbulence type forecasts (e.g. convection, jet-stream shear, terrain) utilizing EDR		X		
Implement finer grid resolution for WAFS data		X		
Implement calibrated probabilistic forecasts for icing, turbulence and cumulonimbus cloud		X		
Provide partial dataset of meteorological information for integration into flight planning, flight management and ATM decision support systems for en-route weather		X		
Implement SIGWX in XML/GML format as a replacement to SIGWX in BUFR format		X		
Make available WAFS data via SWIM		X		
Provide increased dataset of meteorological information suitable for integration into flight planning, flight management and ATM decision support systems for en-route weather			X	
Fully integrated multi-member ensemble hazard forecasts				X
Implementation of the WAFS-database, populated with meteorological information from appropriate models to produce ensemble forecasts of global meteorological information				X
Implementation of high spatial and temporal resolution resulting in improved representations of meteorological information				X
Provide full dataset of meteorological information covering en-route weather suitable for integration into flight planning for en-route operations, flight management and ATM decision support systems				X
Fully automated gridded and SIGWX output				X
Full implementation of SWIM for access to WAFS data				X
Retirement of legacy WAFS products and dissemination systems				X

— END —