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WORKING PAPER

MEETING OF THE METEOROLOGY PANEL (METP)
WORKING GROUP MOG

FIRST MEETING

Gatwick, London, United Kingdom, 8 to 11 September 2015

Agenda Item 4: Matters relating to WAFS
4.3: Development of WAFS and co-ordination with other METP Groups.

Medium Term Strategy for the WAFS for ASBU1 (2018-2023)

SUMMARY

This paper presents a strategy to develop the WAFS to meet the aspirations of the ASBU1 as first proposed to the MET Divisional Meeting (2014).
Action by the METP-WG/MOG is in paragraph **Error! Reference source not found.**3.

1. Introduction

1.1 This paper provides a description of tasking that will need to be addressed for services that are expected for the WAFS for ASBU1 in support of the GANP.

2. Emerging requirements

2.1 The current WAFS Grids have served the purposes of flight planning for a generation or more. Increasingly there are requirements for more detailed and more timely information with respect to wind and hazardous weather phenomena both in the en-route phase of flight but also in the terminal area. In addition, the future requirements of Air Traffic Management and Trajectory Based Operations (TBO) will need much higher resolution data than is provided today. Also there are evolutionary changes in rules that are developed and levied on

operators to be able to operate in a TBO environment that may require additional services from WAFS.

2.2 Today's WAFS Grids

2.2.1 The current WAFS Grids are provided on a regular horizontal grid of 1.25 degrees by 1.25 degrees, at 3-hourly time intervals from T+6 to T+36 and for 14 vertical levels between FL050 and FL530. Forecasts are updated every 6 hours and are typically made available around 4.5 hours after data time.

2.2.2 The horizontal grid approximates to a near 140km square at the equator but becomes smaller towards the poles. The 1.25 degree grid resolution and 3-hourly temporal resolution provides sufficient detail in the wind field for flight planning of long haul flights, but can be insufficient to capture the fine detail of the wind field that may be encountered by flights of short duration (say, less than 3 hours).

2.2.3 In addition, the 1.25 degree horizontal resolution is too coarse to adequately describe the hazardous phenomena of Icing, Turbulence and Cumulonimbus Clouds. These phenomena typically occur on much smaller scales and may last from a few tens of minutes to several hours meaning that they sometimes cannot be adequately represented on the WAFS output.

2.3 Considerations.

2.3.1 The global numerical models used by the WAFC's today run at native horizontal resolutions of around 10-20km, but output is still usually generated at 3-hourly intervals and at standard pressure levels that approximate to a number of convenient flight levels. In the future, it will be possible to provide output at more frequent time intervals and for exact flight levels by interpolation between model levels.

2.3.2 Since 2013, WAFS datasets have been distributed only as Global files. Previously, WAFS datasets were split into eight sub-areas known as Octants. This segmenting process along with 'thinning' of grid points towards the poles made the file sizes smaller, but increased the number of files and meant that the files had to be 'stitched together' to make global files. These global datasets were made available via the AFS Satellite broadcasts (ISCS until 2012 and SADIS until July 2016) or can be downloaded via the WAFS FTP (Secure SADIS FTP and WIFS) sites. Using today's technology, the WAFCs are planning to provide users with the opportunity to download their data using web services. Web services will allow

the user to choose which data they wish to download e.g. global or regional files or data for a particular flight trajectory, for specific times and so on.

2.3.3 Today's Global numerical models are run every 6 hours. Due to the time taken to assimilate observational data from many different sources and the large amount of processing time involved these models typically do not produce results till about 4 hours after the nominal data time. For example, a forecast based on observational data around 12 UTC will not become available till after 16 UTC. This 6-hourly production schedule for Global NWP models is unlikely to change in the foreseeable future.

2.4 Flight Planning

2.4.1 Flight planning software varies in its sophistication but ideally systems should be capable of interpolating in 4 dimensions, i.e. for horizontal location (N-S and E-W), for height and for time. This is computationally expensive to do. By providing more data on a finer grid, for each hour and at more vertical levels, the amount of interpolation that needs to be carried out by the end user will be considerably reduced (potentially to nil) but at the expense of larger datasets.

2.5 Hazard Forecasts

2.5.1 The WAFCs have been providing forecasts of Icing, Turbulence and Cb clouds on a trial basis since 2010 and on an operational basis since 2013. These first generation global hazard forecasts have a number of shortcomings:-

(i) The horizontal resolution is too coarse, and this provides a very 'blocky' appearance when fields are visualised;

(ii) The scales used for Icing and Turbulence are not readily correlated to a traditional understanding of severity, and;

(iii) Some of the parameters provided, such as in-cloud turbulence and Cb base, have limited utility.

2.5.2 Users have also requested that the Turbulence information be expressed in terms of type and severity in units of EDR (Eddy Dissipation Rate) and for Icing to be expressed in terms of severity. In addition, the probability of encountering these hazards has been

requested. The probability of encountering these hazards can be assessed more readily by the use of ensemble output from a number of different numerical models.

2.6 Validation of existing WAFS parameters

2.6.1 The increase in the number of proposed vertical levels to potentially every 1000 feet means that the maximum wind and tropopause information can be more precisely determined by inspection of the wind and temperature fields. The 'classical' outputs of maximum wind and tropopause height are not direct model outputs and have been known to give inconsistent values in some circumstances. Therefore, a reduction in the number of WAFS parameters may be possible.

3. Action by the METP-WG/MOG

3.1 The meeting is invited to review the content of this paper and decide on an appropriate action.

Appendix – Proposed future WAFS Gridded fields

Horizontal Resolution 0.25 x 0.25 degree

Temporal Resolution T+0, 3, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 39, 42, 45, 48, 51, 54, 57, 60, 63, 66, 69, 72.

Vertical levels: SFC, 1000, 2000, 3000, 4000, 5000FT AMSL

FL050, 060, 070, 080, 090, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240, 250, 260, 270, 280, 290, 300, 310, 320, 330, 340 ,350, 360, 370, 380, 390, 400, 410, 420, 430, 440, 450, 460, 470, 480, 490, 500, 510, 520, 530, 540, 550, 560, 570, 580, 590, 600

Update frequency: 6-hours

Elements:

U-Wind Component

V-wind component

Temperature

Height

RH – FL050-250 only

Icing Probability- FL050-250 (to be decided)

Icing Severity – FL050-250 (to be decided)

Turbulence Probability – All levels

Turbulence Severity – EDR

Turbulence Type

Cb Extent – Single element - % cover per 0.25 deg grid square

Cb Top – Single element – to nearest Kft.