International Civil Aviation Organization
CAR/SAM Regional Planning and Implementation Group (GREPECAS)

INFORMATION PAPER

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Salvador, Brazil, 16 – 18 November 2022

Agenda Item 2: Global and Regional Developments
2.3 Programmes and Projects Progress Report

WORLD AREA FORECAST SYSTEM (WAFS) UPGRADES

(Presented by the United States)

EXECUTIVE SUMMARY

This paper describes the upcoming changes to the World Area Forecast System (WAFS) service provision by World Area Forecast Centres (WAFC) Washington and London, which have been formulated and agreed through the Meteorology Panel (METP) and its Working Group on Meteorological Operations Group (WG-MOG) for the WAFS.

Strategic Objectives:	• Air Navigation Capacity and Efficiency
References:	• Meteorology Panel (METP) Working Group on Meteorological Operations Group (WG-MOG) World Area Forecast System (WAFS) Work Stream, Seventeenth Meeting (virtual, 25-27 April 2022) • METP Fifth Meeting (virtual 7-9, 11, 14, 16 and 18 June 2021)

1. Introduction

1.1 The United States is one of two global providers of World Area Forecast System (WAFS) information. World Area Forecast Centre (WAFC) Washington and WAFC London have been providing global meteorological upper-air gridded forecasts and WAFS Significant Weather (SIGWX) forecasts for international flight planning that has basically not changed in 15 years.

1.2 Beginning in late 2023 and continuing into late 2024, major changes and improvements are coming to the WAFS. The upcoming WAFS changes have been formulated and agreed upon through the Meteorology Panel (METP) and its Working Group on Meteorological Operations Group (WG-MOG) for the WAFS.

2. Upcoming WAFS Upgrades

2.1 The WAFCs have been working on the next generation of WAFS provision since 2018, which will bring an upgrade in the horizontal, vertical, and temporal resolutions to the WAFS upper-air gridded forecasts. A tabular listing of the new upper-air gridded forecasts is included in the **Appendix**. The new data will be implemented in late 2023 (date to be confirmed) and includes:

- the provision of wind, temperature, relative humidity and geopotential height at 0.25 degree horizontal resolution
- data at 1,000 foot flight level (FL) intervals
- data at 1-hourly intervals from 6-hours to 24-hours, 3-hourly intervals from 27-hours to 48-hours, and wind and temperature data at 6-hourly intervals out to 120-hours.

2.2 The upgrade to the WAFS Significant Weather (SIGWX) forecasts will follow in 2024 (date to be confirmed) when SIGWX forecasts will be produced for 3-hourly intervals for the 6-hour to 48-hour period.

2.3 Some changes will be made to the WAFS SIGWX forecast content:

- It will cover FL100 to FL600 in a single forecast (i.e., no separate medium level SIGWX)
- Tropopause spot heights will be replaced by tropopause contours
- Icing objects will be available for the whole globe
- Only occasional (OCNL) and frequent (FRQ) cumulonimbus clouds will be shown (it is not possible to include embedded [EMBD] cloud)
- Turbulence objects will include clear air and orographic turbulence. There will be no separate in-cloud turbulence field.

2.4 The new SIGWX forecasts will be produced in IWXXM[1] format. BUFR[2] format SIGWX will be retired 2 years after the new SIGWX is introduced, and WAFC produced "paper copy" SIGWX charts for T+24 will cease in 2028. It should be noted that ICAO Annex 3 has stated for many years that the digital version of SIGWX forecasts should be used and integrated into flight planning and meteorological visualization software. Customized "paper copy" chart relevant for a specific flight can be created if needed from the digital visualizations.

3. Delivery of WAFS data via SADIS[3] and WIFS[4]

3.1 Increasing the resolution of the data is going to have a huge impact on its total volume, and therefore the SADIS and WIFS systems will be upgraded. Both WAFC's have been working together to develop a consistent approach for both systems which will make it easier for users to switch to the other system for backup in the event of any failure.

3.2 It is planned that the new system will be a cloud hosted service, which will deliver key benefits such as the ability to scale dynamically according to demand. Cloud hosting also increases operational availability as the system is hosted on an extensive underlying network of servers, so should one server fail the system will seamlessly migrate to another.

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[1] ICAO Meteorological Information Exchange Model
[2] Binary Universal Form for the Representation of meteorological data
[3] Secure Aviation Data Information Service – operated by WAFC London
[4] WAFS Internet File Service – operated by WAFC Washington

3.3 The new system will enable users to download only the data they are interested in (for example covering a particular area, or selection of vertical levels) and will be interoperable with other System Wide Information Management (SWIM) systems. The WAFCs plan to host test servers for the next generation WAFS products and IWXXM formatted operational meteorological (OPMET) data for demonstration and testing. This will enable users and workstation providers to prepare and adapt their systems in advance of these new data sets becoming available on the upgraded SADIS and WIFS systems in late 2023.

4. Additional information

4.1 The World Area Forecast Centres (WAFC) have prepared an information flyer on the next generation of the WAFS, which is provided in the **Attachment** (separate document).

4.2 For more information, please contact Debra Blondin debra.blondin@noaa.gov at WAFC Washington.

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Appendix A

Fixed valid times of available WAFS upper-air gridded forecasts with a horizontal resolution of 0.25°of latitude and longitude:

Upper-air gridded forecasts	*1-hourly intervals*	*3-hourly intervals*	*6-hourly intervals*
Wind, temperature, geopotential altitude	6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23 and 24 hours*	27, 30, 33, 36, 39, 42, 45 and 48 hours*	54, 60, 66, 72, 78, 84, 90, 96, 102, 108, 114 and 120 hours*
Flight level and temperature of tropopause			
Direction, speed and flight level of maximum wind			
Humidity			
Horizontal extent, and flight levels of base and top, of cumulonimbus clouds	6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23 and 24 hours*	27, 30, 33, 36, 39, 42, 45 and 48 hours*	Not provided
Icing			
Turbulence			

* after the time (0000, 0600, 1200 and 1800 UTC) of the synoptic data on which the forecasts were based

Availability (marked by X) of WAFS upper-air gridded forecasts with a horizontal resolution of 0.25° of latitude and longitude as a function of flight level

Flight Level	*ICAO Standard Atmosphere pressure level (hPa)*	*Geopotential Altitude*	*Wind*	*Temperature*	*Turbulence*	*Icing*	*Humidity*
FL 050	843.1	X	X	X	—	X	X
FL 060	812.0	X	X	X	—	X	X
FL 070	781.9	X	X	X	—	X	X
FL 080	752.6	X	X	X	—	X	X
FL 090	724.3	X	X	X	—	X	X
FL 100	696.8	X	X	X	X	X	X
FL 110	670.2	X	X	X	X	X	X
FL 120	644.4	X	X	X	X	X	X
FL 130	619.4	X	X	X	X	X	X
FL 140	595.2	X	X	X	X	X	X
FL 150	571.8	X	X	X	X	X	X
FL 160	549.2	X	X	X	X	X	X
FL 170	527.2	X	X	X	X	X	X
FL 180	506.0	X	X	X	X	X	X
FL 190	485.5	X	X	X	X	X	—
FL 200	465.6	X	X	X	X	X	—
FL 210	446.5	X	X	X	X	X	—
FL 220	427.9	X	X	X	X	X	—
FL 230	410.0	X	X	X	X	X	—

Flight Level	*ICAO Standard Atmosphere pressure level (hPa)*	*Geopotential Altitude*	*Wind*	*Temperature*	*Turbulence*	*Icing*	*Humidity*
FL 240	392.7	X	X	X	X	X	—
FL 250	376.0	X	X	X	X	X	—
FL 260	359.9	X	X	X	X	X	—
FL 270	344.3	X	X	X	X	X	—
FL 280	329.3	X	X	X	X	X	—
FL 290	314.9	X	X	X	X	X	—
FL 300	300.9	X	X	X	X	X	—
FL 310	287.4	X	X	X	X	—	—
FL 320	274.5	X	X	X	X	—	—
FL 330	262.0	X	X	X	X	—	—
FL 340	250.0	X	X	X	X	—	—
FL 350	238.4	X	X	X	X	—	—
FL 360	227.3	X	X	X	X	—	—
FL 370	216.6	X	X	X	X	—	—
FL 380	206.5	X	X	X	X	—	—
FL 390	196.8	X	X	X	X	—	—
FL 400	187.5	X	X	X	X	—	—
FL 410	178.7	X	X	X	X	—	—
FL 420	170.4	X	X	X	X	—	—
FL 430	162.4	X	X	X	X	—	—
FL 440	154.7	X	X	X	X	—	—
FL 450	147.5	X	X	X	X	—	—
FL 460	140.6	X	X	X	—	—	—
FL 470	134.0	X	X	X	—	—	—
FL 480	127.7	X	X	X	—	—	—
FL 490	121.7	X	X	X	—	—	—
FL 500	116.0	X	X	X	—	—	—
FL 510	110.5	X	X	X	—	—	—
FL 520	105.3	X	X	X	—	—	—
FL 530	100.4	X	X	X	—	—	—
FL 540	95.7	X	X	X	—	—	—
FL 550	91.2	X	X	X	—	—	—
FL 560	87.0	X	X	X	—	—	—
FL 570	82.8	X	X	X	—	—	—
FL 580	79.0	X	X	X	—	—	—
FL 590	75.2	X	X	X	—	—	—
FL 600	71.7	X	X	X	—	—	—

Availability (marked by X) of WAFS upper-air gridded forecasts with a horizontal resolution of 1.25° of latitude and longitude as a function of flight level

WAFS forecasts with a horizontal resolution of 1.25° will be provided for users unable to process WAFS forecasts with a horizontal resolution of 0.25°.

Flight Level	*ICAO Standard Atmosphere pressure level (hPa)*	*Geopotential Altitude*	*Wind*	*Temperature*	*Humidity*
FL 050	843.1	X	X	X	X
FL 080	752.6	X	X	X	X
FL 100	696.8	X	X	X	X
FL 140	595.2	X	X	X	X
FL 180	506.0	X	X	X	X
FL 210	446.5	X	X	X	—
FL 240	392.7	X	X	X	—
FL 270	344.3	X	X	X	—
FL 300	300.9	X	X	X	—
FL 320	274.5	X	X	X	—
FL 340	250.0	X	X	X	—
FL 360	227.3	X	X	X	—
FL 390	196.8	X	X	X	—
FL 410	178.7	X	X	X	—
FL 450	147.5	X	X	X	—
FL 480	127.7	X	X	X	—
FL 530	100.4	X	X	X	—

** after the time (0000, 0600, 1200 and 1800 UTC) of the synoptic data on which the forecasts were based.*

Fixed valid times of available WAFS upper-air gridded forecasts with a horizontal resolution of 1.25° of latitude and longitude

Upper-air gridded forecasts	*3-hourly intervals*
Wind, temperature, geopotential altitude	6, 9, 12, 15, 18, 24, 27, 30, 33 and 36 hours*
Flight level and temperature of tropopause	
Direction, speed and flight level of maximum wind	
Humidity	

* after the time (0000, 0600, 1200 and 1800 UTC) of the synoptic data on which the forecasts were based