International Civil Aviation Organization

INFORMATION PAPER

ICAO Asia and Pacific (APAC)
Twenty-Seventh Meeting of the Meteorology Sub-Group (MET SG/27)

Bangkok, Thailand, 04 to 08 September 2023

Agenda Item 6: Research, development and other initiatives

WAFS AND SADIS CHANGES 2023 AND 2024

(Presented by Karen Shorey, WAFC London and SADIS Manager)

SUMMARY

This working paper outlines upcoming changes to the World Area Forecast System (WAFS) data sets and the introduction of a SWIM compliant version of SADIS and WIFS.

1. INTRODUCTION

1.1 This paper and the accompanying presentation reports on the upcoming changes to the World Area Forecast System (WAFS) data sets in 2023 and 2024 as well as the SADIS and WIFS systems that are used to deliver the data.

1.2 All of these changes have been agreed though the ICAO Met Panel Meteorological Operations Group (MOG) at its annual meetings.

2. DISCUSSION

WAFS Gridded Data Upgrades – November 2023

2.1 World Area Forecast Centre (WAFC) London and WAFC Washington have been working closely together to define the next generation WAFS provision, which will bring an upgrade in the horizontal, vertical and temporal resolutions to all WAFS gridded data sets. A full summary of the new data is included in Appendix A. The new data includes:

- the provision of wind, temperature, relative humidity and geopotential height at 0.25 degree horizontal resolution
- data at 1000ft flight level 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 These data sets are being added to ICAO Annex 3 - *Meteorological Service for International Air Navigation*, and the new Procedures for Air Navigation Services — Meteorology (PANS-MET, Doc 10157) with Amendment 81 which is applicable in November 2024 however both WAFCs are intending to introduce the new data 1 year earlier in November 2023.

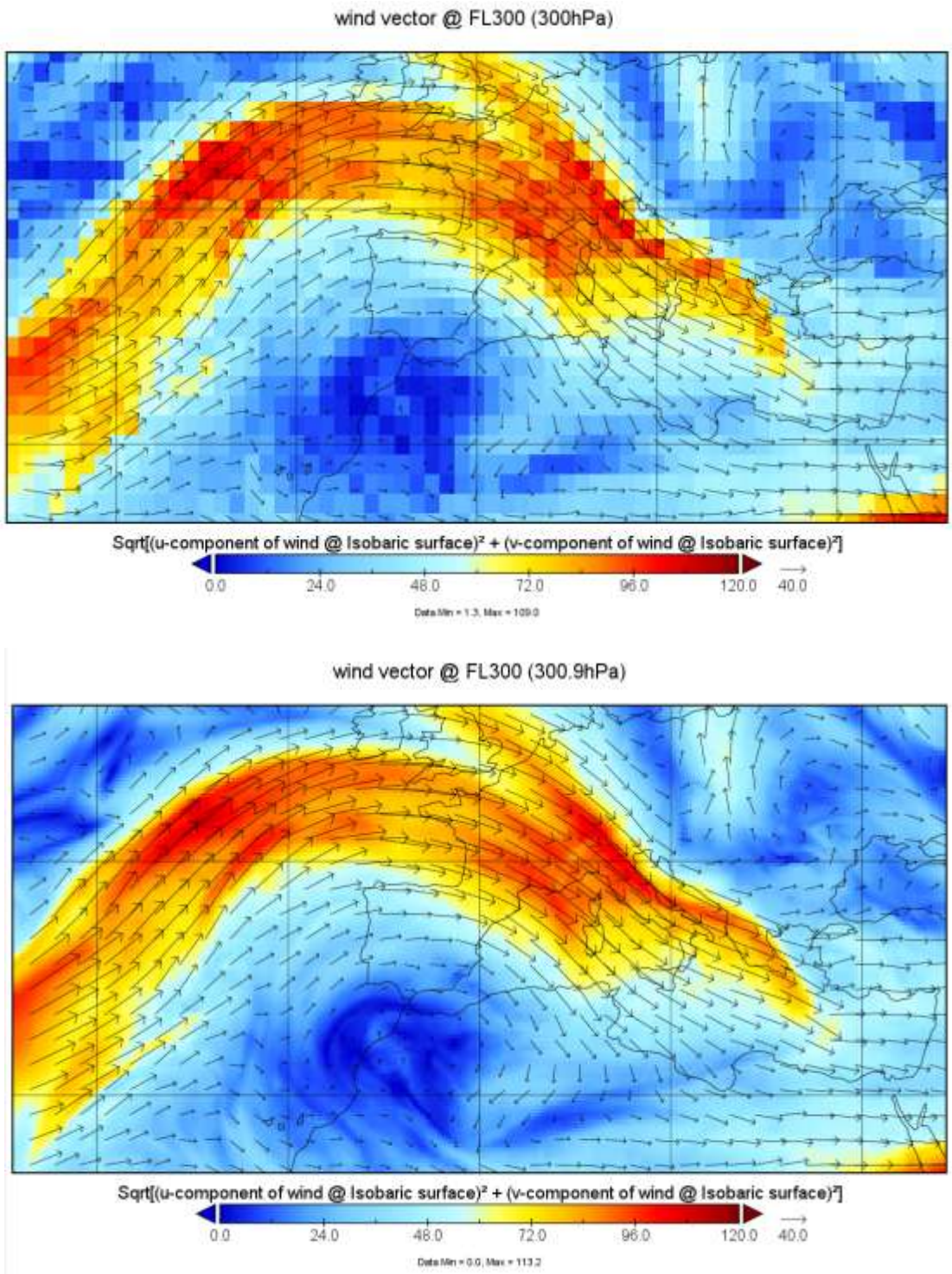

Figure 1 – Comparison of WAFS wind data at 1.25 degree horizontal resolution (top) and 0.25 degree horizontal resolution (bottom)

2.3 The existing 1.25 degree wind, temperature, relative humidity and geopotential height WAFS data sets will be retained, however it is important to note that the 1.25 degree hazard data sets (for cumulonimbus, icing and clear air turbulence) will be retired in November 2023 as these were removed as a requirement from Annex 3 in November 2020.

2.4 In order to deliver the new, much larger, WAFS data sets to users effectively, and in order to comply with the ICAO Global Air Navigation Plan (GANP) requirement to provide meteorological information through SWIM compliant systems an update to the SADIS and WIFS systems is being developed.

2.5 The new SADIS API's will adhere to the EUROCONTROL SWIM yellow profile requirements https://www.eurocontrol.int/concept/system-wide-information-management and will be published in the European SWIM registry https://eur-registry.swim.aero/services. The WIFS API adheres to similar requirements and will be published in the https://nsrr.faa.gov/ registry.

2.6 The new SADIS and WIFS APIs will deliver the WAFS gridded data using the Open Geospatial Consortium (OGC) Environmental Data Retrieval (EFR) API https://ogcapi.ogc.org/edr/ framework. This is an industry standard protocol. The WAFS data will be organized into a series of "collections" from which users can pick and choose the data they require.

2.7 Users will be encouraged to download data on a regional basis if it suits their needs, which will help to reduce the overall volumes of data. Figure 2 shows the regions or "tiles" of data that will be available.

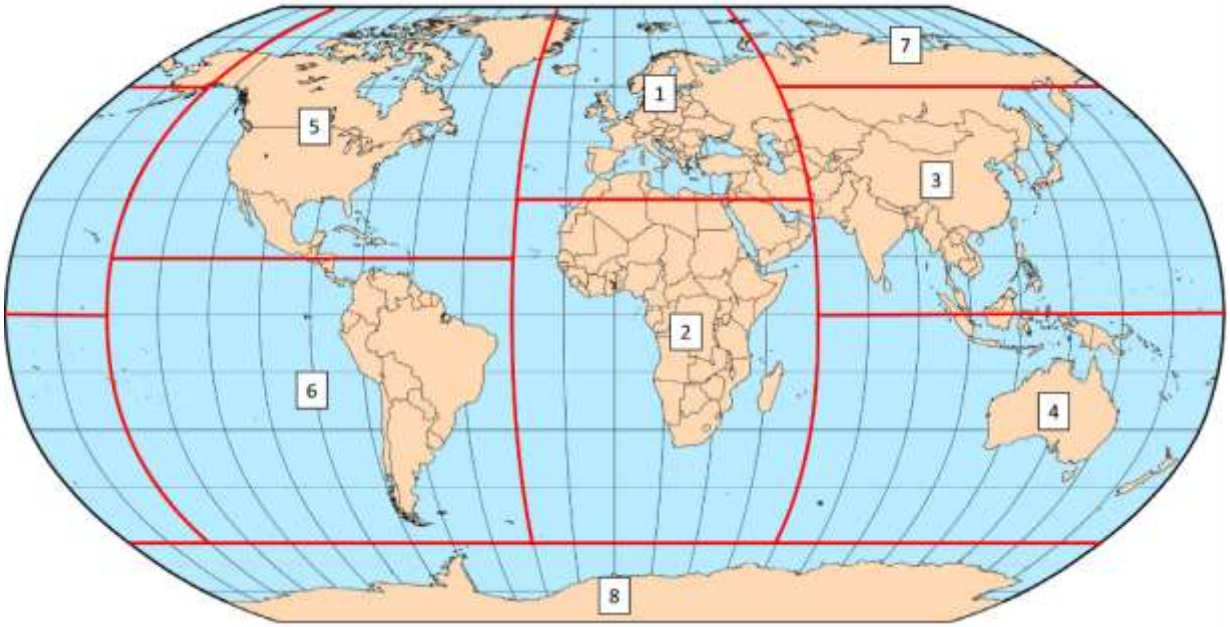

Figure 2 – Regions/Tiles of data that will be made available on the SADIS and WIFS APIs

2.8 Users will be able to request the data by making a request that looks something like this:

https://xxxxx.api.metoffice.gov.uk/collections/egrr_wafs_windtempgeo_0p25/items/YUVDYA2015_017FLALL

In this example data is being selected from the collection that contains 0.25 degree wind, temperature and geopotential height information. The code "YUVDYA2015_017FLALL" describes the individual data fields and can be decoded as follows:

Y = WAFS GRIB	
UV = u and v wind	D = Deterministic
D = Deterministic	Y = 0.25 horizontal resolution
A2 = tile area 2	015-017 = forecast timesteps
FLALL = all flight levels.	

WAFS SIGWX Upgrades – July 2024

2.9 In addition to the WAFS gridded data changes both WAFCs have been working on a major upgrade to the WAFS SIGWX forecasts. Currently only a 24-hour SIGWX forecast is produced 4 times daily (based off the 00, 06, 12 and 18 UTC model data) and this no longer meets the needs of the aviation industry particularly for short-haul flight and ultra-long haul flights.

2.10 In July 2024 multi timesteps SIGWX forecasts will be introduced, and four times daily forecasts will be produced for the 6-hour to 48-hour period (at 3 hourly intervals).

2.11 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 SWM, 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 cloud will be shown. It is not possible to include embedded [EMBD] cloud
- Turbulence objects will include both clear air and orographic turbulence. There will be no separate in-cloud turbulence field.

2.12 The new SIGWX forecasts will come in a new IWXXM format, and the schema that is going to be used can be found here: https://schemas.wmo.int/iwxxm/2023-1/WAFSSigWxFC.xsd.

2.13 A selection of test data sets that users, or their software providers can try to visualize are provided here: https://www.metoffice.gov.uk/services/transport/aviation/regulated/wafs-sigwx-test-data.

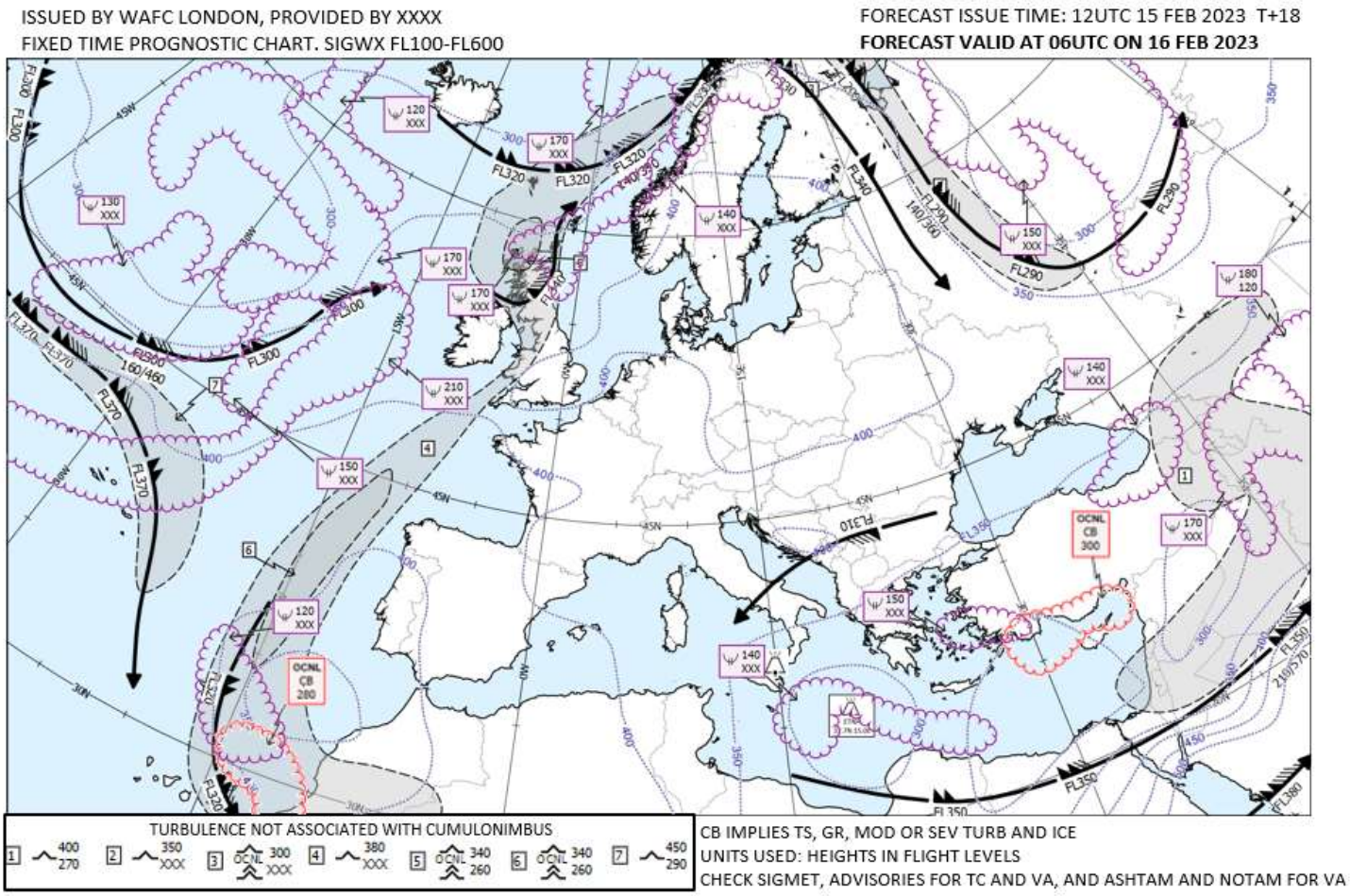

Figure 3 – Example multi timestep SIGWX visualization

2.14 It should be noted that the new multi timestep SIGWX is intended to be used digitally, and therefore sets of briefing charts will not be supplied by the WAFC's (apart from the 24-hour forecast on the old SADIS FTP and WIFS). A set of three images will be provided for each forecast timestep that users can use to ensure that their visualizations of the data matches with the WAFC version however it is important to note that these will not be suitable to print out onto A4 paper and used for pilot briefing.

2.15 The new SADIS and WIFS APIs will deliver the WAFS SIGWX data and the data will be organized into collections which allows users to choose whether to download the IWXXM data or cross checking images.

2.16 An information sheet that summarises the upcoming SIGWX changes has been included as an attachment to this paper.

OPMET Data

2.17 The SADIS and WIFS APIs will provide OPMET data (METAR, TAF, SIGMET etc) to users, organized in a series of collections:

Collection Name	Data format	Collection Content
tac_opmet_reports	TAC Global and regional	TAF, METAR, SPECI, SIGMET (all types), AIRMET, GAMET, AIREP
iwxxm_opmet_reports	IWXXM Global and regional	TAF, METAR, SPECI, SIGMET (all types), AIRMET
tac_advisory_reports	TAC Global only	SWA, VAA, TCA, NEM, NOTAM-ASHTAM
iwxxm_advisory_reports	IWXXM Global only	SWA, VAA, TCA
graphical_reports	PNG Global only	VAG, TCG
Notices	TAC	Relevant "NO" messages.

2.18 All collection types will come in with a "global coverage" option, whilst the "tac_opmet_reports" and "iwxxm_opmet_reports" ones will also have 6 regional groupings to choose from which relate to the ICAO regions.

2.19 Users will be encouraged to download data on a regional basis if it suits their needs, which will help to reduce the overall volumes of data, by making a request that looks something like this:

https://xxxxxx.api.management.metoffice.cloud/ads-sadis-opmet/1/collections/iwxxm_advisory_reports/locations/GLOBAL?interval=PT5M--2007-12-14T15:30

2.20 Data will be published at 5 minute intervals (from the time the system received it), and 36-hours worth of data will be held on the system in case users need to recover lost data. The WAFC's are also looking at publishing data that updates every minute as well.

Data on the current SADIS FTP and WIFS systems

2.21 The new SADIS and WIFS APIs will provide access to the new WAFS data sets, whilst the current SADIS FTP and WIFS systems will be retained up until November 2028 when they will be retired.

2.22 The table that follows summarises what will happen to the different WAFS data sets currently on SADIS FTP and WIFS.

Data set	**Plan**
1.25 wind/temp/geopotential/humidity	Retained, with the same levels/timesteps as at present.
1.25 hazard data (CB, icing, CAT)	Retired in November 2023. *Note these fields stopped being an ICAO requirement in November 2020.*
0.25 hazard data (CB, icing, CAT)	Retained, with the same levels/timesteps as at present.
T+24 SIGWX SWH (High level) BUFR	Retained, but will span FL100-FL600 with some content changes. Will then be retired in July 2026.
T+24 SIGWX SWH (High level) PNG Charts Area A,B,B1,C,D,E,F,G,H,I,J,K and M	Retained, but will span FL100-FL600 with some content changes Will then be retired in November 2028.
T+24 SIGWX SWM (Medium level) BUFR	Retired in July 2024.
T+24 SIGWX SWM (Medium level) PNG Charts Area NAT, EURO, MEA and ASIA SOUTH	Retired in July 2024.
OPMET DATA (METAR, TAF, SIGMET etc)	Retained.

2.23 The T+24 SIGWXs forecast available will change in appearance/content slightly in July 2024. This includes:

- They will be valid for FL100 to FL600
- CB bases will not be shown on the PNG charts
- tropopause spot heights will become contours (and will not be included in the BUFR)
- tturbulence areas will look a little different and will include orographic turbulence as well as CAT.

2.24 Users will be strongly encouraged to migrate their systems over to use data from the new SADIS or WIFS API as soon as possible in order to benefit from the improved data sets.

Using the new APIs

2.25 SADIS FTP users will be invited to get involved in testing the new SADIS API components as soon as they are available. The notifications will be sent out as a SADIS Administrative message.

2.26 When it comes to using the new SADIS API system operationally, users will be asked to re-register (so that up to date contact details are captured) and sign up to a user level agreement. Once registration is complete users will be able to get an authentication token that gives access to the system.

2.27 WIFS users will also be invited to try and out use the new WIFS API in due course.

2.28 By developing a consistent technology approach for the new SADIS and WIFS APIs the WAFCs will make it far easier for users to switch over to their alternate/backup system in the event of an outage. Users will be expected to re-register for their alternate/backup system in order to do this.

2.29 If there are questions about the new API systems please e-mail the appropriate provider via either SADISmanager@metoffice.gov.uk or wifs.admin@noaa.gov ,

3. CONCLUSION

3.1 The next year brings big changes to the WAFS data sets, SADIS and WIFS systems, and users will need to make changes to their systems and software in order to benefit from the extra levels and timesteps of WAFS data.

3.2 The new APIs will allow a certain degree of user customization of the WAFS data sets for the first time, and will provide data in a SWIM compliant way. Both of these work towards the ICAO goals for modernizing the meteorological data provision to users.

4. ACTIONS BY THE MEETING

4.1 The meeting is invited to:

a) Note the information in this paper

b) Talk to their technical team or software provider about the upcoming changes and start to prepare for them

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APENDIX A – WAFS gridded data sets available from November 2023.

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. *Note WAFS London data will only be available out to 66 hours for the 0000 and 1200 data.*

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	—

Flight Level	***ICAO Standard Atmosphere pressure level (hPa)***	***Geopotential Altitude***	***Wind***	***Temperature***	***Turbulence***	***Icing***	***Humidity***
FL 220	427.9	X	X	X	X	X	—
FL 230	410.0	X	X	X	X	X	—
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

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JULY 2024

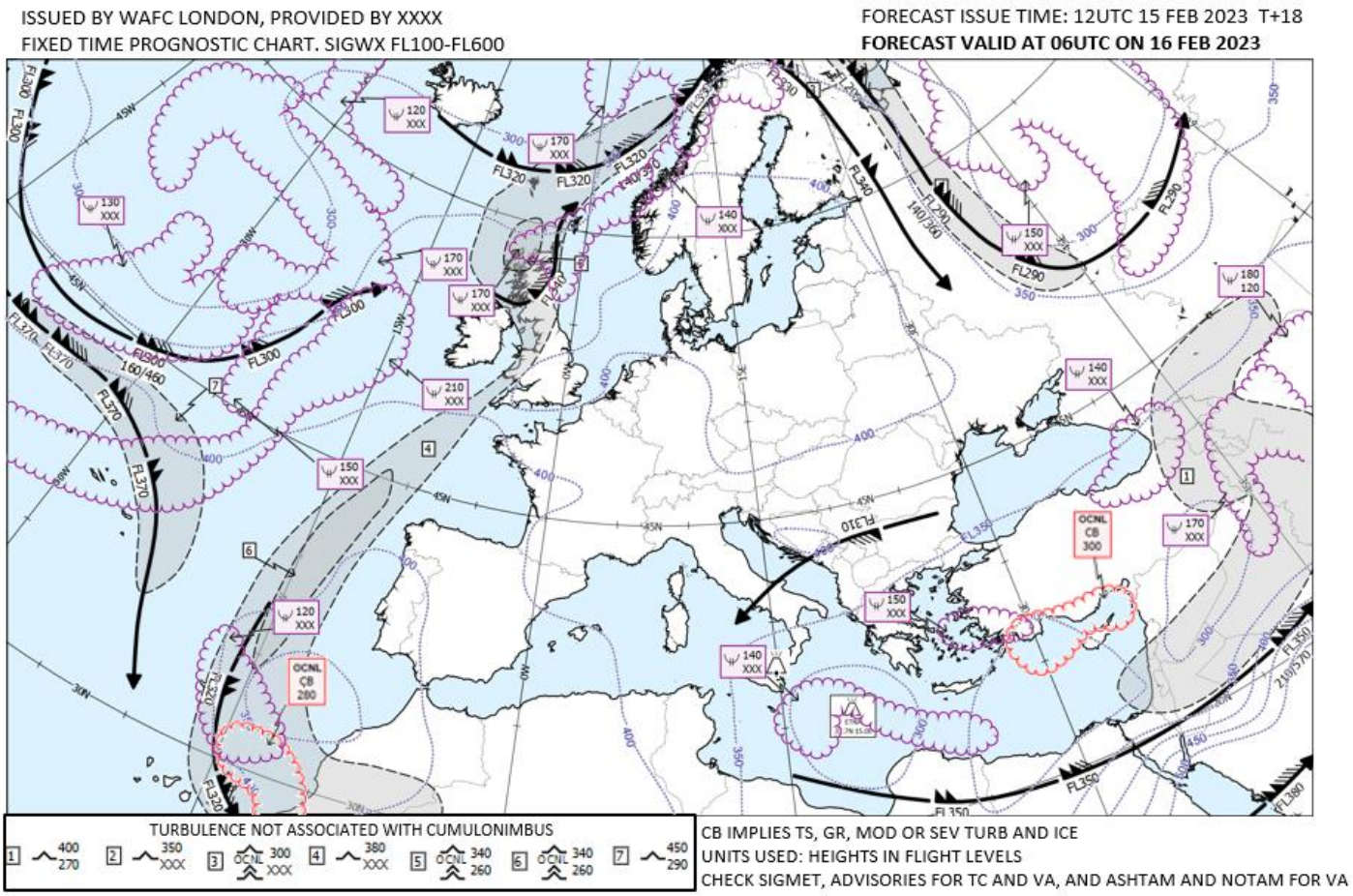
Changes to WAFS SIGWX Forecasts

JULY 2024

In early July 2024 the WAFS SIGWX products will be changing as the World Area Forecast Centres introduce multi-timestep SIGWX forecasts that spans FL100 to FL600 for the first time.

The following forecast time-steps will be produced:

T+6, T+9, T+12, T+15, T+18, T+21, T+24, T+27, T+30, T+33, T+36, T+39, T+42 and T+48.



IWXXM FORMAT

The new SIGWX forecasts will be provided in IWXXM format.

Test data sets are updated regularly and available here: https://www.metoffice.gov.uk/services/transport/aviation/regulated/wafs-sigwx-test-data

IWXXM schema information is available here: https://schemas.wmo.int/iwxxm/2023-1RC1/

VISUALISING THE NEW SIGWX DATA

Users should set up their systems to visualise the IWXXM data, and allow individual layers to be toggled on and off. Existing SIGWX display conventions mostly still apply.

Suggested visualisation colour scheme:

- Jet Stream – black
- Tropopause contours (NEW) – blue dashed line
- Turbulence areas – black dashed outer line, shaded grey
- Cumulonimbus areas – red scalloped line (no CB base info)
- Icing areas – purple scallops
- Volcano and tropical cyclone markers – black or red.

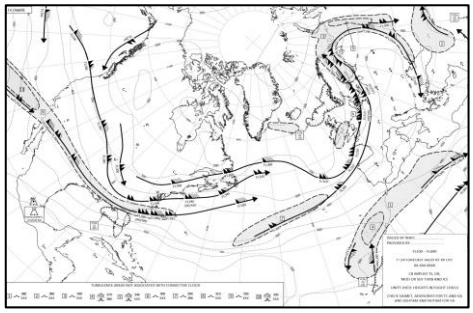
A set of three charts will be provided to enable users to check their systems are visualising the SIGWX data properly. These are not to be used for flight briefing documents. **Flight briefing documents need to be created from the IWXXM data sets according to local user requirements.**

NOAA Met Office

IMPORTANT: The following medium level SIGWX forecast data sets will be retired in July 2024

Charts
PGNE14 KKCI (NAT)
PGZE14 EGRR (ASIA SOUTH)
PGDE14 EGRR (EURO)
PGCE14 (MEA)

SWM BUFR
JUJE00 EGRR/KKCI
JUME00 EGRR/KKCI
JUNE00 EGRR/KKCI
JUOE00 EGRR/KKCI
JUTE00 EGRR/KKCI



If you have questions please e-mail your service provider: wifs.admin@noaa.gov or SADISManager@metoffice.gov.uk

Data available on SADIS FTP and WIFS after July 2024

T+24 (SWH) BUFR Data
JUBE99, JUCE00, JUVE00, JUWE96, JUFE00, JUTE97 EGRR and KKCI files.
Note: data will be labelled as SWH but will encompass FL100 to FL600. The JUTE97 tropopause file will not contain data as BUFR cannot handle tropopause contour data.

T+24 png format charts
PGEE05 KKCI (Area A), PGSE05 EGRR (Area B), PGIE05 KKCI (Area B1), PGRE05 EGRR (Area C), PGZE05 EGRR (Area D), PGGE05 EGGR (Area E), PGGE05 KKCI (Area F), PGCE05 EGRR (Area G), PGAE05 EGRR (Area H), PGAE05 KKCI (Area H), PGBE05 KKCI (Area I), PGJE05 KKCI (Area J), PGKE05 EGRR (Area K), PGDE29 KKCI (Area M)

There will be some changes to the appearance of the png charts:

- They will be valid for FL100 to FL600
- CB bases will not be shown
- tropopause spot heights will become contours
- turbulence areas will look a little different and will include orographic turbulence as well as CAT.

IMPORTANT: The BUFR data sets will be retired in July 2026, and the png format charts will be retired in 2028.

HOW TO GET THE NEW SIGWX DATA

By the end of 2023 the WAFC's intend to invite SADIS and WIFS users to try out the SIGWX element of the SADIS API or the WIFS API. This beta service will be available until the go live data in July 2024.

Both WAFC's are working together to provide a consistent API offering. It will use the framework of the Open Geospatial Consortium (OGC) Environmental Data Retrieval API https://ogcapi.ogc.org/edr/ and will be SWIM compliant.

WHAT DO YOU NEED TO DO

1. Make sure that your software provider is aware of the upcoming changes and make sure that their software will be able to visualise the IWXXM data.
2. Try to visualise the test IWXXM data sets that have been provided.
3. Make the relevant teams in your organisation aware of the need to download data from the SADIS API or WIFS API systems.
4. Look out for the announcements by WAFC London and WAFC Washington inviting you to try out the new SADIS API or WIFS API beta systems in late 2023 or early 2024

Note: The SADIS API and WIFS API that delivers WAFS gridded data sets will use the same API technology and will be available for operational use from November 2024.