



*International Civil Aviation Organization*

**MIDANPIRG Meteorology Sub-Group  
Tenth Meeting (MET SG/10)**

*(Virtual Meeting, 17–19 May 2022)*

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**Agenda Item 4: MET Planning and Implementation issues – Performance Framework  
for MET implementation in the MID Region**

REVIEW OF THE IMPLEMENTATION OF WAFS AND SADIS  
SADIS AND WAFS UPDATE

(Presented by the SADIS Provider)

**SUMMARY**

This paper provides an update on changes to the World Area Forecast System (WAFS) and changes in the operation of the WAFS London operated Secure Aviation Data Information System (SADIS).

**1. INTRODUCTION**

1.1 This paper reports on WAFS and SADIS operational matters as well as recent and upcoming changes in the provision of data on SADIS. These changes have been agreed through the ICAO Met Panel Meteorological Operations Group (MOG) at its annual meetings.

1.2 Changes being made to SADIS and WAFS data are in line with the ICAO Global Air Navigation Plan, Aviation System Block Upgrades.

**2. OPERATIONAL SADIS MATTERS**

**2.1 SADIS Efficacy Survey**

2.1.1 The annual SADIS efficacy survey for 2022 will commence on 1 July 2022 and users will be notified of it by SADIS administrative messages and via an ICAO letter to focal points. The SADIS provider would like to thank those who responded last year, and would like to encourage all SADIS users to participate in the 2022 Survey.

**2.2 SADIS Data Catalogue**

2.2.1 A catalogue of data usually present on SADIS has been created (from data obtained during the February 2022 monitoring period) so that missing TAF and METAR data can be more easily identified. The latest edition of the catalogue is hosted within the documentation section on the SADIS server, and the WG-MOG public webpage (<https://www.icao.int/airnavigation/METP/Pages/Public-Documents.aspx>).

2.2.2 If a SADIS user identifies that some METAR or TAF data is absent, the list should be consulted to see if it is usually present before reporting it to the SADIS Manager ([sadis.manager@metoffice.gov.uk](mailto:sadis.manager@metoffice.gov.uk)). There are two courses of action:

- The aerodrome is listed: the SADIS manager will raise the issue with ROC London who will investigate and work with the other ROCs to try and restore the data.
- If the aerodrome is not listed: the data feeds will be checked to see if the data is available however it may be necessary for the SADIS user to contact the State in question to ask for it to be disseminated internationally.

### 2.3 **WAFS Verification Data.**

2.3.1 Verification data for harmonized WAFS gridded upper air forecasts Cumulonimbus cloud forecasts is available from the "WAFS London Performance Indicators" webpage: <http://www.metoffice.gov.uk/aviation/responsibilities/icao>. Unfortunately verification data is not currently available for turbulence but it is hoped that this will be published within the next couple of months. Information on the timeliness of the WAFS data sets is also provided on the webpage.

2.3.2 Verification data for harmonized WAFS gridded upper air forecasts for Icing potential is available from the "WAFS Washington webpage: <http://www.emc.ncep.noaa.gov/gmb/icao/>.

2.3.3 The verification data should be used in conjunction with the guidance material available on the WG-MOG public webpage (in the MOG-WAFS Reference Documents section).

### 2.4 **SADIS Workstation Evaluations**

2.4.1 The SADIS provider has put together a SADIS evaluation guide which users can use to evaluate their own systems. The intention of this guide is to assist users in identifying problems with their SADIS data visualization system/software by clearly showing what constitutes an acceptable standard. Users can then feed back any "non-compliance" issues to their software provider.

2.4.2 The new guide is called the 'SADIS Workstation Evaluation Guide' and is hosted in the documentation section on SADIS as well as on the WG-MOG public webpage.

2.4.3 Individual SADIS Workstation evaluations can still be carried out by the SADIS provider if required, however this work will be chargeable. Please contact the SADIS to discuss costs and an evaluation schedule should this be required.

## 3. **RECENT UPGRADES**

### 3.1 **IWXXM format data**

3.1.1 On 5 November 2020, ICAO Annex 3 - *Meteorological Service for International Air Navigation* made it mandatory for States to produce their METARs, TAFs, SIGMETs, AIRMETs, VAA and TCAs in IWXXM format (ICAO Meteorological Information Exchange Model).

3.1.2 IWXXM data is available on SADIS for States served by ROC London, ROC Toulouse, ROC Vienna and ROC Moscow. In due course data for other parts of the world will be added once the inter-regional connections are established, but this activity is taking much longer than expected.

## 3.2 0.25 degree WAFS hazard data

3.2.1 On 5 November 2020, improved WAFS data sets were introduced in line with changes listed in ICAO Annex 3 Amendment 79. Training material is available here: <https://www.metoffice.gov.uk/services/transport/aviation/regulated/wafs-2023>

3.2.2 The new turbulence field called “Turbulence Severity” uses the Graphical Turbulence Guidance forecast techniques that were developed by the National Center for Atmospheric Research (NCAR). These algorithms are able to forecast both clear air turbulence and orographic turbulence, and provide an eddy dissipation rate (EDR) which is a turbulence measure that is independent of aircraft type.

3.2.3 The new icing field called “Icing Severity” gives a categorical assessment of icing (Nil, Trace, Slight, Moderate and Severe) and uses improved icing algorithms.

3.2.4 Turbulence Severity and Icing Severity, along with the three cumulonimbus fields (extent, base and top) are being produced with a horizontal resolution of 0.25 degrees. Timesteps remain unchanged, with data provided for 6-hours to 36-hours at 3 hourly intervals. The levels the data is provided for is largely unchanged, however there will be three new turbulence layers which compensate for the retirement of the in-cloud turbulence field.

3.2.5 The new data sets are available on SADIS in the /GRIB2/COMPRESSED/EGRR/ directory.

3.2.6 The existing Turbulence Potential, Icing Potential and 1.25 degree cumulonimbus fields are no longer listed in ICAO Annex 3, but will continue to be published on SADIS until November 2023. They have not been changed or updated in any way. The in-cloud turbulence field has already been retired.

3.2.7 SADIS users are strongly encouraged to migrate their services from the old 1.25 degree hazard data sets to the new 0.25 degree versions as soon as possible.

## 4. NOVEMBER 2023 WAFS AND SADIS UPGRADES

4.1 Both WAFCs have been working to define the next generation WAFS provision, which will bring an upgrade in the horizontal, vertical and temporal resolution to all WAFS 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 resolution
- data at 1000ft flight level intervals
- data at 1-hourly intervals from 6-hours to 24-hours, three hourly intervals from 27-hours to 48-hours, and wind and temperature data at 6-hourly intervals out to 120-hours.

4.2 Increasing the resolution of the data is going to have a huge impact on the volume of data available, and therefore a new SADIS delivery mechanism will be built. The new “SADIS API<sup>1</sup>” service will be SWIM<sup>2</sup> compliant and will be based on the Open Geospatial Consortium Environmental Data Retrieval<sup>3</sup> API. This will enable users to customize the data sets that are downloaded. For example, it will be possible for users to choose which region to download data for (a set of 8 fixed

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<sup>1</sup> [https://en.wikipedia.org/wiki/Application\\_programming\\_interface](https://en.wikipedia.org/wiki/Application_programming_interface)

<sup>2</sup> <https://www.eurocontrol.int/concept/system-wide-information-management>

<sup>3</sup> <https://ogcapi.ogc.org/edr/>

regions will be provide, as well as global data) as well to specify which vertical levels of data are required. This should make managing the volume of data easier for downstream users.

4.3 OPMET data will also be made available via API and users will be able to choose which specific data they would like.

4.4 The WAFS gridded data API and OPMET API's are expected to become operational in November 2023. As soon as a beta version is available users will be invited to try out the new services and encouraged to provide the SADIS provider with feedback.

4.5 The upgrade to the WAFS 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. Medium level SIGWX charts will be retired, and instead a single SIGWX forecast that covers the airspace between FL100 and FL600 will be produced in IWXXM format. BUFR format SIGWX will be retired 2 years later, and WAFS 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 should be integrated into flight planning and meteorological visualization software from which a customized "paper copy" chart relevant for a specific flight can be created if needed.

4.6 Test IWXXM data sets have been made available and are available here: <https://www.metoffice.gov.uk/services/transport/aviation/regulated/wafs-sigwx-test-data> and SADIS users are encouraged to try to visualize them.

4.7 The existing SADIS FTP server will continue to run until November 2028, however it will not host the upgraded WAFS gridded or SIGWX data sets.

4.8 The SADIS manager ([sadis.manager@metoffice.gov.uk](mailto:sadis.manager@metoffice.gov.uk)) is happy to answer any questions relating to the planned changes.

## 5. CONCLUSION

5.1 Significant changes to SADIS and the WAFS data sets are coming over the next two years and users will need to make updates to their systems in order to be able to benefit from it. The group is invited to consider formulating the following action:

### **Draft Action 10/xx – 0.25 degree WAFS hazard data**

SADIS users should integrate the new 0.25 degree WAFS hazard data into systems and software prior to November 2023 if they have not already done so.

### **Draft Action 10/xx – Annex 3 Amendment 81 WAFS and SADIS Upgrades**

SADIS users are invited to;

a) familiarize themselves with the proposed WAFS and SADIS changes planned for November 2023 and 2024;

b) discuss the upcoming changes with their technical departments about how their organization could adapt to these technological changes

b) get involved in in trying out the new Beta SADIS API's once they become available in late 2022 or 2023.

**6. ACTION BY THE MEETING**

6.1 The meeting is invited to:

- a) note the information contained in this paper; and
- b) discuss any relevant matters as appropriate.

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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:**

<i>Upper-air gridded forecasts</i>	<i>1-hourly intervals</i>	<i>3-hourly intervals</i>	<i>6-hourly intervals</i>
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**

<i>Flight Level</i>	<i>ICAO Standard Atmosphere pressure level (hPa)</i>	<i>Geopotential Altitude</i>	<i>Wind</i>	<i>Temperature</i>	<i>Turbulence</i>	<i>Icing</i>	<i>Humidity</i>
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	—
FL 240	392.7	X	X	X	X	X	—
FL 250	376.0	X	X	X	X	X	—

<i>Flight Level</i>	<i>ICAO Standard Atmosphere pressure level (hPa)</i>	<i>Geopotential Altitude</i>	<i>Wind</i>	<i>Temperature</i>	<i>Turbulence</i>	<i>Icing</i>	<i>Humidity</i>
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