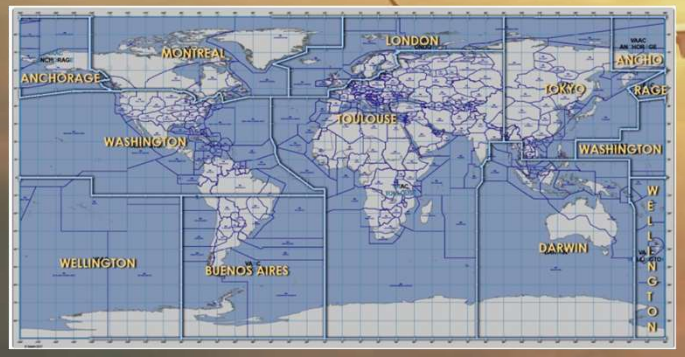
VAAC Toulouse

METEO FRANCE
À VOS CÔTÉS, DANS UN CLIMAT QUI CHANGE

A first familiarization with QVA during a VOLCEX over EURNAT



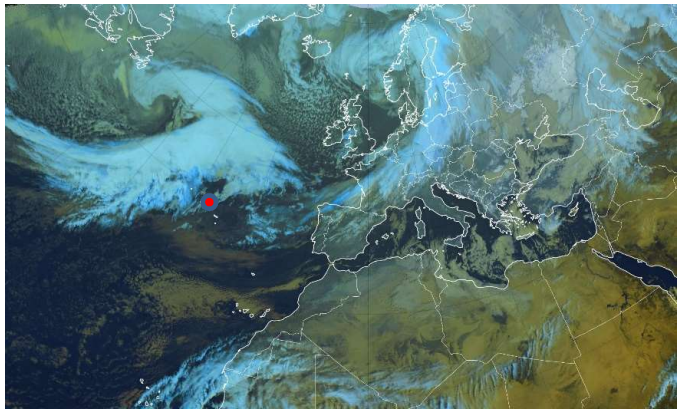
VOLCEX24 – Weather situation

Time of explosive eruption

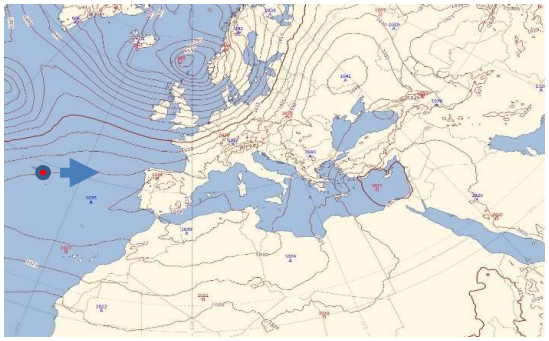
VAAC Toulouse

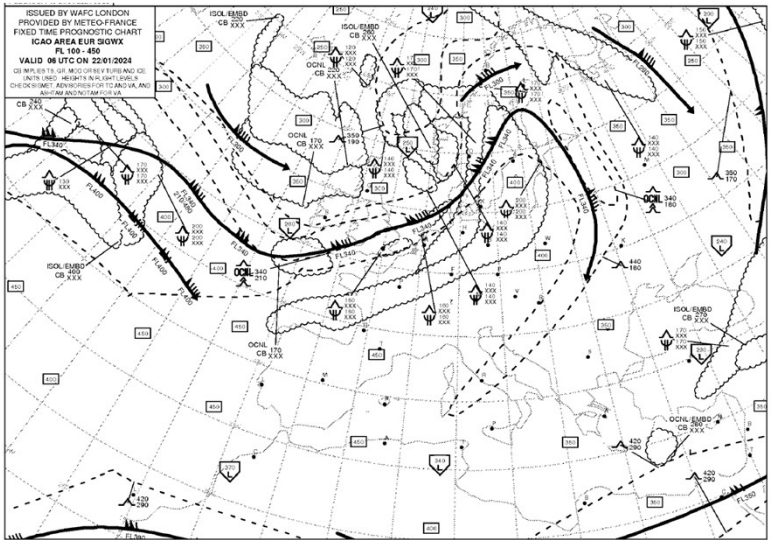
High FL:
- lows are located over Northern Atlantic,
- A large High extends from Caribbean to Madeira.

This configuration favors fast W winds over Atlantic Ocean, from Azores to Northern and Central Europe.
Disturbances move via this rapid jet , associated with clouds and precipitation from Ocean to Northern and Central Europe.



Low FL :
South-West wind over Acores
High pressure with moderate wind could spread ash cloud slowly in low FL toward Iberian peninsula





An intense eruption

VAAC Toulouse

Only an intense eruption that lasts, could provide ash cloud reaching Europe.

The simulated eruption:
- Lasts 100h00
- High plume 13000m
- Provide 4 times more ash quantity as a regular eruption for such a volcano

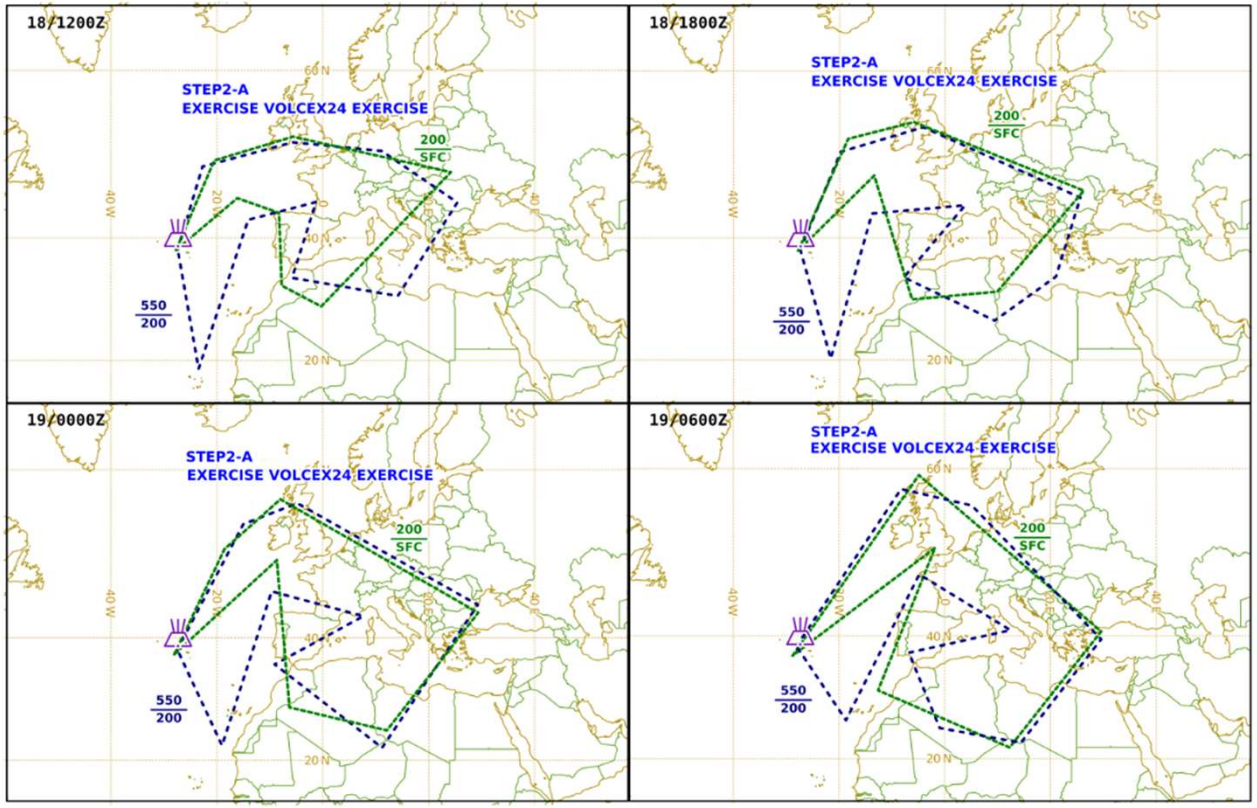
Volcex Directives and provided data

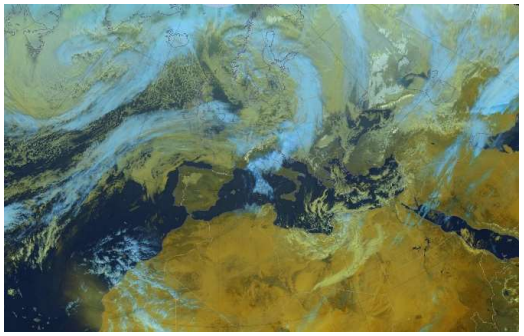
VAAC Toulouse

- Schedule table : 2 steps
- VAA/VAG
- Current ash concentration charts
- Explanation pages (extract of the flyer with an example over VAAC Toulouse area)
- Some probabilistic data (charts and vertical cross section, video)
- Some deterministic concentration(charts and vertical cross section, video)
- Polygon designed on charts of ash concentration in entire atmosphere
- Comparison current data with future data
- Data Access on website vaac.meteo.fr

VAG, 2 days later, after eruption

VAAC Toulouse





VOLCANIC ASH ADVISORY
DTG:20241118/1200Z
VAAC:TOULOUSE
VOLCANO: TERCEIRA 382050
AREA: AZORES
SUMMIT ELEV: 1023M

METEO FRANCE

ADVISORY NR: 2024/2
INFO SOURCE:EXERCISE VOLCEX24 EXERCISE
AVIATION COLOUR CODE:ORANGE
ERUPTION DETAILS: ERUPTION AT 20241118/1150Z EXERCISE VOLCEX24 EXERCISE
RMK: EXERCISE VOLCEX 24 PLEASE DISREGARD. EXERCISE EXERCISE EXERCISE
NXT ADVISORY:NO LATER THAN 20241119/0800Z.

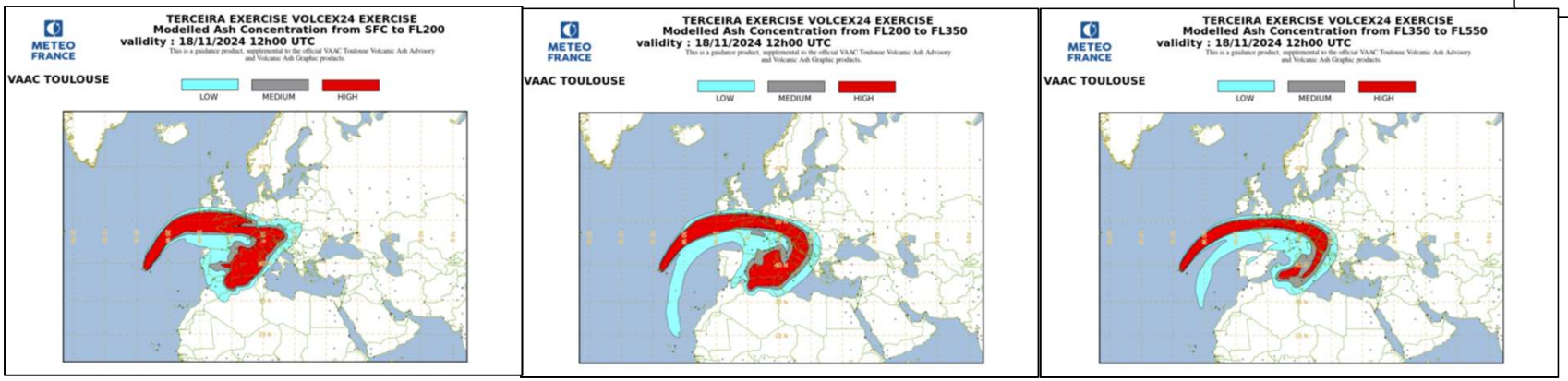
Current Ash Concentration charts , T00, T06, T12, T18

layer of 150 to 200 FL thickness

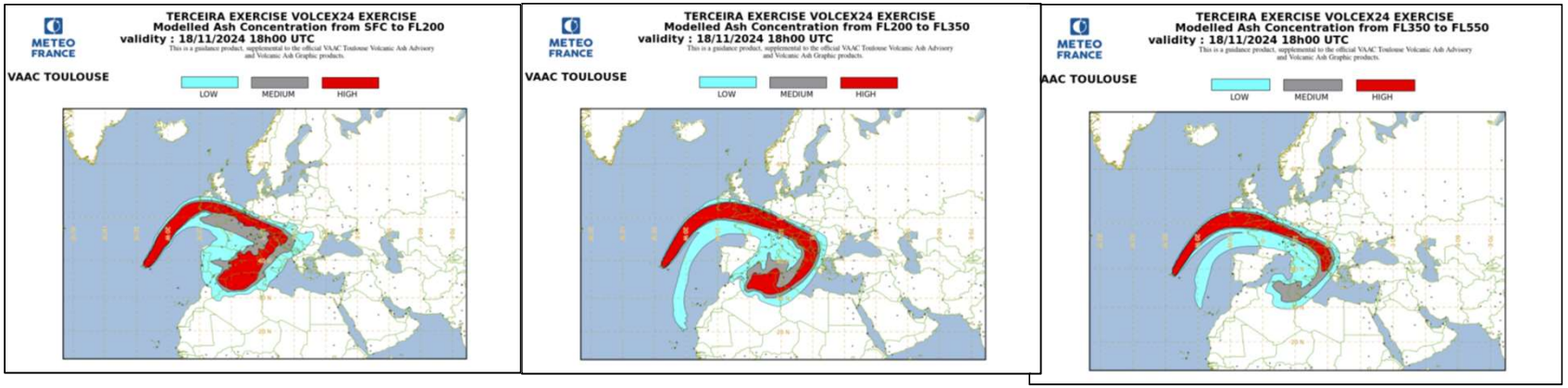
VAAC Toulouse

Blue/green	LOW	0.2 mg/m³
Grey	MEDIUM	2 mg/m³
Red	HIGH	4 mg/m³

SFC-FL200 FL200-FL350 FL350-FL550



18/11/24 12utc



18/11/24, 18utc

QVA

VAAC Toulouse

The VAAC Toulouse QVA ensemble set consists of 100 forecast predictions (+ the deterministic run). In addition to the deterministic model run, the ensemble model runs are launched with the following source term parameters modified:

- ash ejection height: h*0.8, h *0.9, h, h*1.1, h*1.2
- emission profile : umbrella and uniform
- quantity of ash particles : q/3, q/2, q, q*2, q*3 (q=deterministic run quantity)
- size of ash particles

The vertical resolution of the gridded data will be in 5,000-foot flight levels (FL) from mean sea level to FL 600 (Table 2).

Table 2: Vertical resolution

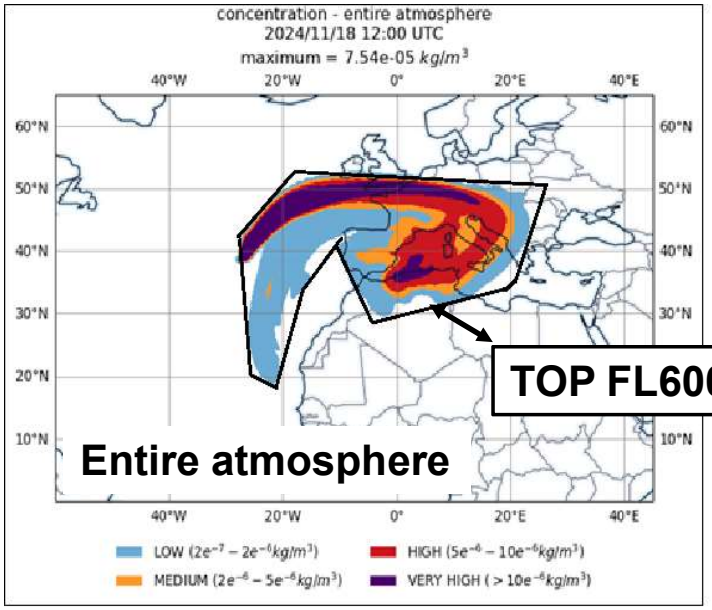
Mean sea level to FL 50	FL 150 to FL 200	FL 300 to FL 350	FL 450 to FL 500
FL 50 to FL 100	FL 200 to FL 250	FL 350 to FL 400	FL 500 to FL 550
FL 100 to FL 150	FL 250 to FL 300	FL 400 to FL 450	FL 550 to FL 600

Concentration thresholds:
exceeding 0.2mg/M3
exceeding 2mg/M3
exceeding 5mg/M3
exceeding 10mg/M3

In three-hourly valid time increments: 0, 3, 6, 9, 12, 15, 18, 21 and 24 hours.

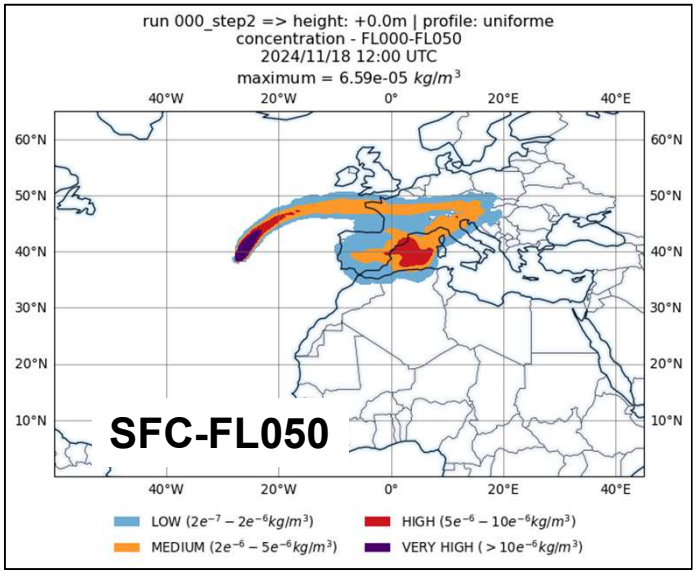
Deterministic QVA

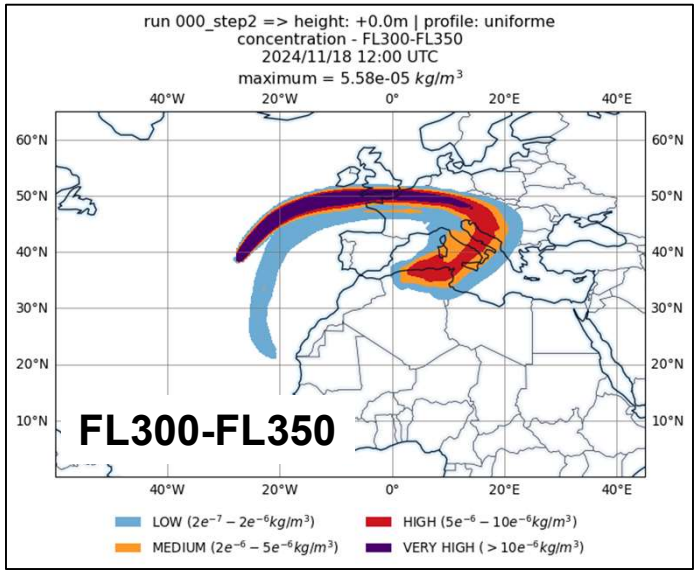
VAAC Toulouse

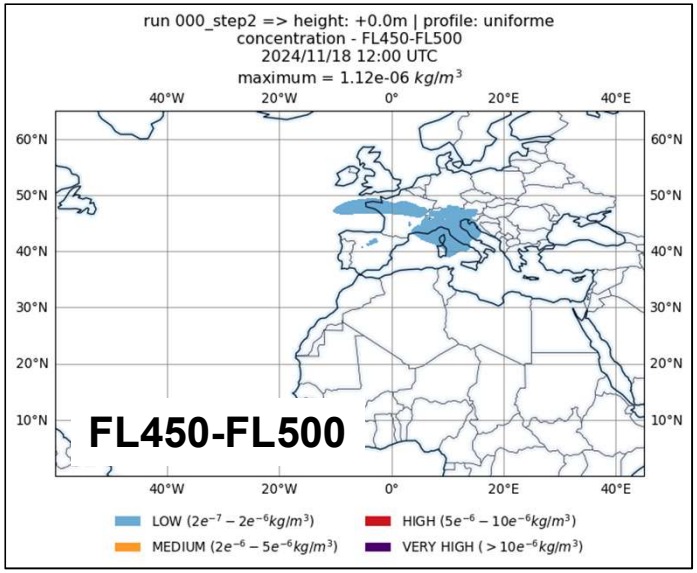


Colour Legend:

layer of 50 FL thickness







Comparison current VAG and future polygon of QVA

VAAC Toulouse

Comparison of a QVA and VAG information for Monday 18 November 2024 at 12UTC

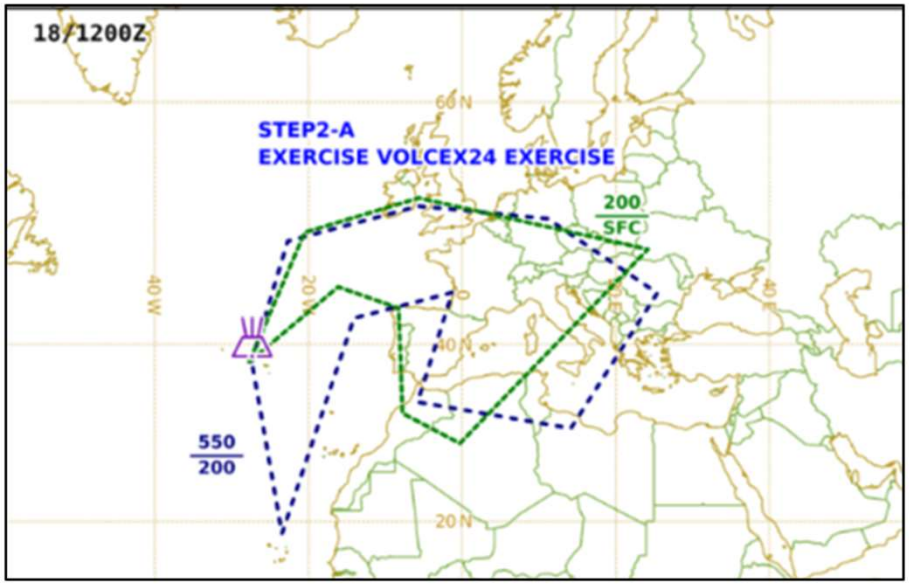


***Fig.1**: VAG, 18/11/2024 at 12utc*

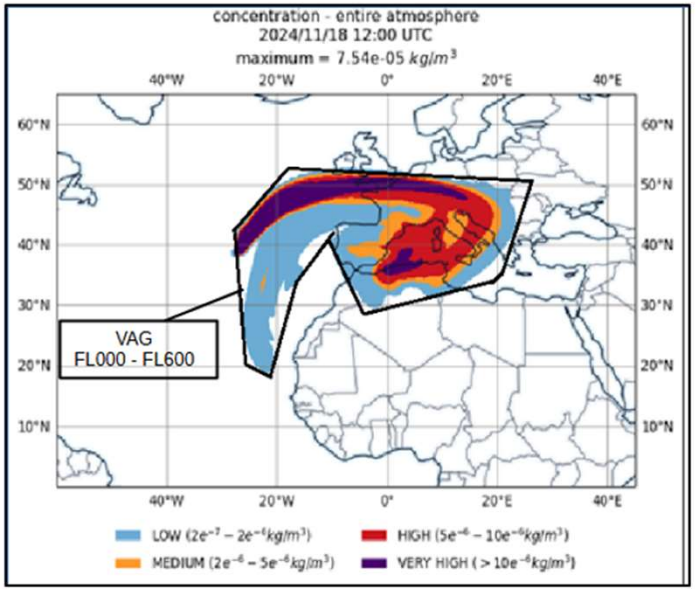


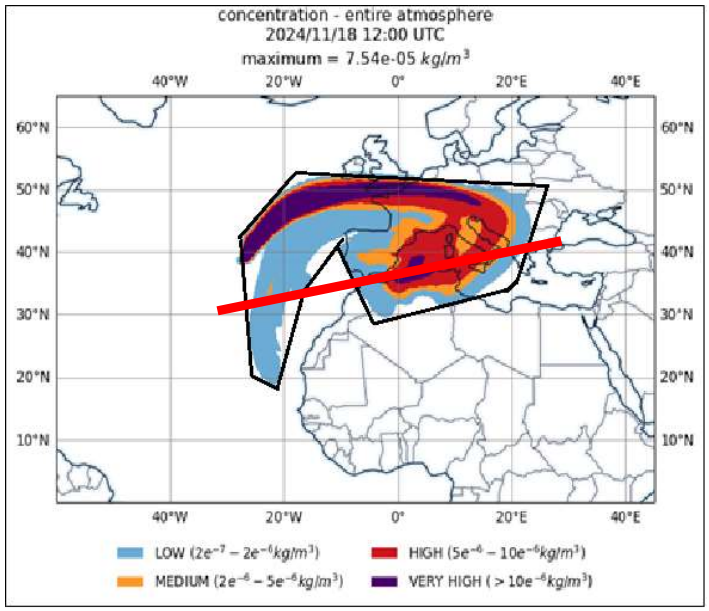
***Fig 2** : IWXXM objects showing all QVA thresholds 18/11/2024 at 12utc*

Fig 1 : over Atlantic Ocean, west of Canary Islands, current VAG covers the area with distinct low concentration (<2mg/m3) in low layers. High concentration only above FL200.

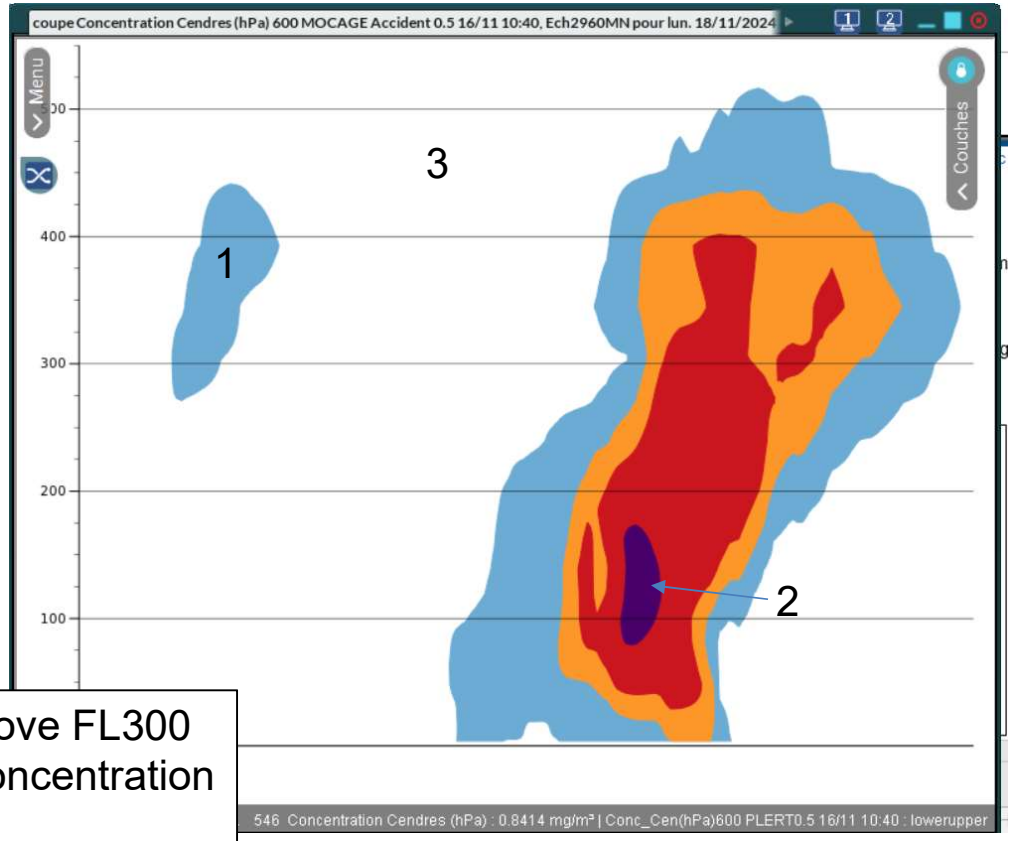
Fig 2 : VAG polygon is not sufficient to know which flight levels contains low (or high) ash concentration.

Vertical cross section deterministic QVA

VAAC Toulouse



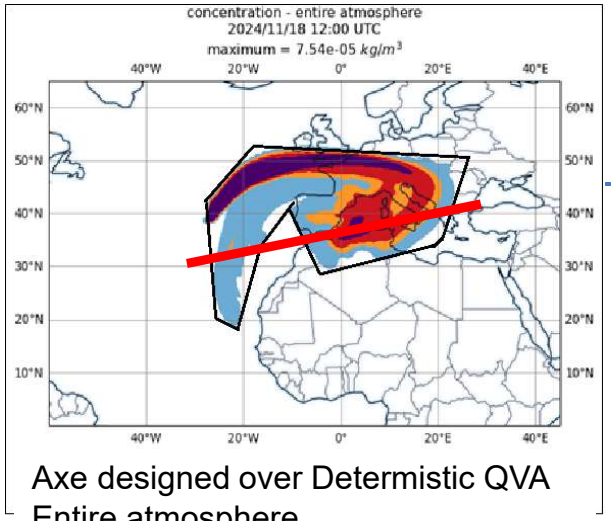
Entire atmosphere



1 : Ash only above FL300
2 : Very high concentration
3 : no ash

Vertical cross section : percentage of members exceeding xxmg/m3

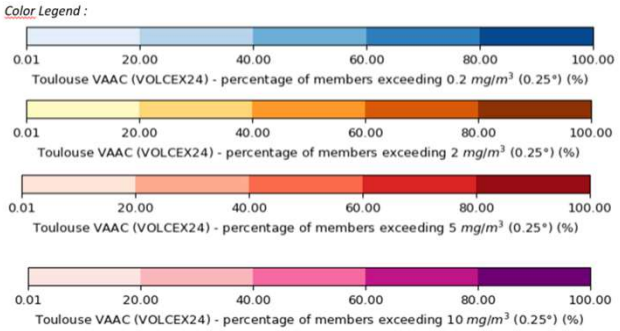
VAAC Toulouse



Axe designed over Determistic QVA
Entire atmosphere

1 : Probability to encounter ash in upper atmosphere

2: High probability to encounter ash but low risk in high concentration



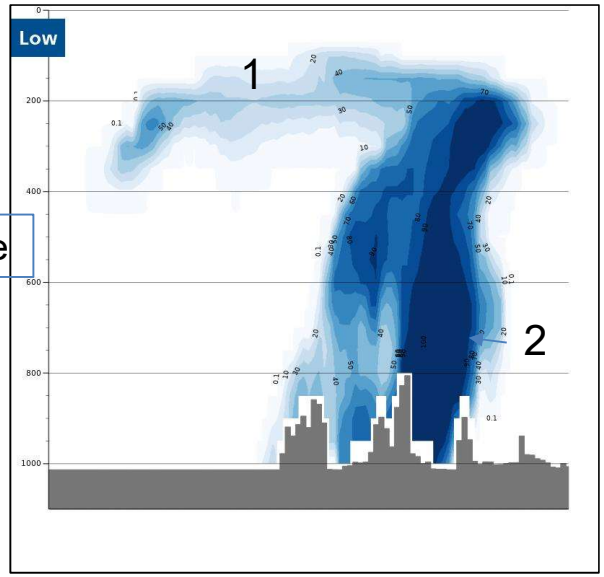
Low

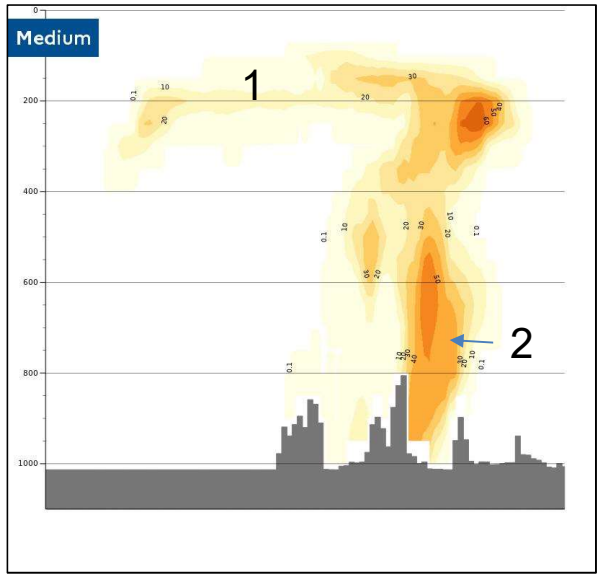
Medium

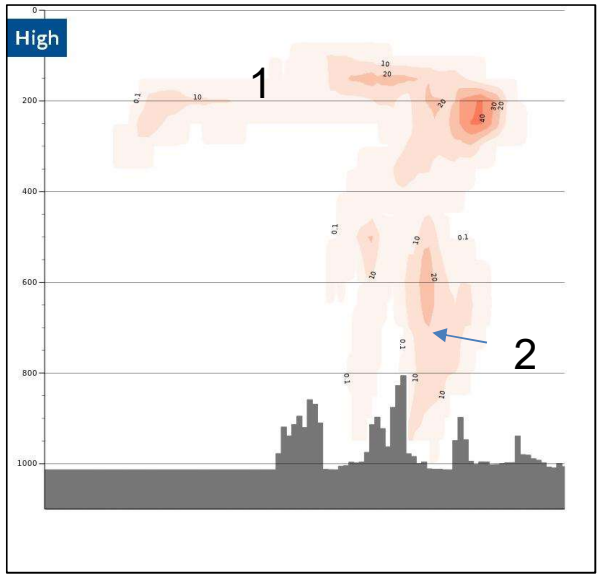
High

Very high

pressure



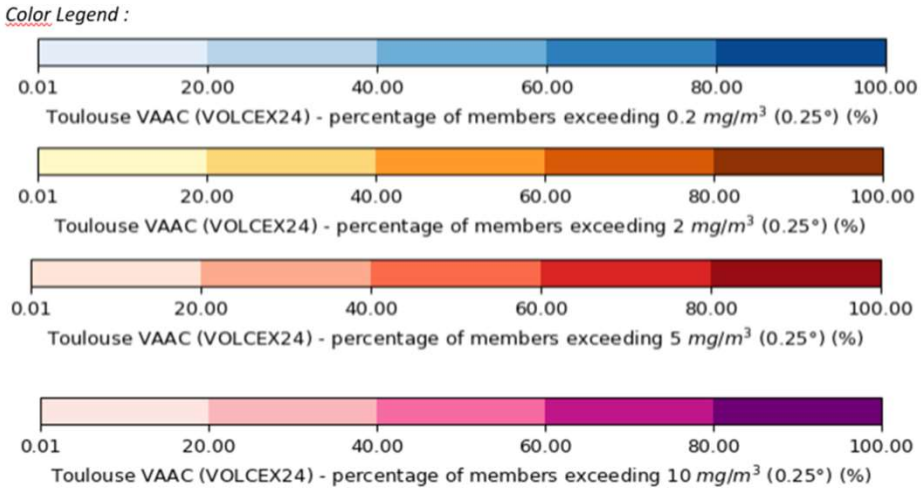




Video :
percentage of members exceeding xxmg/m3
Determistic and probalitic QVA

VAAC Toulouse

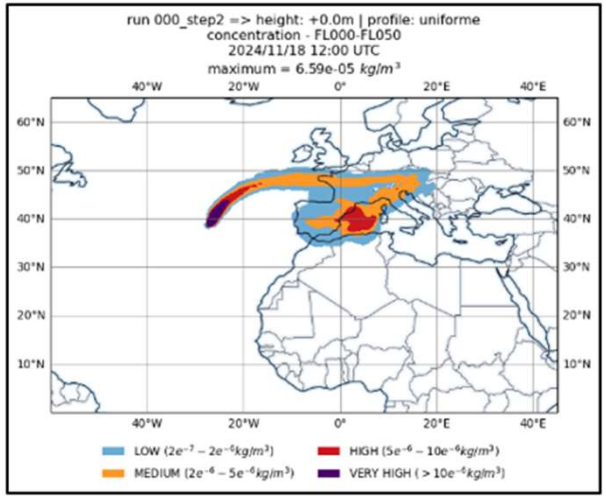
videos



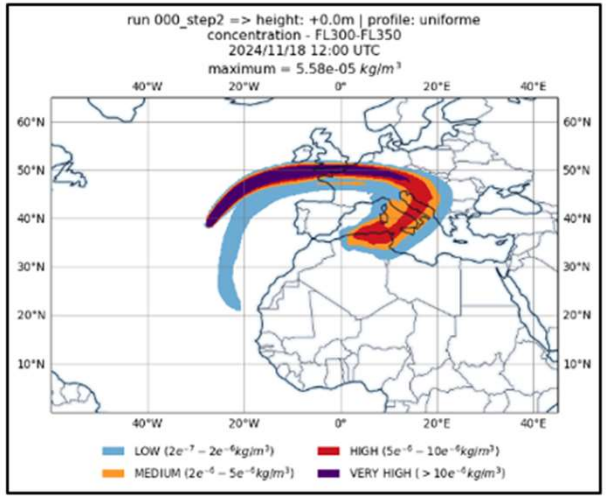
Deterministic QVA limits; probabilistic QVA contribution

VAAC Toulouse

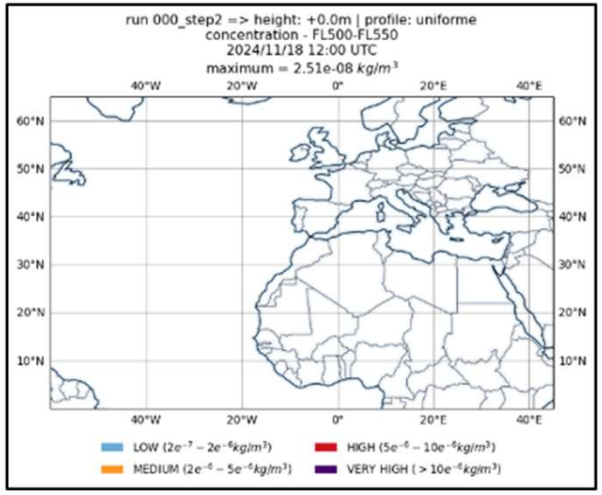
Some deterministic objects showing QVA, near MSL, FL300, FL500, Validity 18/11/2024, 12UTC



Mean sea level to FL50



FL300-FL350



FL500-FL550

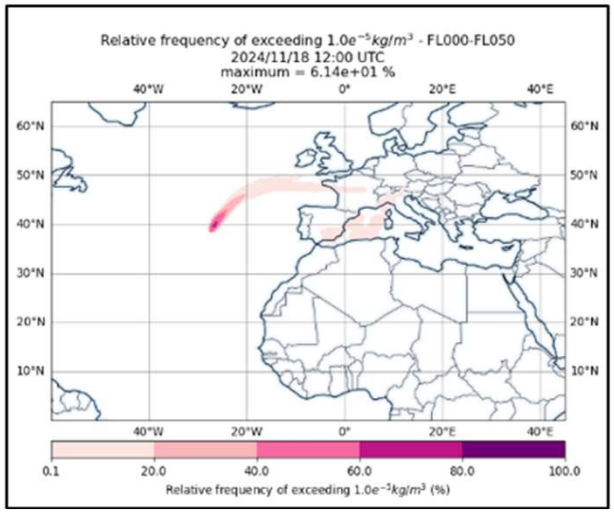
Ash cloud doesn't reach FL500.

In order to estimate the validity of this forecast and the risk of flying at FL500, in low FL (and others FL), probabilistic information can help.

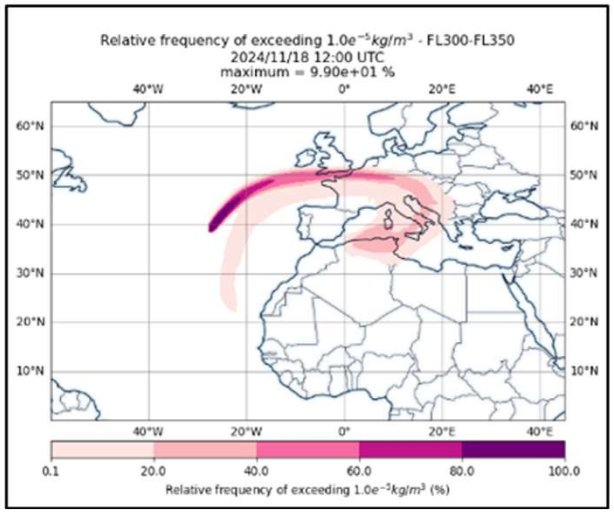
percentage of members exceeding 10mg/m3

VAAC Toulouse

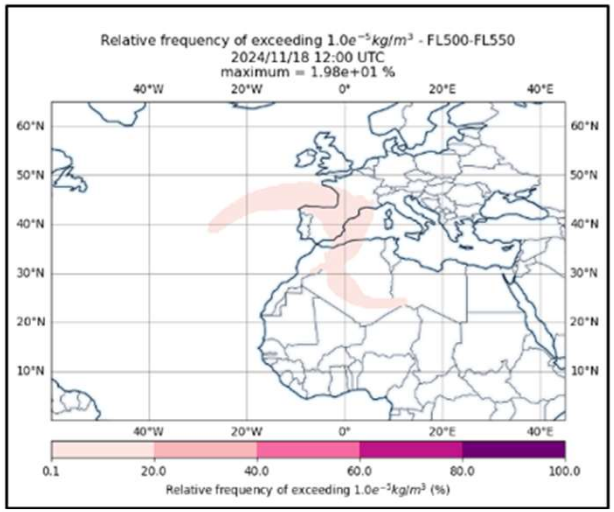
Relative frequency of concentration exceeding 10mg/m3, Validity 18/11/2024, 12utc



Mean sea level to FL50



FL300-FL350



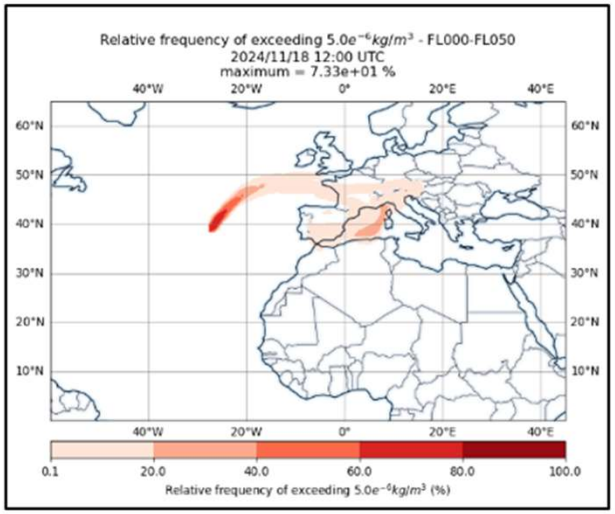
FL500-FL550

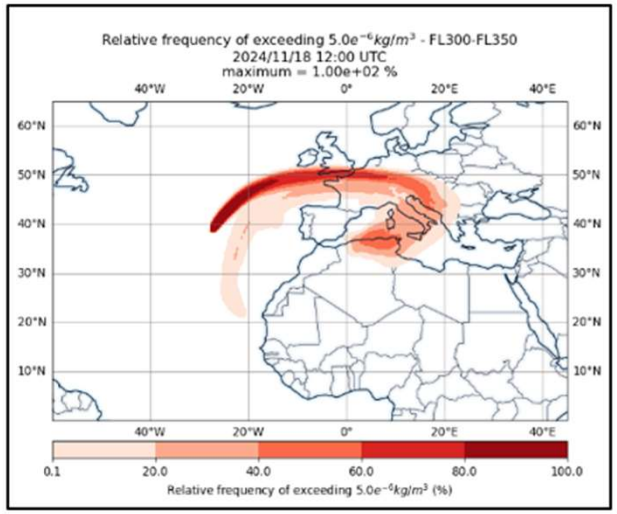
The risk of meeting ash cloud exceeding 10mg/m3 at FL500 over South-Western Europe and Algeria is very low but not null. The reason: some members of ensemble have ash at this level, but most don't - including the deterministic model run.

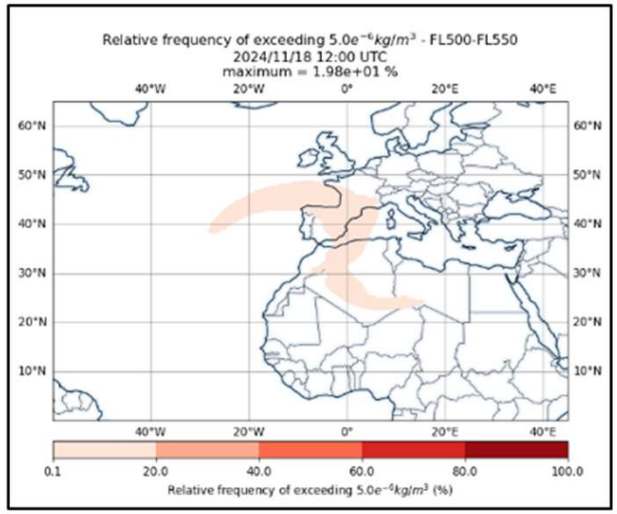
percentage of members exceeding 5 mg/m3

VAAC Toulouse

Relative frequency of concentration exceeding 5mg/m3, Validity 18/11/2024, 12utc







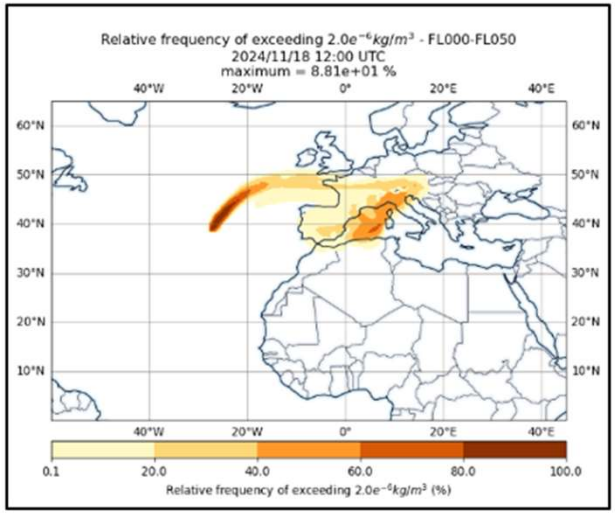
Mean sea level to FL50 FL300-FL350 FL500-FL550

The risk of meeting ash cloud exceeding 5mg/m3 at FL500 over South-Western Europe and Algeria is very low but not null. The reason: some members of ensemble have ash at this level, but most don't - including the deterministic model run

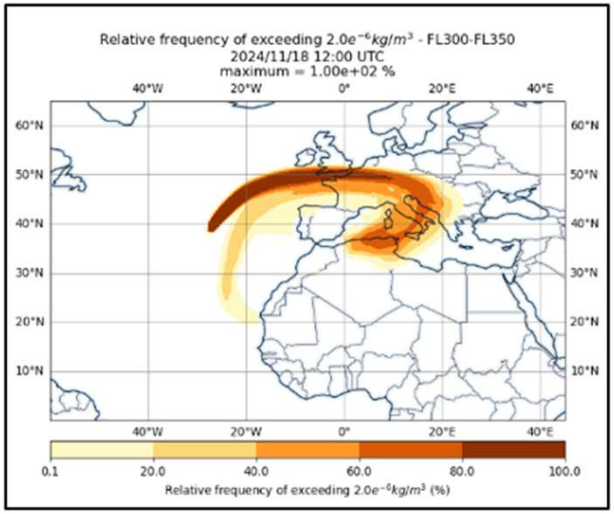
percentage of members exceeding 2 mg/m3

METEO FRANCE
VAAC Toulouse

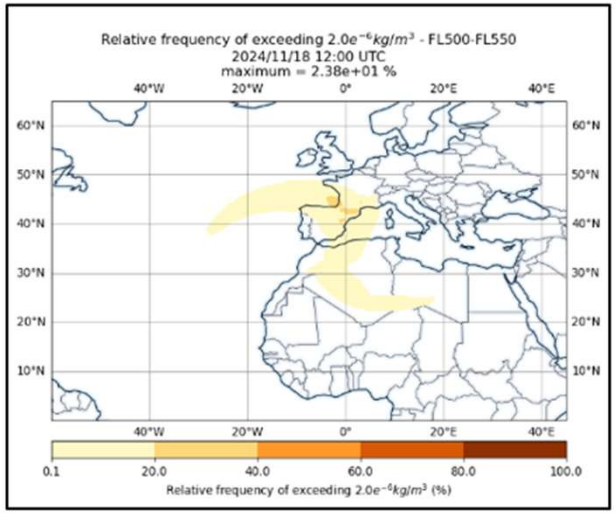
Relative frequency of concentration exceeding 2mg/m3, Validity 18/11/2024, 12utc



Mean sea level to FL50



FL300-FL350



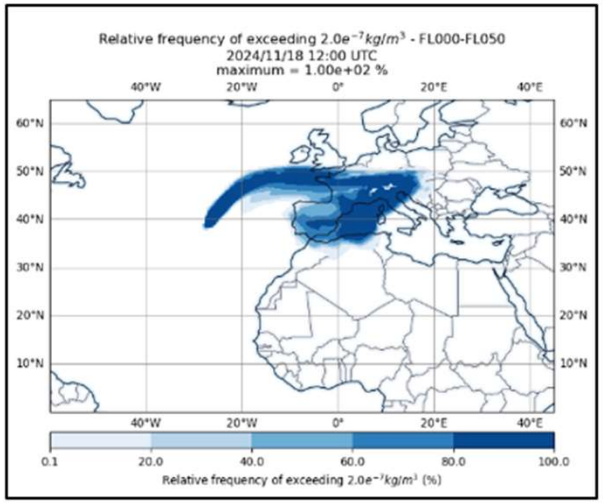
FL500-FL550

The risk of meeting ash cloud exceeding 2mg/m3 at FL500 over South-Western Europe and Algeria is very low but not null. The reason: some members of ensemble have ash at this level, but most don't - including the deterministic model run

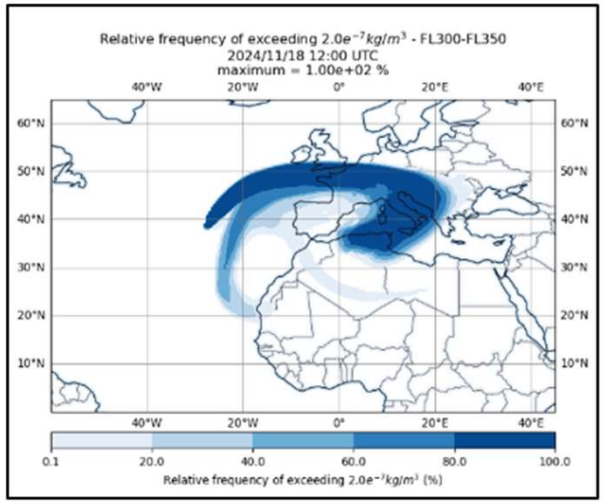
percentage of members exceeding 0.2mg/m3

VAAC Toulouse

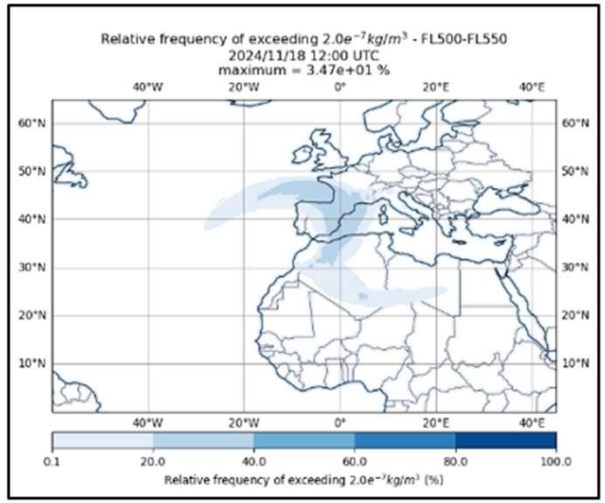
Relative frequency of concentration exceeding 0.2mg/m3, Validity 18/11/2024, 12utc



Mean sea level to FL50



FL300-FL350



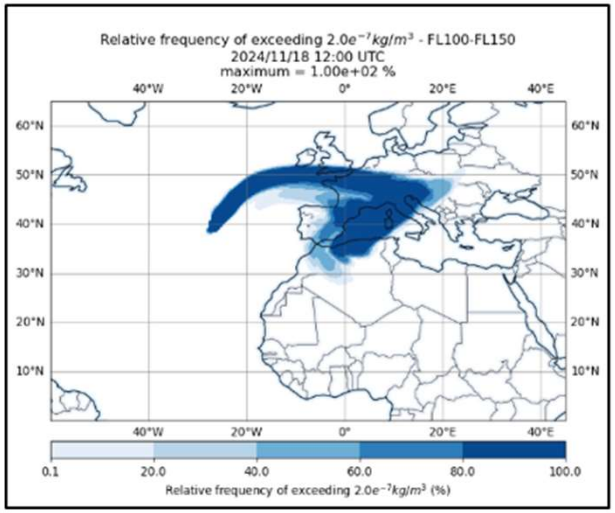
FL500-FL550

The risk of meeting ash cloud exceeding 0.2mg/m3 at FL500 over South-Western Europe and Algeria is very low but not null. The reason: some members of ensemble have ash at this level, but most don't - including the deterministic model run

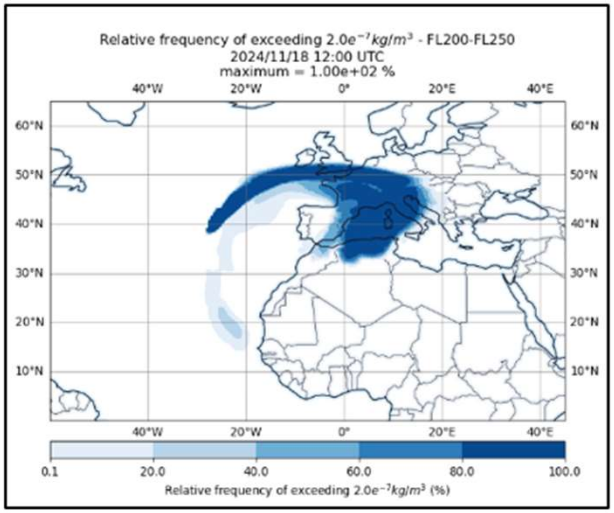
5000ft vertical resolution contribution
Estimate of risk of flying in low layer:
percentage of members exceeding 0.2mg/m3

VAAC Toulouse

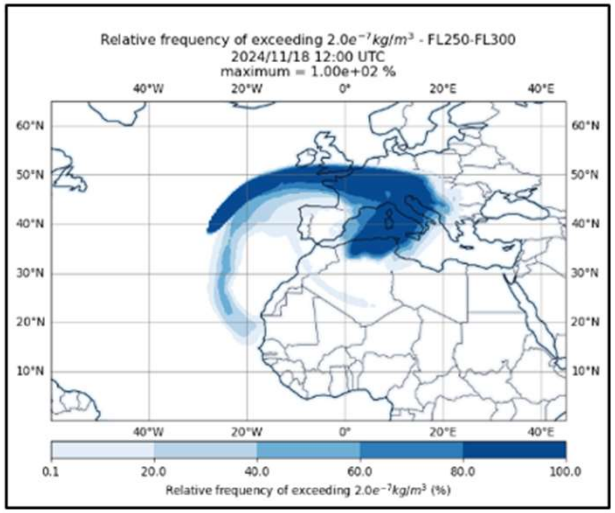
Relative frequency of concentration exceeding 0.2mg/m3 in low layers : Validity 18/11/2024, 12utc



FL100 –FL150



FL200-FL250



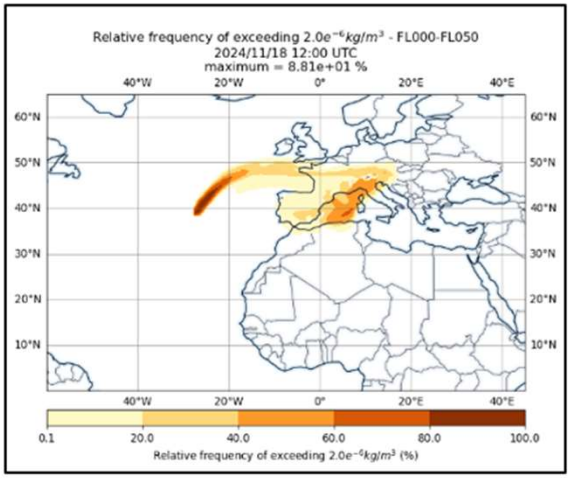
FL250-FL300

Over Atlantic Ocean, west of Canary Islands, it is unlikely to encounter ash from Mean sea level up to FL200, and it is likely above FL200.

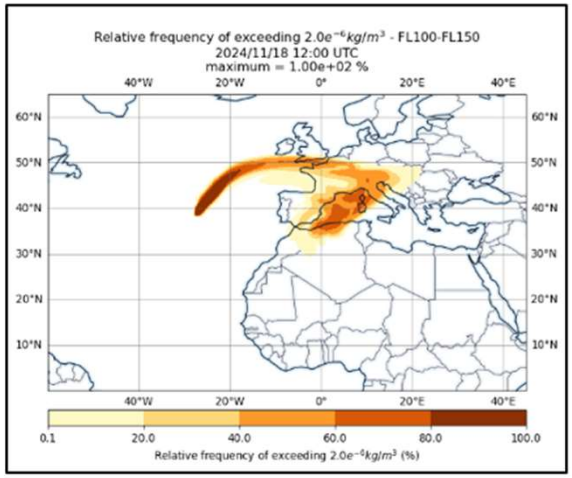
5000ft vertical resolution contribution
Estimate of risk of flying in low layer: percentage of members exceeding 2mg/m3

VAAC Toulouse

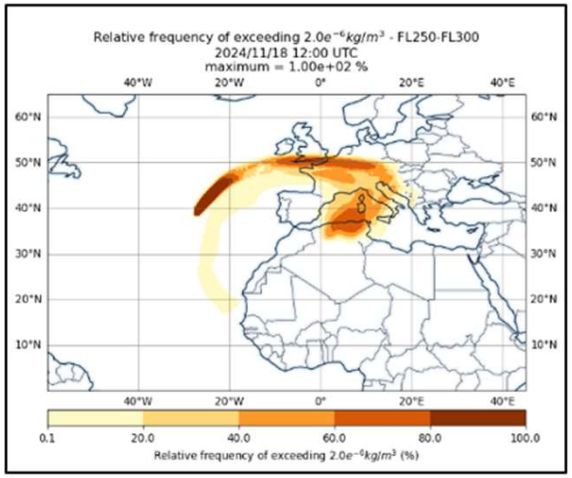
Relative frequency of concentration exceeding 2mg/m3 in low FL: Validity 18/11/2024, 12utc



Mean sea level to FL50



FL100-FL150



FL250-FL300

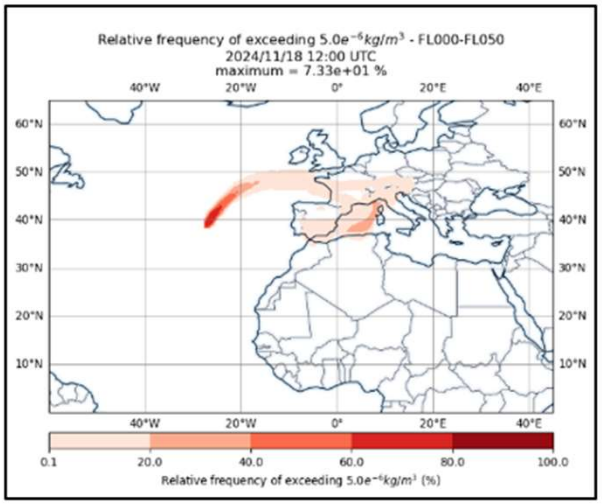
Over Atlantic Ocean, west of Canary Islands: Theses charts show low risk of medium concentration above FL250. Would it be possible to fly through?

Over Northern Italy/Switzerland: would it be possible to fly at these FL where there is high risk of ash cloud?

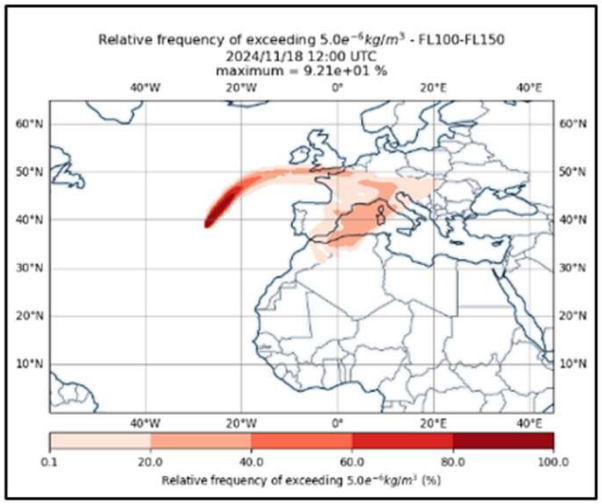
5000ft vertical resolution contribution
Estimate of risk of flying in low layer: percentage of members exceeding 5mg/m3

VAAC Toulouse

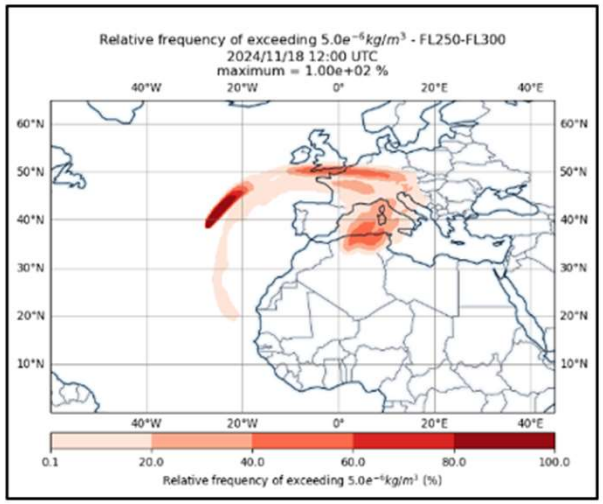
Relative frequency of concentration exceeding 5mg/m3 in low FL: Validity 18/11/2024, 12utc



Mean sea level to FL50



FL100-FL150

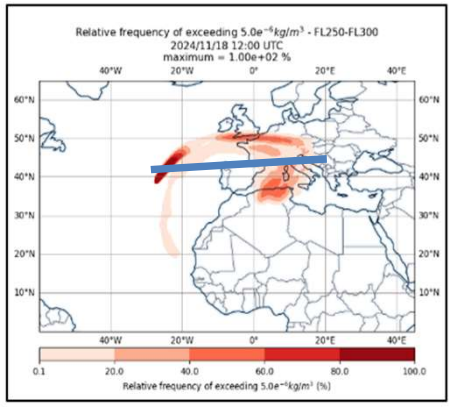


FL250-FL300

And what about high FL: which ash concentration risk above FL300? Let's look at the charts below:

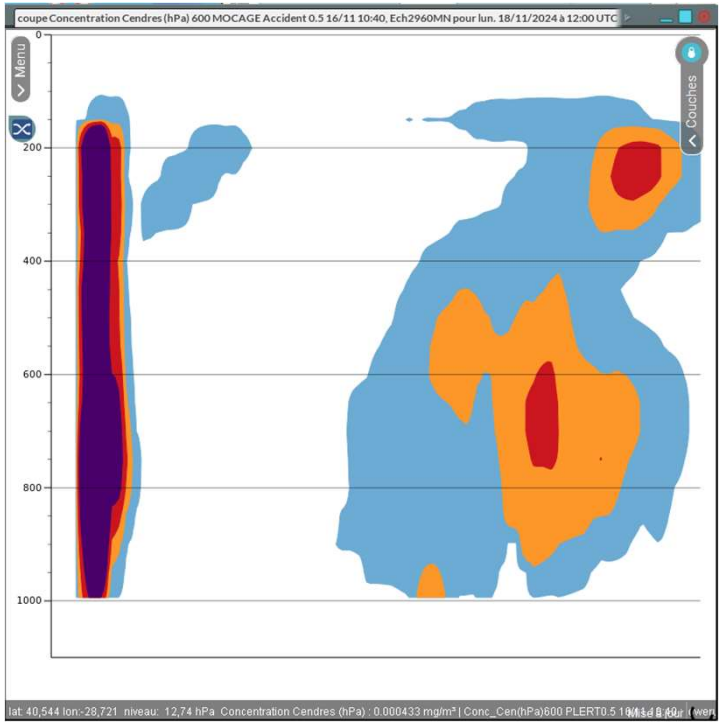
which ash concentration above FL300 ?

VAAC Toulouse



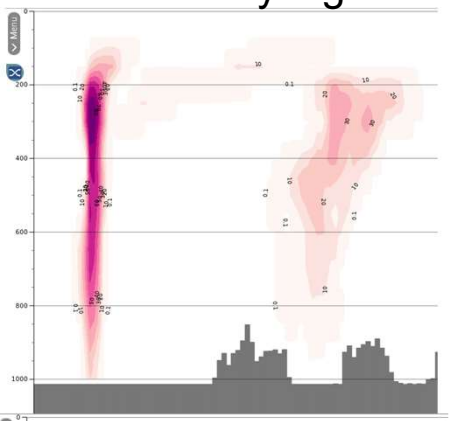
FL layer 250-300

Deterministic cross section

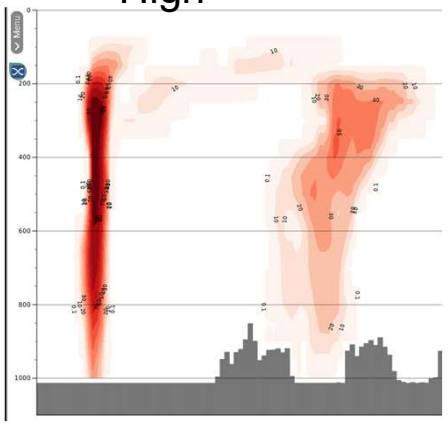


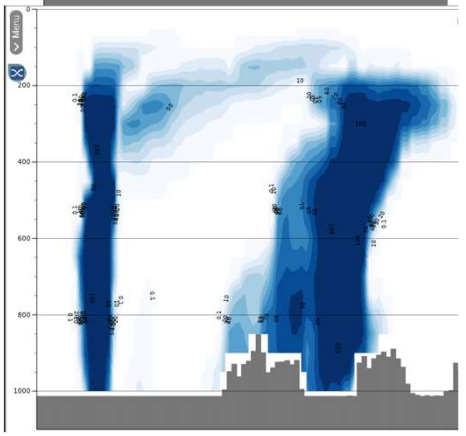
Probabilistic cross section

Very high

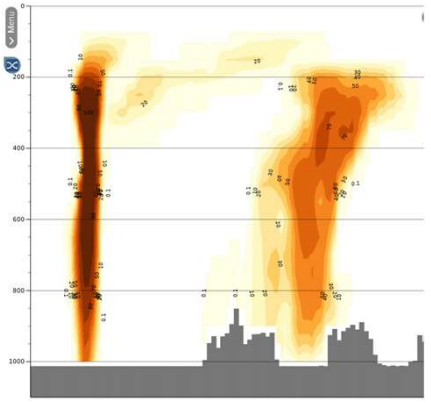


High





Low



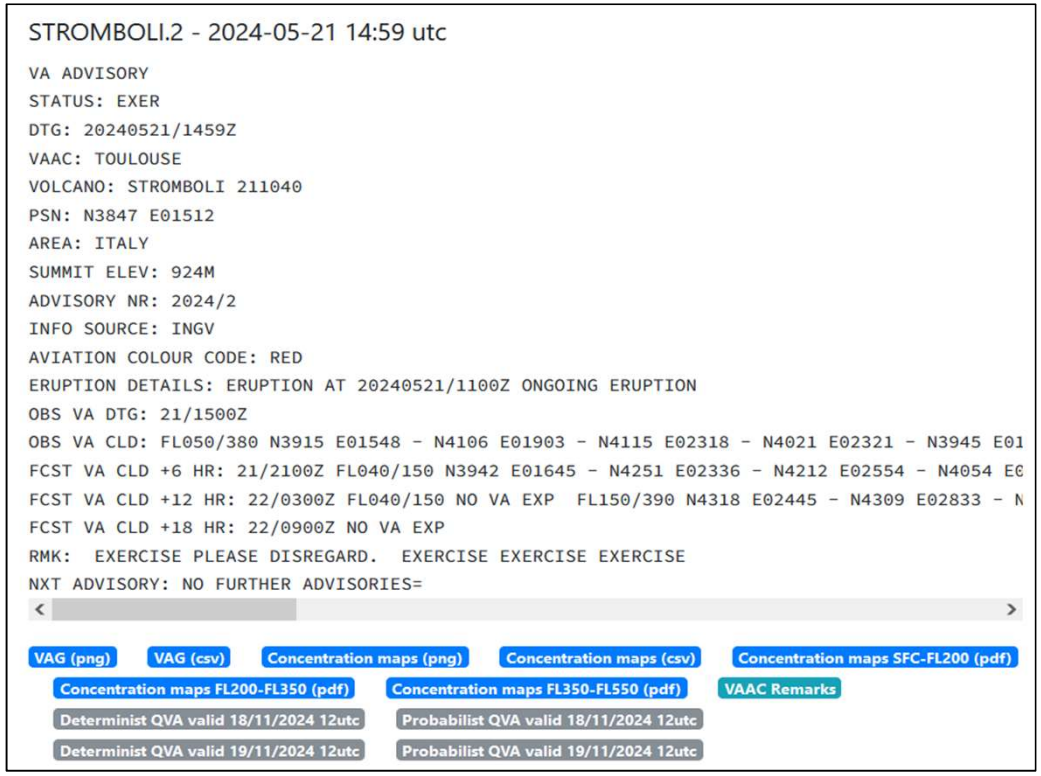
Medium

It’s possible to check with charts of concentration ash on a FL layer or from vertical cross section.

Access to QVA data of VAAC Toulouse during VOLCEX24

VAAC Toulouse

For a first familiarization, a selection of QVA charts will be available on http://vaac.meteo.fr/ under VAA through buttons as in exemple below :



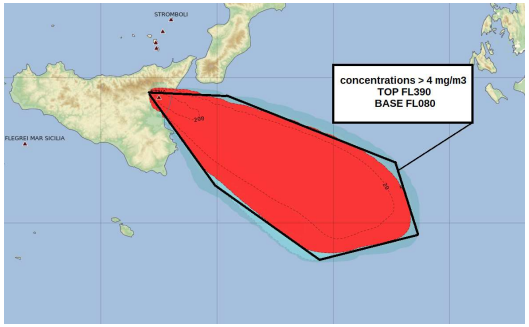
Question to regulator

VAAC Toulouse

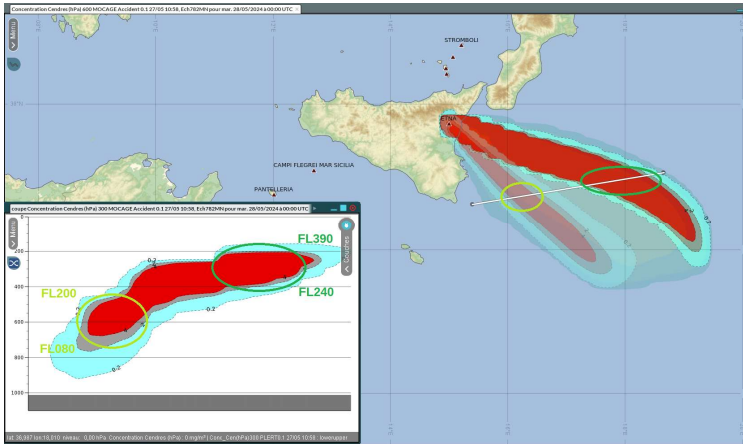
Europeen Regulator : current rules ,
flight autorisation according to threshold of

Blue/green	LOW	0.2 mg/m³
Grey	MEDIUM	2 mg/m³
Red	HIGH	4 mg/m³

What will the regulator allow in such an exemple of Etna eruption
With a polygon of ash concentration exceeding 4mg/m3 from FL080 to FL390
(*Fictive eruption of Etna, Mocage HR*)



According to vertical crossing section, 2 or 3 clouds could be designed on a VAG.



QVA using API

METGATE_MF

What is METGATE_MF?

- It is the aeronautical API portal for Météo France,
- Released as part of the SWIM programme end 2025, published on the SWIM Registry, abiding by CP1 requirements,
- Currently exposes Web Services (WCS, WFS) and will support OGC API, end 2025 :
  - **OPMET (IWXXM)**: Aerodrome Reports and Forecasts, SIGMET (incl. TC and VA), AIRMET, VAA, TCA, SWXA, Local report,
  - **Vector Products (IWXXM)**: ICING, CAT (Turbulence), RDT (Thunderstorms), QVA IWXXM,
  - **Gridded Forecasts (HDF)**: JET, WIND, TROPO, QVA (NetCDF4),
  - **RAW Products**: Radar 3D

in progress 2025 Roadmap

Using Webservices

- Machine-to-machine communication,
  - Request/Reply, using HTTPS,
  - Publish/Subscribe using AMQP 1.0
- GetCapabilities:
  - Lists all product instances and request functionalities,
- DescribeFeatureType (WFS) or DescribeCoverage (WCS):
  - Describes a specific product instance,
- GetFeature (WFS) or GetCoverage (WCS):
  - Retrieves the data, with filtering, sorting, counting, etc

A simple WCS Request

I want a subset of the latest {Grid Product},

1. Retrieve a description of its coverage, using a DescribeCoverage request,
2. Use the parameters found to extract exactly what is required,
3. Send the request using GetCoverage -> use the NetCDF file.

1

Request URL:

```
GET https://metgate.meteo.fr/broker_service/WCS?service=WCS&
version=2.0.1&request=DescribeCoverage&coverageid=WIND_last
```

2

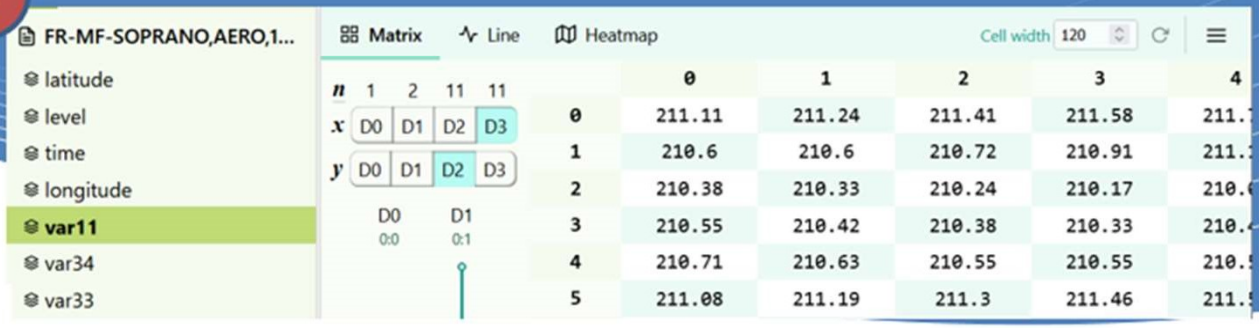
Request URL:

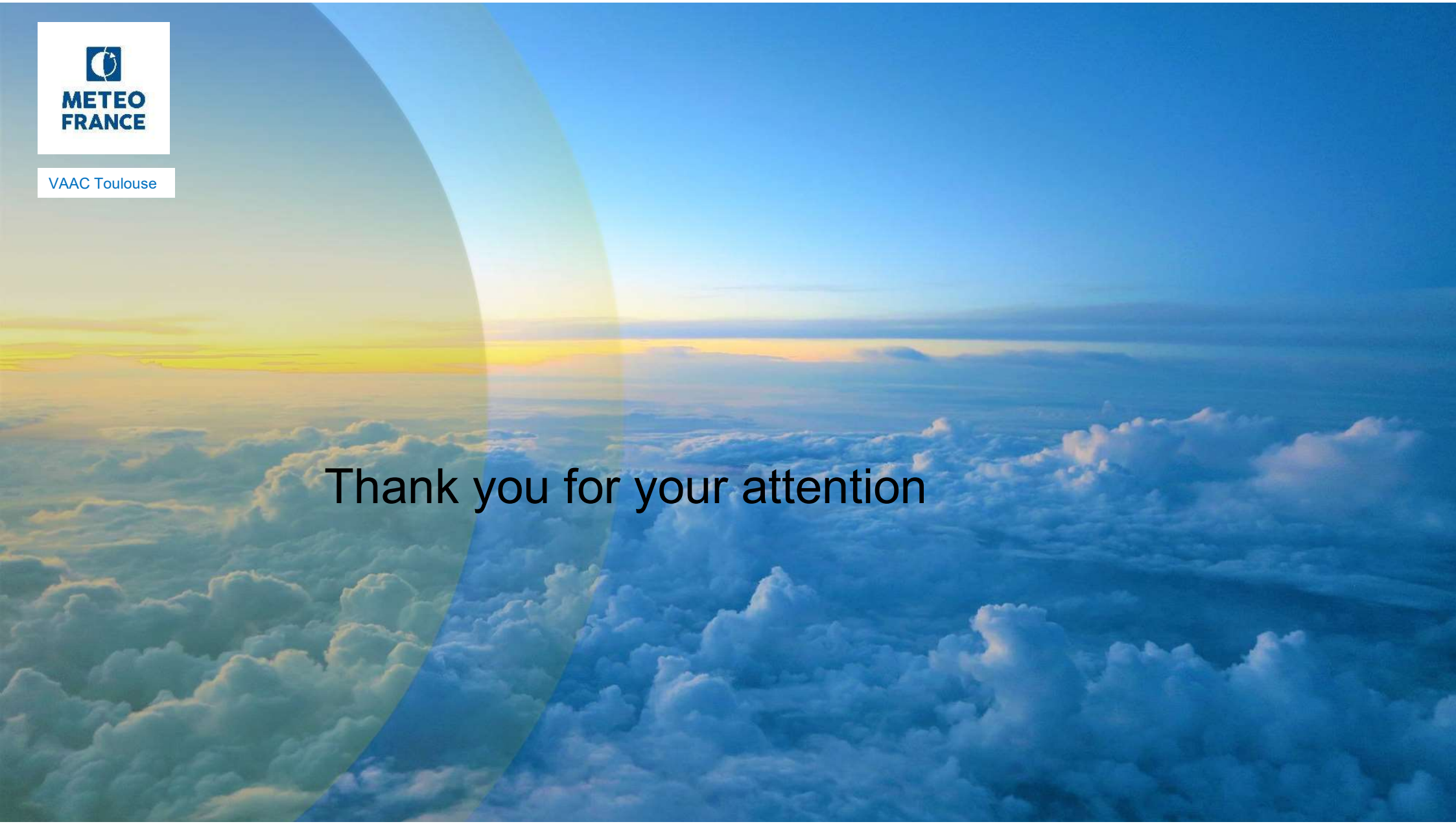
```
GET https://metgate.meteo.fr/broker_service/WCS?service=WCS&version=2.0.1&
request=GetCoverage&coverageid=WIND_last&subset=longitude[0,5]&
subset=latitude[45,50]&subset=level[15000.0,17500.0]&
subset=time[2024-10-30T05:00:00,2024-10-30T06:00:00]
```

3

FILE

011	Temperature
034	v-component of wind
033	u-component of wind




METEO
FRANCE
VAAC Toulouse
Thank you for your attention