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Aviation Weather: a critical safety pillar in flight operations

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Issues to discuss

- 1: Weather information : the basics
  - during planning, including fuel decision
  - situation awareness in flight with available tools
- 2: safety critical issues in flight operations
  - weather forecast and actual weather : delivered
  - PBN QNH
  - turbulence
  - Alternate decision and diversion
- 3: pilot training including use of digital real time weather
- 4: European ATM and weather

1: Weather information: the basics

➢ during planning , including fuel decision

Main kinds of weather info:

- aerodrome weather (TAF / METAR)
- temp/wind charts - Significant Wx charts
- SIGMET, like for MOD/SEV Turbulence
- TC, VA and Space Weather advisories
- optional: Wx depictions, like radar / satellite

1: Weather information: the basics

➢ during planning , including fuel decision

Pilots considerations during briefing for a specific flight / airplane:

- are the planned airports useable ?
- is a detailed look at some needed ?
- choice of alternate, usability of destination ?
- enroute weather ?
- are any advisories relevant ?
- change of time/date of operation needed ?

1: Weather information: the basics

➢ during planning , including fuel decision

FUEL DECISION is taken , but uncertainties and unknowns remain:

- accuracy of TAF (different quality control methods in use globally)

- broad-brush Sigwx charts (improvements are coming soon - how good are they ?)

1: Weather information: the basics

➢ Situation awareness in flight with available tools

Information from aircraft´s own sources:

- aircraft sensed, like temperture & wind
- aircraft systems: Wx radar, lightning detection (rare)
- safety nets: windshear alerting
- looking out of the cockpit - window

1: Weather information: the basics

➢ Situation awareness in flight with available tools

Information sources:

- basic: voice ATIS, voice VOLMET
- better: ACARS uplink of Wx,
  pilot selected or automated
- better yet : company support by dispatch
- safety relevant, and economic:
  satellite weather (Connectivity required)

2: Safety critical issues in flight operations

➢ weather forecast and actual weather : delivered

Wx forecast for aerodromes:

- Terminal Aerodrome Forecasts, TAF
- example:

```
TAF EDDM 061100Z 0612/0718 34008KT CAVOK
  TEMPO 0616/0621 RA
  PROB40
  TEMPO 0616/0618 30020G35KT 3000 TSRA FEW010 BKN030CB
  BECMG 0618/0620 25006KT
  PROB30
  TEMPO 0620/0702 BKN012
  BECMG 0708/0710 31005KT
```

Issued every 6 hrs mostly-

3 hrly issuance would yield improved forecasts.

2: Safety critical issues in flight operations

➢ weather forecast and actual weather : delivered

Wx report for aerodromes:

- Meteorological Aerodrome Report, METAR
- Example – note the ´´///´´:

```
EDDM 061620Z AUTO 26014KT 7000 +SHRA VCTS SCT008 BKN037 BKN047 FEW///CB 12/11 Q1010 RETS BECMG 26007KT NSW
EDDM 061550Z AUTO 26026G38KT 9999 SHRA VCTS FEW014 BKN035 BKN049 FEW///CB 13/12 Q1009 RETS TEMPO 3000 TSRA
EDDM 061520Z AUTO 33007KT 300V360 9999 -SHRA VCTS FEW///CB 18/12 Q1007 RESHRA TEMPO 33020G35KT 3000 TSRA FEW010 BKN030CB
EDDM 061450Z AUTO 35008KT 9999 -SHRA FEW///CB 19/11 Q1006 TEMPO FM1600 30020G35KT 3000 TSRA FEW010 BKN030CB
```

- issue: AUTO reports can lack ceiling information that reports by humans have.

  OK / not OK ? Need improvements!

2: Safety critical issues in flight operations

➢ PBN QNH

The local altimeter setting (QNH) is a crucial part for PBN approaches with barometric based vertical navigation.

> Safety risk through mis-communication !

Solutions include:

- use of D-ATIS > Connectivity is Key !
- clear communication via voice and ACARS
- cross-check with QNH received at briefing
- flying a 3-d approach when one is available, especially when ceiling and/or visibility are low

2: Safety critical issues in flight operations

- turbulence
  - Connectivity is key to receiving inflight updates !

Turbulence :

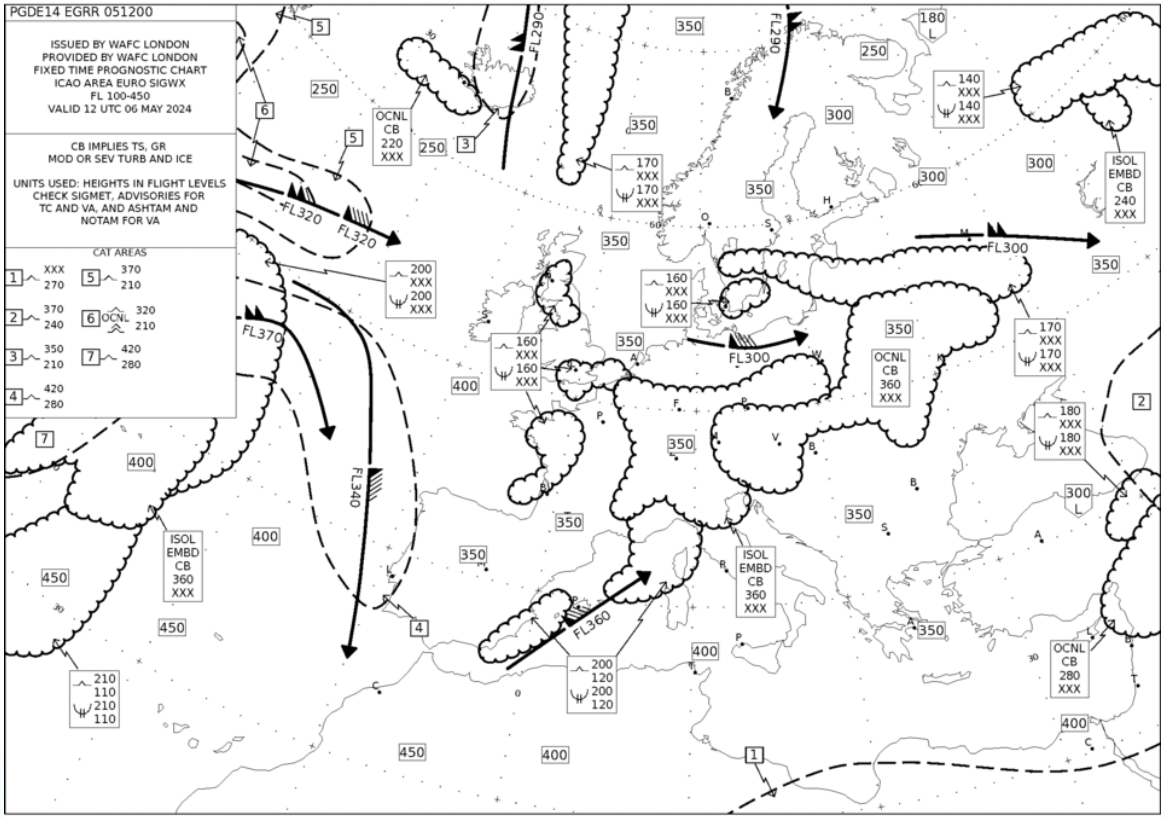
- Improved, high resolution forecasts are available
- Automated turbulence reports of some aircraft are online, and available (may cost, IATA turbulence aware)
- Many cases where persons suffer injury seem to be related to flight close to / in convection. : WHY ?
- Equipment ?? Training ? Using the equipment, like wx radar properly ? Proper use of eFB weather ??

2: Safety critical issues in flight operations

➢ weather forecast and actual weather : delivered

Enroute: high level significant wx chart.

Example:



Valid:
06 May 2024, 12z

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2: Safety critical issues in flight operations

- weather forecast and actual weather : delivered
  - Connectivity is key to receiving inflight updates !

Enroute: improvements enabled this year:

Upgrades of the World Area Forecast System

> hazard objects, IWXXM, 3 hourly issuance, all parameters, including **turbulence,** all at improved granularity

Link >>>

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2: Safety critical issues in flight operations

➢ weather forecast and actual weather : delivered

Question is, if the upgraded WAFS covers all of Europes needs .

- What about the information in the cross border forecasts ?
- Lower level features, like an upcoming snow storm, or actual area and movement of thunderstorms for example, are not communicated to pilots. Such info should be available !
- Digital ATIS at more airports - a great enhancement.

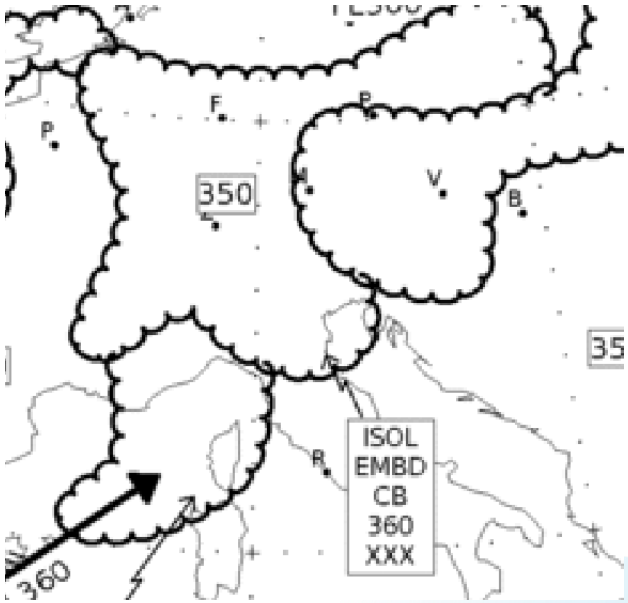
2: Safety critical issues in flight operations

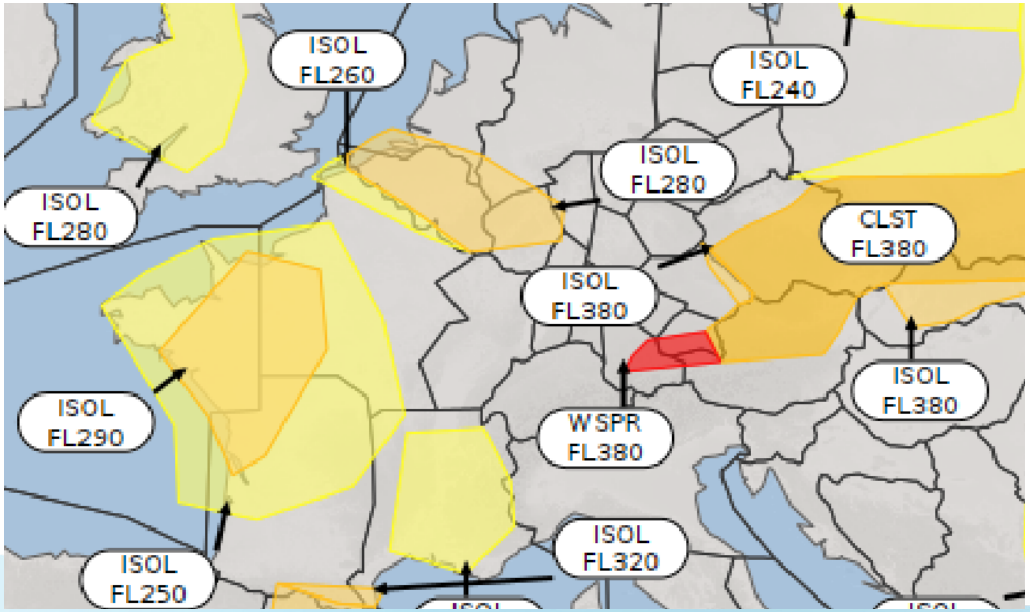
- weather forecast and actual weather : delivered

Enroute: high level significant wx chart.

Issues: improved info is not shown to pilots

Example: Cross Border Convection Forecast





Cross Border
Convection Forecast
Courtesy DWD
Valid: 12-15z, 06 May 2024

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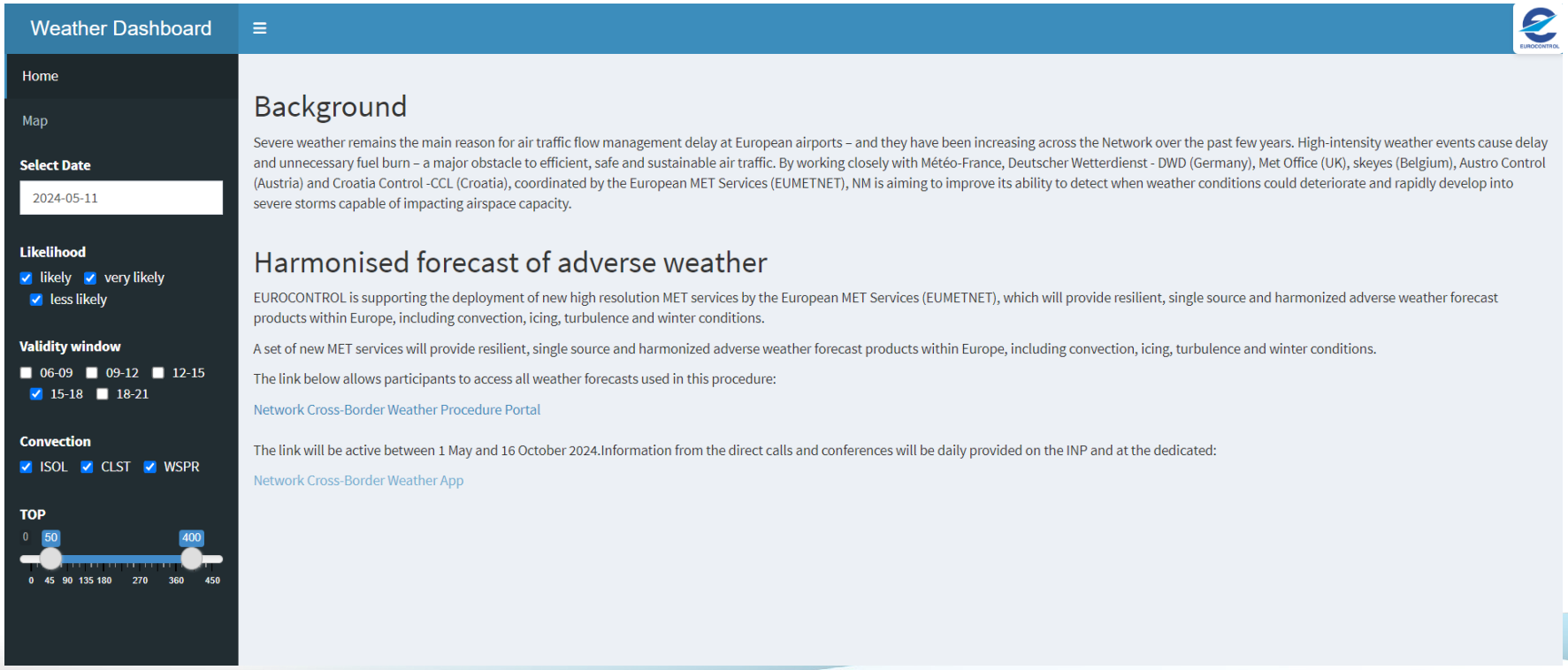
2: Safety critical issues in flight operations

- weather forecast and actual weather : delivered

…or hidden behind passwords…

…..in plain sight, in the NOP Portal. ??



https://nmocoperationsanalysis.shinyapps.io/weather_app/

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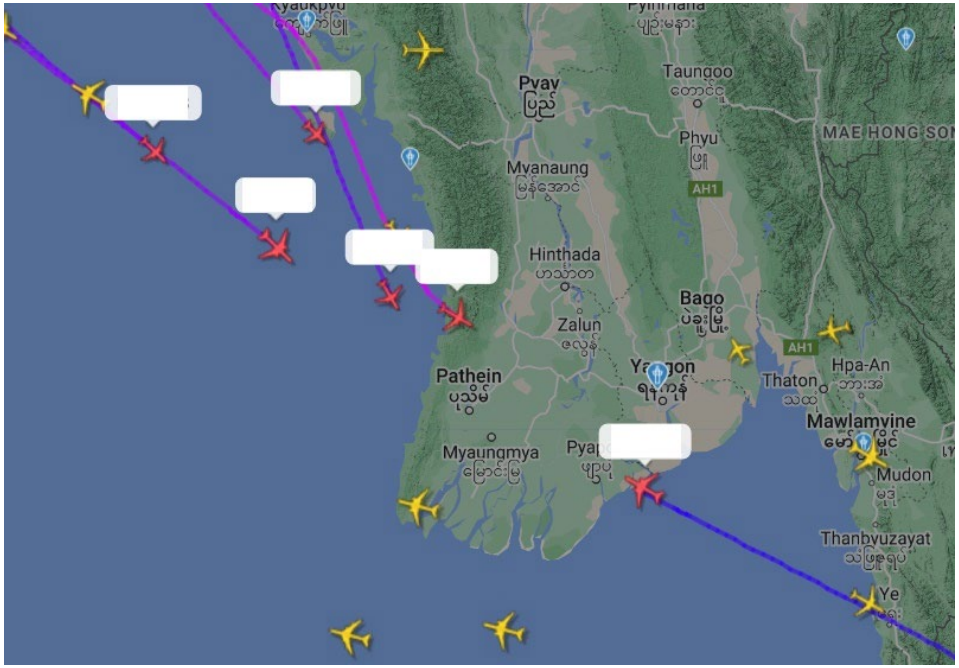
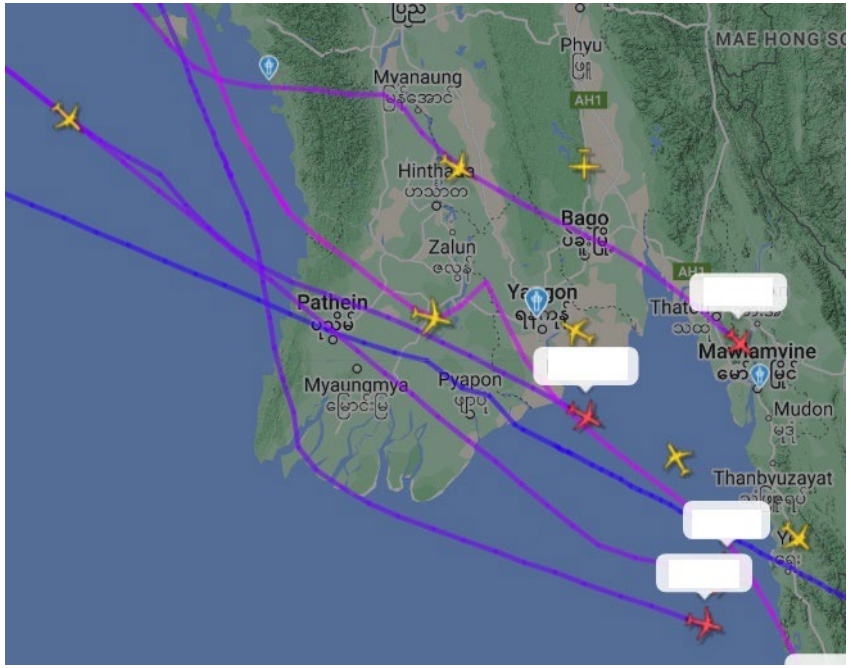
2: Safety critical issues in flight operations

- turbulence
  - Successfully dealing with CB takes airspace & coordination





Flightradar24/K.Sievers

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2: Safety critical issues in flight operations

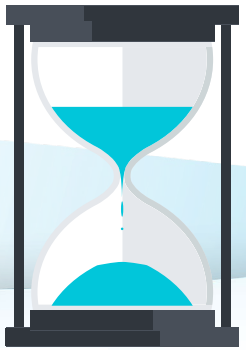
➢ Alternate decision and diversion

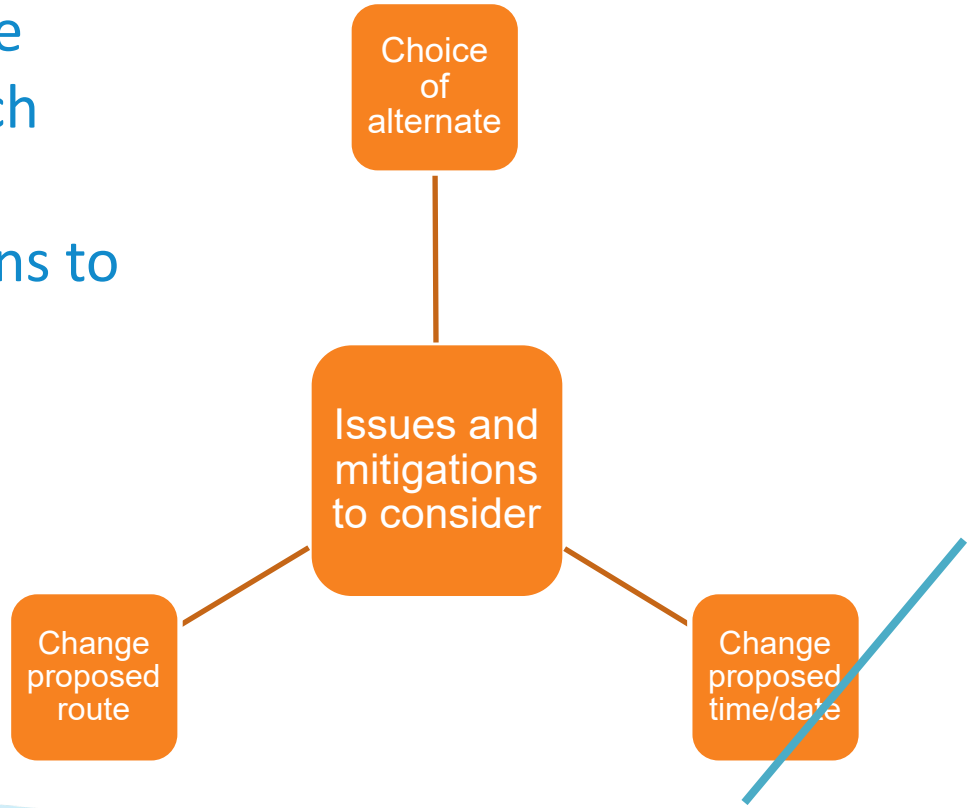
> Decision making as per airline operations manual at Dispatch

Enroute: similar considerations to planning,

> but with time pressure !

> No ´hold position´ button in the cockpit !





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2: Safety critical issues in flight operations

- Alternate decision and diversion
  - Connectivity is Key !

Fast provision of complete and accurate information is safety relevant. Needs to encompass the latest available

- actual and forecast weather at the alternate airport
- weather enroute
- operational information on actual usability and handling support

2: Safety critical issues in flight operations

- Alternate decision and diversion
  - Connectivity is Key !

Ideally, all that info is uplinked in timely manner.

- only possible for aircraft having at ACARS or another form of connectivity

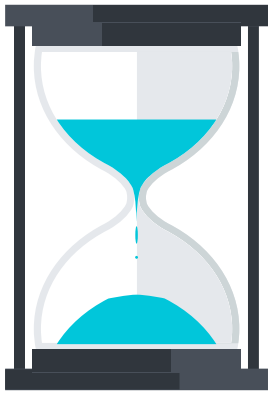
- without connectivity, **workload** on pilots increases substantially as listening to ATIS, VOLMET or asking ATC essentially **takes one pilot away** from flying.

- Support by company dispatch can be valuable

2: Safety critical issues in flight operations

➢ Alternate decision and diversion

- To be noted: flying to the alternate uses up substantial fuel reserves aircraft carry !



- - margins are getting thin
- - consequently, declaration of MINIMUM FUEL may well be required
- - any unforeseen delay / fuel usage will lead to the MAYDAY FUEL declaration

3: Pilot training including use of digital real time weather

Learning Objectives of EASA

- unchanged since 2016
- do not include specifics on the use of digital, real time, weather
- Open question: is adequate training beeing provided ?

3: Pilot training including use of digital real time weather

Training needs to include benefits and pitfalls of digital weather interpretation and also

- checking that what is displayed is current

- knowing what ´current´ means. The aircraft wx radar will offer up-to-the second informaton, whereas up-linked satellite or groud wx radar pictures could be 10, 20 or even 30 minutes old.

4: European ATM and Weather

- Real world operation capability in Europan ATM is hampered by

  - lack of timely adjustments in ATM to account for coming weather situations
  - apparent lack of weather information on display @ the air traffic controllers stations
  - lack of availability of pre-planned, coordinated measures like those shown in the ´playbook´ in the USA.

4: European ATM and weather

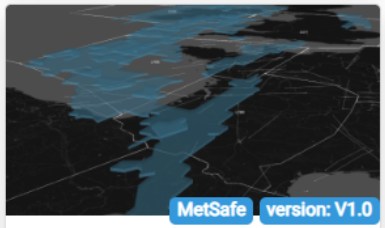
- Real world operation capability in Europan ATM is enhanced by tools in the SWIM catalogue.
  - the question is: are they applied / used ?!?

De-Icing Need/ area

De-Icing Need/ area -service is a nowcast-type forecast of aircraft de-icing needs before takeoff. I...

De-Icing Need/ Point

De-Icing Need/ point - service is a nowcast-type forecast of aircraft de-icing need before takeoff. I...



European Contrail...

European Contrails forecast product using a multimodel approach and delivered as a WFS (GeoJSON...

European Convecti...

Convection forecast product using a multimodel approach and delivered as a WFS (GeoJSON) SWIM w...

https://eur-registry.swim.aero/services

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4: European ATM and weather

- Real world operation capability in Europan ATM
  - are they in widespread, coordinated use ??
  - can pilots make use of them ?

Icing Intensity v...

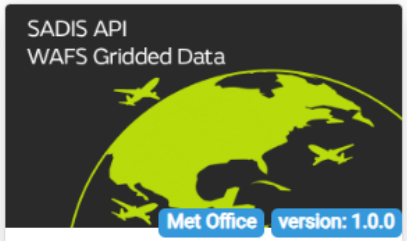
The Icing Intensity AMQP Service delivers icing intensity forecast information for air traffic for a...

Met Office 4D-Tra...

The Met Office 4D Trajectory API service supplies global meteorological data for tailored flight tra...

OpasSo2lhDatasetN...

OPAS service coordinates the OPAS SO2LH notification service which allows subscribed users to receiv...



SADIS WAFS Gridde...

The SADIS World Area Forecast Service (WAFS) Gridded Data service (the Service) supplies tiles of me...

https://eur-registry.swim.aero/services

4: European ATM and weather

- Improved real world operating capability in Europan ATM

  needs a coordinated plan on severe weather mitigation.

- the Cross Border Convection forecast seems to be the only tool in use to communicate and highlight severe weather.

- Is it effective ?

- what about other kinds of weather disturbances, like snow storms, unusual jetstream patterns ?

Conclusion: Connectivity is key !

- ECA perspective on weather

- Steps to take: Mandate Connectivity and do ATM with a focus on weather.

  - Cross Border Forecasts for Pilots
  - 3-hourly TAF updates
  - get appropriate weather information into the cockpit
  - train pilots to use of modern, digital weather

Conclusion: Connectivity is key !

- Weather information affecting safety
  - Risk assessment and mitigation lies in the hands of experienced crews- they depend on weather information
- Safety critical issues in flight operations
  - diversion due to weather, disruption management is one of the tasks of pilots - they need timely support.
- pilot training including use of digital real time weather
  - needs to come about, so full use is made of what´s available.
- ATM and weather
  - modern tools are needed - and a PLAN !

Thank you very much for your attention !

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