



Data4Safety

Partnership for Data Driven Aviation Safety Analysis

Supported by EASA

Meteorological Information and Data4Safety

15th of May 2019

D4S is co-funded by
the European Union





ADVERSE WEATHER



GO-AROUND MANAGEMENT



D4S – Sources of Meteorological Information

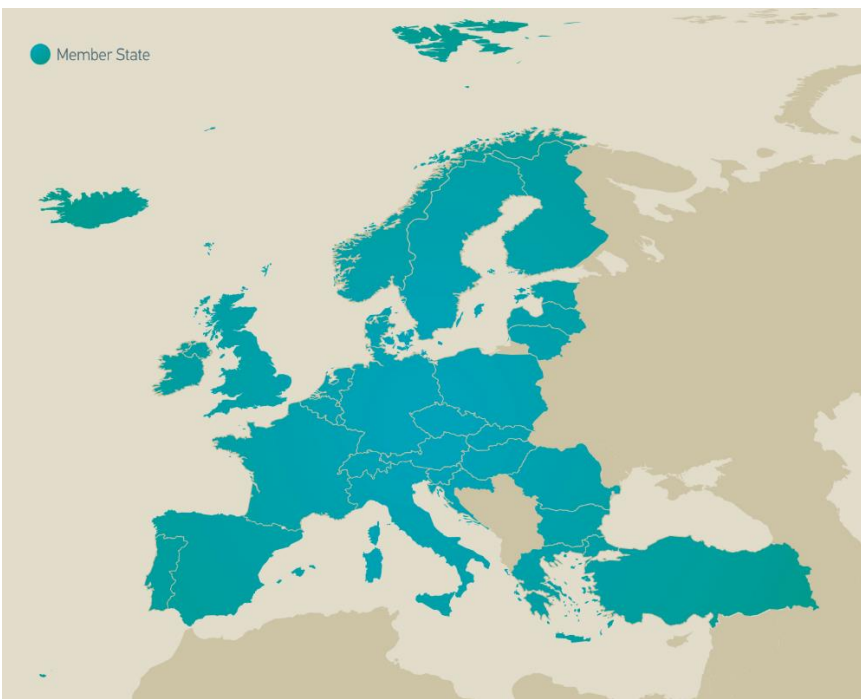


- Members:** National Meteorological Services, full Members of EUMETNET.
- Cooperating:** National Meteorological Services or other institutions participating in one or more optional EUMETNET Programmes.
- Others:** Other organisations cooperating with EUMETNET.

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Monitoring Climate and Weather from Space



30 Member States



Contact: Dr Lothar Schüller (lothar.schueller@eumetsat.int)



Meteorological information for Data4Safety

- Through engagement with EUMETNET and EUMETSAT, EASA is coordinating to consider the possible integration of the meteorological information described on the following slides.
- The ownership of the different forms of data is recognised, and through EUMETNET and EUMETSAT, appropriate coordination and permissions will be sought.



➤ Meteorological Information

➤ METAR/TAF/SIGMET/AIRMET

- Data familiar to today's pilots
- EU coverage (and beyond)

➤ METAR:

YUDD 021820Z 29008KT 9999 -SHRA SCT046CB 10/09 Q1013 RESHRA=

➤ TAF:

YUDD 021700Z 0218/0324 29008KT 8000 BKN040 BECMG 0219/0221 BKN012
PROB30 TEMPO 0302/0308 4000 BR BKN009 BECMG 0305/0308 BKN040=

➤ SIGMET:

YUDD SIGMET 2 VALID 101200/101600 YUSO-
YUDD SHANLON FIR SEV TURB FCST WI N4230 E02145 - N4315 E02115 -
N4345 E02145 - N4330 E02215 - N4245 E02230 -N4230 E02145 FL250/370
INTSF FCST AT 1600Z WI N4145 E02315 - N4230 E02200 - N4330 E02215 -
N4315 E02345 - N4145 E02315=

*YUDD Fictional Location Identifier

➤ Meteorological Information

➤ Ground based Weather Radar

➤ 'OPERA' data initially

- Wide EU coverage
- Composite
- Quality controlled

➤ Raw ground based weather radar ideally:

- Higher resolution (spatially and temporally)
- Doppler data
- Dual-polarisation

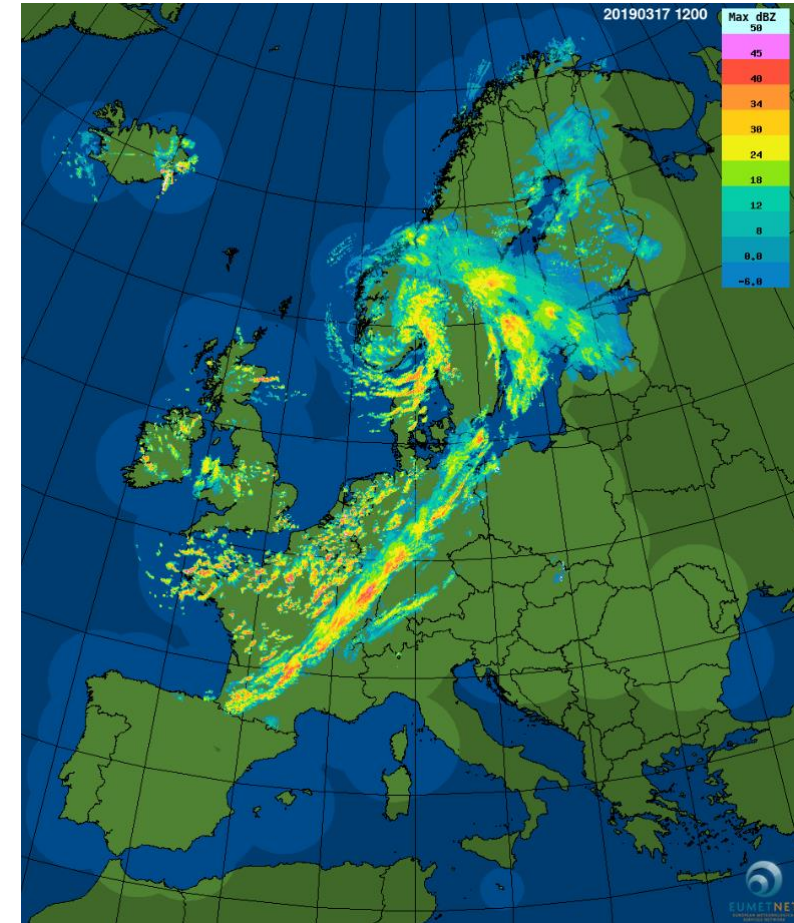


Image: OPERA

➤ E-AMDAR

- Very good coverage of wind and temperature
- Limited coverage of turbulence/icing/humidity data

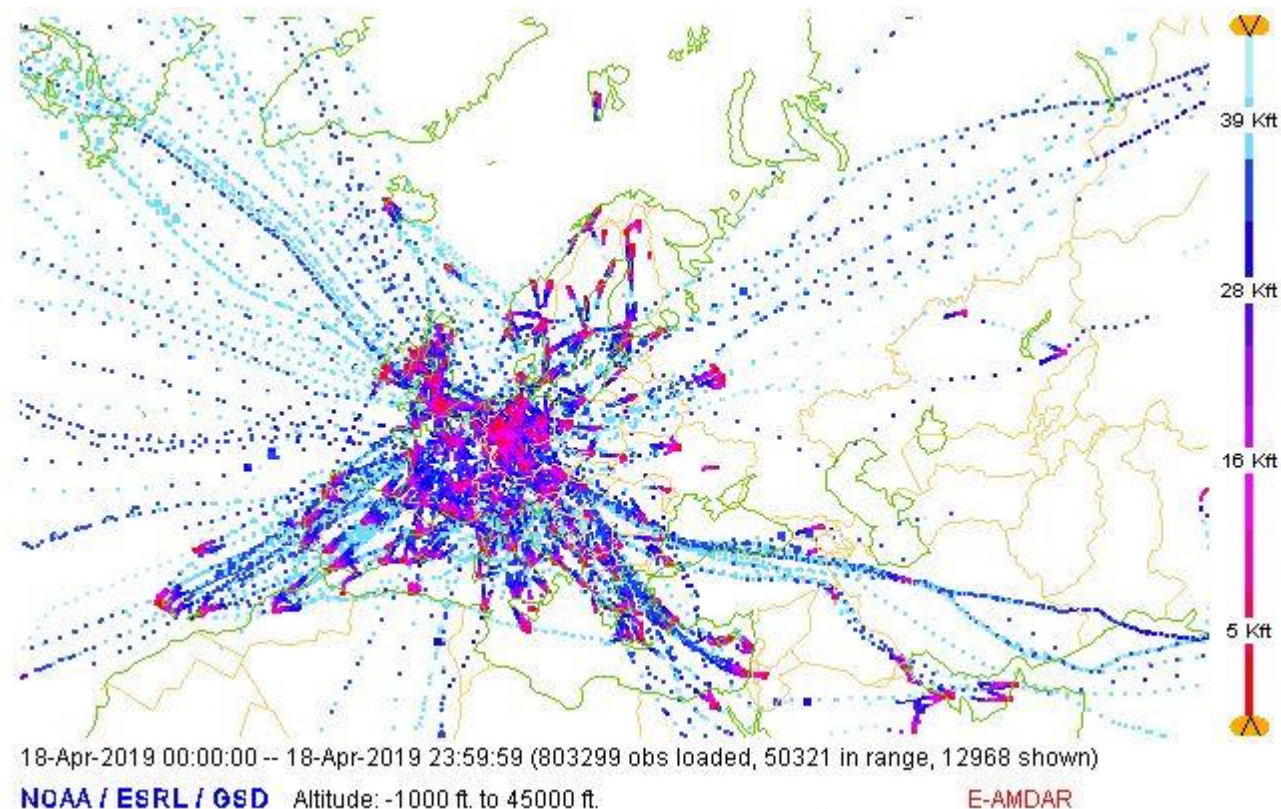


Image: EUMETNET

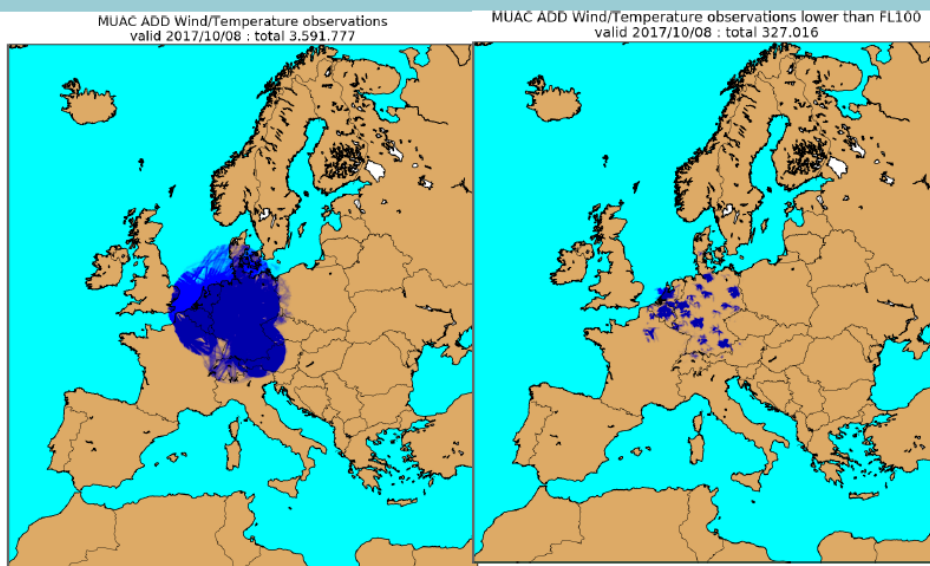
E-AMDAR reports (colour coded by height) for example of coverage

➤ Meteorological Information (continued)

➤ ADS-B/Mode-S EHS

- Derived wind and temperature data
- Mode-S EHS can be collected via ATC with low cost receivers
 - Very large volumes of data (SESAR DM Project, led by KNMI, Netherlands)

KNMI Mode-S EHS



For the MUAC area alone 20 Million+ raw observations per day

Resulting in 3,5 Million quality controlled observations per day

http://mode-s.knmi.nl/documents/EMADDC_MET_EXPO_2017_v1.pdf

Co-financed by the European Union
Part of SESAR Deployment 2020

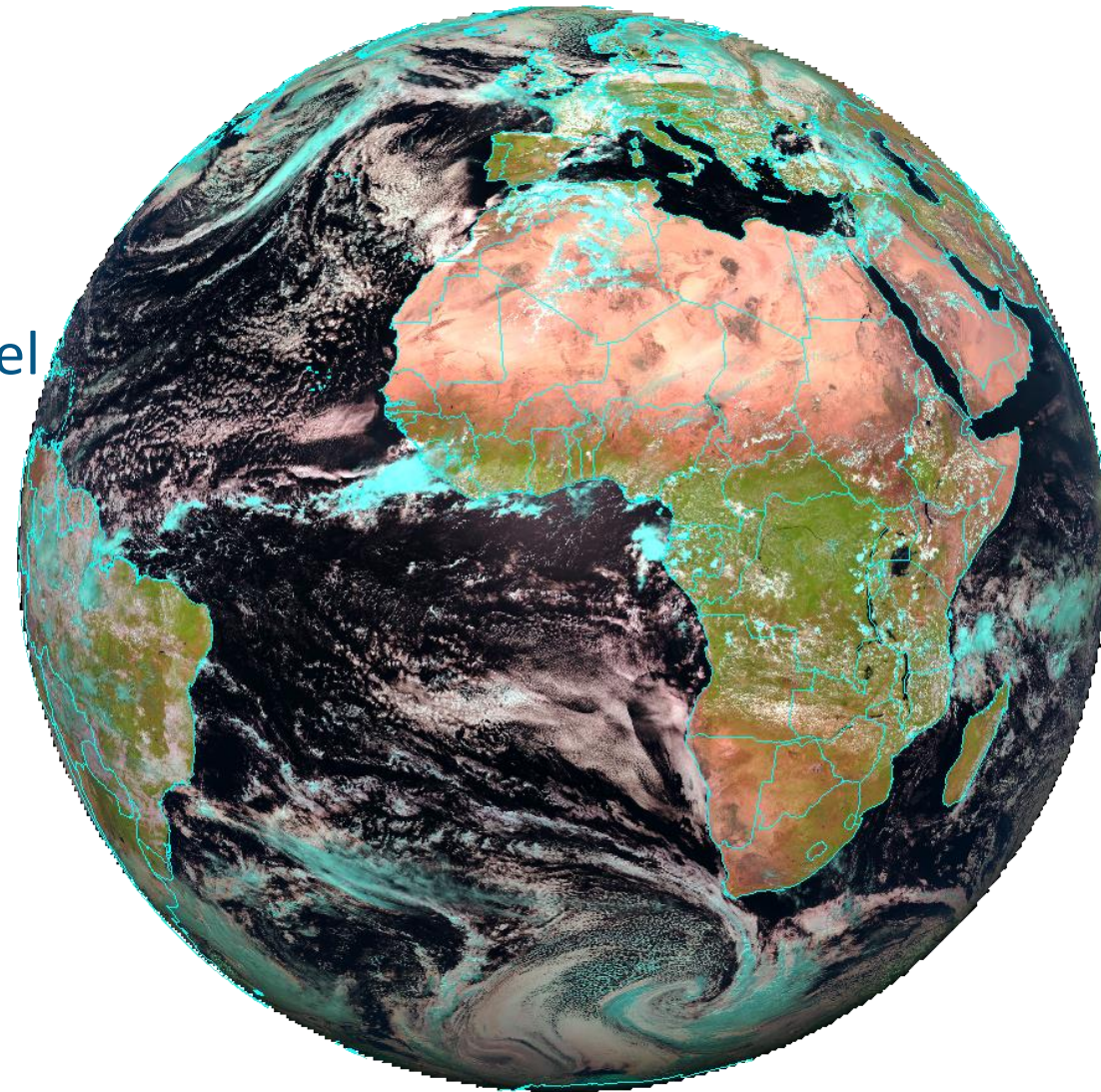


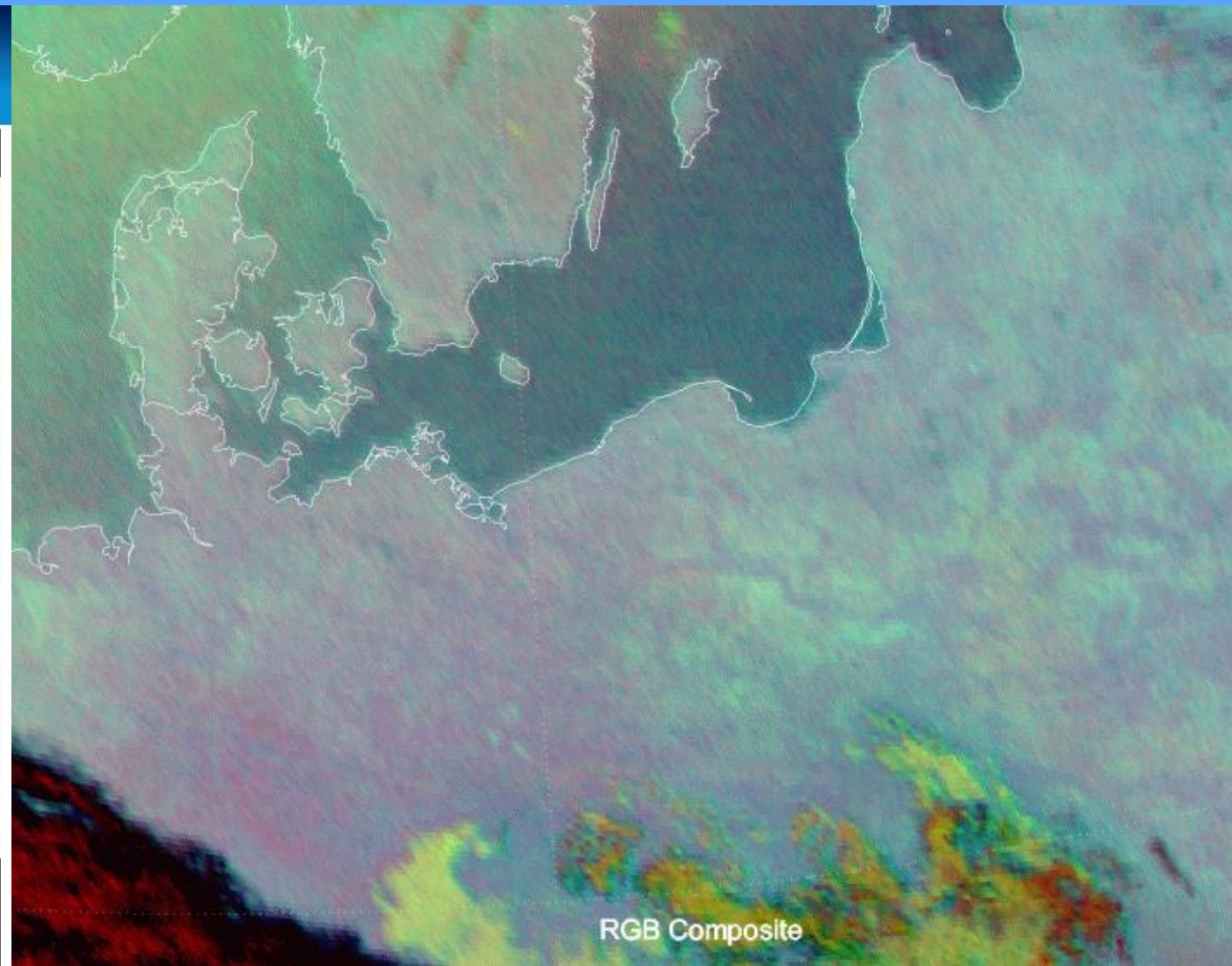
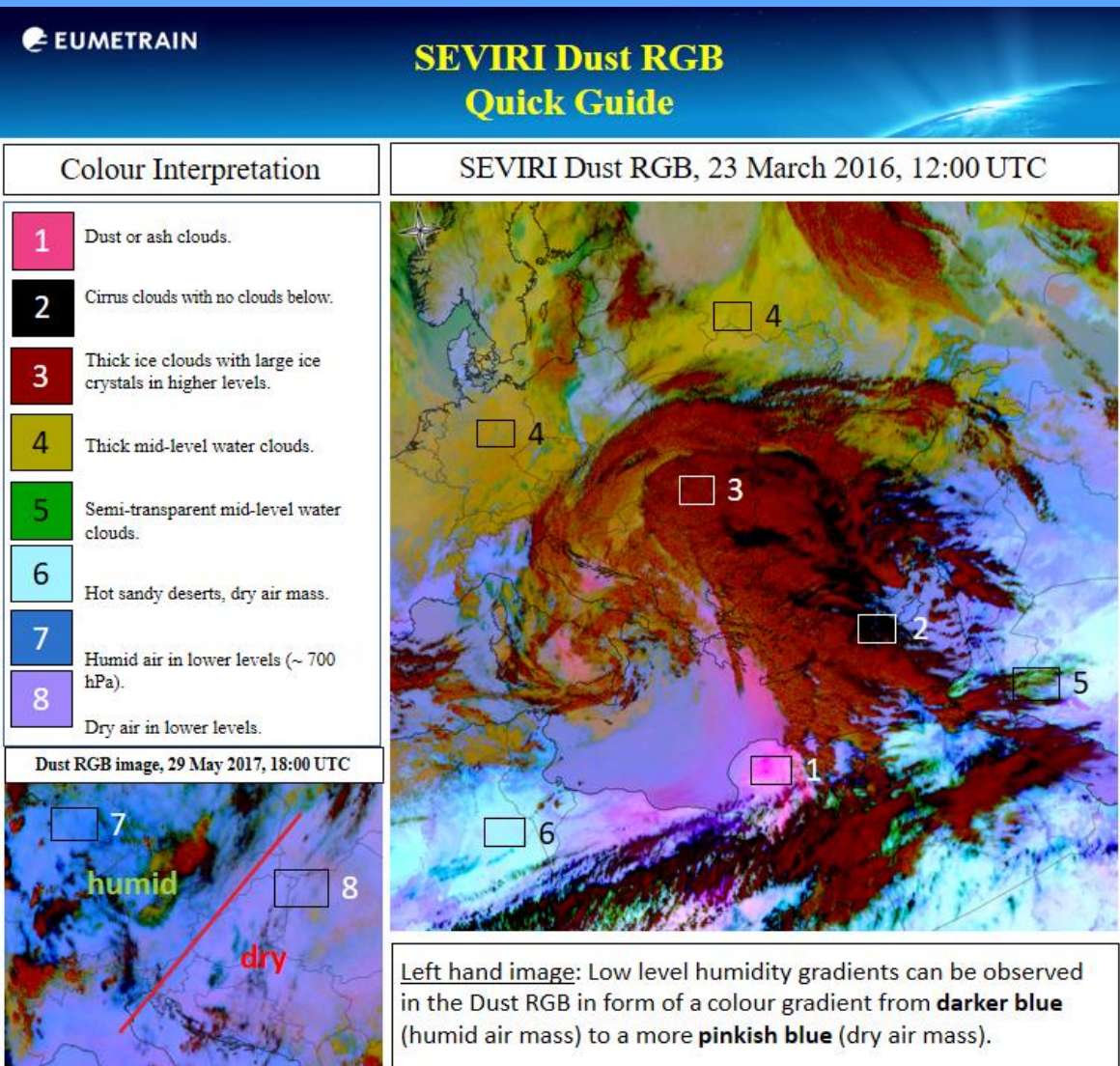
- Meteorological Information (continued)
 - Lightning location information
 - High spatial and temporal resolution
 - Radiosonde (weather balloons)
 - Vertical profile – low spatial/temporal resolution
 - Wind and temperature, temperature, humidity
 - Profiles from ceilometers/vertical profilers
 - Cloud/Wind
 - Ceilometers at aerodromes

➤ Satellite Meteorological Information

➤ Meteosat Second Generation

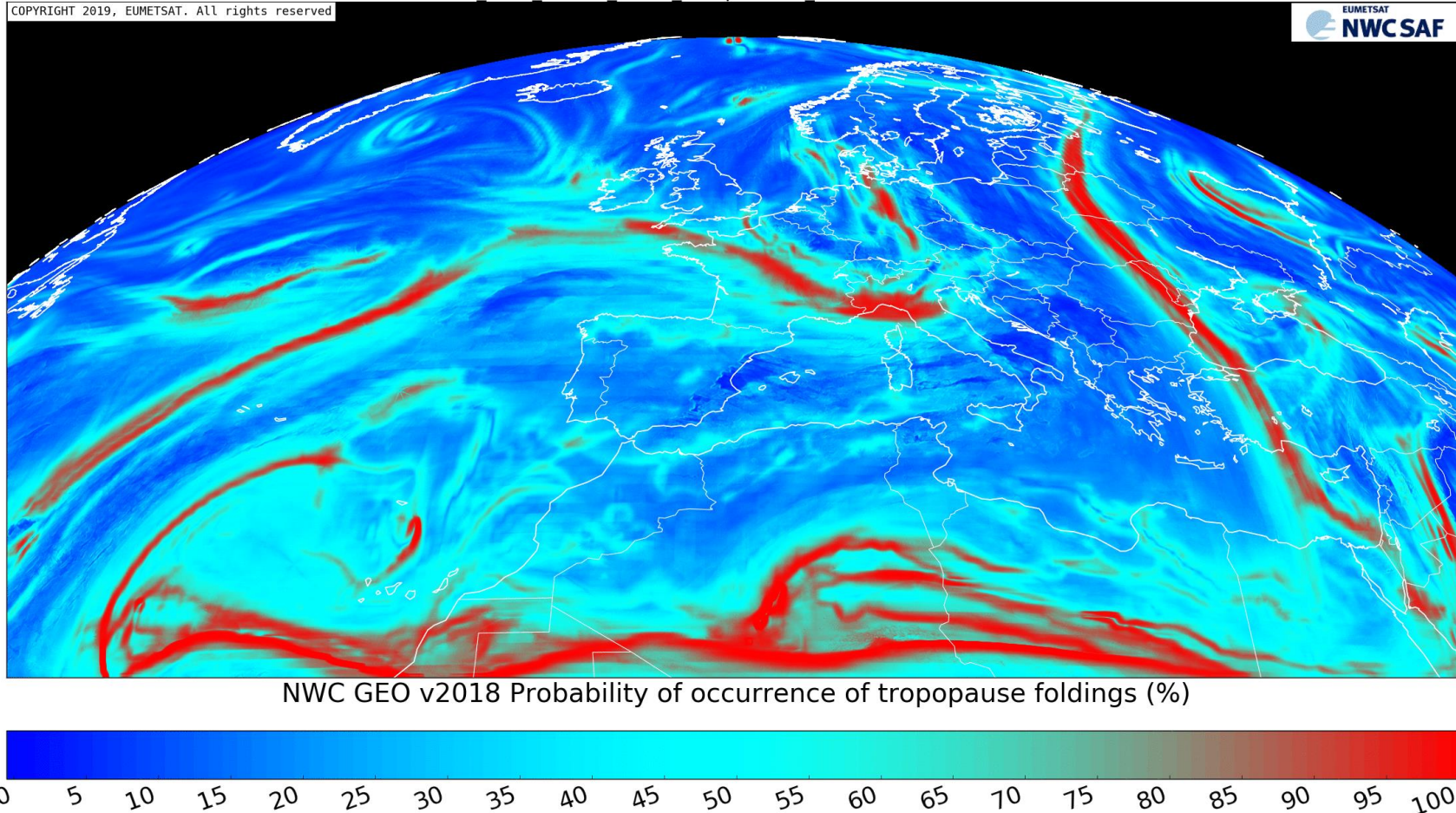
- 12 Bands (detected wavelengths)
- Including 1 higher resolution Visible channel
- Can be combined in multiple ways
 - Determine specific characteristics of cloud
 - Monitor aerosols, sea/land surfaces
- Can identify
 - Instability (areas for future convection)
 - Humidity (supports convection)
 - Wind (atmospheric motion vectors)
 - Weather systems, fronts, boundaries





Probability of occurrence of turbulence

S_NWC_ASII-TF_MSG4_Europe-VISIR_20190509T063000Z



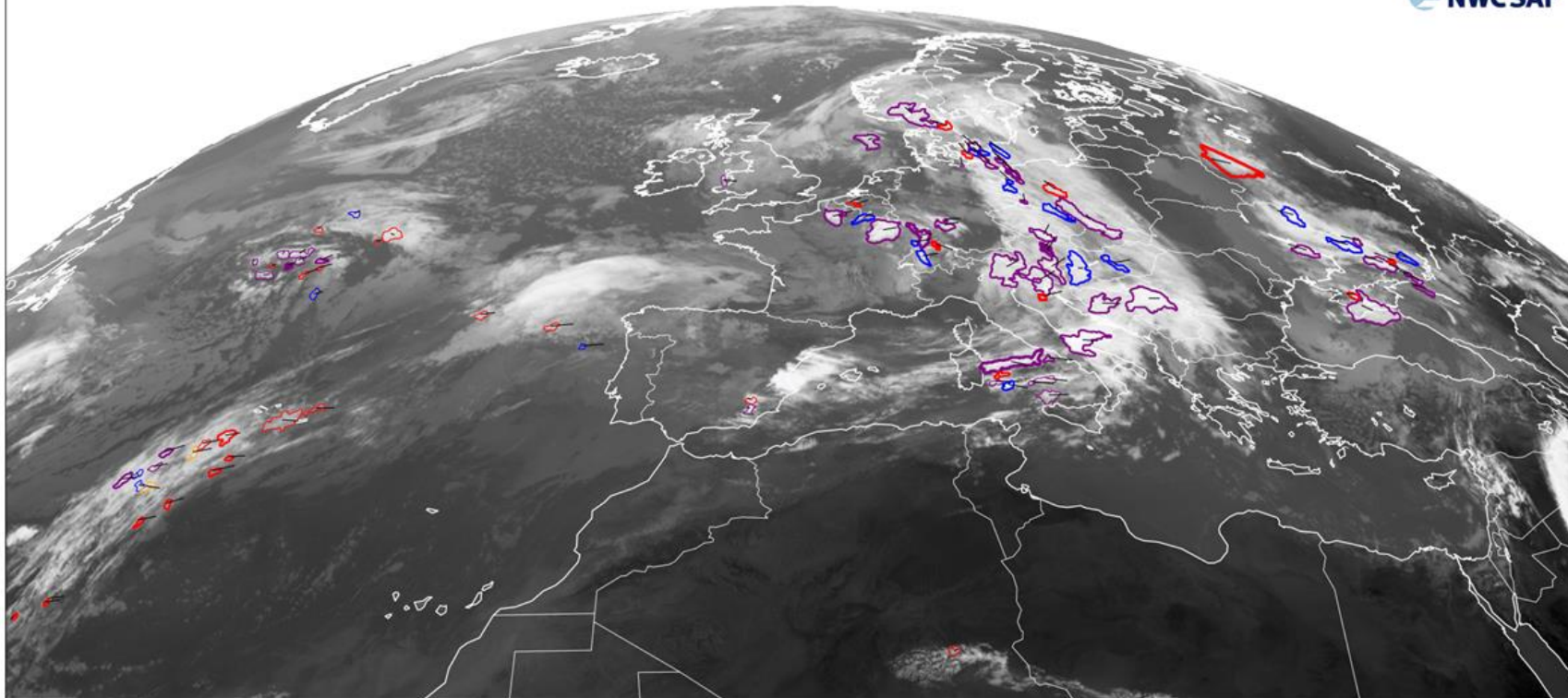
Tropopause folding can, simply, be described as a low tropopause (typically 25000-30000 FT in summer, mid latitudes) in a cold airmass undercutting a high tropopause (typically 35000-40000 FT, summer, mid latitudes) in a warm airmass with a resulting 'fold'. This is often the case along weather fronts (separating cold and warm airmasses).

Thunderstorm detection and tracking

S NWC RDT-CW MSG4 Europe-VISIR 20190509T063000Z

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EUMETSAT
NWCSAF



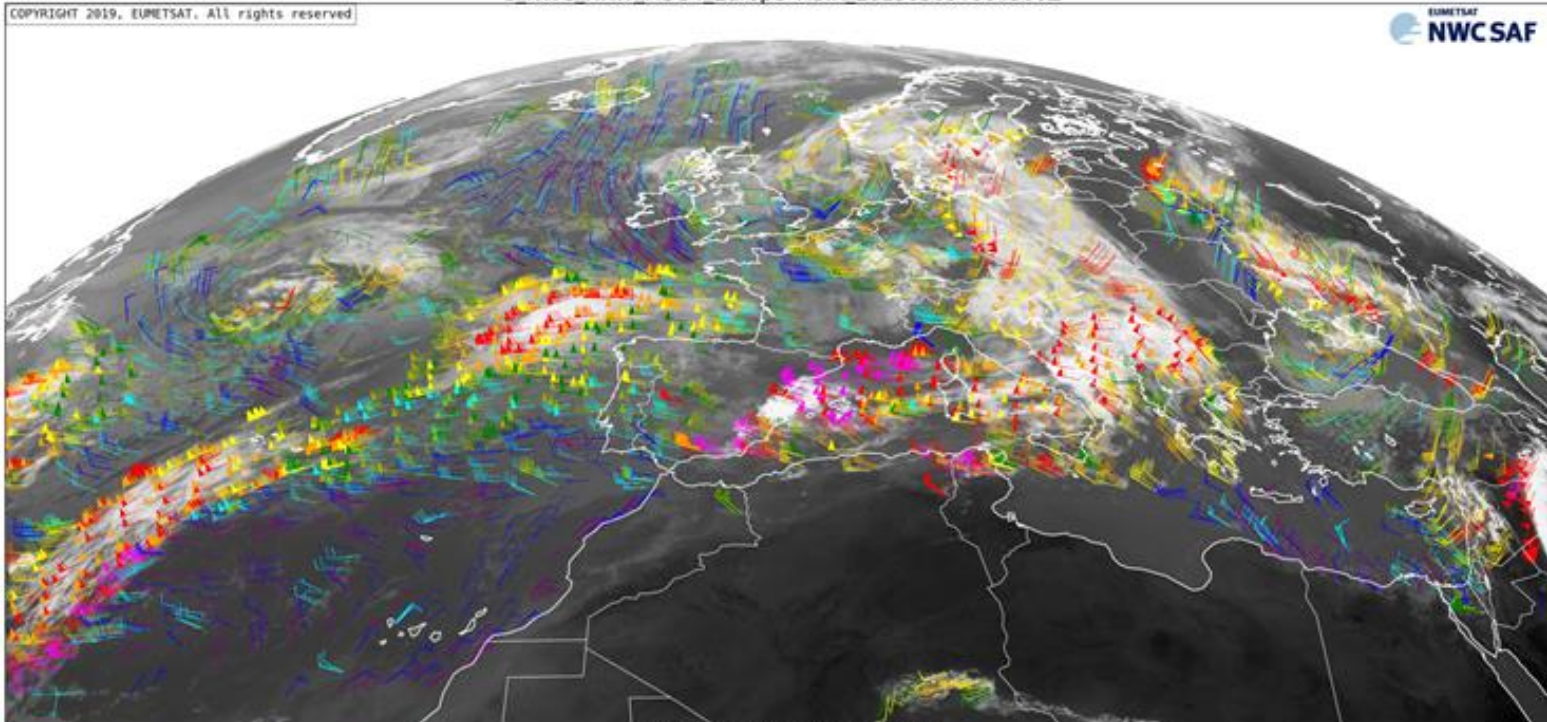
NWC GEO v2018 RDT-CW

— Triggering
 — Triggering from Split
 — Growing
 — Maturity
 — Decaying

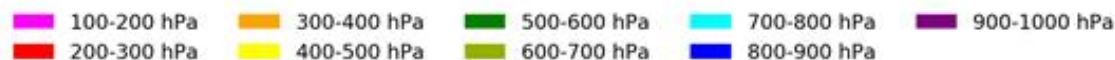
The underlying image is infra-red. Dark shades represent warm/hot, light shades represent cold. The deserts of Algeria and Libya are cloud free and hot. A mass of cloud (white, cold and therefore at high altitude) is northwest of Portugal/Spain. The different coloured contours identify the stages of thunderstorm development as per the key.

Winds determined from atmospheric motion vectors

S_NWC_HRW_MSG4_Europe-VISIR_20190509T064500Z

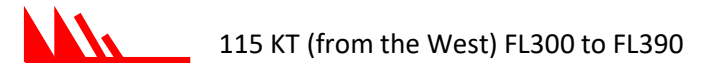


NWC GEO v2018 HRW



The colour key represents height (in pressure levels). The red colour (200-300 hPa) represents 30000 to 39000 FT (FL300 to FL390).

The key for the wind speed is such that a triangle represents 50 KT, and a single line 10 KT (half line 5KT), i.e.



Cloud features are necessary for the tracking. Over the desert areas of Algeria for example, there is no cloud and therefore no wind assessment.



- Numerical Weather Prediction (NWP, ‘Model Data’)
- Future potential for incorporating ‘model data’
 - High resolution regional models
 - ‘Nowcast models’
 - To verify/validate
 - To improve
 - To identify correlations/impacts to better inform all stakeholders



Summary

- Meteorological observations such as satellite data, ground based weather radar, lighting location data, E-AMDAR, ADS-B/Mode-S derived data – has high temporal and spatial resolution
 - **Key to address aviation safety challenges**
 - **BigData sources**
- Challenging to integrate/correlate with FDM/other traffic data
 - **D4S provides a solution, with technology, governance and dataprotection**
- Meteorological information such as TAFs, METARs, SIGMET, AIRMET remain the basis of pre- and-in flight planning
 - **Can be correlated with higher resolution meteorological data and the FDM**



Benefits

- The ‘fusion’ of **FDM** and other **aviation data of high spatial and temporal resolution** *with high resolution meteorological information* is an exciting opportunity.
 - **Identify correlations** that may not be otherwise detectable
 - Feed into **development of ‘impact’ based forecasts** - not just the raw meteorological data, but ‘what it means to the aviator’
 - **Target** research for enhancement of existing meteorological observations and forecasts for aeronautical purposes
- Aviation stakeholders benefit
- Meteorological community benefits



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