The Global Voice of Pilots

IFALPA

Fulfilling Pilots´ Associations Requirements

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ABOUT IFALPA

- Global non-profit organization representing pilot associations
- 76 Pilot Member Associations world-wide
- In excess of 120,000 pilot members
- IFALPA Headquarters in Montreal, close to ICAO

Outline

- Requirements
- The road to QVA
- Introduction to EASA §
- Requirements fulfilled ?

Main Requirements to assure safety of flights

1. **3-d predictions of volcanic clouds + time,** for real-world 4-d flight profiles
2. **continuous validation** with ground, airborne and satellite measurements
3. **aircraft sensors** for volcanic ash and SO2-clouds
4. **Pilots to be trained on QVA** as well as operation of aircraft in accordance with the SRA of the operator, which needs to be easily accessible to pilots.

For details, see backup slides.

Main Requirements to assure safety of flights

5. The **ash-info to be clearly shown, in colour,** with boundaries between charted values.

6. It is essential that the **flight track is shown** on all graphics.

7. Pilots´ ash info should have the **same information content** as that available in ground information processing and automated decision support systems.

8. **Accumulated ash** exposure of the aircraft shall be **provided to pilots,** as well as **expected ash exposure** for a flight.

For details, see backup slides.

Further measures to improve resiliance of aviation to volcanic eruption risks

a) Information on **hypothetical eruptions**

b) **Information on SO2** clouds should be published for aviation purposes.

c) **Dissimilar redundancy** should be introduced in eruption alerting. VAA and VAG are good, however, they should be supplemented by automated eruption alerts

d) **A single website** should be established by the 9 VAACs

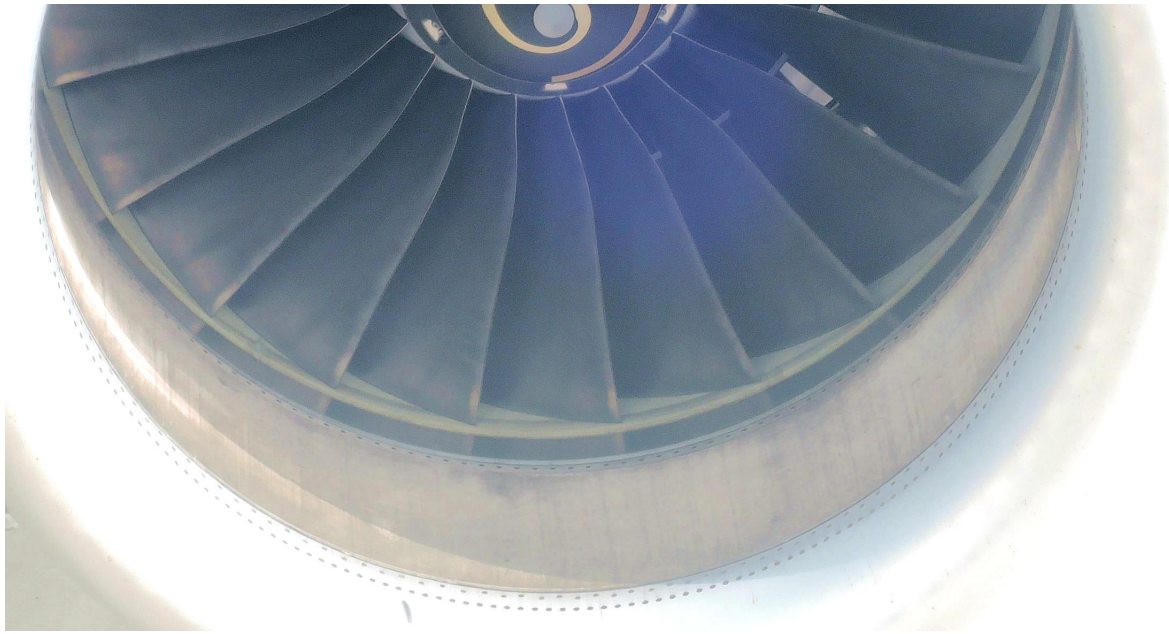
For details, see backup slides.

Geting to know Volcanic Ash

Flight experience: 1000+ km

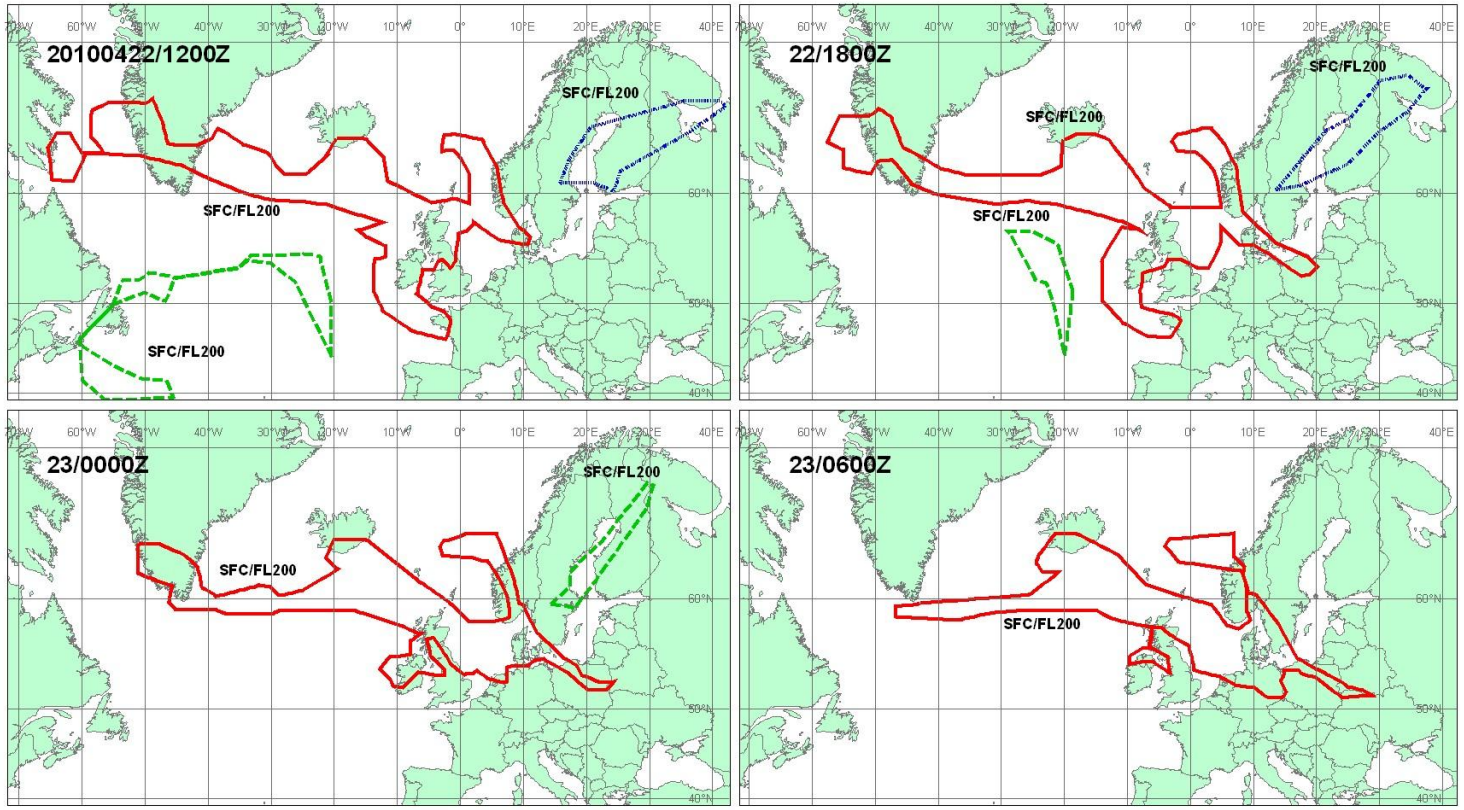
Getting to know Volcanic Ash

02 April 2016 : very dense Sahara dust over Germany



A 320 engine during the Sahara dust event

The Road to QVA



VA ADVISORY
DTG: 20100422/1200Z
VAAC: LONDON
VOLCANO:
EYJAFJALLAJOKULL 1702-02
PSN: N6338 W01937
AREA: ICELAND

SUMMIT ELEV: 1666M
ADVISORY NR: 2010/034
INFO SOURCE: ICELAND MET OFFICE
AVIATION COLOUR CODE: RED
ERUPTION DETAILS: ERUPTION CONTINUING TO AROUND FL100 TO FL120.

RMK: NO SIG ASH ABOVE FL200. ASH CONCENTRATIONS UNKNOWN. ALL PLUMES ON ALL CHARTS APPLY TO SFC TO FL200.
NXT ADVISORY: 201004221800Z

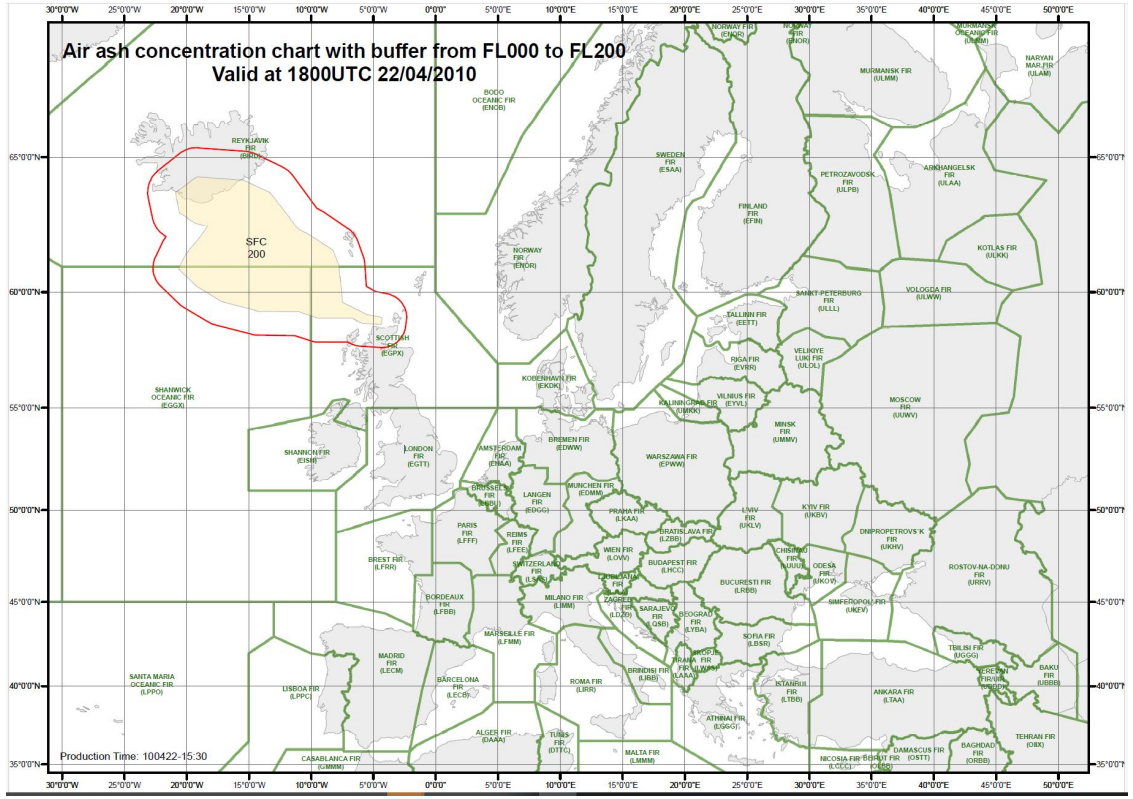
22 APR 2010

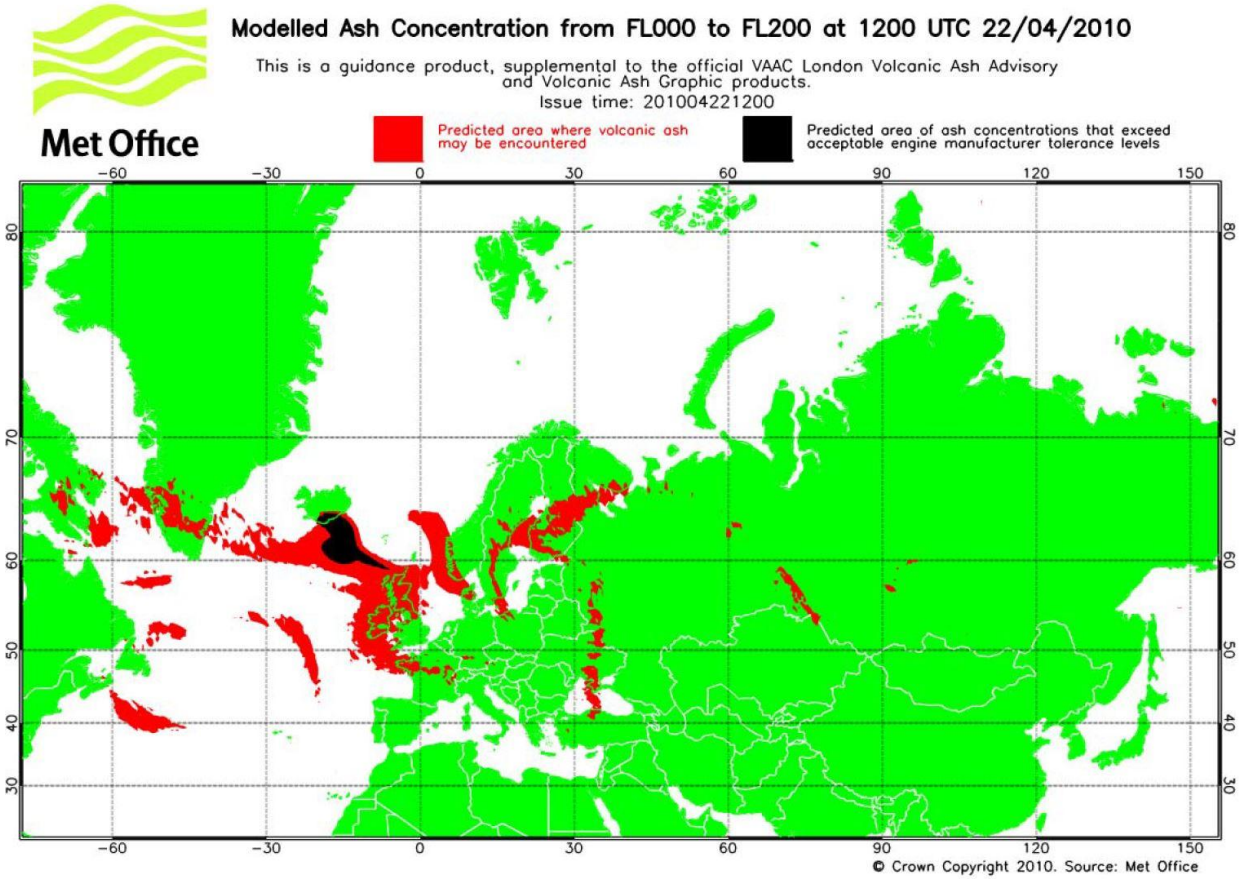
Source, historic: http://www.metoffice.gov.uk/aviation/vaac/

The Road to QVA

SAFETY. SOLIDARITY. SUSTAINABILITY.

22 APR 2010

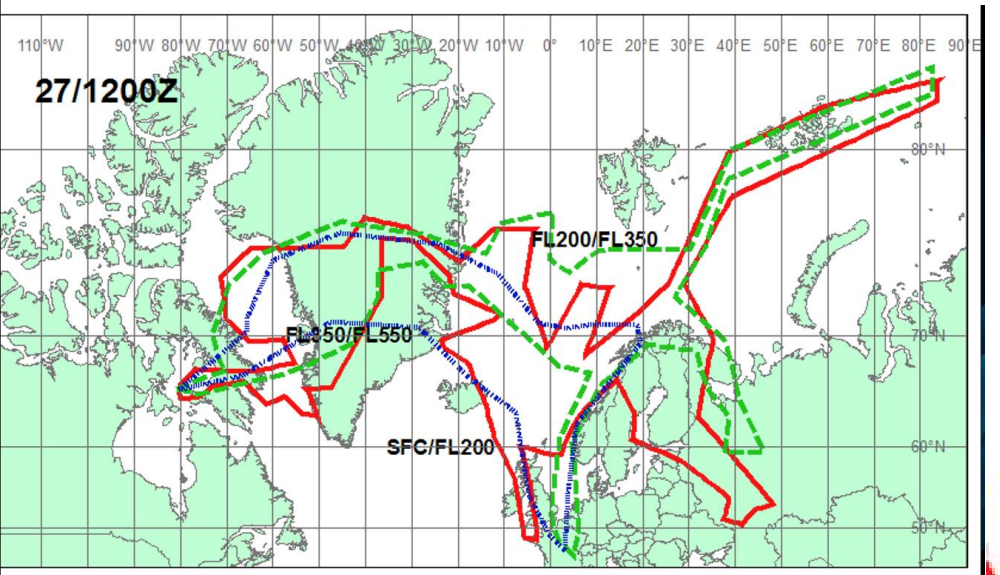




Source, historic: http://www.metoffice.gov.uk/aviation/vaac/

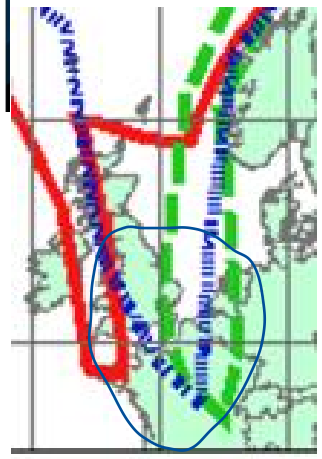
The Road to QVA
May, 2011

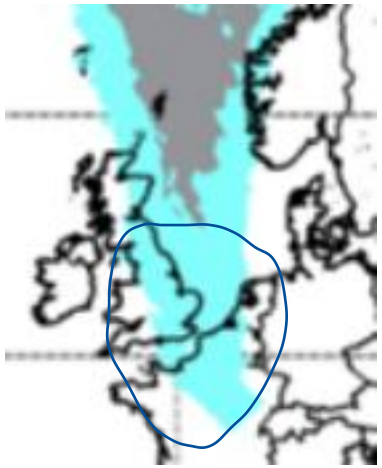
SAFETY. SOLIDARITY. SUSTAINABILITY.

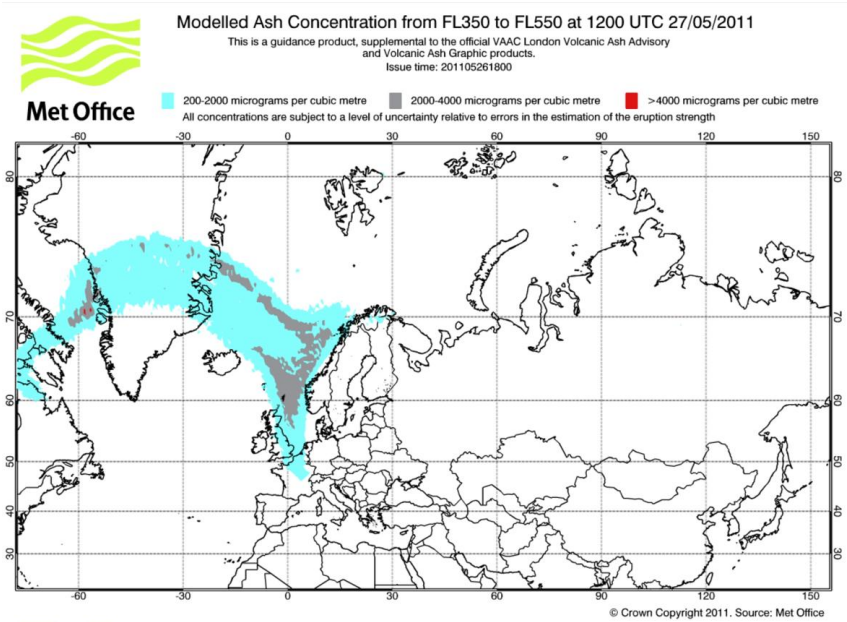


VA ADVISORY
DTG: 20110526/1800Z
VAAC: LONDON
VOLCANO: GRIMSVOTN

Note airspace made useable by ash concentration charts !



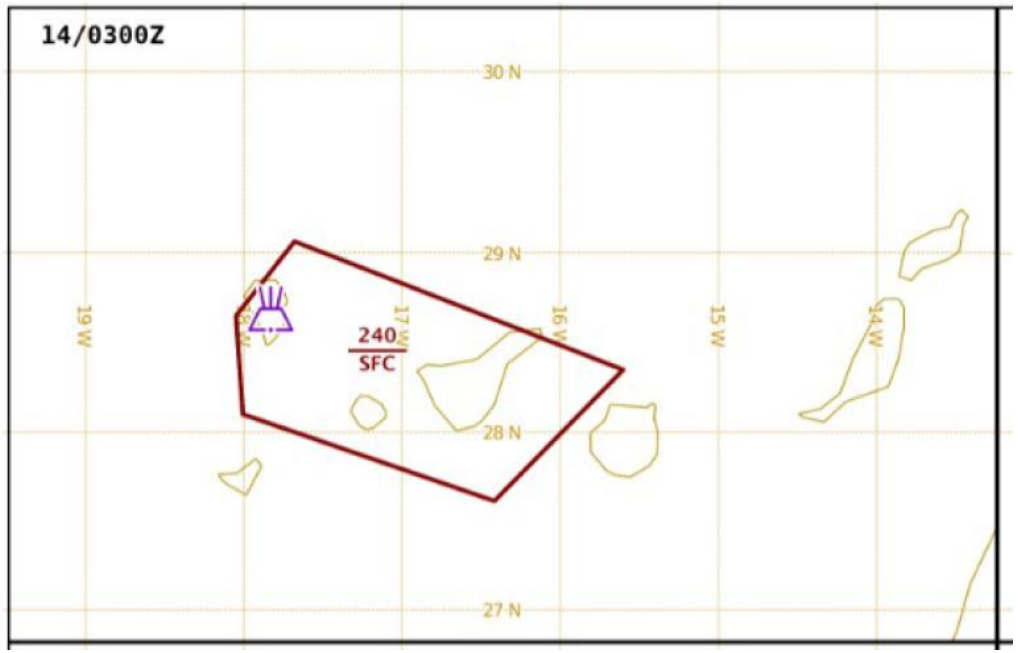


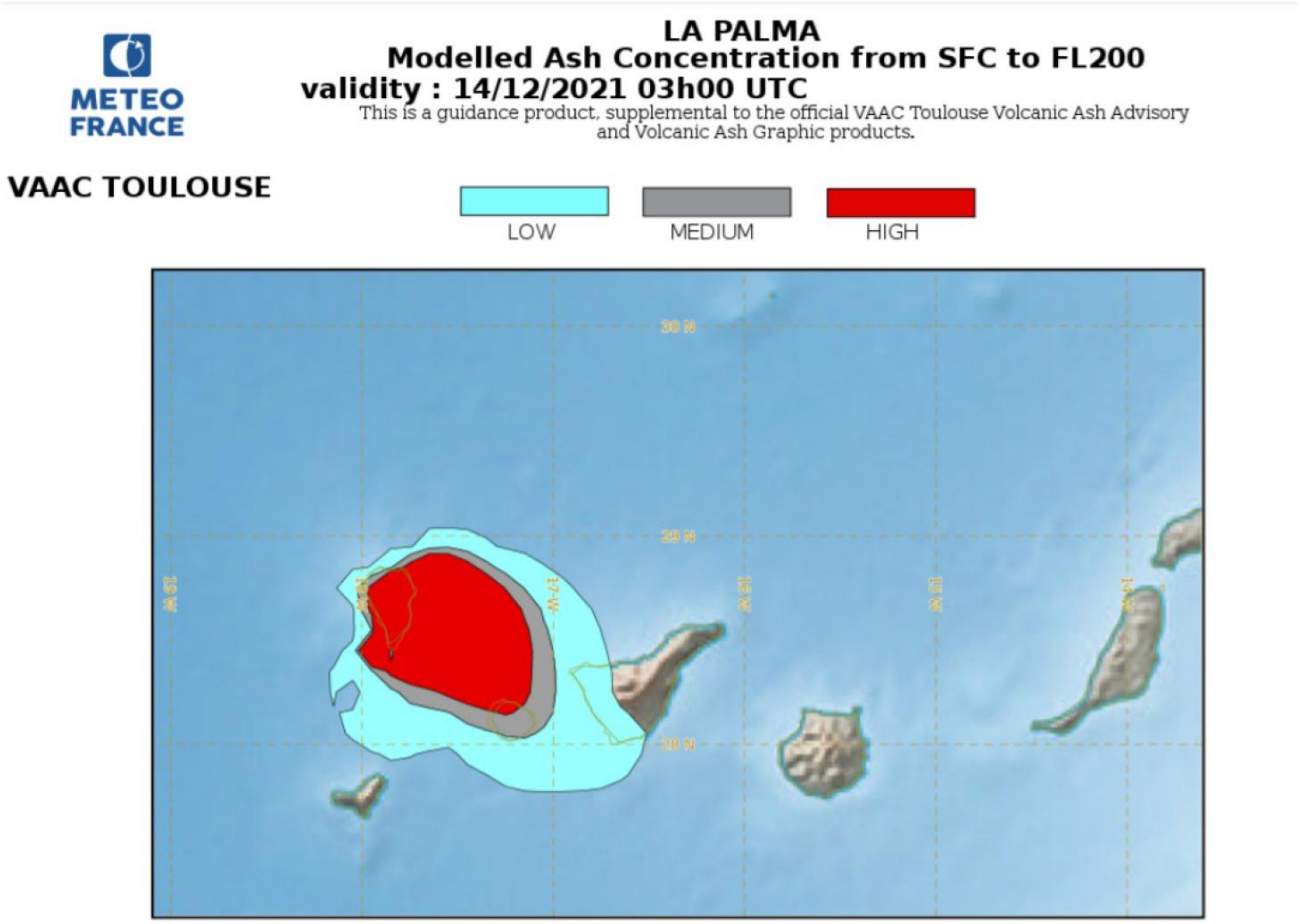


Source, historic: http://www.metoffice.gov.uk/aviation/vaac/

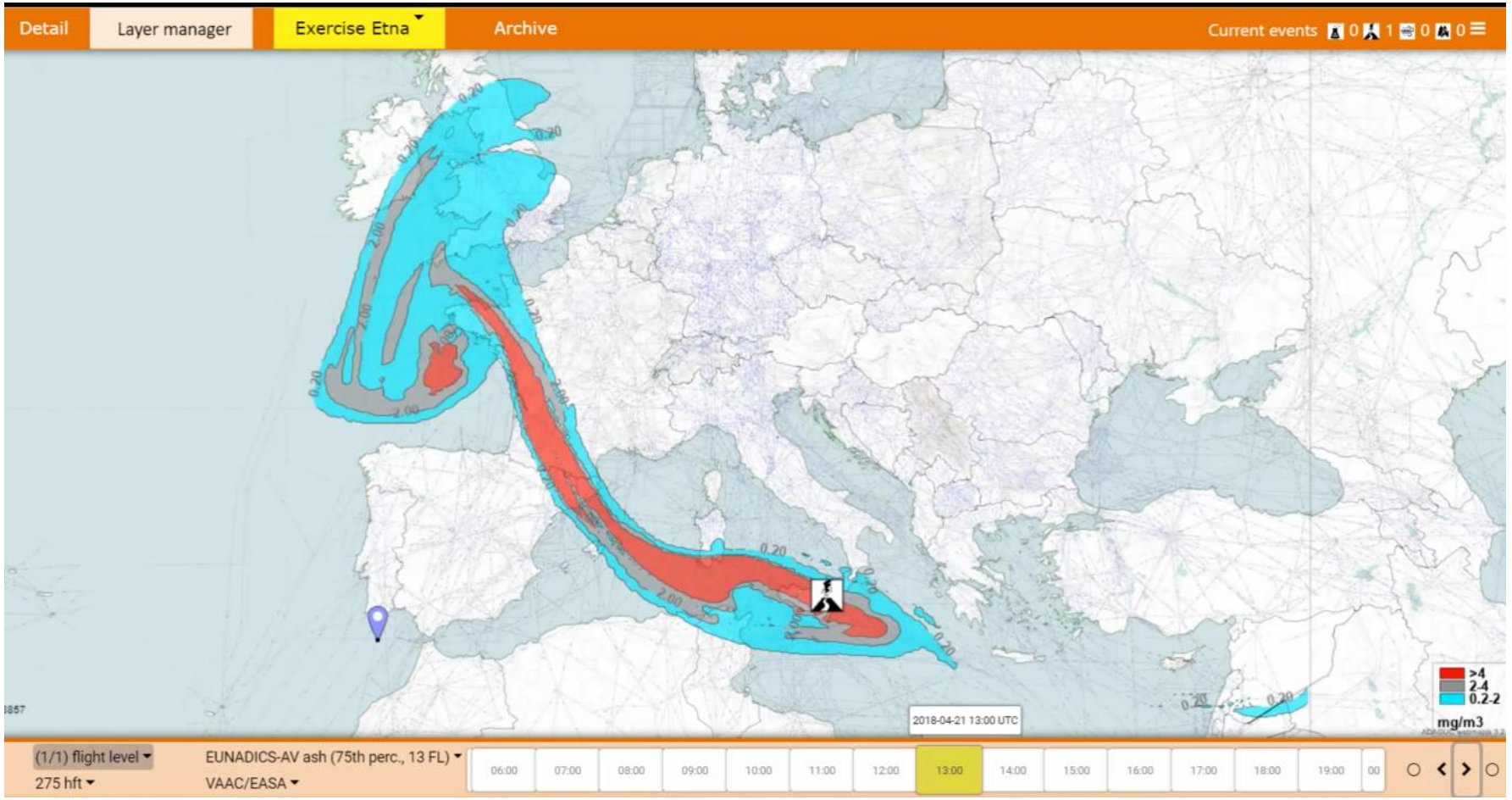
The Road to QVA

VAA for Mt. La Palma, 14 Dec 2021 AND Ash Concentration Chart





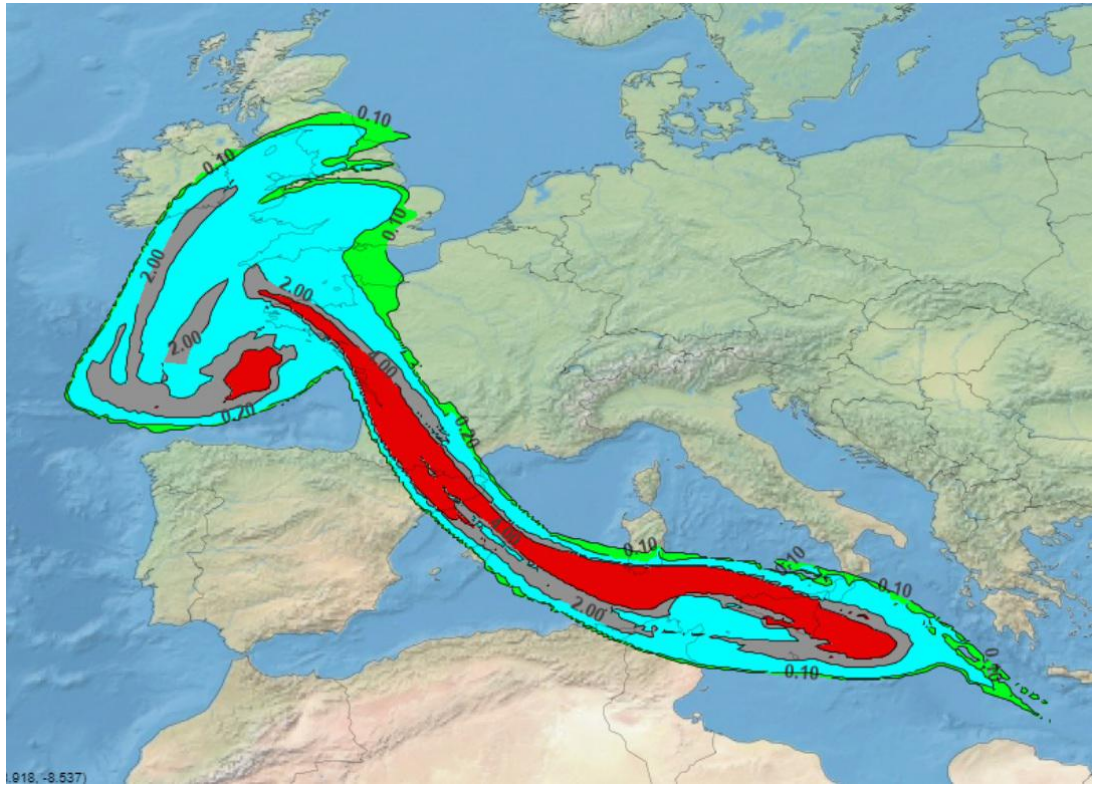
EUNADICS-AV - a research project pioneering 2016 - 2019 what´s now called ´´QVA´´ - and more

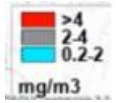


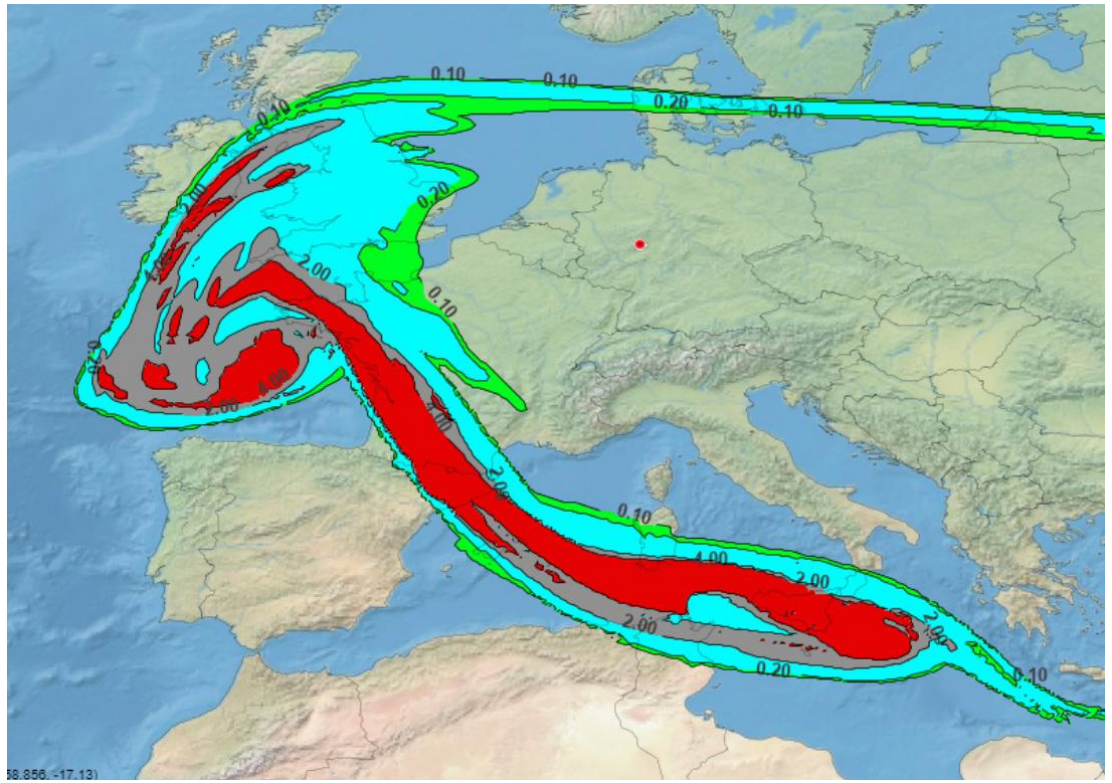
- Ash from GND to FL 650 in 13 x 5000 ft vertical blocks
- 1 hr timesteps
- probabilistic ash as median of all members of the ensemble, or 75%, or 99 % percentile , user selecteable
- concentrations as per European ash concentration charts: 0,2-2, 2-4, >4 mg/cbm or other.

Research material from European Union's Horizon 2020 EUNADICS-AV project grant agreement no. 723986
Project description: https://nhess.copernicus.org/articles/21/3367/2021/

EUNADICS-AV - a research project pioneering 2016 - 2019 what´s now called ´´QVA´´ - and more







75th percentile

99th percentile

Research material from European Union's Horizon 2020 EUNADICS-AV project grant agreement no. 723986
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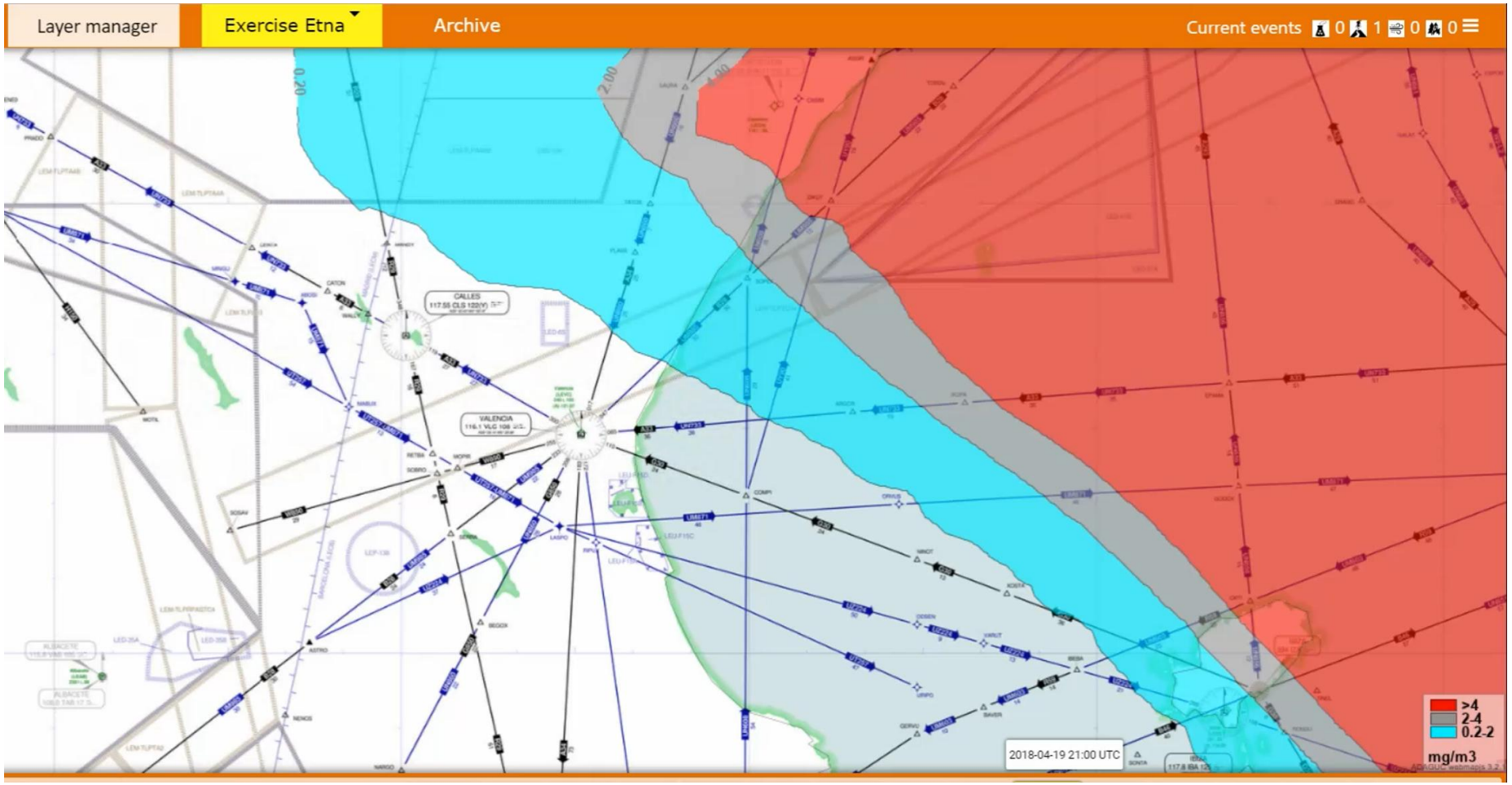

EUNADICS-AV ash
on an aviation background.

Was used on eFB,
including depiction of
aircraft
position.

Result: enhanced situation
awareness

Research material from European Union's Horizon 2020 EUNADICS-AV project grant agreement no. 723986
Project description: https://nhess.copernicus.org/articles/21/3367/2021/

EUNADICS-AV - a research project pioneering 2016 - 2019 what´s now called ´´QVA´´ - and more

EUNADICS-AV concluded with a ´´live´´ exercise that included flying planned trjectories around / through ash that was displayed to the pilot.

Research material from European Union's Horizon 2020 EUNADICS-AV project grant agreement no. 723986
Project description: https://nhess.copernicus.org/articles/21/3367/2021/

Some EASA §, underpinning flight ops with ash concentration charts

SAFETY. SOLIDARITY. SUSTAINABILITY.

EASA
European Union Aviation Safety Agency

Certification Specifications and Acceptable Means of Compliance for Large Aeroplanes (CS-25)

Amendment 28

15 December 2023[1]

[1] For the date of entry into force of Amendment 28, kindly refer to ED Decision 2023/021/R in the Official Publication of EASA.

Annex to ED Decision 2023/021/R *Page 1 of 1515*

EASA, 2023.... current

CS 25.1593 Exposure to volcanic cloud hazards

(See AMC 25.1593)

The susceptibility of aeroplane features to the effects of volcanic cloud hazards must be established.

[Amdt 25/13]

AMC 25.1593 Exposure to volcanic cloud hazards

The aim of CS 25.1593 is to support operators by identifying and assessing airworthiness hazards associated with operations in contaminated airspace. Providing such data to operators will enable those hazards to be properly managed as part of an established management system.

Acceptable means of establishing the susceptibility of aeroplane features to the effects of volcanic clouds should include a combination of experience, studies, analysis, and/or testing of parts or sub-assemblies.

Information necessary for safe operation should be contained in the unapproved part of the flight manual, or other appropriate manual, and should be readily usable by operators in preparing a safety risk assessment as part of their overall management system.

(2) The nature and severity of effects.

(3) Details of any device or system installed on the aeroplane that can detect the presence of volcanic cloud hazards (e.g. volcanic ash (particulate) sensors or volcanic gas sensors).

(4) The effect of volcanic ash on operations to/from contaminated aerodromes. In particular, deposits of volcanic ash on a runway can lead to degraded braking performance, most significantly if the ash is wet.

(5) The related pre-flight, in-flight and post-flight precautions to be observed by the operator including any necessary amendments to Aircraft Operating Manuals, Aircraft Maintenance Manuals, Master Minimum Equipment List/Dispatch Deviation, or equivalents required to support the operator. Pre-flight precautions should include clearly defined procedures for the removal of any volcanic ash found on parked aeroplanes.

(6) The recommended continuing airworthiness inspections associated with operations in volcanic cloud contaminated airspace and to/from volcanic ash-contaminated aerodromes; this may take the form of Instructions for Continued Airworthiness or other advice.

[Amdt 25/13]
[Amdt 25/18]

VA information
for safe operation
to be in the flight manual

To be considered:

ash detectors and volcanic gas sensors installed

contaminated aerodrome ops, including braking performance

pre-flight precautions like AOM amendments, MEL deviations

ash removal procedures

https://www.easa.europa.eu/en/document-library/certification-specifications/cs-25-amendment-28

Some EASA §, underpinning flight ops with ash concentration charts

European Aviation Safety Agency

Certification Specifications and Acceptable Means of Compliance for Large Aeroplanes

CS-25

Amendment 13
14 June 2013

(1) Identify the features of the aeroplane that are susceptible to airworthiness effects from volcanic clouds. These may include, but are not limited to, the following:

a. The malfunction or failure of one or more engines, leading not only to reduction or complete loss of thrust but also to failures of electrical, pneumatic, and hydraulic systems;

b. Blockage of pitot and static sensors, resulting in unreliable airspeed indications and erroneous warnings;

c. Windscreen abrasion, resulting in windscreens being rendered partially or completely opaque;

d. Fuel contamination;

e. Volcanic ash and/or toxic chemical contamination of cabin air-conditioning packs, possibly leading to loss of cabin pressurisation or noxious fumes in the cockpit and/or cabin;

f. Erosion, blockage, or malfunction of external and internal aeroplane components;

g. Volcanic cloud static discharge, leading to prolonged loss of communications; and

h. Reduced cooling efficiency of electronic components, leading to a wide range of aeroplane system failures.

(2) The nature and severity of effects.

(3) Details of any device or system installed on the aeroplane that can detect the presence of volcanic cloud hazards (e.g. volcanic ash (particulate) sensors or volcanic gas sensors).

(4) The effect of volcanic ash on operations to/from contaminated aerodromes. In particular,

Identify features susceptible to VA :

Engines

Windscreen

Fuel contamination

Air conditioning / pressurization

Blockage of components

and, and, and....

EASA, 2013.... 11 years ago

Requirements fulfilled by QVA, better than today ?

1.	3-d predictions of volcanic clouds + time	improved
2.	continuous validation	to do, essential
3.	aircraft sensors	not yet
4.	Pilots to be trained on QVA	to do, essential
5.	ash-info to be clearly shown, in colour	yes
6.	flight track is shown	yes, enabled
7.	same information content as on ground	improved
8.	Accumulated and expected ash to be provided to pilots	to do

Additional requirements (not addressed)

hypothetical eruption information, information on SO2, dissimilar redundancy in alerting, a single website for global clouds

Conclusion

- Requirements shown
- The road to QVA shown
- Introduction to EASA § given

- Requirements fulfilled ?

Partially, a lot to do with regards to Pilots´ education, the regulatory environment, assuring proper presentation of QVA to pilots and verification of QVA.

SAFETY. SOLIDARITY. SUSTAINABILITY.

Thank you very much for your attention !

Klaus Sievers
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Backup - Files

Main Requirements to assure safety of flights

SAFETY. SOLIDARITY. SUSTAINABILITY.

1. 3-d predictions of volcanic and their evolution over time ,
   to support volcanic ash information for 4-d trajectories are needed.

2. continuous validation and updating using ground, airborne
   and satellite measurements

3. aircraft should be equipped with sensors / devices that indicate
   the presence and amount of volcanic ash and SO2-clouds to pilots.

4. Pilots shall be trained with regards to flight planning with volcanic clouds
   and QVA as well as operation of aircraft when using QVA. All this in accordance
   with the SRA of the operator, which needs to be easily accessible to pilots.

Main Requirements to assure safety of flights

SAFETY. SOLIDARITY. SUSTAINABILITY.

5. The ash-information should be clearly shown on paper or electronic displays, in colour, with clear boundaries between charted values.

6. It is essential that the flight track is shown on all graphics and satellite pictures presented to pilots to facilitate determination if a flight can be performed safely.

7. The displayed ash information should have the same information content as that available in ground information processing and automated decision support systems.

8. Information limits to ash exposure of the aircraft as well as relevant accumulated dose shall be provided to pilots, as well as expected ash exposure for a flight.

Further measures to improve resiliance of aviation to volcanic eruption risks

SAFETY. SOLIDARITY. SUSTAINABILITY.

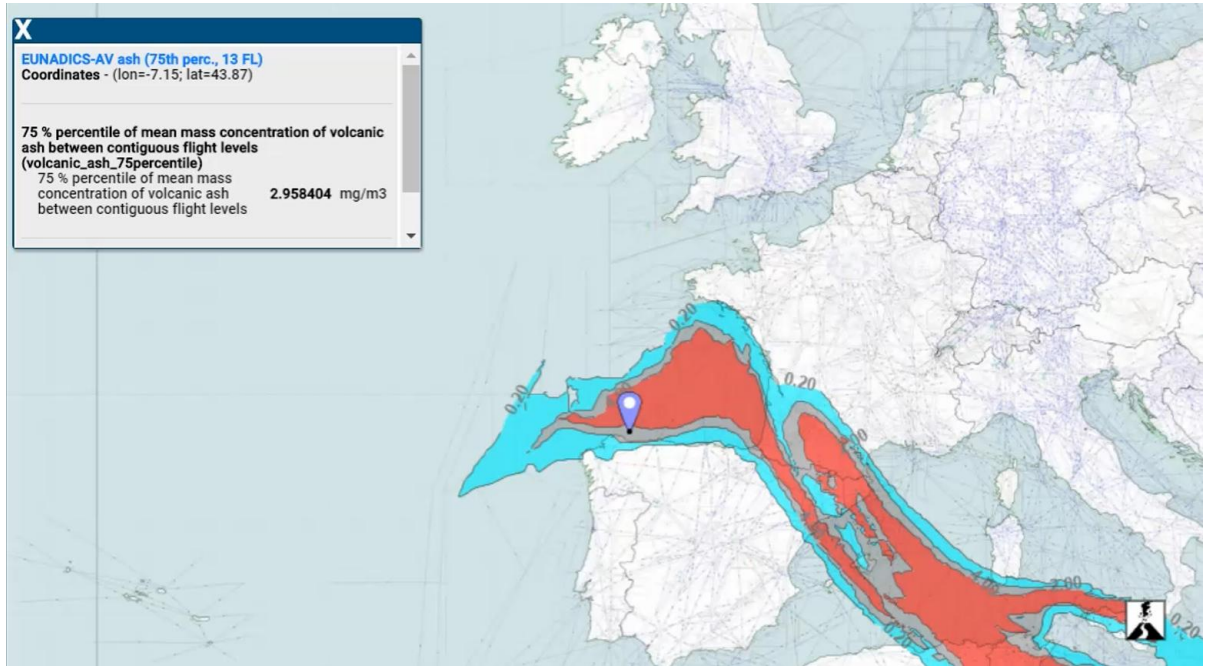
a) Information on hypothetical eruptions should be published and considered during flight planning, including diversion routes and airports.

b) Information on SO2 clouds should be published for aviation purposes.

c) Dissimilar redundancy should be introduced in eruption alerting. VAA and VAG are good , but they should be supplemented by automated eruption alerts transmitted to aircraft, directly to pilots´ eFB.

d) A single website should be established by the 9 VAACs to show all ash- and SO2-cloud related information, including valid advisories.

EUNADICS-AV - a research project pioneering 2016 - 2019 what´s now called ´´QVA´´ - and more

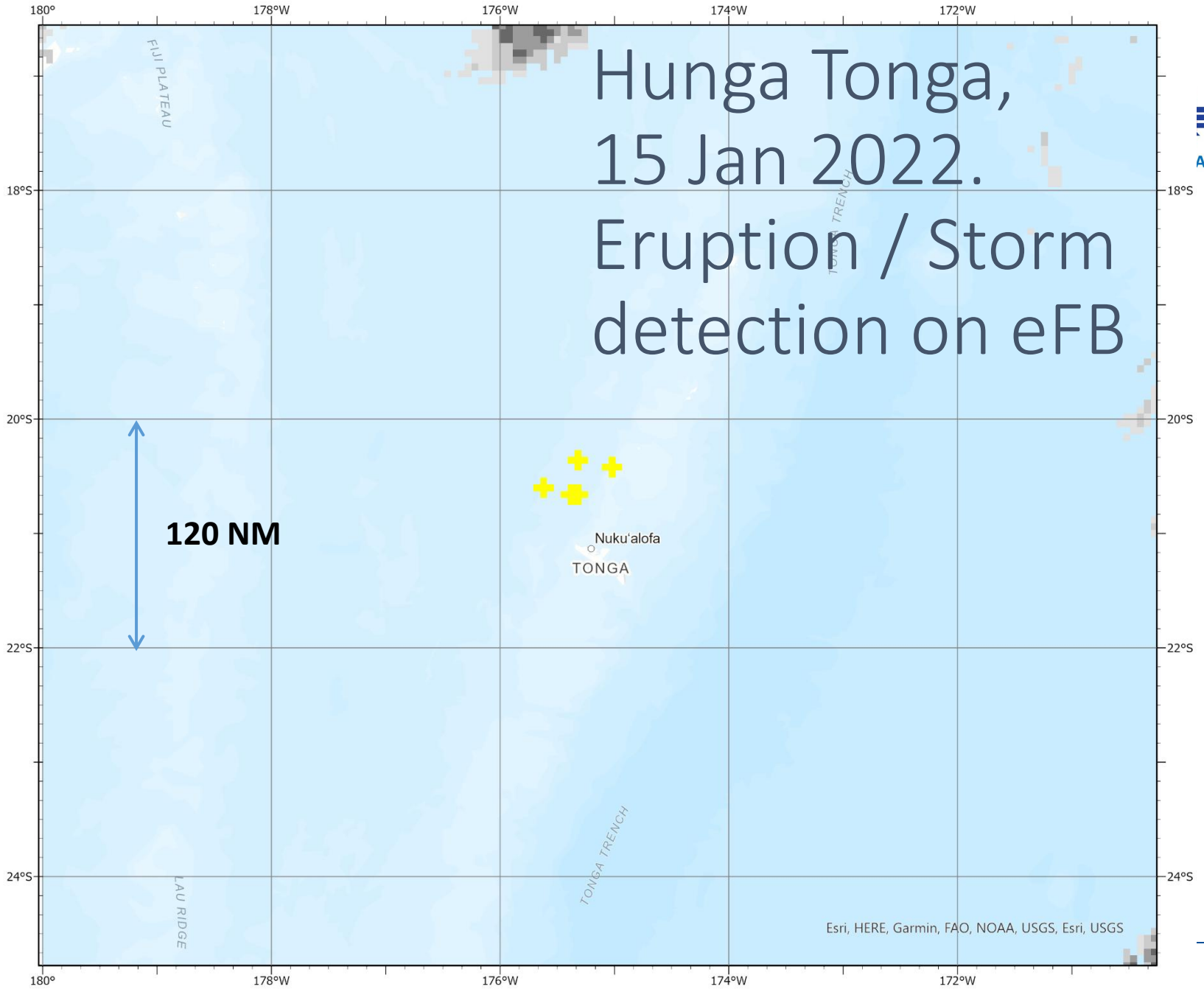


75 % percentile of mean mass concentration of volcanic ash between contiguous flight levels (volcanic_ash_75percentile)

Definition of ash concentration used in Eunadics

Research material from European Union's Horizon 2020 EUNADICS-AV project grant agreement no. 723986
Project description: https://nhess.copernicus.org/articles/21/3367/2021/

Hunga Tonga, 15 Jan 2022. Eruption / Storm detection on eFB



Cloud Top Height (CTH)

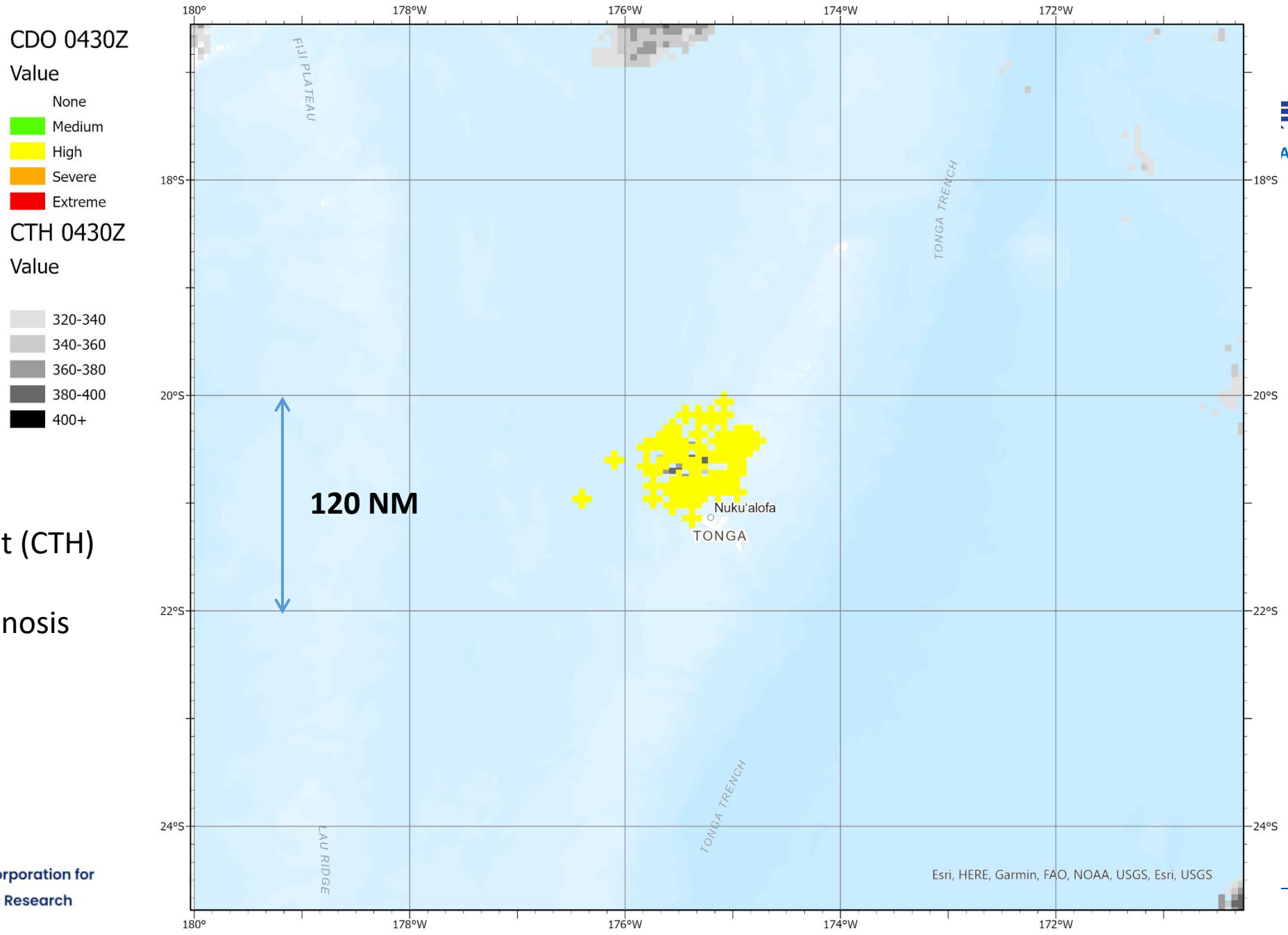
Convection Diagnosis Oceanic (CDO).

Eruption

+ 05 min.

Courtesy, Ken Stone

NCAR UCAR University Corporation for Atmospheric Research



Cloud Top Height (CTH)

Convection Diagnosis Oceanic (CDO).

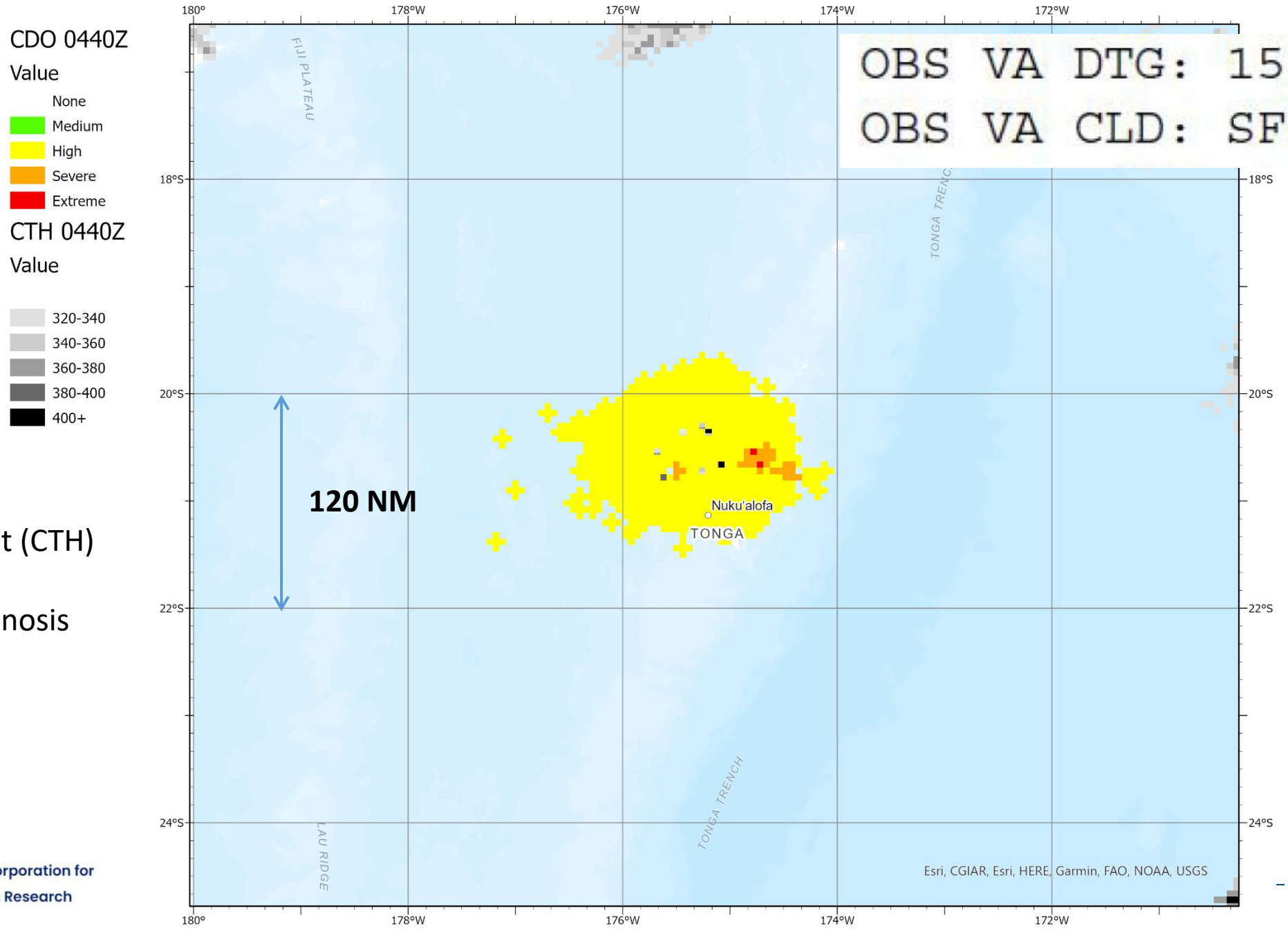
Eruption

+ 15 min.

Courtesy, Ken Stone

NCAR UCAR University Corporation for Atmospheric Research

ABILITY.



Cloud Top Height (CTH)

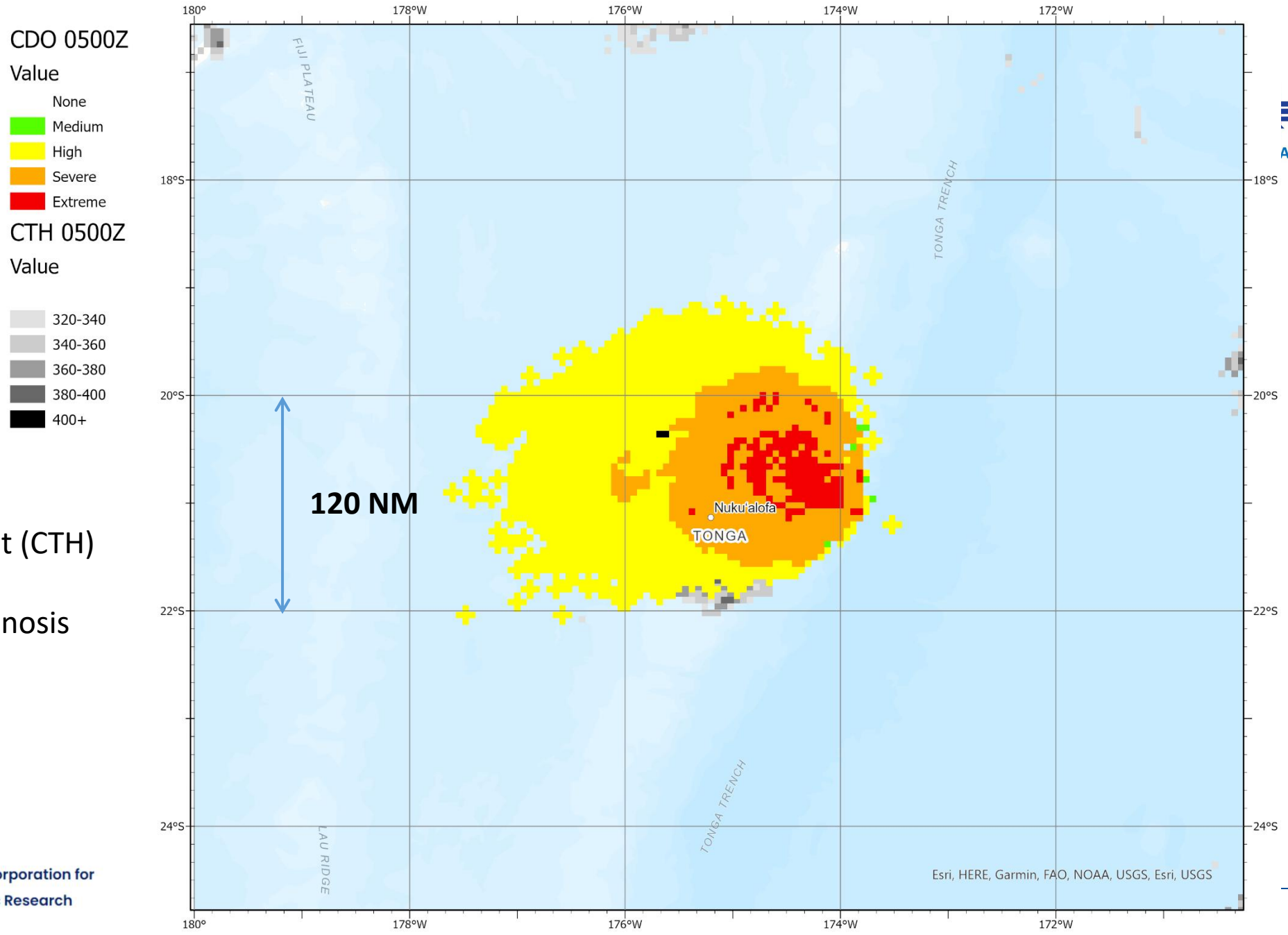
Convection Diagnosis Oceanic (CDO).

Eruption

+ 25 min.

Courtesy, Ken Stone

NCAR UCAR University Corporation for Atmospheric Research



ABILITY.

Eruption

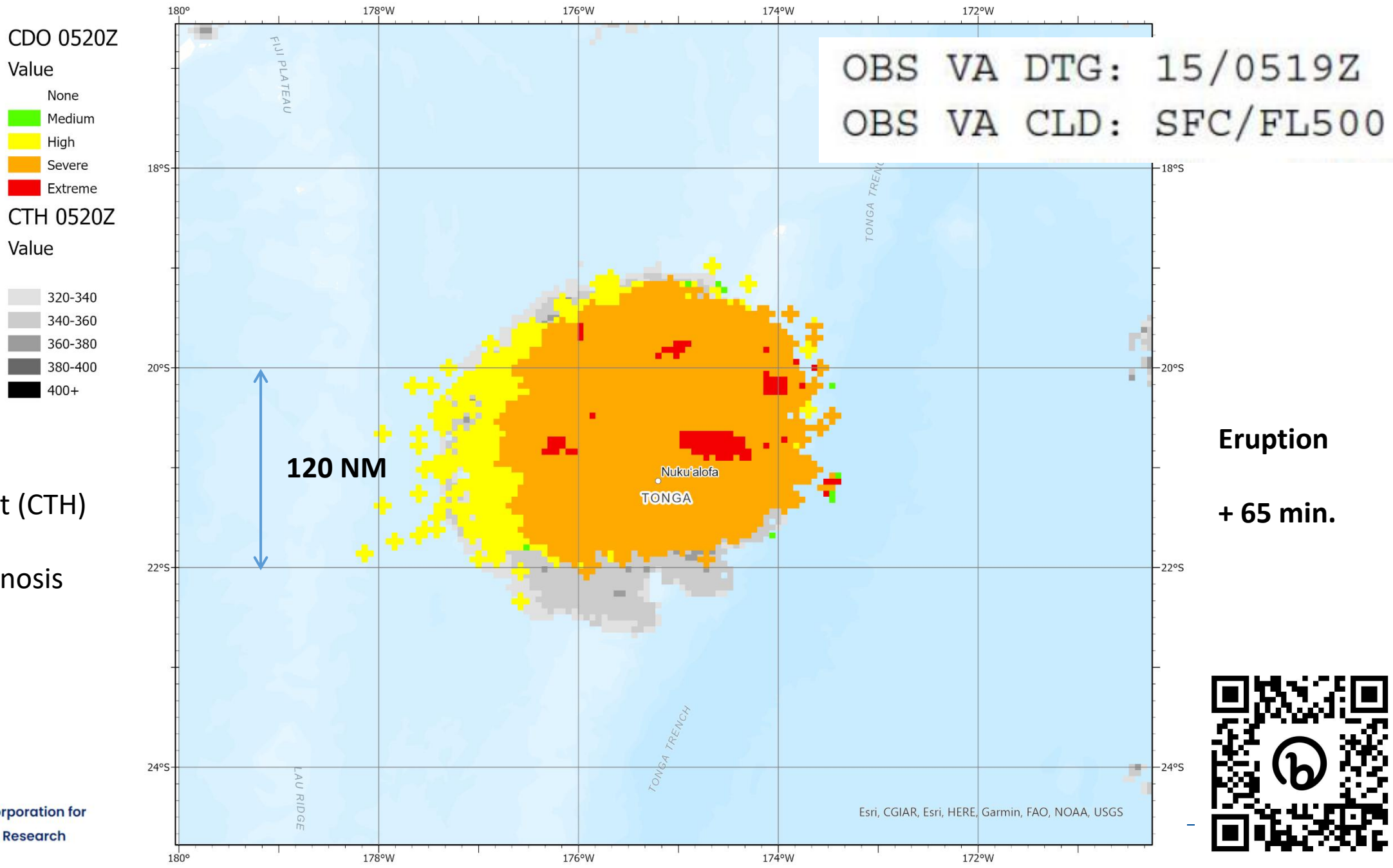
+ 45 min.

Cloud Top Height (CTH)

Convection Diagnosis Oceanic (CDO).

Courtesy, Ken Stone

NCAR UCAR University Corporation for Atmospheric Research



Cloud Top Height (CTH)

Convection Diagnosis Oceanic (CDO).

Eruption

+ 65 min.

Courtesy, Ken Stone

NCAR UCAR University Corporation for Atmospheric Research

PLEASE FOLLOW IFALPA ONLINE

SAFETY. SOLIDARITY. SUSTAINABILITY.

Thank you!

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