Turbulence in the air: creating a heat map and building a seasonal diagram

12th Montreal Industry Problem Solving Workshop

22 August 2022

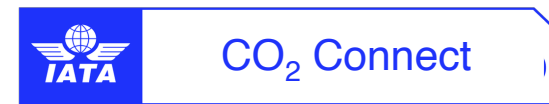Operational Data Solutions Team, IATA

Overview

1. IATA and Operational Data Solutions

2. Turbulence

3. Problem for the Workshop

4. Data for the Workshop

IATA in brief
International Air Transport Association

◆ **Global** trade association for the world's **airlines** founded in 1945, representing **83%** of global traffic.

◆ To **represent**, **lead** and **serve** the airline industry.

◆ The **IATA Operational Data Solutions Team** manages programs, platforms and products built upon aviation operational data.

IATA MRO SmartHub	IATA Turbulence Aware
IATA Aviation Safety Culture Survey (I-ASC)	IATA CO_2 Connect

◆ **Turbulence Aware** is the industry-leading live turbulence data repository.

IATA

Turbulence is

The leading cause of injuries to cabin crew and passengers in non-fatal accidents (FAA)

Costing the aviation industry hundreds of millions of dollars every year

Causing brand damage and contributing to the fear of flying

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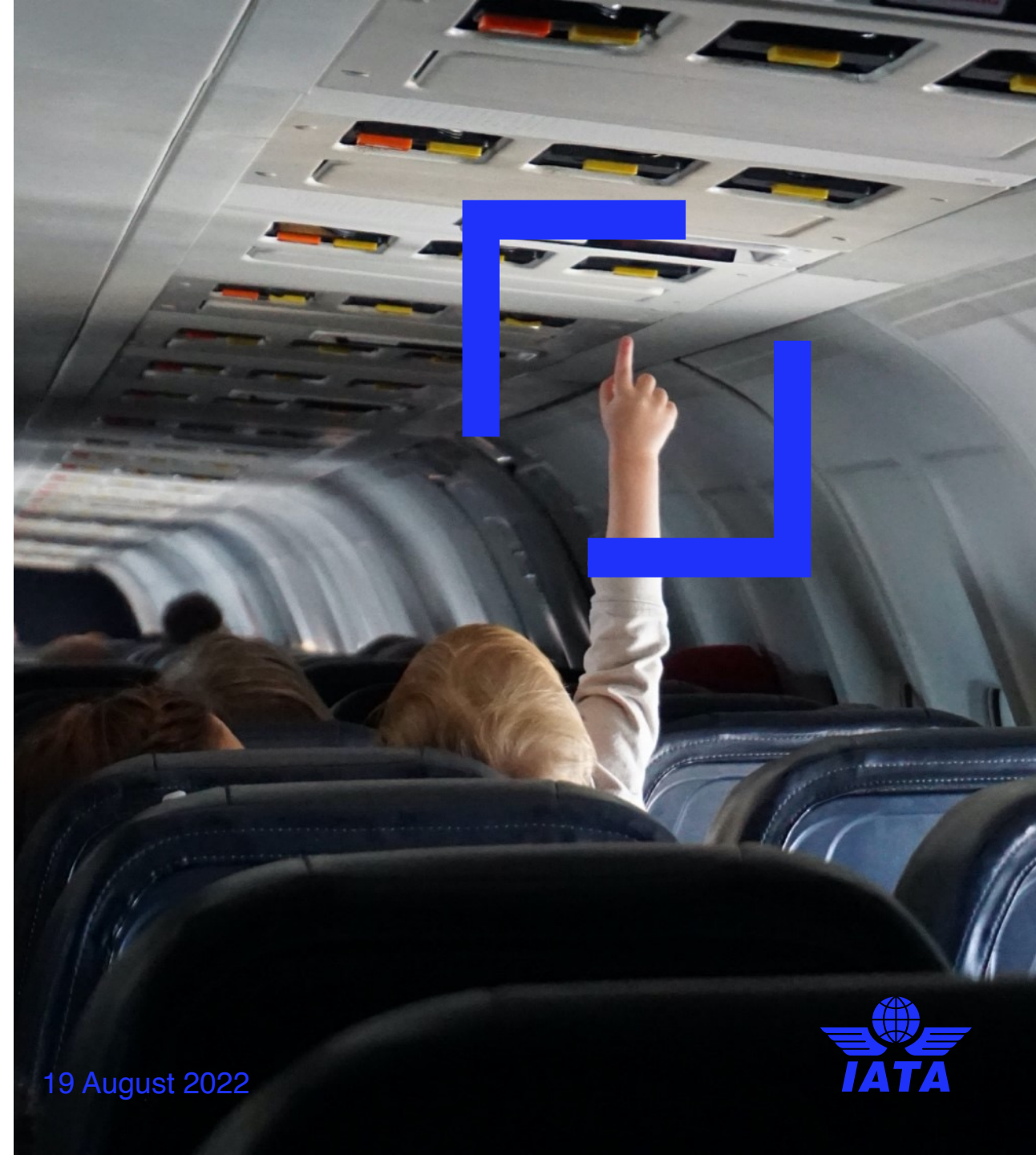
KCMH UA /OV APE 230010/TM 1516/FL085/TP BE20/SK BKN
**WX FV03SM HZ FU/TA 20/TB LGT**

- KCMH - Closest weather reporting airport (Columbus Ohio)
- UA - Routine PIREP
- /OV APE 230010 - location
one zero miles southwest of Appleton VOR
- /TM 1516 - time 1516 UTC
- /FL085 - altitude eight thousand five hundred
- /TP BE20 - aircraft type
- /SK BKN065 - base of the broken cloud layer is six thousand five hundred
- /WX FV03SM HZ FU - flight visibility 3 miles with haze a smoke
- /TA 20 - air temperature 20 degrees Celsius
- /TB LGT - light turbulence

Pilot Reports are Subjective

Light turbulence in a King Air is likely little to no turbulence in an A320
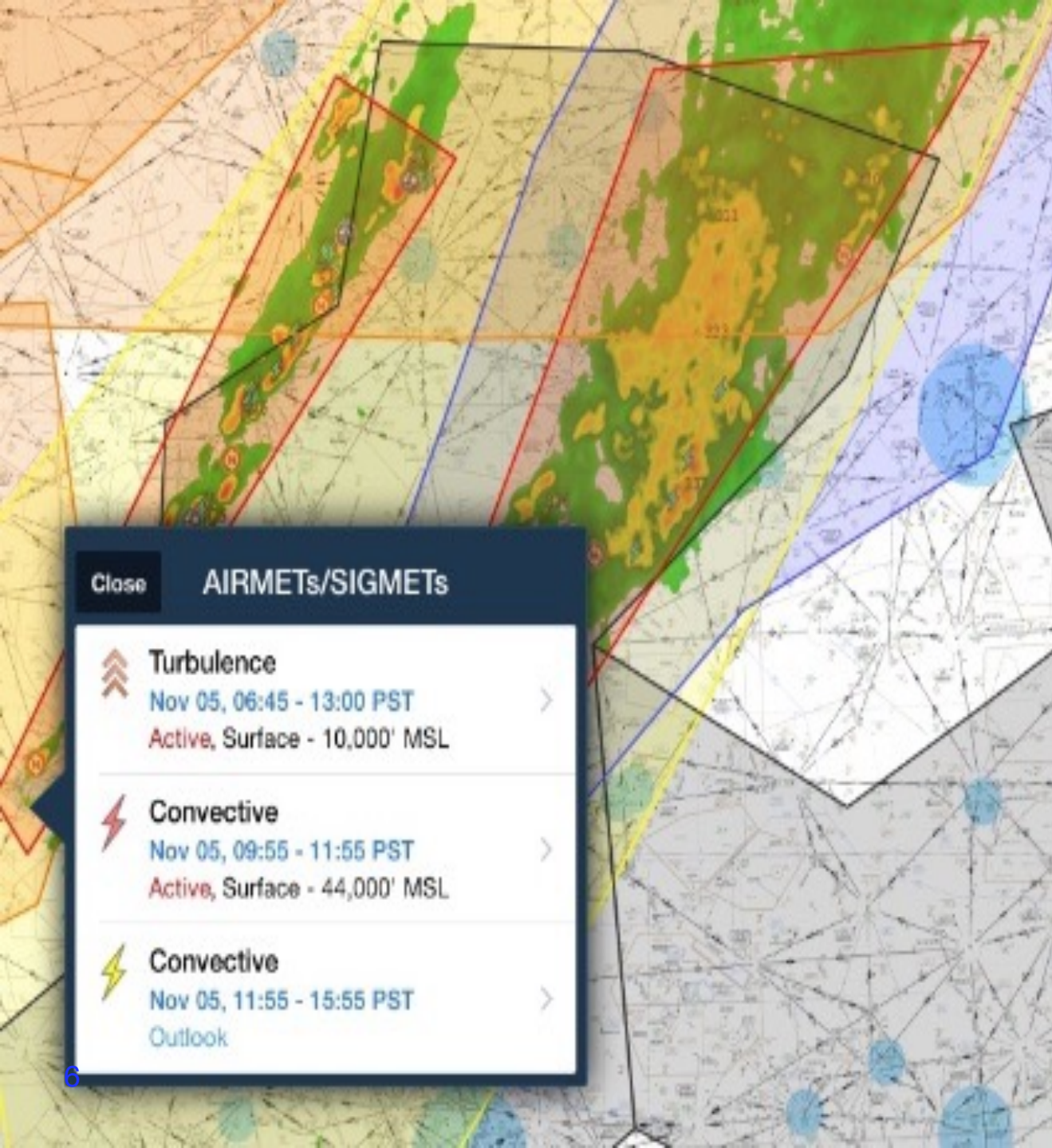
Forecasts may be inaccurate and hours old

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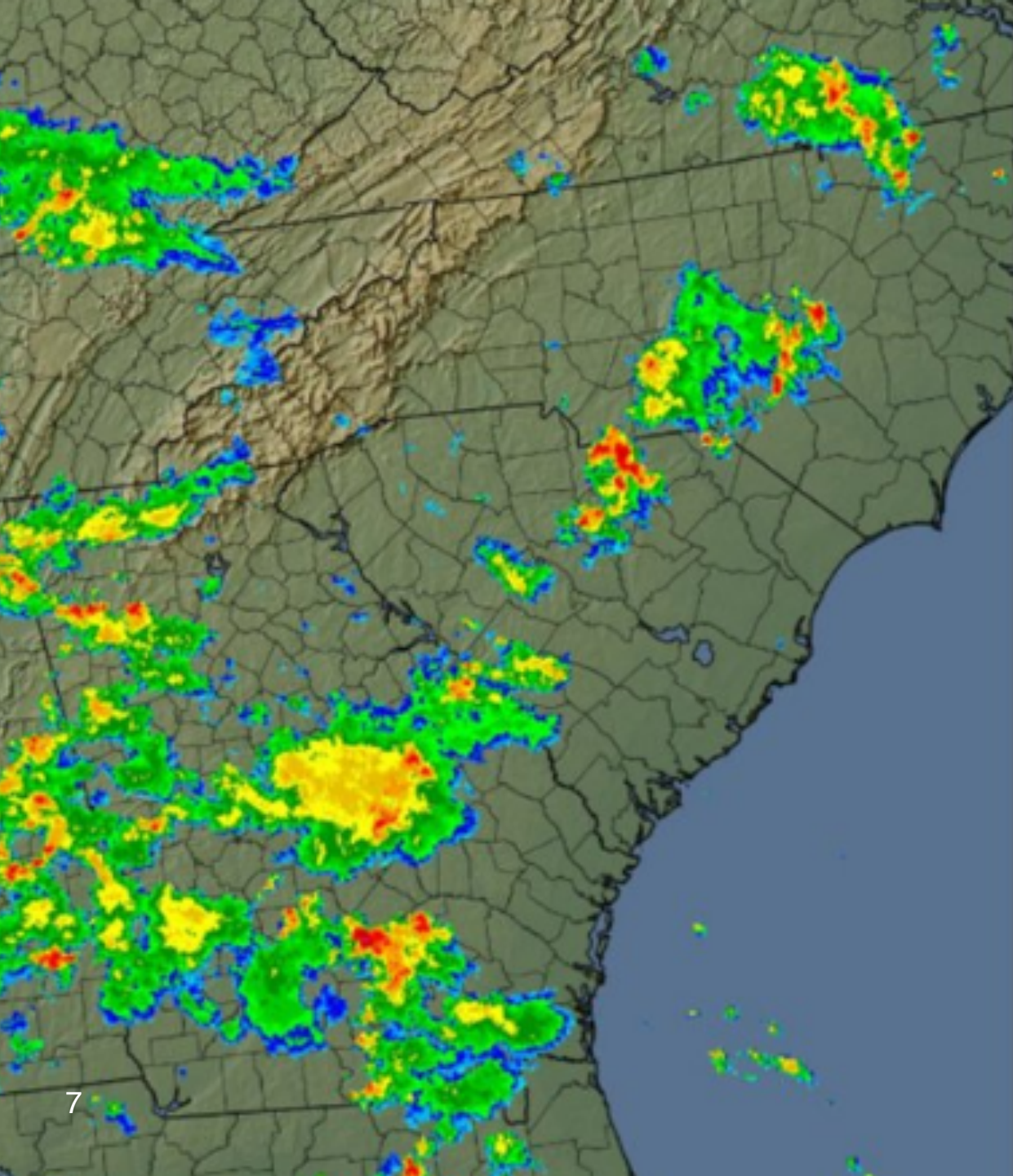
Weather radar cannot detect clear air turbulence

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Industry shift to data-driven turbulence management

Recent technical advancements now enable aircraft

to accurately calculate the turbulence state of the

atmosphere in flight

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What is real-time turbulence data?

Eddy Dissipation Rate (EDR)

- Turbulence intensity metric measuring the state of the atmosphere around an aircraft in flight

- An aircraft independent absolute value

- Simple software installation based on NCAR* v2 open source algorithm

- No hardware required to calculate EDR
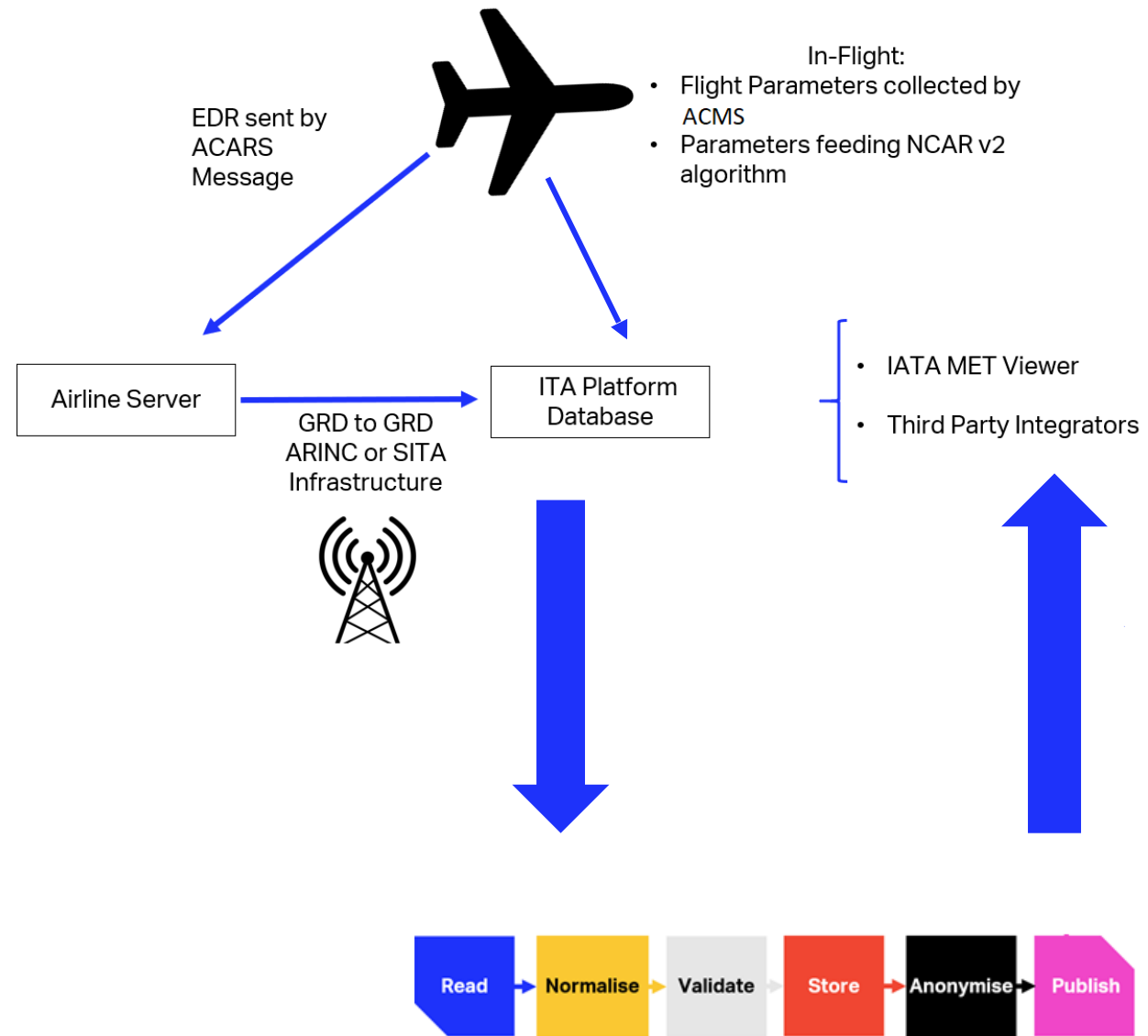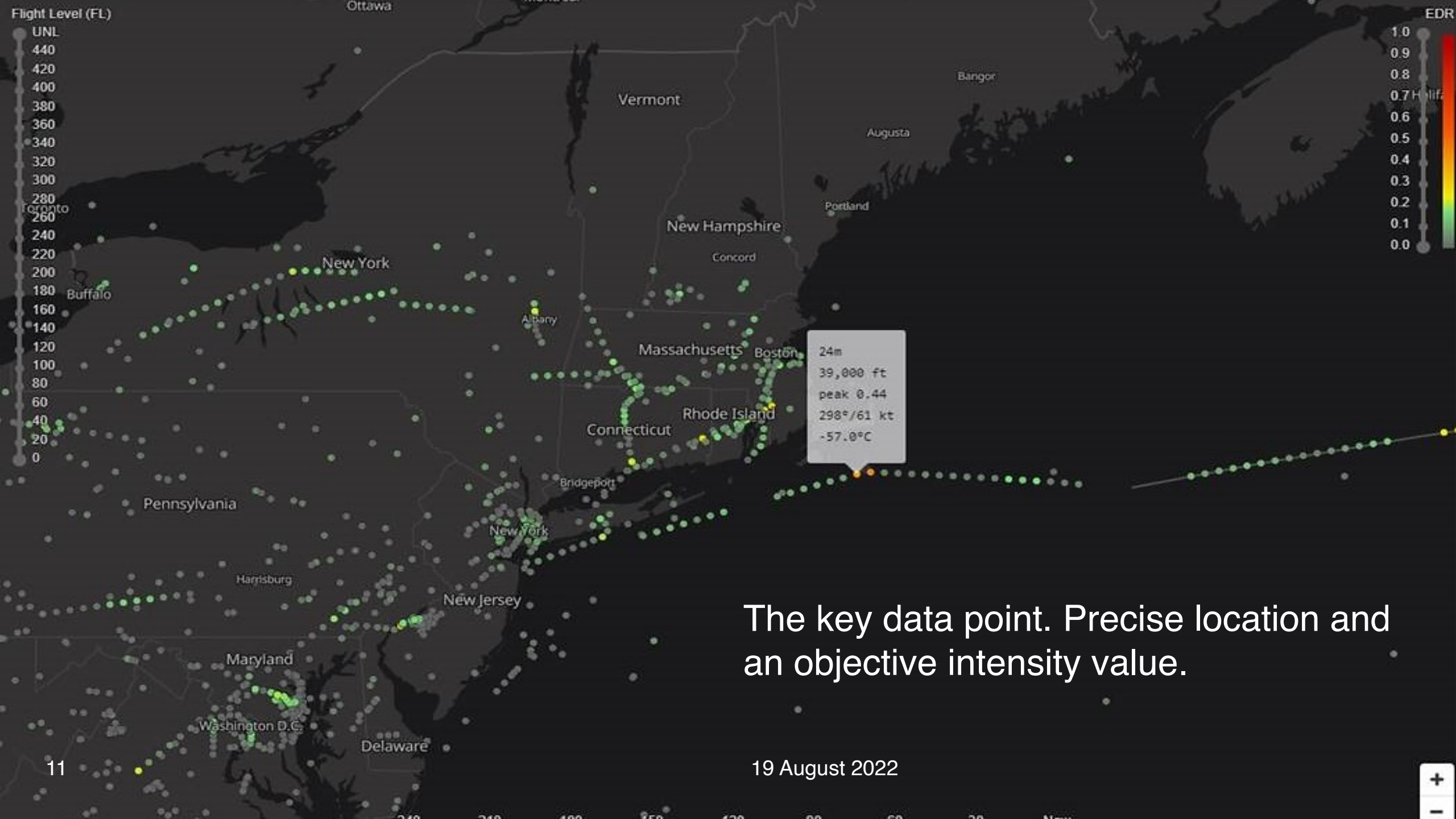
*US National Center for Atmospheric Research

Turbulence Aware

A global platform for sharing automated EDR* turbulence reports in real time

EDR sent by ACARS Message

In-Flight:
- Flight Parameters collected by ACMS
- Parameters feeding NCAR v2 algorithm

Airline Server

GRD to GRD ARINC or SITA Infrastructure

ITA Platform Database

- IATA MET Viewer
- Third Party Integrators

Read → Normalise → Validate → Store → Anonymise → Publish

* Eddy Dissipation Rate

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The key data point. Precise location and an objective intensity value.

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Problem for the Workshop

Pilots do not have the time to process raw data and must have access to summarized data, which is quicker and easier to interpret.
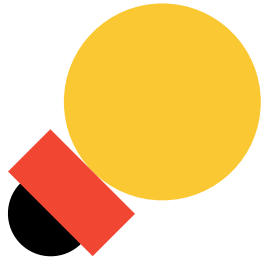
Summarized data enables pilots to take better decisions in a timely fashion.
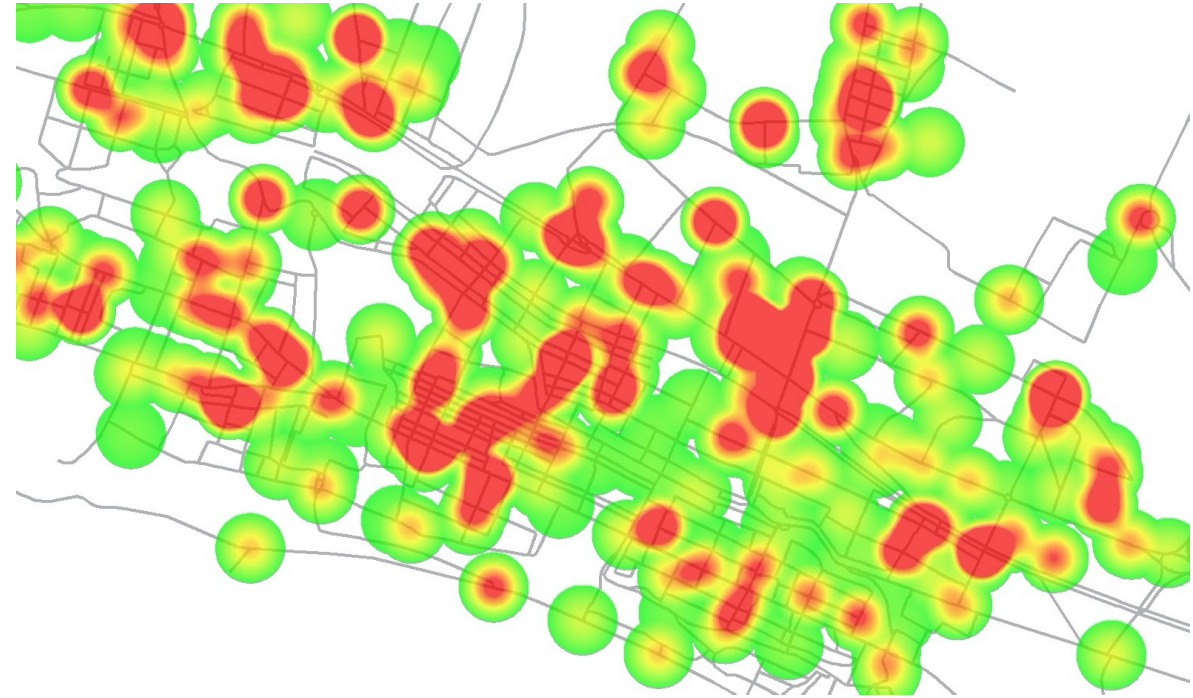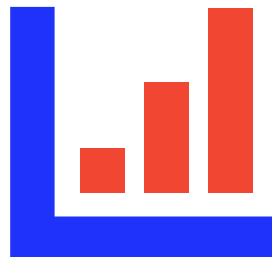
IATA
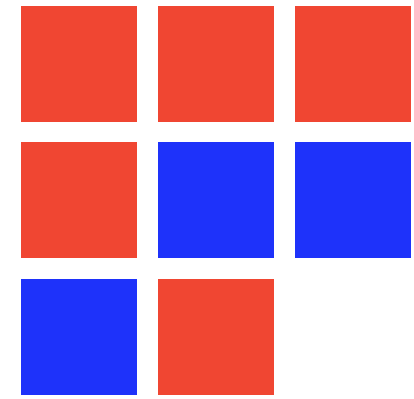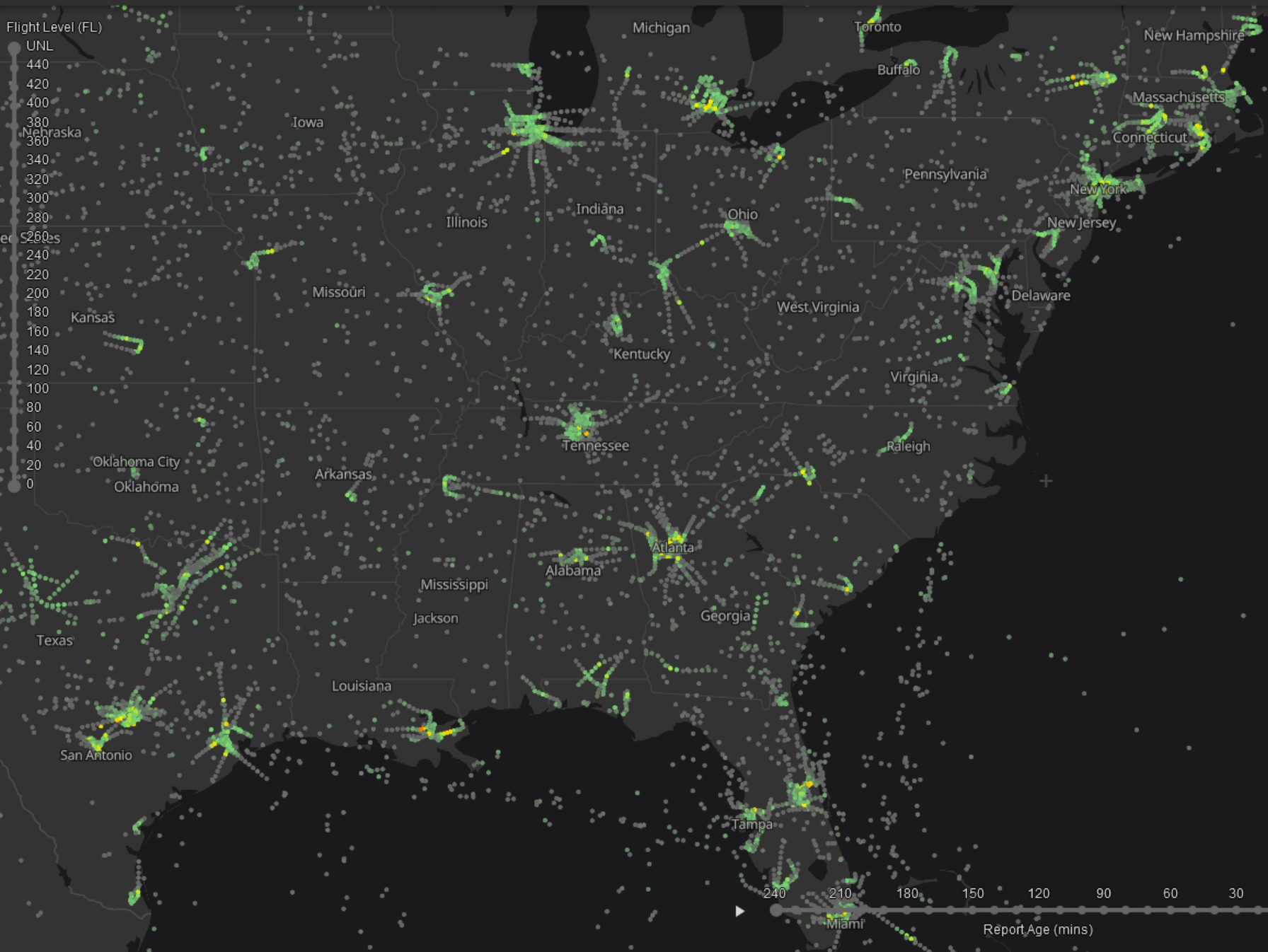
How can we condense individual live turbulence reports, so they make more sense to pilots?

Problem for the Workshop

Raw data can be distilled into a **turbulence heat map** for a given flight level and area (plus or minus 2k feet).
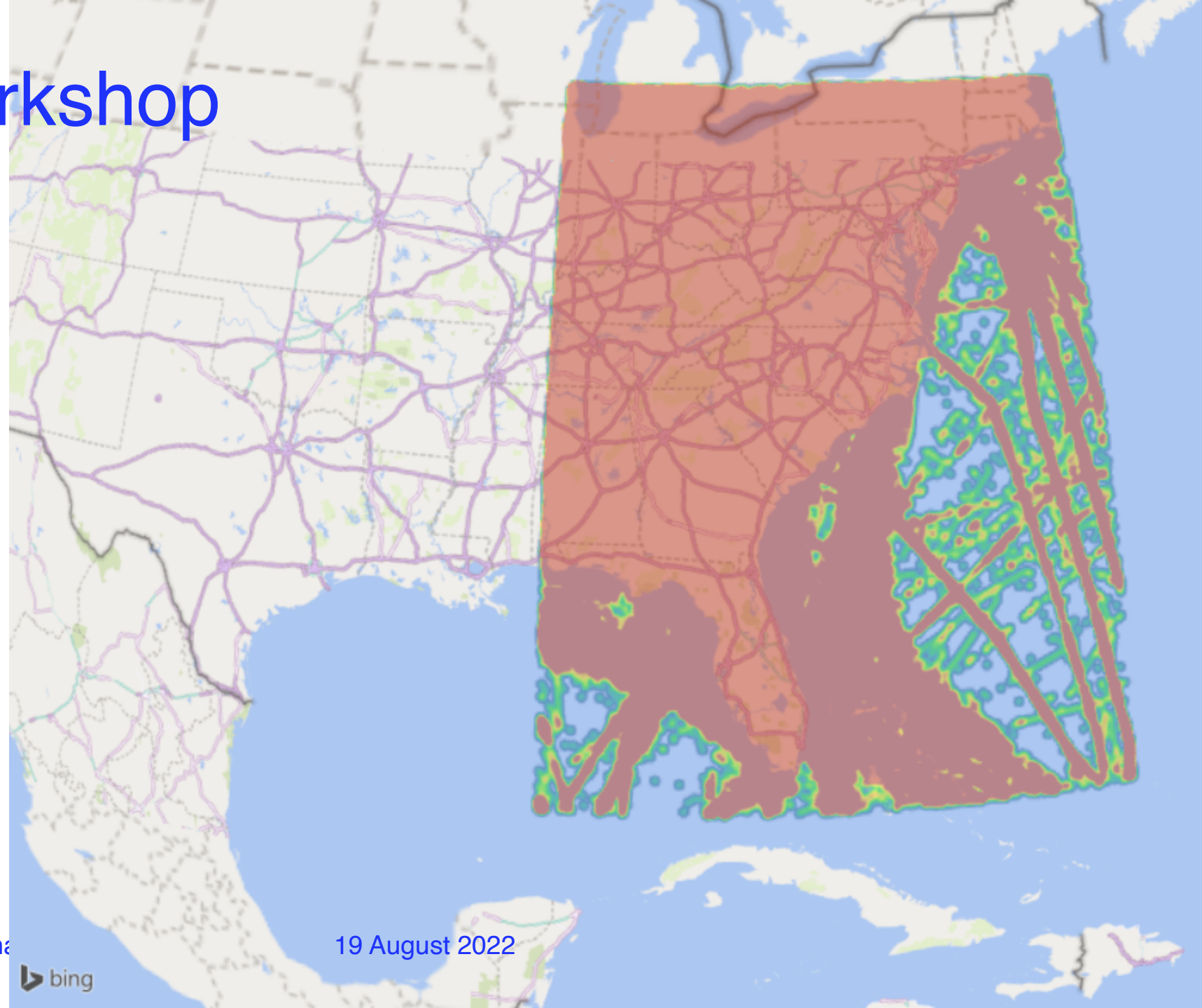
Furthermore, can we use tools such as Statistics, ML, and AI to spot trends and build seasonal diagrams to advice pilots?
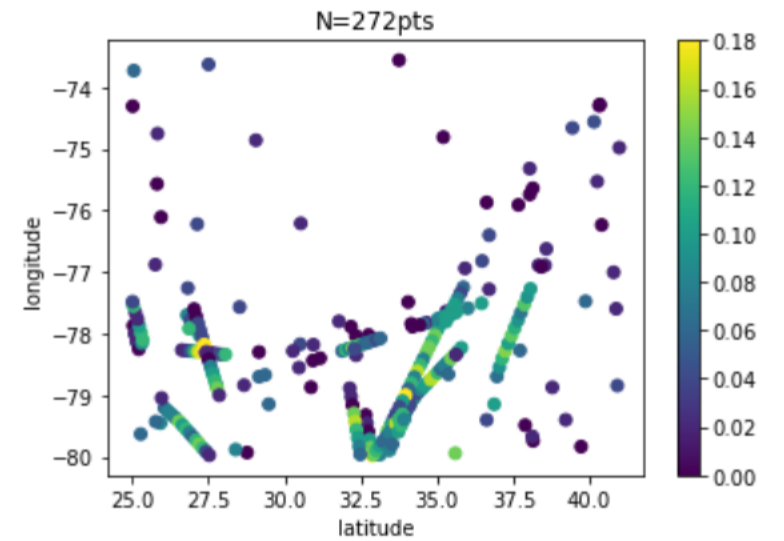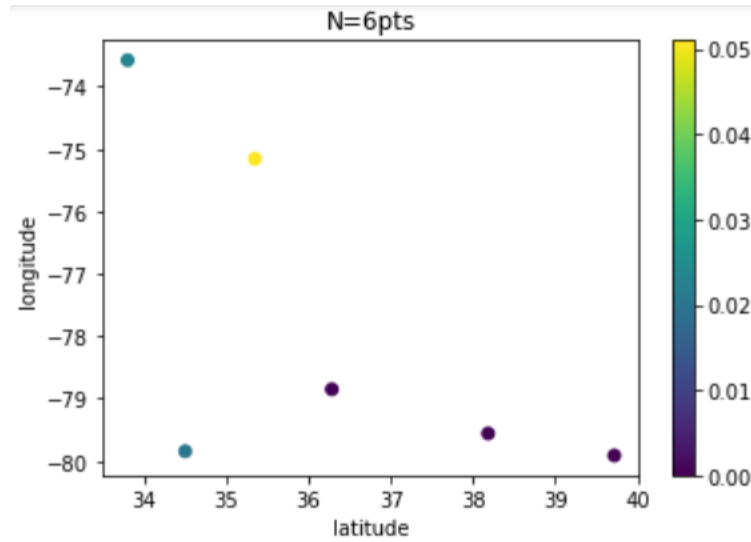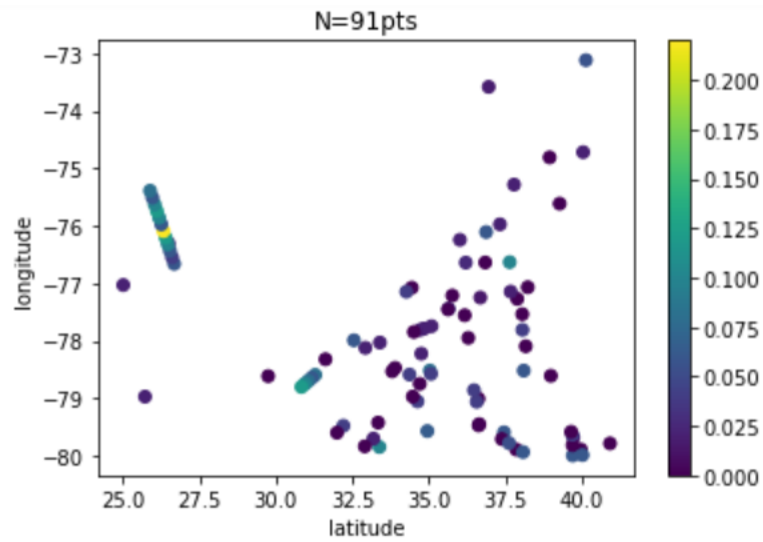

For example, a pilot wants to see the heat map of the displayed area for flight level 24 (meaning that all data points from 22k feet to 26k feet are considered).

IATA

Data for the Workshop

- North-east corner: 43N, 70W.

- South-west corner: 24N, 88W.

- The above coordinates cover one of the most data-dense areas in the database and most flights from New York to Florida.

- Must consider only live data, 4-hour window, and within ±2k feet.

- 16.7M observations over two years.

Data for the Workshop

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Questions and Answers