
Turbulence Aware
14th Montreal Industry Problem Solving Workshop
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Facilitating industry shift to data-driven turbulence mitigation

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
- contributing to the fear of flying

149% - the projected increase in the frequency of severe turbulence

*P. Williams, 2017

Why it's challenging to manage turbulence

Pilot reports are subjective

Forecasts are hours long and inaccurate

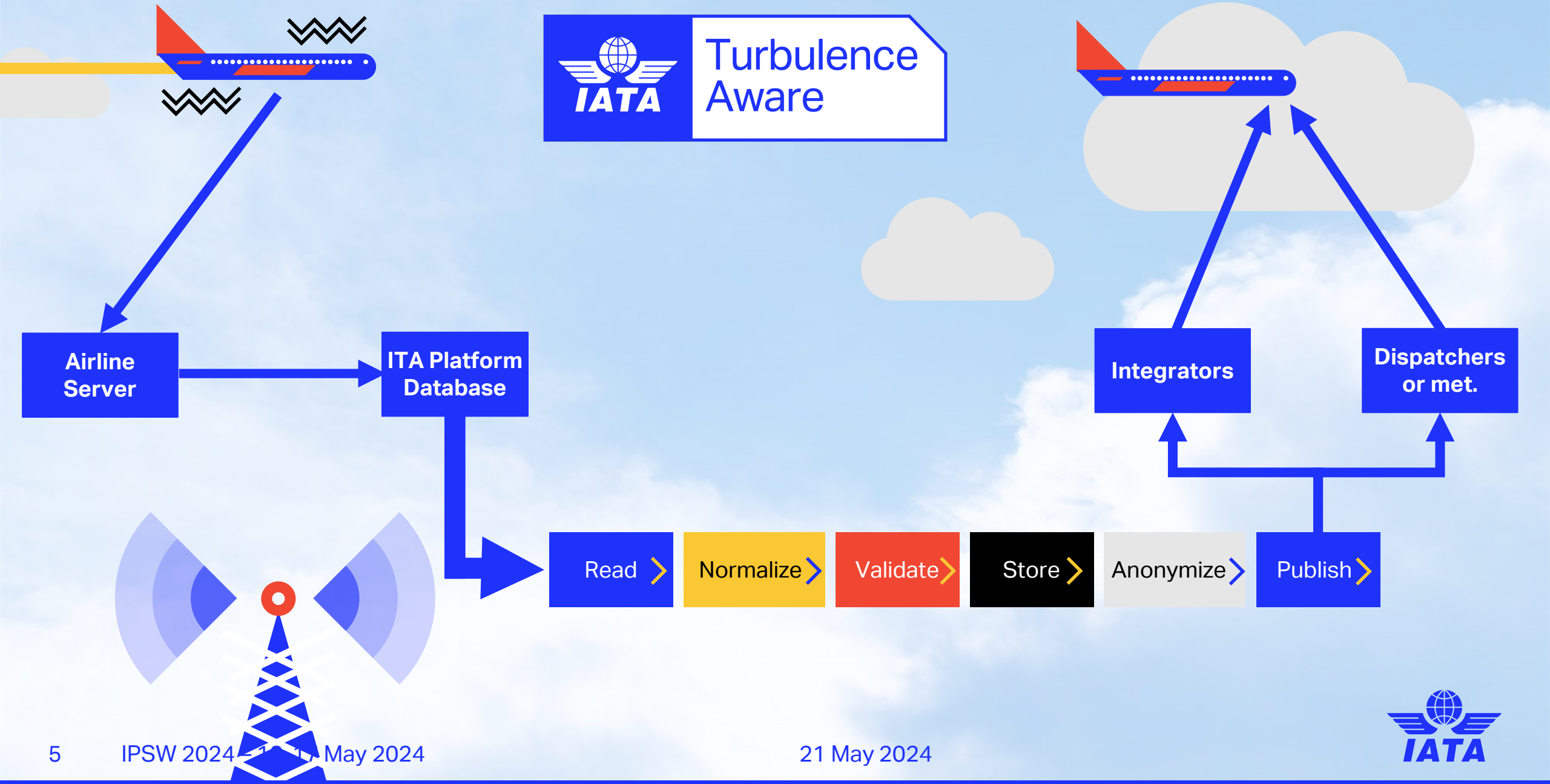
Weather radar cannot detect clear air turbulence

Industry shift to data-driven turbulence management

Yes, we can do it!

Recent technical advancements now enable an aircraft to calculate the turbulence state of the atmosphere in flight accurately

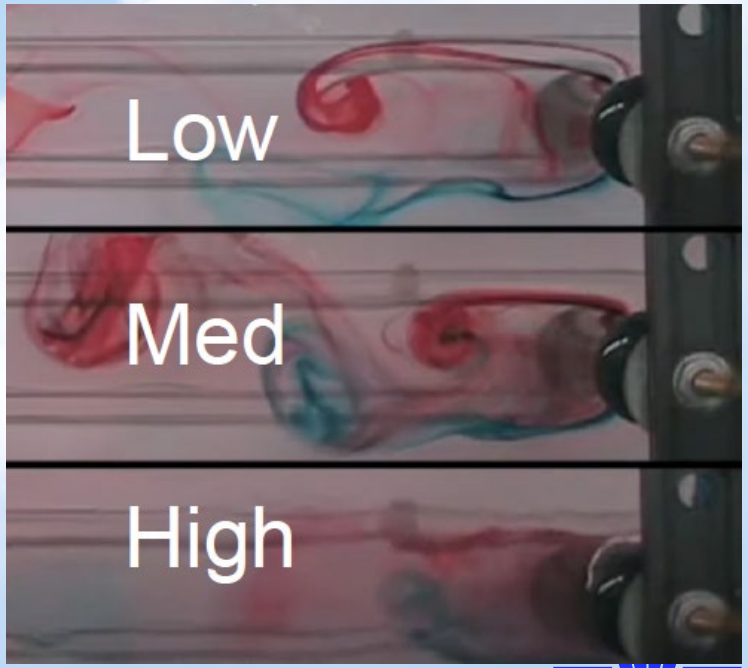
What if we could *objectively* measure the *state of the atmosphere* around the aircraft and *share* the data in real-time across the industry so ***Pilots, Dispatchers, Flight Operational Managers, Passengers*** (and everybody else in the industry) know exactly where is turbulence, and can manage it proactively instead of reactively?


Turbulence Aware
Airline Server
ITA Platform Database
Integrators
Dispatchers or met.
Read
Normalize
Validate
Store
Anonymize
Publish

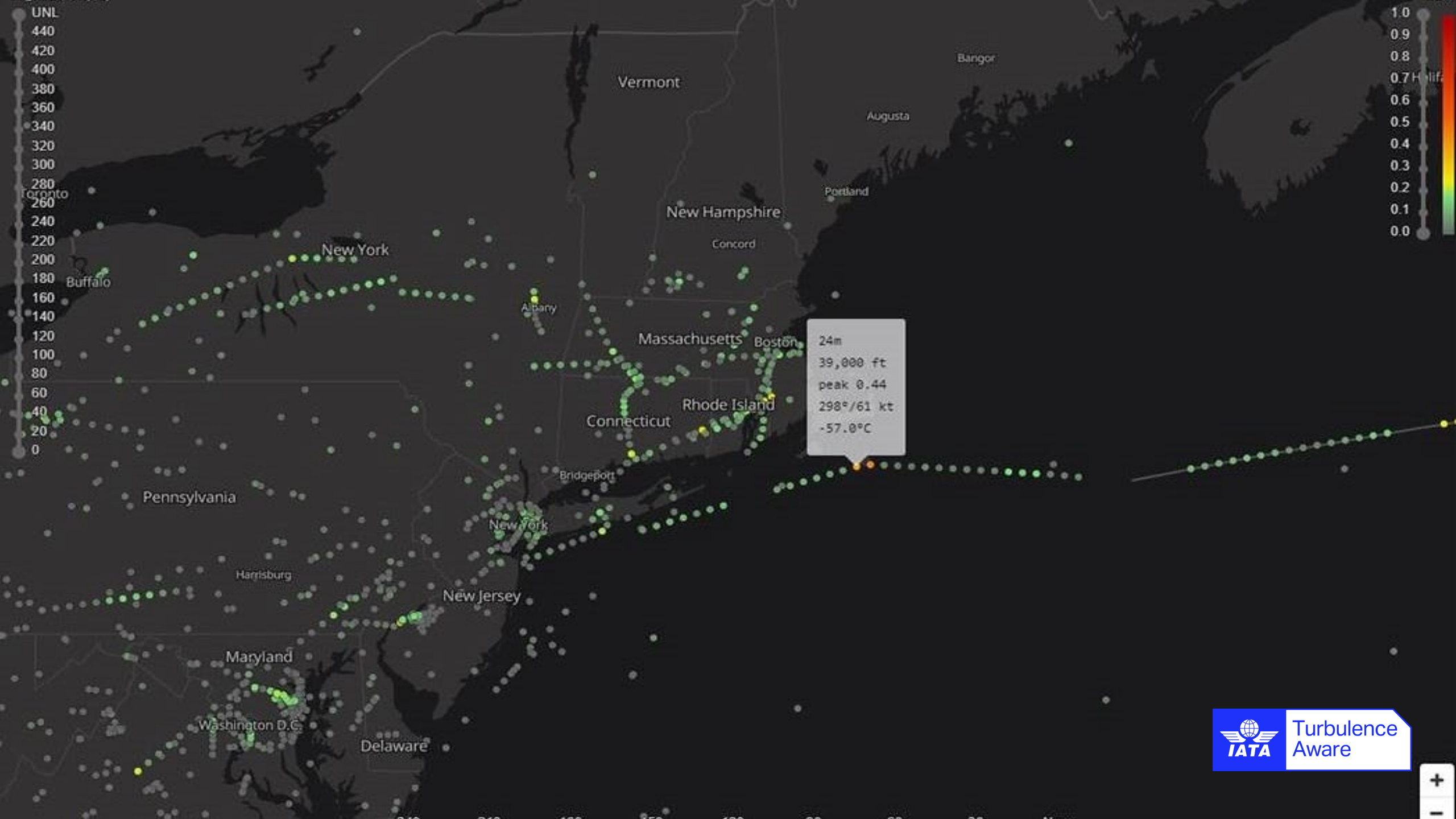
How to measure turbulence?

Eddy Dissipation Rate (EDR)

- Turbulence intensity metric measuring the state of the atmosphere around an aircraft in flight
- It goes from 0 to approximately 1
- An aircraft-independent absolute value



High dissipation rate = High atmospheric turbulence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Concord
Toronto
New York
Buffalo
Albany
Massachusetts
Boston
Rhode Island
Connecticut
Bridgeport
Pennsylvania
New York
Harrisburg
New Jersey
Maryland
Washington D.C.
Delaware
24m
39,000 ft
peak 0.44
298°/61 kt
-57.0°C
IATA
Turbulence Aware

Problem #1

- **How long does turbulence last?**
- And does its duration depend on the time of the year? Is there a relationship between turbulence duration and altitude? What about wind speed and temperature?
- Meteorologists have been attempting to answer that question for a very long time, and this is the first time we have enough objective data to address the question

Video

- The next video shows the aircraft's trajectory and live turbulence data as the TA platform publishes it
- This is an example of how live turbulence data can be operationalized and used for tactical decisions
- The pilot in the video had no access to live turbulence data. What could the pilot have done if he or she had known the state of the atmosphere in real-time?

Problem #2

- Given the aircraft's location, heading, and speed, **we want to determine the likelihood of turbulence ahead of the aircraft** based on live and historical turbulence data. Such information can then be dispatched to the pilots in real-time so they can make informed tactical decisions and avoid turbulence
- Can take into account wind speed and direction, temperature and location, history and live data

Problem #3 – Bonus question!

- **We want to count the number of thermal-based turbulent events** based on EDR and cloud cover data at low levels
- Relevant for the descent phase (which is very often “bumpy”)
- Lack of guidance or forecasts for the descent phase of the flight
- Analysis limited to select areas (for example, Rocky Mountains, spring and summer)

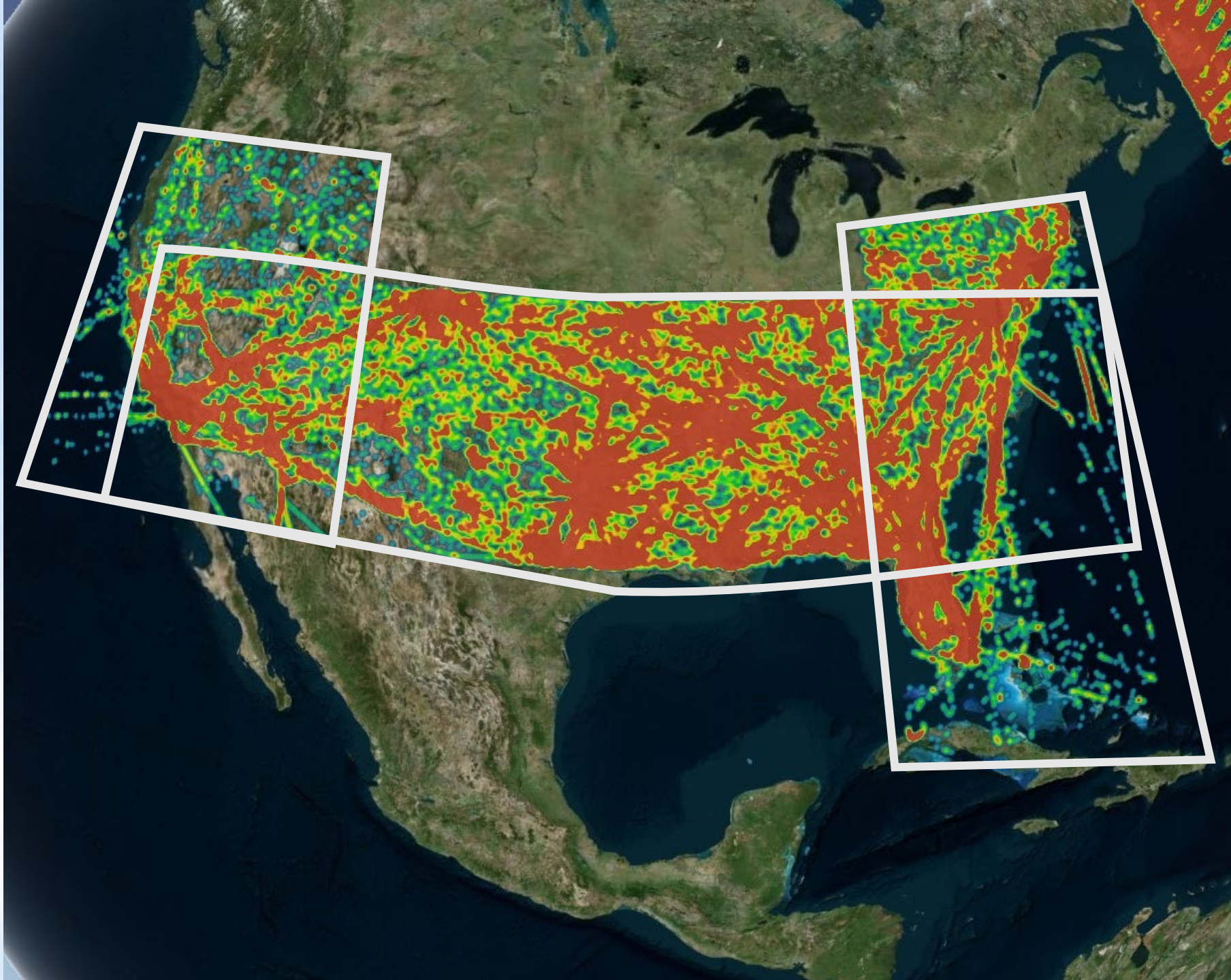
Data set – Record structure

- 4D position
- Intensity of the turbulence (EDR)
- Wind speed and direction
- Temperature
- Flight no. (masked)
- Departure and arrival airport

Depending on the duration and turbulence of the flight, the TA Platform collects an average of 15 to 70 data points for each flight

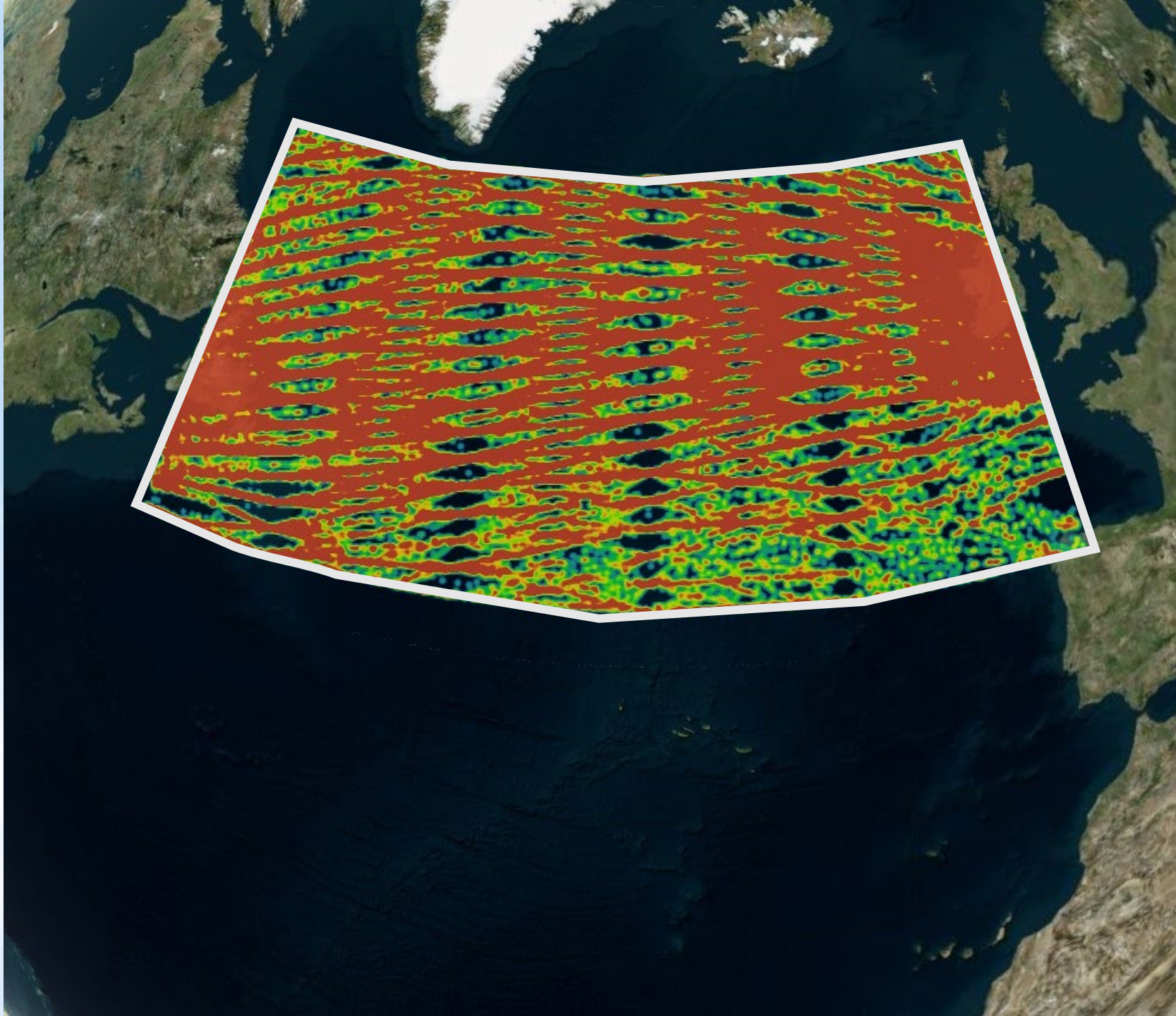
Data set – Coverage

- US East Coast
- US West Coast
- Corridor US East to West Coast



Data set – Coverage

- North Atlantic Tracks



The answers to these questions will improve the sky safety

Join the Team and help **pilots**,

dispatchers, **flight operation**

managers and millions of

passengers

fly safer

Q&A

Thank you