Turbulence Events & Injuries

Sonnie Bates, PhD
CEO, WYVERN Ltd

Andrew Dunbeck
GM, Flight Safety
Delta Air Lines

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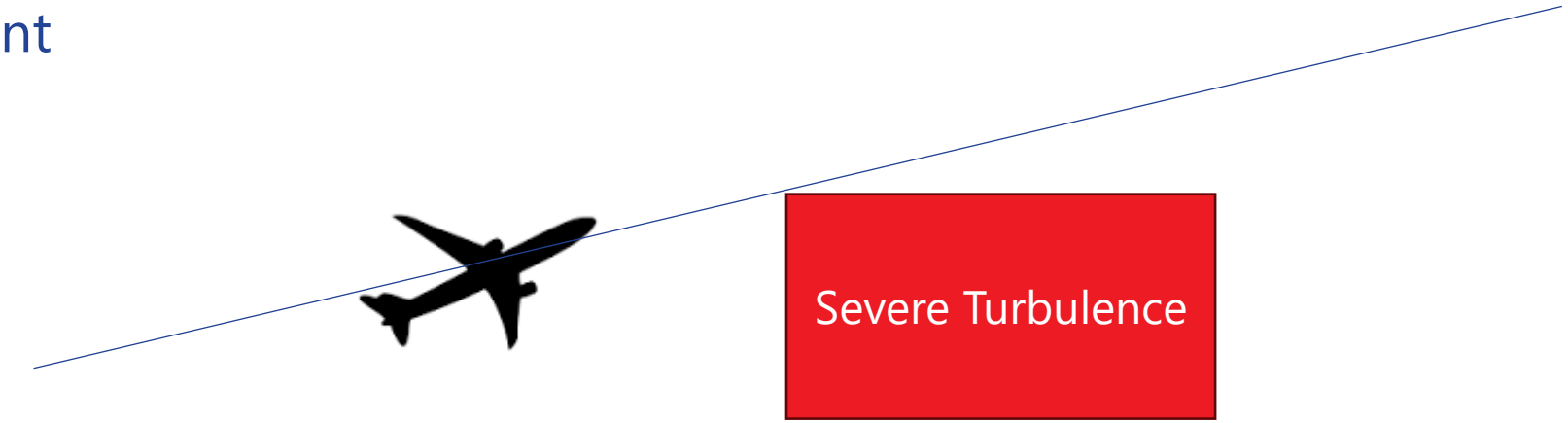
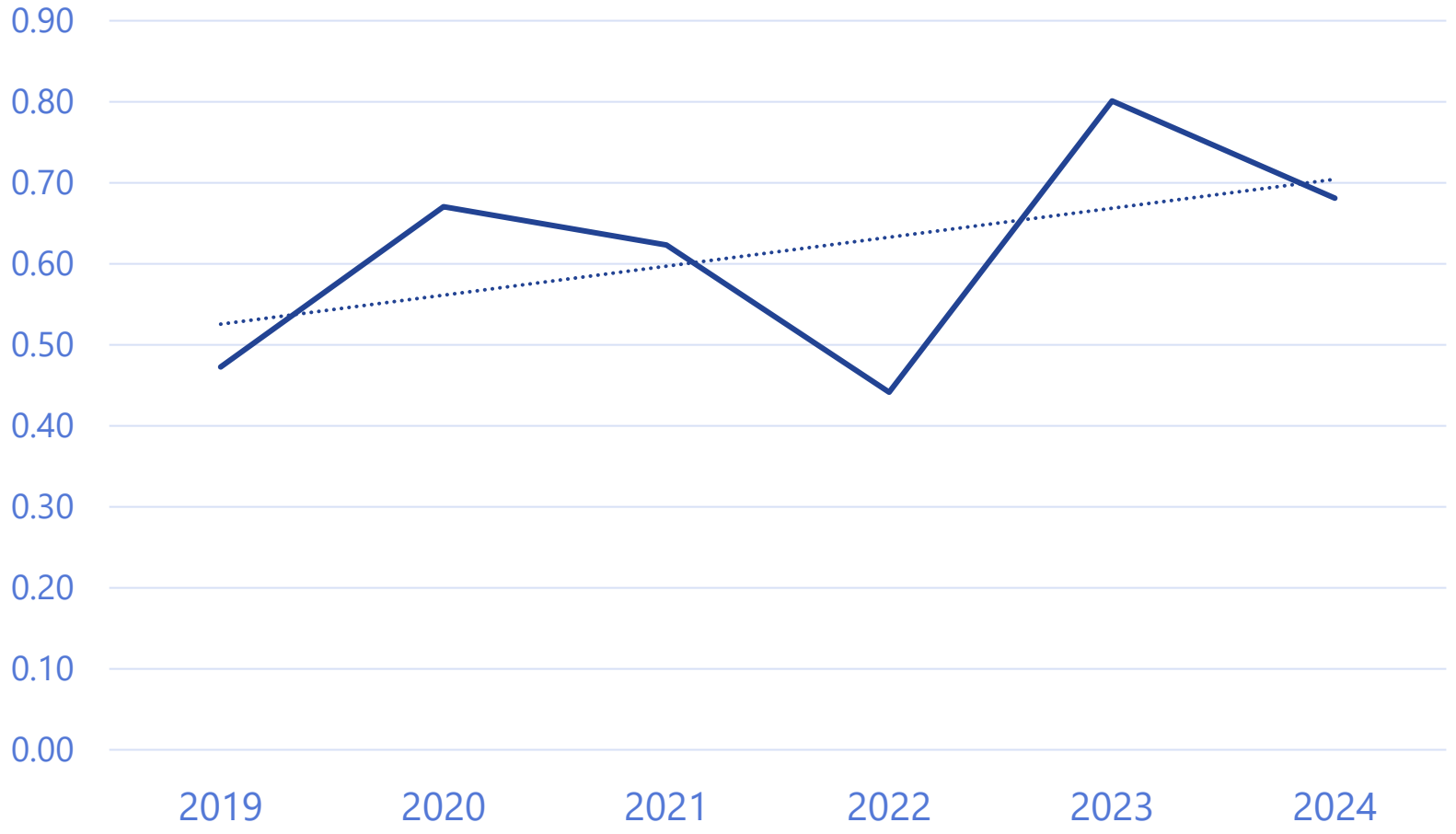
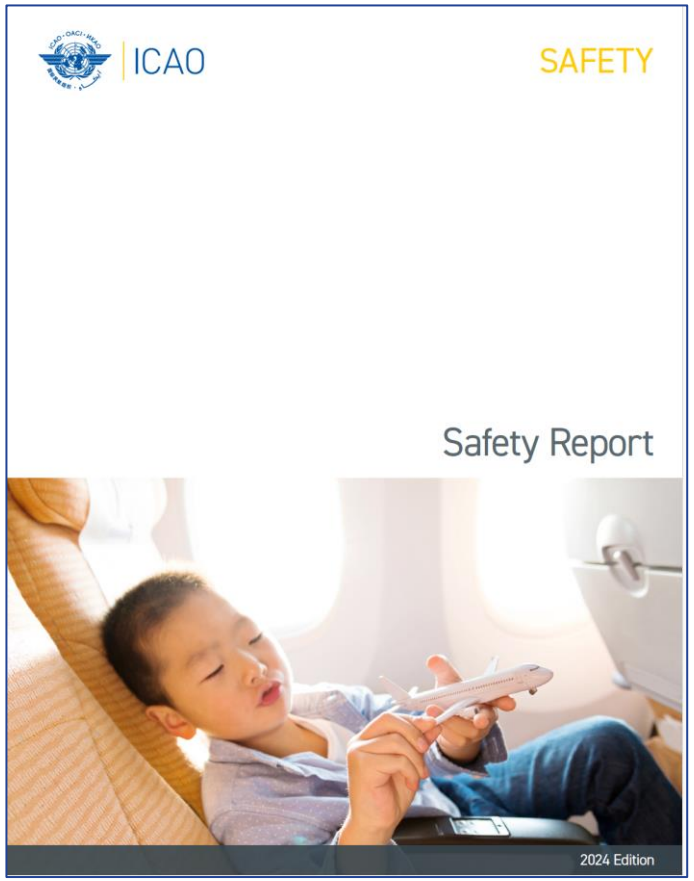
There I Was

- Turbulence encounter at cruise over the Atlantic
- Hard jolt (like hitting a huge hole in the road with a small car)
- Auto-pilot disconnect, right bank about 30 degrees
- No damage - No injuries
- Severe embarrassment



ICAO Safety Report: Turbulence Accident Rate





Past 5 years: TURB accounted for the most accidents.

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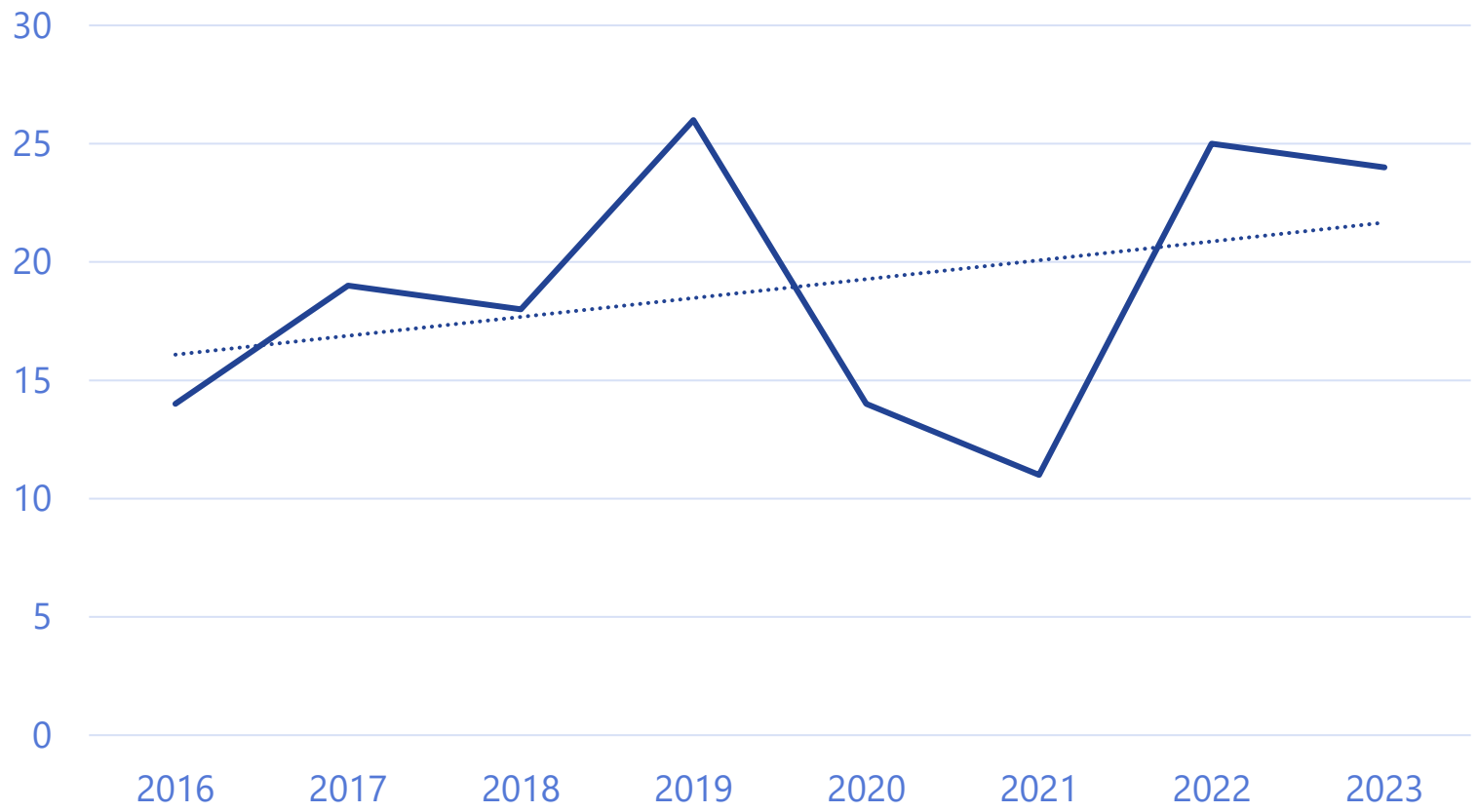
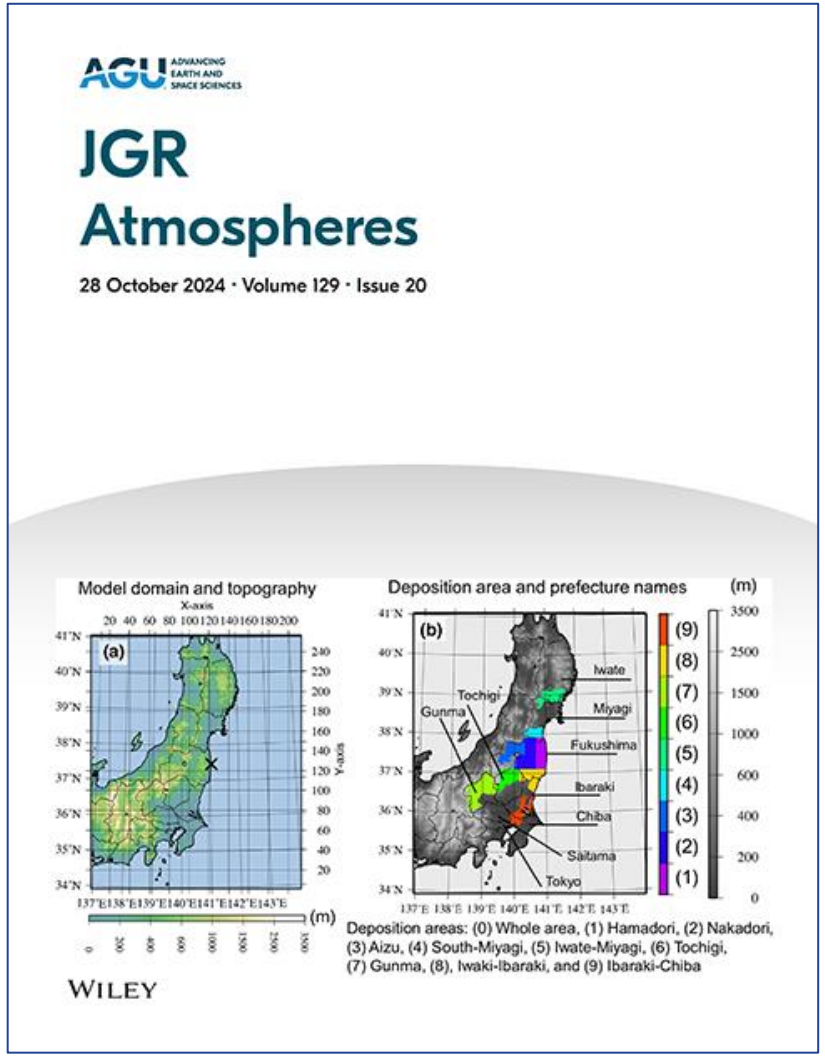
ICAO Turbulence Accidents 2016-2023



Recent Research

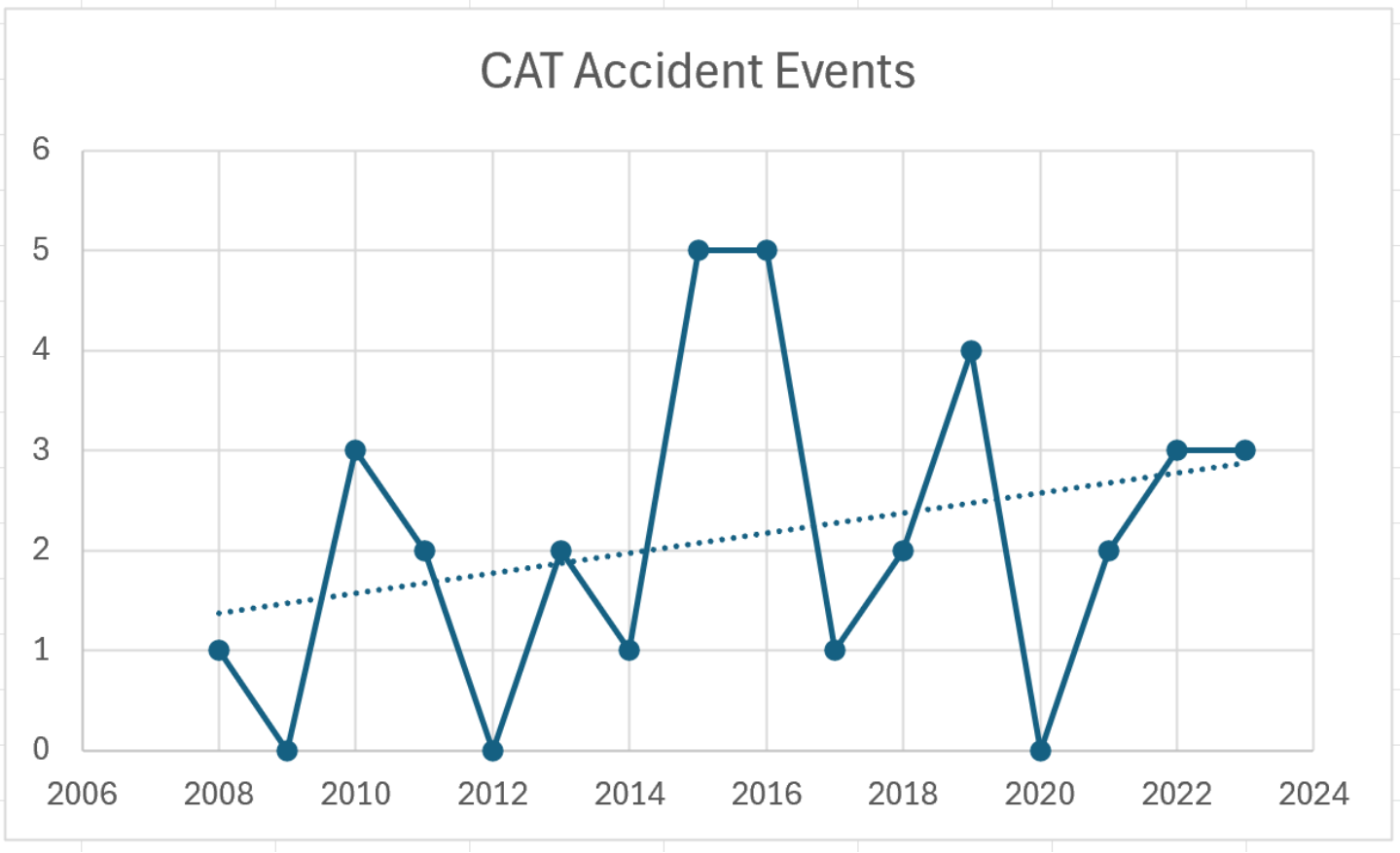
- Atmospheric reanalyses show increases in the frequency of Clear-Air Turbulence (CAT) in recent decades over several regions
- CAT frequency is projected to increase in the future over East Asia, Middle East, North Africa, North Pacific and North America
- The largest increase in CAT is projected to occur over East Asia
- Turbulence is responsible for 71% of all weather-related accidents
- CAT is difficult to detect and avoid



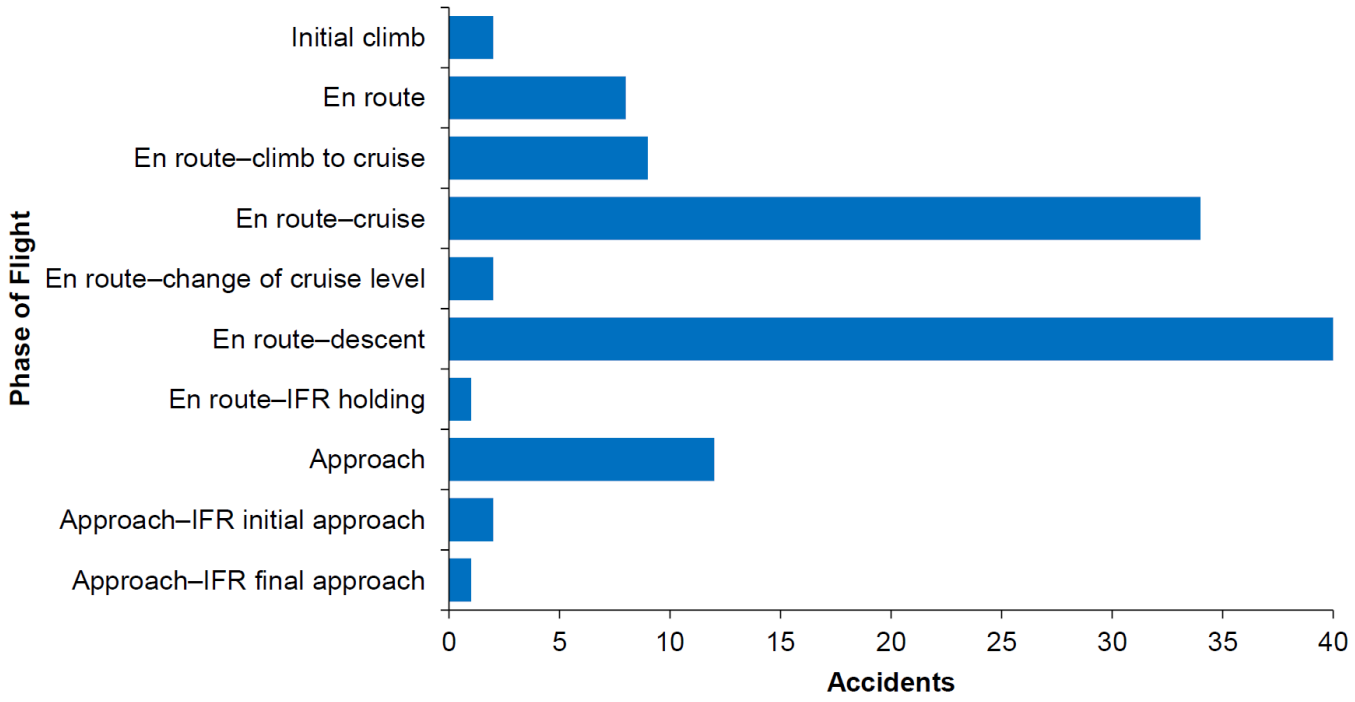
Foudad, M., Sanchez-Gomez, E., Jaravel, T., Rochoux, M. C., & Terray, L. (2024). Past and future trends in clear-air turbulence over the northern hemisphere. *Journal of Geophysical Research:Atmospheres*, *129*, e2023JD040261. https://doi.org/10.1029/2023JD040261

NTSB Data

- Upward trend since 2008
- Turbulence was involved in more than a third (38%) of Part 121 air carrier accidents between 2009 and 2018.



NTSB Study



Turbulence-related Part 121 accidents by phase of flight, 2009–2018.

Preventing Turbulence-Related Injuries in Air Carrier Operations Conducted Under Title 14 *Code of Federal Regulations* Part 121

Many recommendations with focus on improving data capture and sharing

Safety Research Report

NTSB/SS-21/01
PB2021-100927

National Transportation Safety Board

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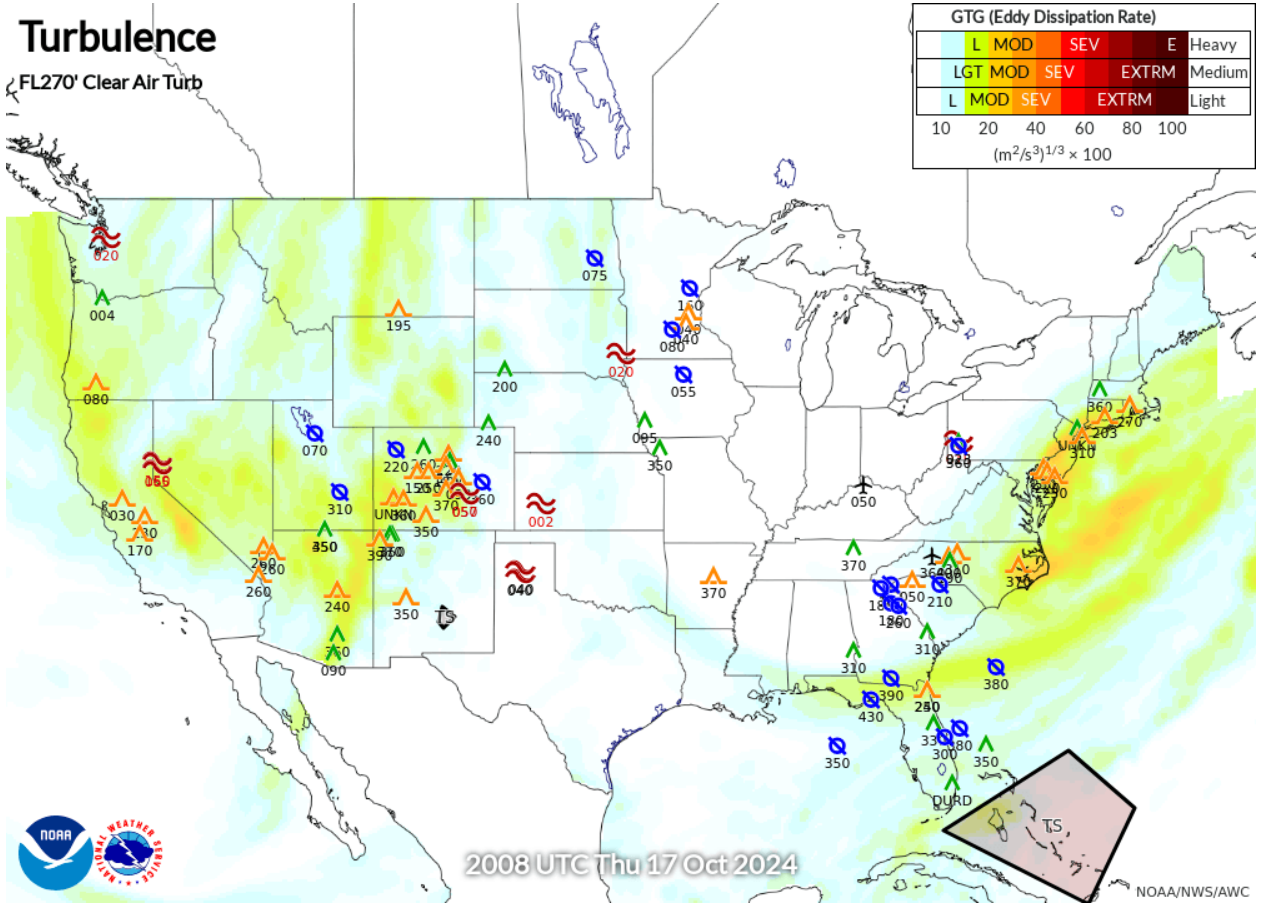
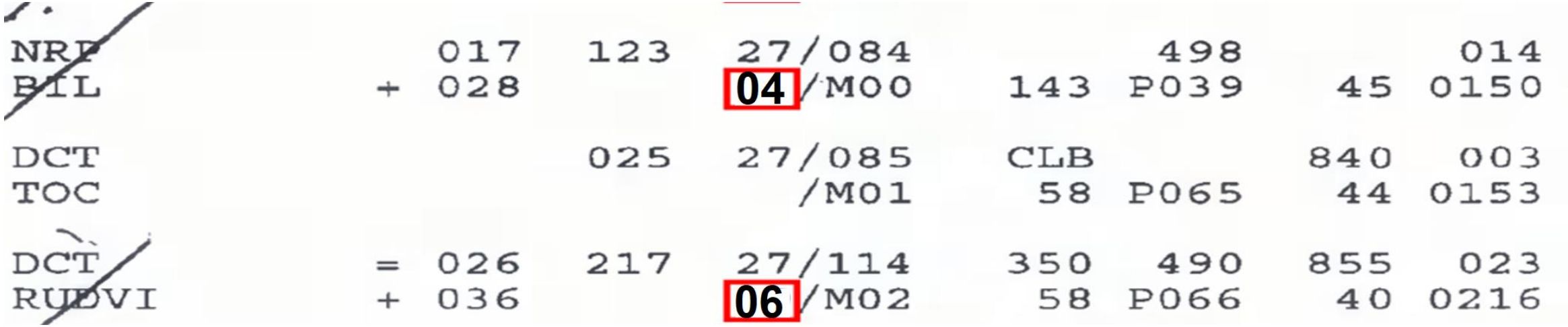
Strategic Decision-Making

- Review the latest graphics
- Graphical Turbulence Guidance Nowcast (GTGN™) uses PIREPs and EDR data
- Can be used for tactical decision-making



Shear Rate on Flight Plan

- Flight crews should review and brief significant shear rates before flight
- See SKYbrary article on Shear Rate https://skybrary.aero/articles/shear-rate-sr



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NRP          017   123   27/084          498          014
BIL    +     028         04/M00   143  P039    45  0150

DCT                025   27/085   CLB          840   003
TOC                      /M01    58  P065    44  0153

DCT          =     026   217   27/114   350   490  855   023
RUBVI        +     036         06/M02    58  P066   40  0216
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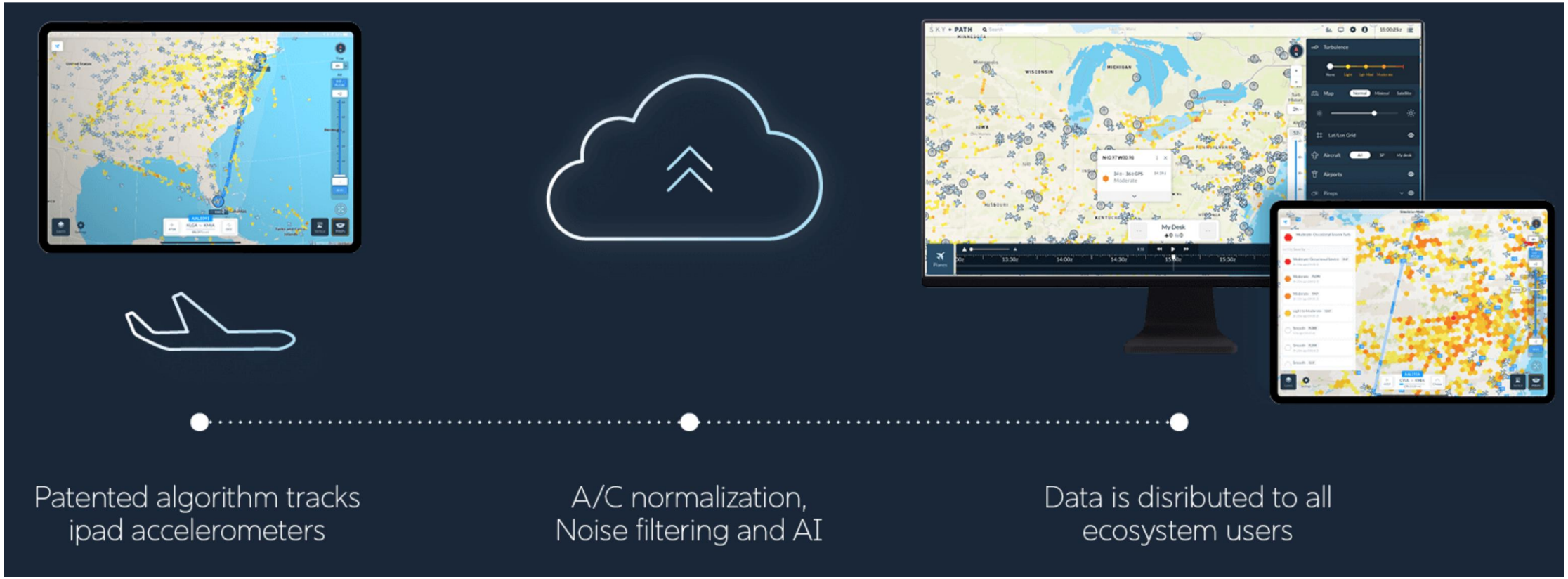
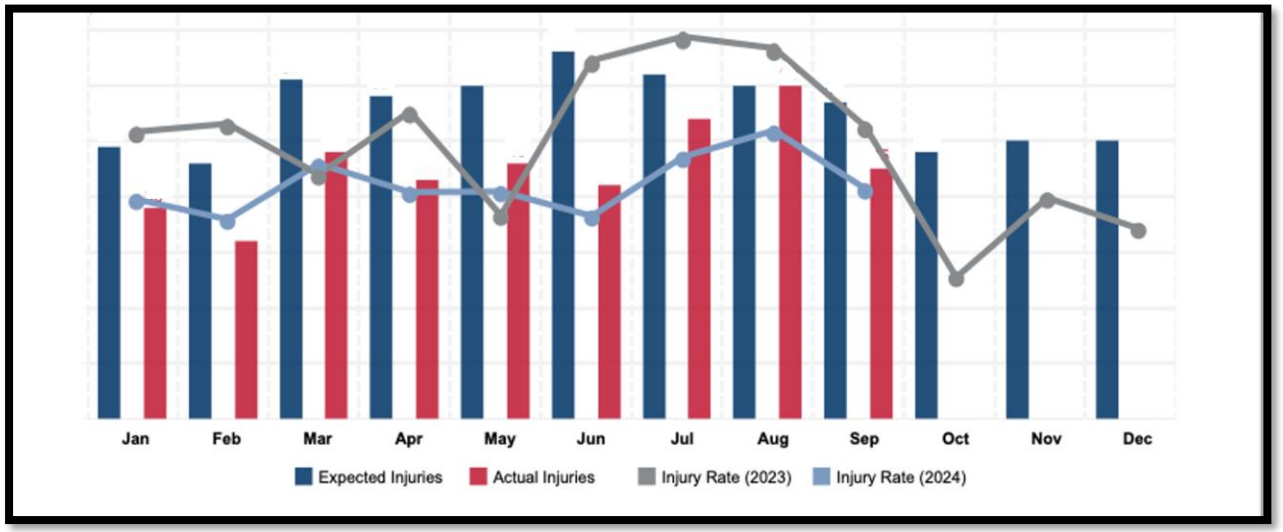
Tactical Decision-Making (Example)



https://skypath.io/

DELTA

- The tablets used by pilots provide an opportunity to share data and details around turbulence that may be experienced by a given flight
- Through intentional focus on data shared with pilots and pilots communicating with the cabin crew, we have seen a reduction in injuries in the cabin during turbulence



Key Takeaways

- Turbulence is an understated risk in commercial air transport. While not necessarily causing the most injuries, it is experienced on nearly every flight and has the potential to be fatal.

- The key to mitigating this risk is detection and communication to those at risk – the flight attendants.

- Having a well-formulated plan for how turbulence encounters will be detected, analyzed, communicated, and mitigated is necessary for each airline.