



# Status & Analysis of Global Turbulence Reporting

*TURBULENCE MITIGATION WORKSHOP IV (NCAR/MITRE sponsored by FAA)*

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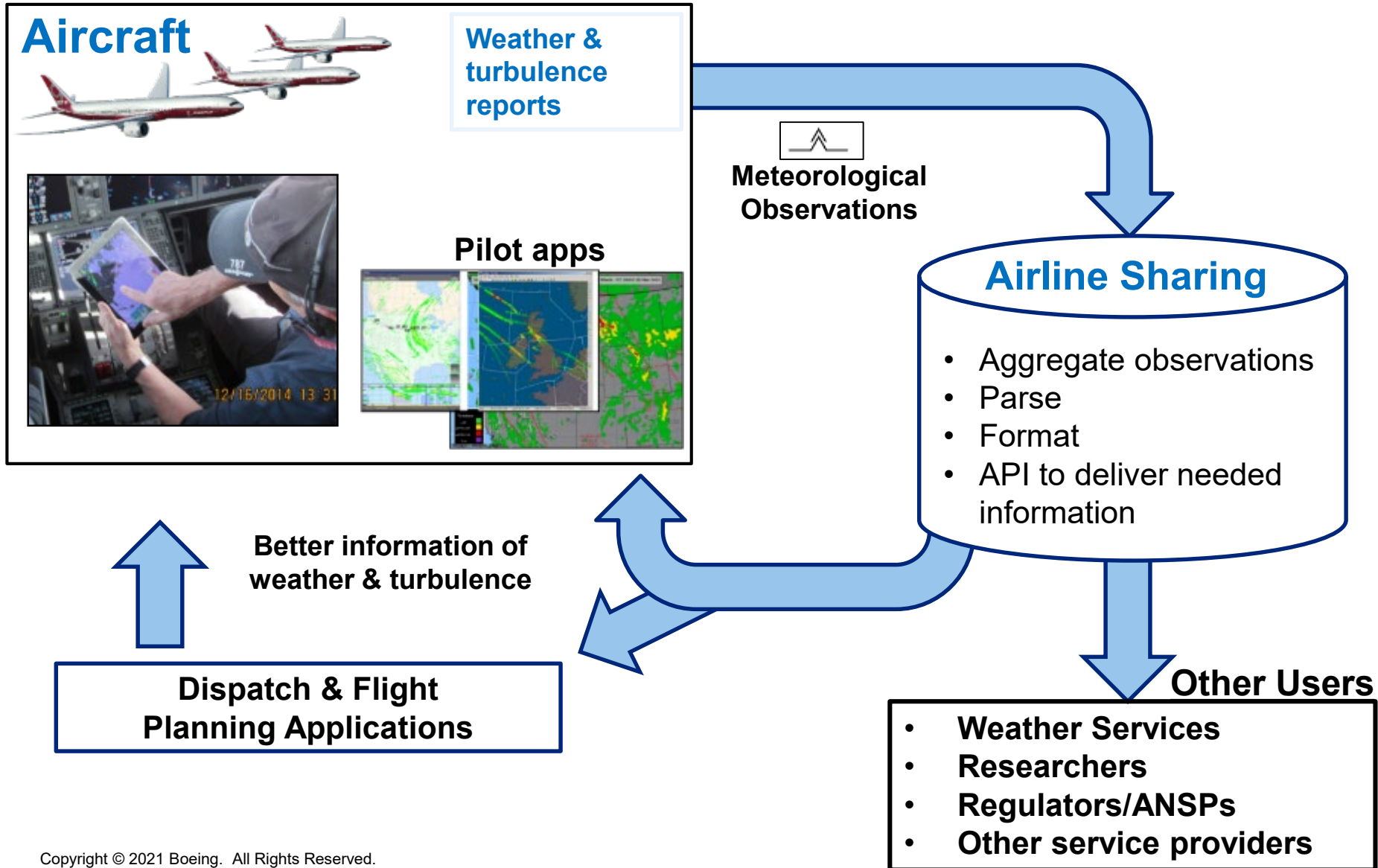
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# Agenda

- ❑ Integration at Boeing
  - ❑ Airplane Capability: Weather & EDR reporting
  - ❑ Services & Apps: Includes Jeppesen and ForeFlight
- ❑ Industry adoption
- ❑ Geographical analysis
- ❑ Tropopause analysis
- ❑ Conclusion & next steps

# Concept of Operations & Information Flow

Generate meteorological data to support airline world-wide operations



# Boeing Model Current Availability

**Boeing offers an airplane option applicable to:**

- 777-200/-200LR/-300/-300ER/Freighter/-8/-9
- 787-8/-9/-10
- 737-7, 737-8, 737-8200, 737-9, 737-10

**The content includes:**

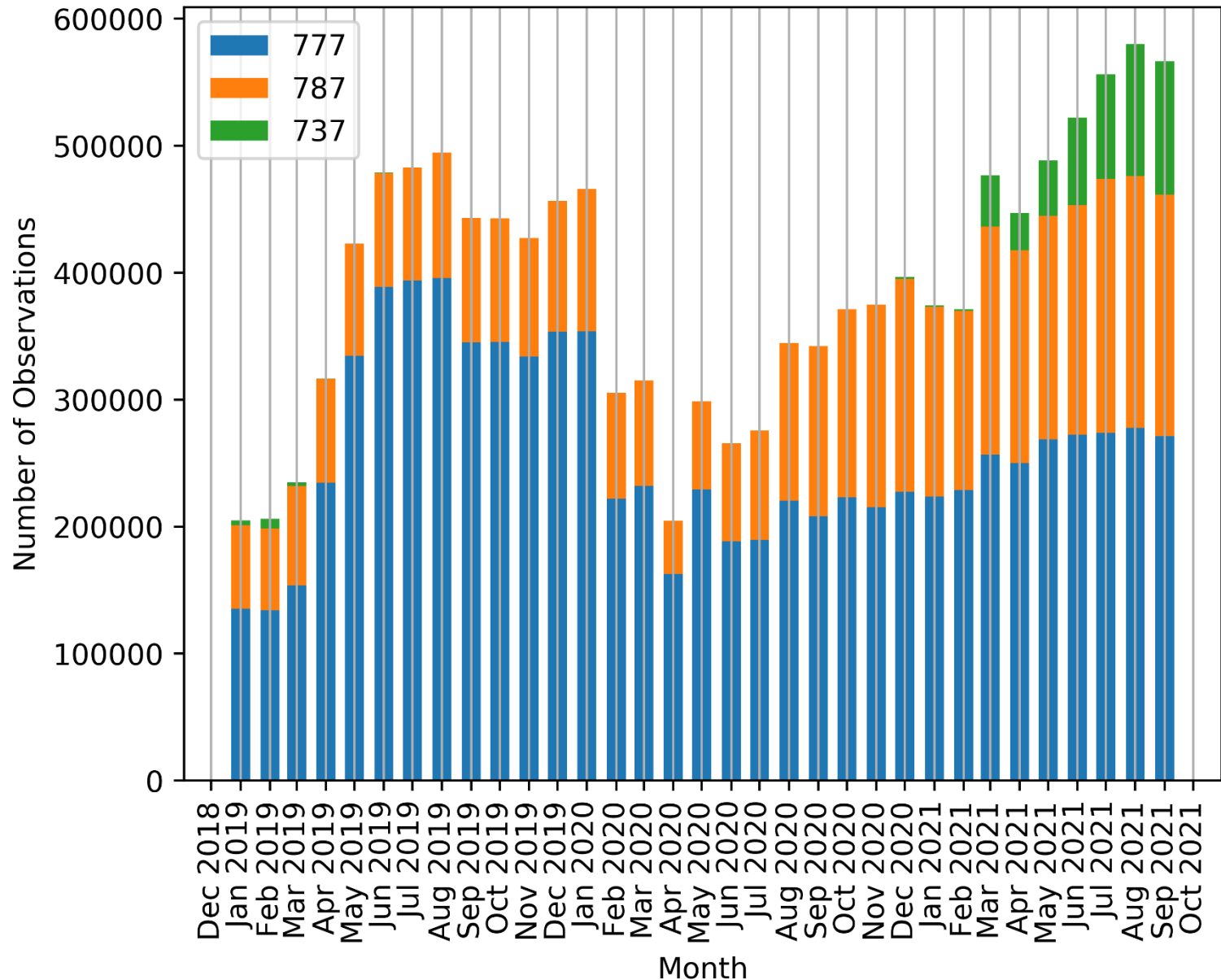
- observation date and time
- aircraft identification
- flight number
- departure
- destination
- latitude
- longitude
- altitude
- static air temperature
- wind direction
- wind speed
- icing
- mean/peak EDR turbulence
- software provisions for humidity & cloud properties on certain models

**If interested:** Please contact Boeing to request incorporation of the aircraft weather and turbulence reporting option.

**This capability is available at aircraft delivery or for existing fleet**

# Monthly 777, 787, and 737 MAX Observations

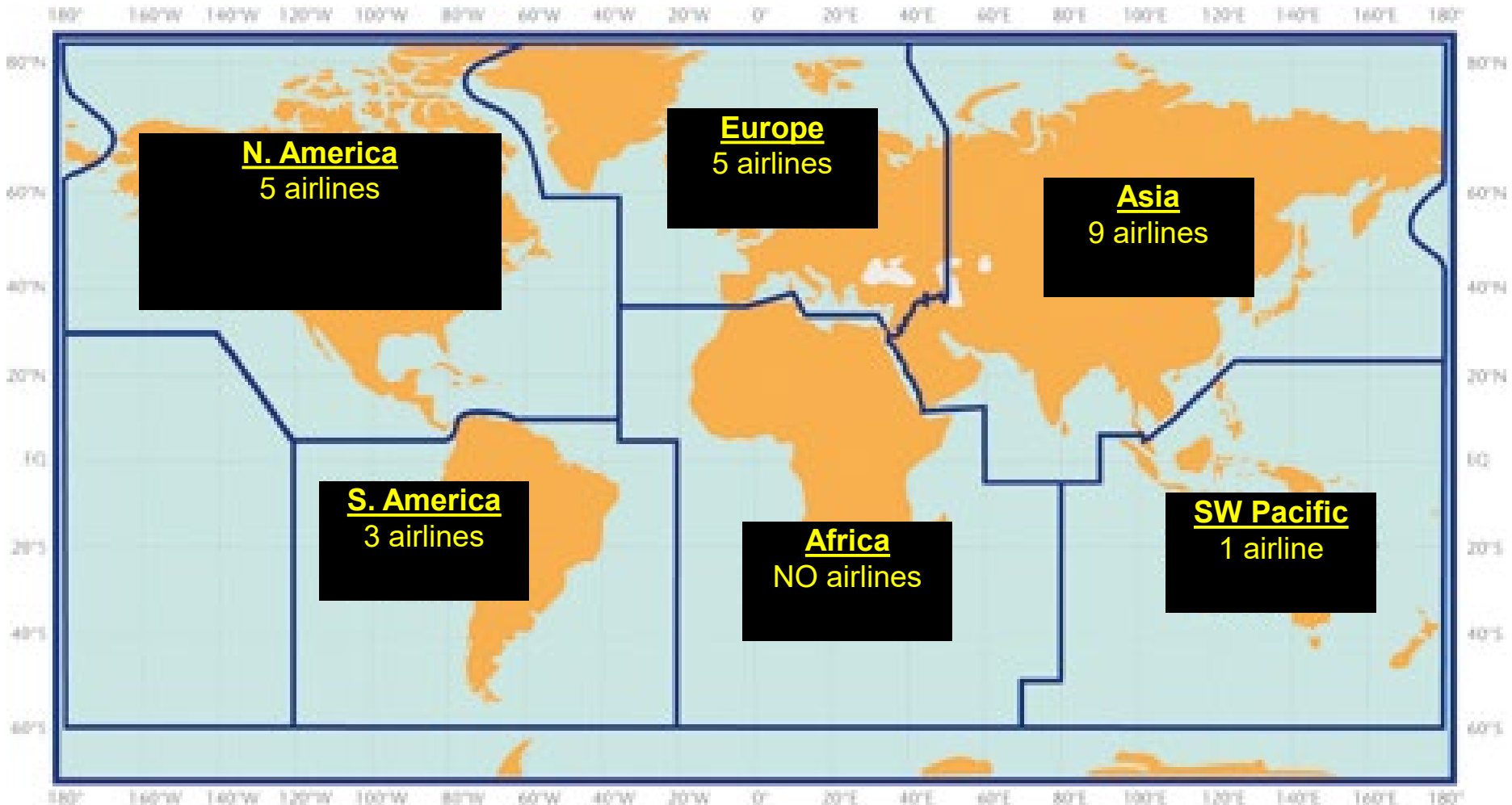
Monthly Observations thru 10/1/2021



# Adoption of Weather & Turbulence Observations

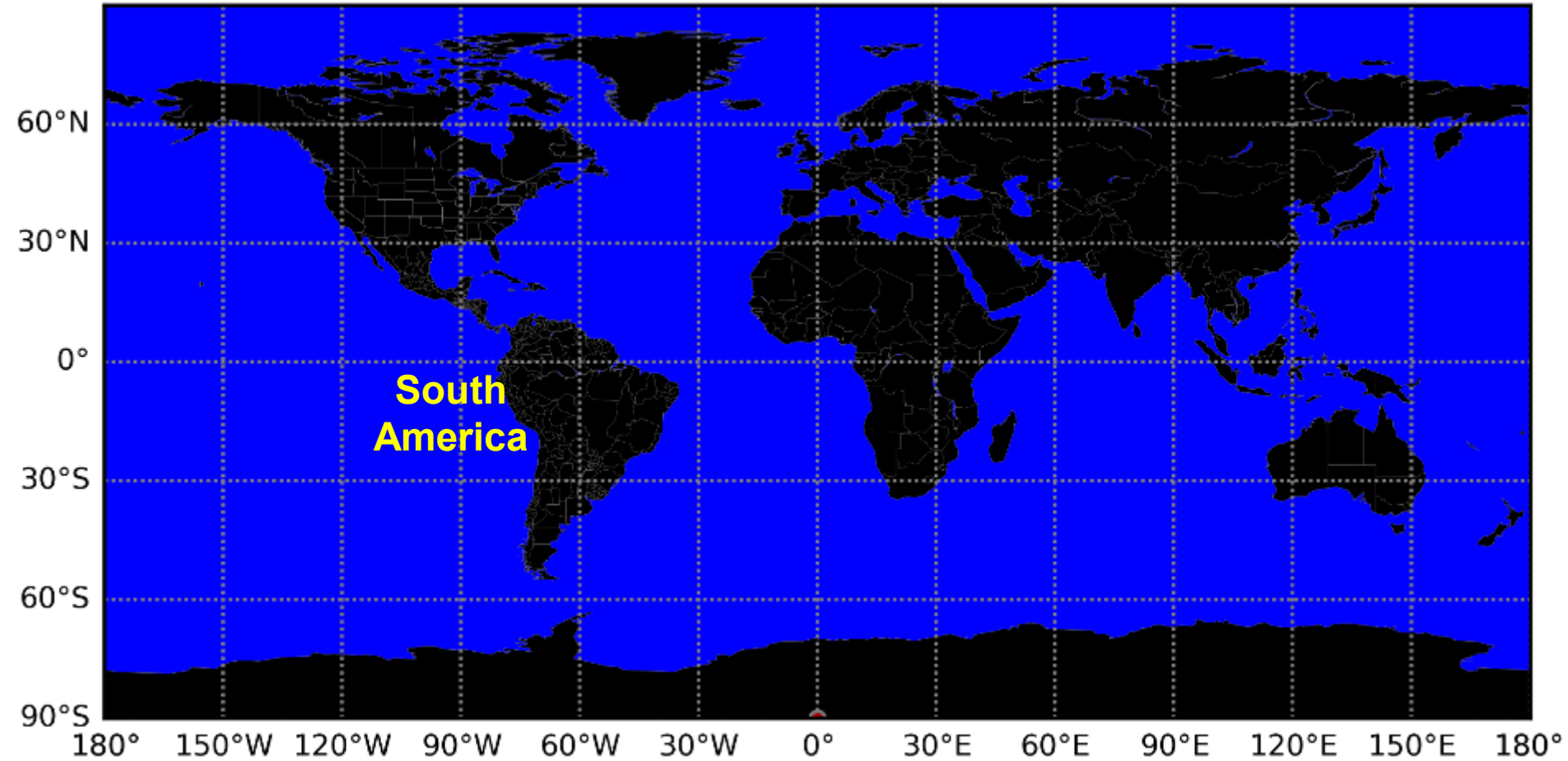
## Status:

- To date, Boeing assists over [20 airlines](#) (and growing):
  - Aircraft include 777, 777X, 787, 737 MAX
  - WMO** regions as below:



# Regional Coverage

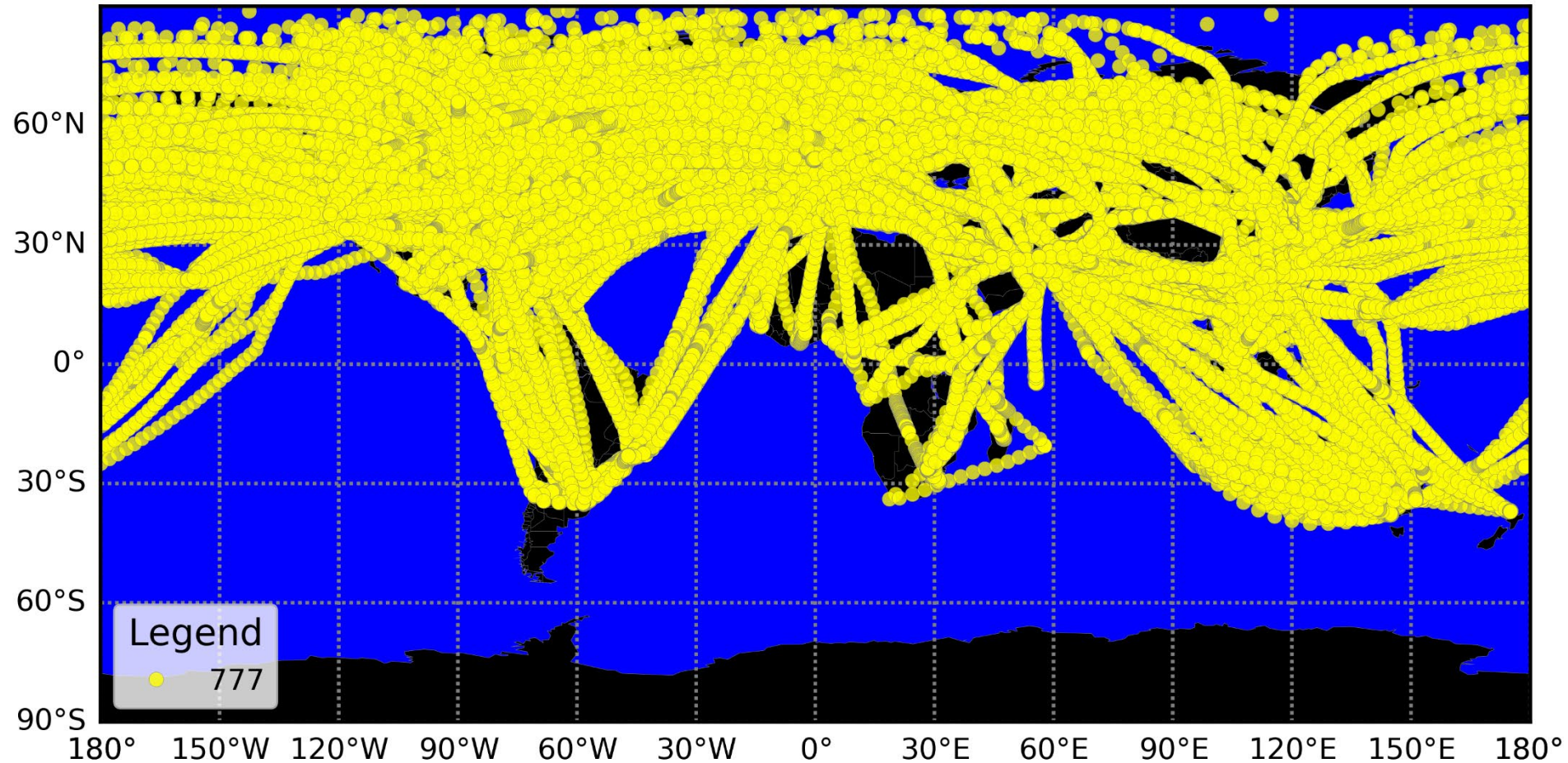
Where are the \*new\* regions airlines are now observing?





# Observations (777)

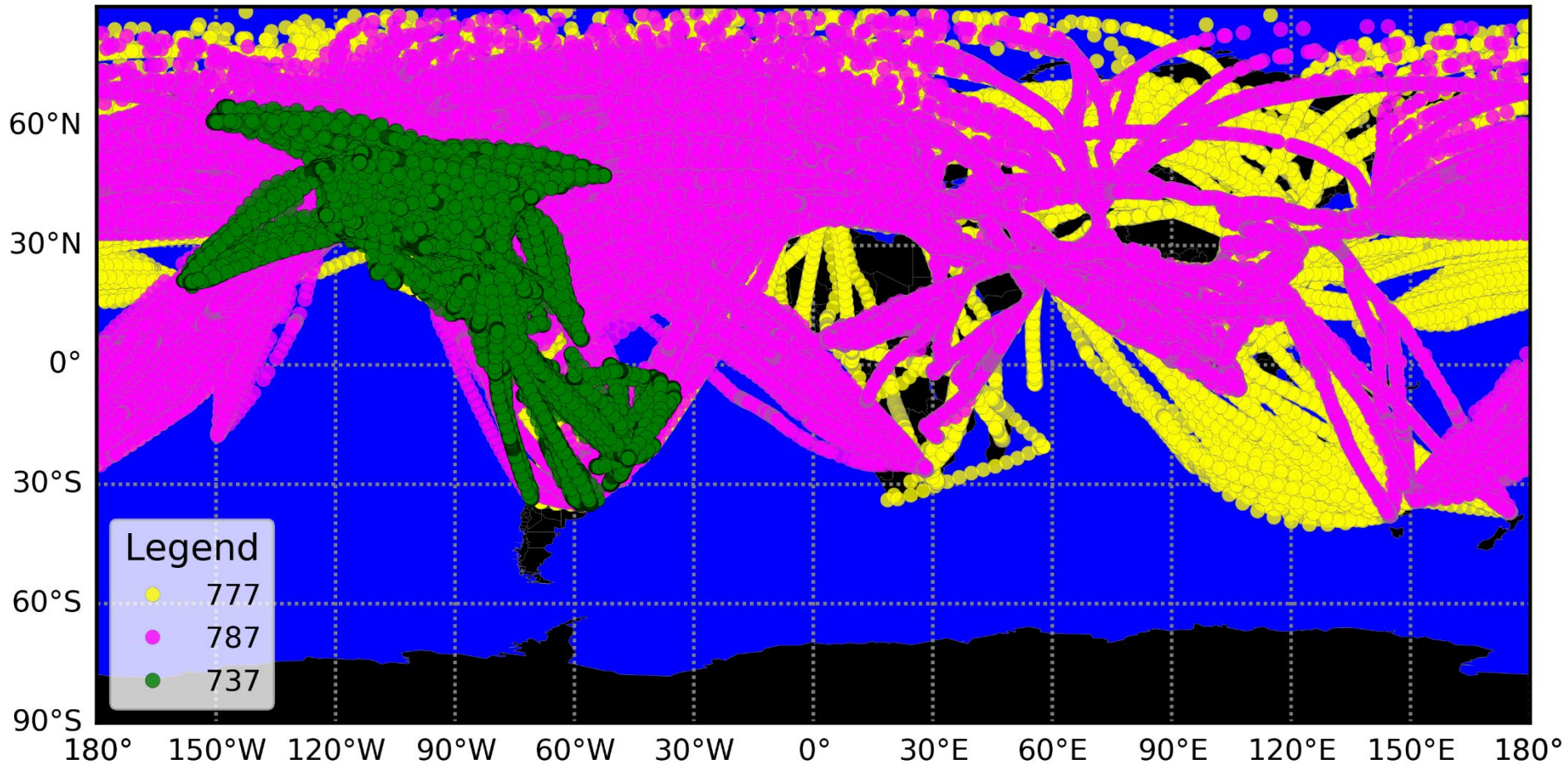
777 EDR Turbulence Observations 9/1/21 thru 9/30/21





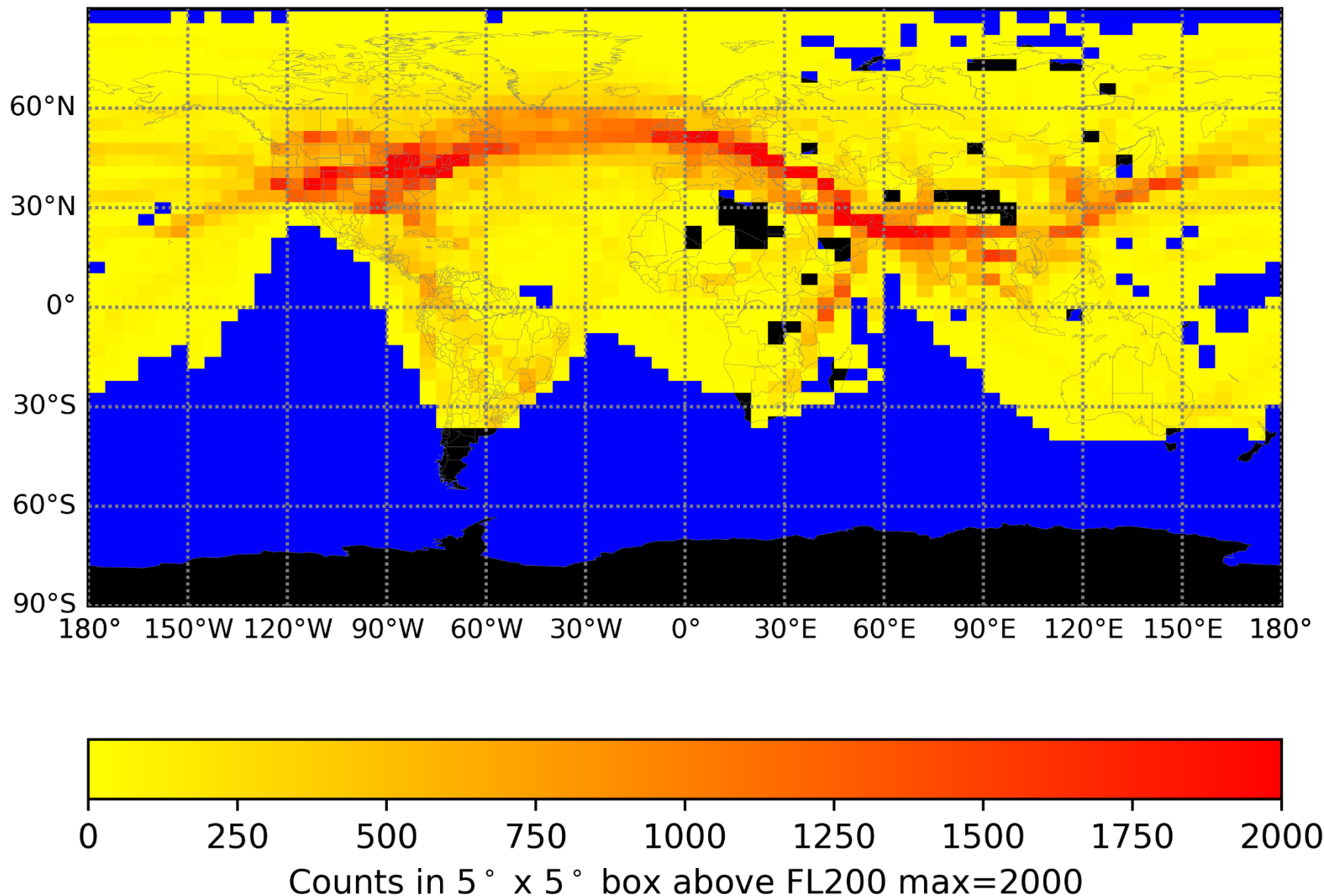
# Observations (777, 787 & 737 MAX)

777, 787, & 737 EDR Turbulence Observations 9/1/21 thru 9/30/21



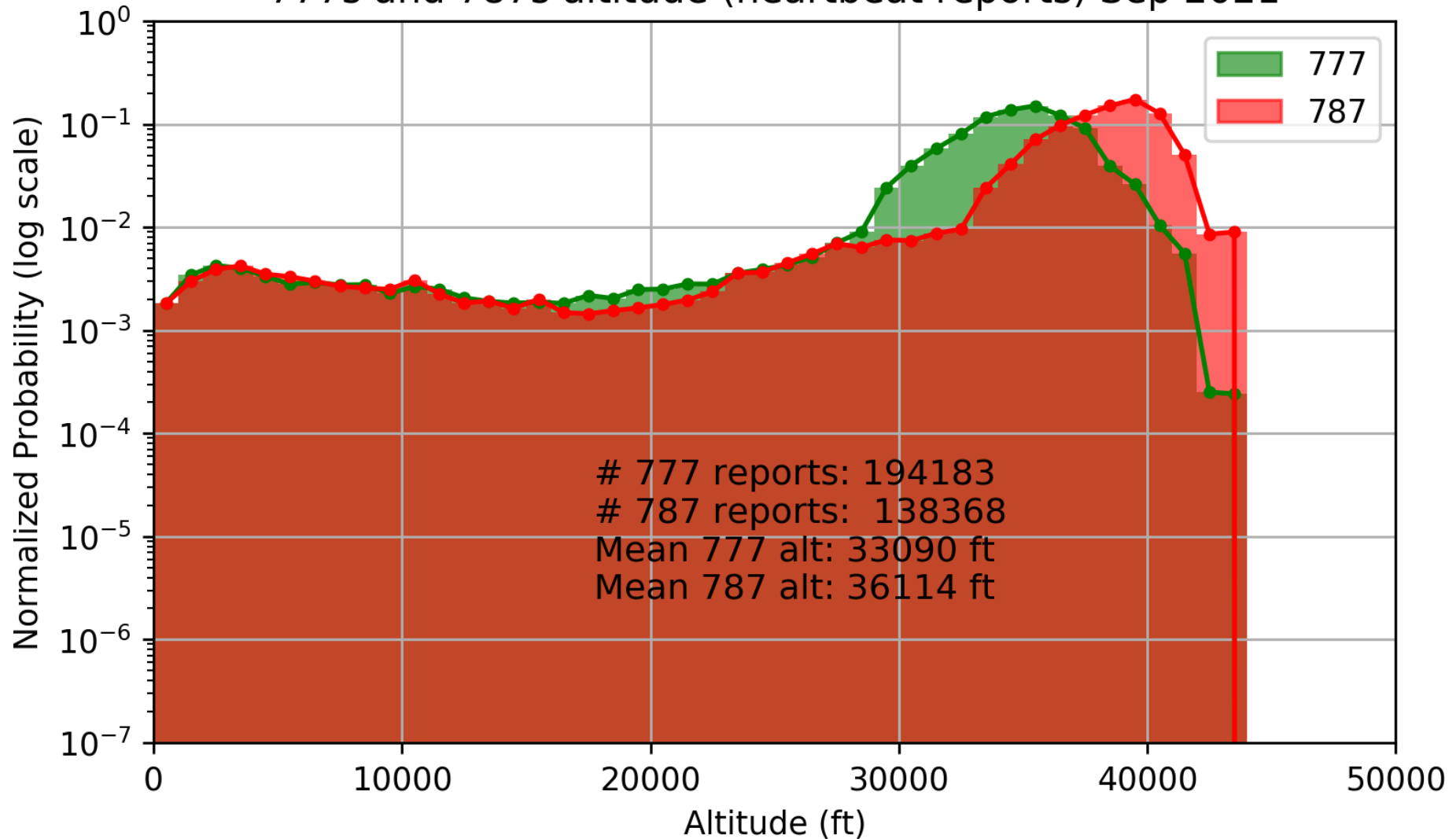
# Histogram Map Plot (“heatmap”)

Counts of 777, 787, 737 MAX EDR Observations 9/1/21 thru 9/30/21

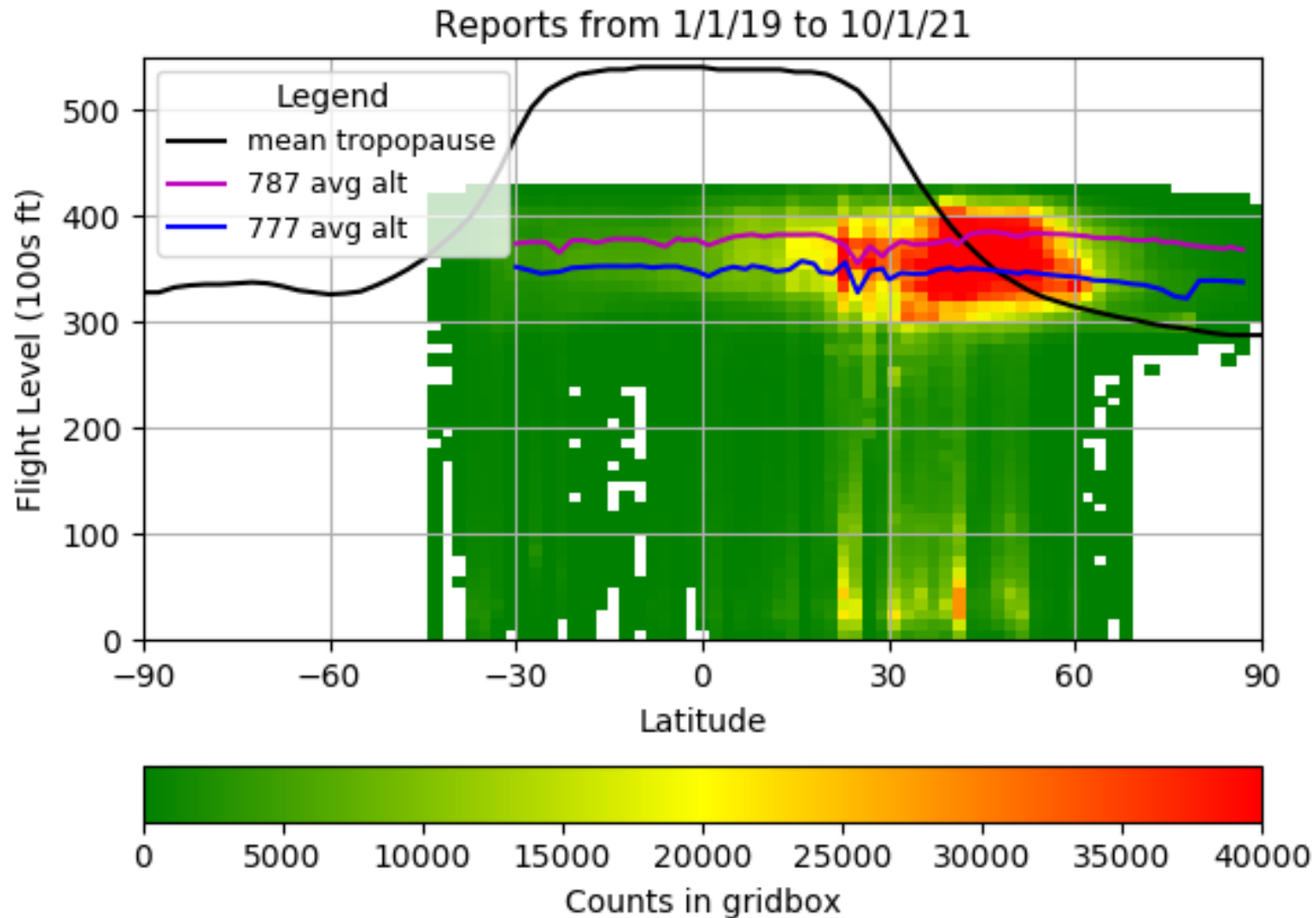


# Operational Altitude

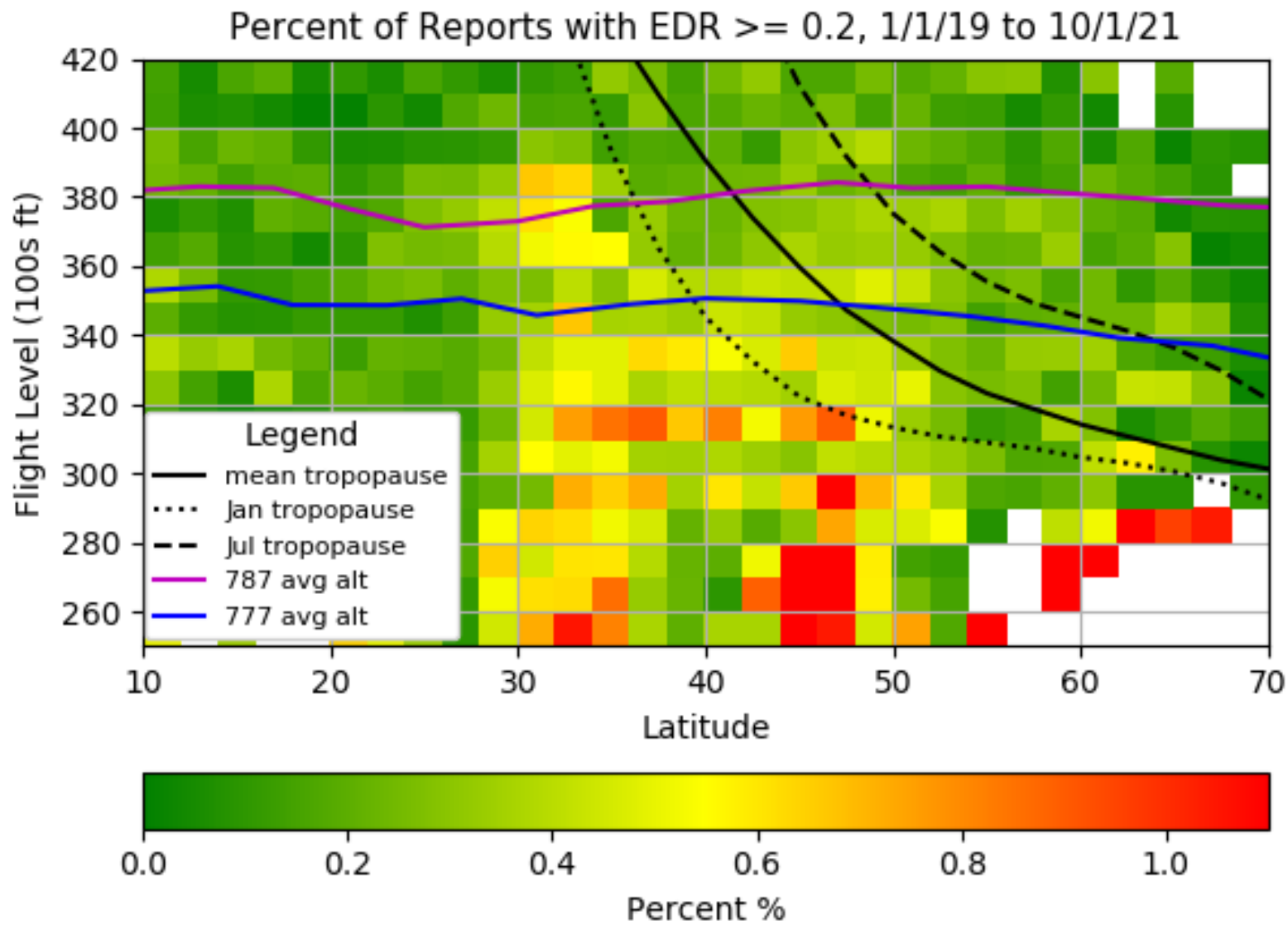
777s and 787s altitude (heartbeat reports) Sep 2021



# Latitudinal Total Observations (“heatmap”)



# Moderate-or-Greater Turbulence Probability





# Conclusions

- ❑ Adoption of EDR reporting is enabling better understanding of global turbulence.
- ❑ Airline coverage is becoming representative of most WMO regions, but additional routes still needed.
- ❑ EDR observations below and near tropopause show higher occurrence of moderate-or-greater turbulence than in stratosphere.

## Next Steps

- ❑ Continued industry data sharing is key to getting full value from these observations, as it helps create the “full solution” for customer use.
- ❑ Mature our plans for meteorological parameters beyond turbulence (e.g. water vapor, cloud & ash properties).
- ❑ Continue to collaborate with other technologies that show promise (e.g. AI satellite-derived turbulence inference).