Delta Meteorology and Pacific Operations

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Lead Meteorologist

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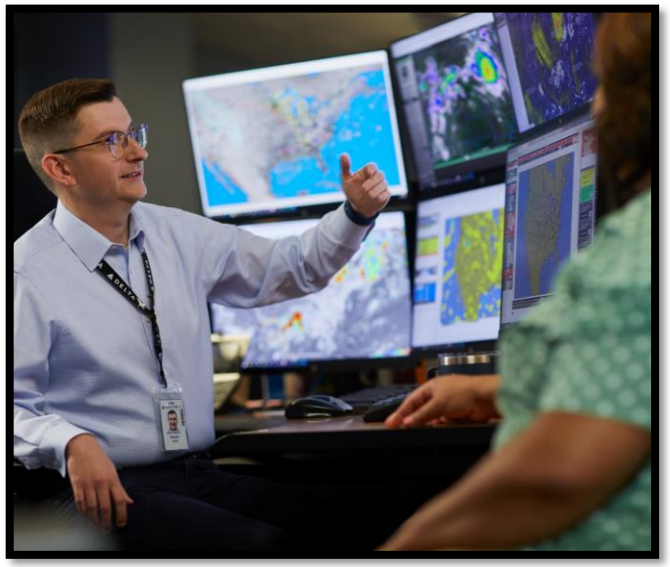
Agenda

- Staffing and Location
- Upper Air Meteorology
- Surface Meteorology
- Other Involvements
- Pacific Operations
- Pacific ETOPS

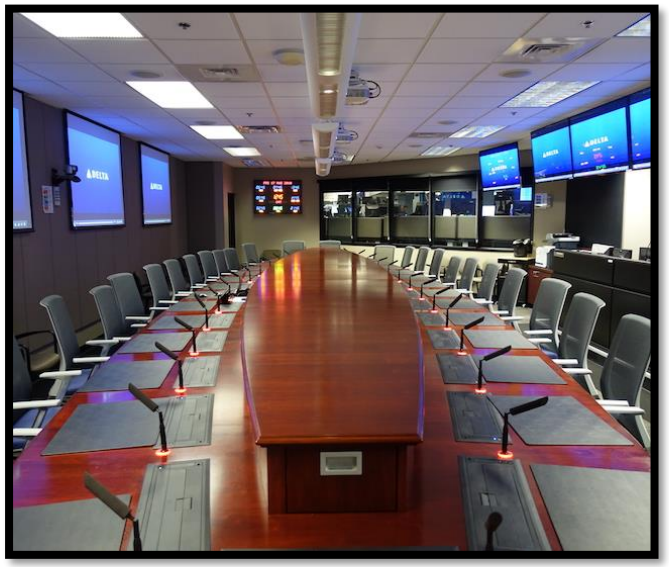
Operations and Customer Center (OCC)

Meteorology is located within Delta's OCC located in Atlanta. Over 30 departments are represented in the OCC



Meteorology includes

- 24/7 Support
- 3 Upper Air Desks
- 2 Surface Desks



Outside the OCC, Meteorology supports other divisions like Flight Operations, Airport Customer Service and TechOps.

Delta Meteorology Staffing

- 22 Senior Aviation Meteorologists
- 3 Lead Meteorologists
  - Warren Weston
  - Eric Wildgrube
  - Mark Yerges
- 1 College Co-Op
- 1 Project Manager: Heather Heitzman
- 1 Manager: Stephanie Klipfel

We also provide our products to KLM and Air France and collaborate with Joint Venture partners Korean Air and Virgin Atlantic. We are building relationships with Aeromexico and LATAM.

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What is Upper Air Meteorology?

En Route Weather Hazards

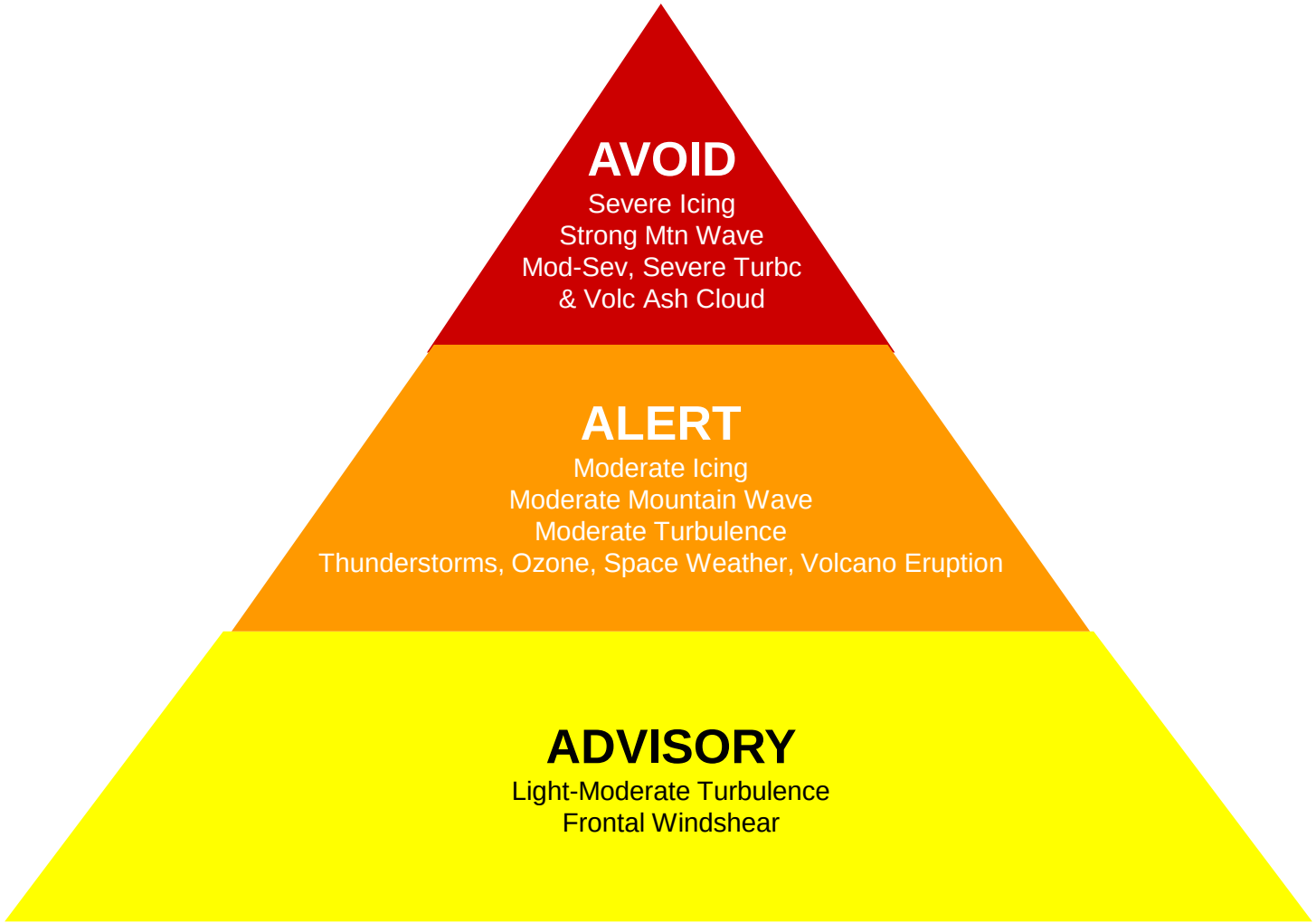
Federal Regulations require airlines to have a system to obtain forecast and reports of “adverse weather phenomena”. The FAA has approved Delta products & processes for en-route weather hazards with the Threat Plot (TP) System:

- Turbulence
- Mountain Waves
- Thunderstorms
- Ozone
- Volcanic Ash
- Space Weather

EWINS Approval:

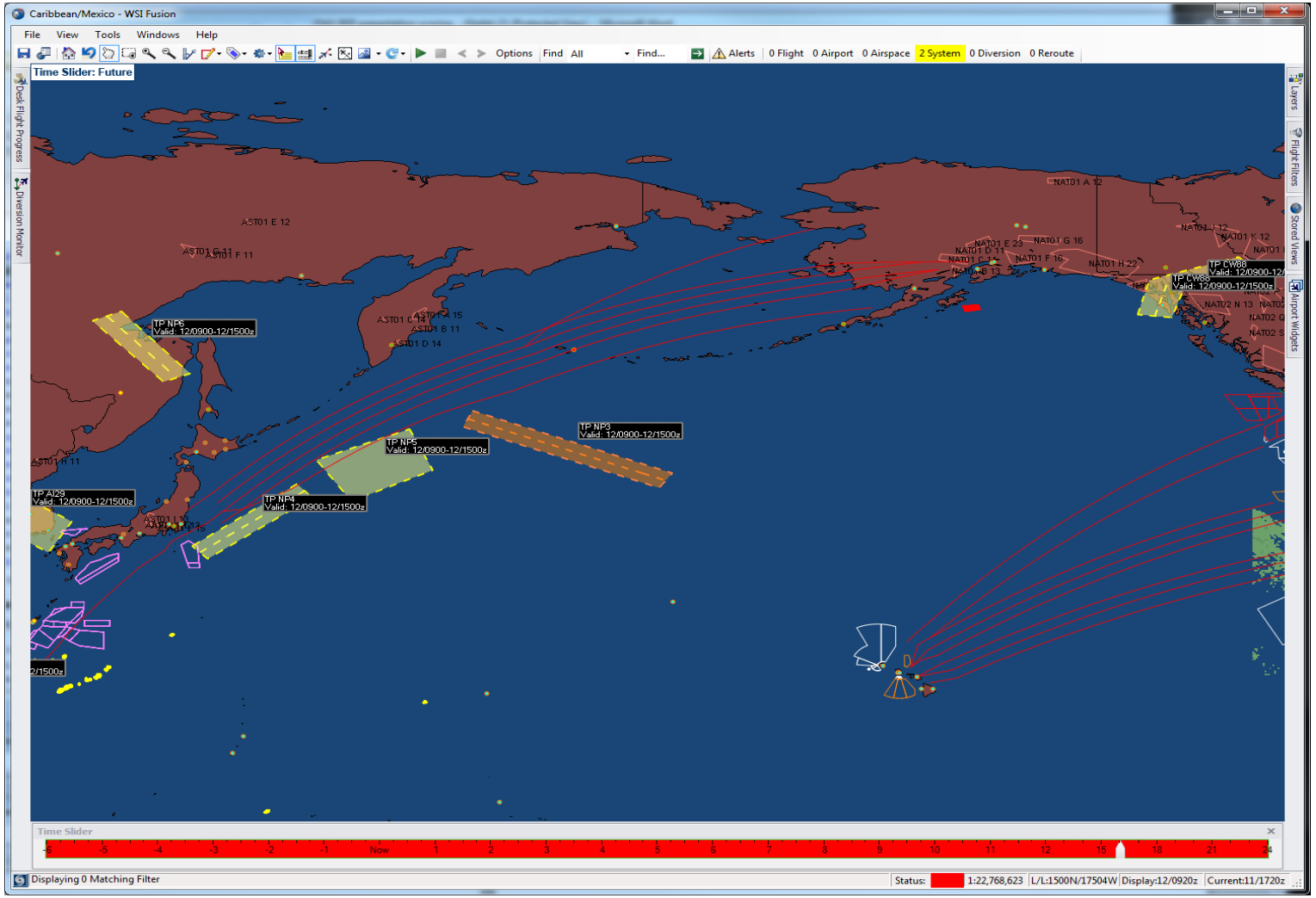
FAA approval is through a program called Enhanced Weather Information System (EWINS). Basic requirements for an EWINS include training, sources of weather data, analysis & forecast procedures, distribution and quality control. Any weather sources used to meet FAA regulations must be added to our EWINS manual and listed in our Ops Spec. This approval is what allows us to override the National Weather Service forecast.

TP Types and Hazard Intensity



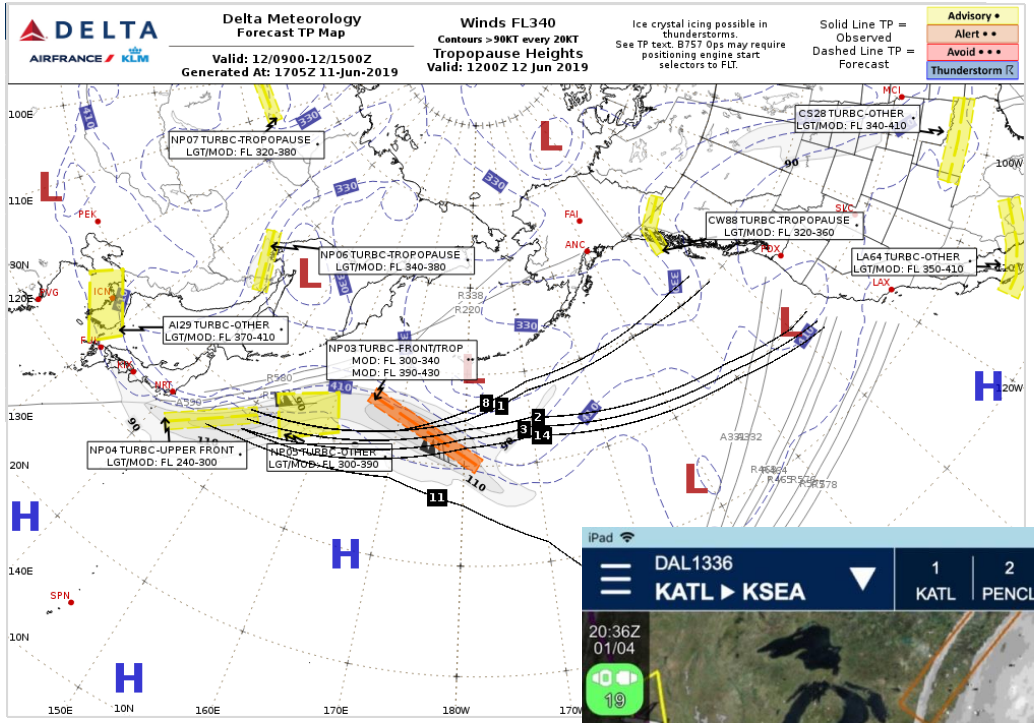
Dispatch and TP's

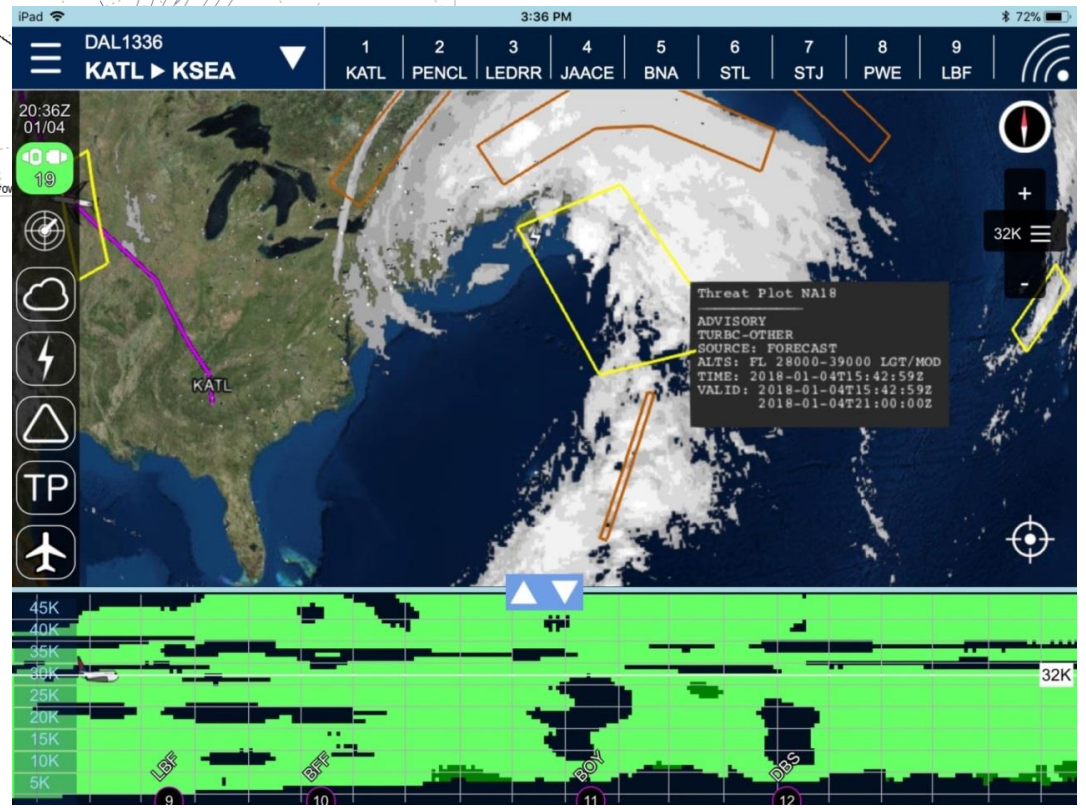
- TP's are overlaid on Delta's Flight Following Tool as soon as they are issued
- Can use time slider to view current or future TP's



TP Distribution to Pilots

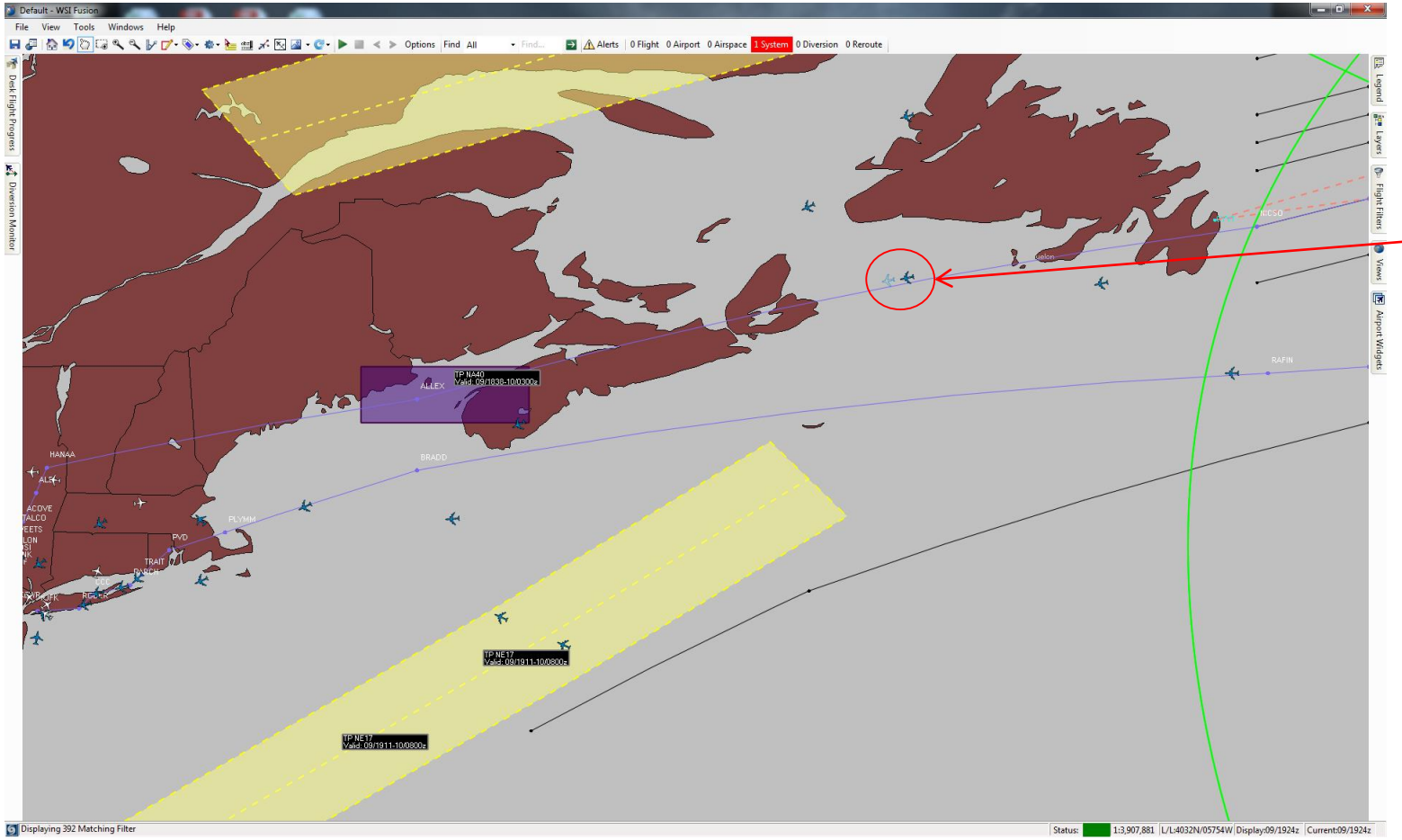
- International pilots receive a paper copy or save electronically preflight
- Domestic pilots receive text summary preflight
- TP's can also be viewed on flight deck tablet





TP Auto Uplink

New TP's are automatically sent to flights based on the flight plan 60 minutes prior to entering TP.



Flight routed thru TP will receive:

TP NA40 091838Z
1.AW EC ME
2.* ALERT *
HAZ:TSTMS
SOURCE:SATELLITE
AREA:45N065W 44N065W
44N068W 45N068W
CVRG:SCT
TOPS:FL350
TREND:NC
MVG FROM:CELLS 23020
3.VALID 091838Z/100300Z
4.CANCEL NA39
ALONG ROUTE
ENTER 09/2003Z ALLEX078092
EXIT 09/2022Z ALLEX254045

Turbulence Reporting

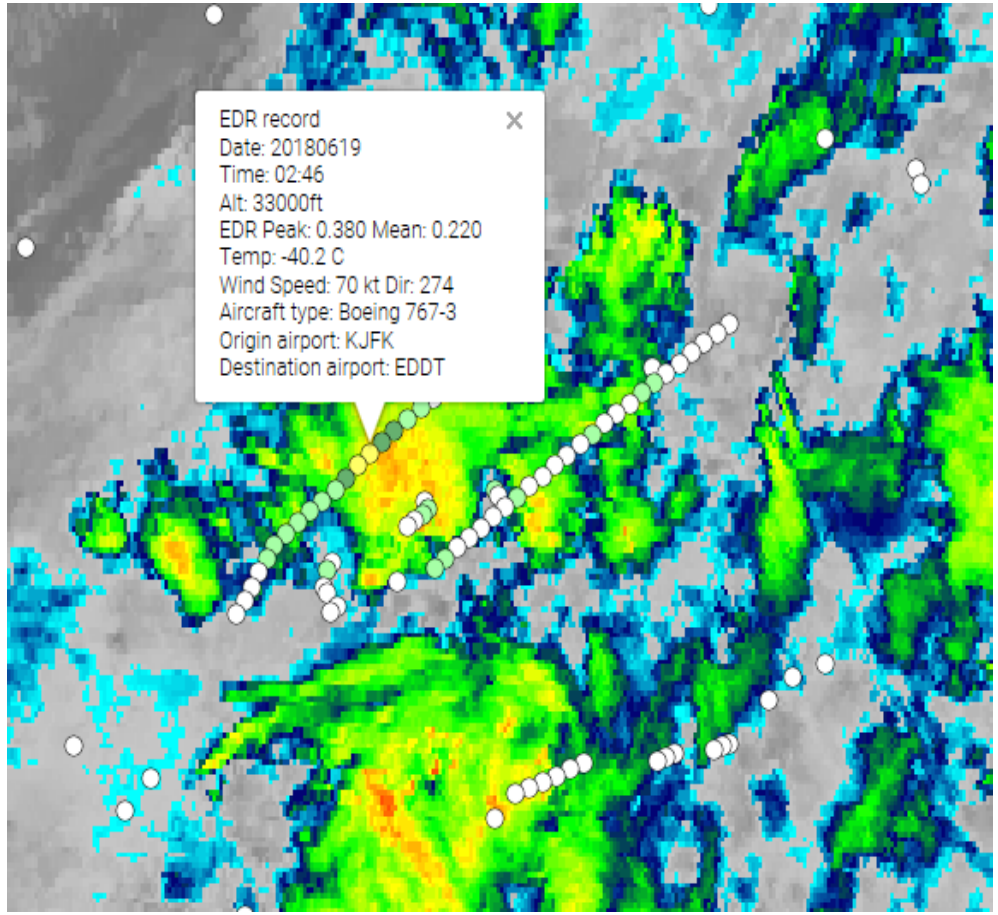
Meteorologist continuously monitor & adjust TP's as needed.

Pilot Reports received from:

- Delta pilots
- KLM and Air France pilots
- Other airlines reporting to ATC

Delta and the industry is progressing towards aircraft auto-turbulence reporting called EDR. Delta fleet is about 50% equipped. EDR counts from May 24, 2023:

	Smooth	Turbulence	Total
DL	43,059	6,854	49,913
OA	53,777	23,420	77,197
Total	96,836	30,274	127,110



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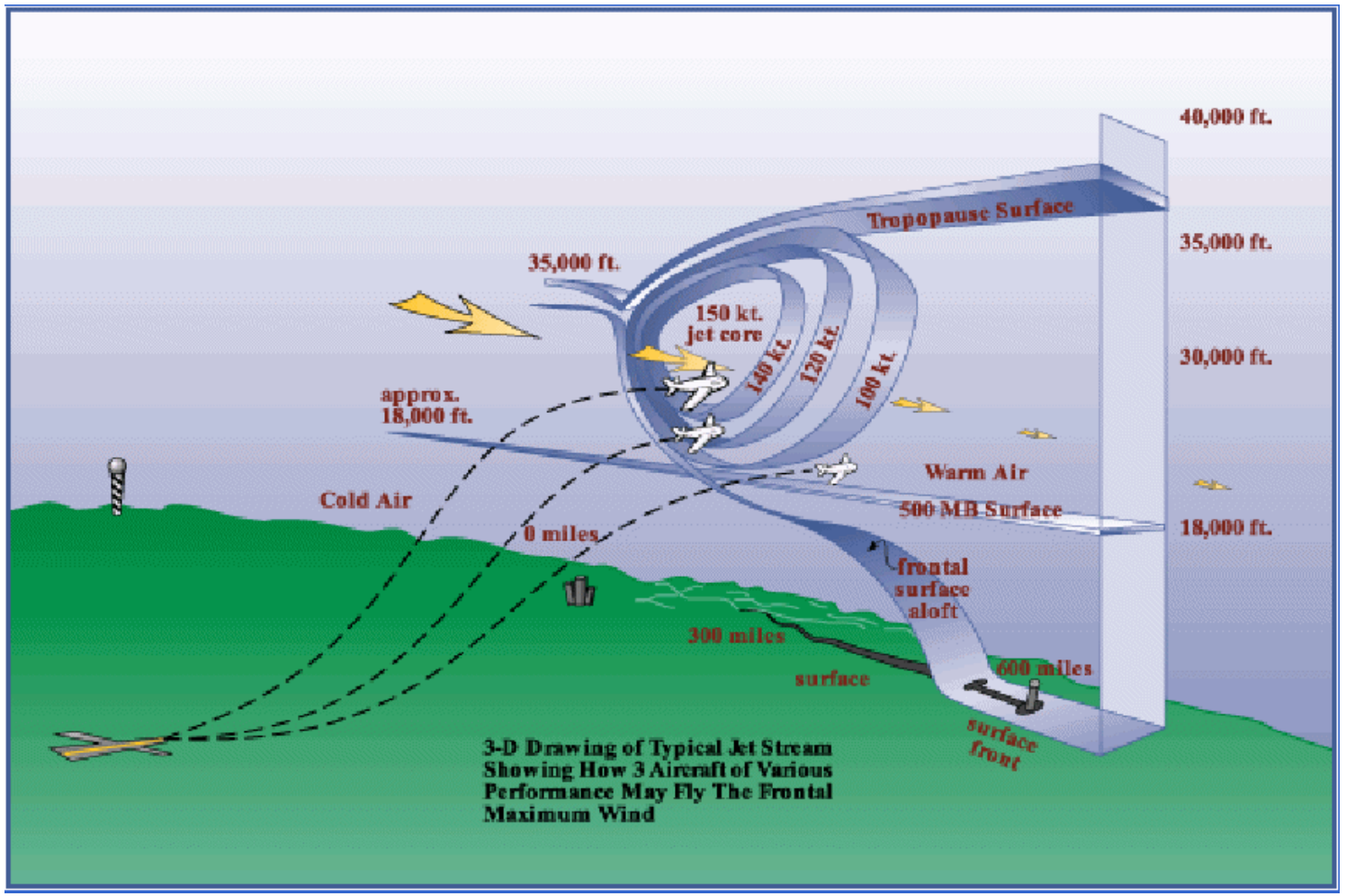
Hazards

Clear Air Turbulence

Meteorologists analyze the atmosphere for features that cause turbulence.

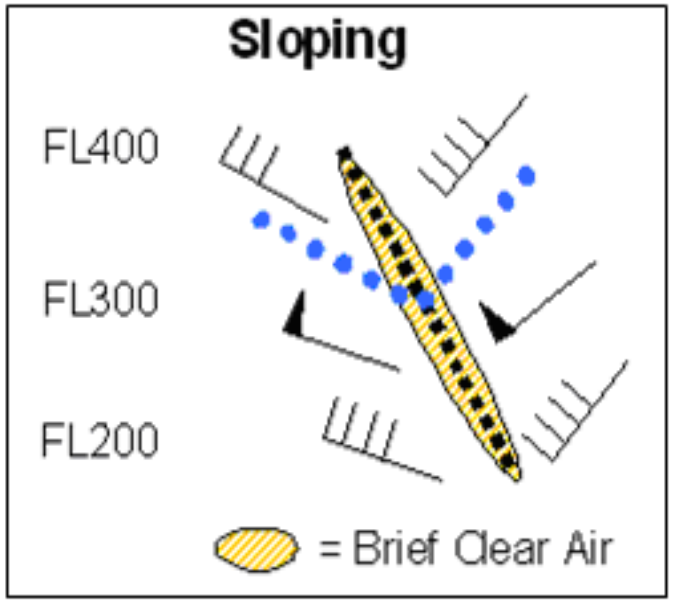
- Front
- Tropopause

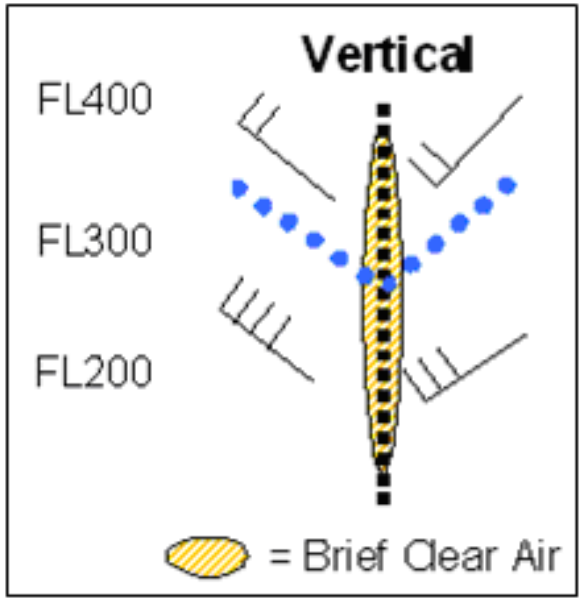


Clear Air Turbulence

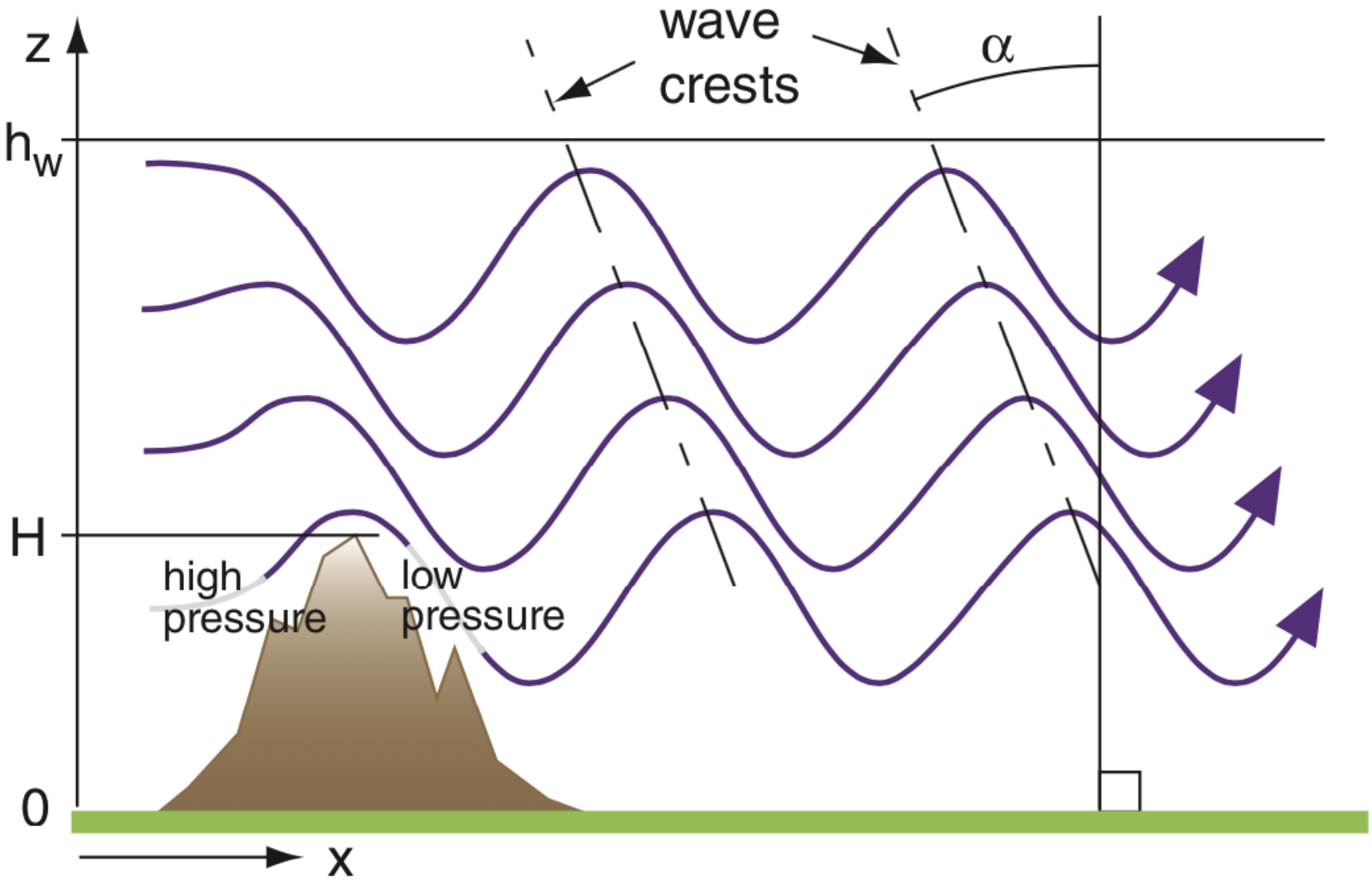
Upper level tough lines are changes in wind direction horizontally and/or vertically. Numerous components can indicate turbulence intensity.

- Cause(s)
- Structure
- Movement
- Strength

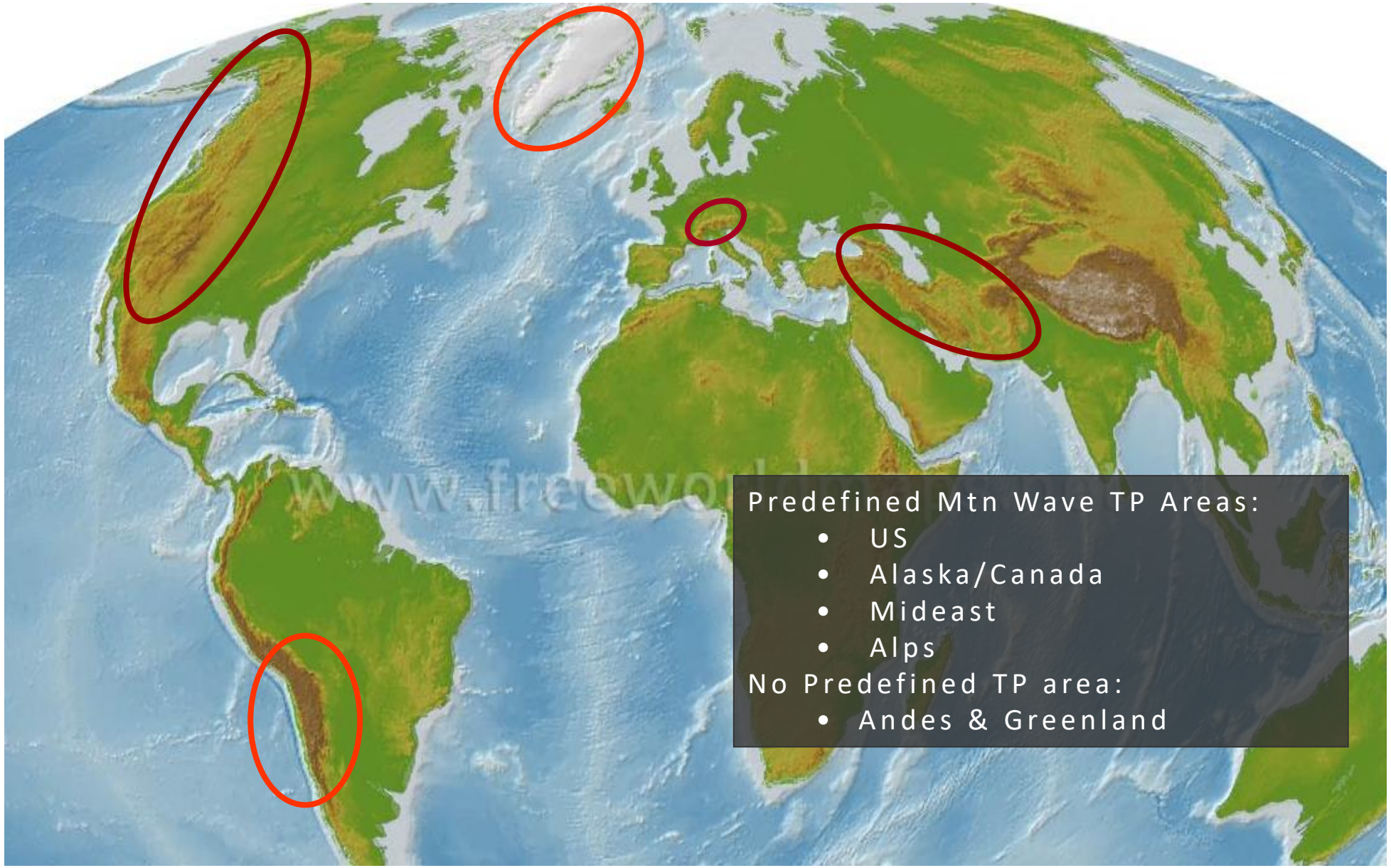




Mountain Waves Cross Section

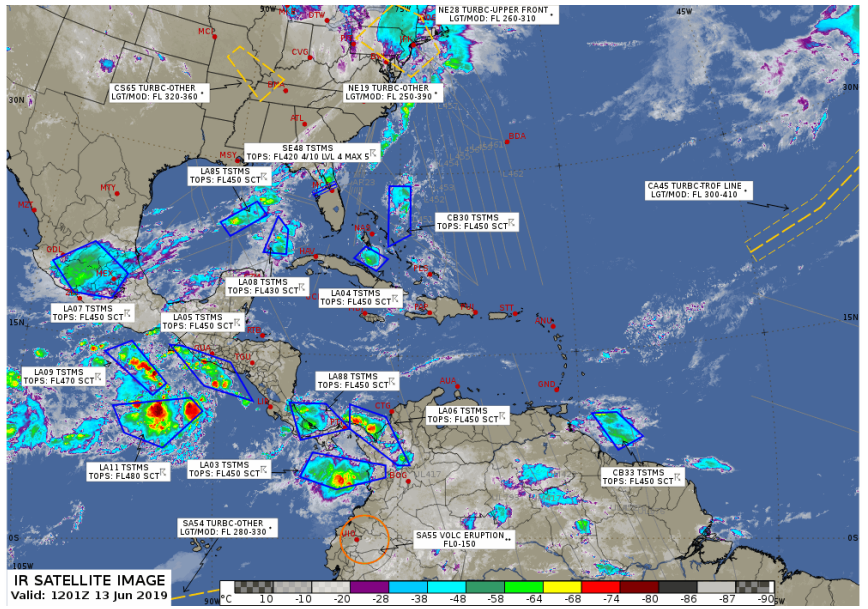


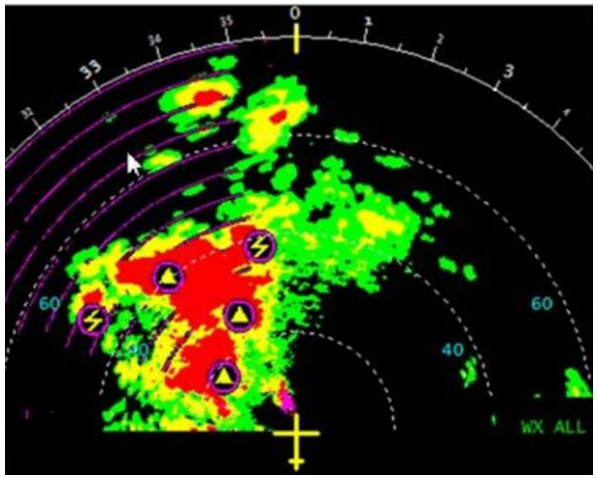
Global Mountain Wave Areas



Thunderstorms

- Delta Meteorology issues thunderstorm TP’s for significant coverage that could cause significant route deviations
- Dispatch considers for strategic route selection
- Pilots uses onboard radar for tactical decisions



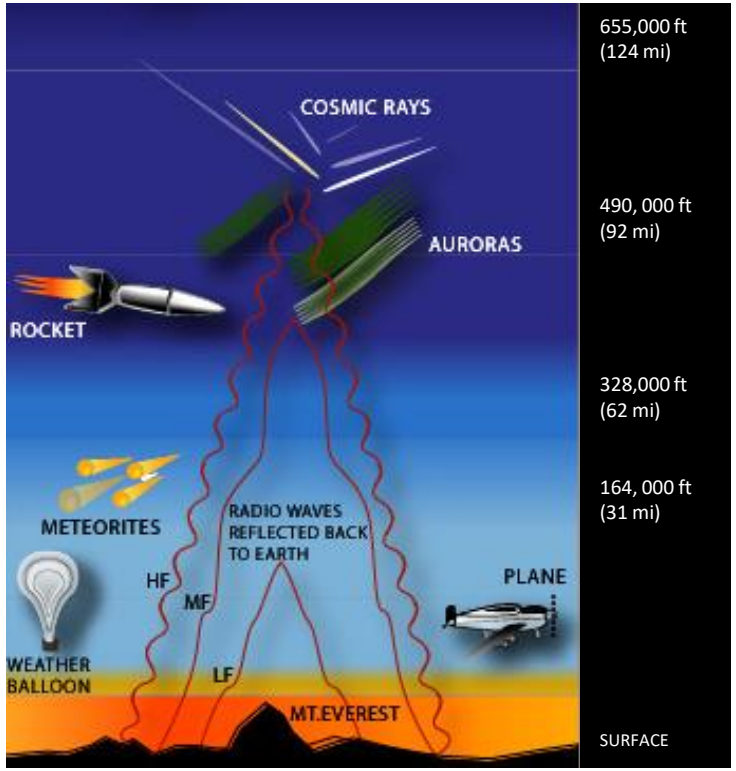


Active Volcano Region

Space Weather Hazards

Space Weather Impacts include:

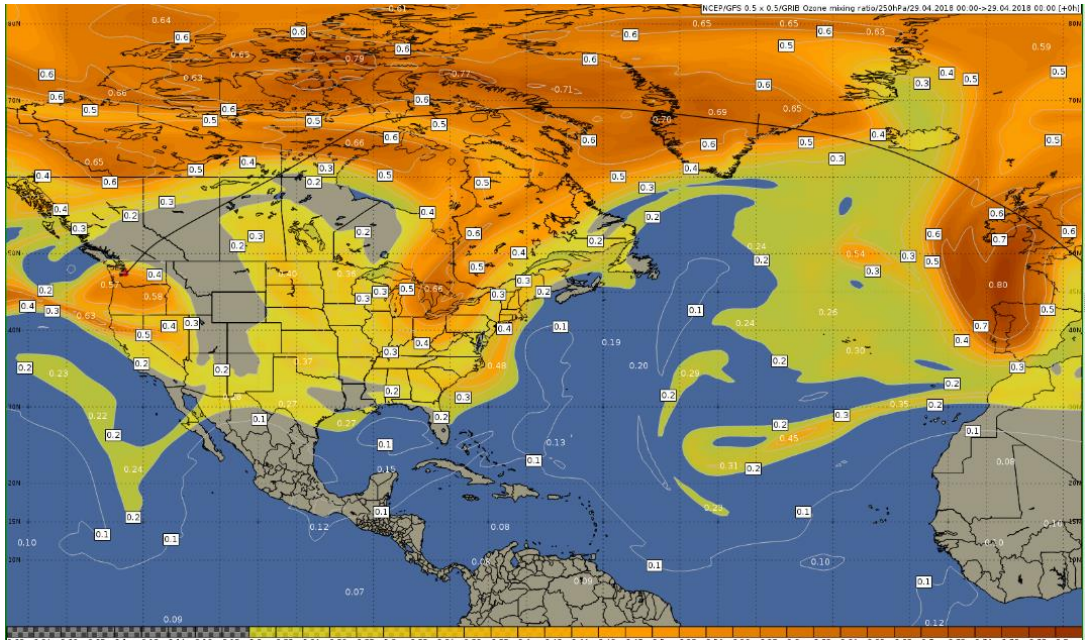
- Communication degradation or outage
- GPS degradation or outage
- Increased radiation dosage for crews and customers



Ozone

Federal regulations require concentrations to remain below specified concentrations. Delta manages by:

- Method 1: Ozone Filters
  - -On International/Over Water Aircraft
- Method 2: Ozone TPs
  - -Issued for Areas of significant ozone concentration
  - -Usually Applies to:
    - -Delta Domestic B767 & B757 to Alaska
    - -B757's over Atlantic & very rarely in Domestic US



Surface Meteorology

Airport Weather Hazards

Delta has products and processes in place for these surface weather hazards:

- Low Clouds/Visibility
- Thunderstorms
- Icing
- Low level wind shear
- Strong winds
- Winter precipitation
- Volcanic Eruptions

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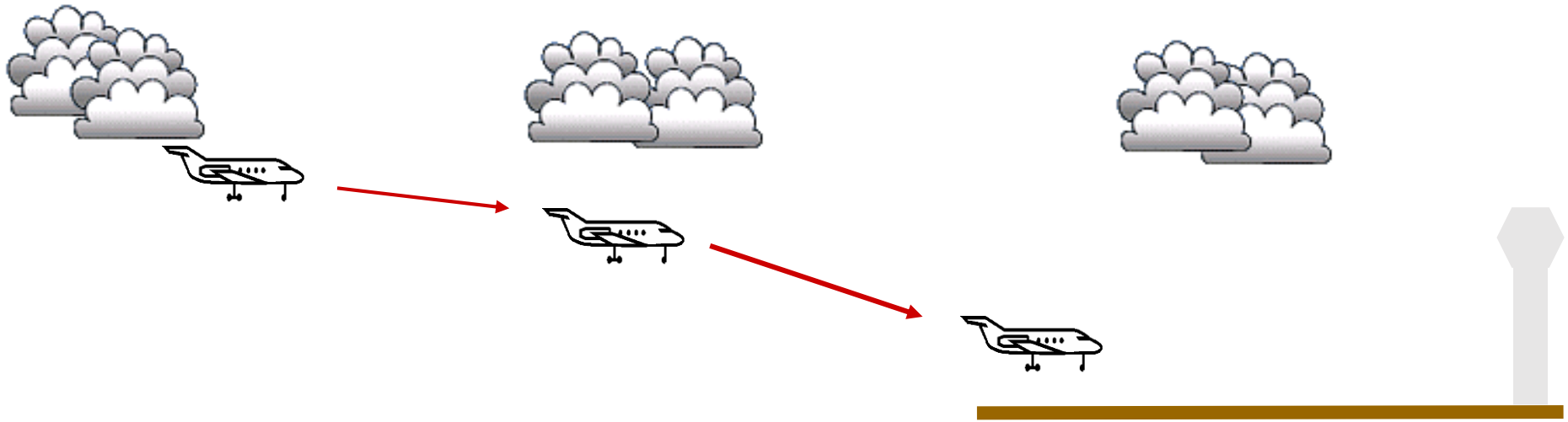
Clouds and Visibility



When arriving with visual approaches, Atlanta can land 130+ aircraft an hour!

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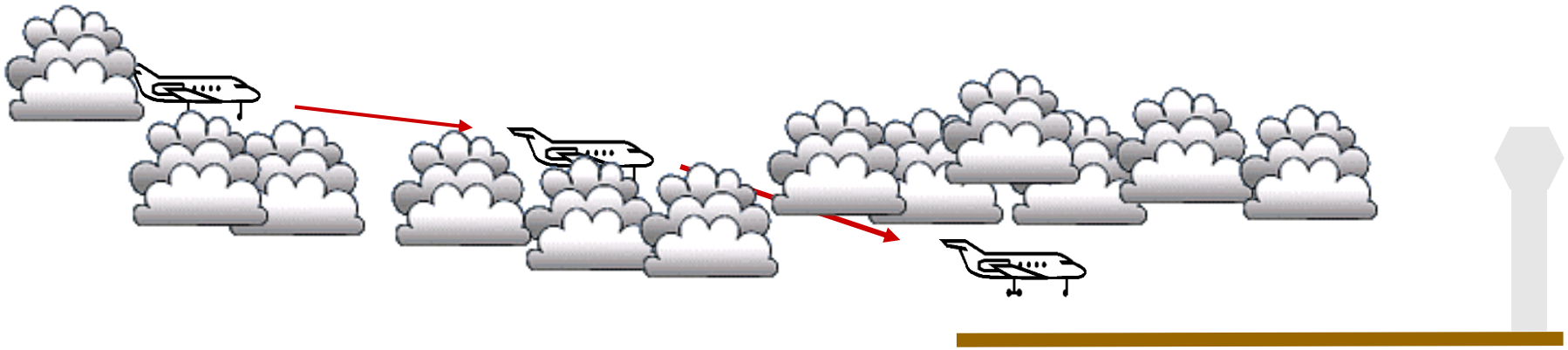
Clouds and Visibility



If pilots can not see the plane in front of them, ATC will space them further apart. With low clouds, Atlanta's arrival rate will drop. Planes can be put into holding, so the dispatcher needs to make sure there is enough fuel for holding and to divert, if needed, to a close-by airport.

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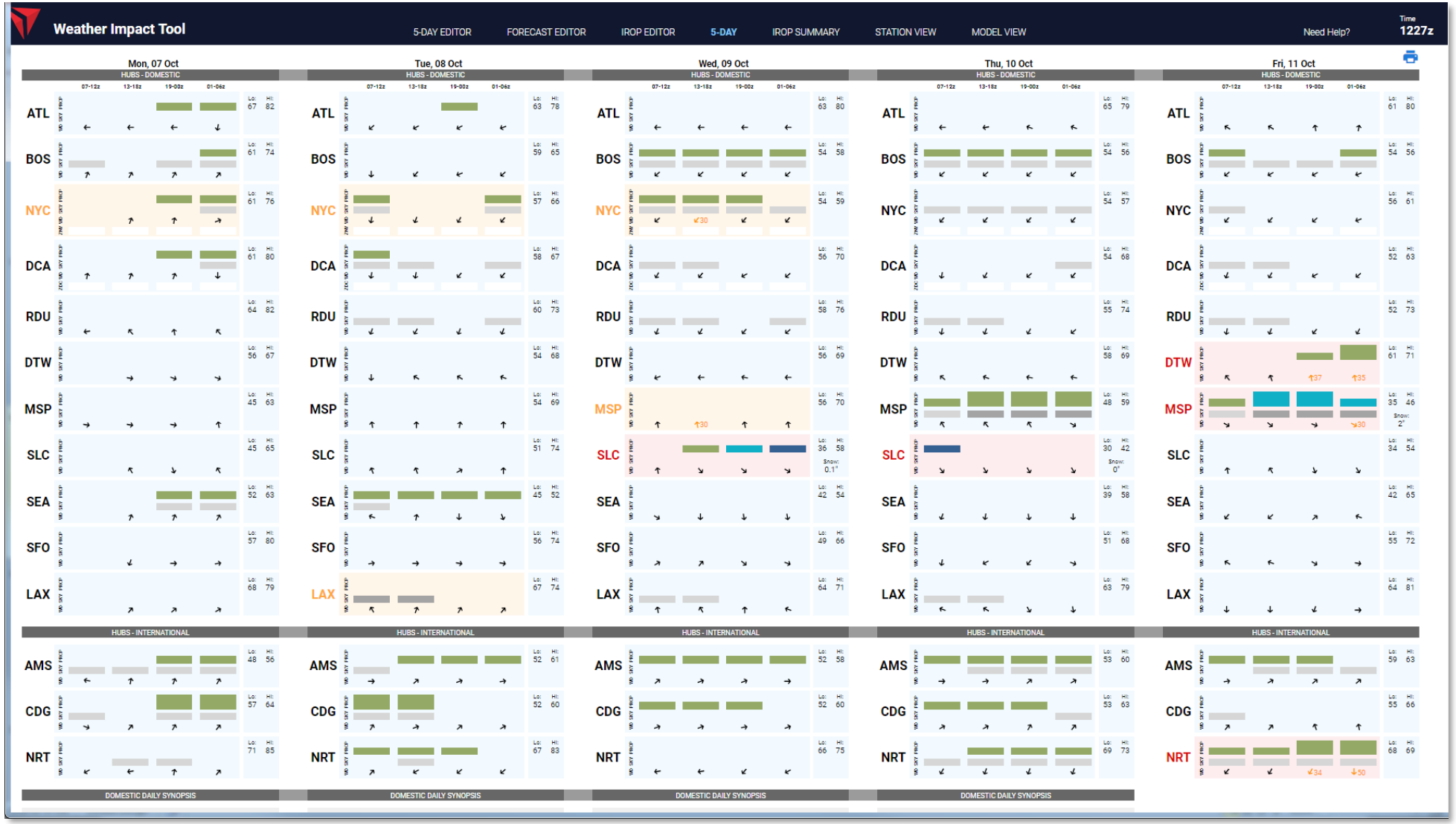
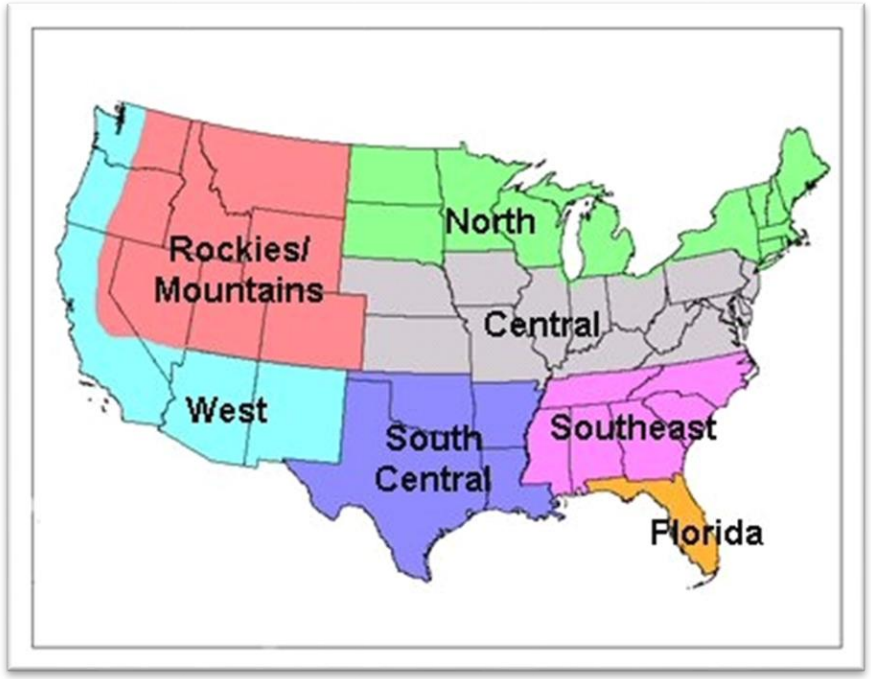
Delta TAF Locations

- We do 9 TAFs for Delta hub airports, updated 4x per day
- TAFs are used by dispatch to determine holding fuel and alternates
- NWS TAF's used for all non-hub cities
- Flight Dispatchers can request a TAF for any location in the world
- Delta Meteorology also produces several TAFs for ETOPS alternates for oceanic flights

5-day Hub Outlook



Winter IROP Thresholds



Regionally Defined Snow Thresholds

- 4+” North and Rockies
- 2+” Central
- ANY for Southeast, Florida, South Central and West Coast

IROP Outlook Based On:

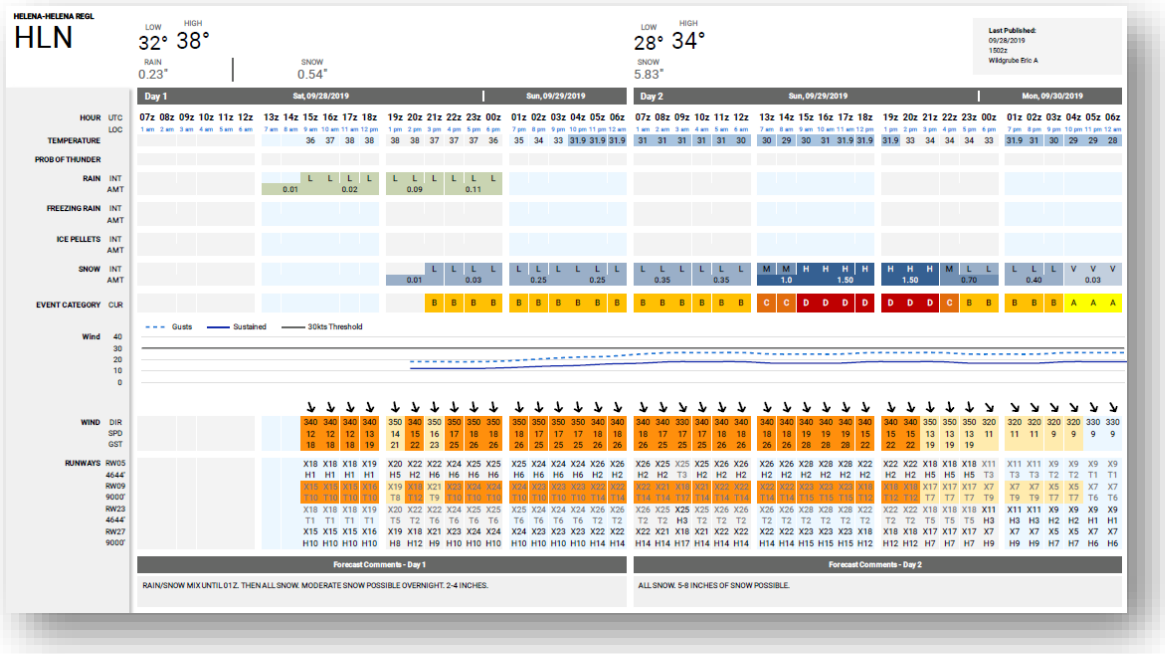
- Snow Thresholds
- Any Freezing Rain/Mix
- Any Ice Pellets
- Wind Gusts 35+KTS

IROP Planning

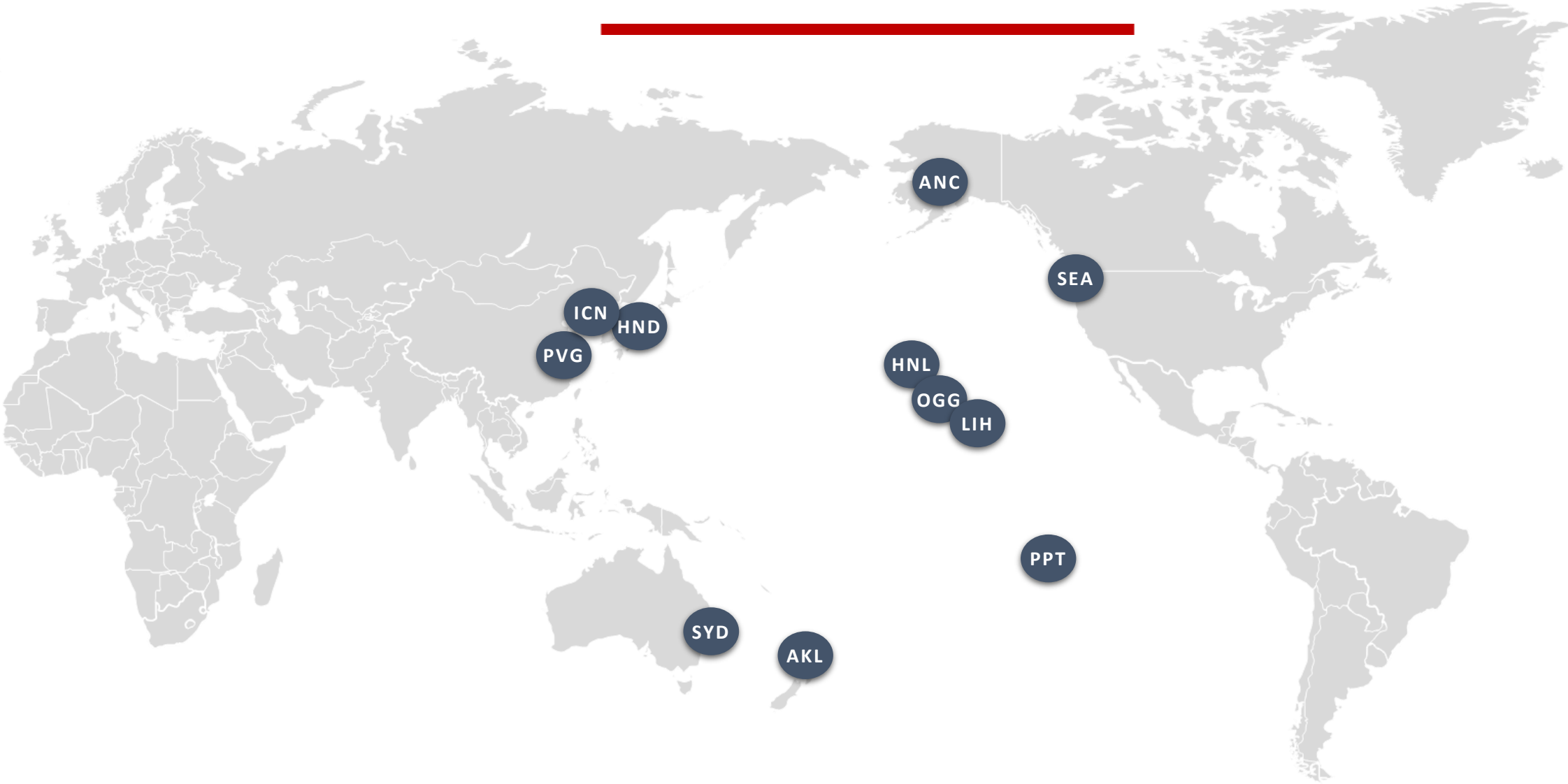
Meteorologists issue hourly forecast for all stations reaching IROP thresholds. This can be for large winter event or a hurricane.

Delta's Strategic Planning Team works with airport to determine level of operations based on:

- Aircraft Limitations
- Airport Constraints
- Local Response
- Deicing Throughput/Aircraft Size
- Employee Readiness
- Transportation



PACIFIC OPERATIONS



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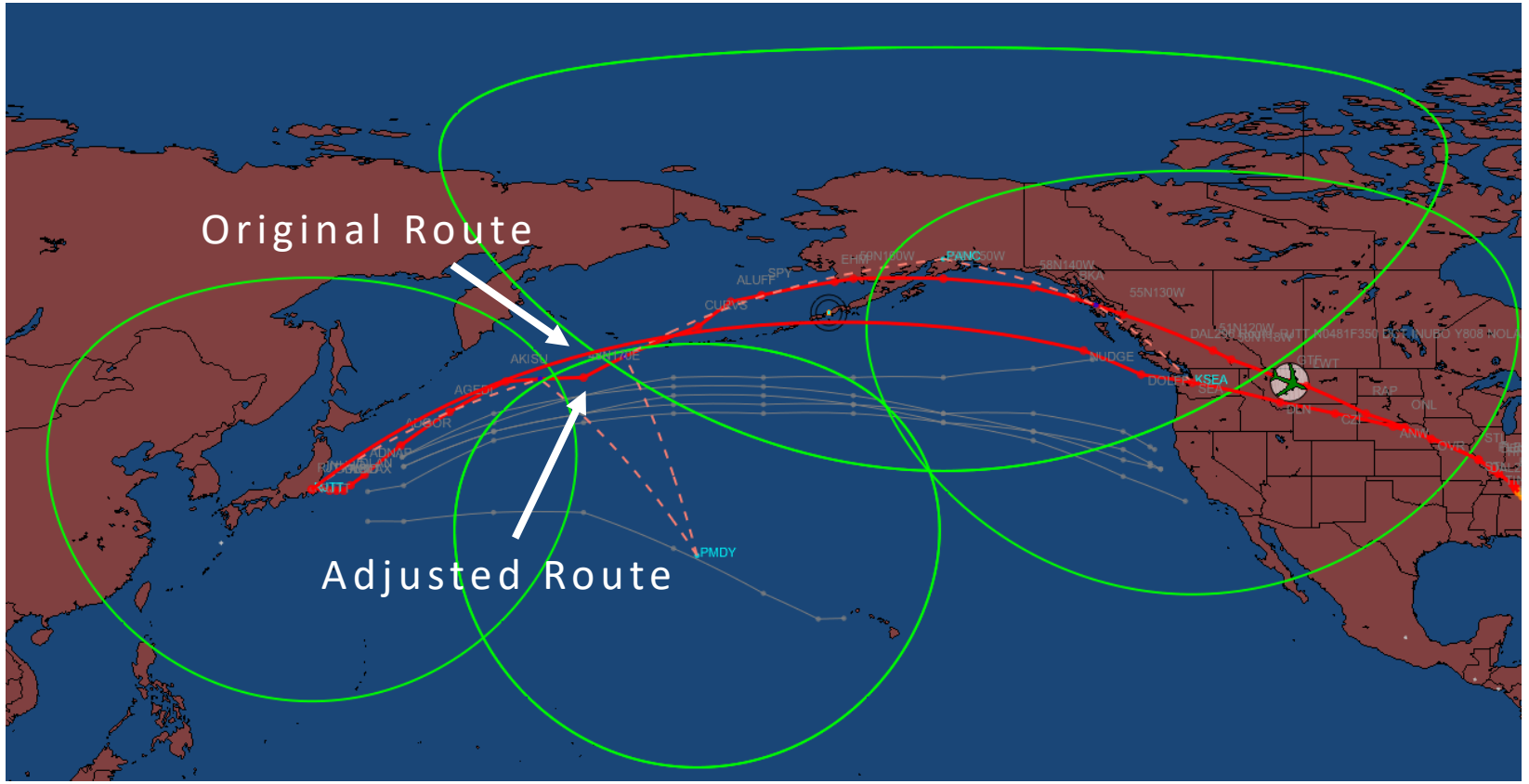
Transpacific or Hawaiian Alternates

Airport	# of DL Flights Used (2022)
KSFO	11,271
PHKO	6,710
PHNL	5,560
PANC	3,035
PASY	2,146
PMDY	1,945
PACD	1,643
PAFA	587



ETOPs operations are required to stay within specific minutes of an alternate airport along the entire oceanic route. The original flight plan had HND, CDB, ANC and SEA as alternates. We issued a CDB TAF that made it no longer useable.

ETOPS and TAF's

The dispatcher adjusted & MDY as an alternate, but this left small gap where flights was not in ETOPS range. The dispatcher had to adjust the route just a few degrees south to make it within ETOPS range. Delta often issues their own TAF's but frequently uses the Govt TAF.

Volcanic Eruptions

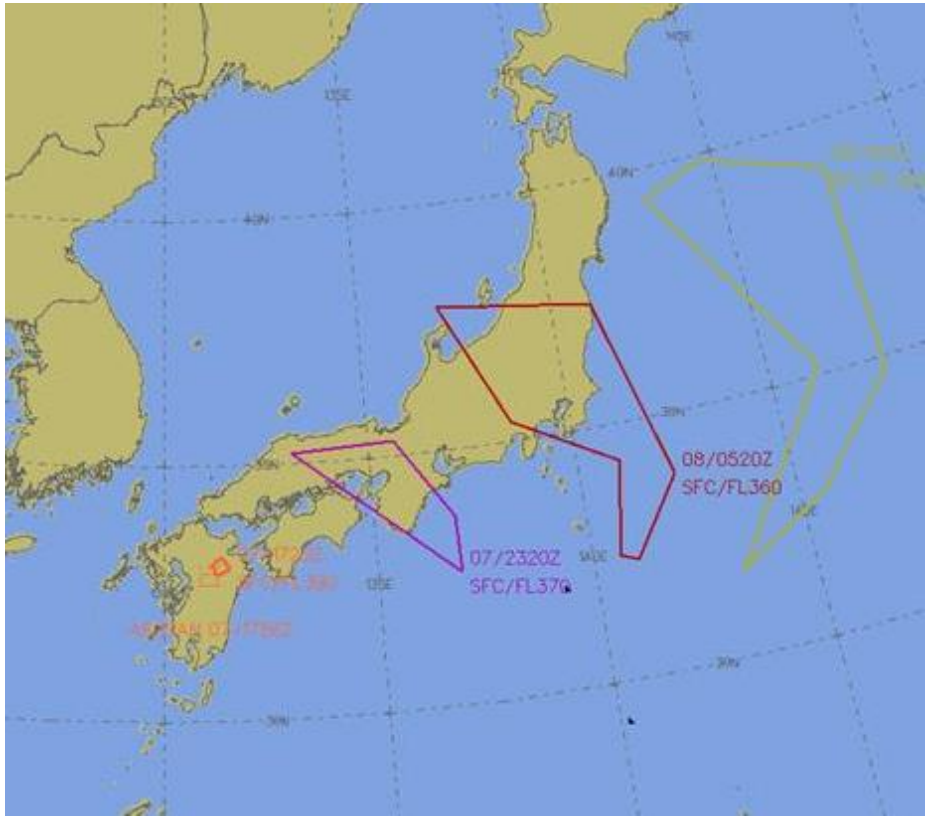
Kamchatka Peninsula

- One of the most impactful volcanic areas in the world straddles Tokyo and Anchorage VAAC. When a major eruption occurs, almost by default, it impacts both VAAC's. This can lead to potential inconsistencies if there is not good VAAC-VAAC communication.

- This is important because due to geopolitical issues, there are already airspace restrictions for Delta's North Pacific routes.

VAAC vs Delta Meteorology

Around 06z, Asosan Volcano went off in Southern Japan with ash to FL390 in the VAAC forecast moving NE right over all of our Japan stations. This included Tokyo, which had quite a bit of flight activity (13 flights arriving between 0425z-0615z and 10 flights departing 0620-0810z).



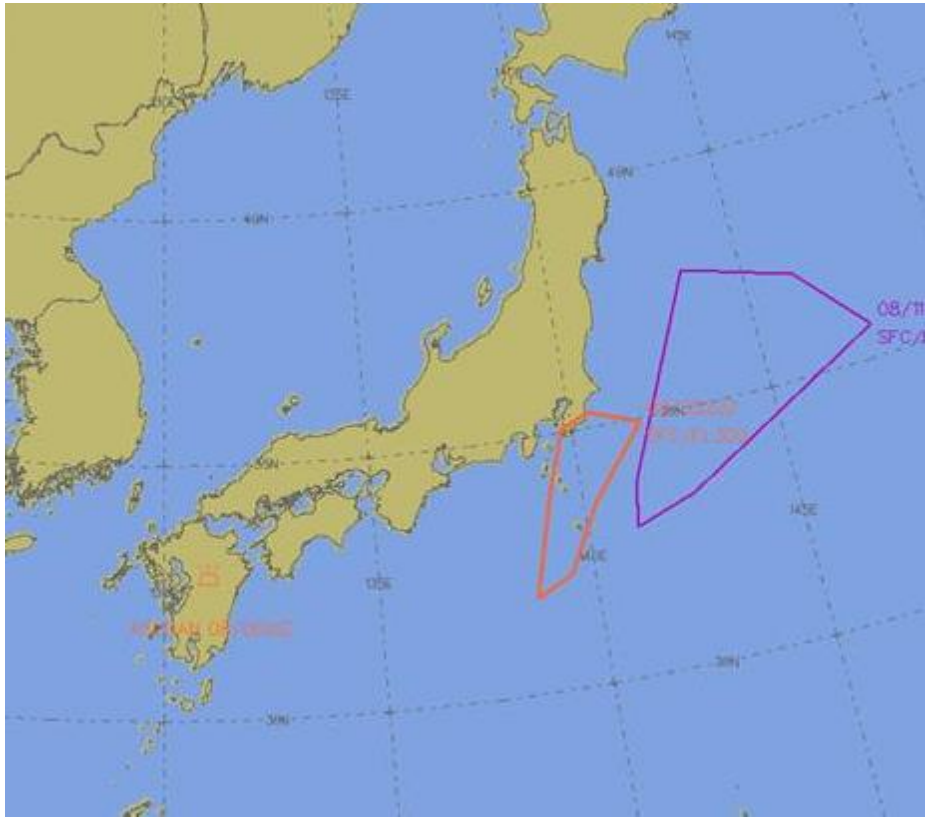
VAAC vs Delta Meteorology

Delta Meteorology was able to use Satellite and Ash dispersion to determine the Ash should stay south of Japan stations and issued these TP’s

VAAC vs Delta Meteorology

Based on Delta Met forecast, Delta flights were able to depart for Japan from the US on time.

On the next advisory, 6 hours later, official VAAC also shifted their forecast south.



Pacific Operations

Delta's Pacific operations are ~90% of what they were pre-COVID

Less flights, but larger aircraft with more seats

Thank You

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