Convective Weather Aviation Hazards

Fort Worth Center Weather Service Unit
National Weather Service

Convective Weather Hazards

Outline of Topics We Will Cover:

- Convective Season Types
  - Dry Line
  - Isolated (aka: Popcorn)
- Downburst / Microburst
- TCF
- Density Altitude
- False Radar Returns (AP)
- AIRMETs/SIGMETs/CWAs/PIREPs
- Emergency Flight Assistance

Controller Requirements

- Advise pilots of hazardous weather that may impact operations within 150NM of their sector or area of jurisdiction.

- Solicit PIREPs when requested or when one of the following conditions exists or is forecast:
  - Ceilings at or below 5,000 feet
  - Visibility at or less than 5 miles
  - Thunderstorms or related phenomena
  - Turbulence of moderate degree or greater
  - Icing of light degree or greater

- Issue pertinent information on observed/reported weather and chaff areas…

Excerpts from 7110.65V Ch. 2-6

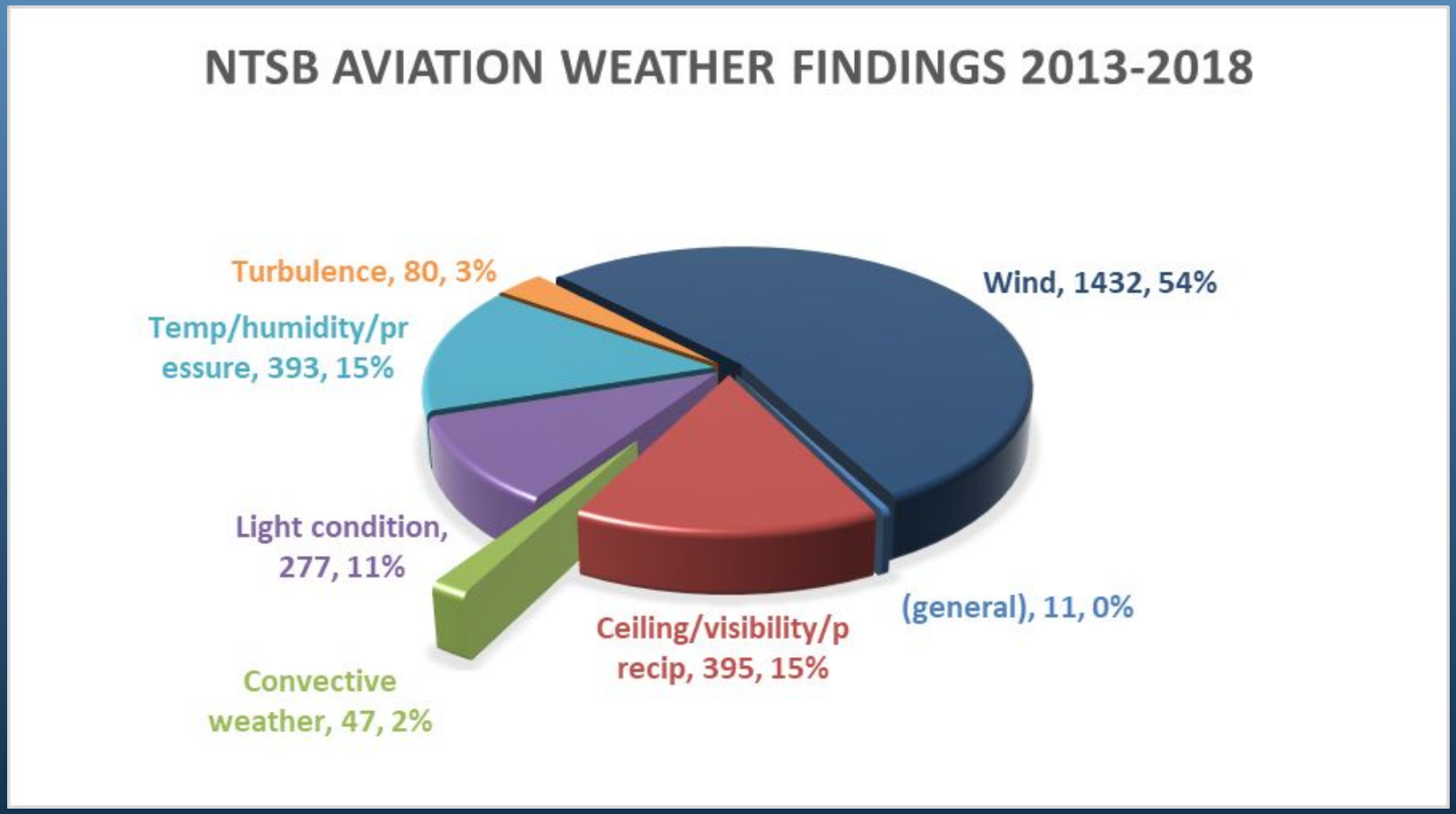
Why This Training?

Part 121 Accidents and Fatalities by Weather-Related Findings and Year, 2013-2018									
	Weather-Related Accidents			*All Accidents*			*% Weather-Related*		
Year	Accidents	Fatal Accidents	Fatalities	Accidents	Fatal Accidents	Fatalities	Accidents	Accidents	Fatalities
Total	***61***	***1***	***2***	***182***	***3***	***10***	34%	33%	20%

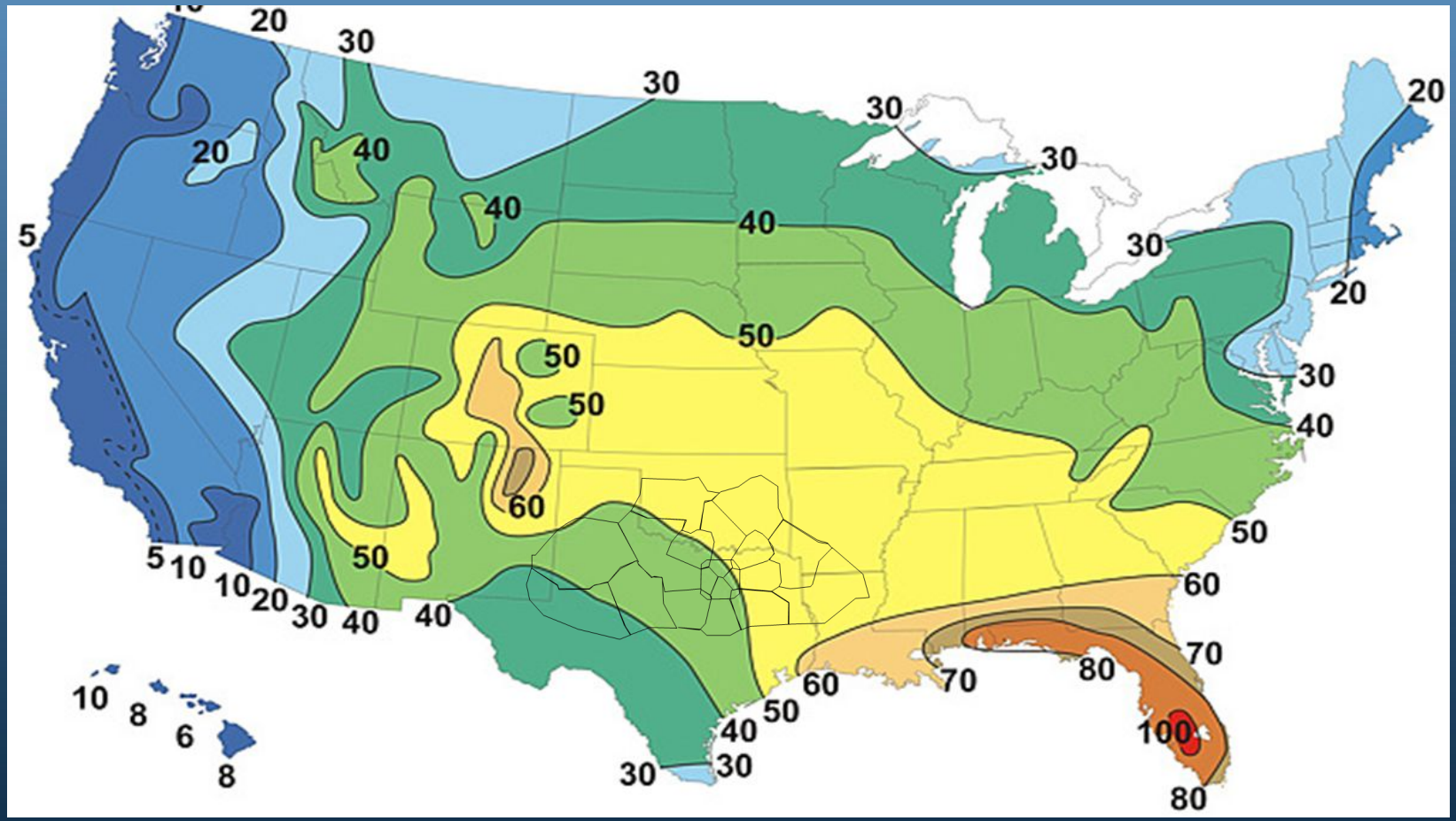
Part 135 Accidents and Fatalities by Weather-Related Findings and Year, 2013-2018									
	Weather-Related Accidents			*All Accidents*			*% Weather-Related*		
Year	Accidents	Fatal Accidents	Fatalities	Accidents	Fatal Accidents	Fatalities	Accidents	Accidents	Fatalities
Total	***84***	***22***	***61***	***263***	***52***	***138***	32%	42%	44%

General Aviation Accidents and Fatalities by Weather-Related Findings and Year, 2013-2018									
	Weather-Related Accidents			*All Accidents*			*% Weather-Related*		
Year	Accidents	Fatal Accidents	Fatalities	Accidents	Fatal Accidents	Fatalities	Accidents	Accidents	Fatalities
Total	***1750***	***385***	***730***	***7510***	***1364***	***2329***	23%	28%	31%
Grand									
Total	***1895***	***408***	***793***	***7955***	***1419***	***2477***	24%	29%	32%

Thunderstorms

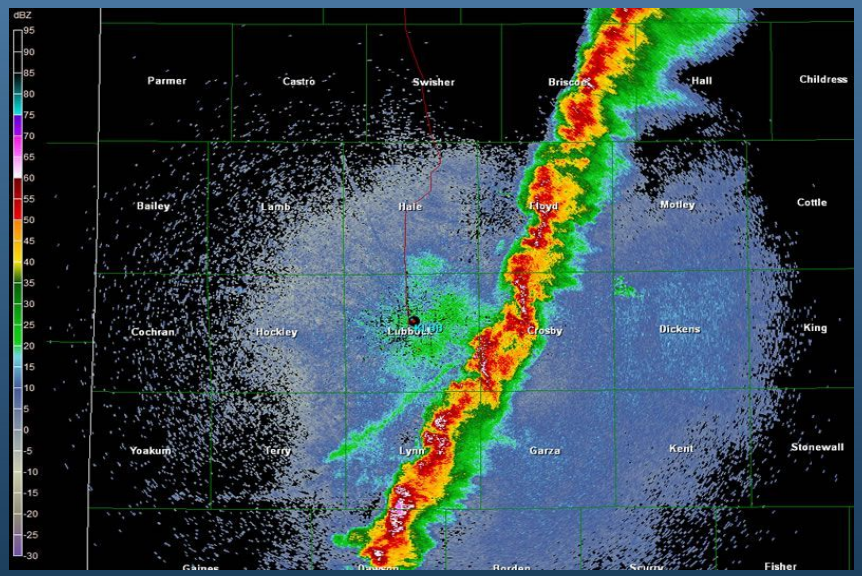


Average Annual Thunderstorm Days



ZFW Has 2 Separate Thunderstorm Season Types

Dry Line



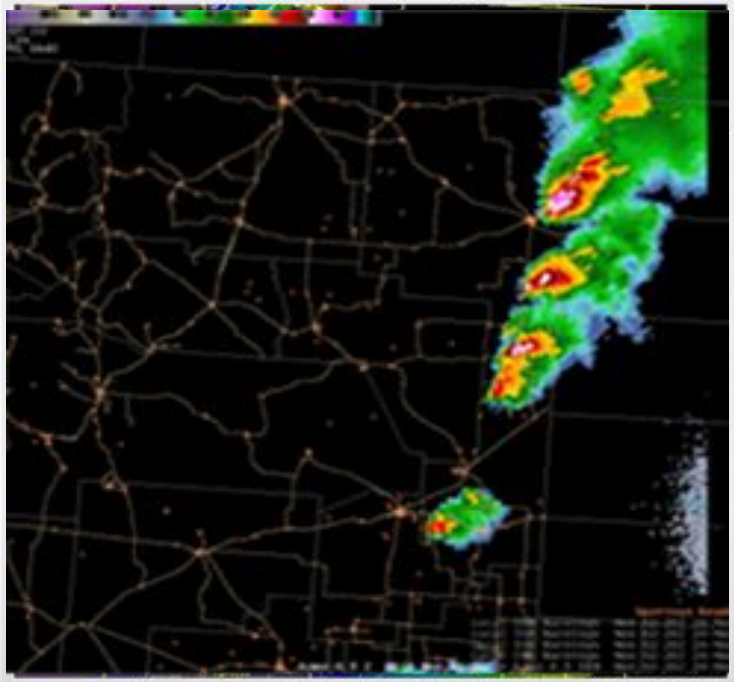
March - June

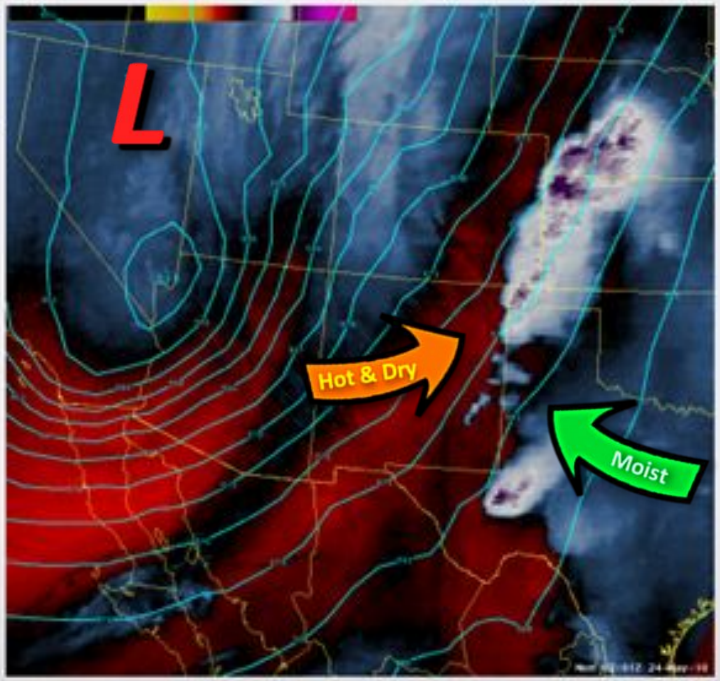
Isolated (Popcorn)

May – Aug

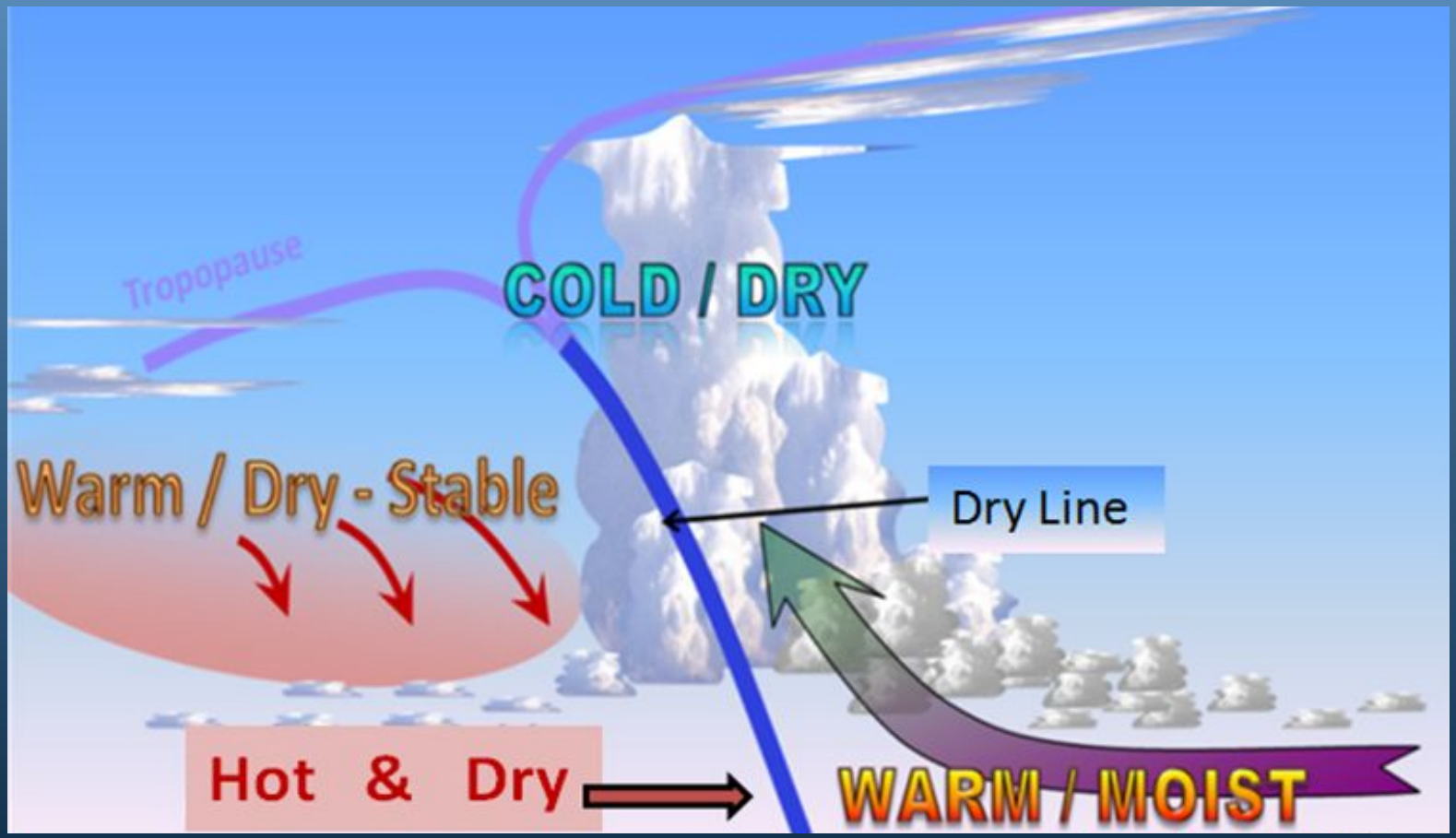
Dry Line Pattern

Satellite and Radar Imagery

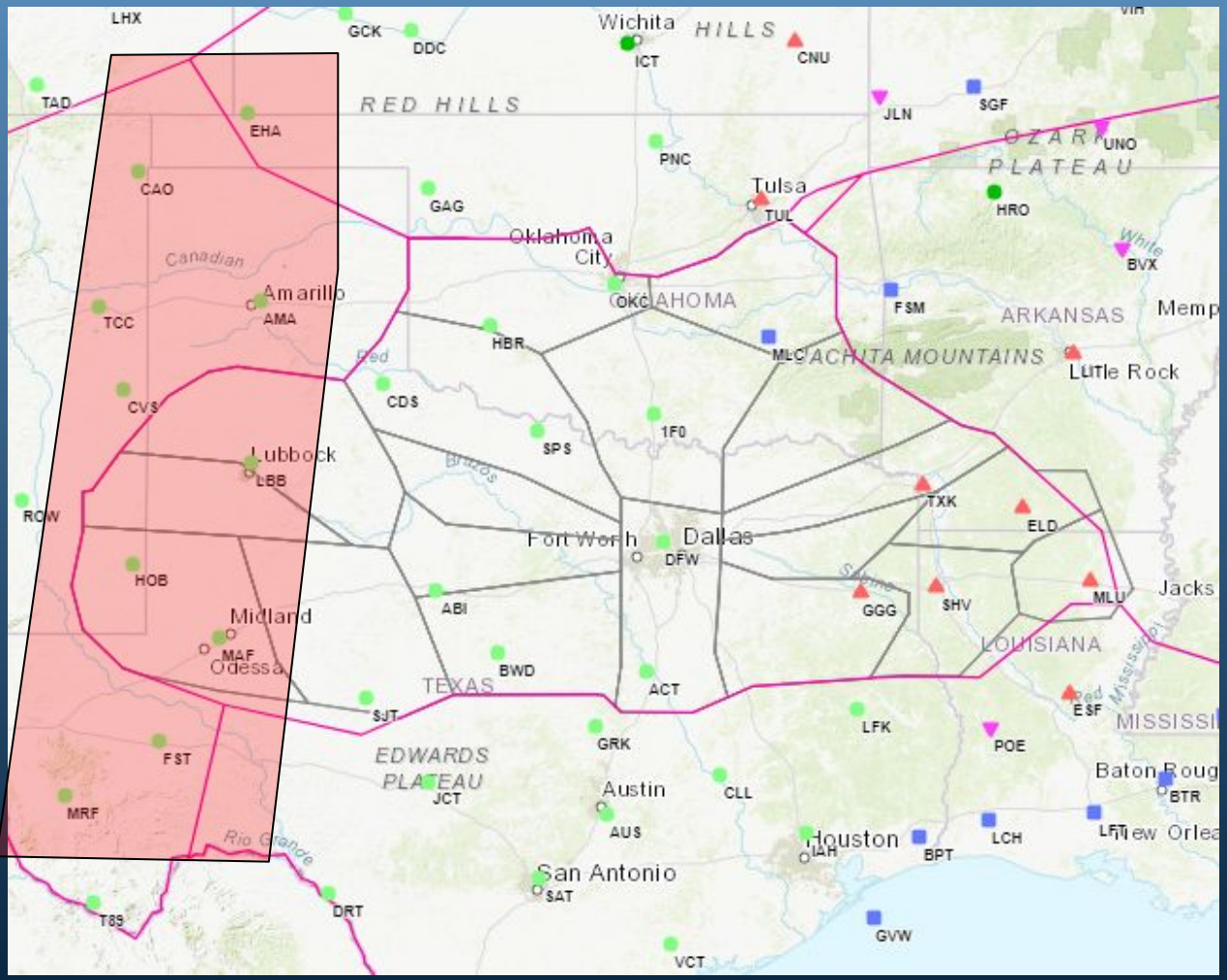




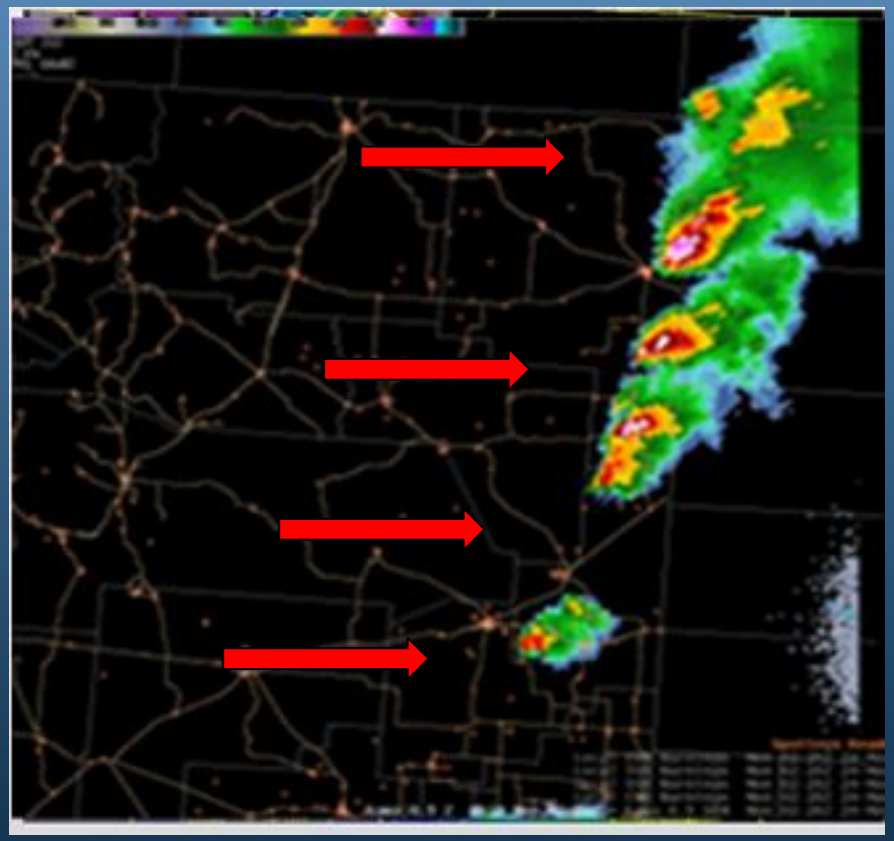
Dry Line Cross Section

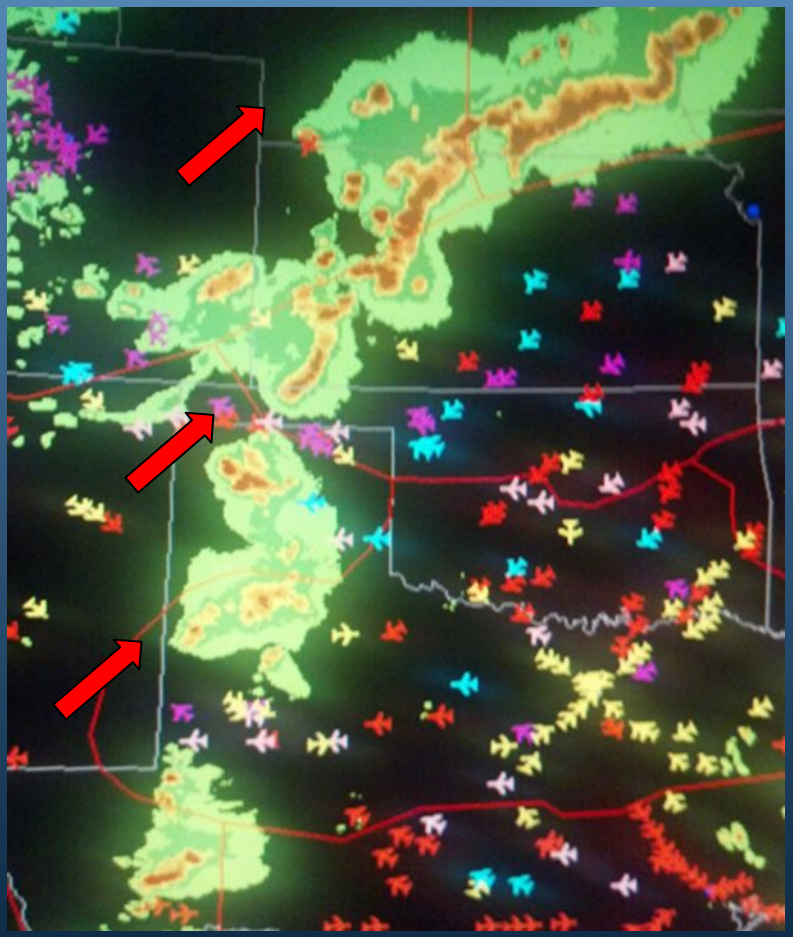


Can Develop Over JEN and RDR Specialties



Playbooks / Reroutes





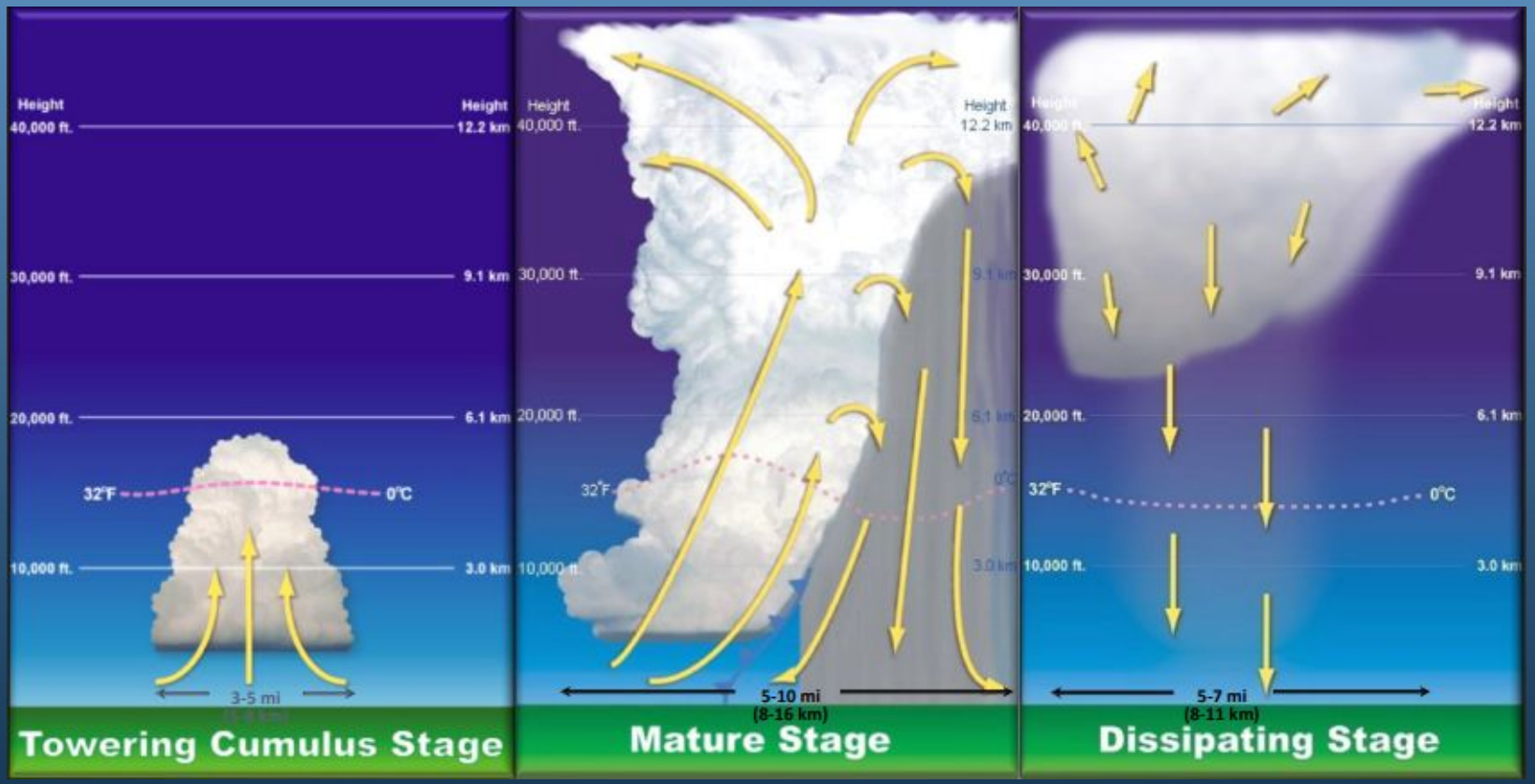
Isolated Thunderstorms

Often called “popcorn” convection, these single-cell thunderstorms are small, brief, weak storms that grow and die within about an hour.

Typically driven by daytime heating on a summer afternoon.

Single-cell storms may produce downburst winds, large hail, icing, turbulence, and outflow boundaries that form other isolated storms.

Thunderstorm Cell Life Cycle

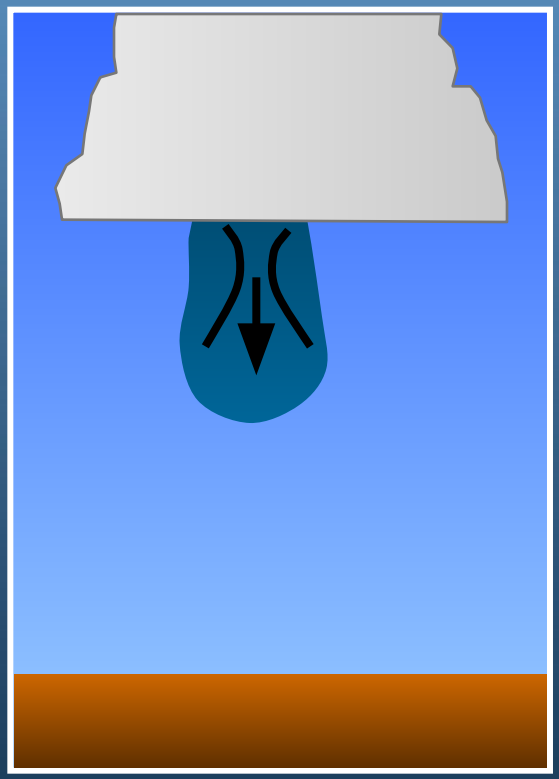


FORMATION – Bubbling cumulus clouds up to FL200. Turbulence possible.

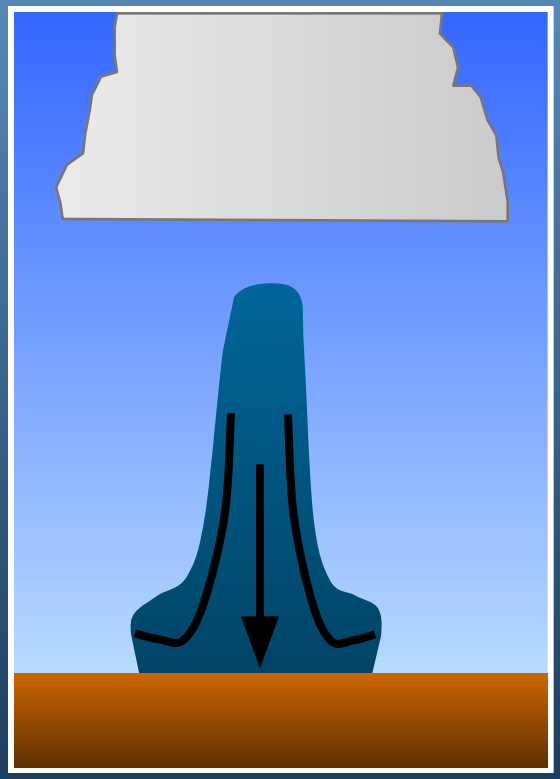
MATURE - Tops AOA FL450. Most dangerous stage with severe turbulence and icing possible.

DISSIPATION – Downdraft cuts off the updraft and begins weakening. Severe icing and turbulence remain possible.

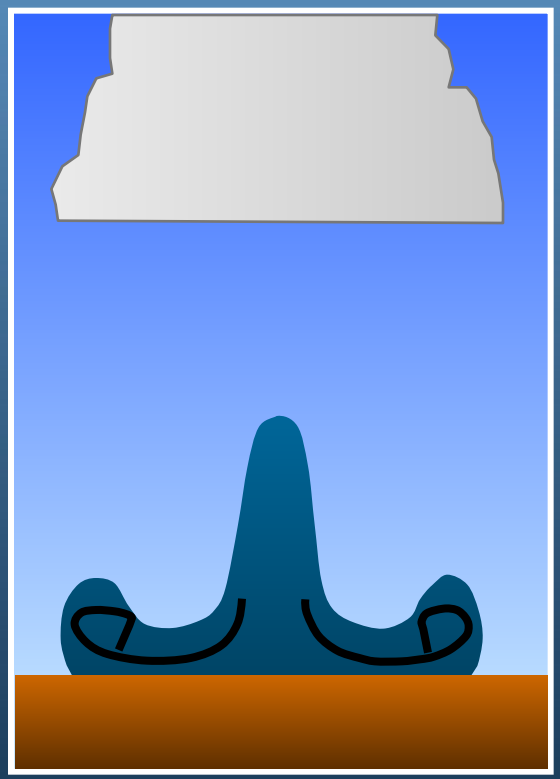
Downburst / Gust Front Life Cycle



FORMATION – Evaporation and precipitation drag forms downdraft

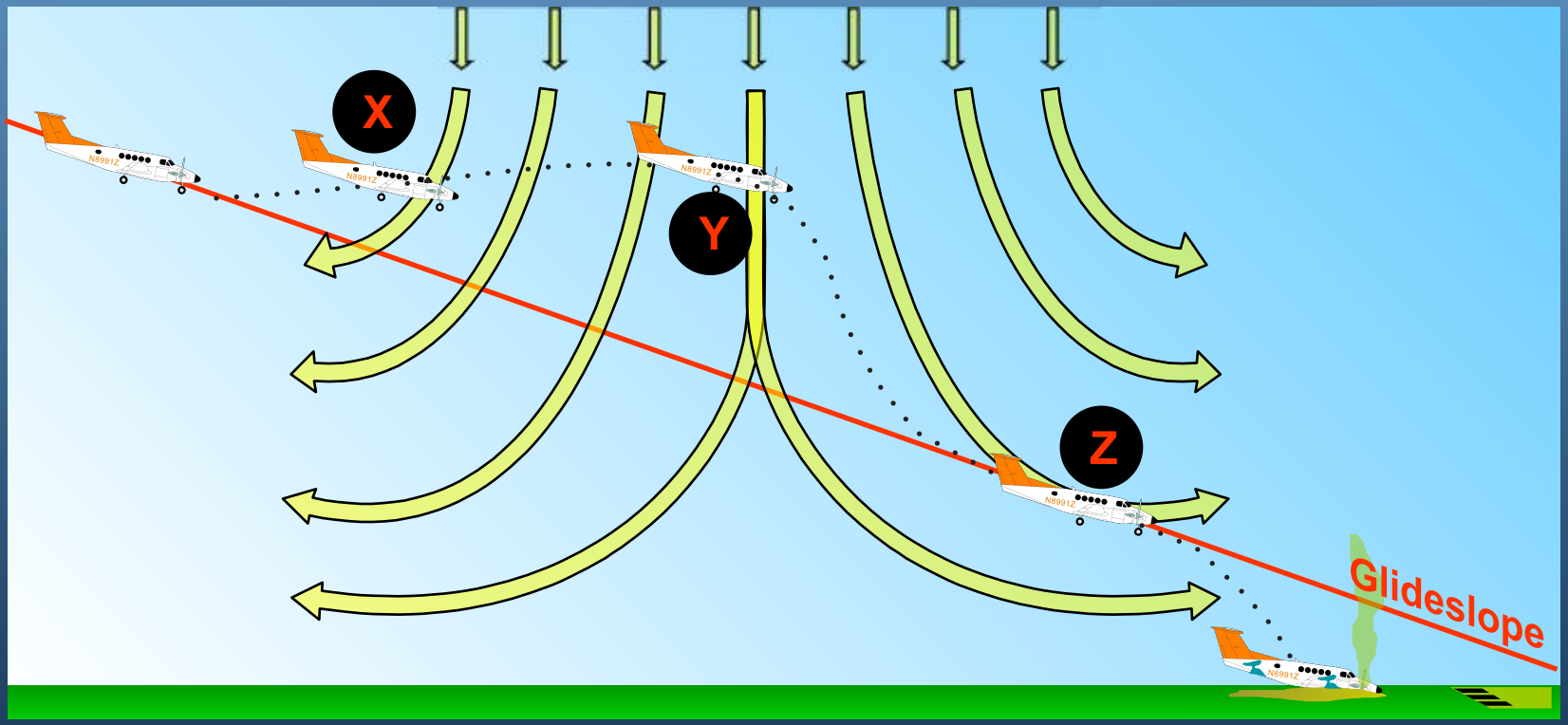


IMPACT – Downdraft quickly accelerates and strikes ground



DISSIPATION – Downdraft moves away from point of impact

Downburst / Gust front



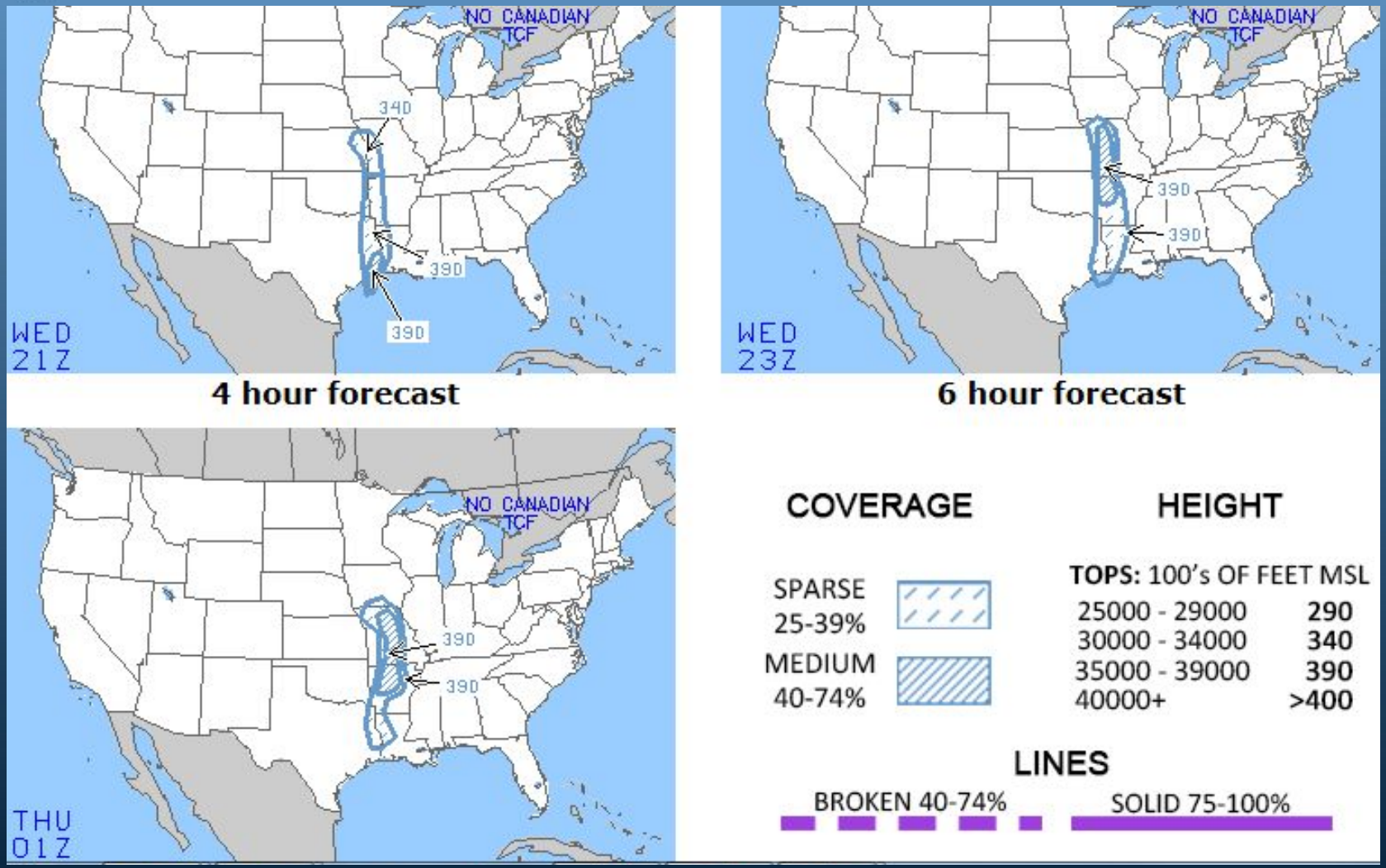
At point X, the airplane enters the microburst zone where a headwind causes it to balloon above the normal glideslope. At the center of the microburst, point Y, there is a downdraft which causes the airplane to sink. At point Z, the airplane enters the most lethal zone where a sudden tailwind causes the airplane to lose airspeed.

Microburst Types

- **A dry microburst is associated with virga**
  - Downdraft is driven by evaporative cooling of raindrops falling through dry, unsaturated air
- **A wet microburst is associated with a concentrated rain shaft**
  - Downdraft is driven by both evaporative cooling and precipitation drag of raindrops dragging air to the ground

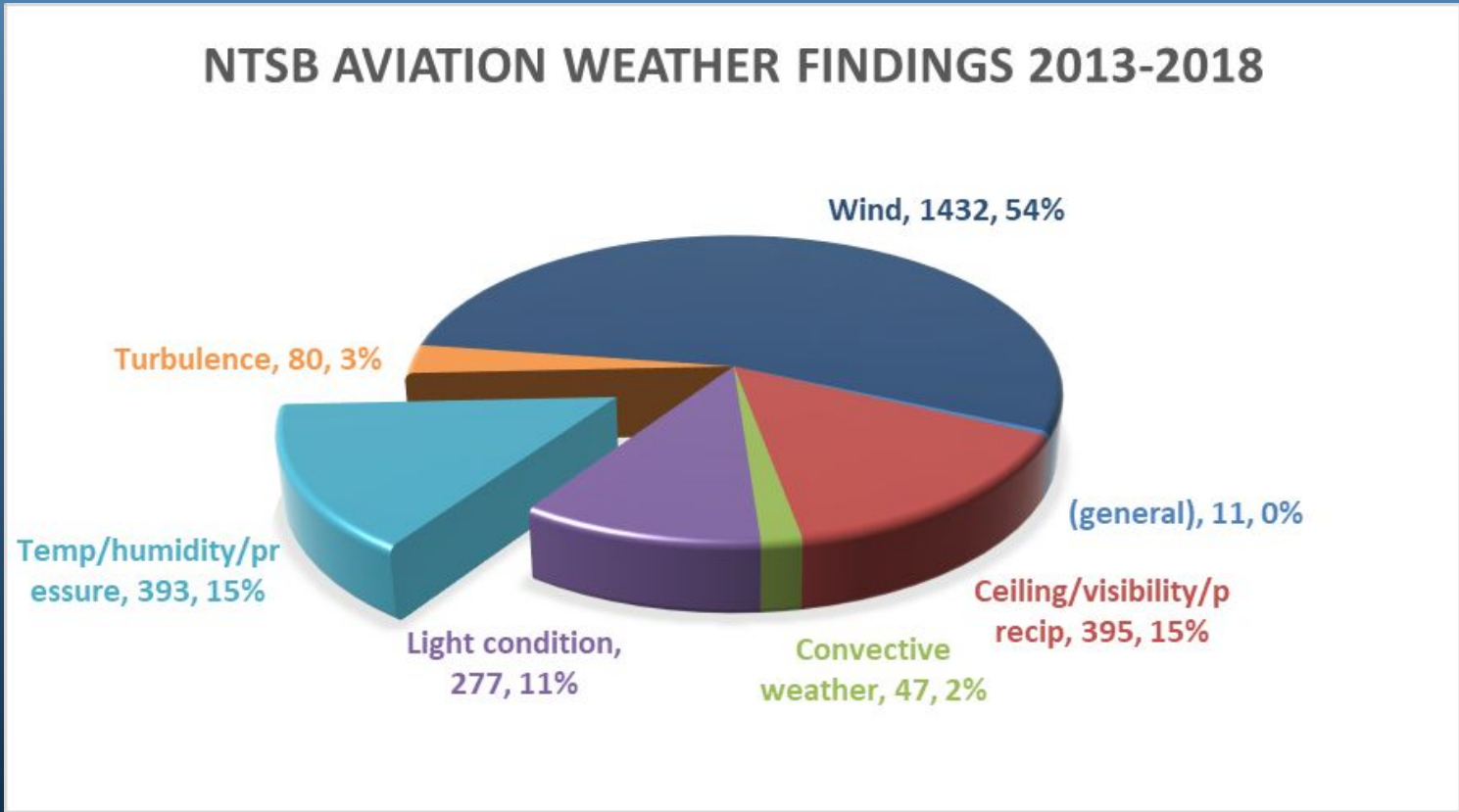
Downburst / Gust front

Traffic Flow Management Convective Forecast (TCF)

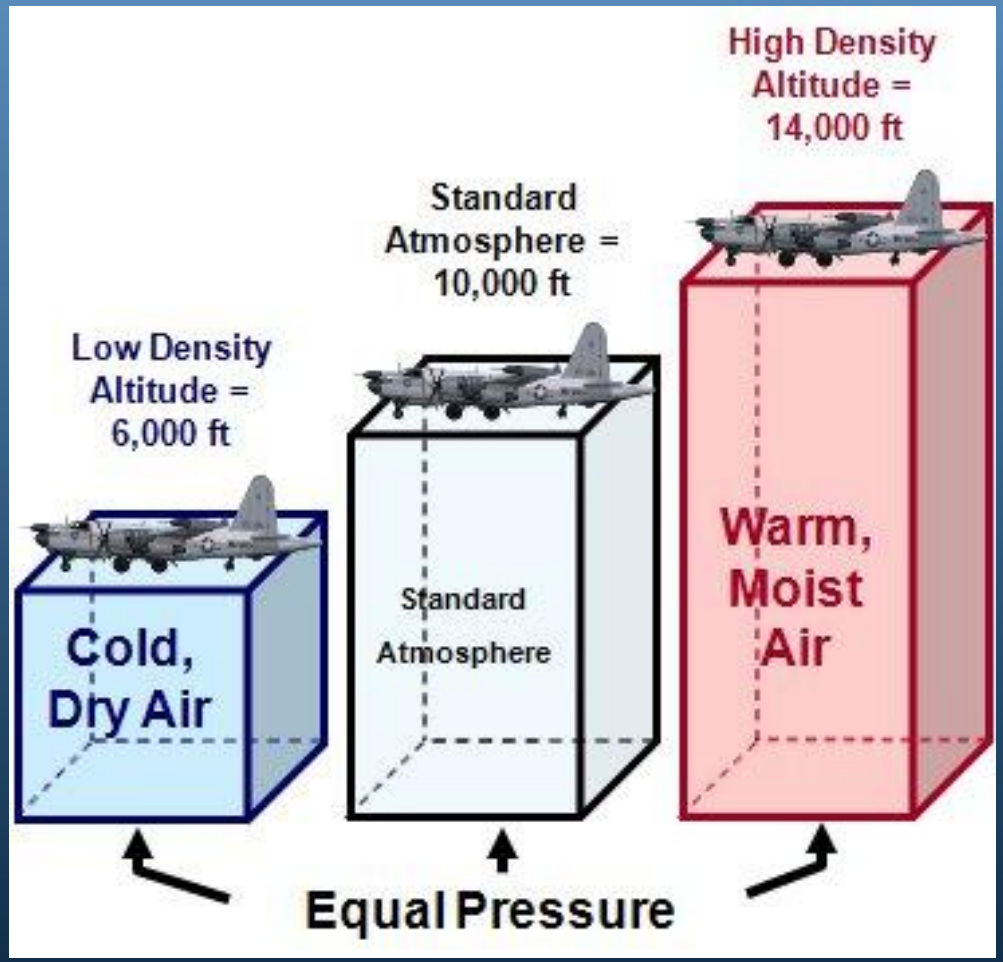


Other Summer Hazards

High Density Altitude



Density Altitude



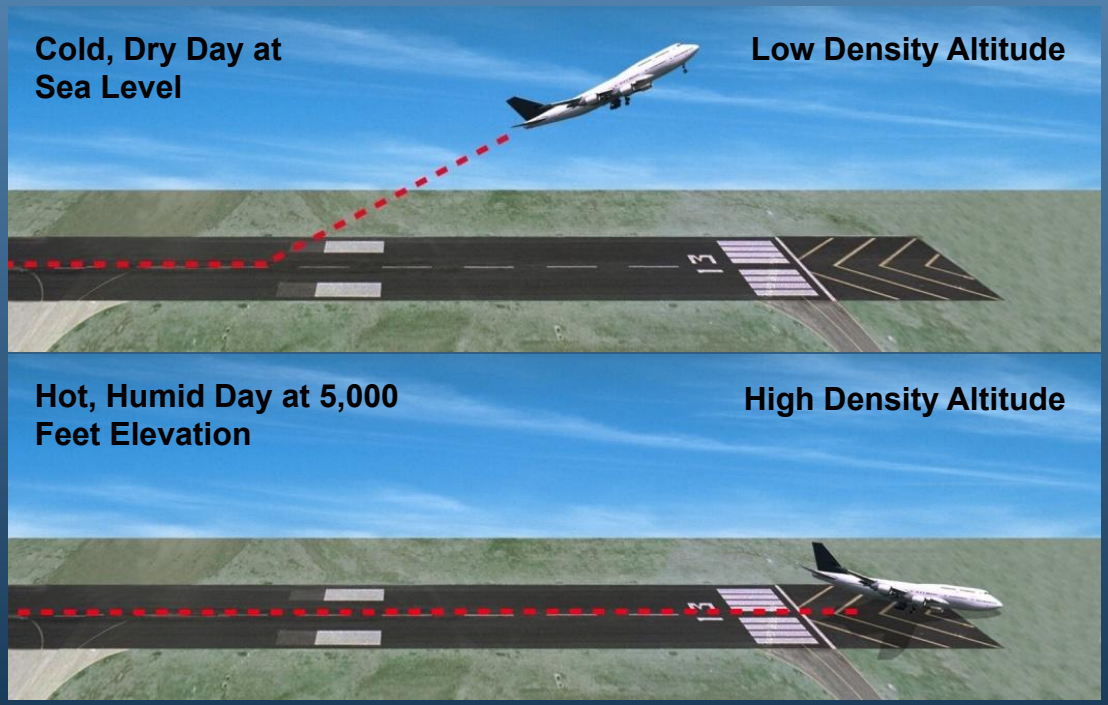
- Air density is related to pressure, temperature, and humidity

High Density Altitude

Hazardous because it reduces aircraft:

- **Power**
  - **Engine ingests less air to support combustion**
- **Thrust**
  - **Propeller has less "grip"**
  - **Jet exhausts less mass**
- **Lift**
  - **Air exerts less upward force on the airfoils**

High Density Altitude Hazardous Effects



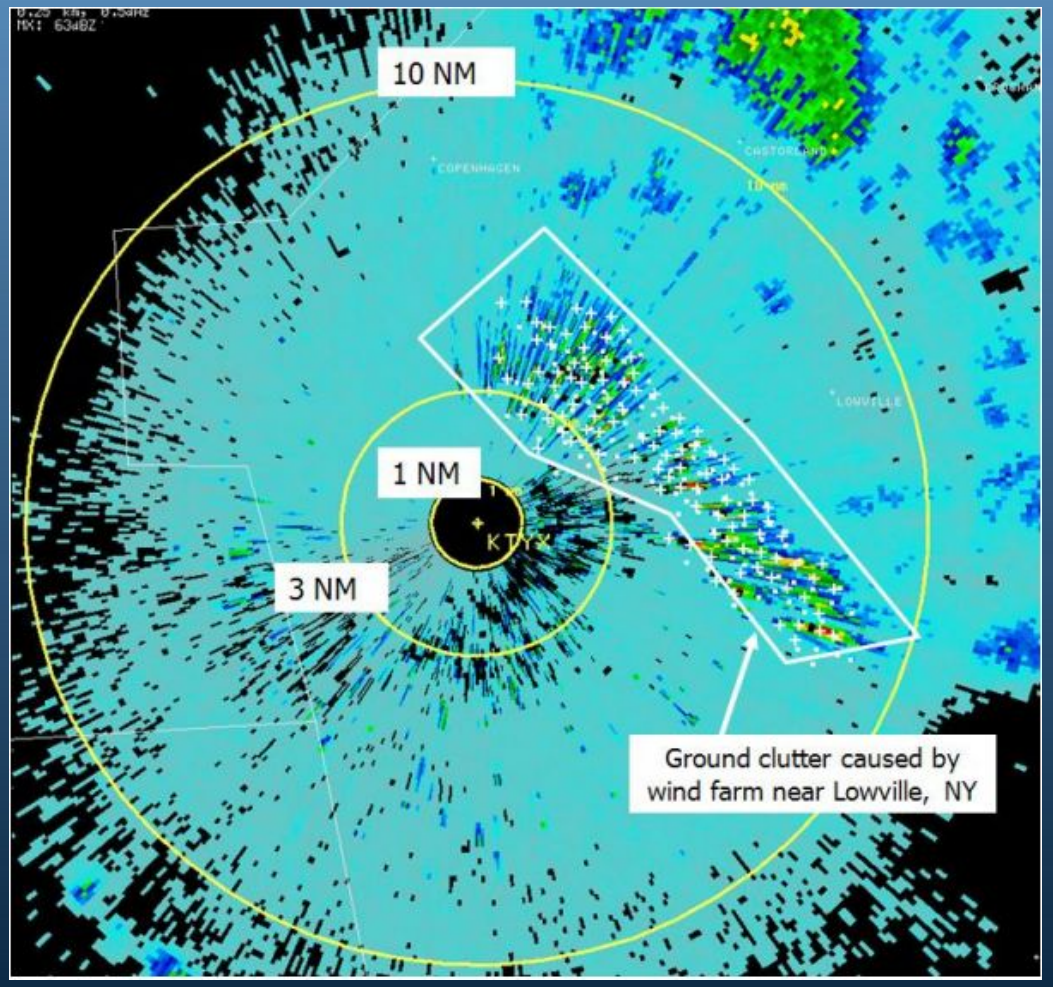
- Longer takeoff roll is required
- Smaller rate of climb
- Lowers an aircraft's service ceiling
- Longer landing roll required

Weather Radar Issues

- Beam Blockage
- Ground Clutter
  - Mountains/Buildings
  - Wind Farms
  - Migrating Birds/Insects
  - Highway Traffic
- Bright Banding
- Chaff

Weather Radar Issues

- **Wind Farms**
  - **Can call the CWSU to remove radars**



AIRMETs and SIGMETs

- AIRMET (Airmen's Meteorological Information)
  - ✔ **ADVISES e.g. MOD TURB/ICE**
  - ✔ Issued by NWS Aviation Weather Center
  - ✔ Every 6 hours
  - ✔ Plotted on WARP

- SIGMET (Significant Meteorological Information)
  - ✔ **WARNS e.g. SEV TURB/ICE**
  - ✔ See SIGMET button on EDST
  - ✔ Issued by NWS Aviation Weather Center
  - ✔ Plotted on WARP

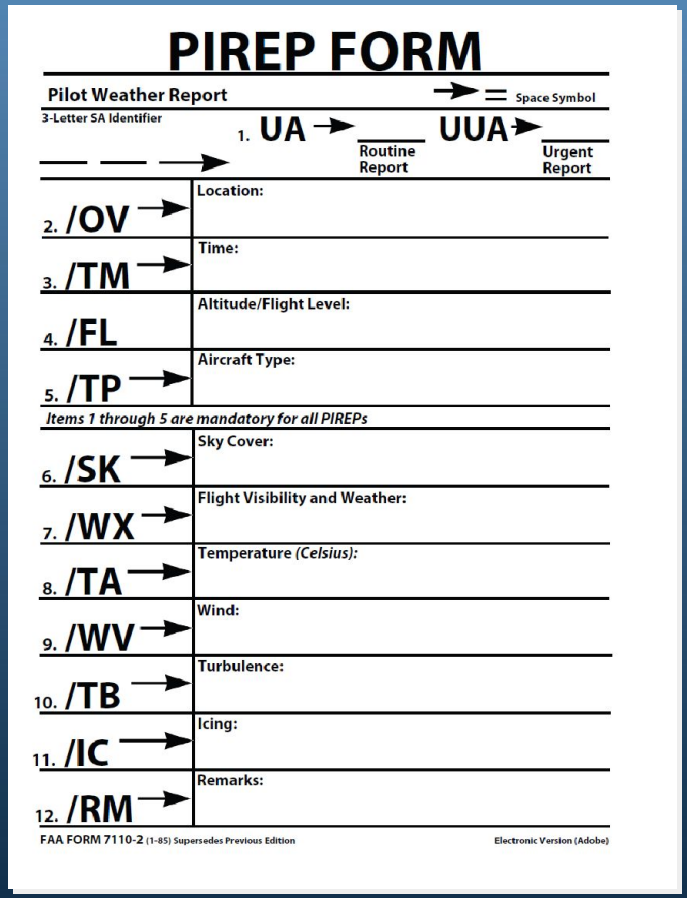
Center Weather Advisories

- CWA's (Center Weather Advisories)
  - ✔ ADVISE potential hazards / WARN new hazards
  - ✔ e.g. SEV TURB, SEV ICE, LIFR CONDS, TSRA
  - ✔ Issued by NWS Center Weather Service Unit
  - ✔ Plotted on WARP

Importance of PIREPs

- Provide verification of forecasted hazards
- May change the forecast product, e.g. a Center Weather Advisory, AIRMET or SIGMET.

Help us help you!



PIREP FORM

Pilot Weather Report → = Space Symbol

3-Letter SA Identifier

1. UA → Routine Report UUA → Urgent Report

— — →

2. /OV →	Location:
3. /TM →	Time:
4. /FL	Altitude/Flight Level:
5. /TP →	Aircraft Type:

Items 1 through 5 are mandatory for all PIREPs

6. /SK →	Sky Cover:
7. /WX →	Flight Visibility and Weather:
8. /TA →	Temperature *(Celsius)*:
9. /WV →	Wind:
10. /TB →	Turbulence:
11. /IC →	Icing:
12. /RM →	Remarks:

FAA FORM 7110-2 (1-85) Supersedes Previous Edition Electronic Version (Adobe)

Emergency Flight Assistance: What can the CWSU meteorologist do to help?

The CWSU meteorologist will immediately lend support to the safety of the operation and can assist with the following:

Ceilings

The meteorologist will help guide aircraft towards the best direction or altitude.

Evaluation of PIREPs, METARs, estimated cloud bases/tops, and satellite imagery

Emergency Landings

The meteorologist quickly views METARs in the area of the aircraft and can provide viable options to land.

Note: The CWSU will not know which airport is open/runway length viable, but they can provide options that have sufficient weather conditions

Icing

The meteorologist can help guide aircraft towards best direction or altitude.

Evaluation of PIREPs, estimated freezing levels, and radar.

We're a resource for you; please use us!

Next time you come on shift or return from a break, stop in and check on the weather in and around your sector.

Questions?