

Application of Weather Forecast Tools to Planning a Winter Cross Country Flight

Rhon Williams

4/22/23



Who am I?

- Pilot License – Commercial ASMEL, Helicopter, Glider
- Certificated Flight Instructor – Airplanes, Instruments, Gliders
- Airframe & Powerplant Mechanic
- Over 3000 hours in 40 years
- FAA Safety Team (FAAST) Representative
- Retired Engineering Manager (PhD in Electrical Engineering)
- Experimental Aircraft Builder – Early Bird Jenny N1915J



Scope

- The pilot's needs for weather information varies drastically based on the mission
- Weather tools needed change over planning time window
 - Sample tools
- This briefing is based on planning a winter cross-country
- Example is for trip California to Ohio and back last December
- Live tool demos



Addresses Two Audiences

- Pilots
 - Using forecasts to pick alternate routes and days
 - Briefing provides examples of how to dig out the critical nuggets needed for critical decision making

- Weather forecasters
 - Show how their products are applied in the real world
 - What works and what doesn't
 - What other variations are still needed

Needs for weather information vary based on the mission

- Glider –
 - Need cloud bases, thermals and wind
 - Specialized products like xcskies.com and skysight.io
 - Cancel with minimum impact
- Light sport - Must be good VFR, any wind is too much
 - Cancel with minimum impact
- Single engine piston (Cirrus, non FIKI)
 - Focus of this briefing
 - Personal minimums and get-there-itis
- Multiengine/Jet
 - Corporate/charter
 - Aircraft generally capable
 - No go choice is hard, Significant impact on client and job?
- Airline
 - Dedicated Dispatch office & weather office
 - Go unless severe weather disrupts system



Decision process drives risk management

Three aspects of decision process

- Who does planning and no go decision?
 - Dispatch office & weather office
 - Help from corporate policy and management
 - Private Pilot with personal minimums
- Aircraft capability
 - Power - Speed and altitude
 - Icing capability
- Expected dispatch reliability
 - Impact of no go decision

Needs vary by season and region

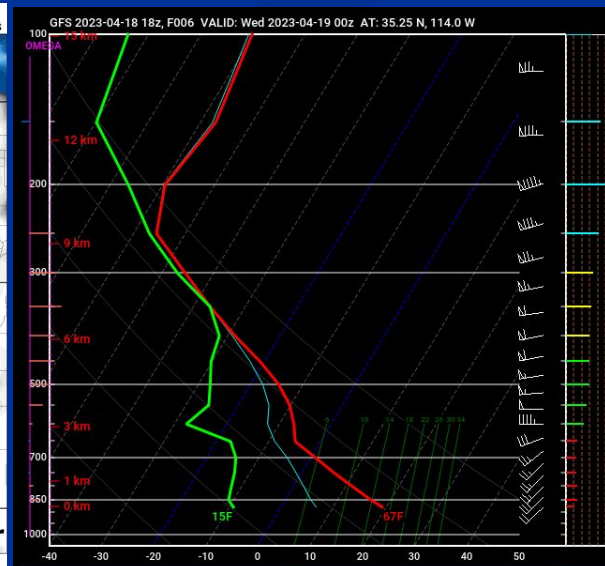
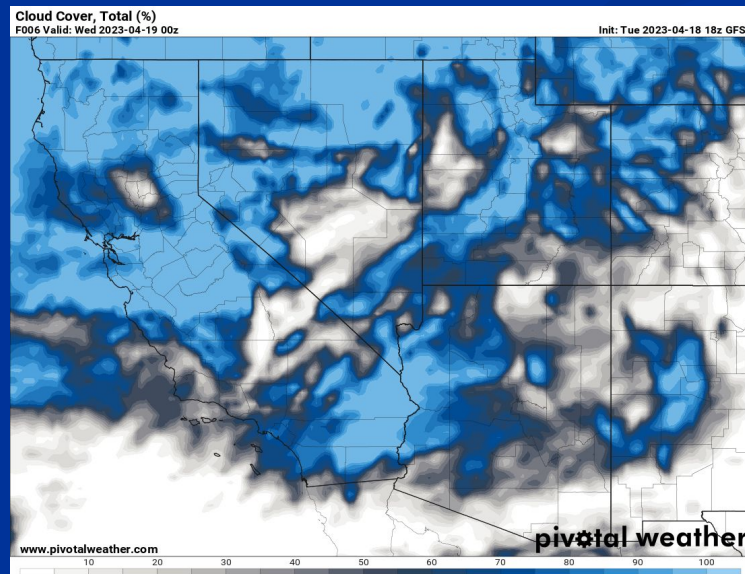
- Challenge of long cross-country flights is that weather likely to vary across regions and season
- Summer flight decisions driven by fronts & thunderstorms
- Winter flight decisions driven by icing

Forecast needs during planning window

- Begin watching weather about two weeks prior
 - What is range of weather conditions across the flight path?
 - What is the range of conditions that are likely on the expected day of flight?
 - Where are the likely decision points?
- One week prior
 - Identify multiple routes – picking different terrain will change the weather
 - Identify target date, plus or minus one – mitigates “get there it-is”
- Three days prior
 - More tools become active
 - Forecast likely stabilizes, confirm dates
- Night before – reliable forecasts, confirm route and ETE
- Morning of – did anything change?

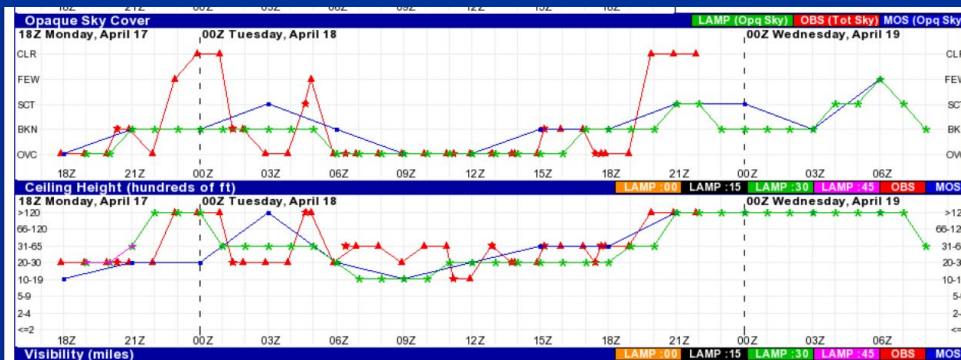
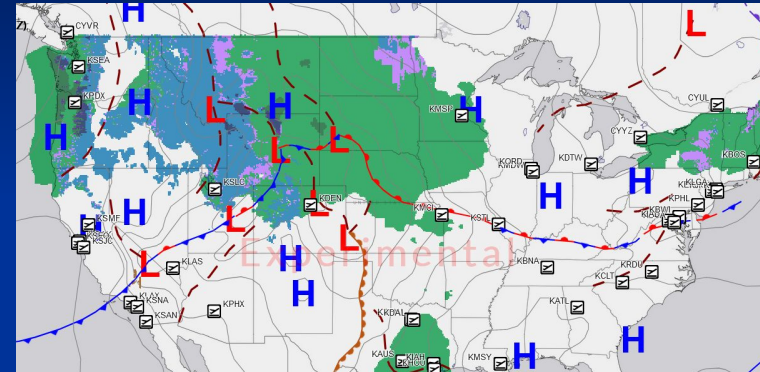
Preferred tools

- Two weeks prior –
 - **Pivotal Weather** using GFS and **Ventusky**
 - Precip type and probability in various regions
 - Cloud patterns
 - Temps and Cloud levels in Skew-T (but only at points)
- 10 days to 4 days prior –
 - **Weather Underground** for key cities, good timing but no cloud heights
 - Continue Pivotal Weather as above
 - Continue Ventusky as above



Preferred tools

- 3 days prior
 - **AWC GFA** Prog Charts, cloud charts
 - **Weatherspork**: map, profile, and grid
- Day before
 - Continue Weatherspork
 - **Foreflight MOS**
 - **AWC GFA** – big picture along route
 - **NWS LAMP Meteogram** – Cloud bases
 - **CWSU Oakland** (weather.gov/zoa) – Specific TAFs
- Morning of – same as above

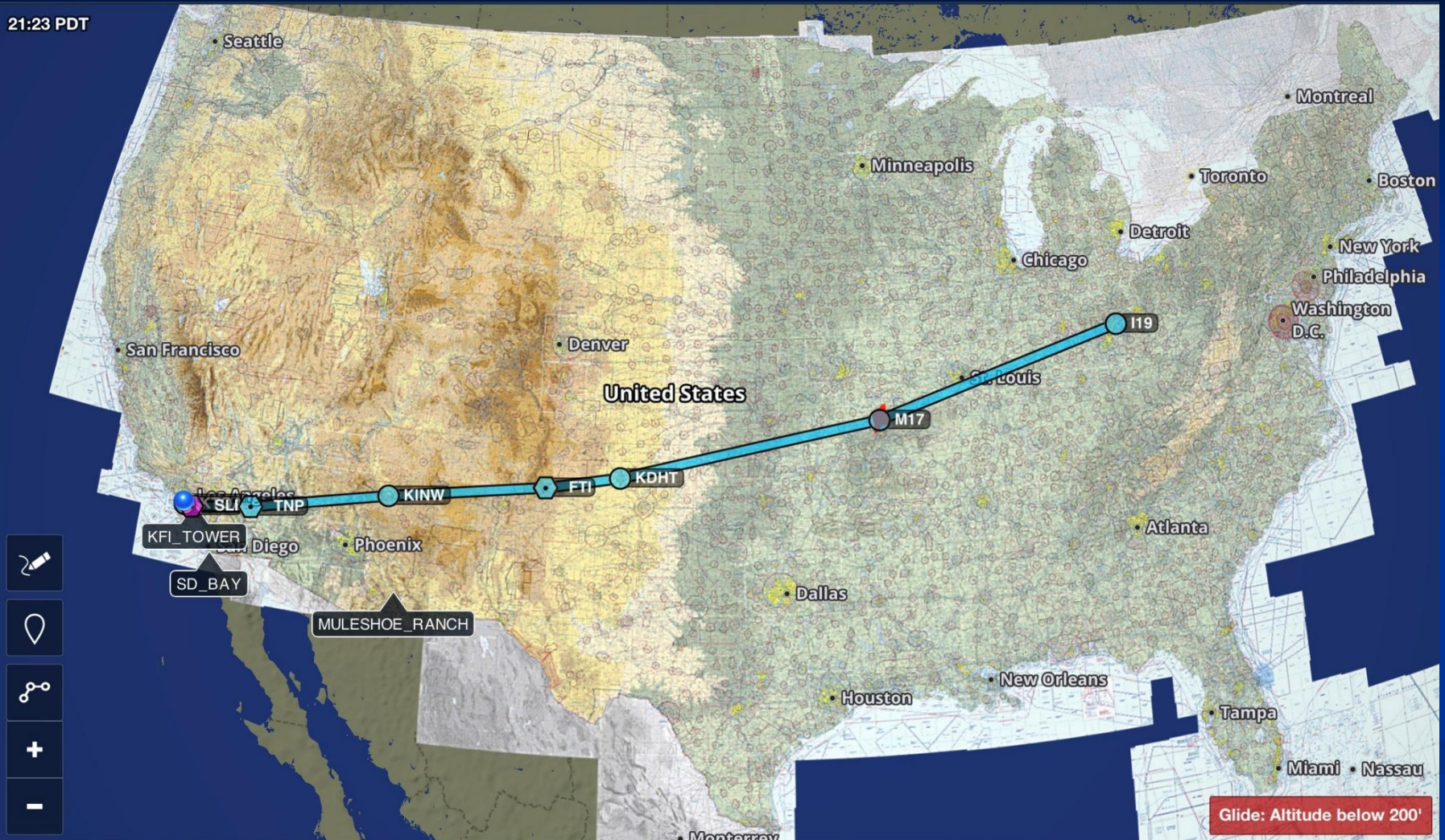


Example flight - Plan overview

- Fly Cirrus SR22 at 170 knots from Torrance, CA (Near Los Angeles) to Dayton, OH to visit family
 - About 1700 nm requires 10 hr flying, four legs over **two days**
 - Constraints
 - Airplane returns on 12/18, but needs oil change
 - Arrive Dayton by Friday 12/23, but rain/snow expected 12/22
 - Arrive before super cold moves in Friday night 12/23
 - Maintain VMC to avoid icing
 - Short winter days, lose 3 hr clock time
 - Target departure Tuesday 12/20
 - Expect lunch/fuel at Winslow (KINW) or Show Low (KSOW)
 - Expect overnight in Texas: Dalhart (KDHT) or Borger (KBGD)
 - Expect lunch/fuel in: Bolivar (M17) or Berryville (4M1)
 - Arrive Beavercreek (I19) before FBO closes and before weather changes

Route Layout in Foreflight

21:23 PDT

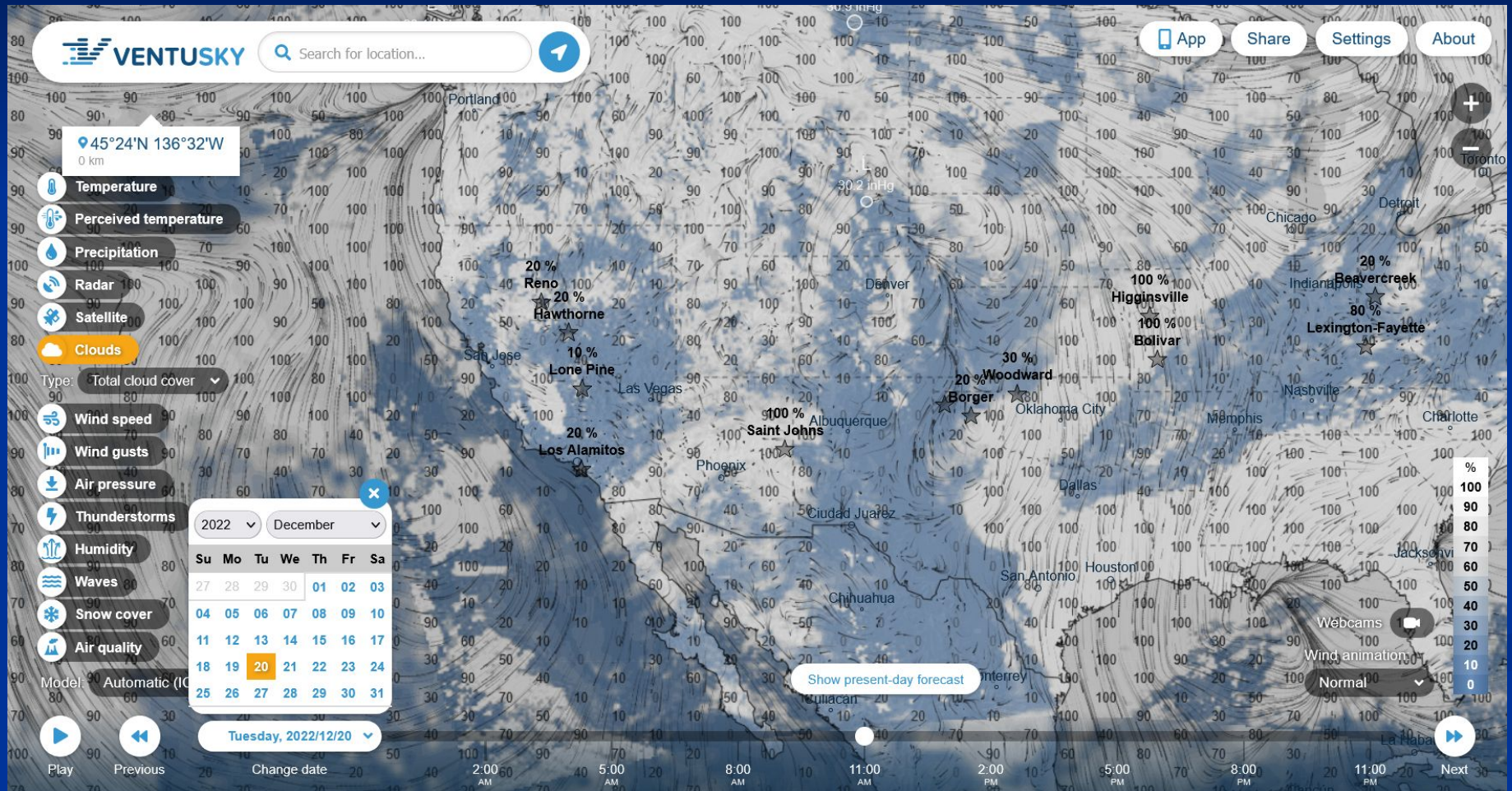


Torrance (TOA) to Winslow (INW)

- Watching cloud cover for two weeks
- Forecasts consistently show many clouds enroute
 - But at what altitude? Terrain? Icing?
 - **Ventusky** separates high, mid, low
 - Examples follow

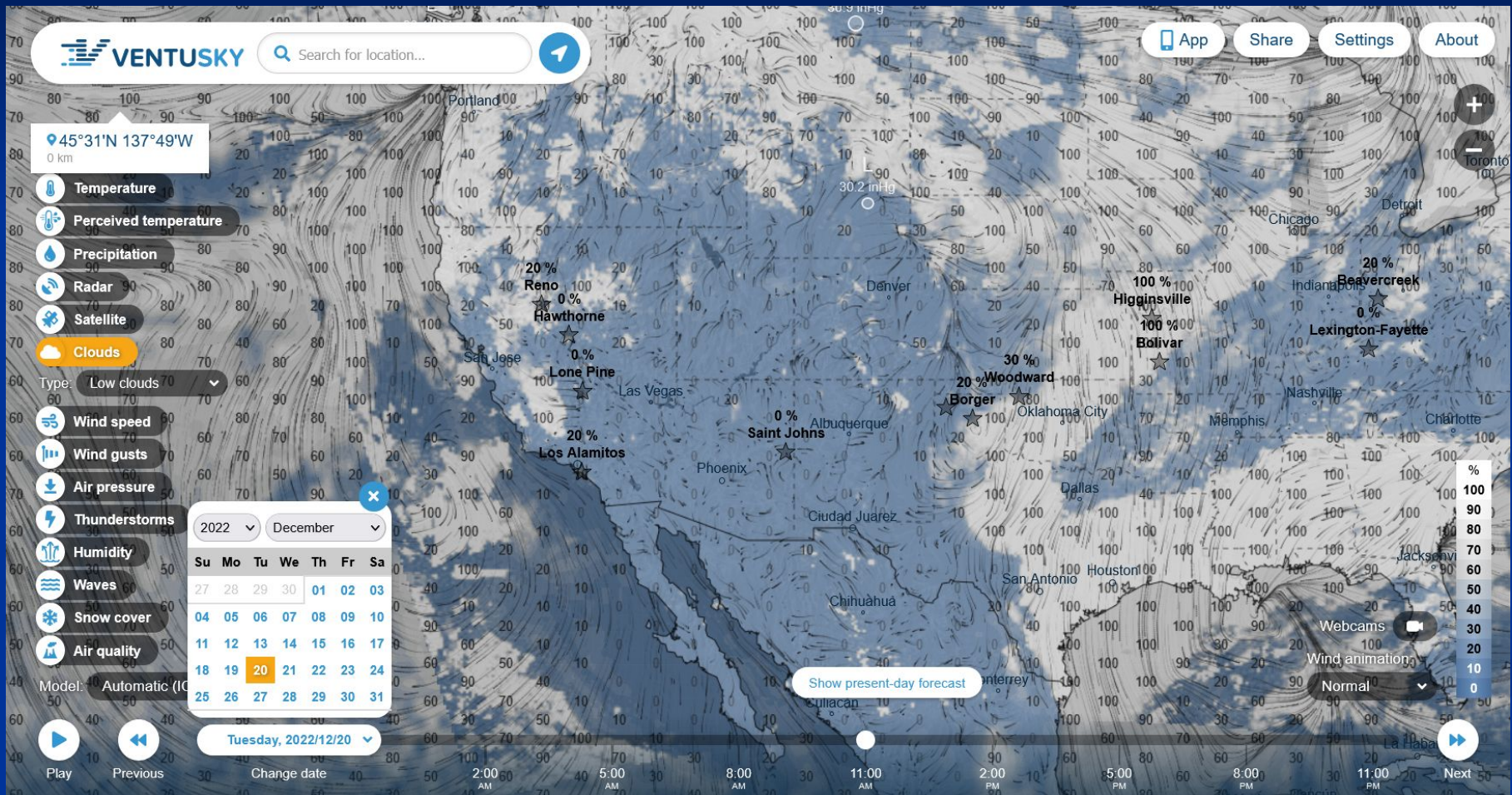
Ventusky – Total Clouds 12/20/22

■ Potential problems in Arizona and Texas



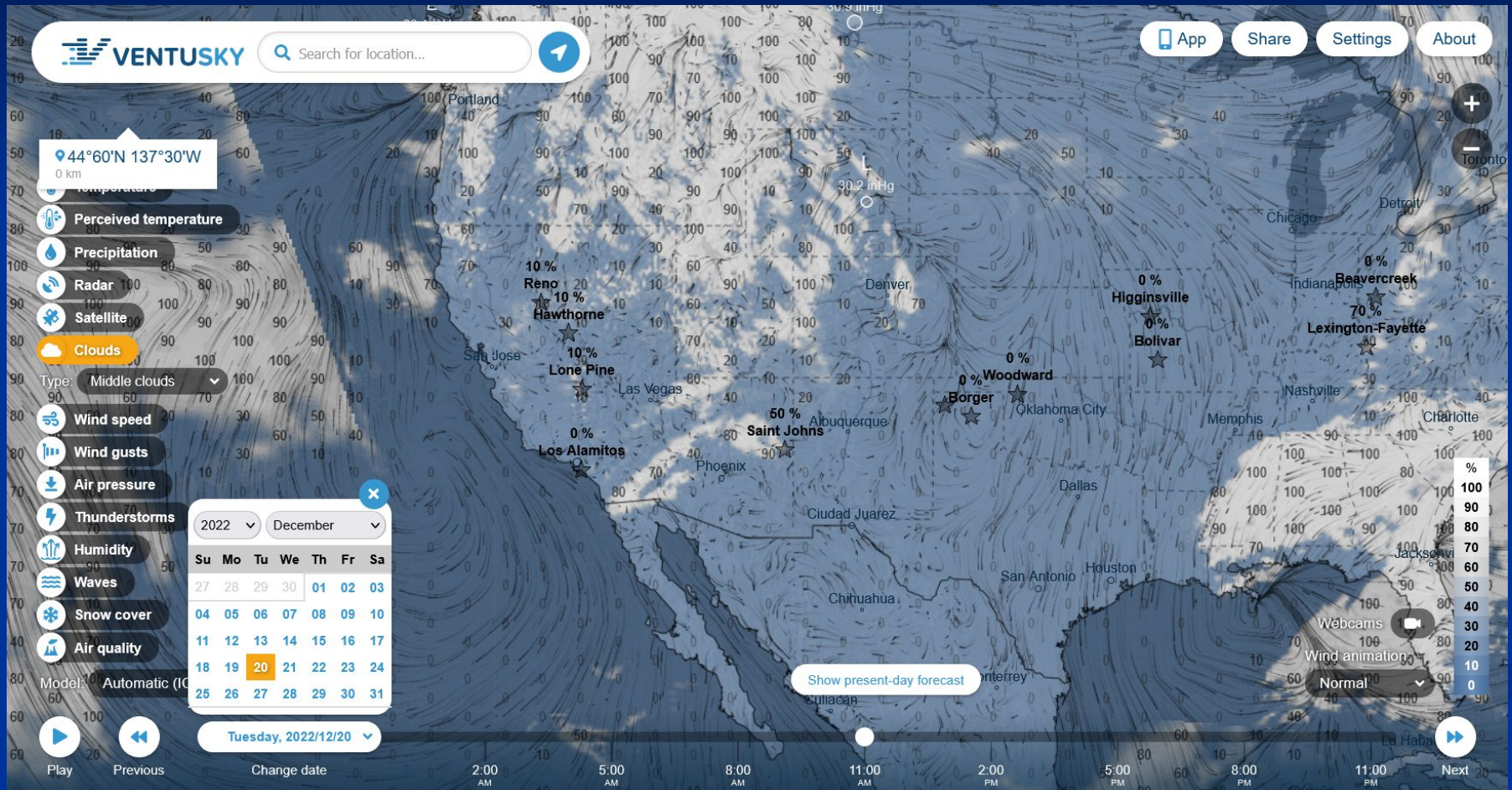
Ventusky – Low Clouds

- Low clouds in Texas, plan for alternative



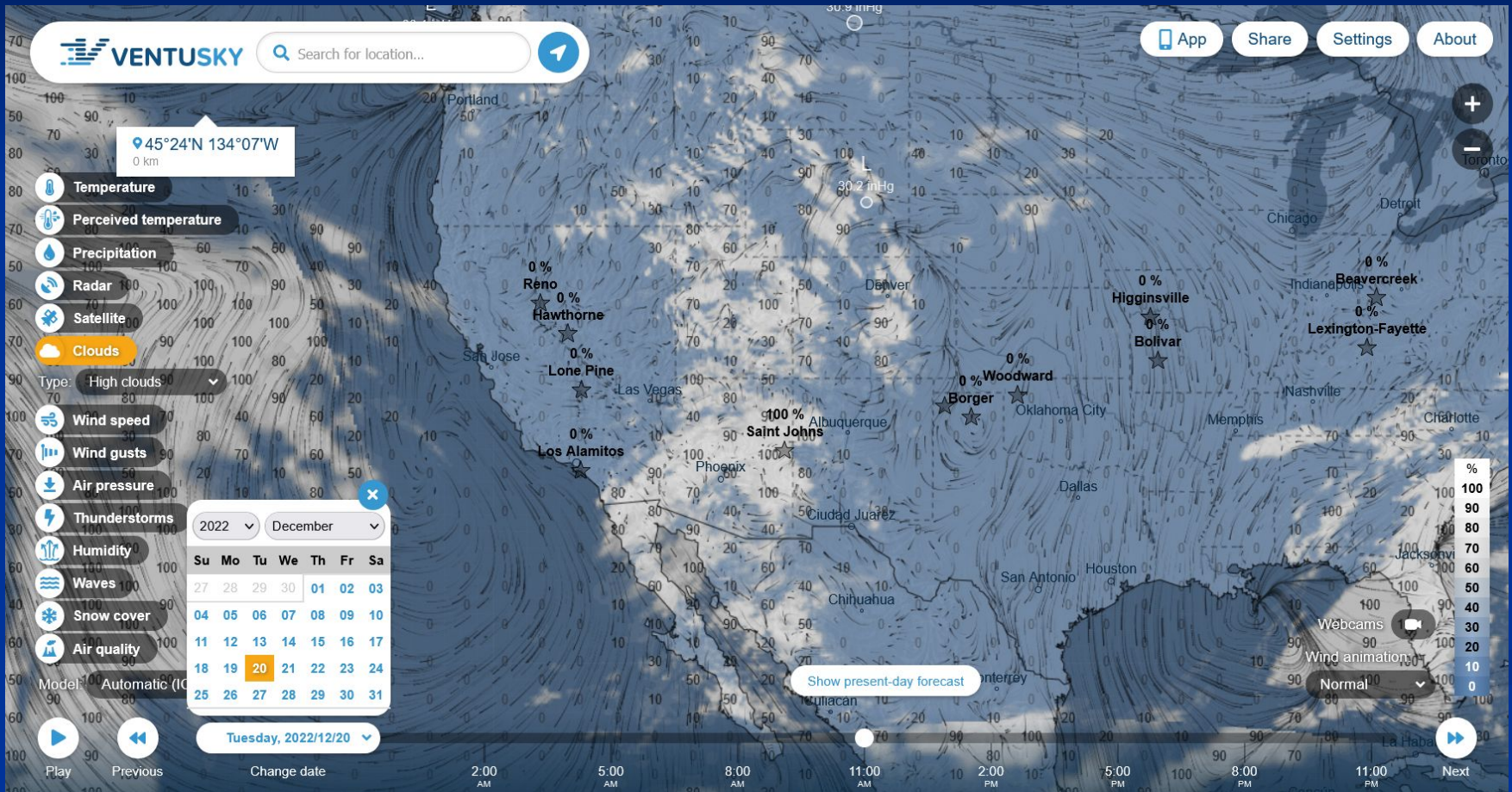
Ventusky – Middle Clouds

- Mid level clouds no problem



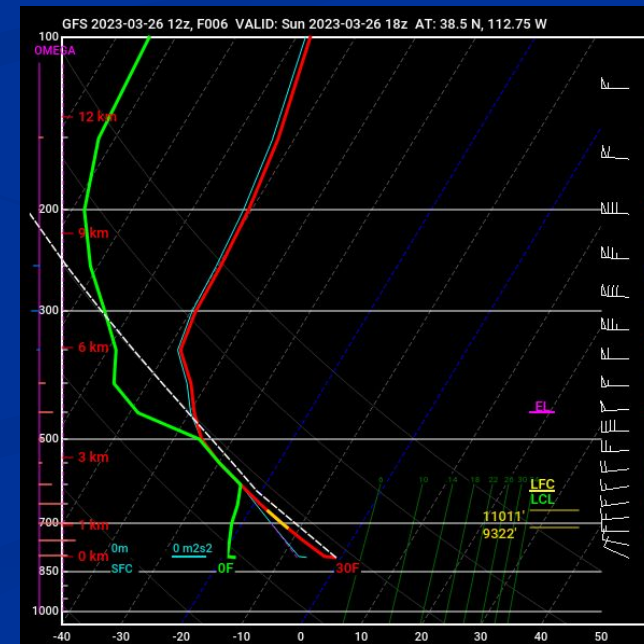
Ventusky – High Clouds

- Since clouds are only high level – good to go
- Confirmed with multiple point Skew-T views



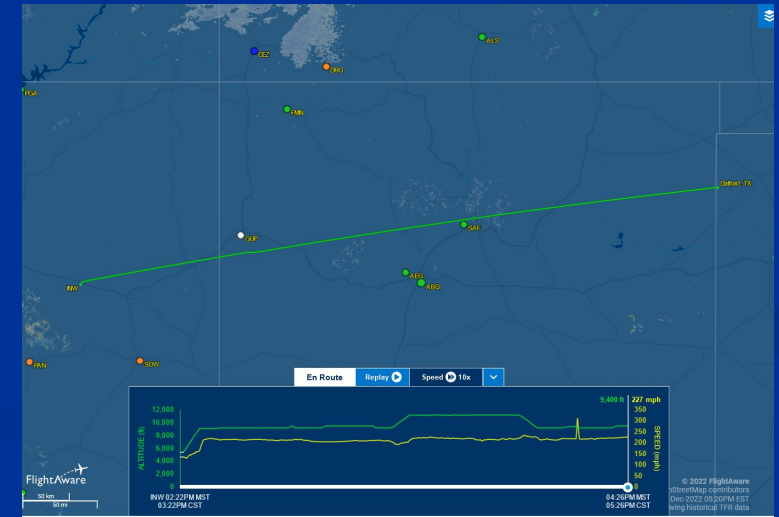
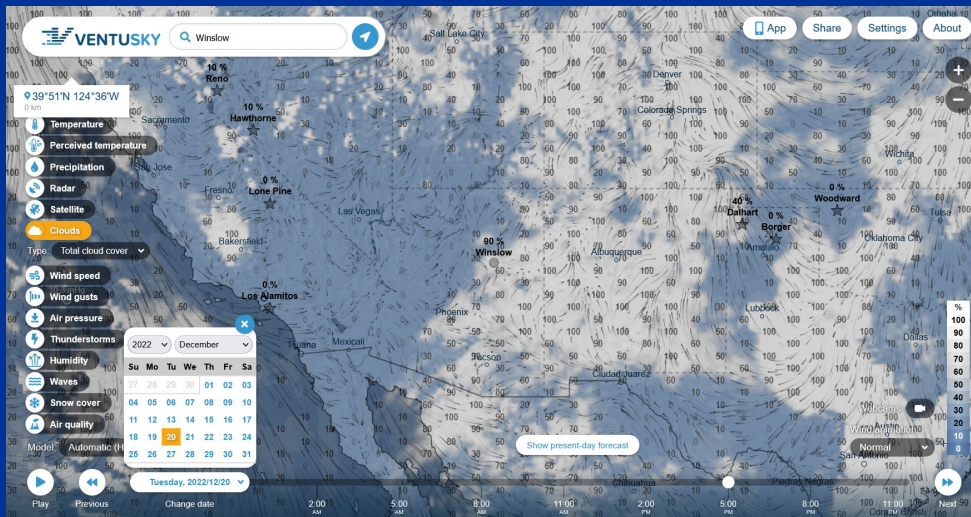
Torrance (TOA) to Winslow (INW)

- Watching cloud cover for two weeks
- Forecasts consistently show many clouds enroute
 - But at what altitude? Terrain? Icing?
 - **Ventusky** separates high, mid, low
 - **Skew-T** shows all clouds are high
 - **LAMP** meteogram confirms short term
- What about next day, if I have to turn back?
- Given no weather constraints
 - Optimize on fuel price and lunch

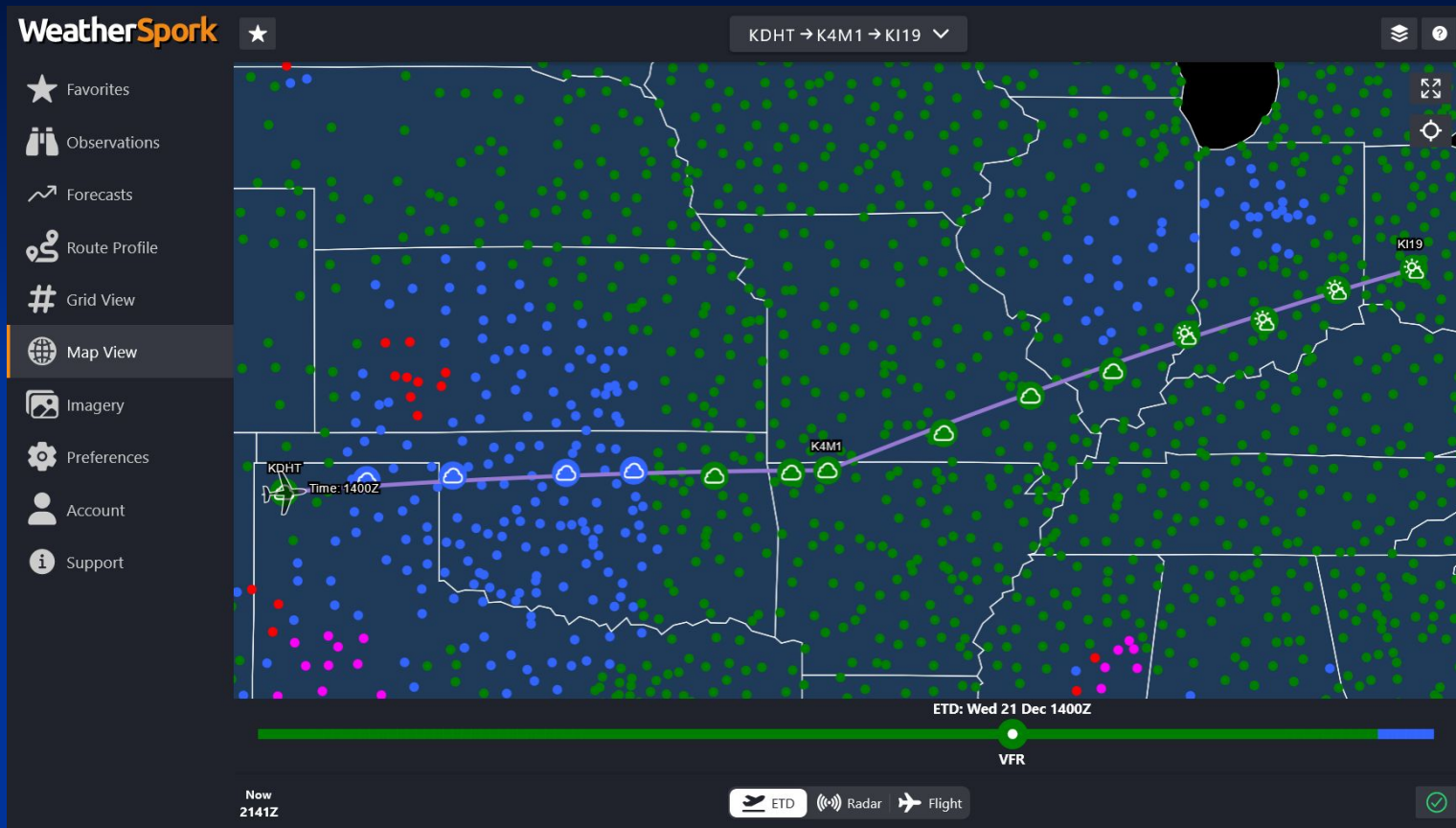


Winslow (INW) to Dalhart (DHT)

- Forecasts show higher clouds in western segment
- Tall rocks near Albuquerque could be a challenge
- Possible weather east of Dalhart triggers consideration of alternatives
- Ends up being easy straight line flight



Day Two - DHT to M17 overview



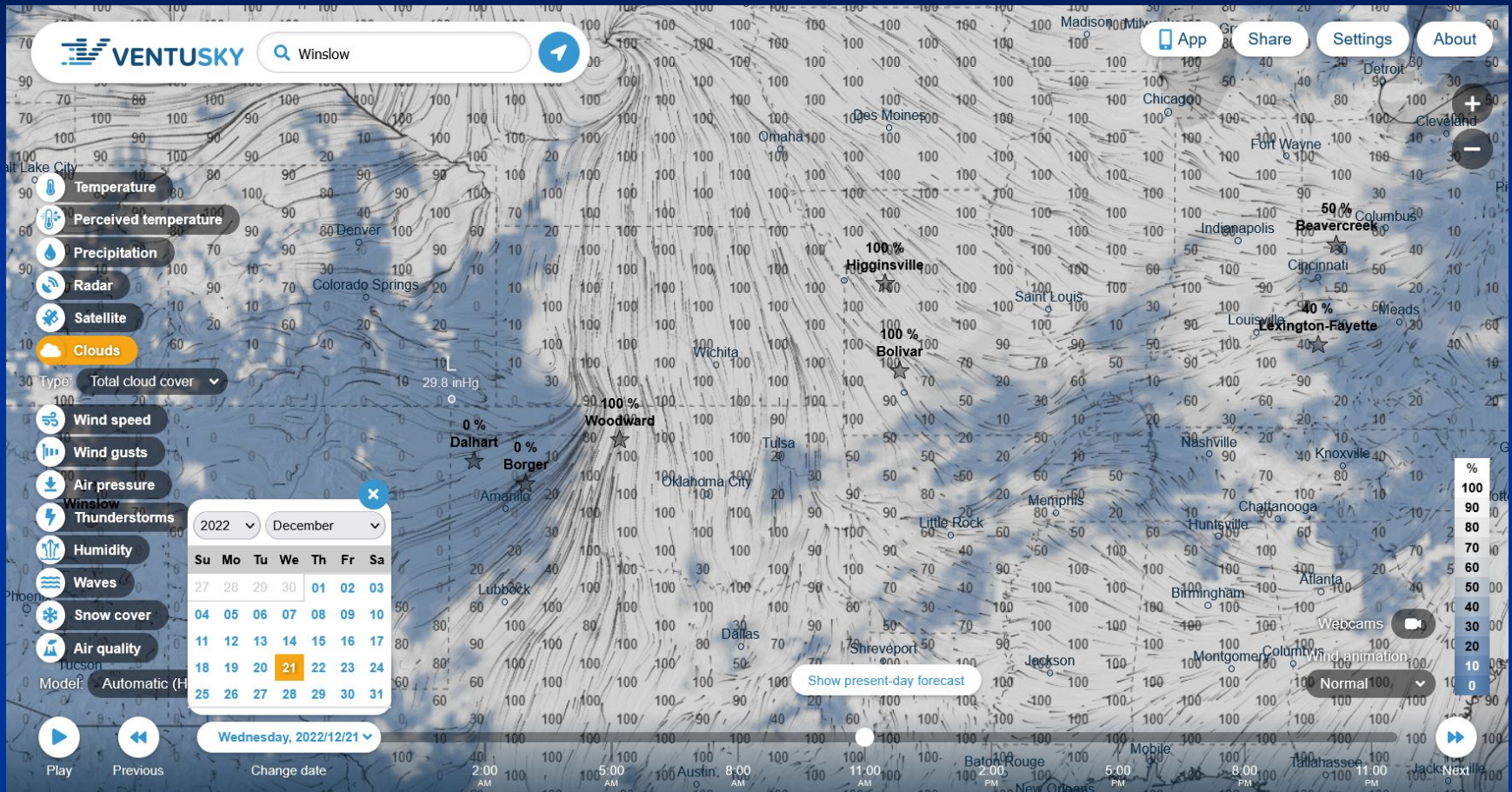
- Is Green good to go? VFR is >3000 ft & 5 nm
- Is Blue good enough? MVFR is > 1000 ft & 3 nm
- Is Magenta no go? LIFR is < 500 ft or < 1 nm

Dalhart (DHT) to Bolivar (M17)

- Freezing level at surface – dare not file IFR
- Band of IFR to LIFR wanders in Oklahoma
 - Does it block passage? Can I go around it?
 - Changed fuel stop more north or more south multiple times
 - IFR or LIFR says nothing about depth of clouds
 - Forecast tops may say 24K ft – is it solid to ground?

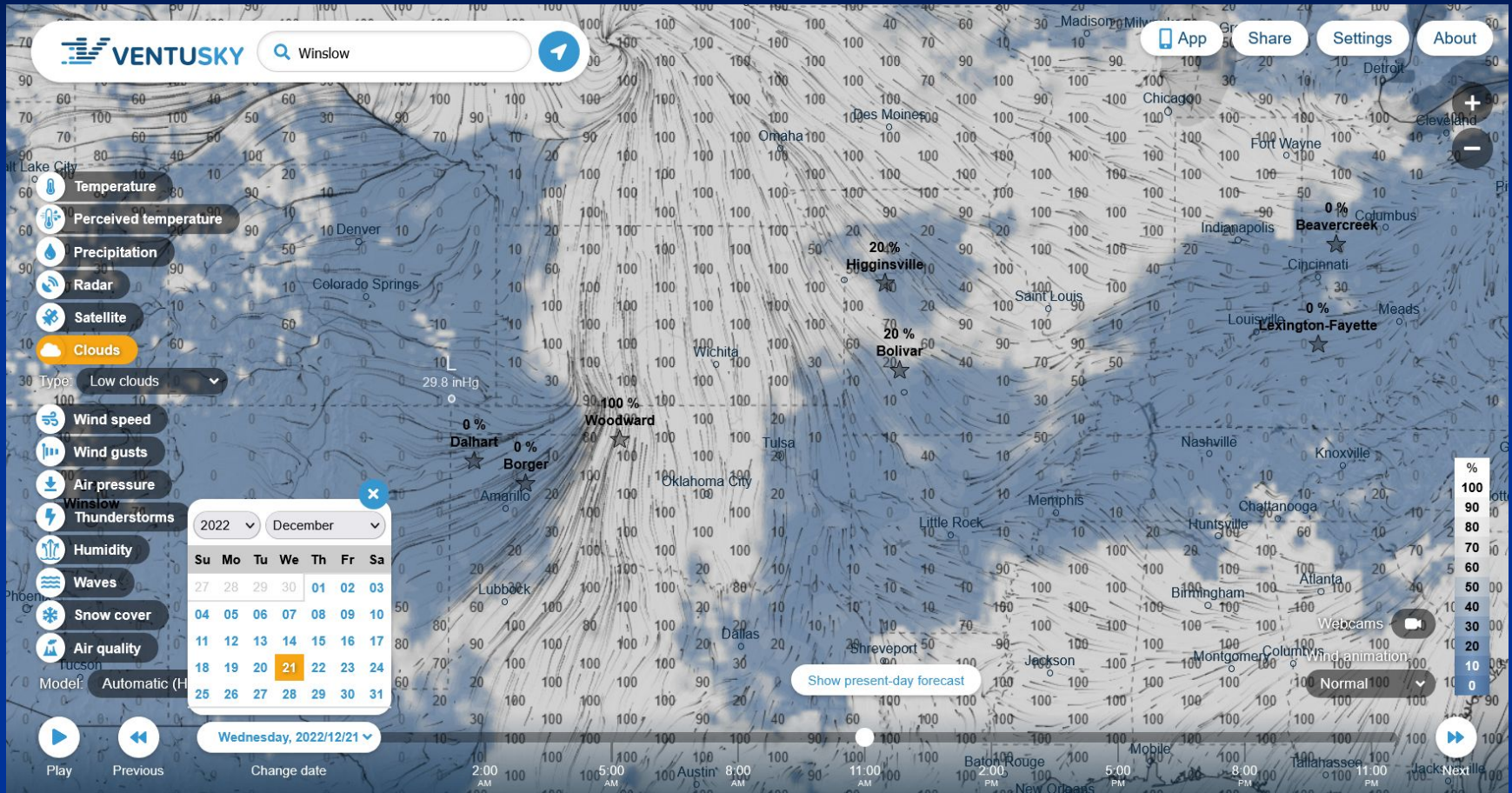
Is it passable between layers?

- Total clouds do not look good



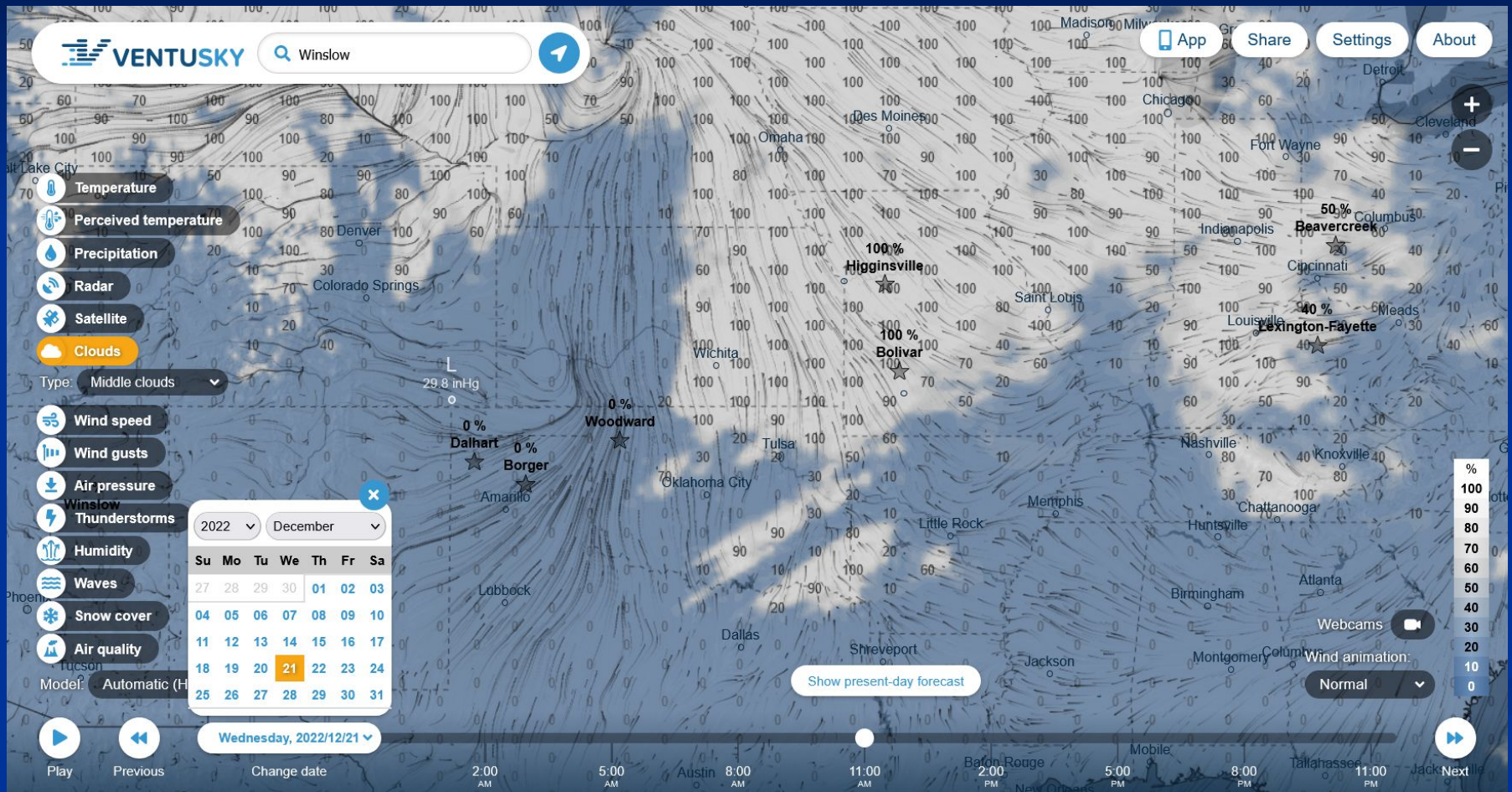
Is it passable between layers?

- Enroute airports are LIFR



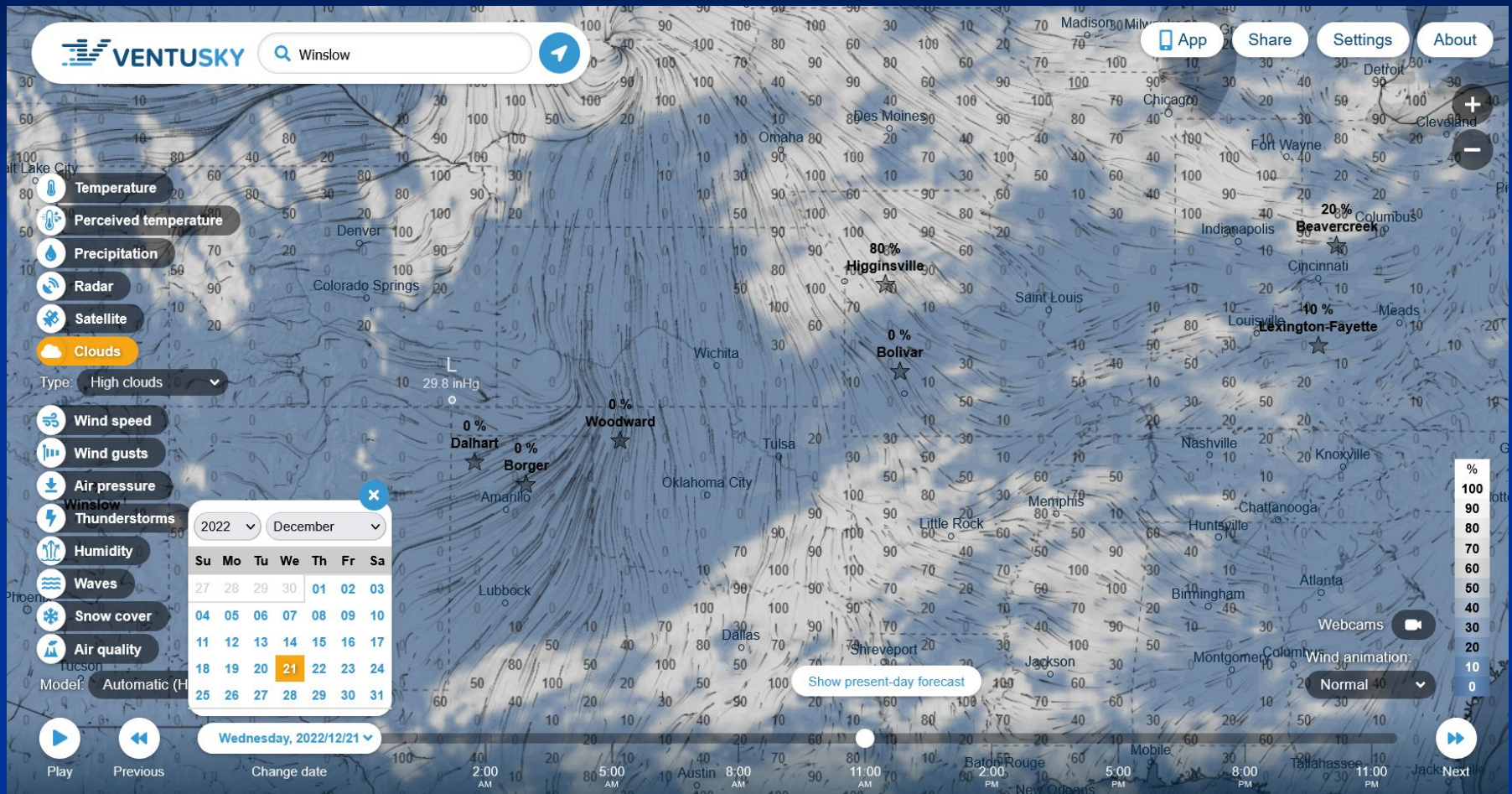
Is it passable between layers?

- Mid level is questionable



Is it passable between layers?

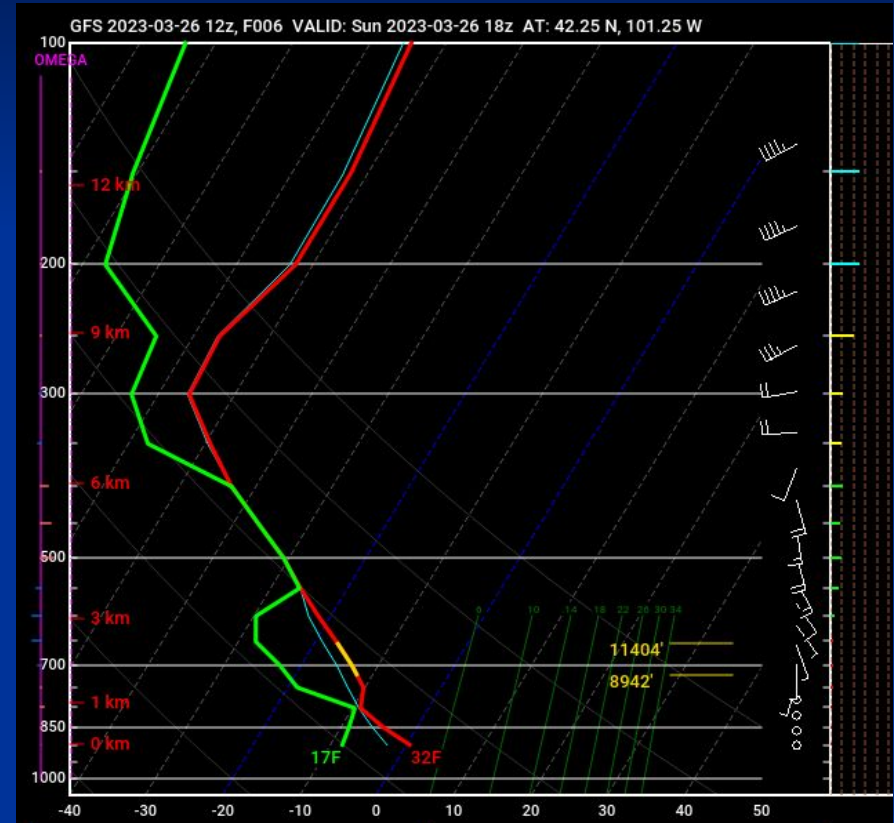
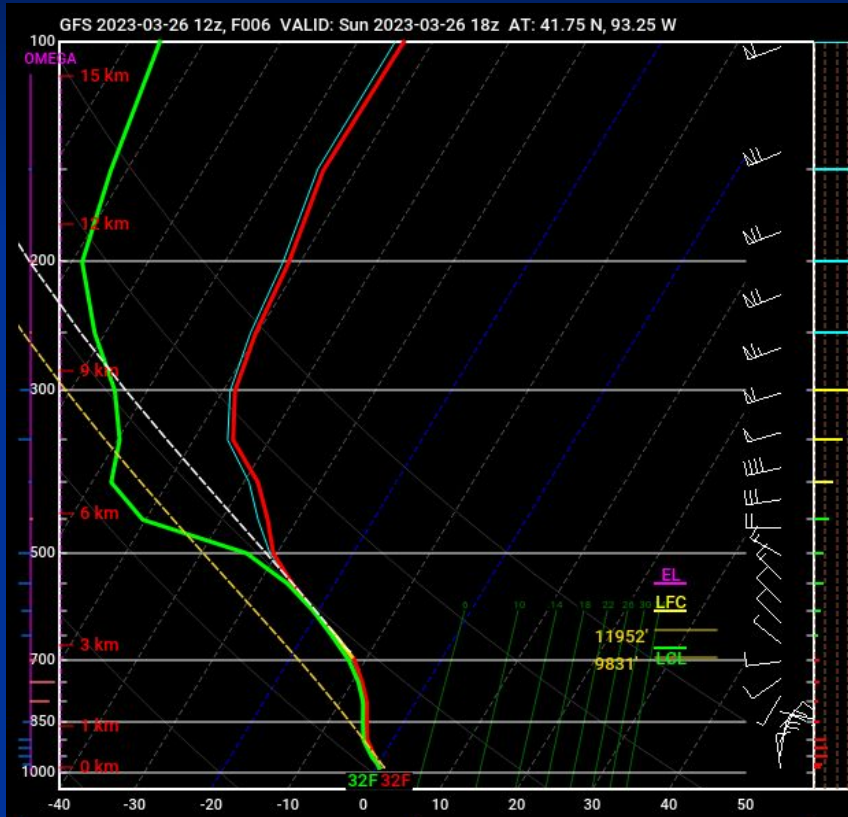
- High level is clear



Is it passable between layers?

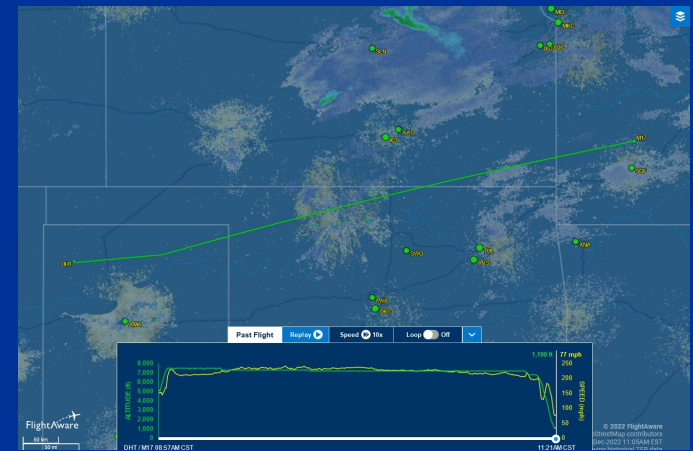
■ Not in this area

Okay in this area



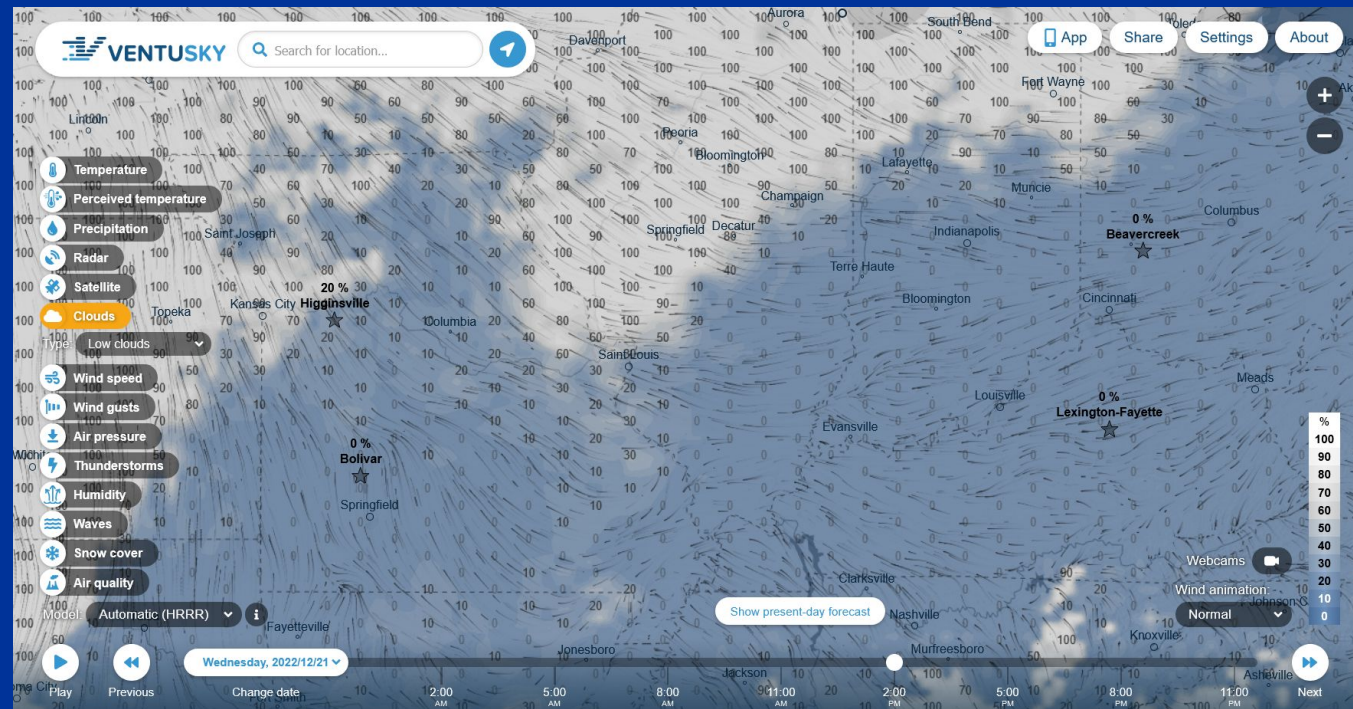
Dalhart (DHT) to Bolivar (M17)

- In the morning, Weather looks good further east, but ...
 - File for southerly route through Arkansas
 - Before takeoff, I estimate 50% chance of finding an open layer vs turning back to DHT, then going home
 - After departure, climb to 7,500 ft in clear, layer above about 15,000 ft, tops of undercast forms about 4,000, many METARS reporting IFR below
- Soon realize that I can see clear path between layers all the way to the horizon, and turn direct to M17
- What risks am I accepting for next 100 nm?
 - Emergency let down may find IFR or LIFR with ice likely



Bolivar (M17) to Beavercreek (I19)

- Almost missed getting courtesy car to lunch
- Ongoing threat that any delay could make further travel east impossible
- Flight after lunch was routine in excellent VFR
- Good landing at I19, and with some begging, I arranged for a hangar



What if I had to delay a day?

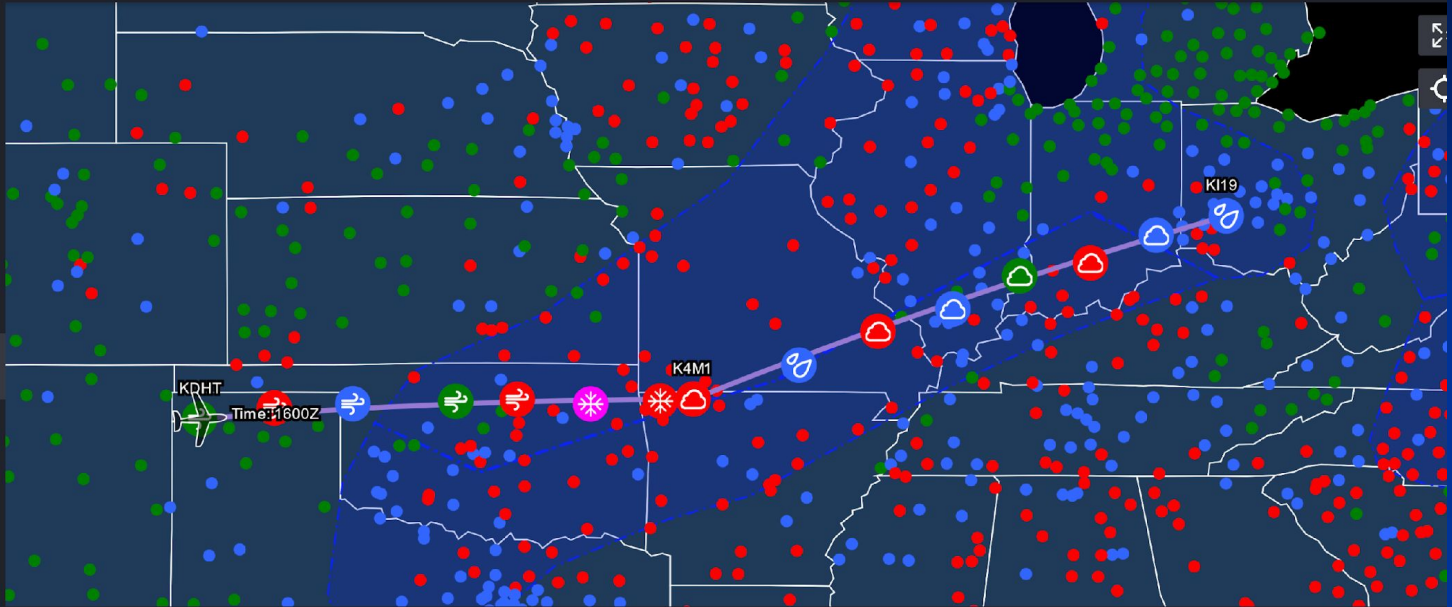
WeatherSpork



KDHT → K4M1 → KI19



- ★ Favorites
- 📊 Observations
- 📈 Forecasts
- 📍 Route Profile
- # Grid View
- 🌐 Map View
- 🖼️ Imagery
- ⚙️ Preferences
- 👤 Account
- 📖 Support



ETD: Thu 22 Dec 1600Z

IFR

Now
1622Z

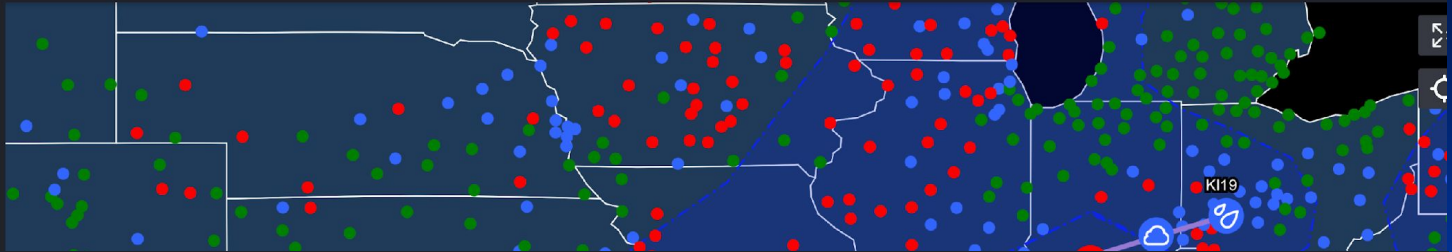


What if I had to delay a day?

WeatherSpork ★

KDHT → K4M1 → KI19 ▾

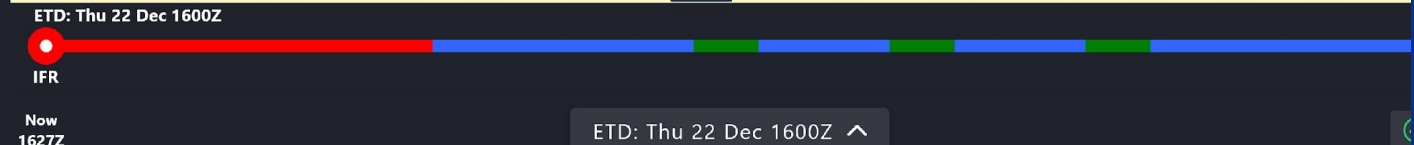
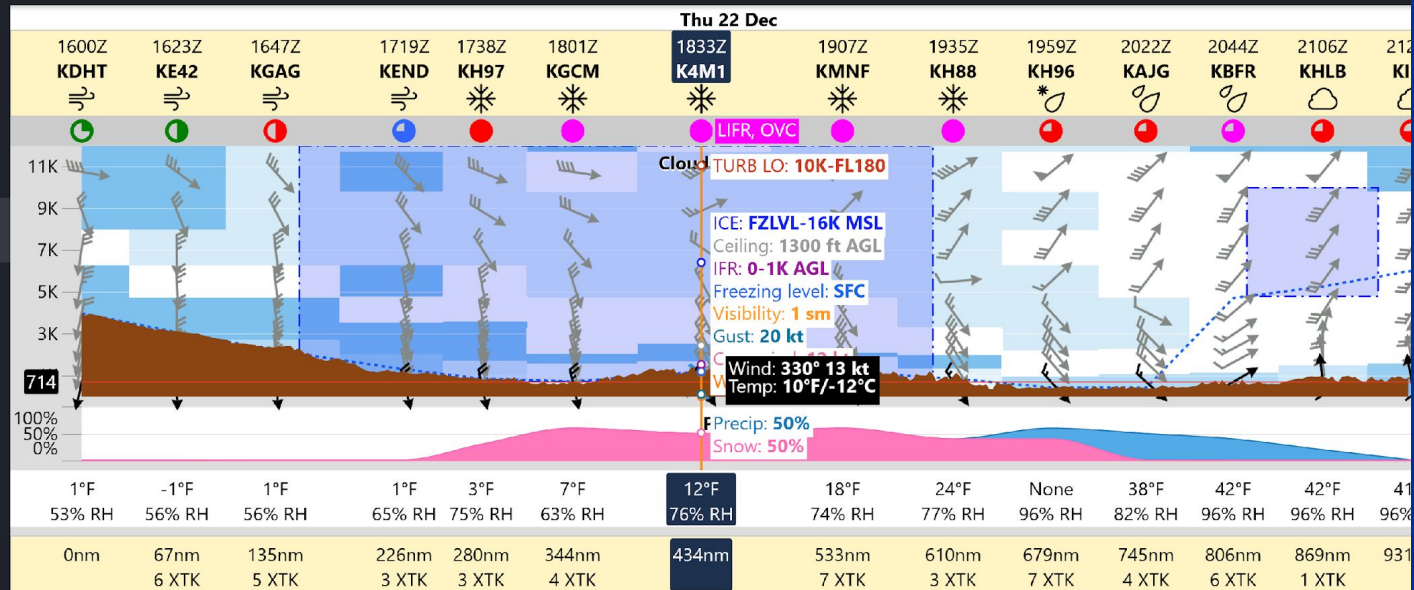
- ★ Favorites
- 📊 Observations
- 📈 Forecasts
- 👤 Route Profile



WeatherSpork ★

KDHT → K4M1 → KI19 ▾

- ★ Favorites
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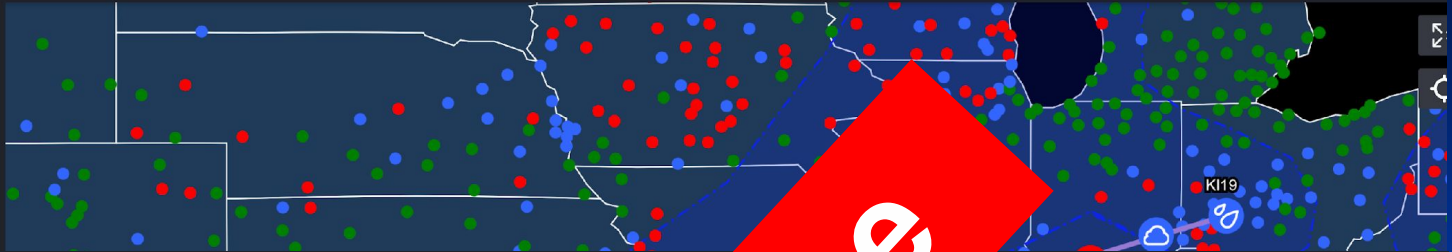


What if I had to delay a day?

WeatherSpork ★

KDHT → K4M1 → KI19 ▾

- ★ Favorites
- 📊 Observations
- 📈 Forecasts
- 🗺️ Route Profile



WeatherSpork ★

KDHT

- ★ Favorites
- 📊 Observations
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- # Grid View
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- 🖼️ Imagery
- ⚙️ Preferences
- 👤 Account
- 📖 Support



ETD: Thu 22 Dec 1600Z

IFR

Now
1627Z

ETD: Thu 22 Dec 1600Z ^

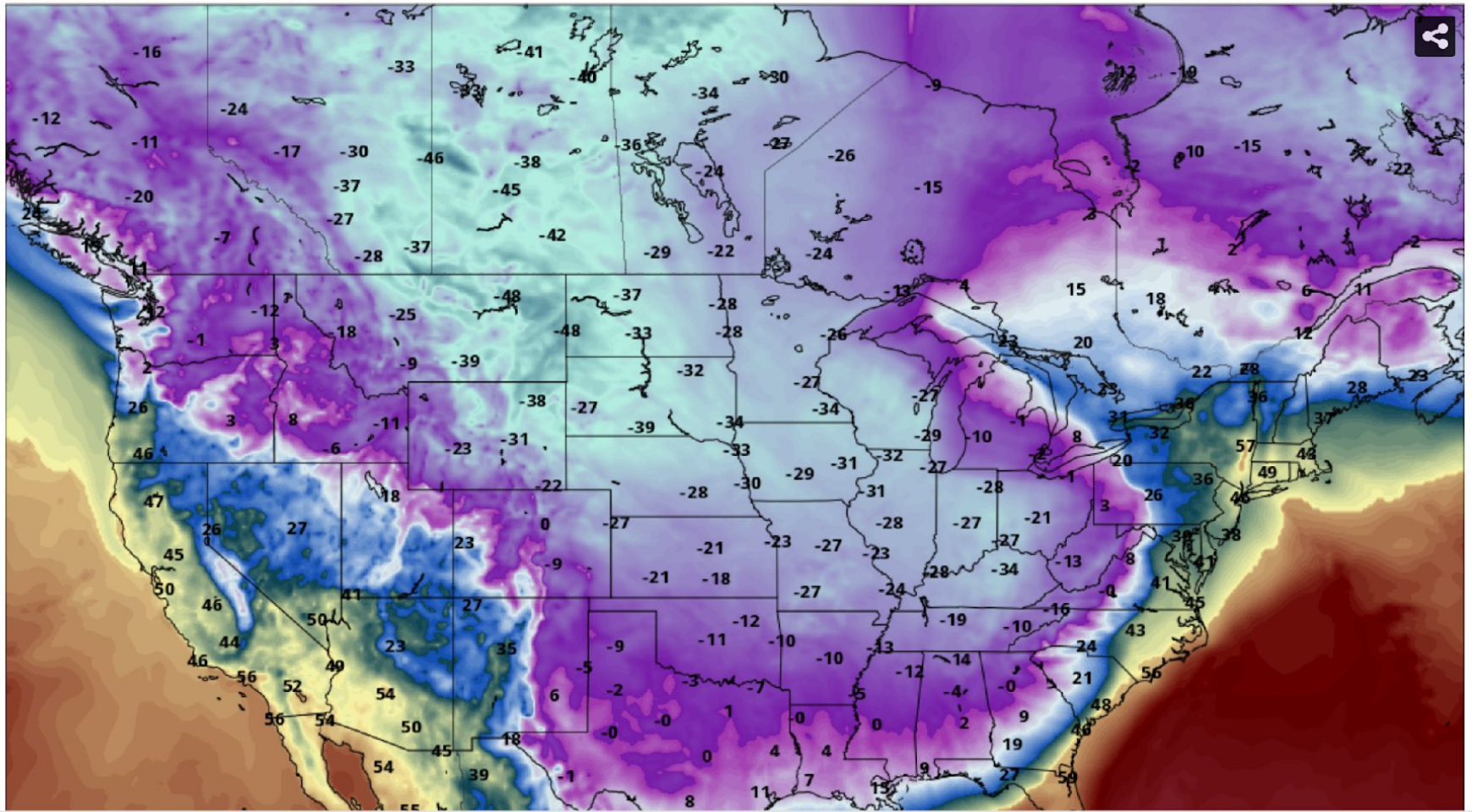
Weather While in Dayton

FLASH SALE - 20% OFF ALL PLUS SUBSCRIPTIONS & STORE MERCHANDISE

2 m AGL Wind Chill/Heat Index (°F)

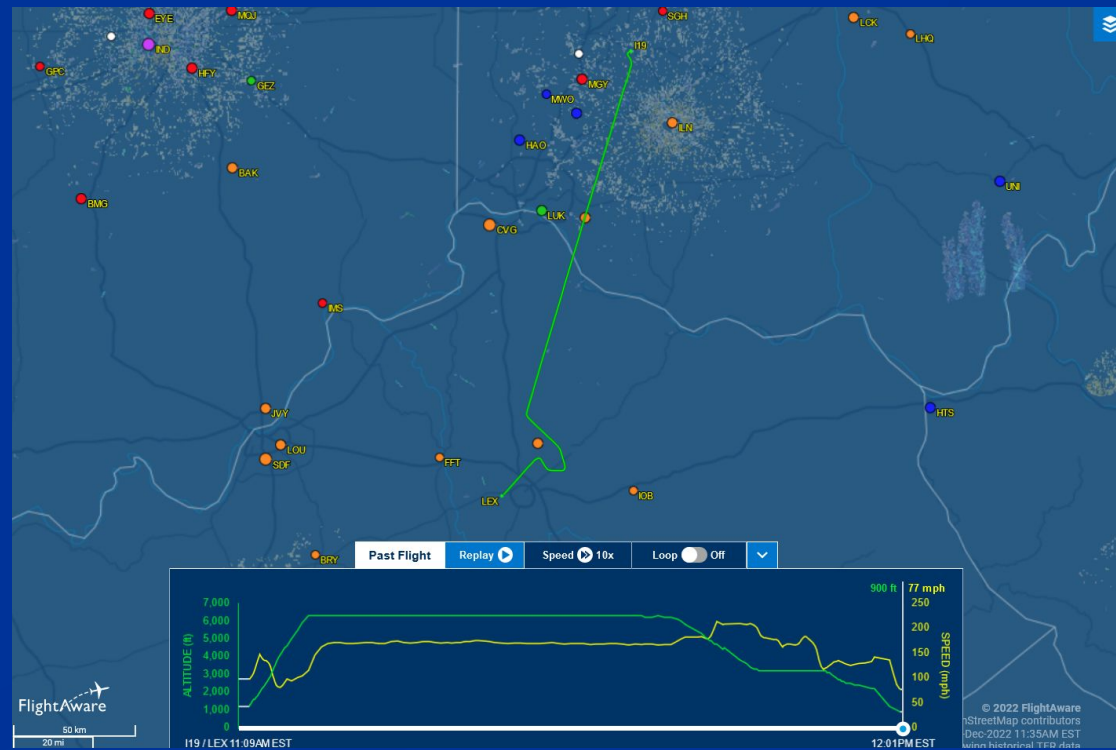
F018 Valid: Fri 2022-12-23 12z

Init: Thu 2022-12-22 18z GFS



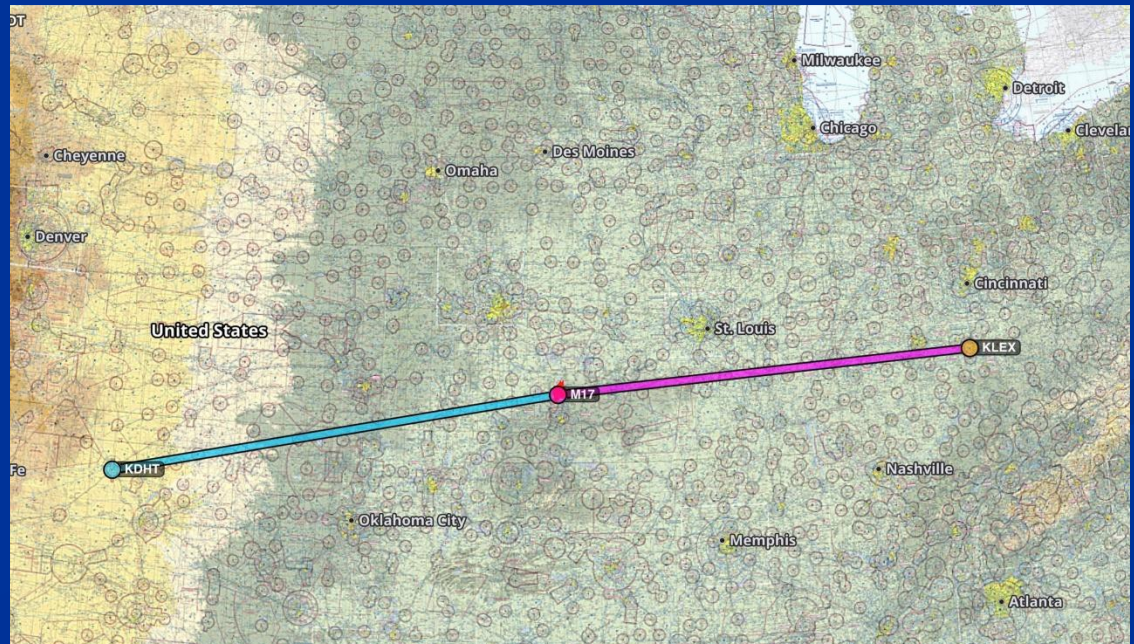
Holiday is over, time to go home

- Plan 1 hr flight to Lexington (KLEX) for Dec 27.
- Weather forces 1 day delay
- Temps up to 40s, so filed IFR in MVFR conditions
- Short IFR flight is no problem mid day Wednesday 12/28.



When can I go west?

- Wanted to stay two nights in Lexington, so start looking at forecasts west bound
- Found rain/snow/ice expected to move in on Thursday afternoon and will last a week
- Can I get out of the area Thursday morning?
- Need two good days to be home



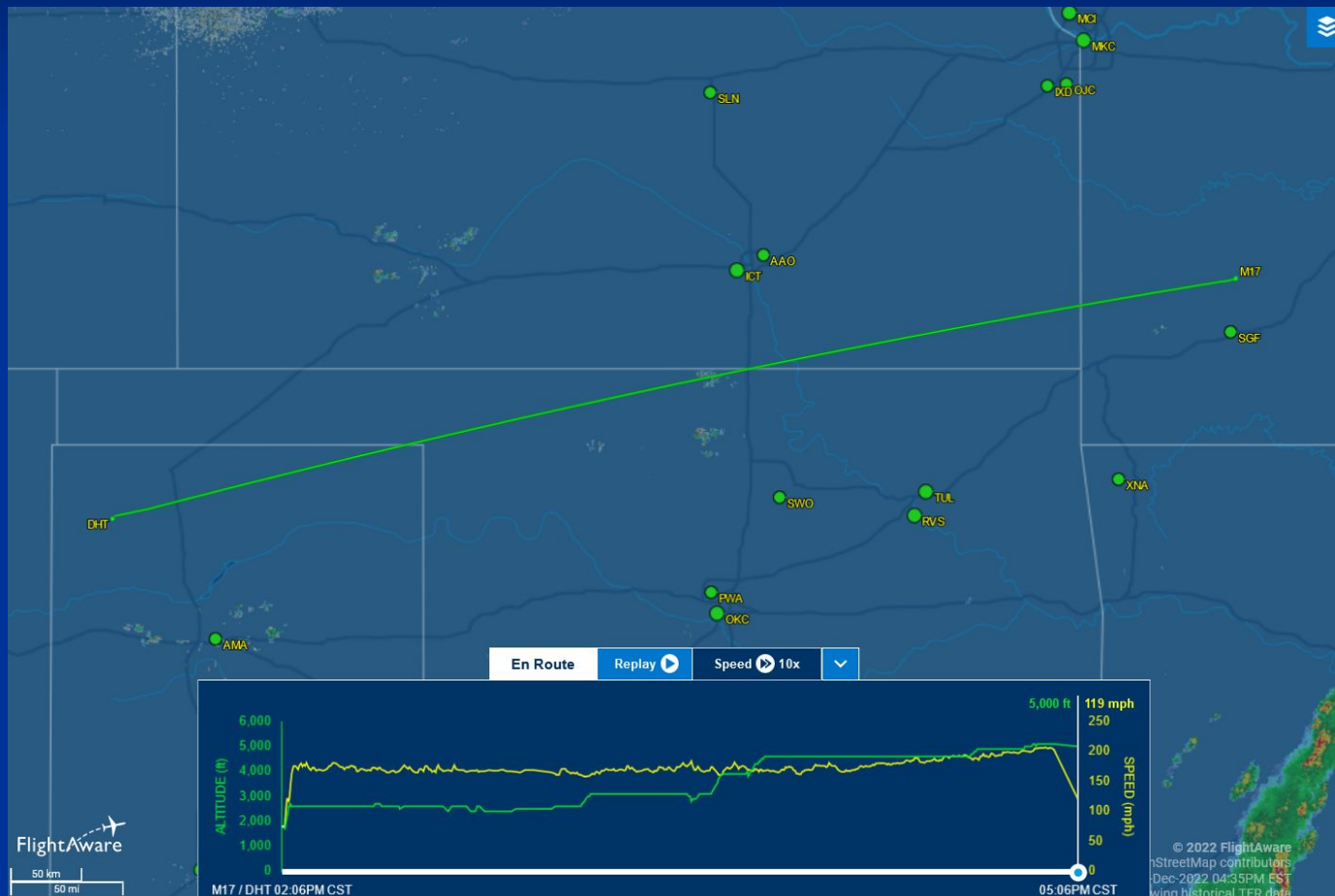
Route LEX to M17

- Successful departure Thursday 12/29
- Routine lunch/fuel stop at Bolivar (M17)
- Weather closes in on Lexington later on Thursday



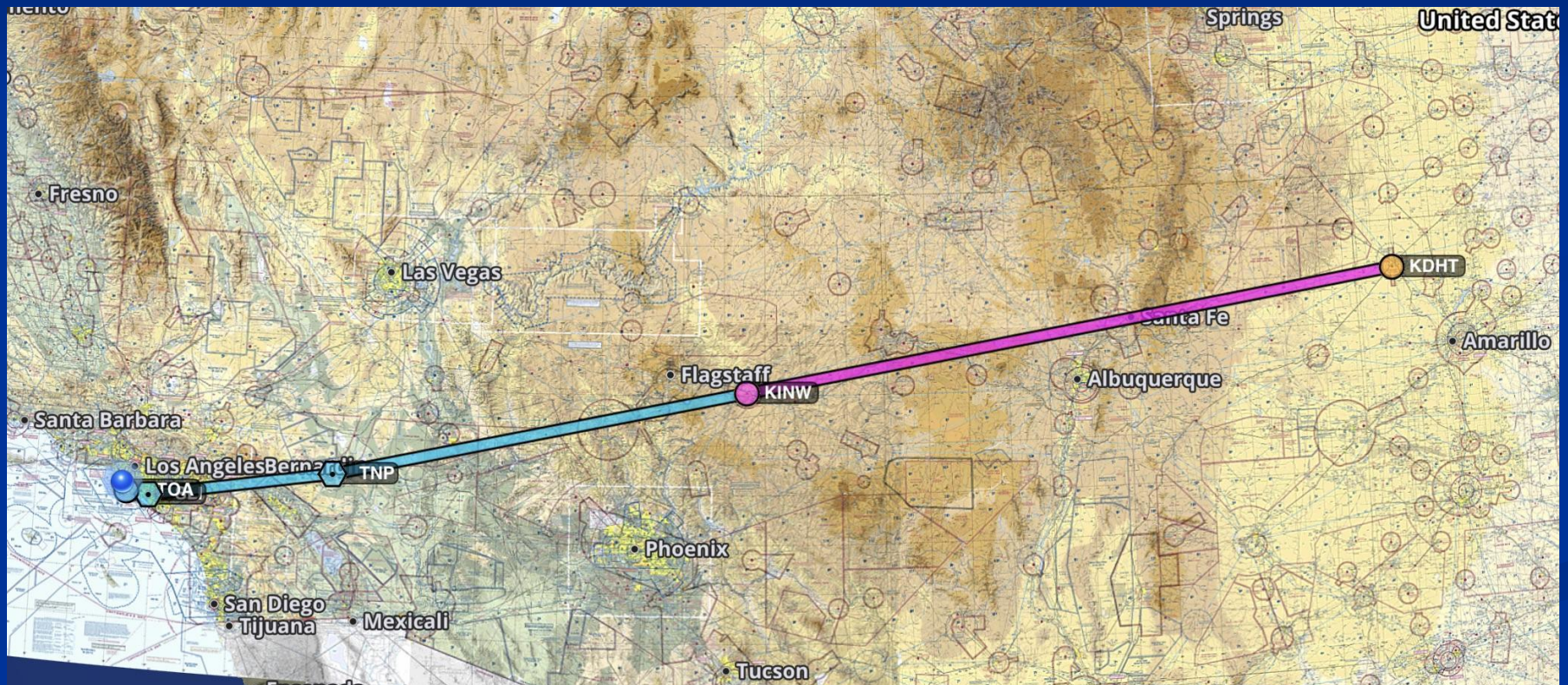
Route M17 to DHT

- Routine arrival in DHT, nothing worse than 30 knot headwinds enroute



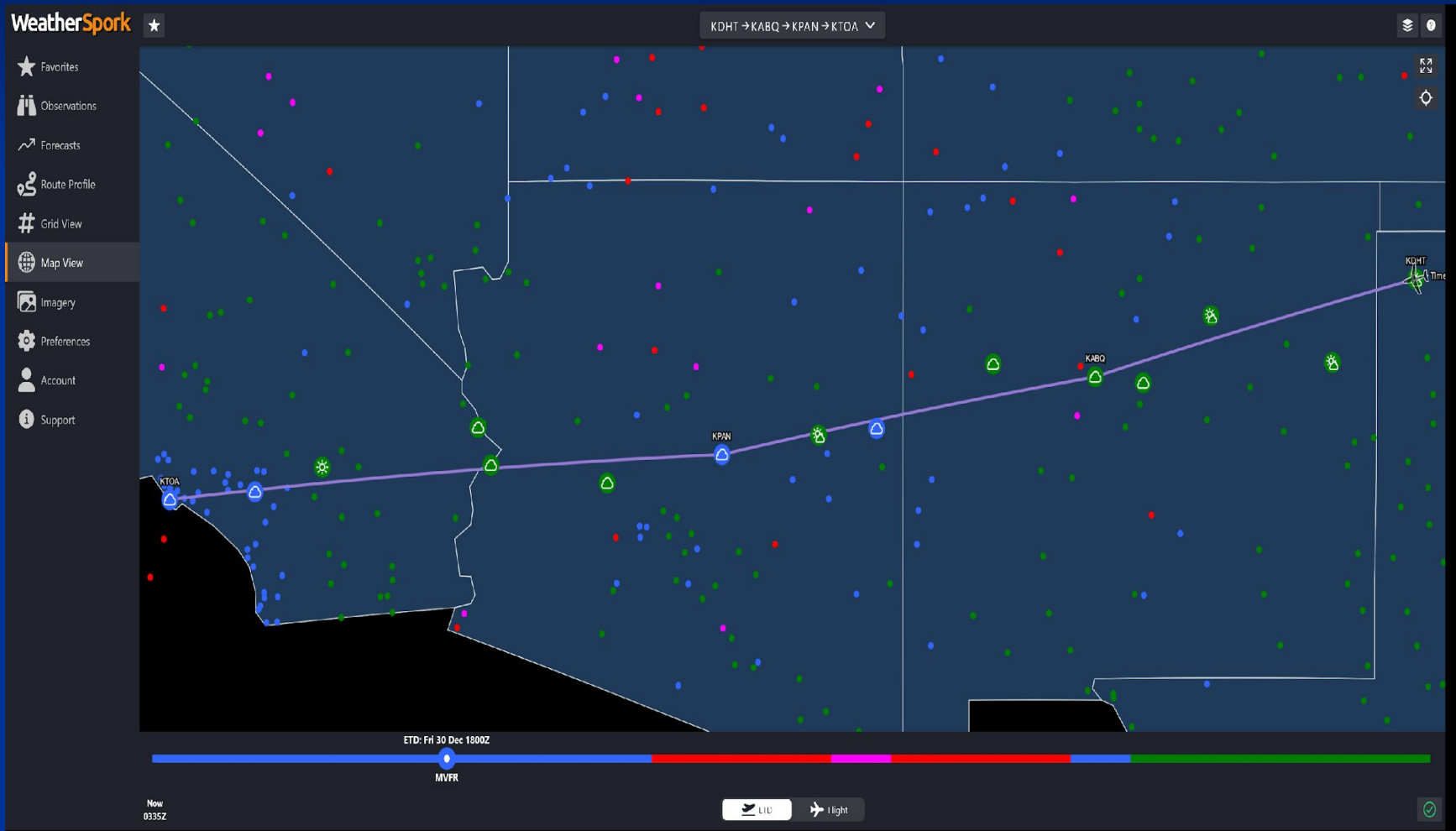
Route DHT to INW to TOA

- Watching forecast for DHT to TOA – challenges ahead



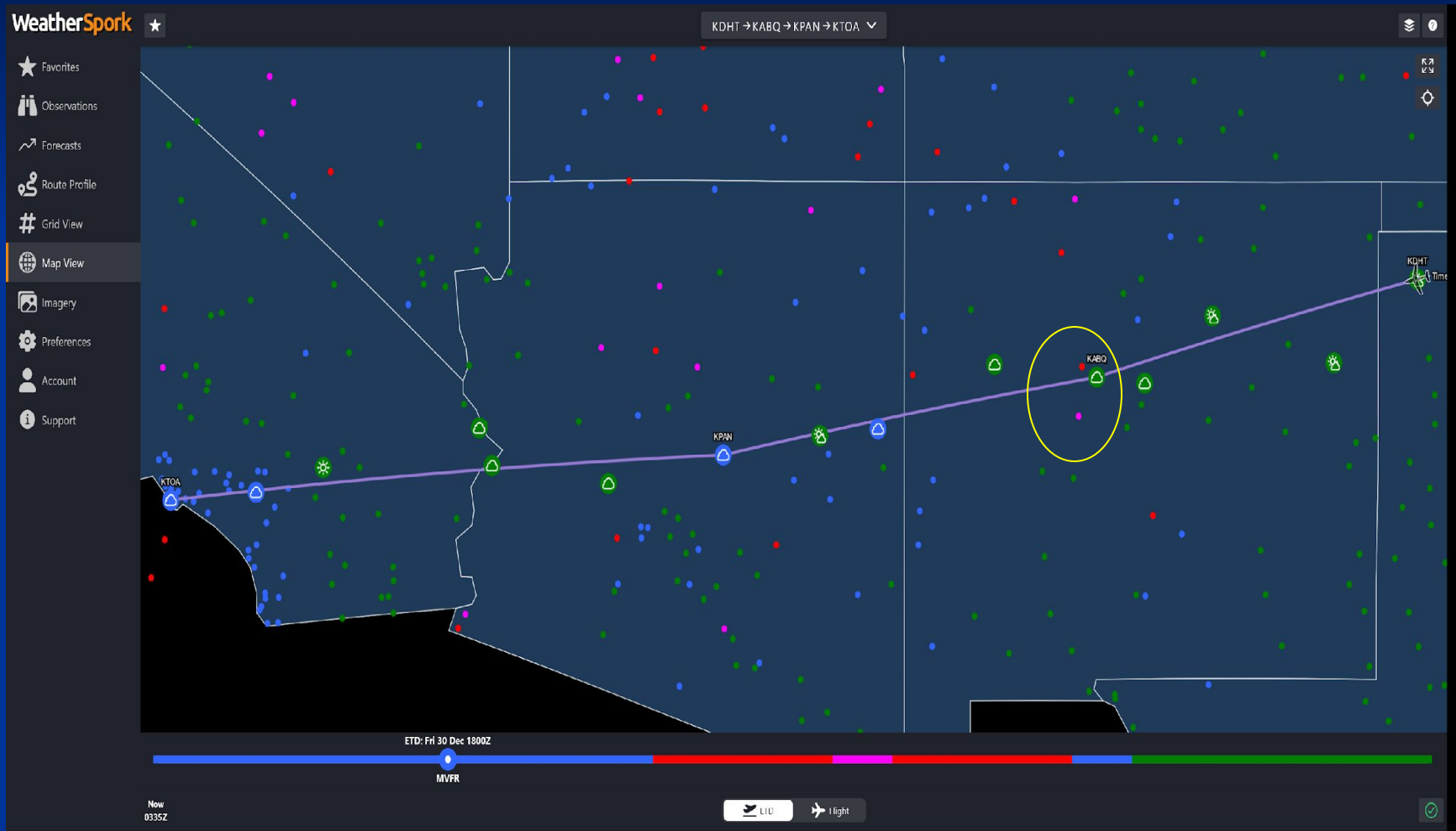
Plan view DHT to TOA as forecast for 12/30/22

- Initial look seems easy

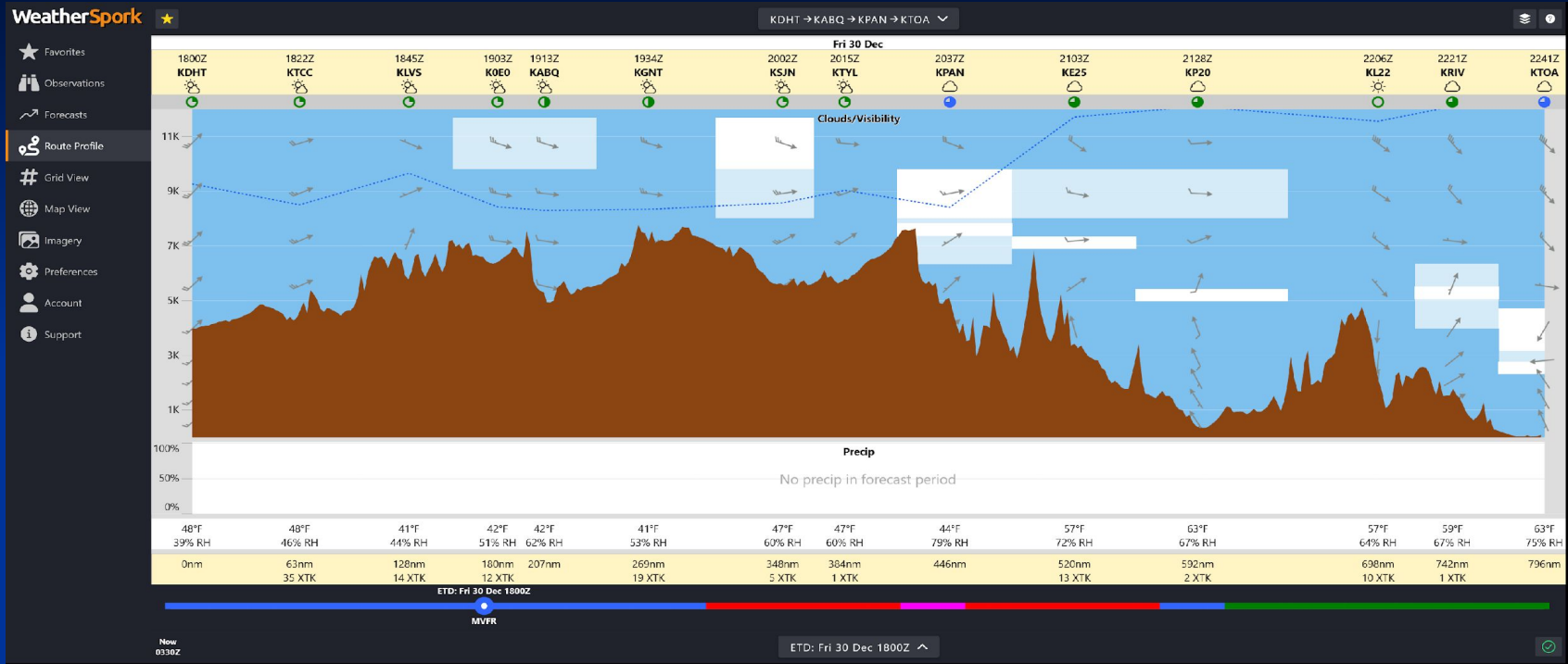


Plan view DHT to TOA as forecast for 12/30/22

- But, zoom in near ABQ

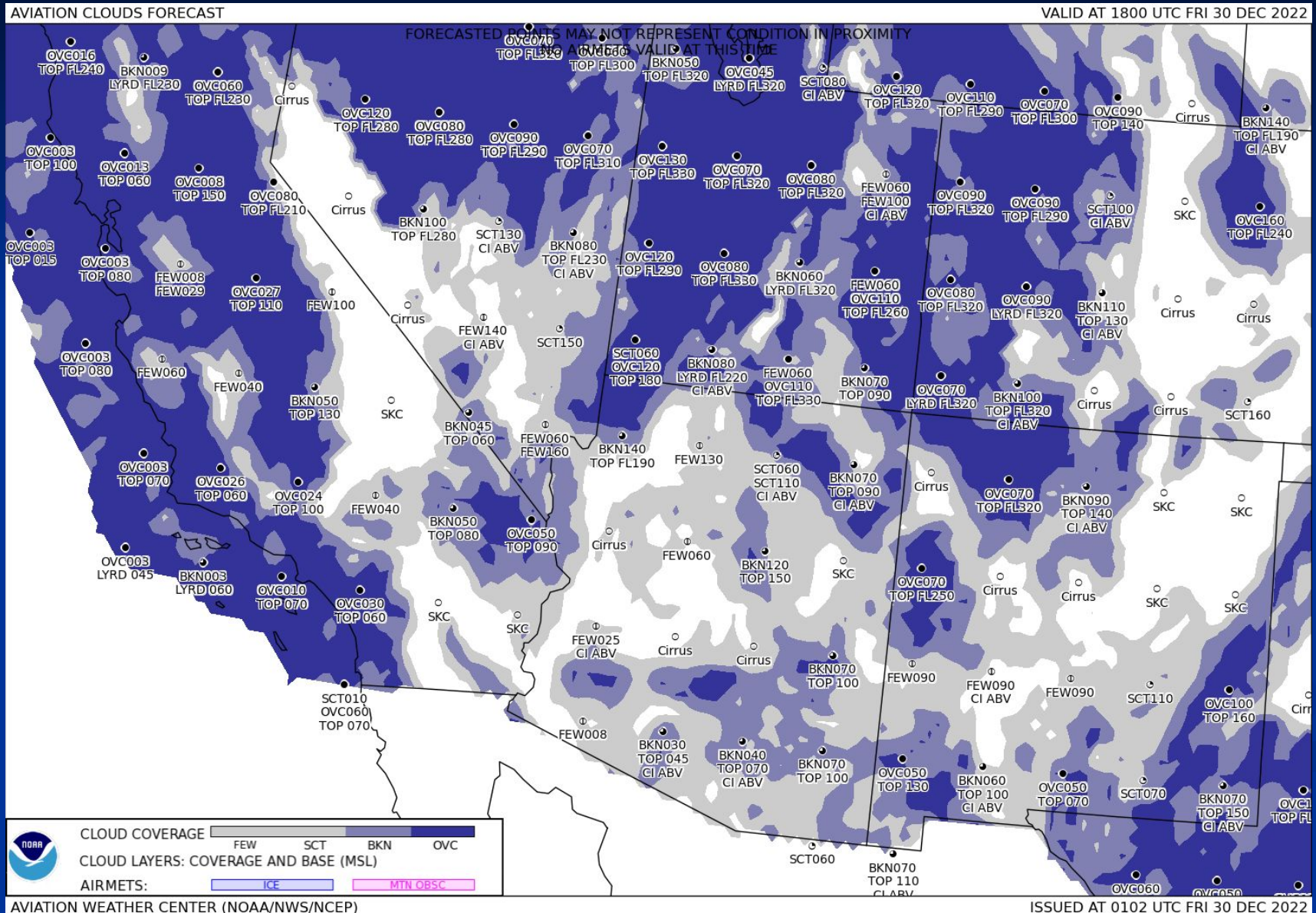


Profile view DHT to TOA as forecast for 12/30/22



- Stay below freezing level
- Only partly cloudy past Albuquerque
- Consider multiple options for lunch: Winslow (INW), Showlow (SOW), Payson (PAN)

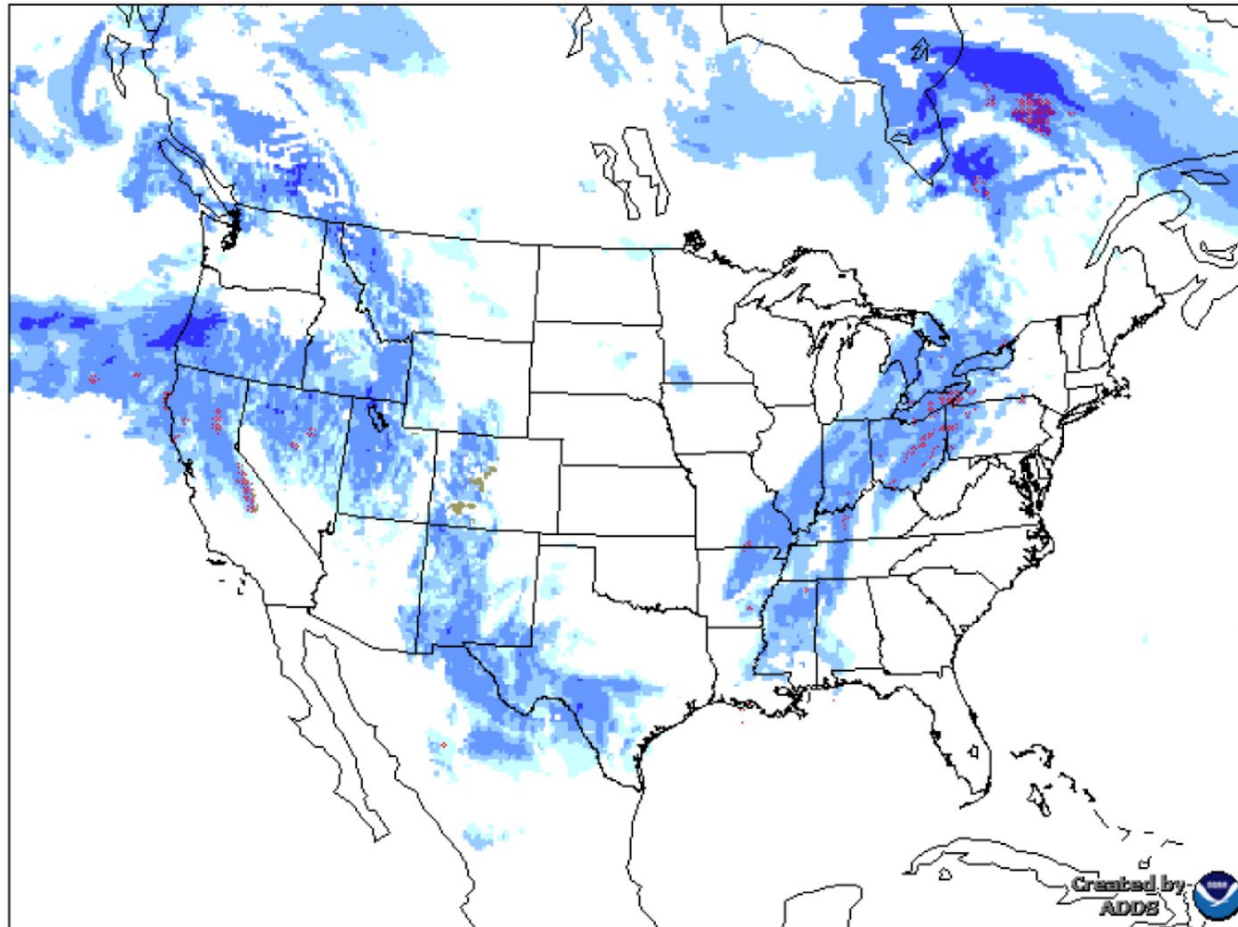
GFA for Clouds seen Thursday evening



Icing Severity Reinforces STAY VMC

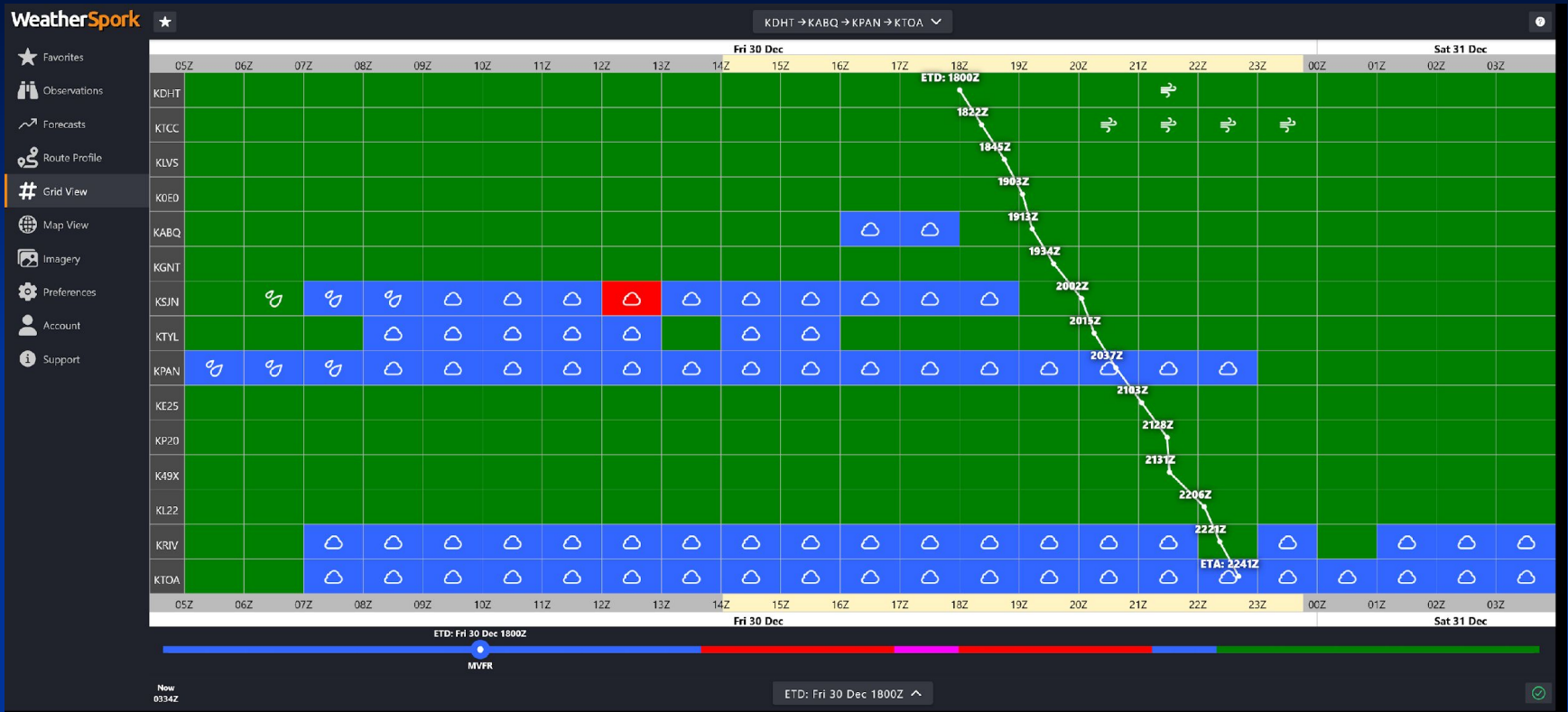
Icing severity at 11000 ft. MSL

15 hr forecast valid 1700 UTC Fri 30 Dec 2022



SLD threat terrain None Trace Light Moderate Heavy

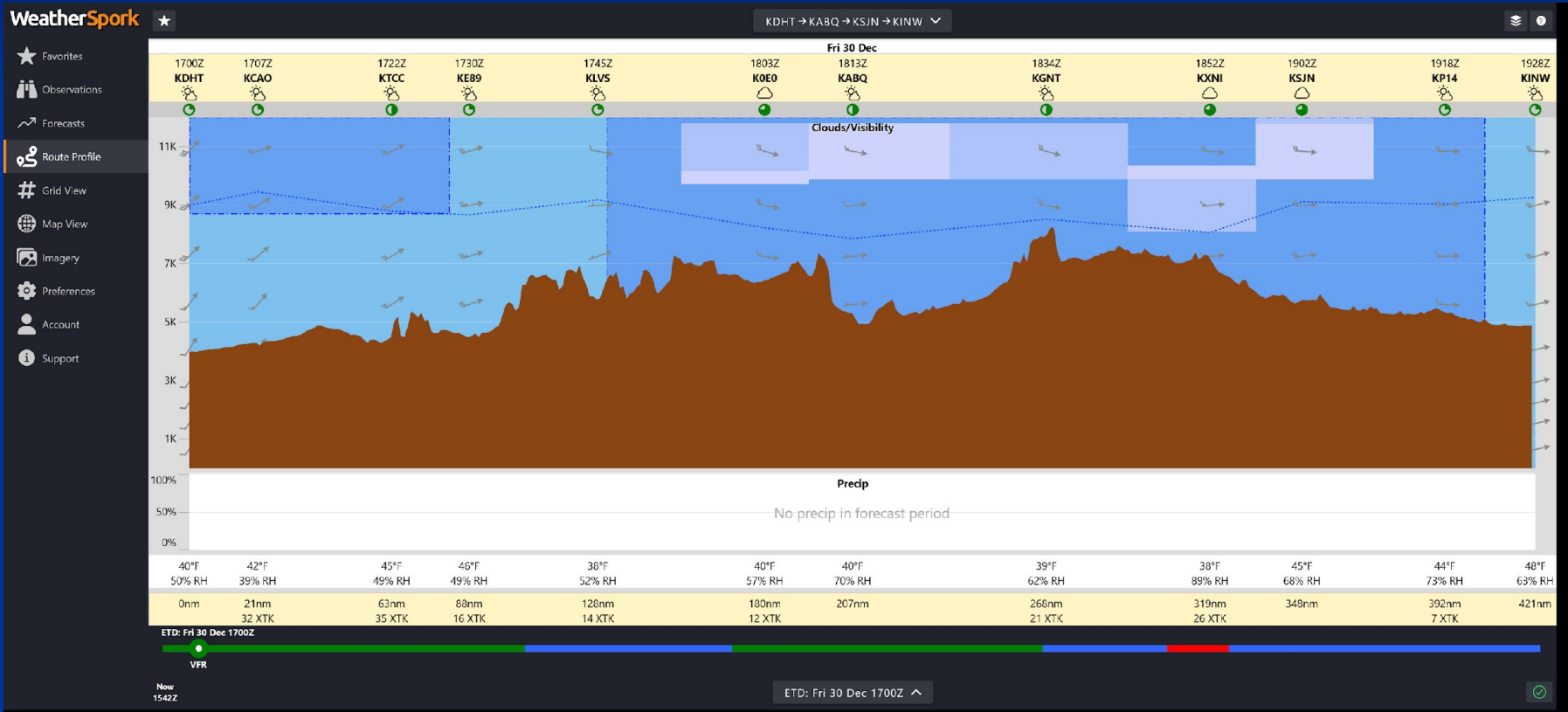
Grid view DHT to TOA as forecast for 12/30/22



- Looks like good VFR?
- What does MVFR mean near lunch stop?
- MVFR at destination, but temp warm and home field

DHT to INW

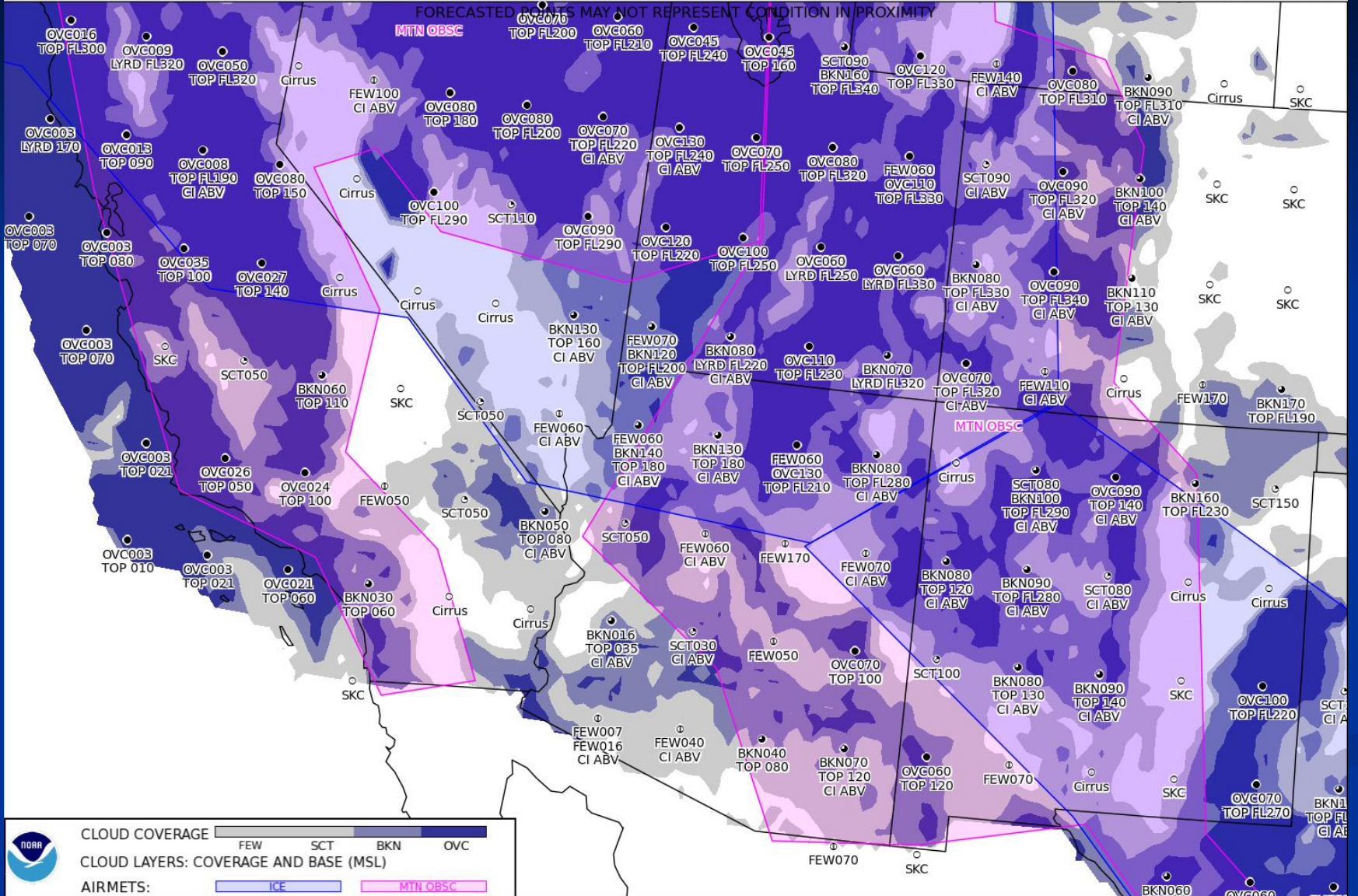
- Next morning, forecast is almost the same
- ABQ does not appear to be a problem, but has high rocks



GFA shows more clouds

AVIATION CLOUDS FORECAST

VALID AT 1800 UTC FRI 30 DEC 2022

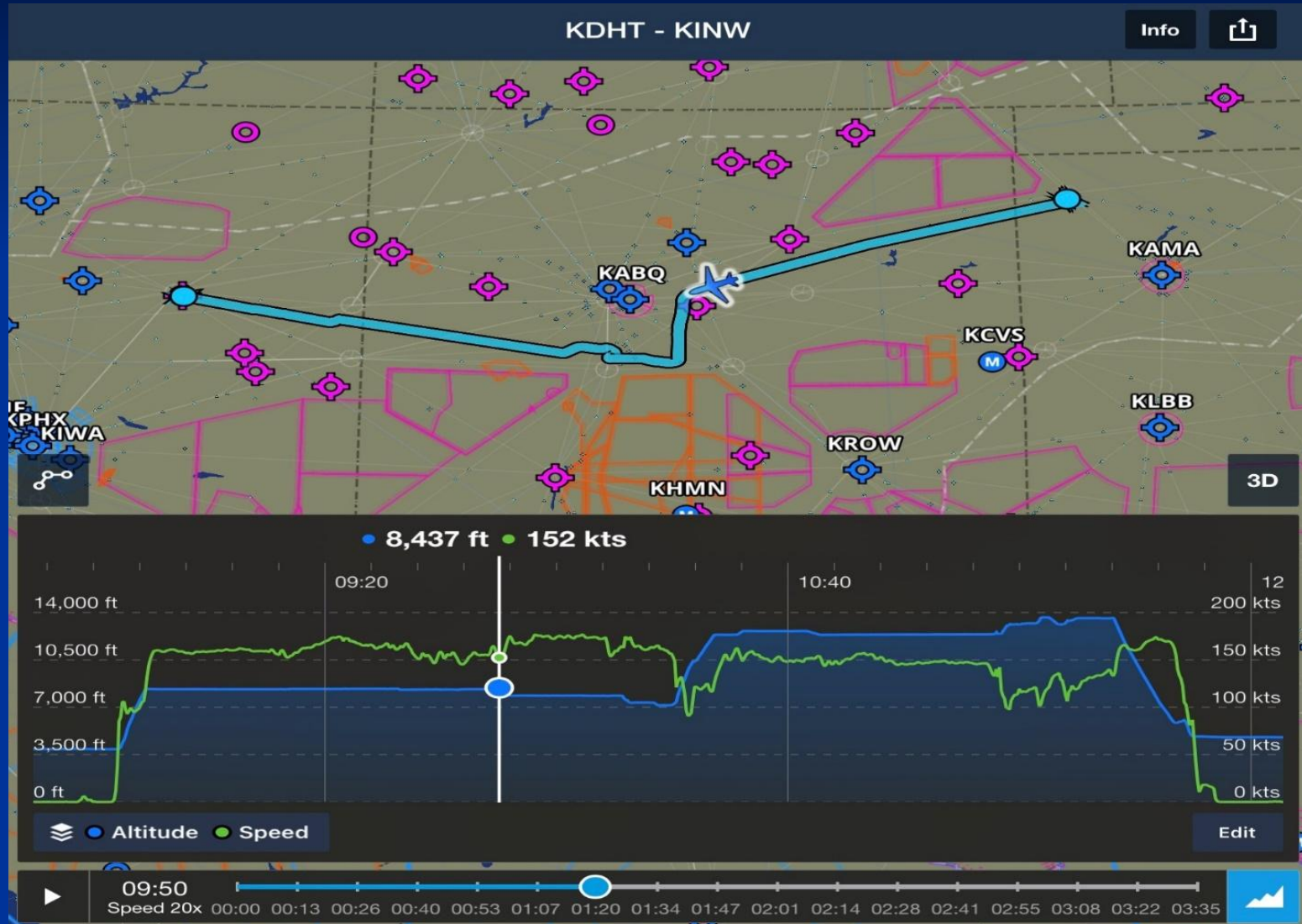


AVIATION WEATHER CENTER (NOAA/NWS/NCEP)

ISSUED AT 1302 UTC FRI 30 DEC 2022

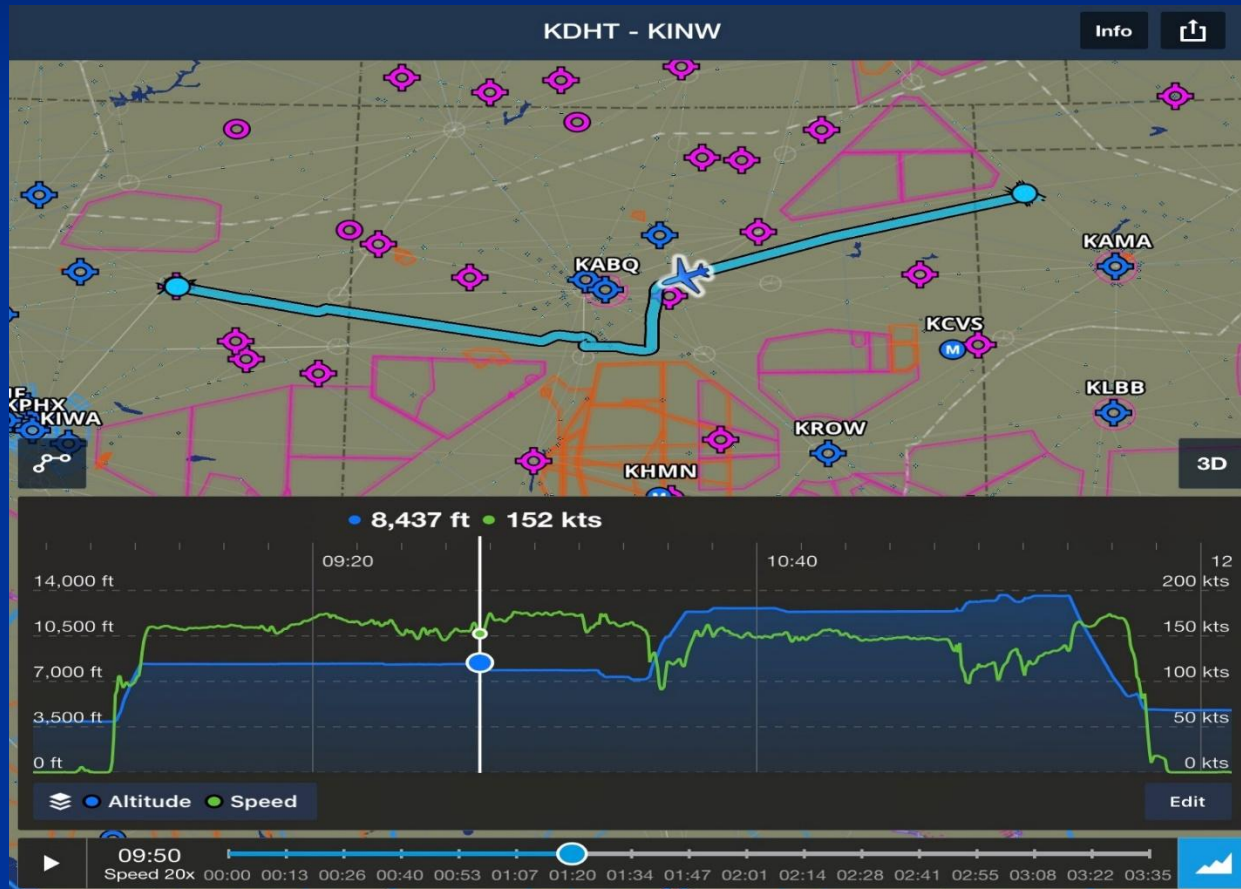
Track Dalhart to Winslow (INW)

- Mountain tops east of ABQ are in clouds, turn south



Track Dalhart to Winslow (INW)

- Lowering bases, okay until terrain starts up
- Big hole with blue sky above – CLIMB
- Looks clear above all the way to Winslow



View just west of ABQ at 12,500 ft

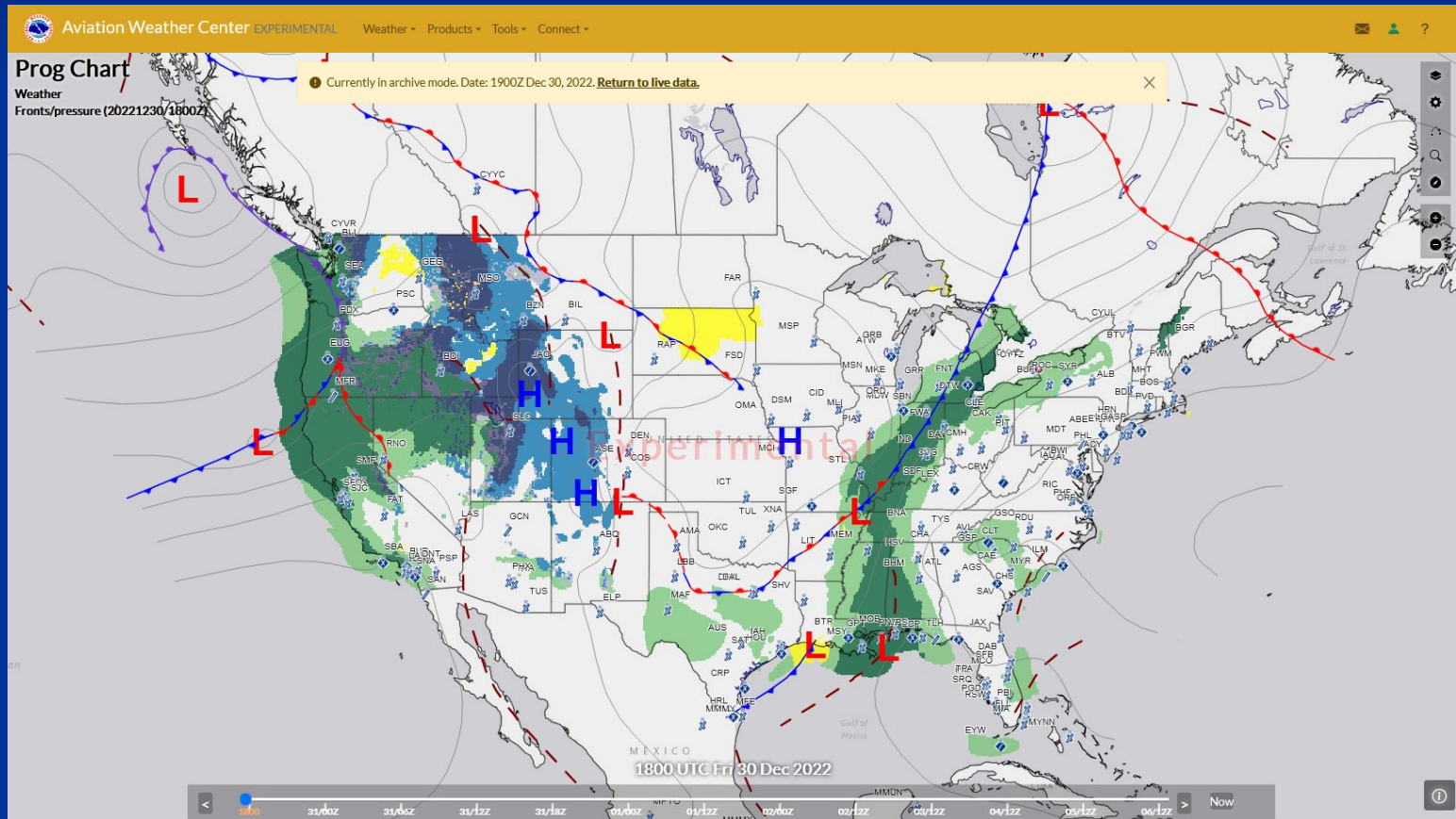


Where did this come from?



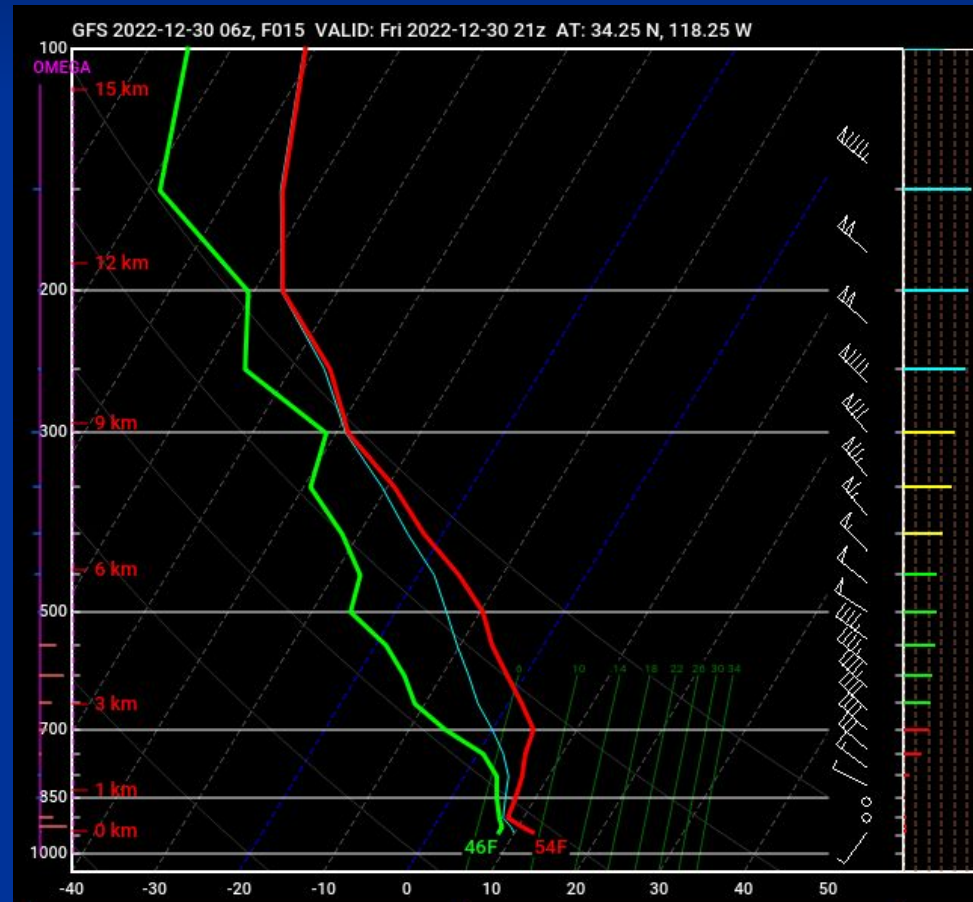
Lunch at Winslow

- Undercast clears just before INW, do not need alternate
- Now planning for last leg home
- TOA will need approach through clouds, but freezing level high



Lunch at Winslow

- Skew-T confirms IFR is feasible
- TOA will need approach through clouds, but freezing level high



INW to TOA

- Planned to stay VFR through Banning pass
- Picked up IFR clearance in Ontario area
- Routine IFR approach through broken clouds
- Home at last



Summary

- Summer flights –
 - Main hazard is thunderstorm avoidance – NEXRAD helps a lot
 - Per cent coverage is key enabler to stay VMC around storms
 - Convective outlook is too broad to be useful
 - Storms typically local - May need to land and wait a few hours
 - Expect one bad day with three good days
- Winter flights –
 - Main threat is icing – must stay VMC
 - Expect one good day and five bad ones
 - Numerous forecast tools are needed across planning time frame

Summary

- Flying is a risk tradeoff
- Weather is the single biggest uncontrollable risk
- Best mitigation is to have multiple options – routes and times
- Decision making requires good tools to pick the right time and route for least risk
- I very much appreciate the improvement in forecasting over the last ten years

Links to Real Time Tools

■ Pivotal Weather

- https://www.pivotalweather.com/model.php?rh=2023021818&fh=102&dpdt=&mc=&r=us_sw&p=prateptype_cat-imp&m=gfs

■ Ventusky

- <https://www.ventusky.com/>

■ Weather Underground

- https://www.wunderground.com/forecast/us/ca/manhattan-beach/KCAMANHA9?cm_ven=localwx_10day

■ Weatherspork (Subscription)

- <https://app.weatherspork.com>

■ NOAA GFA

- <https://beta.aviationweather.gov/gfa/#progchart>

■ NOAA LAMP Meteogram

- https://www.nws.noaa.gov/mdl/gfslamp/meteodata.php?forecast_time=01&sta=KLgb

■ CWSU ZOA

- https://www.weather.gov/zoa/?&p=fcid.ar&lon=-118.4711&lat=33.9434&zoom=8&map=topo&priority=8&hov_er

Comments on Tools

- NOAA GFA Beta
 - Colors sometimes do not match key
 - Airport data characteristics is not useful, use METAR/TAF like CWSU ZOA instead
 - Vertical Cross Section view often does not work
- NOAA LAMP Meteogram
 - Great, but need longer time range
- CWSU ZOA
 - Popup windows sometimes off page

Thank you for listening –

Questions?

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