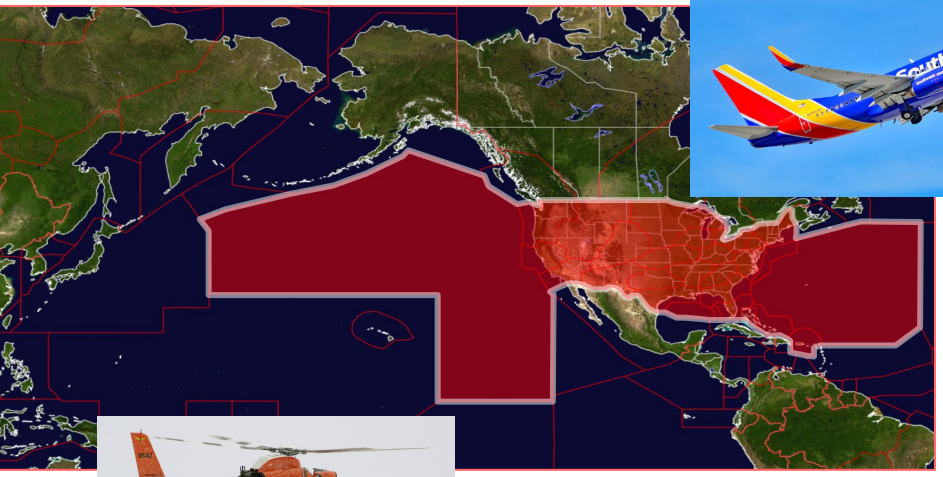
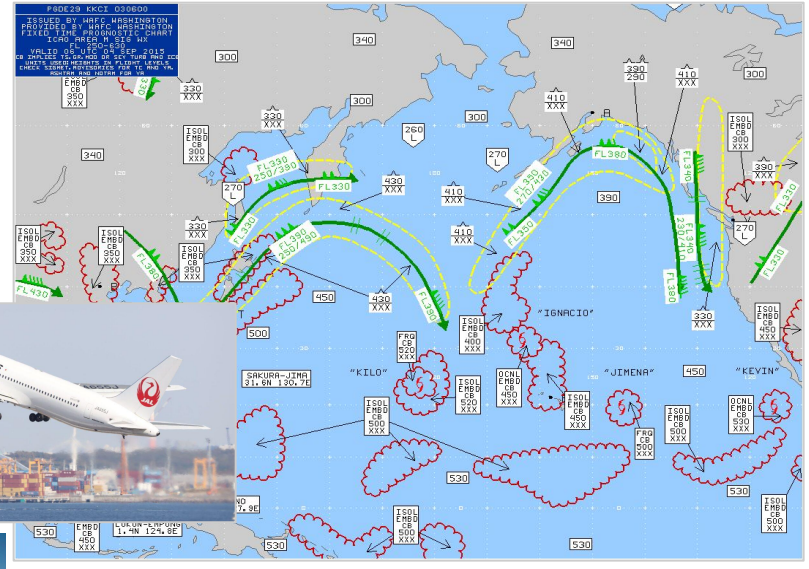
Ensemble Uses/Performance/Needs at the Aviation Weather Center

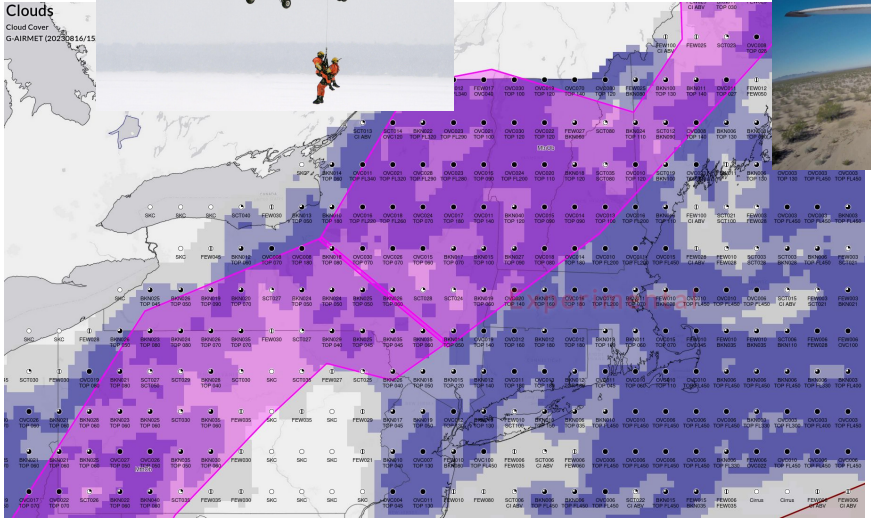
Rob Hepper, Techniques Development Meteorologist



Southwest

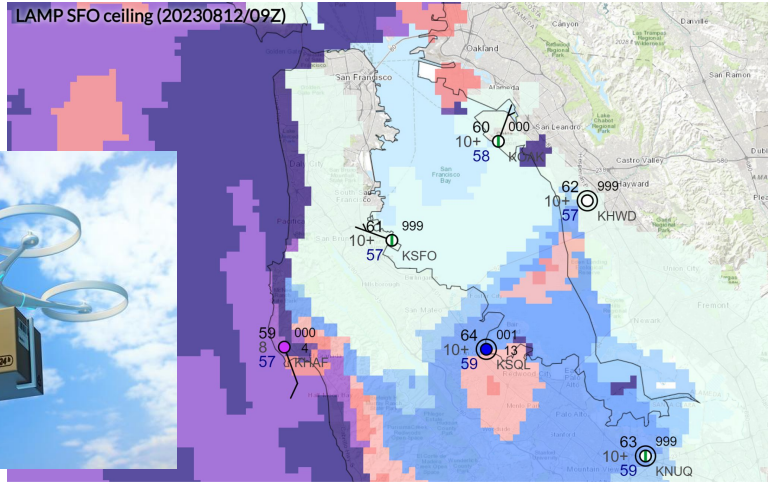

FSDE29 KKCI 030600
ISSUED BY WAFC WASHINGTON
PROVIDED BY WAFC WASHINGTON
FIXED TIME PROGNOSTIC CHART
ICAO AREA M SIG WX
FL 250-630
VALID 06 UTC 04 SEP 2015
"IGNACIO"
"JIMENA"
"KEVIN"
"KILO"
SAKURA-JIMA
31.6N 130.7E

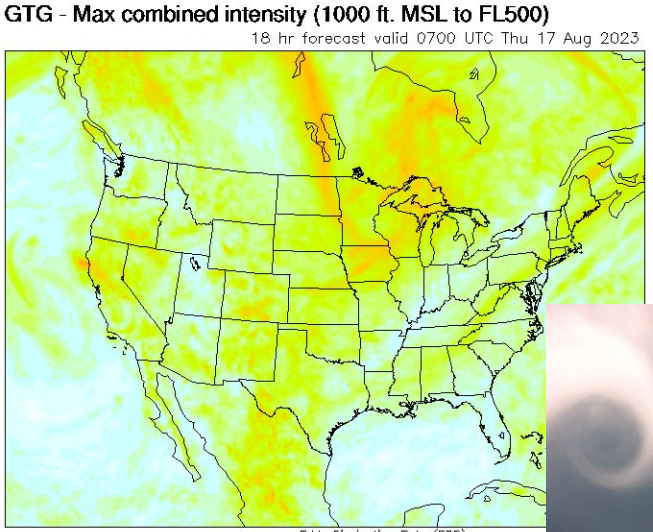
JAPAN AIRLINES

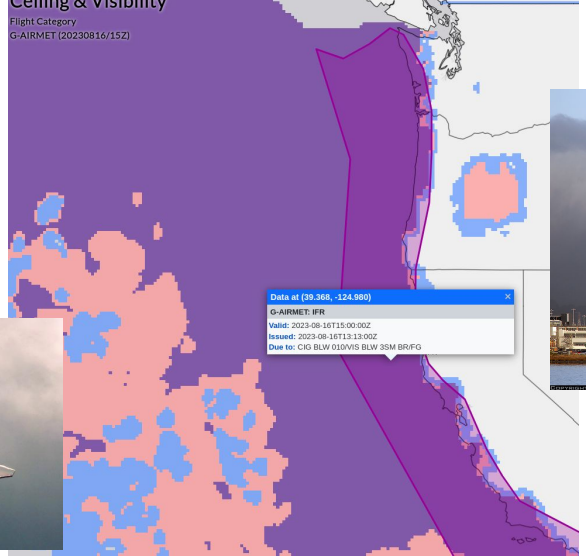

Clouds
Cloud Cover
G-AIRMET (20230816/15

N2350

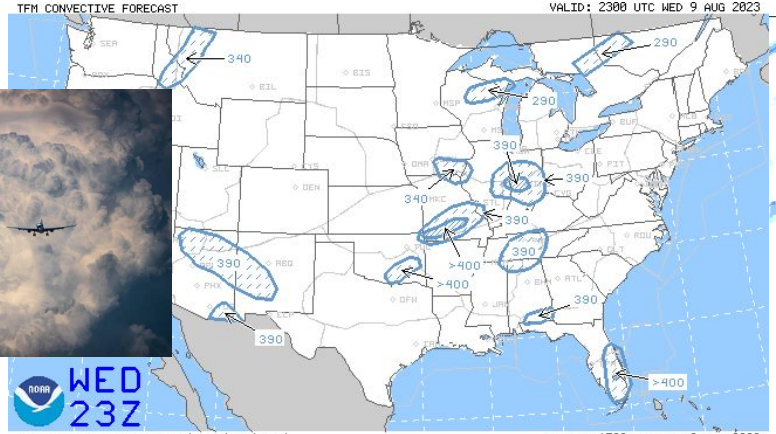
FRAGILE
DO NOT DROP

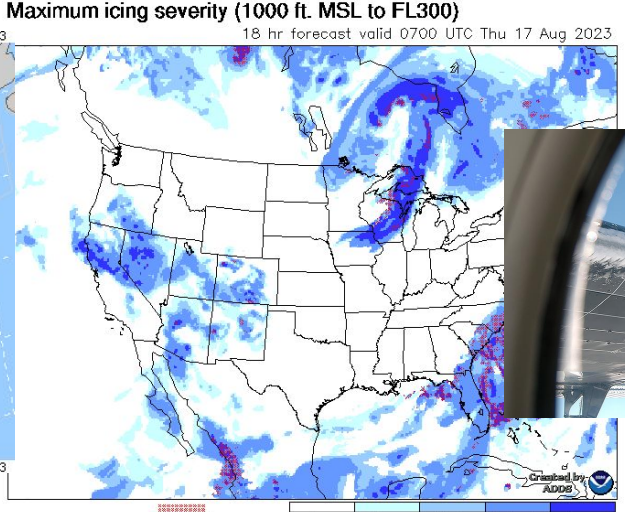

LAMP SFO ceiling (20230812/09Z)
KOAK
KHWD
KSFO
KHAF
KSQL
KNUQ


GTG - Max combined intensity (1000 ft. MSL to FL500)
18 hr forecast valid 0700 UTC Thu 17 Aug 2023
Eddy Dissipation Rate (EDR)
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9

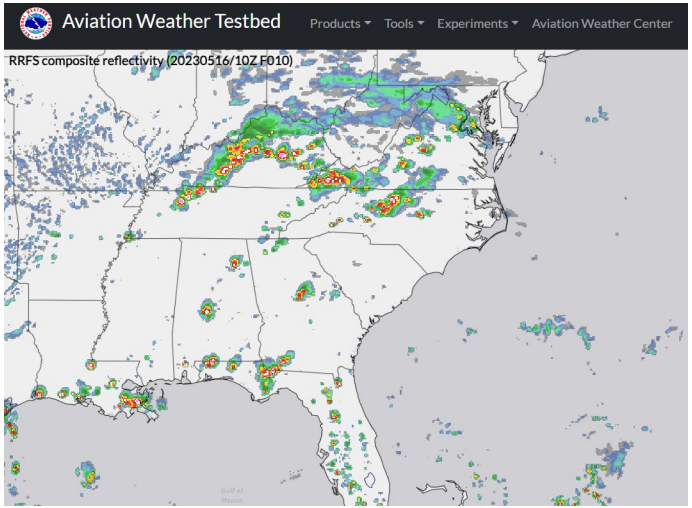

Ceiling & Visibility
Flight Category
G-AIRMET (20230816/15Z)
Data at (39.368, -124.980)
G-AIRMET: IFR
Valid: 2023-08-16T15:00:00Z
Issued: 2023-08-16T13:13:00Z
Due to: CIG BLW 010/VIS BLW 3SM BR/FG

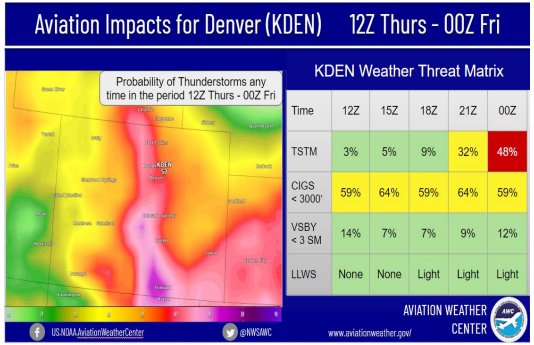
AIRLINERS.NET

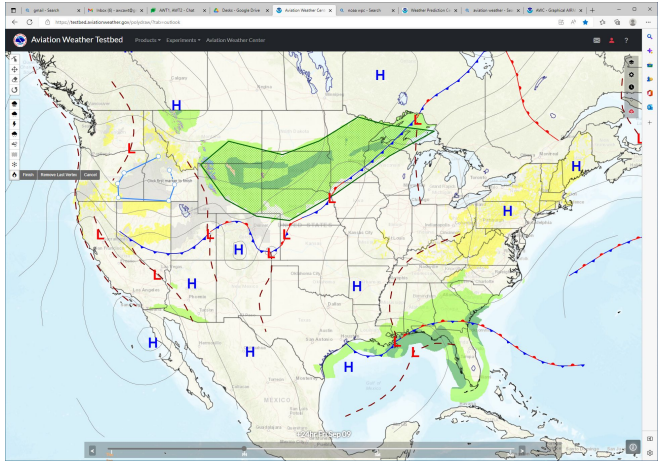

TFM CONVECTIVE FORECAST
VALID: 2300 UTC WED 9 AUG 2023
340
290
290
390
390
340
390
390
>400
>400
390
390
390
>400
WED
23Z
AVIATION WEATHER CENTER (NOAA/NWS/NCEP)
ISSUED: 1700 UTC WED 9 AUG 2023


Maximum icing severity (1000 ft. MSL to FL300)
18 hr forecast valid 0700 UTC Thu 17 Aug 2023
Created by ADDS

AWC Aviation Weather Testbed (AWT)

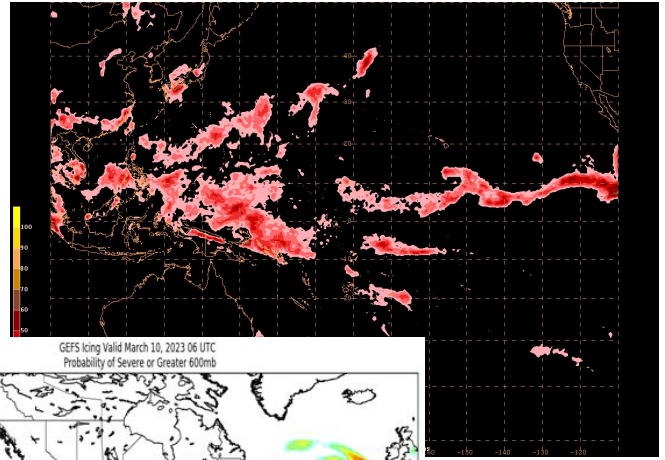


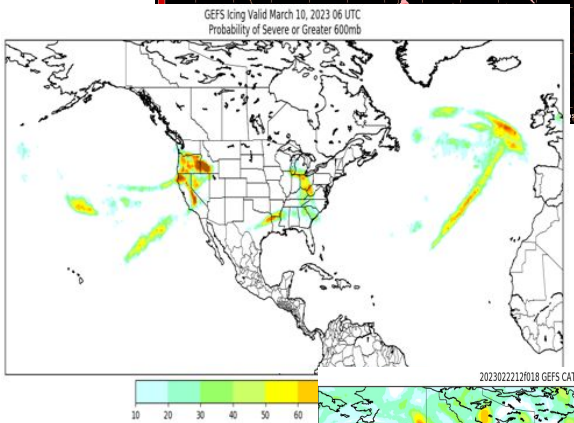


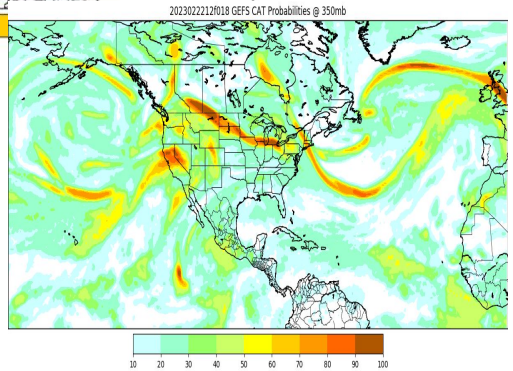


Global Ensembles

- International Civil Aviation Organization (ICAO) requirement for World Area Forecast Centers (WAFCs; Washington and London) to produce global probabilistic guidance for in-flight icing, turbulence, and convection by 2027
- Ensemble Prediction of Oceanic Convective Hazards (EPOCH) operational on WCOSS2 June 2023
  - Calibrated probabilities, driven by GEFS/GEPS
- GEFS driven probabilistic icing and turbulence in development
- Eventually blend WAFC Washington and WAFC London probabilistic guidance to create consistent World Area Forecast System (WAFS) probabilistic guidance
- For more detail:
  - Alex Korner poster - ***Global, Probabilistic Guidance for Convection, Turbulence, and In-Flight Icing***

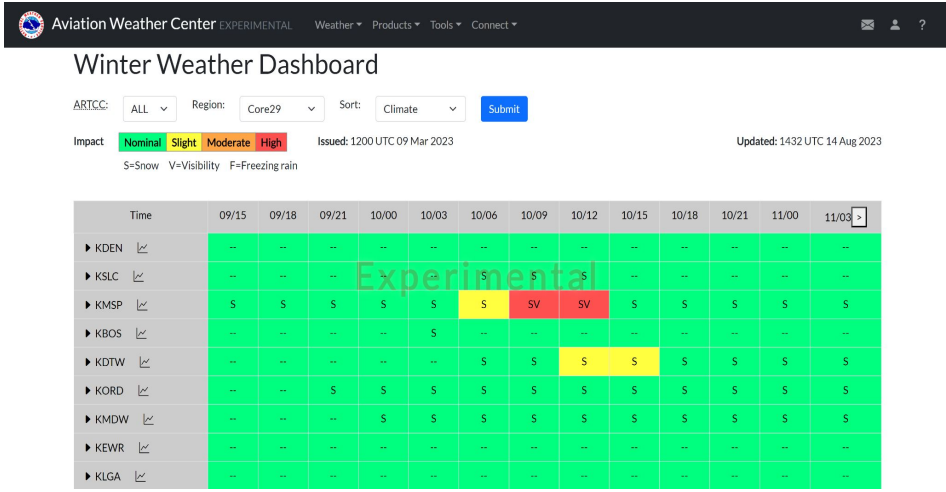


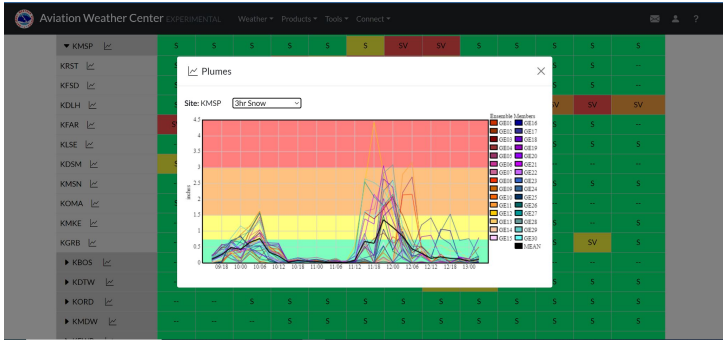




Winter Weather Dashboard

- Decision support for FAA air traffic managers and operational meteorologists to coordinate long range strategic winter weather planning
- Convey impacts due to potential snowfall accumulation, freezing rain accumulation, or visibility restrictions
- Current operational version driven by SREF input
- New version utilizing GEFS input in development as part of AviationWeather.gov upgrade

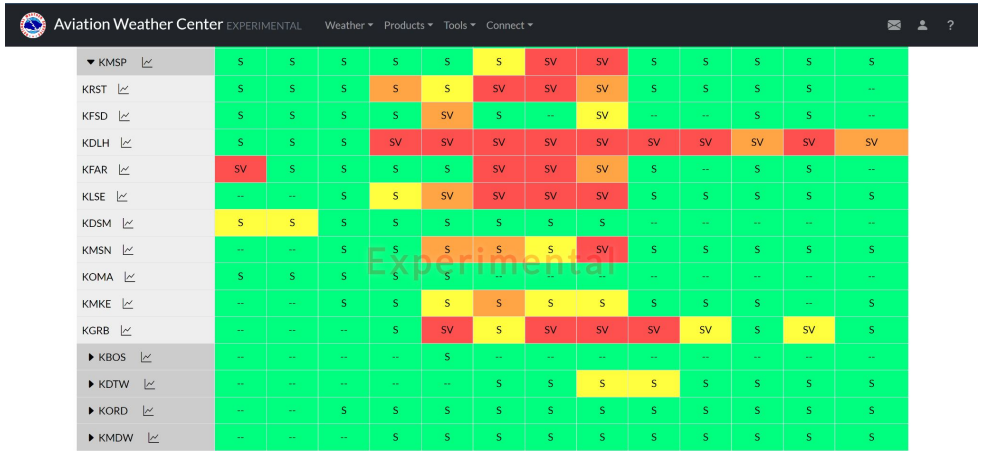




Group 1 (30" +)	Group 2 (15"-30")	Group 3 (0.1"-15")	Group 4 (Trace)
DEN (60")	EWR (28")	SEA (11")	FLL/MIA
SLC (59")	LGA (26")	CLT (6")	LAX
MSP (50")	JFK (23")	MEM (5")	MCO
BOS (42")	IAD (22")	DFW (3")	PHX
DTW (41")	BWI (21")	ATL (2")	SAN
MDW (39")	PHL (21")	LAS (1")	SFO
ORD (39")	DCA (17")	IAH (0.5")	TPA

Criteria			
Snow: 3+" 24 hour snow: 12+" Freezing Rain: 0.1" Vis: <0.5 SM	Snow: 1.5-3" 24 hour snow: 6-12" Freezing Rain: 0.05-0.1" Vis: <1 SM	Snow: 0.75-1.5" 24 hour snow: 2-6" Freezing Rain: 0.01-0.05" Vis: <3 SM	Snow: 0.15-0.75" 24 hour snow: 1-2"
Snow: 1.5-3" 24 hour snow: 6-12" Freezing Rain: 0.05-0.1" Vis: <1 SM	Snow: 0.75-1.5" 24 hour snow: 2-6" Freezing Rain: 0.01-0.05" Vis: <3 SM	Snow: 0.15-0.75" 24 hour snow: 1-2"	Snow: 0.001-0.15" 24 hour snow: 0.15-1"
Snow: 0.75-1.5" 24 hour snow: 2-6" Freezing Rain: 0.01-0.05" Vis: <3 SM	Snow: 0.15-0.75" 24 hour snow: 1-2"	Snow: 0.001-0.15" 24 hour snow: 0.15-1"	

Winter Weather Dashboard - GEFS Challenges



- SREF individual member GEMPAK grids used as input to current operational dashboard
  - Provide explicit snow and freezing rain accumulations
- GEFSv12 individual member output does not include explicit winter precip accumulations
- Requires complex algorithms to produce accumulations of snow and freezing rain for new GEFS dashboard
  - Total precip
  - Percent frozen precip
  - Categorical precip types
  - Not ideal!
- Big thumbs up from AWC on explicit winter precip accumulations in GEFSv13

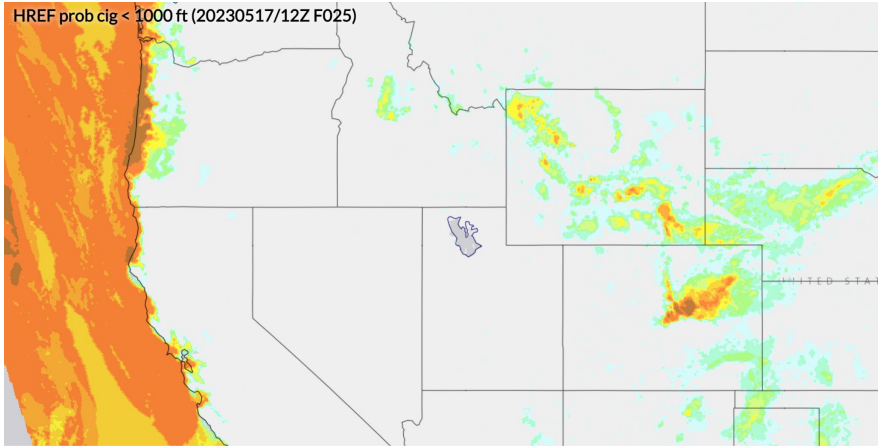
Regional Ensemble Aviation Hazard Needs

Icing & Turbulence

- Forecast Icing Potential (FIP) and Graphical Turbulence Guidance (GTG) products currently post process solely from deterministic regional models (RAP)
- Projects underway to merge FIP and GTG into UPP for RRFS
- Opportunity to produce regional ensemble guidance for icing and turbulence in RRFS ensemble?
  - Resource challenges

Ceiling & Visibility

- AWC C&V forecasters generally prefer guidance from the Localized Aviation MOS Program (LAMP) over that of HREF
  - HREF members not originally developed with C&V in mind
  - HREF probabilistic thresholds don't align with flight category thresholds

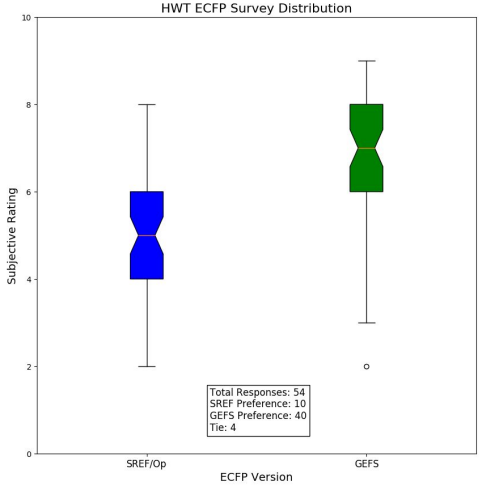


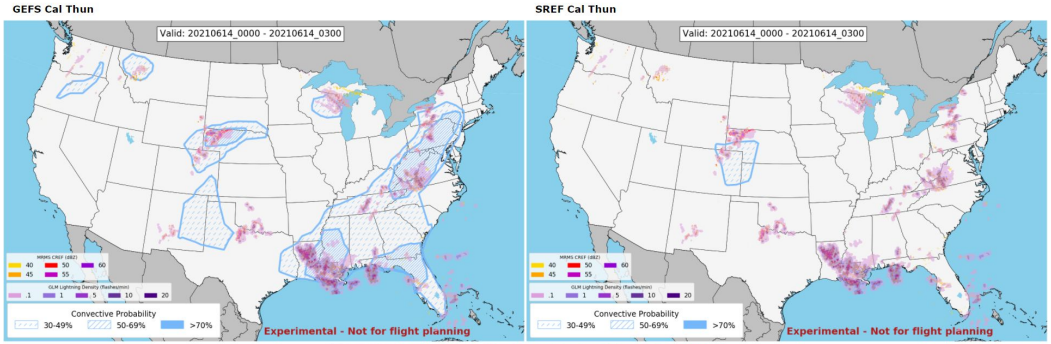
HREF Probabilistic Thresholds	*Ceiling*	*Visibility*
	< 1000 ft	< 1/4 mi
	< 2000 ft	< 1/2 mi
	< 3000 ft	< 1 mi
	< 4500 ft	< 2 mi
	< 6000 ft	< 4 mi

Category	Color	Ceiling		Visibility
LIFR Low Instrument Flight Rules	Magenta	below 500 feet AGL	and/or	less than 1 mile
IFR Instrument Flight Rules	Red	500 to below 1,000 feet AGL	and/or	1 mile to less than 3 miles
MVFR Marginal Visual Flight Rules	Blue	1,000 to 3,000 feet AGL	and/or	3 to 5 miles
VFR Visual Flight Rules	Green	greater than 3,000 feet AGL	and	greater than 5 miles

Extended Convective Forecast Product (ECFP)

- Highlight high confidence (>30%) areas of convective probability for extended range traffic flow management planning
- Operational ECFP driven by SPC SREF calibrated thunder probabilities
- 2021 AWT/HWT collaboration to test prototype GEFS calibrated thunder based ECFP
- SREF calibrated thunder very diurnally driven
- GEFS a significant improvement

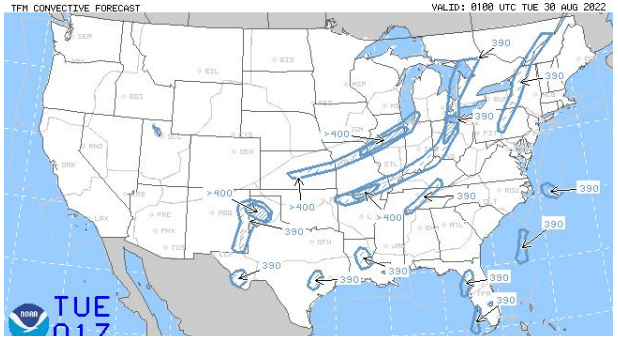




EXPERIMENTAL — NOT FOR FLIGHT PLANNING

Traffic Flow Management (TFM) Convective Forecast (TCF)

- High confidence graphical representation of forecasted convection
- Produced every 2 hours with at 4-, 6-, and 8-hr forecast lead times, depicting areas of sparse (25%), medium (40%), or solid line (75%) convective coverage for specific echo top heights
- Forecaster produced March-October, automated November-February
- Authoritative source of convective weather forecast information for Traffic Flow Management strategic planning for FAA and airlines



COVERAGE

SPARSE 25-39%

MEDIUM 40-74%

HEIGHT

TOPS: 100's OF FEET MSL

25000 - 29000	290
30000 - 34000	340
35000 - 39000	390
40000+	>400

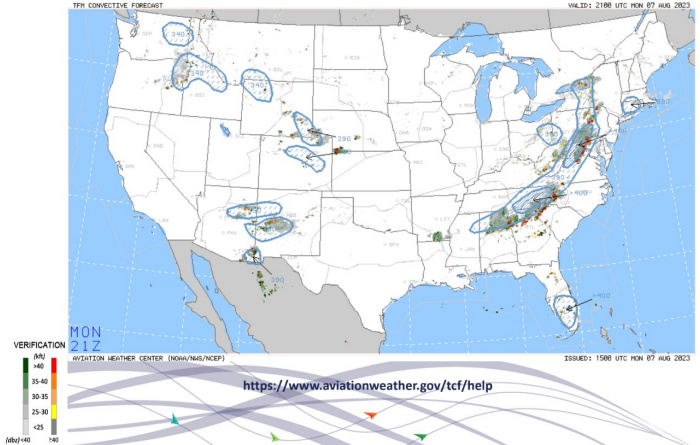
LINES

SOLID 75-100%

Mon Aug 7, 2023 IT: 15Z VT: 21Z FCST HR: 6-HR

COLLABORATION PARTICIPANTS: | AAL (2) | AWC | CMAC | FDX | JBU | NAM | OKX | ZAU | ZBW | ZDC | ZDV | ZFW | ZHU | ZID | ZJX | ZLC | ZME | ZMP | ZNY | ZOB | ZTL |

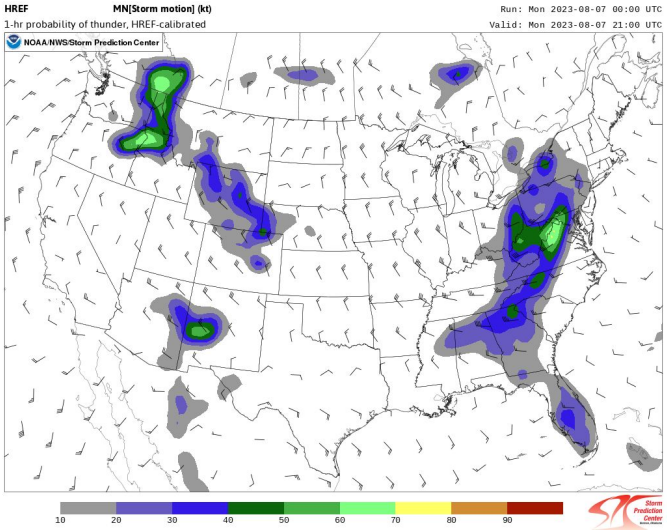
ATOSysOps



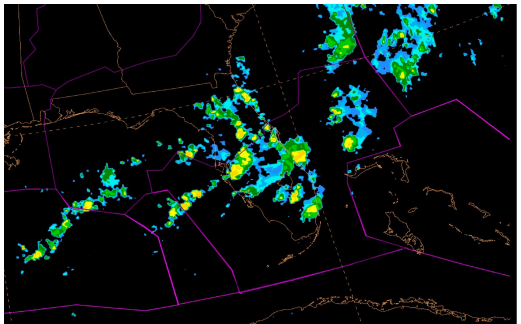
- Verified Well
  - ZBW/ZNY/ZOB/ZDC/ZTL/ZME Sparse
  - ZNY/ZDC Medium (PA/VA)
  - ZTL Medium (NC/TN)
  - ZMA Sparse (S FL)
  - ZOB Sparse (PA/OH)
  - ZDV Sparse X2 (CO & CO/WY)
  - ZAB Sparse X3 (NM and AZ)
  - ZLC Sparse (MT/WY)
  - ZSE Sparse (ID/OR)
- Verified Close
  - ZLC Sparse (ID/OR)
- Over-forecast
  - ZBW Sparse (CT/MA)
  - ZSE Sparse (WA)
- Missed
  - ZID Medium (WV)
  - ZJX/ZTL Medium (SC/GA)
  - ZJX Sparse (N FL)
  - ZME/ZFW Sparse (S AR)
  - ZDV Medium (NE/KS)
  - ZAB Medium (TX/NM)

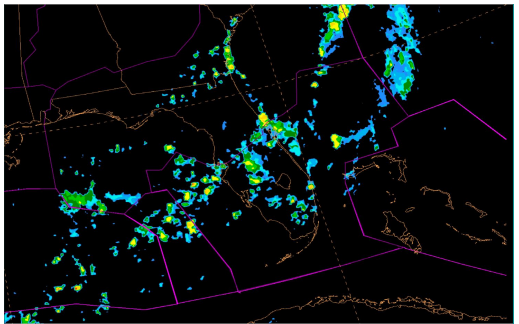
Federal Aviation Administration

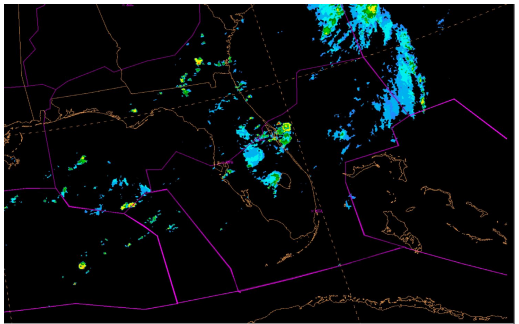
Traffic Flow Management (TFM) Convective Forecast (TCF)



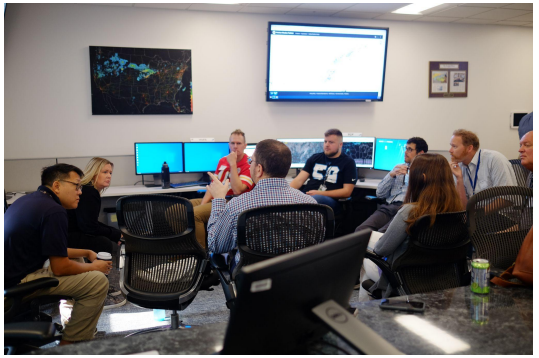
- AWC TCF forecasters heavily utilize HREF ensemble guidance in forecast creation
  - Particularly SPC calibrated thunder probabilities
- Forecasters (both AWC and CWSU) well tuned to behavior of individual HREF members
- RRFS single core ensemble a large paradigm shift for operations
  - Feedback from AWT experiments involving RRFS includes large amount of uncertainty from operational participants
  - Socialization is key!



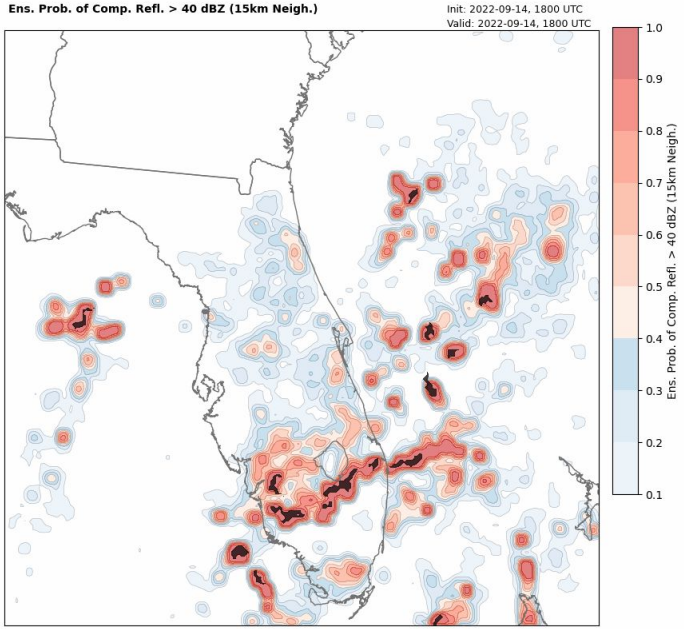


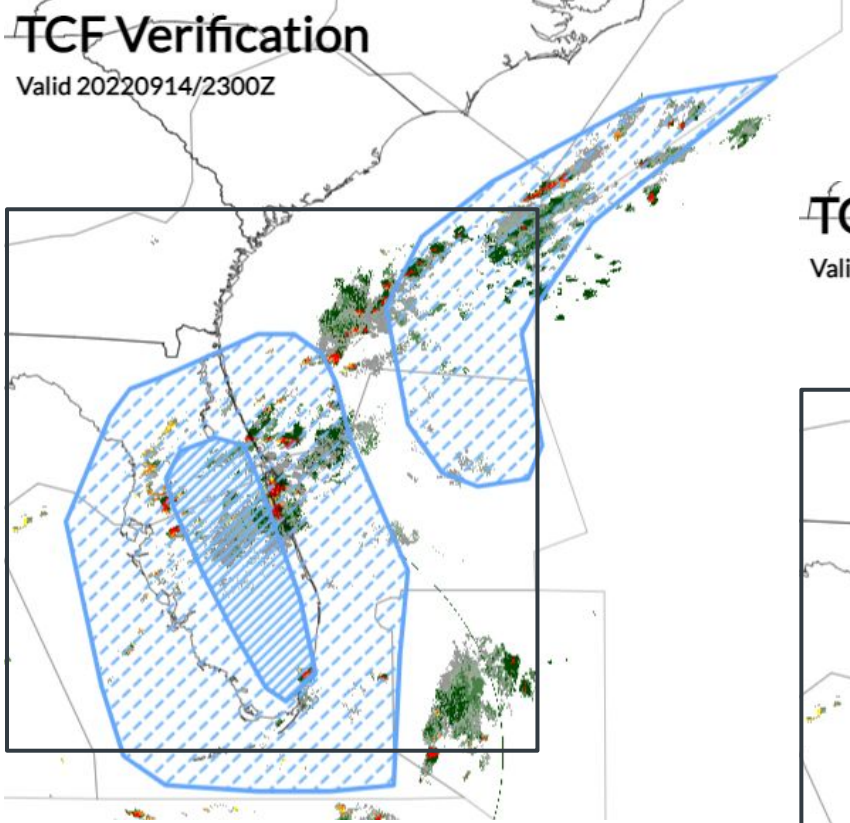


AWT Summer Experiment 2022 - WoFS



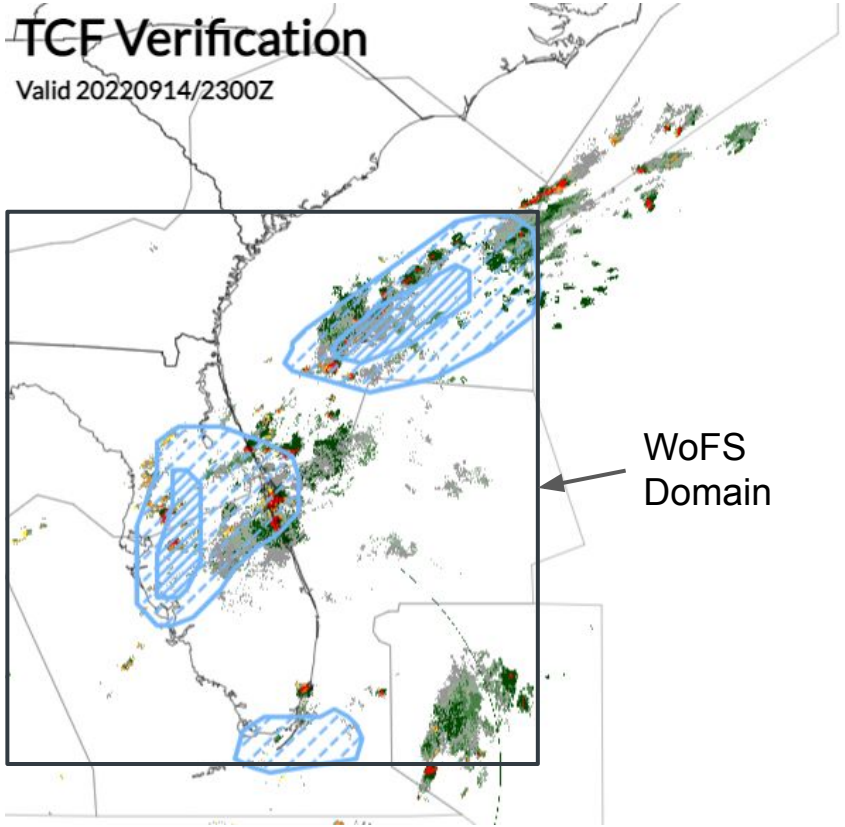
- First testbed evaluation of Warn on Forecast System focused on aviation
- WoFS has potential to add significant value to aviation convective TFM
  - Shorter TCF lead times (4-6 hrs)
  - AWC/CWSU IDSS
- Additional WoFS domains would greatly increase utility for aviation
- Increase “agility” of TFM process to utilize rapidly updating probabilistic guidance





AWC Final 19z 4-hr forecast

AWT Exp 21z 2-hr forecast



AWC Ensemble Takeaways/Recommendations

- *High resolution ensembles*
  - Continued collaborative feedback process with NOAA Testbeds
  - Assess timing for beginning socialization in operations
  - Scope feasibility of regional scale probabilistic guidance for in-flight icing and turbulence
- *Continued development of post processed probabilistic calibrated guidance products*
- *Jack Lind* - ***Evaluating User-Understanding of Probabilistic Information at the 2023 AWT Experiment*** *(Wednesday, Session 6b)*