



# The 6<sup>th</sup> NWS Ensemble Users Workshop: Aviation Weather Center Update

David R. Bright, Benjamin R. Schwedler, Steve A. Lack,  
Matt A. Strahan, Jeff S. Smith\*, George Liu<sup>^</sup>, Amy R.  
Harless, Brian P. Pettegrew, C. Bruce Entwistle

Aviation Weather Center / Aviation Weather Testbed, Kansas City, MO

\* Cooperative Institute for Research in the Atmosphere, Boulder, CO

<sup>^</sup> NCEP Central Operations, College Park, MD



*Where Americas Climate and Weather Services Begin*

NWS Ensemble Users Workshop  
March 25, 2014



# Outline

- **Key Operations at the AWC**
  - Domestic & International Advisories and Warnings
  - Traffic Flow Management (TFM) and Decision Support Services (DSS)
- **Applications of Ensembles**
  - Dashboards & MOTL (CCFP)
  - Collaborative Improvement
- **The Ensemble Processor: A Tool for Building Custom Applications**
- **Proposed World Area Forecast System (WAFS) Ensemble**

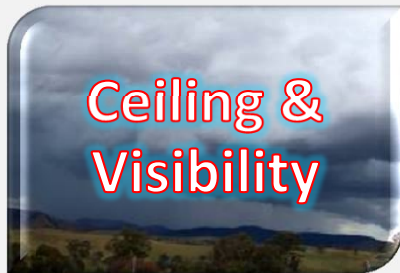


# Domestic & Caribbean Advisories and Warnings



## AIRMETs

Airmen's Meteorological Information  
Advisories to light aircraft & VFR pilots



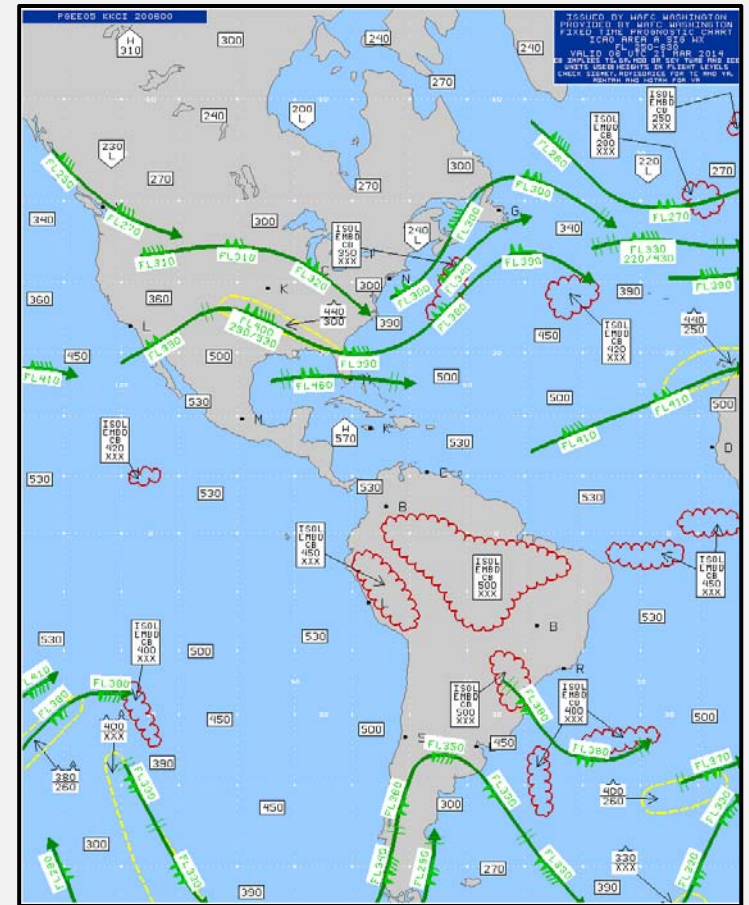
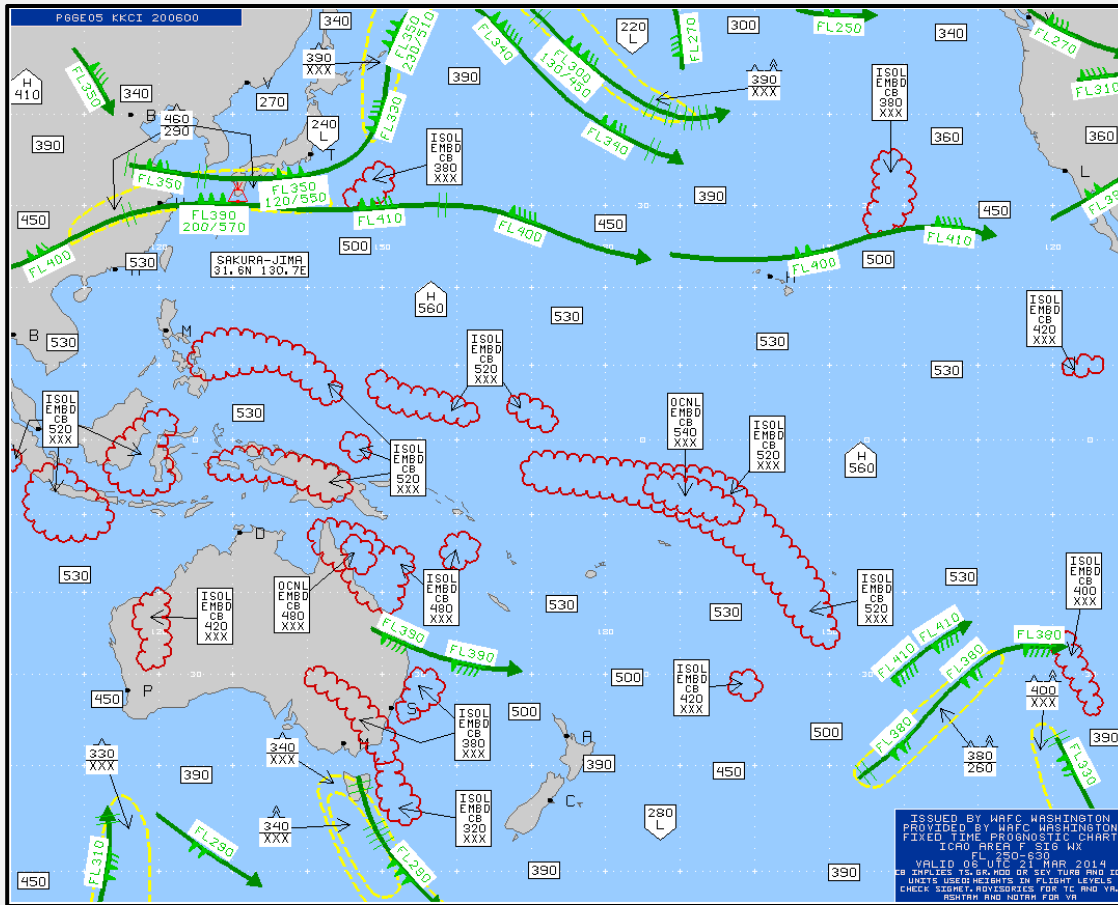
## SIGMETs

Significant Meteorological Information  
Warnings concerning aircraft safety



# International Flight Planning Forecasts

## Global Forecasting: Jets, Turb, Icing, Convection, Trop



The World Area Forecast System (WAFS):  
AWC is 1 of 2 World Area Forecast Centers (WAFC)





# AWC Traffic Flow Management (TFM) and Impact Decision Support Services (IDSS)

**NATIONAL WEATHER SERVICE**

**Nowcasting**

**AWC**

**CCFP**

**Short-term Forecasting**

**Weather prediction & communication for a safe and efficient National Airspace System (NAS)**

**Continuous Communication**

**Expert Analysis**

**Kansas City, MO Facility**

**Warrenton, VA Facility**

2013  
2013

00 FT MSL

300  
250  
180

300  
250  
180

# Winter Dashboard: SREF Based Impact

<http://www.aviationweather.gov/decisionsupport/winterdashboard>

**AVIATION WEATHER CENTER** RELEASE  
NOAA NATIONAL WEATHER SERVICE

USER HOME ADVISORIES FORECASTS OBSERVATIONS USER TOOLS NEWS SEARCH ABOUT

**Aviation Winter Weather Dashboard** INFO

<< Previous SREF Run 1500 UTC Fri 14 Mar 2014 Updated: 1921 UTC Fri 14 Mar 2014

Viewing Old SREF Run ( View Latest ) 2100 UTC Fri 14 Mar 2014 Updated: 0117 UTC Sat 15 Mar 2014 Current Time: 15:07:26 UTC Mon 17 Mar 2014

Next SREF Run >> 0300 UTC Sat 15 Mar 2014 Updated: 0715 UTC Sat 15 Mar 2014

Auto Update:  ARTCC: ALL Region: Mid Atlantic Sort: Climate Impacts First:  Hide Nominal:  24h Snow:  Reset

SREF Cycle: 21Z 14 March 2014

Mouseover dashboard boxes above to display detailed impact information for the selected airport and time period. Click on the Airport Identifier to view SREF plume diagrams.

Impact Type: S : Snowfall F : Freezing Rain V : Visibility<sup>[1]</sup>

Impact Category: Nominal Slight Moderate High

24h Snowfall: Nominal Slight Moderate High

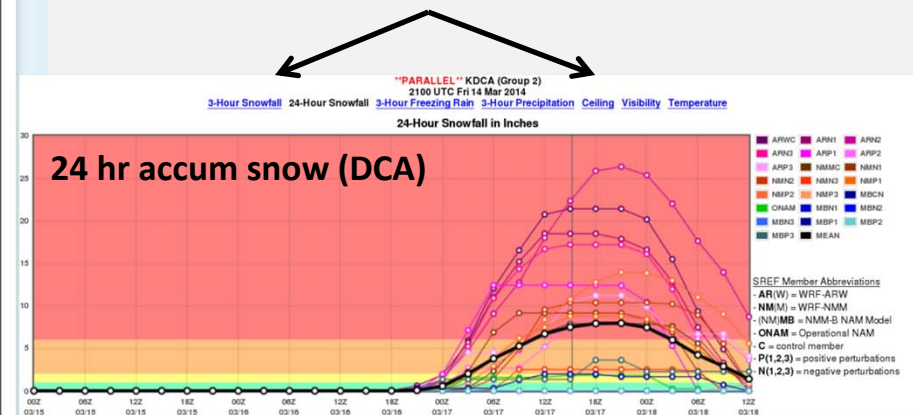
[1] Impacts due to visibility are only displayed when 2m temperature ≤ 28°F.

This dashboard provides a decision support tool to alert operational meteorologists and air traffic managers to potential winter weather impacts at major airports. It was developed at the Aviation Weather Testbed, located at the NOAA Aviation Weather Center.

View Archived SREF Run: 2100 UTC Fri 14 Mar 2014

HPC Winter Weather Products National Heavy Snow Discussion HPC Probabilistic Winter Precipitation Guidance SPC Short-Range Ensemble Products SPC Short-Range Ensemble Plume Charts AWC Terminal Area Forecasts

Plume options for ceiling, visibility, precipitation, temperature



- Collaborative project with FAA and Industry (FAA's CDM-WET)
- CORE-30 airports + diversions
- Also have a summer convective dashboard (not shown)

Impact tuned with airlines via CDM-WET



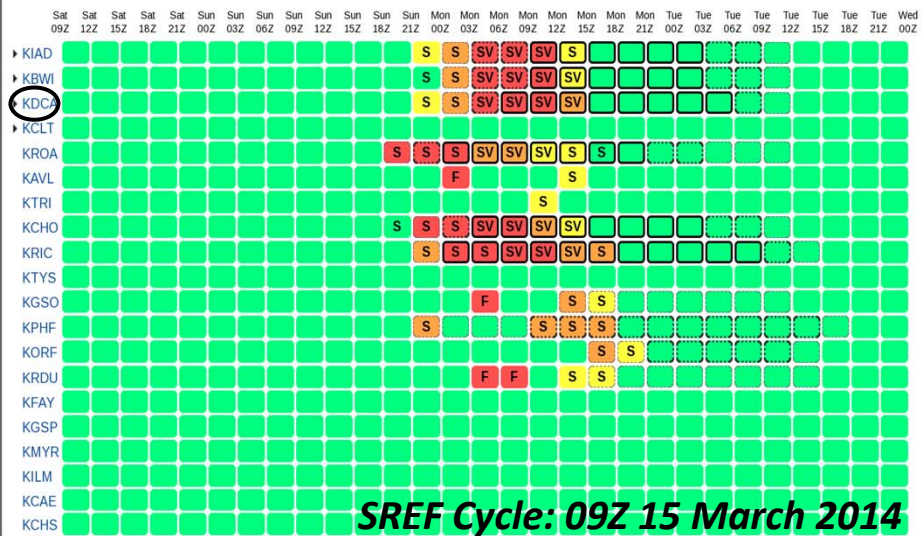
# Winter Dashboard: SREF Based Impact

<http://www.aviationweather.gov/decisionsupport/winterdashboard>

## Aviation Winter Weather Dashboard

<< Previous SREF Run      Viewing Old SREF Run ( View Latest )      Next SREF Run >>  
0300 UTC Sat 15 Mar 2014      0900 UTC Sat 15 Mar 2014      1500 UTC Sat 15 Mar 2014  
Updated : 0715 UTC Sat 15 Mar 2014      Updated : 1319 UTC Sat 15 Mar 2014      Updated : 1914 UTC Sat 15 Mar 2014  
Current Time: 15:06:53 UTC Mon 17 Mar 2014

Auto Update:  ARTCC: ALL    Region: Mid Atlantic    Sort: Climate    Impacts First:  Hide Nominal:  24h Snow:  Reset



Mouseover dashboard boxes above to display detailed impact information for the selected airport and time period. Click on the Airport Identifier to view SREF plume diagrams.

Impact Type: S : Snowfall    F : Freezing Rain    V : Visibility<sup>[1]</sup>

Impact Category: Nominal Slight Moderate High

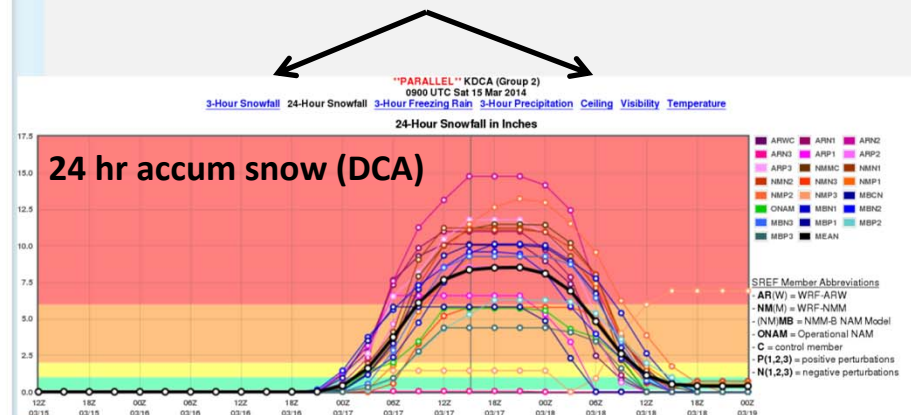
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View Archived SREF Run: 0900 UTC Sat 15 Mar 2014

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**AVIATION WEATHER CENTER** RELEASE  
NOAA NATIONAL WEATHER SERVICE

USER HOME ADVISORIES FORECASTS OBSERVATIONS USER TOOLS NEWS SEARCH ABOUT

**Aviation Winter Weather Dashboard** INFO

<< Previous SREF Run 1500 UTC Sat 15 Mar 2014 Updated: 1914 UTC Sat 15 Mar 2014

Viewing Old SREF Run ( View Latest ) 2100 UTC Sat 15 Mar 2014 Updated: 0114 UTC Sun 16 Mar 2014 Current Time: 15:06:09 UTC Mon 17 Mar 2014

Next SREF Run >> 0300 UTC Sun 16 Mar 2014 Updated: 0734 UTC Sun 16 Mar 2014

Auto Update:  ARTCC: ALL Region: Mid Atlantic Sort: Climate Impacts First:  Hide Nominal:  24h Snow:  Reset

Sat 21Z Sun 00Z Sun 03Z Sun 06Z Sun 09Z Sun 12Z Sun 15Z Sun 18Z Sun 21Z Mon 00Z Mon 03Z Mon 06Z Mon 09Z Mon 12Z Mon 15Z Mon 18Z Mon 21Z Tue 00Z Tue 03Z Tue 06Z Tue 09Z Tue 12Z Tue 15Z Tue 18Z Tue 21Z Wed 00Z Wed 03Z Wed 06Z Wed 09Z Wed 12Z

KIAD K BWI **KDCZ** KCLT KROA KAVL KTRI KCHO KRIC KTYS KGSO KPHF KORF KRDU KFAY KGSP KMYR KILM KCAE KCHS

**SREF Cycle: 21Z 15 March 2014**

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Impact Category: Nominal Slight Moderate High

24h Snowfall: Nominal Slight Moderate High

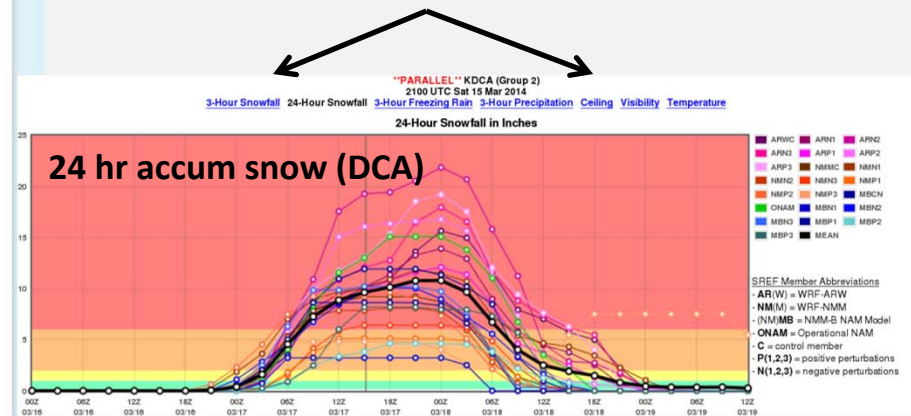
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View Archived SREF Run: 2100 UTC Sat 15 Mar 2014

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<http://www.aviationweather.gov/decisionsupport/winterdashboard>

**Aviation Winter Weather Dashboard**

Viewing Old SREF Run ( [View Latest](#) ) [Next SREF Run >>](#)

0300 UTC Sun 16 Mar 2014 Updated: 0734 UTC Sun 16 Mar 2014

0900 UTC Sun 16 Mar 2014 Updated: 1312 UTC Sun 16 Mar 2014

1500 UTC Sun 16 Mar 2014 Updated: 2151 UTC Sun 16 Mar 2014

Current Time: 15:05:55 UTC Mon 17 Mar 2014

Auto Update:  ARTCC: ALL Region: Mid Atlantic Sort: Climate Impacts First:  Hide Nominal:  24h Snow:  Reset

Sun 09Z 12Z 15Z 18Z 21Z Mon 00Z 03Z 06Z 09Z 12Z 15Z 18Z 21Z Tue 00Z 03Z 06Z 09Z 12Z 15Z 18Z 21Z Wed 00Z 03Z 06Z 09Z 12Z 15Z 18Z 21Z Thu 00Z

→ KIAD → KBWI → **KDCZ** → KCLT → KROA → KAVL → KTRI → KCHO → KRIC → KTYS → KGSO → KPHF → KORF → KRDU → KFAY → KGSP → KMYR → KILM → KCAE → KCHS

**SREF Cycle: 09Z 16 March 2014**

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Impact Type: S : Snowfall F : Freezing Rain V : Visibility<sup>[1]</sup>

Impact Category: Nominal Slight Moderate High

24h Snowfall: Nominal Slight Moderate High

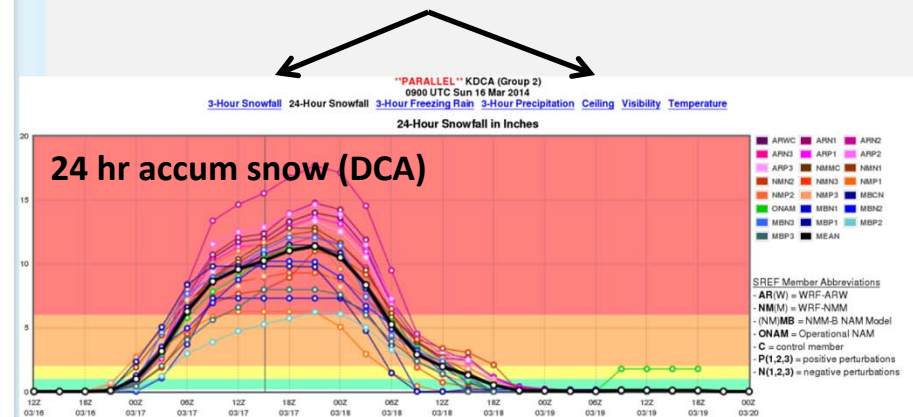
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AVIATION WEATHER CENTER RELEASE  
NOAA NATIONAL WEATHER SERVICE

Aviation Winter Weather Dashboard

Viewing Old SREF Run (View Latest) Next SREF Run >>  
1500 UTC Sun 16 Mar 2014 2100 UTC Sun 16 Mar 2014 0300 UTC Mon 17 Mar 2014  
Updated: 2151 UTC Sun 16 Mar 2014 Updated: 0115 UTC Mon 17 Mar 2014 Updated: 0712 UTC Mon 17 Mar 2014  
Current Time: 15:05:08 UTC Mon 17 Mar 2014

Auto Update:  ARTCC: ALL Region: Mid Atlantic Sort: Climate Impacts First:  Hide Nominal:  24h Snow:  Reset

Sun Mon Mon Mon Mon Mon Mon Mon Tue Tue Tue Tue Tue Tue Tue Wed Wed Wed Wed Wed Wed Thu Thu Thu Thu Thu  
21Z 00Z 03Z 06Z 09Z 12Z 15Z 18Z 21Z 00Z 03Z 06Z 09Z 12Z 15Z 18Z 21Z 00Z 03Z 06Z 09Z 12Z

KIAD S S SV SV SV SV SV S S S  
KRWI S S SV SV SV SV SV S S S  
KDCZ S S SV SV SV SV SV S S S  
KCLT  
KROA S S  
KAVL F F  
KTRI  
KCHO S S SV SV SV SV S S S S S S  
KRIC S S  
KTYS  
KGSO  
KPHF  
KORF  
KRDU F  
KFAY  
KGSP  
KMYR  
KILM  
KCAE  
KCHS

SREF Cycle: 21Z 16 March 2014

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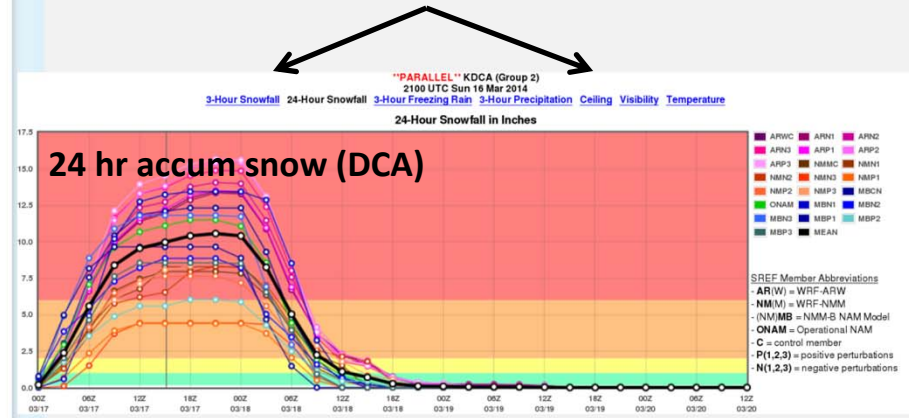
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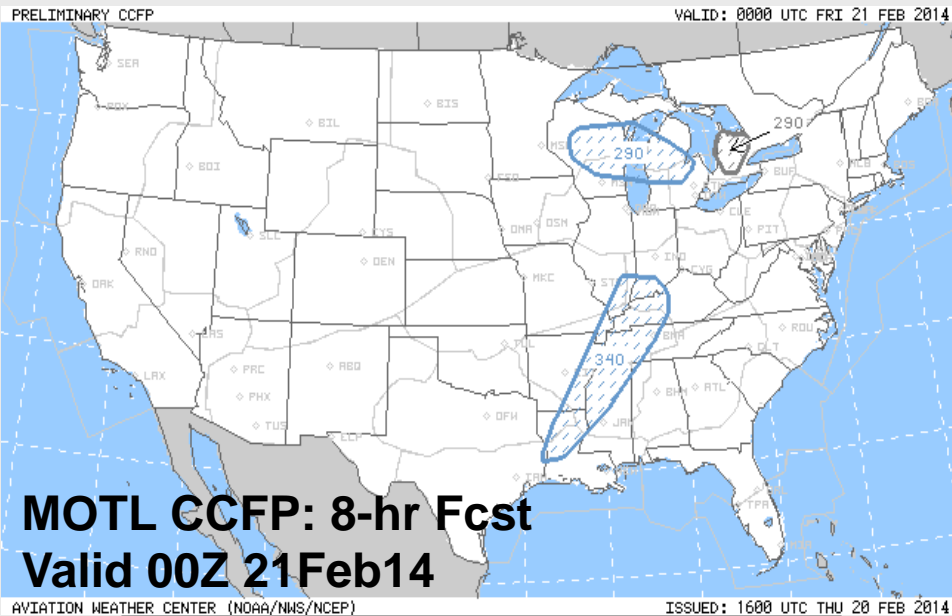
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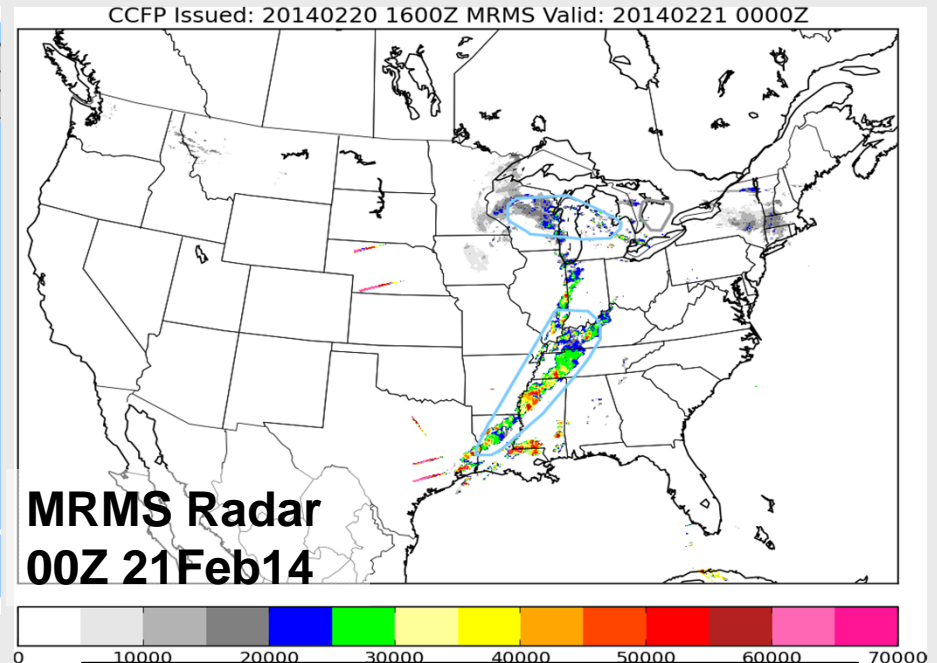
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Impact tuned with airlines via CDM-WET

# Ensemble-Based Development of MOTL Guidance



**Input: SREF + HRRR-TL  
Output: CCFP Polygons**



**SREF + HRRR-TL and Radar**

- **Still early in development cycle (since Jan. 2014)**
  - **SREF SPC Calibrated Thunderstorm and HRRR-TL shown here**
- **FAA via CDM-WET & Industry studying MOTL CCFP and introducing AWS**
  - **AWS = Aviation Weather Statement (“TFM Warnings” for DSS)**



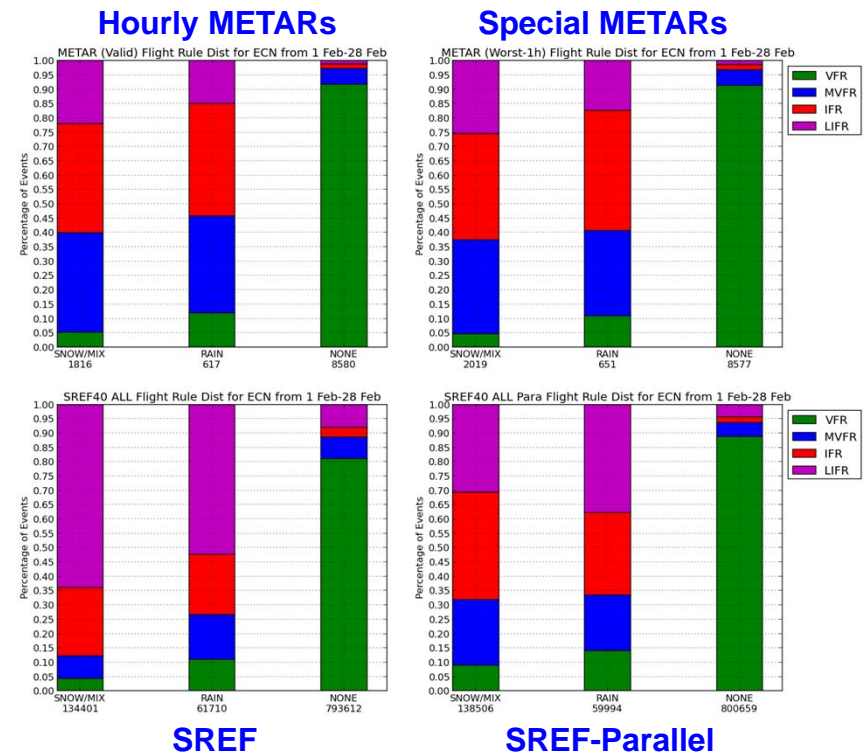
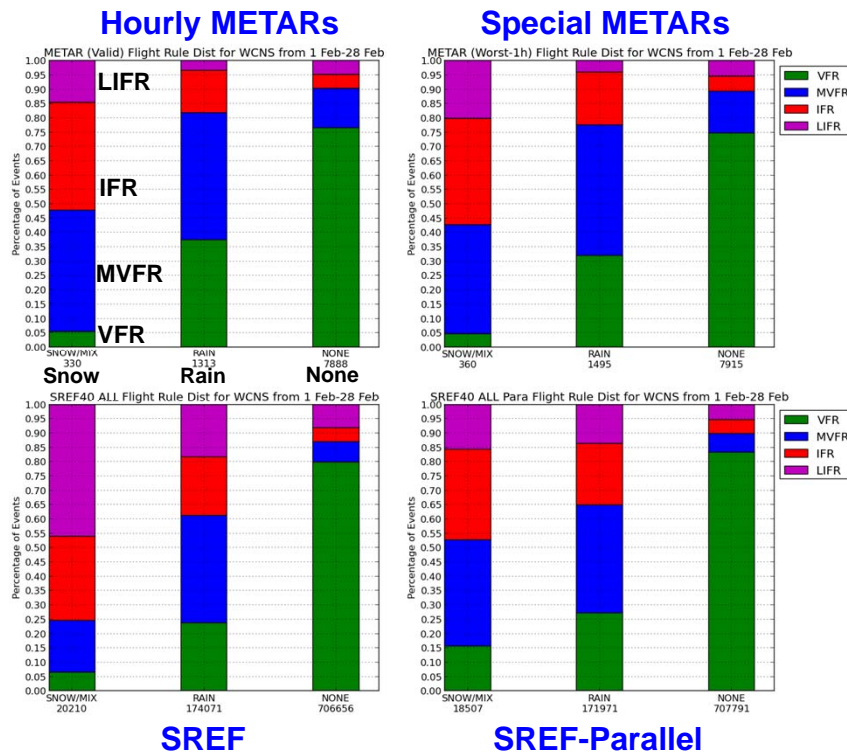
# Flight Rules (Ceiling & Visibility) Improvements

## SREF Parallel vs. Operational – Flight Rule Distribution

February 1-28, 2014

### West Coast (Western OR/WA/CA)

### Northeast (NJ/Ern NY to Ern ME)



- Overall, much improved distribution of C&V flight categories
  - Ceiling in particular very much improved (not shown)
  - Snow: High LIFR much improved; introduced a small, high VFR bias in snow
  - Rain: Generally improved all categories
  - None: LIFR improved NE and West; High VFR bias WC slightly increased

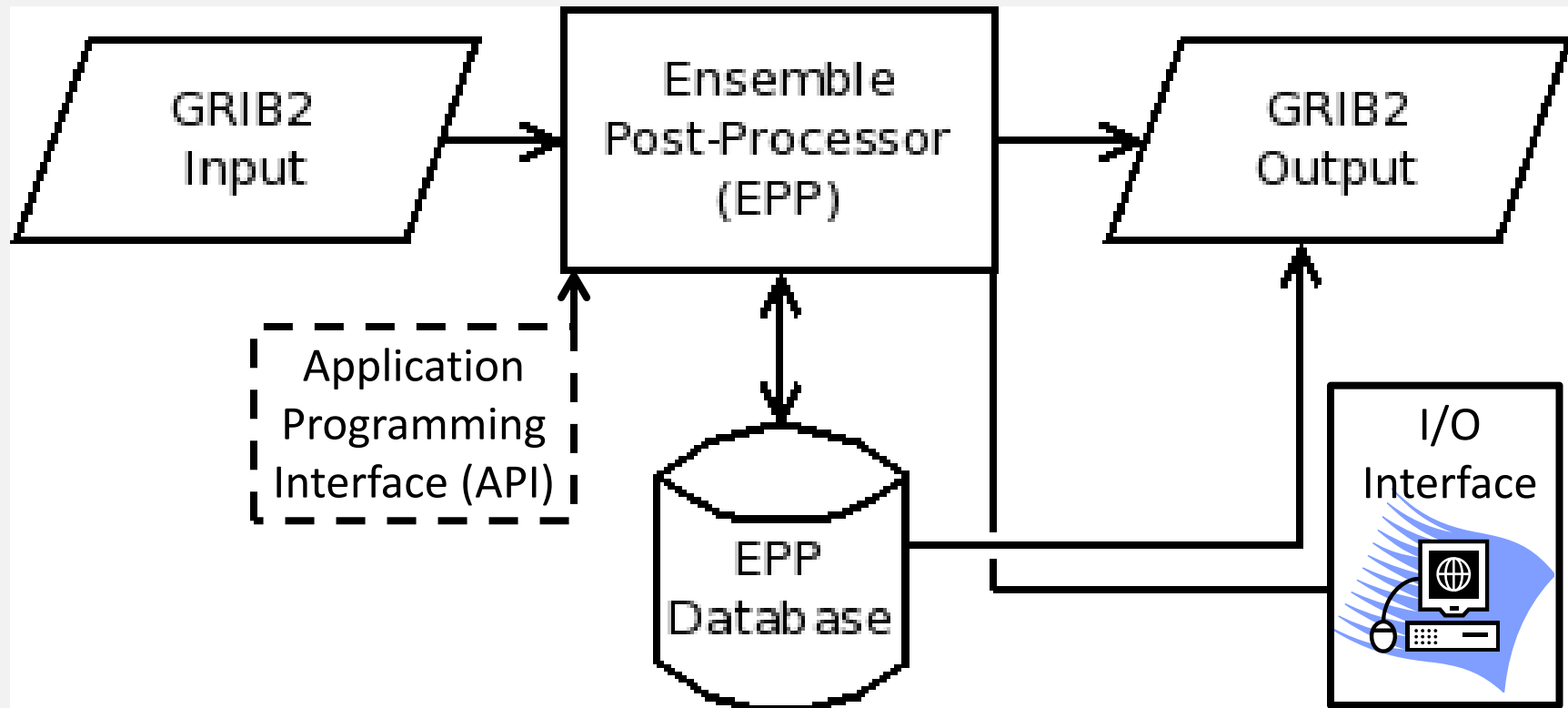


# Ensemble Processor (EP)

## Objective: Tool to Build Specialized Applications

- Ensemble framework at center of NWS/NCEP NWP strategy & NextGen (advanced probabilistic forecasting)
- Looking for a tool to rapidly configure and view ensemble systems in the AWT (FY13 to present)
  - Experiment → Research, Explore, Interactive Use
  - Real-time → Automatic processing into NAWIPS (R2O)
- Software capable of adapting to various ensemble systems (e.g., variable membership, resolution)
- Software capable of supporting standard ensemble variables but more importantly, mission specific post-processing
  - Applied ensemble research and R2O for aviation applications through the AWT
  - Early beta stage for NCEP Short-Range Ensemble Forecast (SREF)

# Ensemble Processor Design Schematic



1. Define ensemble
2. Read GRIB2, store members, ensemble calculations
3. Two-way database interaction
4. Automatic or on-demand output to GRIB2 (for NMAP; AWIPS-2)
5. Web real-time interrogation and display

# EP Technical Specifications

- Server Hardware
  - Twin Xeon X5660 processors (6 core/processor @2.8 GHz)
  - 144 GB of DDR3-1333 RAM
  - Intel SSD 910 800 GB (2000 | 1000 MB/s read|write; 3X I/O gain HD to SDD)
- Software
  - Developed in Java; APIs are written in Java
  - MySQL Geospatial Database
    - Faster and more efficient than PostGIS
  - NetCDF Java libraries to read|write GRIB2 files
  - XML configuration files read on startup
- Currently functional alpha-beta phase in AWT
  - Real-time data
    - NCEP Short-Range Ensemble Forecast (SREF)
      - 21 members (WRF-NMM; WRF-ARW; NMM-B)
      - 0-87 hours (1-hourly 0-39, 3-hourly thereafter)
      - 40 km Grid 212; 16 km Grid 132

# Select Ensemble Data

SREF Ensemble Processor Query Tool

Choose Spatial/Variable Constraints Import, Visualization, Docs

**Ensemble Members**

- 2014-01-31 09
- 2014-01-31 03
- 2014-01-31 09**
- SREF40\_em\_n2
- SREF40\_em\_n3
- SREF40\_em\_p1
- SREF40\_em\_n2

Query Type: avg Variable: [39] temperature\_isobaric Constraint: [ ]

Grid Point(s): Xmin: 1 Ymin: 1 Xmax: 185 Ymax: 129

Lat-Lon Bounding Box: 61.5 N -152.86 W -49 E 12.0 S

Forecast Hour: Min: 00 Max: 00

Millibars: Min: 1000 Max: 1000

Buttons: Refresh Lists, User Tables, Build SQL Query, Run Grid Query

Edit Query Query Results Data Query Results Map

Samples: [ ]

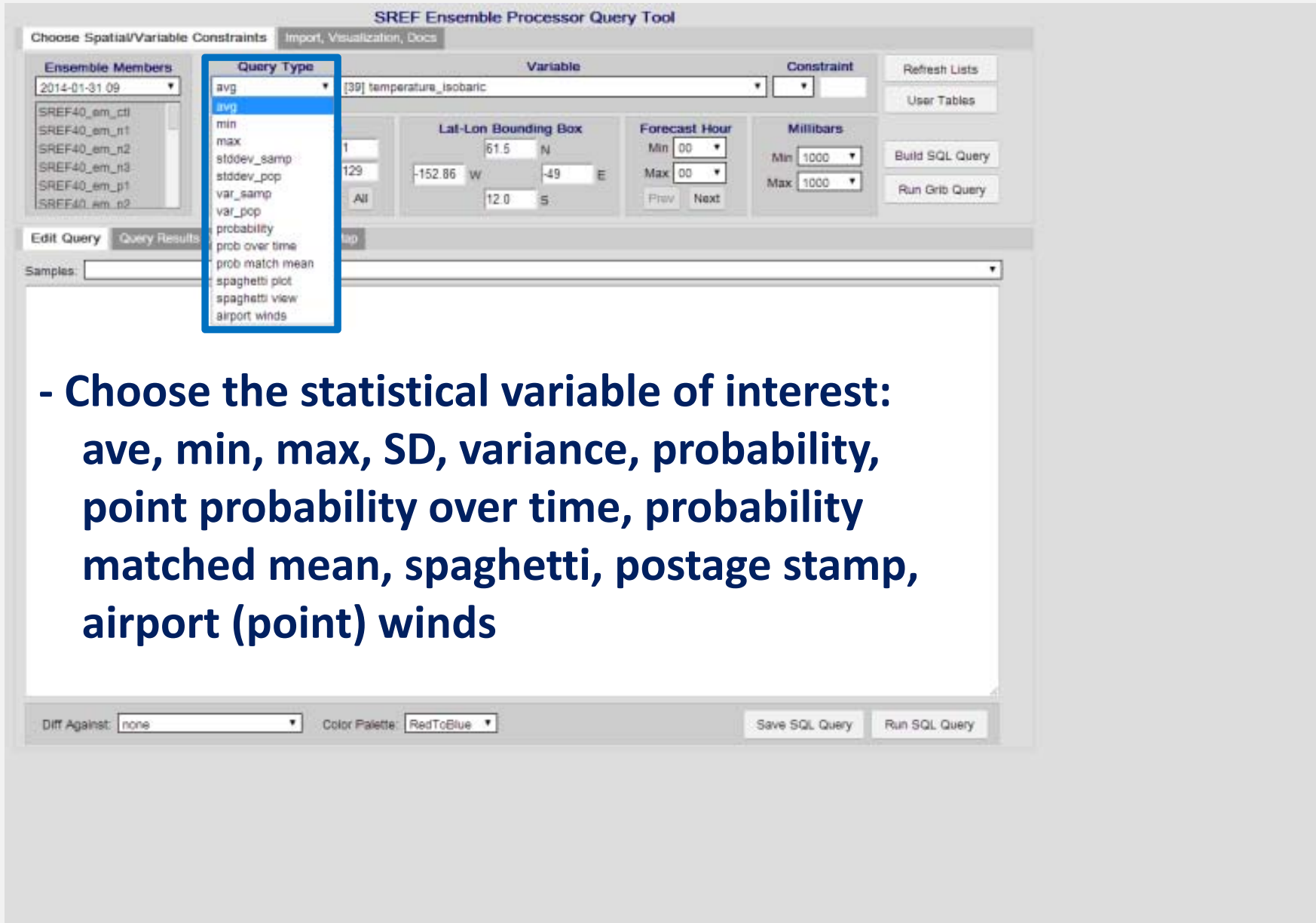
Diff Against: none Color Palette: RedToBlue

Buttons: Save SQL Query, Run SQL Query

- Web interface or runs in “batch”
- Select ensemble cycle time (SREF 03, 09, 15, 21Z)
- Select members (default is all members)



# Select Statistical Calculation



The screenshot displays the SREF Ensemble Processor Query Tool interface. The 'Query Type' dropdown menu is open, showing a list of statistical and visualization options. The 'avg' option is highlighted. The interface includes fields for 'Ensemble Members', 'Variable', 'Constraint', 'Lat-Lon Bounding Box', 'Forecast Hour', and 'Millibars'. The 'Samples' field is empty. The 'Diff Against' field is set to 'none' and the 'Color Palette' is set to 'RedToBlue'. Buttons for 'Refresh Lists', 'User Tables', 'Build SQL Query', 'Run Grib Query', 'Save SQL Query', and 'Run SQL Query' are visible.

**Query Type**

- avg
- min
- max
- stddev\_samp
- stddev\_pop
- var\_samp
- var\_pop
- probability
- prob over time
- prob match mean
- spaghetti plot
- spaghetti view
- airport winds

**Ensemble Members**

2014-01-31 09

SREF40\_em\_ct1  
SREF40\_em\_n1  
SREF40\_em\_n2  
SREF40\_em\_n3  
SREF40\_em\_p1  
SREF40\_em\_p2

**Variable**

[39] temperature\_isobaric

**Constraint**

Refresh Lists  
User Tables

**Lat-Lon Bounding Box**

61.5 N  
-152.86 W -49 E  
12.0 S

**Forecast Hour**

Min 00  
Max 00  
Prev Next

**Millibars**

Min 1000  
Max 1000

Build SQL Query  
Run Grib Query

**Edit Query** Query Results

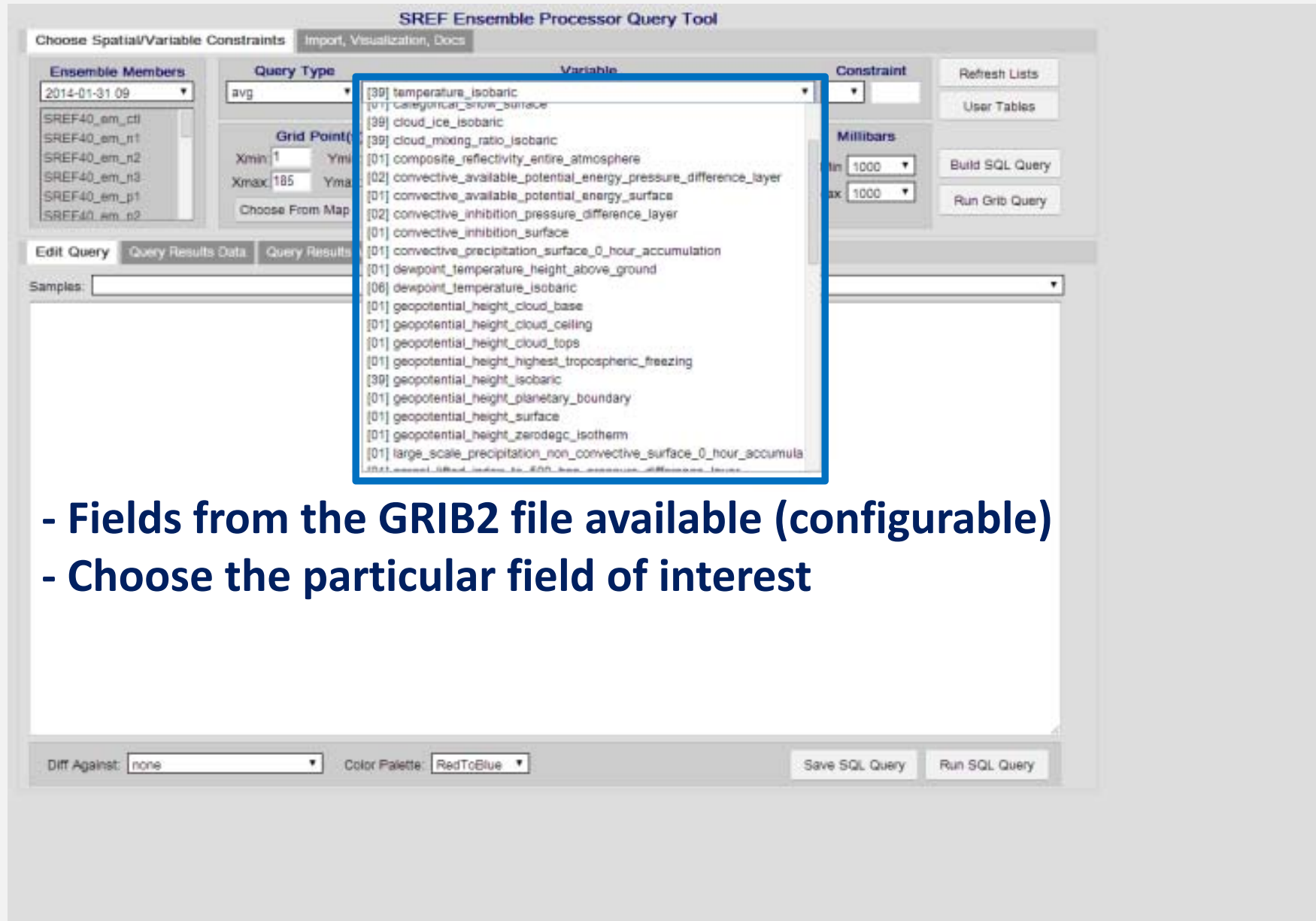
Samples:

Diff Against: none Color Palette: RedToBlue

Save SQL Query Run SQL Query

- Choose the statistical variable of interest:  
ave, min, max, SD, variance, probability,  
point probability over time, probability  
matched mean, spaghetti, postage stamp,  
airport (point) winds

# Select Model Field to Examine



The screenshot displays the SREF Ensemble Processor Query Tool interface. The main window is titled "SREF Ensemble Processor Query Tool" and has tabs for "Choose Spatial/Variable Constraints", "Import, Visualization, Docs", "Edit Query", "Query Results Data", and "Query Results". The "Choose Spatial/Variable Constraints" tab is active. It features several sections: "Ensemble Members" with a dropdown set to "2014-01-31 09" and a list of members; "Query Type" set to "avg"; "Grid Point" settings for Xmin, Ymin, Xmax, and Ymax; and "Variable" and "Constraint" dropdowns. A large dropdown menu is open, listing various model fields such as "temperature\_isobaric", "cloud\_ice\_isobaric", "geopotential\_height\_isobaric", and "large\_scale\_precipitation\_non\_convective\_surface\_0\_hour\_accumulation". The "Millibars" constraint is set to "1000". Buttons for "Refresh Lists", "User Tables", "Build SQL Query", and "Run Grib Query" are visible. At the bottom, there are "Diff Against" and "Color Palette" dropdowns, and "Save SQL Query" and "Run SQL Query" buttons.

- Fields from the GRIB2 file available (configurable)
- Choose the particular field of interest

# Select Forecast Time & Level

SREF Ensemble Processor Query Tool

Choose Spatial/Variable Constraints [Import](#), [Visualization](#), [Docs](#)

Ensemble Members: 2014-01-31 09

Query Type: max

Variable: temperature\_height\_above\_ground

Constraint: [ ]

Grid Point(s): Xmin: 1, Ymin: 1, Xmax: 185, Ymax: 129

Lat-Lon Bounding Box: 61.5 N, -152.86 W, 49 E, 12.0 S

Forecast Hour: Min: 48, Max: 48

Millibars: Min: 1000, Max: 1000

Buttons: Refresh Lists, User Tables, Build SQL Query, Run Grib Query, Save SQL Query, Run SQL Query

- Select the forecast hour (SREF: 0 to 87)
- Choose height or pressure level (if applicable)
  - o All levels in GRIB2 file available
- Query is then executed from either the database or directly through GRIB2 API

Plot: 1/31/14 09Z, Max, 2m Temp, F48

# Plot Rendered Over Google Maps

**SREF Ensemble Processor Query Tool**

Choose Spatial/Variable Constraints | Import, Visualization, Docs

**Ensemble Members**  
2014-01-31 09  
SREF40\_em\_ctl  
SREF40\_em\_n1  
SREF40\_em\_n2  
SREF40\_em\_n3  
SREF40\_em\_p1  
SREF40\_em\_p2

**Query Type**: max  
**Variable**: [01] temperature\_height\_above\_ground  
**Constraint**: [ ]

**Grid Point(s)**  
Xmin: 1 Ymin: 1  
Xmax: 185 Ymax: 129  
Choose From Map: All

**Lal-Lon Bounding Box**  
61.5 N  
-152.86 W -49 E  
12.0 S

**Forecast Hour**  
Min: 48  
Max: 48  
Prev Next

**Millibars**  
Min: 1000  
Max: 1000

Refresh Lists  
User Tables  
Build SQL Query  
Run Grib Query

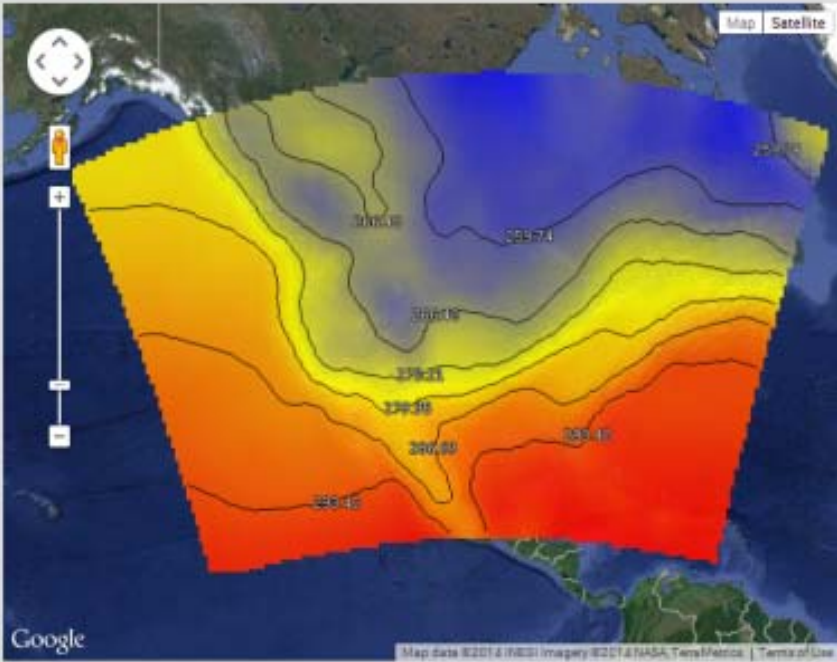
Edit Query | Query Results Data | Query Results Map

**Map / Plot Options**  
Color Palette: RedToBlue  
Nbr contours: 8  
1st Contour Val: 259.74  
Contour Interval: 6.736  
Smoothness: weak  
Lines & Smooth Bkgnd Img

Regenerate Plot

Lat: 51.97 N  
Lon: 93.69 W  
GridX: 108  
GridY: 96  
Value: 256.8492 K  
(date value before smoothing)

Opacity: 90% | Reset  
**Download GRIB2 file**



**Statistics**  
Grid Pts: 23865  
Units: K  
Min: 260.57423  
Max: 301.03333  
Median: 281.81253  
Mean: 279.7221

Map data ©2014 INEGI Imagery ©2014 NASA, TerraMetrics | Terms of Use

- Option exists to manually download a GRIB2 file...  
can then push to NAWIPS or another platform



# Select Statistical Calculation

The screenshot shows the SREF Ensemble Processor Query Tool interface. The 'Query Type' dropdown menu is open, displaying a list of statistical calculations. A red arrow points to 'airport winds' at the bottom of the list. The interface includes fields for Ensemble Members, Variable, Constraint, Lat-Lon Bounding Box, Forecast Hour, and Millibars.

- Choose the statistical variable of interest
- Airport Winds (Spaghetti of point winds)
- Select forecast hour F48

# Select Airport Location

SREF Ensemble Processor Query Tool

Choose Spatial/Variable Constraints | Import, Visualization, Docs

Ensemble Members

2014-01-31 03

- SREF40\_nmm\_ctl
- SREF40\_nmm\_n1
- SREF40\_nmm\_n2
- SREF40\_nmm\_n3
- SREF40\_nmm\_p1
- SREF40\_nmm\_p2
- SREF40\_nmm\_p3

Edit Query | Query Results

Samples:

Diff Against: none

Choose An Airport



Example: DFW Fropa  
09Z 30 Jan 2014 SREF run. DFW Fropa between  
06Z 1 Feb 2014 (F45) and 00Z 2 Feb 2014 (F63).  
Ensemble mean wind shift at F57 (now shown).

Click on the map to select an airport grid point

Cancel OK

- Choose location: Dallas-Fort Worth (DFW) International Airport

# DFW 10 m Wind Forecast

F45 Valid at 06Z 1 Feb 2014 (OBS: S 21G29 kts)

SREF Ensemble Processor Query Tool

Choose Spatial/Variable Constraints

Import, Visualization, Docs

Ensemble Members

2014-01-30 09

- SREF40\_nmm\_ctl
- SREF40\_nmm\_n1
- SREF40\_nmm\_n2
- SREF40\_nmm\_n3
- SREF40\_nmm\_p1
- SREF40\_nmm\_p2
- SREF40\_nmm\_p3

Query Type

airport winds

Variable

[39] temperature\_isobaric

Constraint

Refresh Lists

User Tables

Grid Point(s)

Xmin: 1 Ymin: 1

Xmax: 185 Ymax: 129

Choose From Map All

Lat-Lon Bounding Box

61.5 N -152.86 W -49 E

12.0 S

Forecast Hour

Min 45

Max 45

Prev Next

Millibars

Min 1000

Max 1000

Build SQL Query

Run Airport Qry

Edit Query

Query Results Data

Query Results Map

Map / Plot Options

Color Palette: RedToBlue

Nbr contours: 6

1st Contour Val:

Contour Interval:

Smoothness: weak

Lines & Smooth Bkgnd Img

Odds of Fropa:

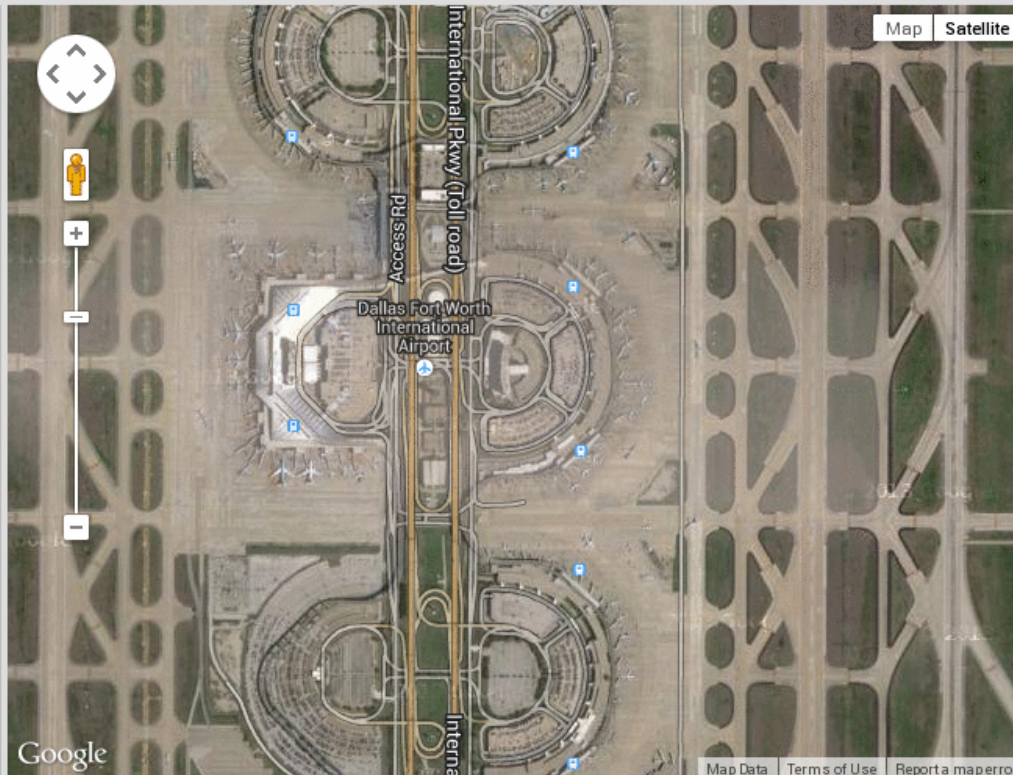
0

Prob of Fropa:

0%

Opacity: 90%

Reset



Wind At DFW (knots)

em_ctl 18.8	nmb_p2 13.3
em_n1 18.6	nmb_p3 16.5
em_n2 16.0	nmm_ctl 17.8
em_n3 16.9	nmm_n1 15.0
em_p1 12.7	nmm_n2 18.3
em_p2 17.6	nmm_n3 17.9
em_p3 20.0	nmm_p1 18.1
nmb_ctl 16.1	nmm_p2 16.5
nmb_n1 16.9	nmm_p3 17.2
nmb_n2 13.7	
nmb_n3 16.7	



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# DFW 10 m Wind Forecast

F51 Valid at 12Z 1 Feb 2014 (OBS: NW 11 kts)

SREF Ensemble Processor Query Tool

Choose Spatial/Variable Constraints [Import, Visualization, Docs](#)

**Ensemble Members**

2014-01-30 09

- SREF40\_nmm\_ctl
- SREF40\_nmm\_n1
- SREF40\_nmm\_n2
- SREF40\_nmm\_n3
- SREF40\_nmm\_p1
- SREF40\_nmm\_p2
- SREF40\_nmm\_p3

**Query Type**

airport winds [39] temperature\_isobaric

**Variable**

[39] temperature\_isobaric

**Constraint**

**Grid Point(s)**

Xmin: 1 Ymin: 1  
Xmax: 185 Ymax: 129

Choose From Map All

**Lat-Lon Bounding Box**

61.5 N  
-152.86 W -49 E  
12.0 S

**Forecast Hour**

Min 51  
Max 51

Prev Next

**Millibars**

Min 1000  
Max 1000

Refresh Lists  
User Tables  
Build SQL Query  
Run Airport Qry

Edit Query [Query Results Data](#) **Query Results Map**

**Map / Plot Options**

Color Palette: RedToBlue  
Nbr contours: 6  
1st Contour Val:  
Contour Interval:  
Smoothness: weak  
Lines & Smooth Bkgnd Img

**Odds of Fropa: 0.05**  
**Prob of Fropa: 5%**

Opacity: 90% Reset

Map Satellite

**Wind At DFW (knots)**

em ctl 10.6	nmb p2 12.9
em n1 17.3	nmb p3 11.2
em n2 12.2	nmm ctl 15.4
em n3 10.6	nmm n1 11.3
em p1 8.1	nmm n2 14.3
em p2 9.2	nmm n3 14.9
em p3 10.4	nmm p1 12.9
nmb ctl 11.3	nmm p2 14.1
nmb n1 11.9	nmm p3 11.1
nmb n2 13.1	
nmb n3 11.6	

Map Data Terms of Use Report a map error

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# DFW 10 m Wind Forecast

F63 Valid at 00Z 2 Feb 2014 (OBS: N 11 kts)

SREF Ensemble Processor Query Tool

Choose Spatial/Variable Constraints [Import, Visualization, Docs](#)

- Ensemble Members**
- 2014-01-30 09
- SREF40\_nmm\_ctl
  - SREF40\_nmm\_n1
  - SREF40\_nmm\_n2
  - SREF40\_nmm\_n3
  - SREF40\_nmm\_p1
  - SREF40\_nmm\_p2
  - SREF40\_nmm\_p3

**Query Type**  **Variable**  **Constraint**

**Grid Point(s)** Xmin:  Ymin:  Xmax:  Ymax:

**Lat-Lon Bounding Box**  N  W  E  S

**Forecast Hour** Min:  Max:

**Millibars** Min:  Max:

- 
- 
- 
- 

[Edit Query](#) [Query Results Data](#) **[Query Results Map](#)**

**Map / Plot Options**

Color Palette:

Nbr contours:

1st Contour Val:

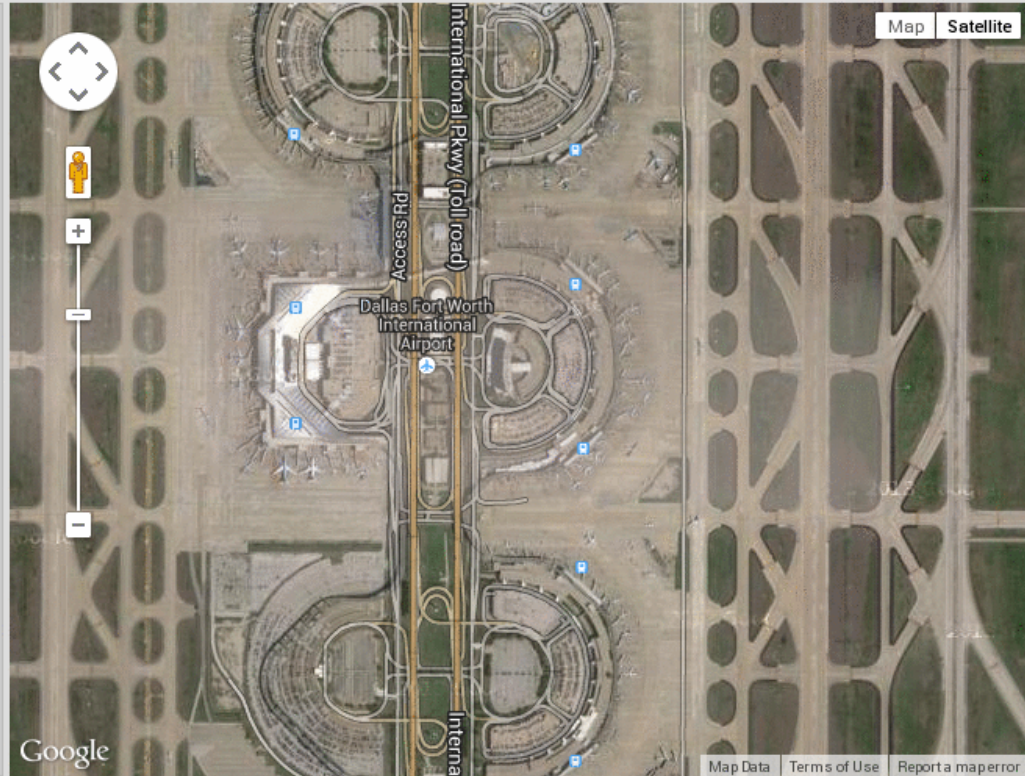
Contour Interval:

Smoothness:

**Odds of Fropa:**  
∞

**Prob of Fropa:**  
100%

Opacity:



**Wind At DFW (knots)**

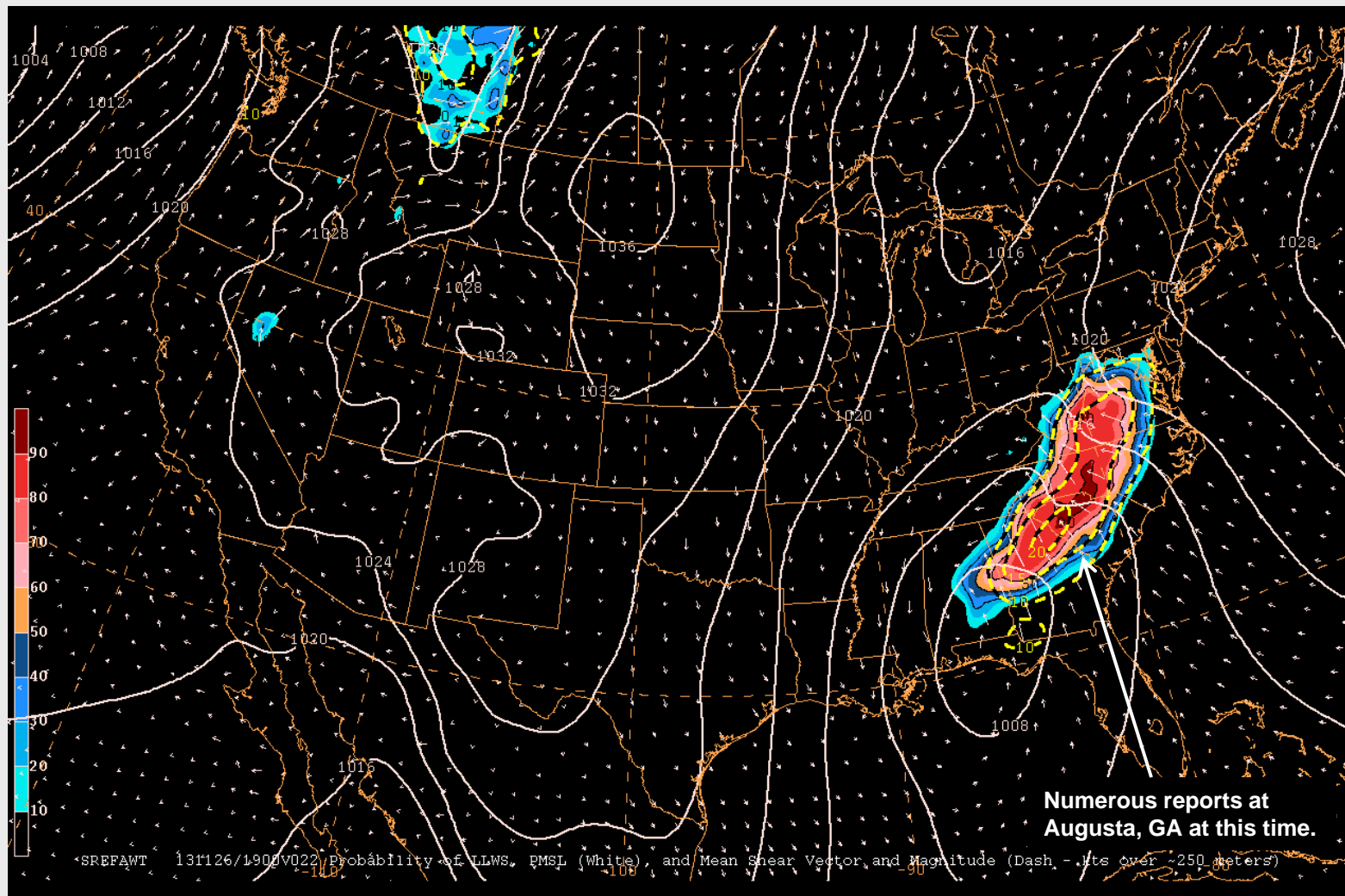
Member	Wind (kts)	Member	Wind (kts)
em_ctl	10.2	nmb_p2	5.1
em_n1	9.9	nmb_p3	8.2
em_n2	10.4	nmm_ctl	10.2
em_n3	8.7	nmm_n1	13.9
em_p1	10.0	nmm_n2	11.4
em_p2	8.9	nmm_n3	7.2
em_p3	6.5	nmm_p1	11.2
nmb_ctl	8.8	nmm_p2	9.0
nmb_n1	11.8	nmm_p3	8.8
nmb_n2	11.5		
nmb_n3	6.7		

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# Application Development for DSS

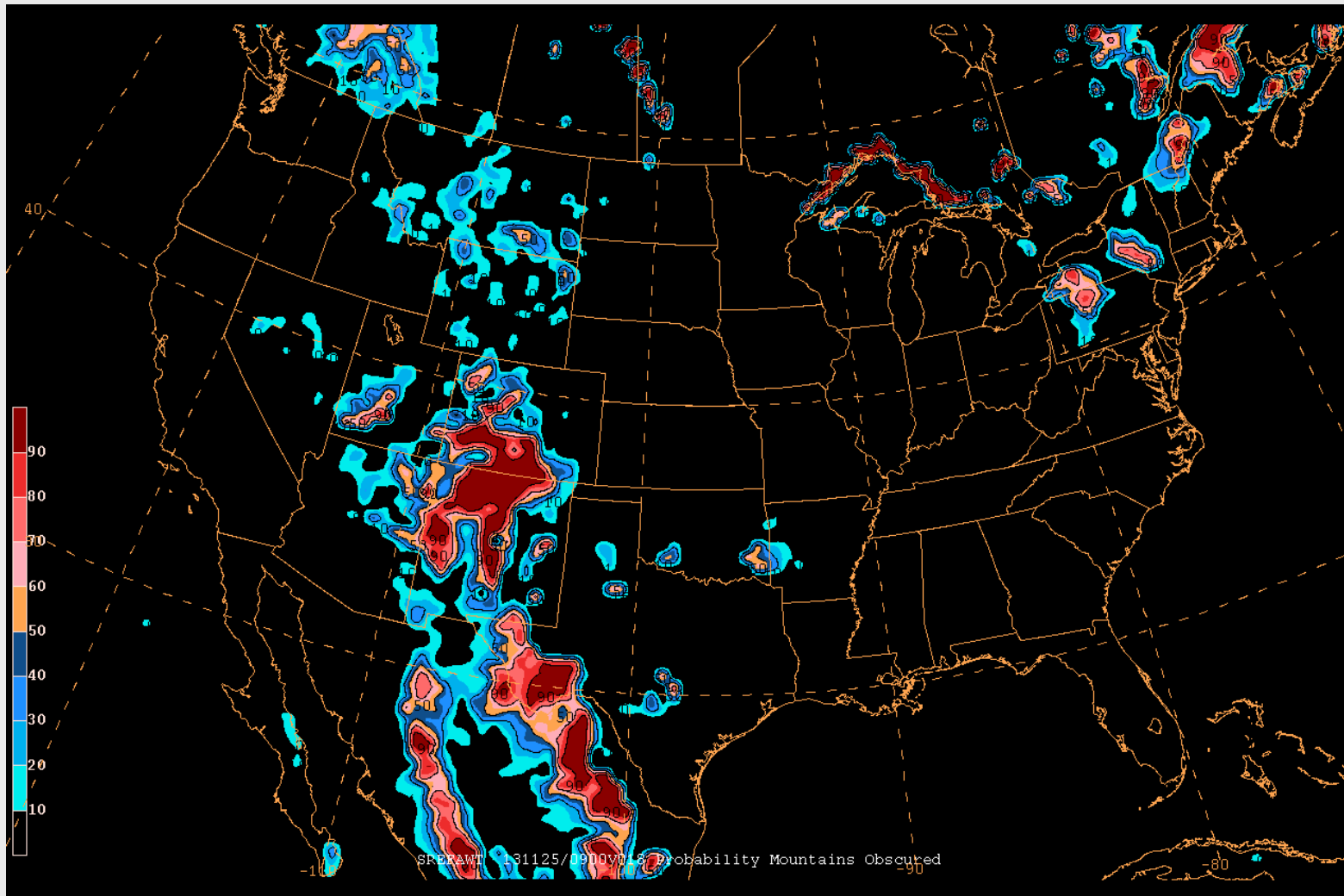
## Low-Level Wind Shear



Likelihood of Low-Level Wind Shear, Mean PMSL (white), Mean peak shear (contour) & vector  
22-hr Fcst Valid 19Z 26 Nov 2013

# Application Development for DSS

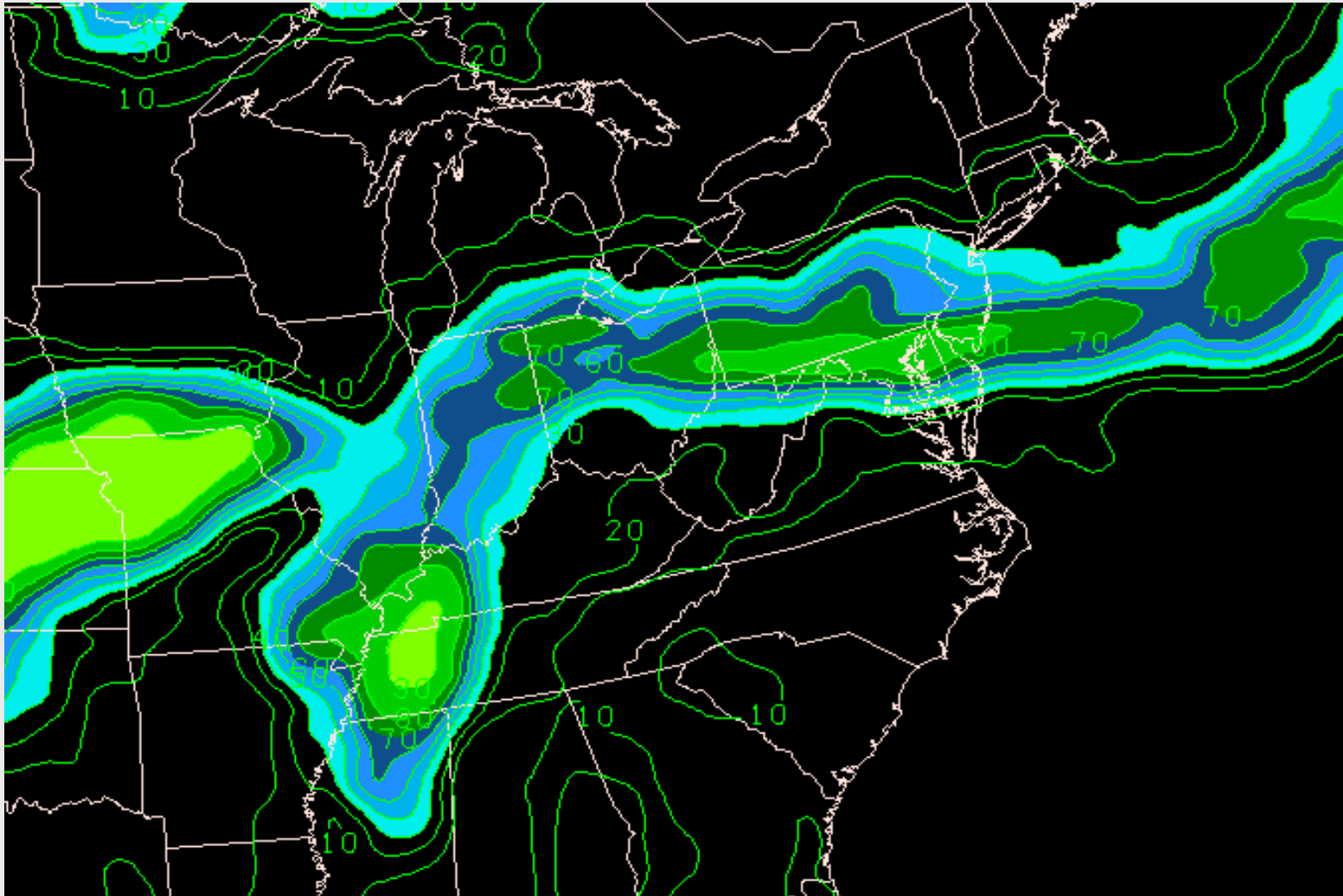
## Mountains Obscured by Clouds



**Likelihood of Mountains Obscured by Clouds**  
**09-hr Fcst Valid 09Z 25 Nov 2013**

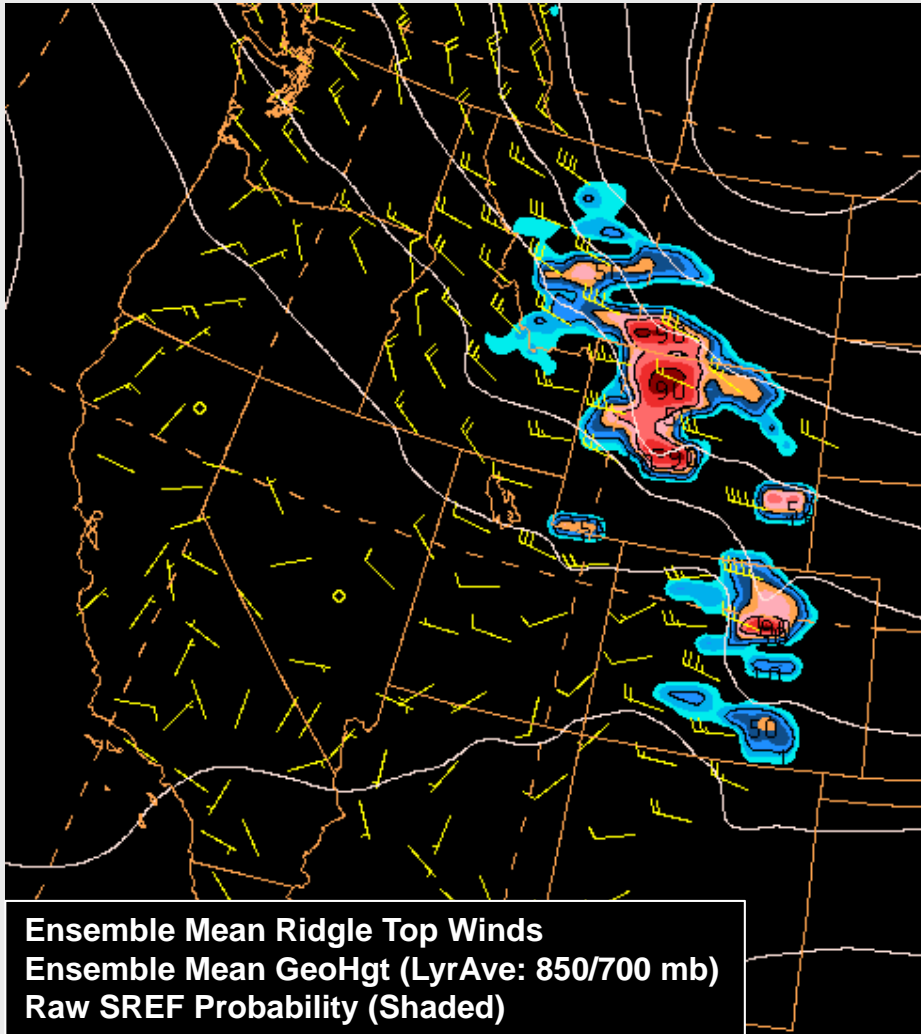


# Application Development for DSS Aircraft Icing

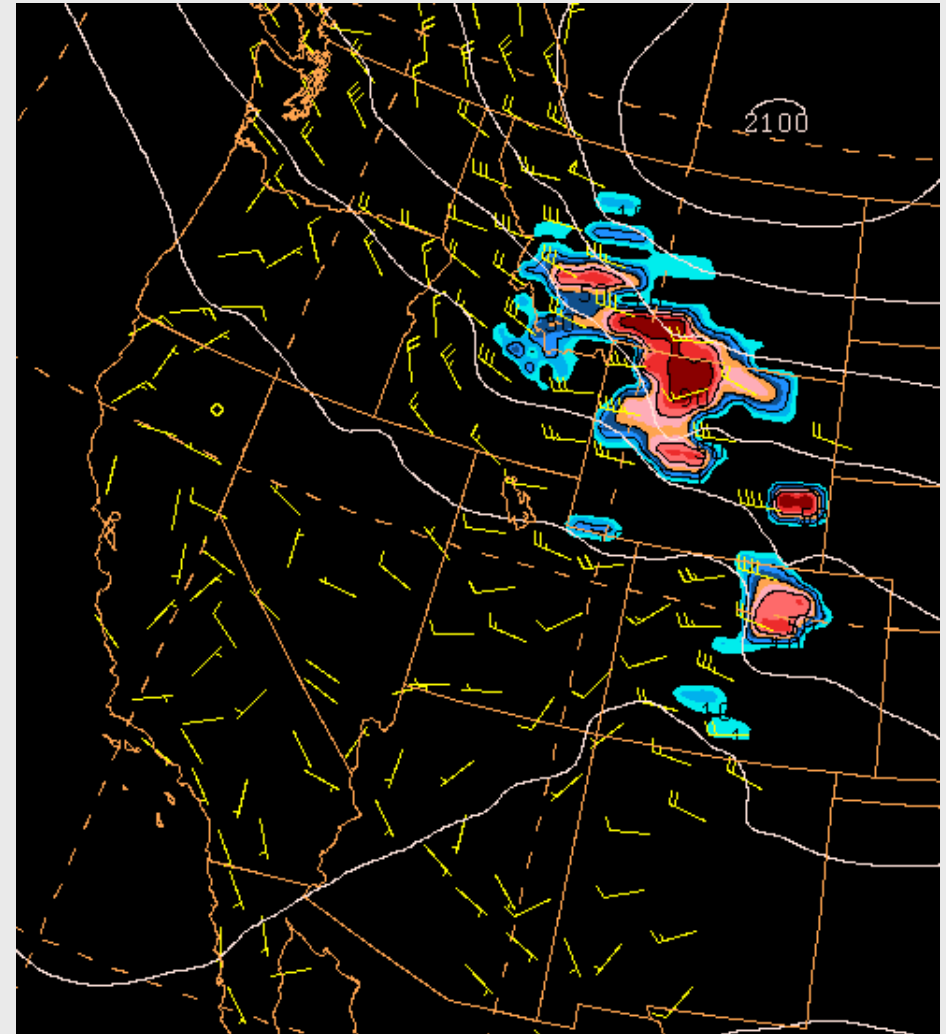


**Likelihood of Icing Conditions**  
**12-hr Fcst Valid 15Z 20 Dec 2011**

# Application Development for DSS Mountain Waves

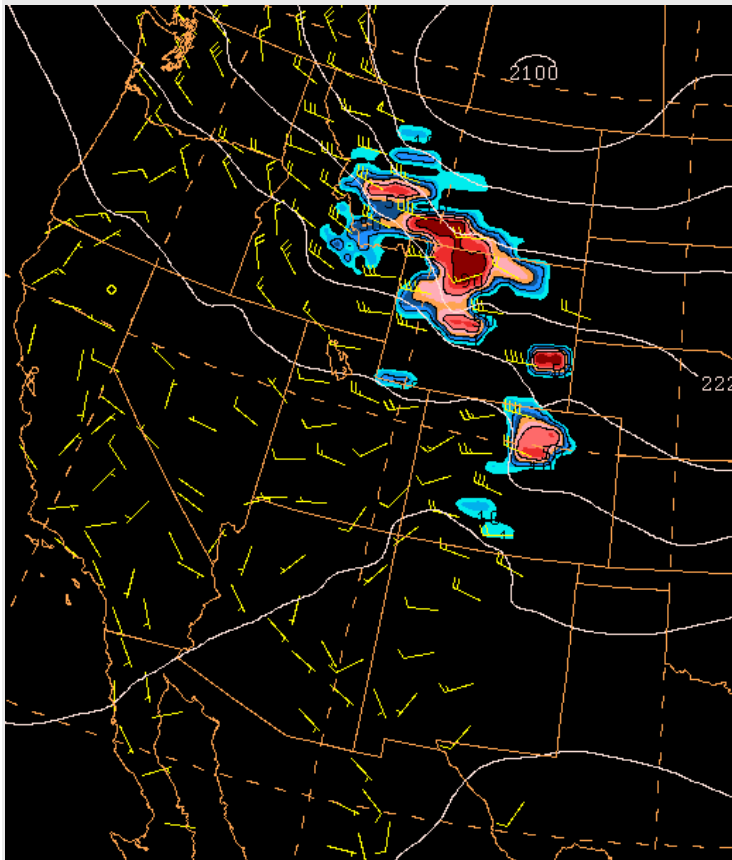


**Likelihood of Mountain Wave Conditions  
48-hr Fcst Valid 15Z 20 Mar 2014**

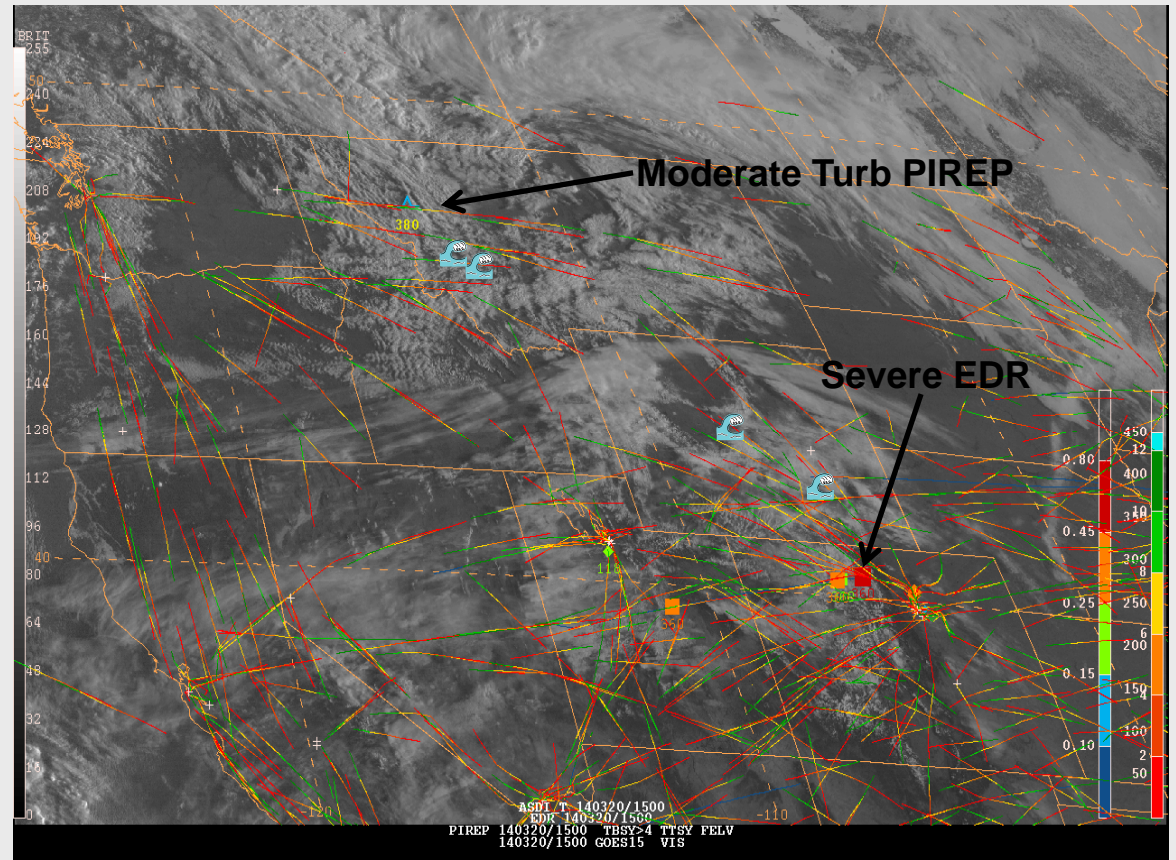


**Likelihood of Mountain Wave Conditions  
12-hr Fcst Valid 15Z 20 Mar 2014**

# Application Development for DSS Mountain Waves



Likelihood of Mountain Wave Conditions  
12-hr Fcst Valid 15Z 20 Mar 2014



Visible Satellite Image 15Z 20 March 2014  
Aircraft Tracks  
Eddy Dissipation Rate (EDR;  $\geq$  "moderate" in boxes)  
Mountain Wave in PIREP remarks 🌪️



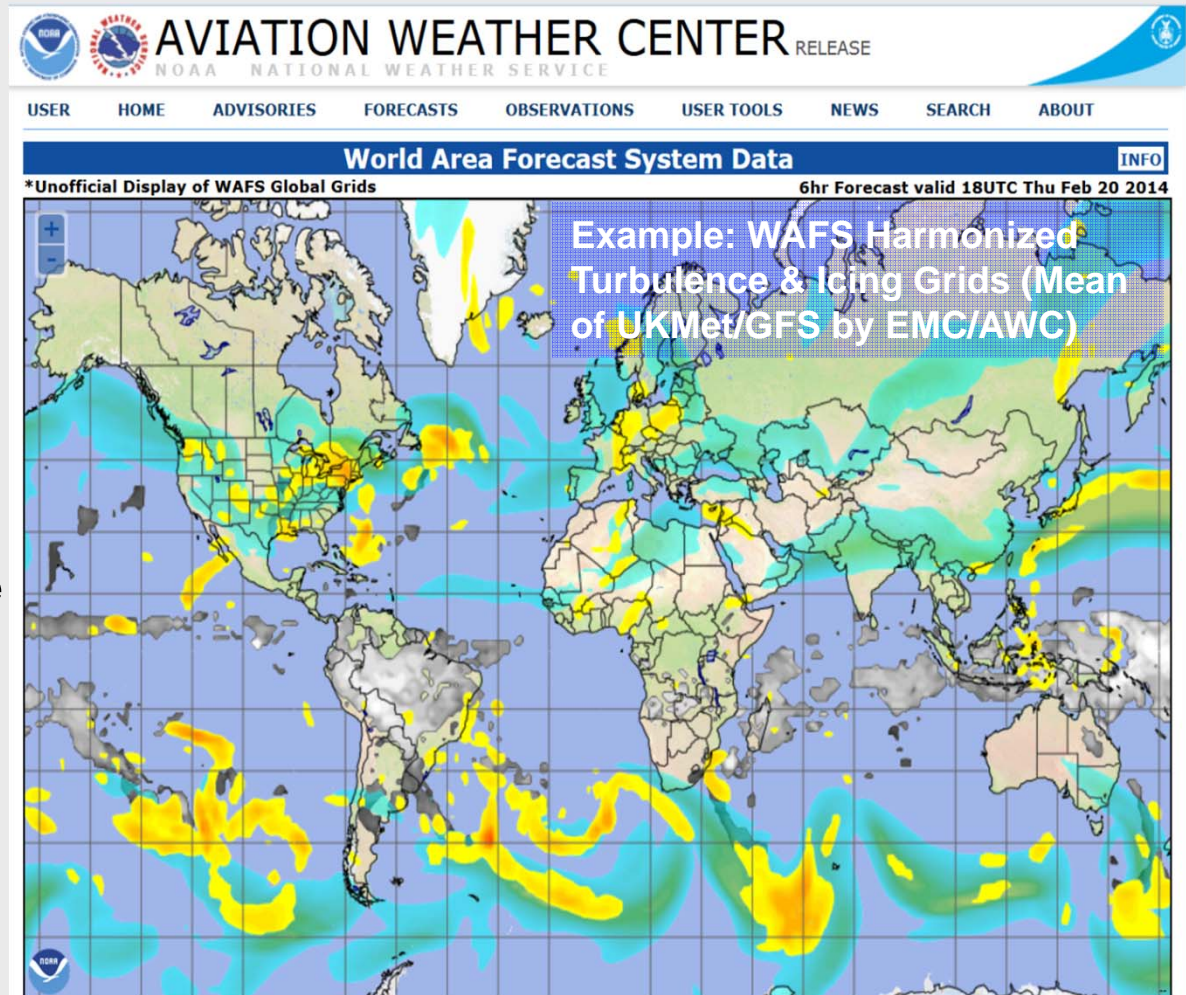
# World Area Forecast Centers

WAFC Washington (Kansas City)

WAFC London (Exeter, UK)



- World Area Forecast Centers (WAFCs) provided authority to operate under the International Civil Aviation Organization (ICAO) World Area Forecast System (WAFS)
- Burgeoning International met offices are seeking a larger role in WAFS forecast process
- One option is a proposed, FAA fundable, and ICAO approved plan for an International WAFS Ensemble



# World Area Forecast Centers

WAFC Washington (Kansas City)

WAFC London (Exeter, UK)



- **The WAFS Vision:**

- WAFS International ensemble of models from qualified Meteorological Service Providers
- WAFS International ensemble available at multiple resolutions via NOMADS-like interface
- Goal to become ICAO's global default as the authoritative source of digital aviation NWP guidance
  - Politically seamless (in time, space and policy)
  - Calibrated (by modeling Center and membership therein)
  - Partnerships with NUOPC?
- Next discussion: The ICAO/WMO Meteorological Division Meeting
  - July 8 – 21, 2014, Montreal, Canada)
  - See Matt Strahan (AWC IOB Chief) for further information & input



# AWC Summary



- Ensemble usage increasing at AWC and AWT
- Building ensemble-based tools to support AWC's Domestic and International forecast, advisory, and warning operations
- Ensembles the basis of CDM, TFM and IDSS MOTL tools
- Ensemble approach recommended by the WAFS/ICAO



***David.Bright@noaa.gov***

***Matt.Strahan@noaa.gov***