Aviation Forecast Verification Tool (AFVT)

Virtual Lab Forum
November 16, 2016

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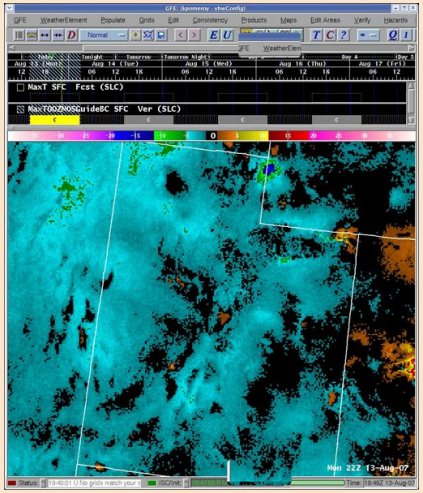
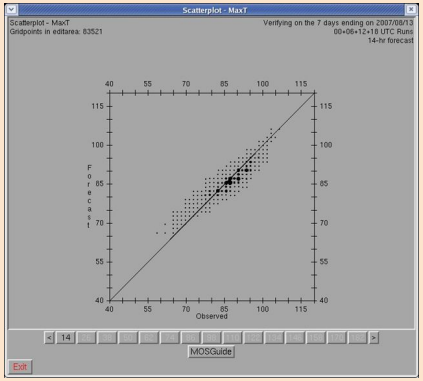
Steve Lanciani

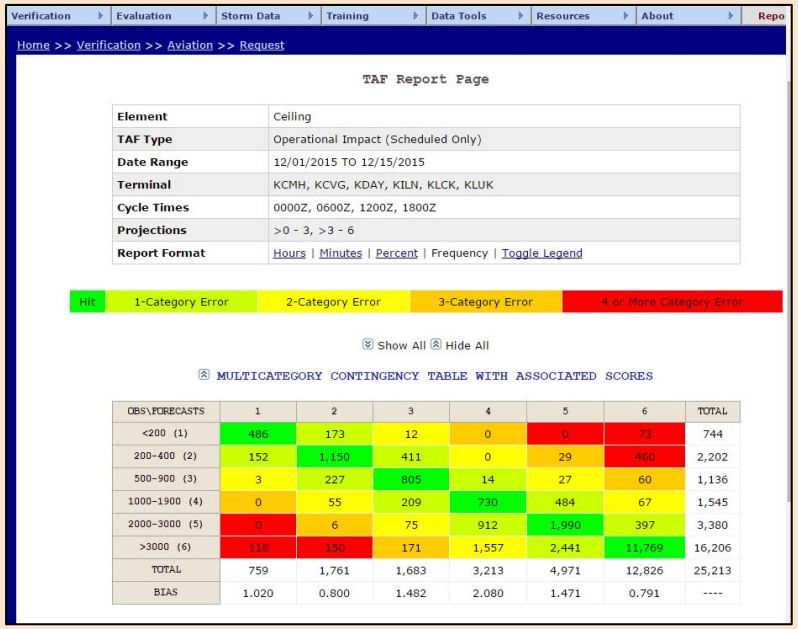
Motivation

Create capabilities to provide near real-time verification results for national-scale gridded forecasts of importance to aviation operations



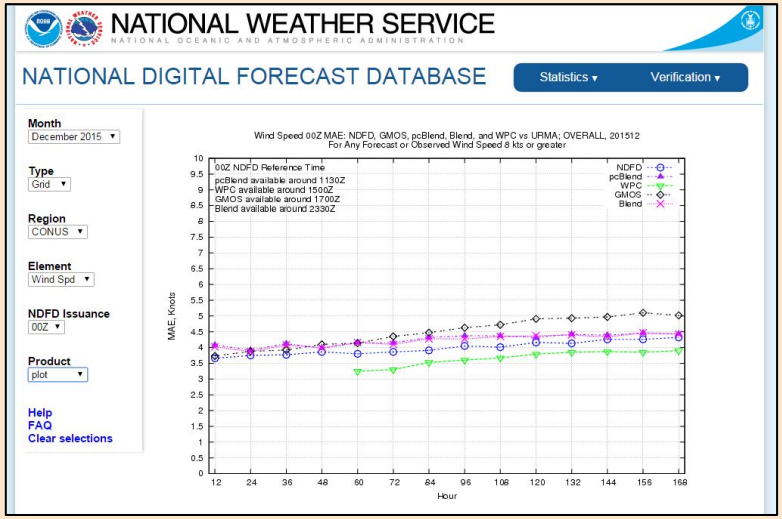


BOIVerify: verifies gridded forecasts
Limitation: locally maintained



OBS\FORECASTS	1	2	3	4	5	6	TOTAL
<200 (1)	486	173	12	0	0	73	744
200-400 (2)	152	1,150	411	0	29	460	2,202
500-900 (3)	3	227	805	14	27	60	1,136
1000-1900 (4)	0	55	209	730	484	67	1,545
2000-3000 (5)	0	6	75	912	1,990	397	3,380
>3000 (6)	118	150	171	1,557	2,441	11,769	16,206
TOTAL	759	1,761	1,683	3,213	4,971	12,826	25,213
BIAS	1.020	0.800	1.482	2.080	1.471	0.791	----

Stats on Demand: verification of alphanumeric products, TAF, watches, warnings
Limitation: does not contain gridded verification



NDFD Verification: verification of gridded forecasts
Limitation: non-operational; not real-time

Aviation Forecast Verification Tool

- MDL is developing AFVT to:
  - store forecasts and observations
  - compute verification metrics
  - depict the verification results via a web-based graphical user interface

- This work is funded by STI and the Aviation and Space Weather Services Branch (ASWSB)

Benefits of AFVT

- Digital Aviation Services
  - NWS provides quality management system data to the FAA
  - ASWSB and STI use for planning and evaluation of improvement to Aviation Services
- Verification
  - NWS managers use for performance management and resource planning
  - NWS forecasters use for continual improvement to their forecast process
  - Guidance product developers use for continual improvement

Initial AFVT Functionality

- Users access through a web-based GUI
  - Allows user to select element, time, and location of interest
  - Displays results as graphs, text, and maps
  - Results available in near real time
- Grid-to-point and grid-to-grid capabilities
- 4+ years of data (2012 - present)

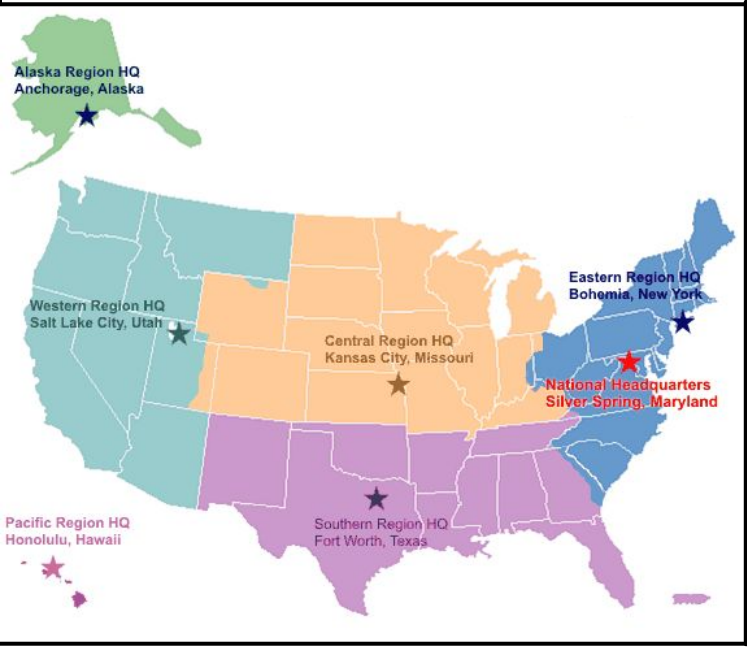
- Prototype access is open to all NOAA users

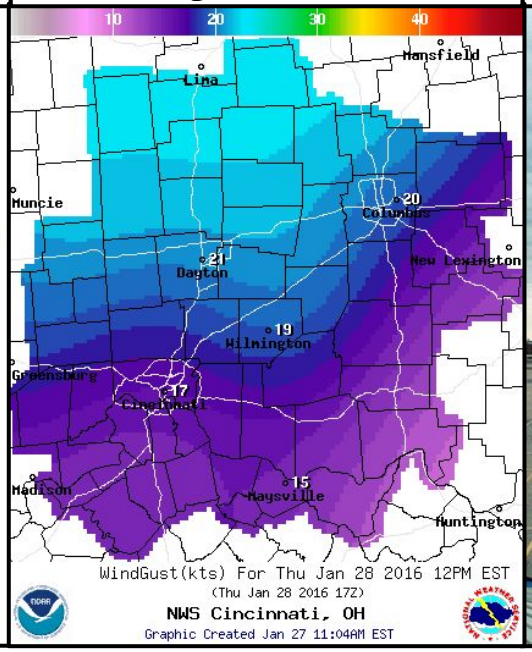
Data Status

Grid-to-Point	Status
Observations	METAR / SPECI (MADIS)
NDFD forecasts	ceiling height, visibility, flight category, sky cover, temperature, dew point, relative humidity, wind speed, wind direction, wind gust
NDFD issuances	00Z-23Z
NDFD projections	1-36 hours
Grid resolution	2.5 km (CONUS)
Guidance/models	GLMP, GMOS
Grid-to-Grid	**Status**
Analysis	RTMA
NDFD forecasts	temperature, dew point, wind speed, wind direction, visibility, sky cover
NDFD issuances	00Z-23Z
NDFD projections	1-36 hours
Grid resolution	2.5 km (CONUS)
Guidance/models	GLMP, GMOS

Verifiable Areas in AFVT

National or by Region	By WFO	At airport or point

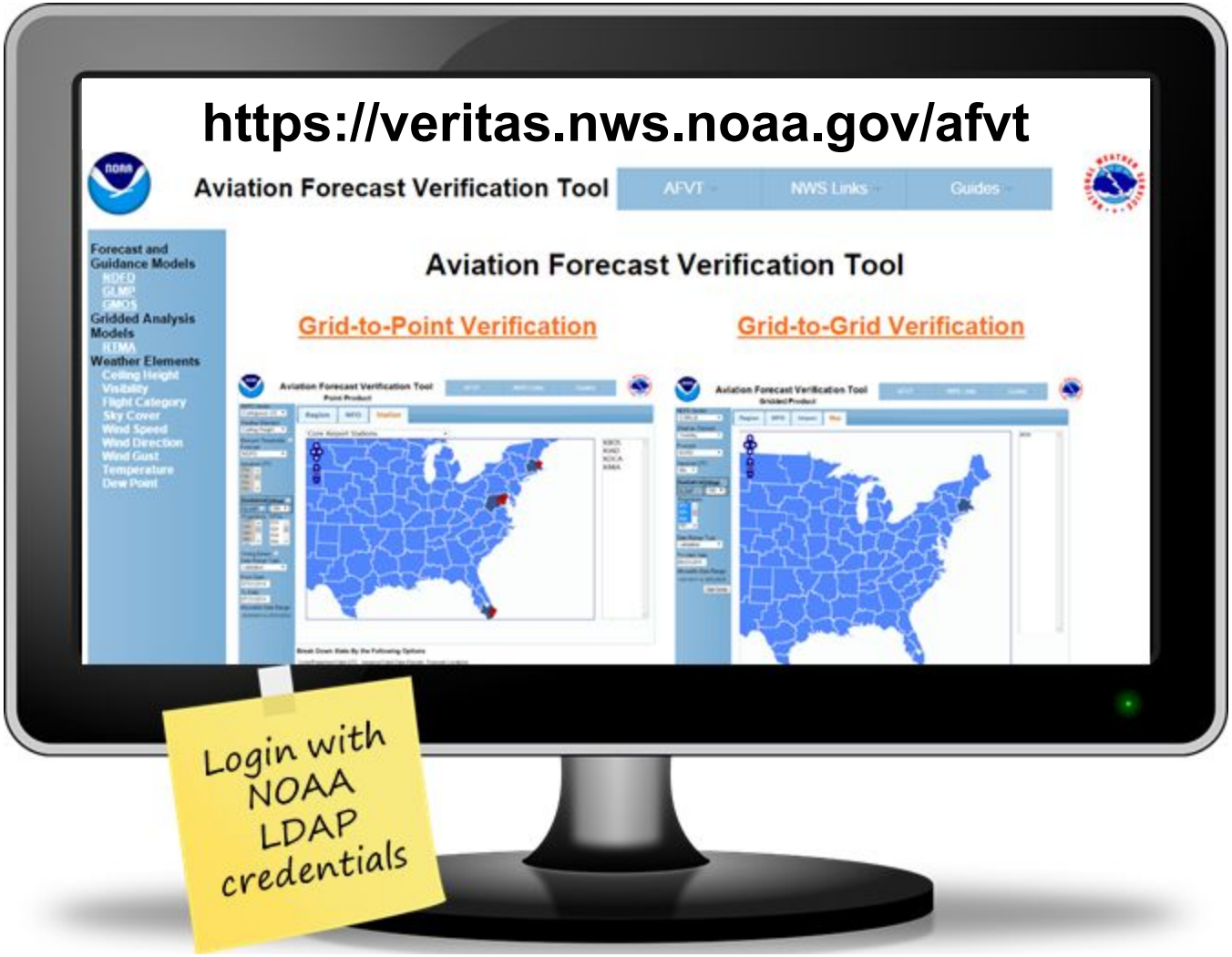




Optional Time Breakdowns

Annual | Seasonal | Monthly | Daily | Hourly

Accessing AFVT



Graphical User Interface

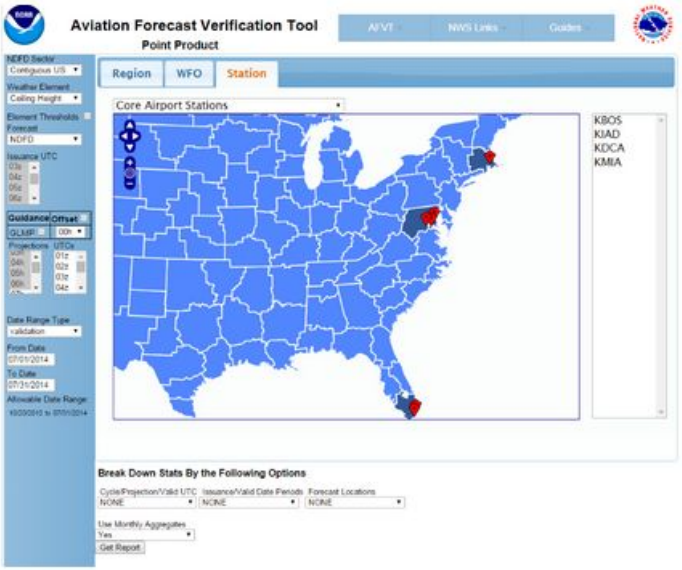
Forecast and Guidance Models
- NDFD
- GLMP
- GMOS

Gridded Analysis Models
- RTMA

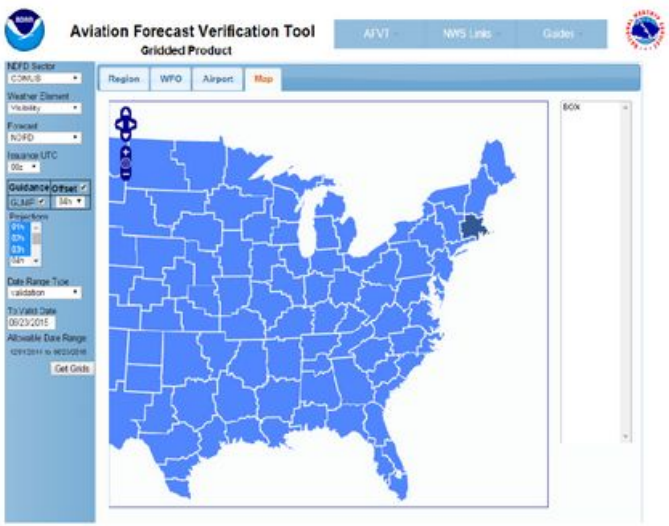
Weather Elements
- Ceiling Height
- Visibility
- Flight Category
- Sky Cover
- Wind Speed
- Wind Direction
- Wind Gust
- Temperature
- Dew Point

Aviation Forecast Verification Tool

Grid-to-Point Verification



Grid-to-Grid Verification



Aviation Forecast Verification Tool
Point Product

AFVT | NWS Links | Guides

NDFD Sector: Contiguous US

Weather Element: Ceiling Height

Element Thresholds

Highest Impact Ob

Forecast: NDFD

Issuance UTC: 00z 01z 02z 03z

Guidance	Offset
GLMP	04h

Projections: 04h 05h 06h

UTCs: 01z 02z 03z 04z

Date Range Type: issuance

From Date: 2016-10-01

To Date: 2016-11-09

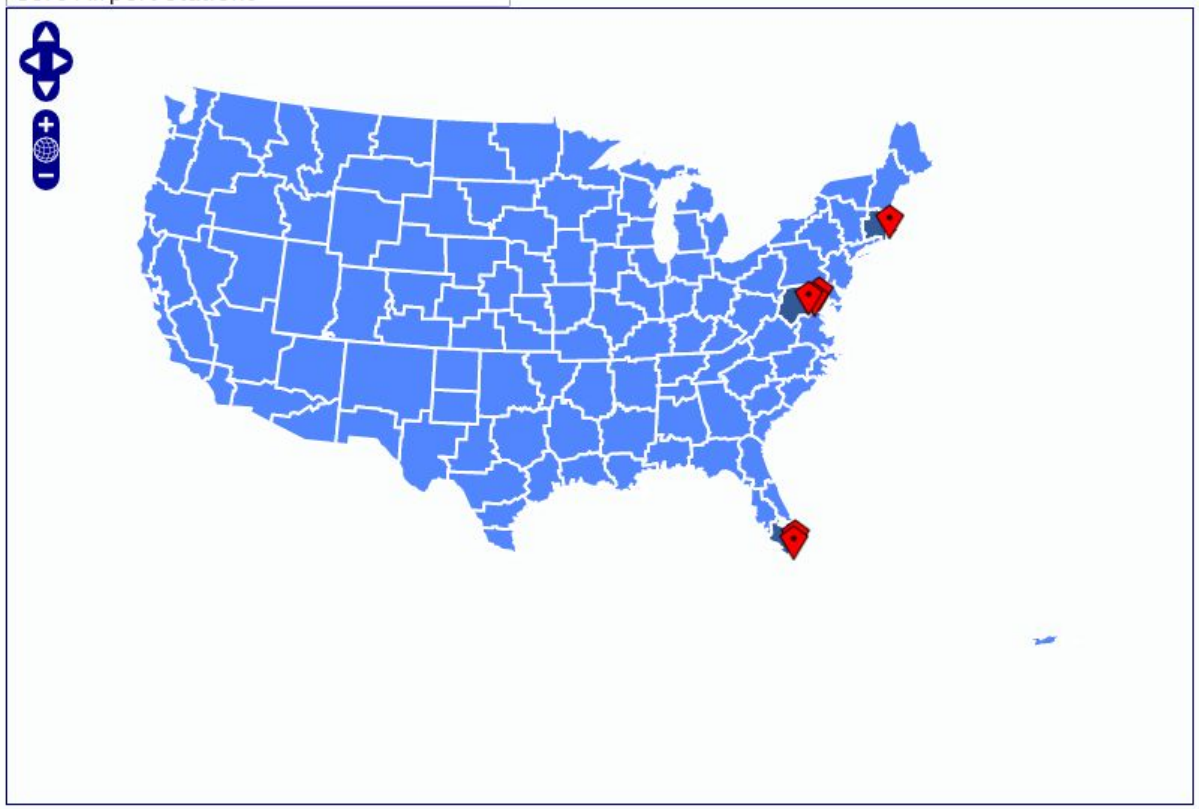
Allowable Date Range: 01/01/2012 to 11/08/2016

Get Report

Region | WFO | Station

Choose a desired station type and click on any WFO area to show available stations of the selected type. And click on any station to select/de-select it. Stats will be computed for the selected stations

Core Airport Stations



KMIA
KBOS
KIAD
KDCA
KBWI

Break Down Stats By the Following Options

Cycle/Projection/Valid UTC	Issuance/Valid Date Periods	Forecast Locations
NONE	NONE	NONE

Grid-to-point interface

Aviation Forecast Verification Tool
Point Product

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NDFD Sector: Contiguous US

Ceiling Height

Element Thresholds

Highest Impact Ob

Forecast: NDFD

Issuance UTC: 00z 01z 02z 03z

Guidance	Offset
GLMP	04h

Projections: 04h 05h 06h

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Date Range Type: issuance

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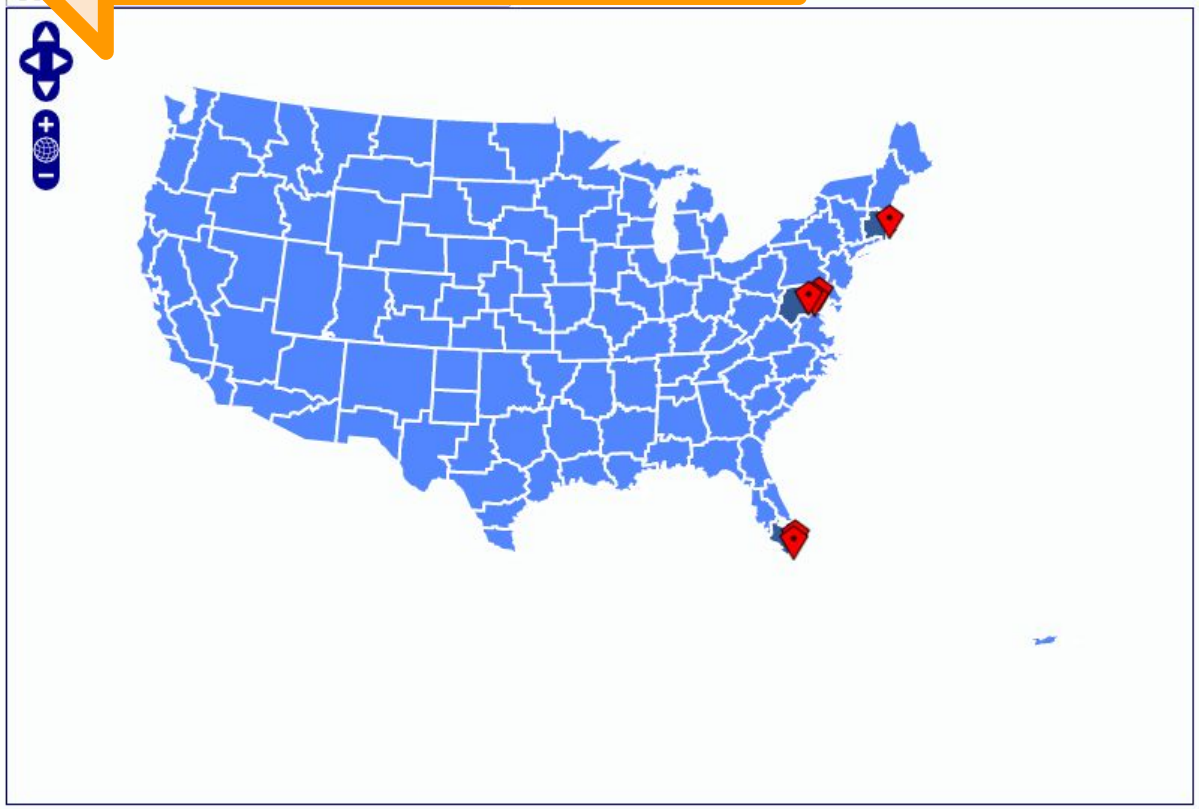
Get Report

Regi | WFO | Station

Select element

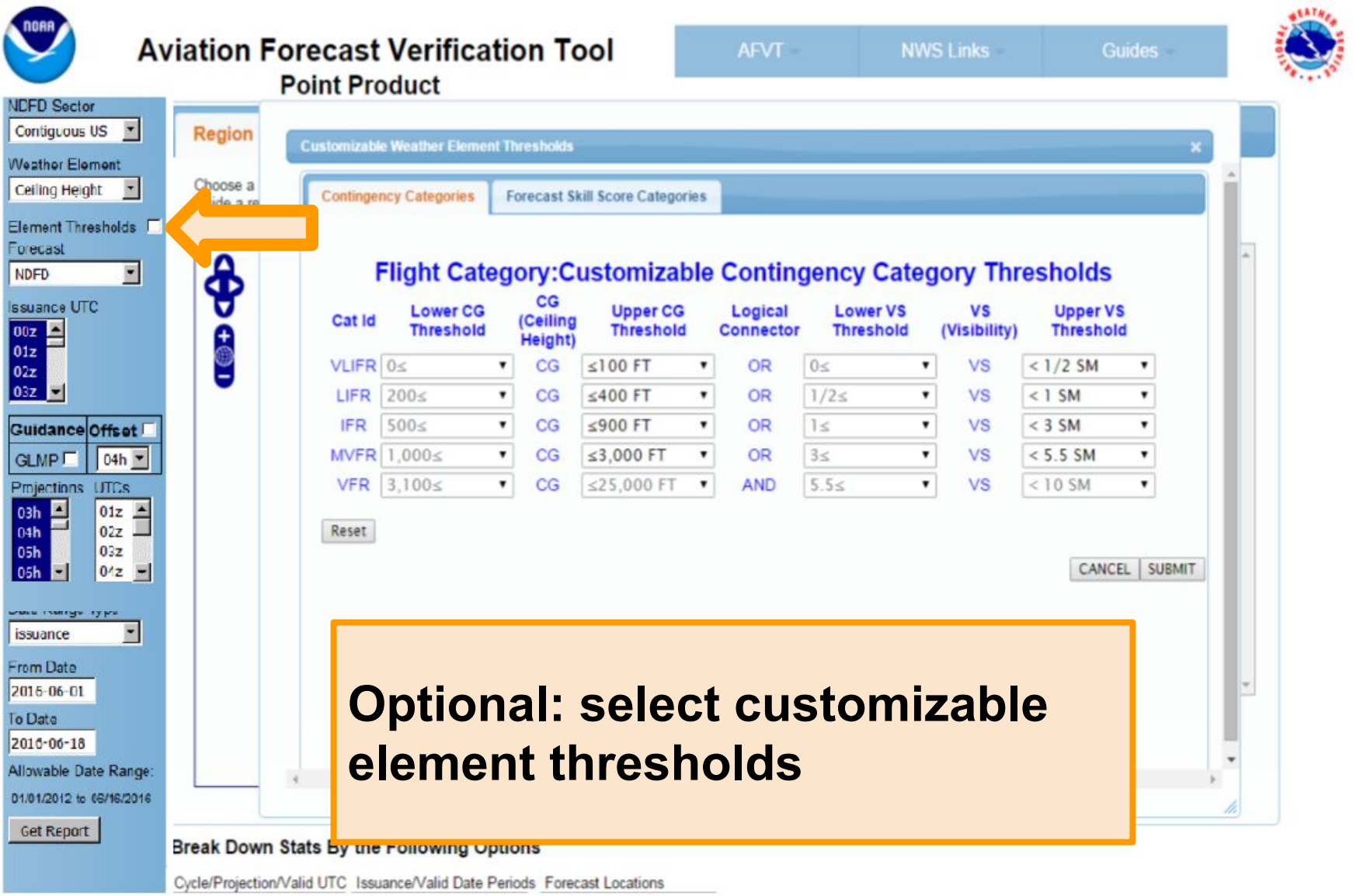
ected type. And click on any station to



KMIA
KBOS
KIAD
KDCA
KBWI

Break Down Stats By the Following Options

Cycle/Projection/Valid UTC	Issuance/Valid Date Periods	Forecast Locations
NONE	NONE	NONE


Aviation Forecast Verification Tool
Point Product
AFVT
NWS Links
Guides
NDFD Sector
Contiguous US
Weather Element
Ceiling Height
Element Thresholds
Forecast
NDFD
Issuance UTC
00z
01z
02z
03z
Guidance
Offset
GLMP
04h
Projections
UTCs
03h
04h
05h
05h
01z
02z
03z
04z
issuance
From Date
2016-06-01
To Date
2016-06-16
Allowable Date Range:
01/01/2012 to 06/16/2016
Get Report
Region
Customizable Weather Element Thresholds
Contingency Categories
Forecast Skill Score Categories
Flight Category:Customizable Contingency Category Thresholds
Cat Id
Lower CG Threshold
CG (Ceiling Height)
Upper CG Threshold
Logical Connector
Lower VS Threshold
VS (Visibility)
Upper VS Threshold
VLIFR 0≤ CG ≤100 FT OR 0≤ VS < 1/2 SM
LIFR 200≤ CG ≤400 FT OR 1/2≤ VS < 1 SM
IFR 500≤ CG ≤900 FT OR 1≤ VS < 3 SM
MVFR 1,000≤ CG ≤3,000 FT OR 3≤ VS < 5.5 SM
VFR 3,100≤ CG ≤25,000 FT AND 5.5≤ VS < 10 SM
Reset
CANCEL
SUBMIT
Optional: select customizable element thresholds
Break Down Stats By the Following Options
Cycle/Projection/Valid UTC
Issuance/Valid Date Periods
Forecast Locations

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Point Product

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NDFD Sector
Contiguous US

Weather Element
Ceiling Height

Element Thresholds
Highest Impact Ob
Forecast
NDFD

Issuance UTC
00z
01z
02z
03z

Guidance	Offset
GLMP	04h

Projections: 04h, 05h, 06h
UTCs: 01z, 02z, 03z, 04z

Date Range Type
issuance

From Date
2016-10-01

To Date
2016-11-09

Allowable Date Range:
01/01/2012 to 11/08/2016

Get Report

AFVT provides 2 station-based verification techniques:

- **Top-of-the-hour observation (default)**
- **Highest-impact observation within the hour (to account for SPECIs)**

Element(s)	High Impact
Ceiling height, visibility, flight category	Lowest value over hour
Wind speed, wind gust, dew point*, relative humidity* (*)=dependent on location/season	Highest value over hour
Temperature	Warm season: highest value Cool season: lowest value
Wind direction	Top of hour verification only - to be revisited

Aviation Forecast Verification Tool
Point Product

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NDFD Sector: Contiguous US

Weather Element: Ceiling Height

Element Thresholds

Highest Impact Ob

Forecast: NDFD

Issuance UTC: 00z 01z 02z 03z

Guidance	Offset
GLMP	04h

Projections: 04h 05h 06h

UTCs: 01z 02z 03z 04z

Date Range Type: issuance

From Date: 2016-10-01

To Date: 2016-11-09

Allowable Date Range: 01/01/2012 to 11/08/2016

Get Report

Region | WFO | Station

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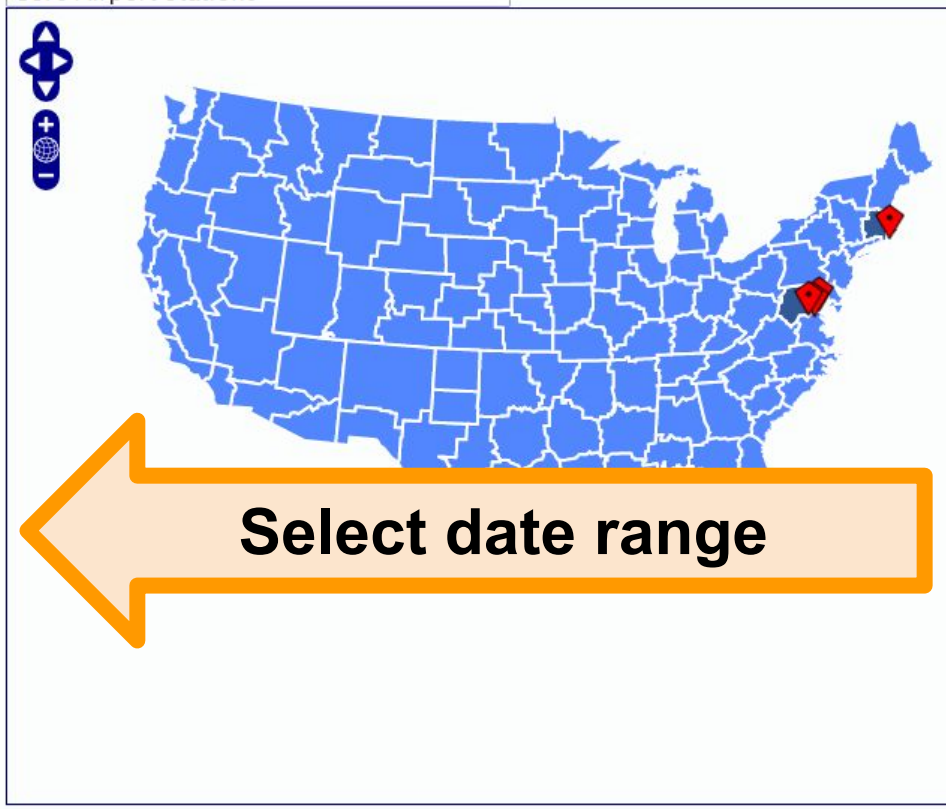
Core Airport Stations

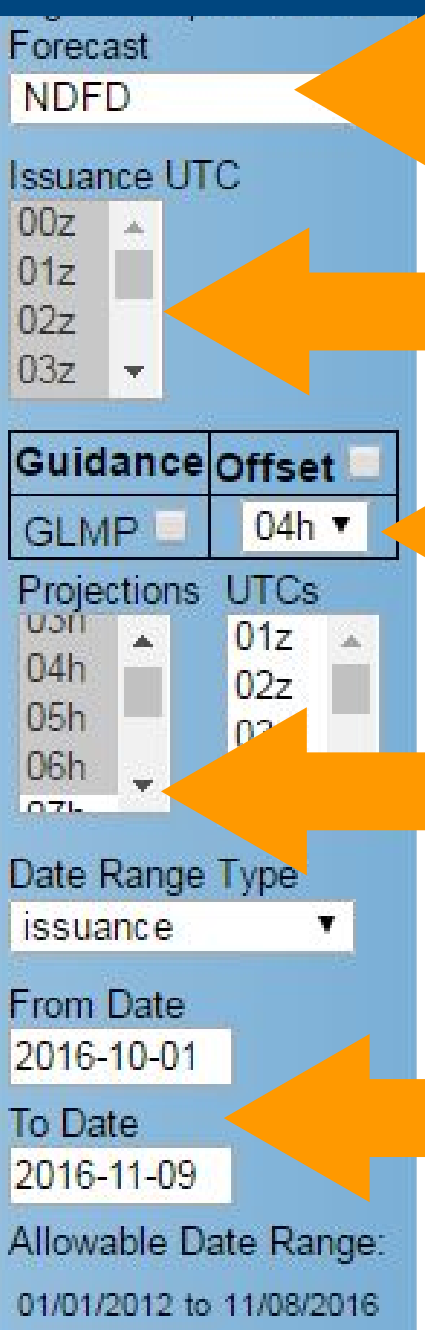


KMIA
KBOS
KIAD
KDCA
KBWI

Select date range

Break Down Stats By the Following Options

Cycle/Projection/Valid UTC	Issuance/Valid Date Periods	Forecast Locations
NONE	NONE	NONE



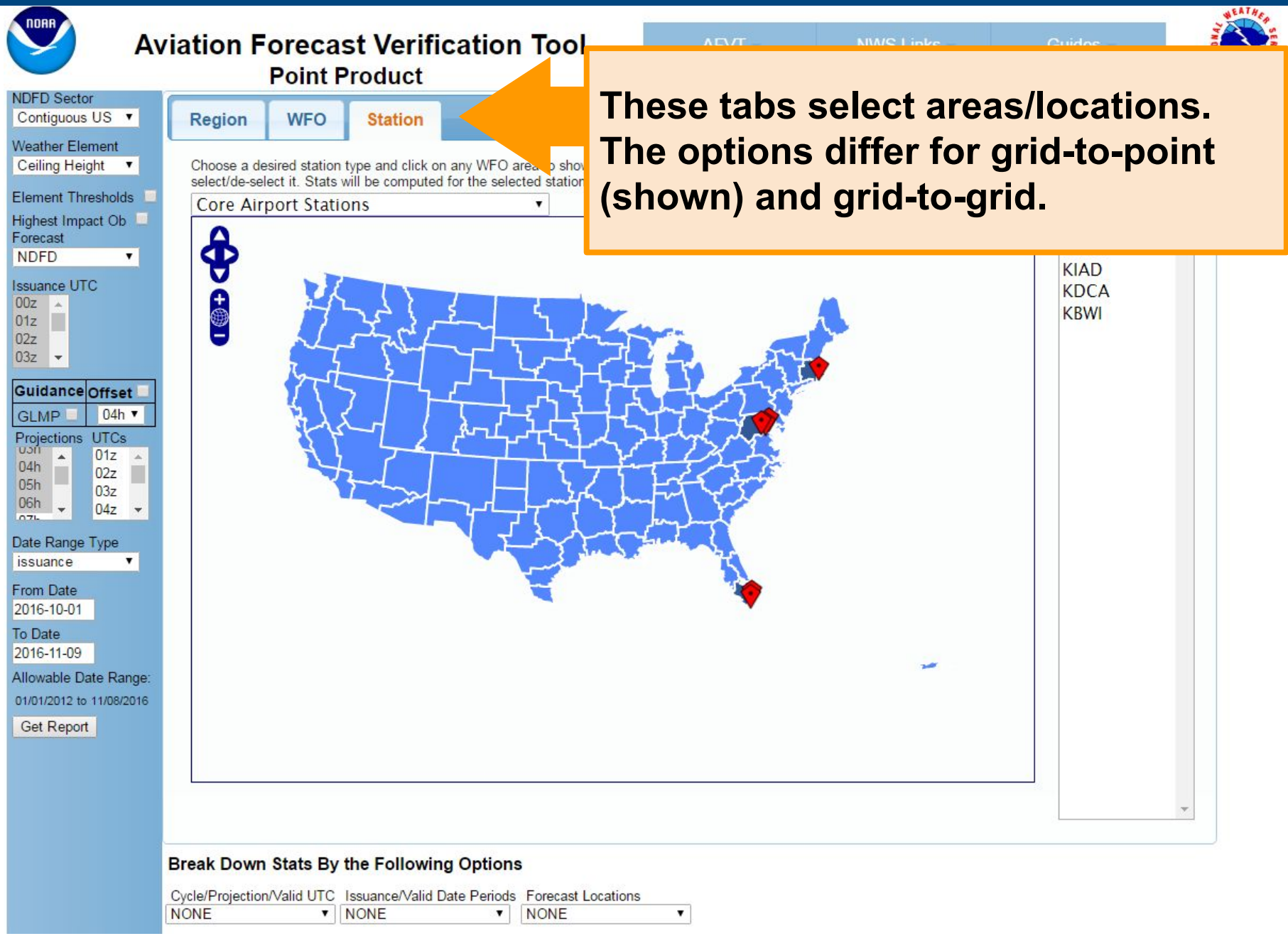
The "base" forecast that other data sources (if any) are compared to (usually NDFD).

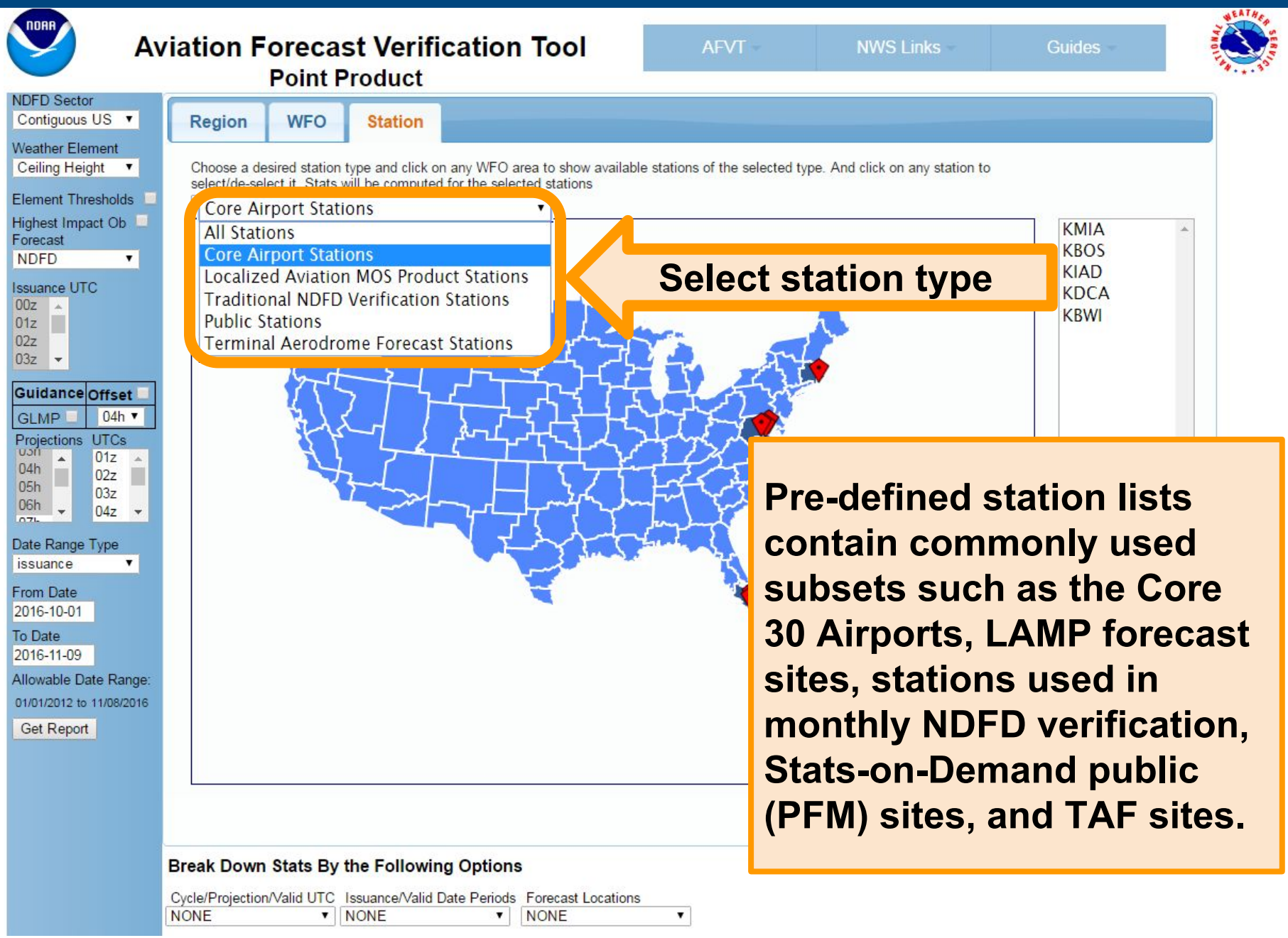
The forecast issuance(s) of the "Base" forecast. Any combination of issuances may be selected.

Check boxes for comparable forecast(s) and time offset(s) (i.e., lead time).

Multiple forecast projections can be selected.

Choose forecast date range.


Aviation Forecast Verification Tool
Point Product
AEVT
NWS Links
Guides
NDFD Sector
Contiguous US
Weather Element
Ceiling Height
Element Thresholds
Highest Impact Ob
Forecast
NDFD
Issuance UTC
00z
01z
02z
03z
Guidance
Offset
GLMP
04h
Projections
04h
05h
06h
UTCs
01z
02z
03z
04z
Date Range Type
issuance
From Date
2016-10-01
To Date
2016-11-09
Allowable Date Range:
01/01/2012 to 11/08/2016
Get Report
Region
WFO
Station
Choose a desired station type and click on any WFO area to show
select/de-select it. Stats will be computed for the selected station
Core Airport Stations
KIAD
KDCA
KBWI
These tabs select areas/locations.
The options differ for grid-to-point
(shown) and grid-to-grid.
Break Down Stats By the Following Options
Cycle/Projection/Valid UTC
NONE
Issuance/Valid Date Periods
NONE
Forecast Locations
NONE


Aviation Forecast Verification Tool
Point Product
AFVT
NWS Links
Guides
NDFD Sector
Contiguous US
Weather Element
Ceiling Height
Element Thresholds
Highest Impact Ob Forecast
NDFD
Issuance UTC
00z
01z
02z
03z
Guidance
Offset
GLMP
04h
Projections
04h
05h
06h
UTCs
01z
02z
03z
04z
Date Range Type
issuance
From Date
2016-10-01
To Date
2016-11-09
Allowable Date Range:
01/01/2012 to 11/08/2016
Get Report
Region
WFO
Station
Choose a desired station type and click on any WFO area to show available stations of the selected type. And click on any station to select/de-select it. Stats will be computed for the selected stations
Core Airport Stations
All Stations
Core Airport Stations
Localized Aviation MOS Product Stations
Traditional NDFD Verification Stations
Public Stations
Terminal Aerodrome Forecast Stations
Select station type
KMIA
KBOS
KIAD
KDCA
KBWI
Pre-defined station lists contain commonly used subsets such as the Core 30 Airports, LAMP forecast sites, stations used in monthly NDFD verification, Stats-on-Demand public (PFM) sites, and TAF sites.
Break Down Stats By the Following Options
Cycle/Projection/Valid UTC
NONE
Issuance/Valid Date Periods
NONE
Forecast Locations
NONE

Aviation Forecast Verification Tool
Point Product

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NDFD Sector: Contiguous US

Weather Element: Ceiling Height

Element Thresholds

Highest Impact Ob

Forecast: NDFD

Issuance UTC: 00z, 01z, 02z, 03z

Guidance	Offset
GLMP	04h

Projections: 04h, 05h, 06h

UTCs: 01z, 02z, 03z, 04z

Date Range Type: issuance

From Date: 2016-10-01

To Date: 2016-11-09

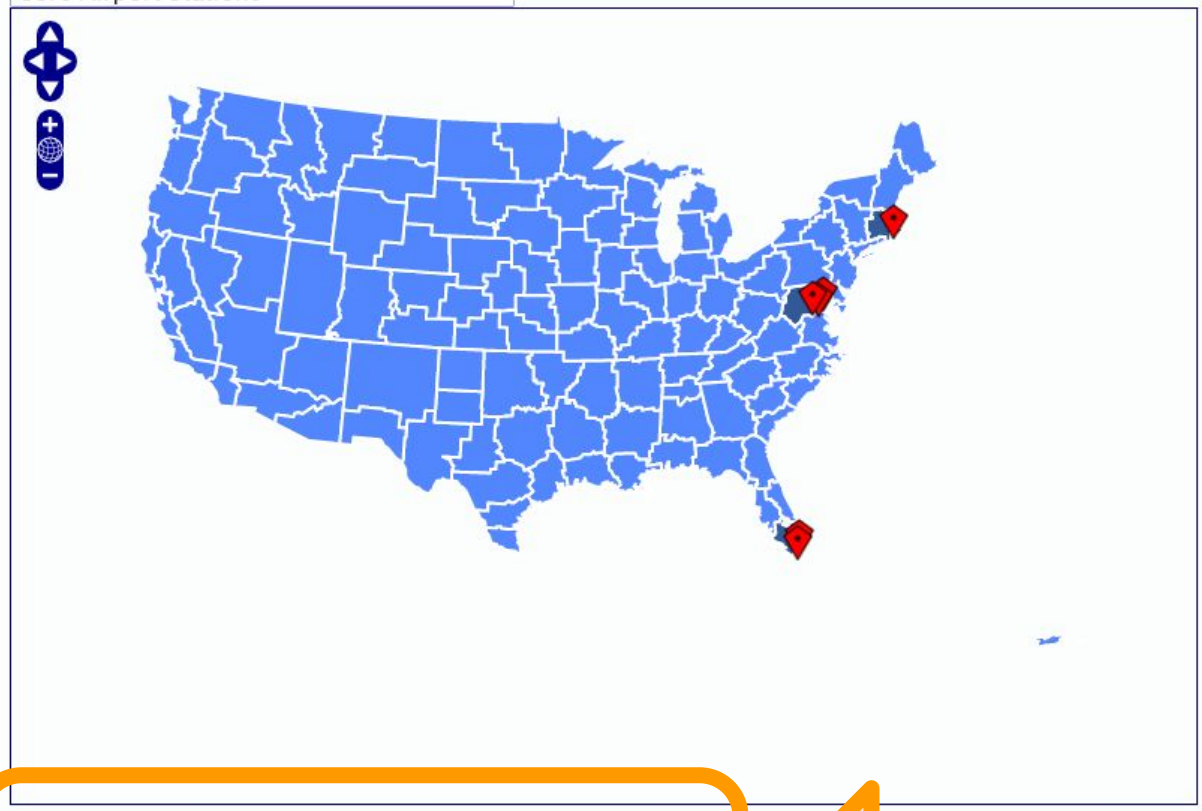
Allowable Date Range: 01/01/2012 to 11/08/2016

Get Report

Region | WFO | Station

Choose a desired station type and click on any WFO area to show available stations of the selected type. And click on any station to select/de-select it. Stats will be computed for the selected stations

Core Airport Stations

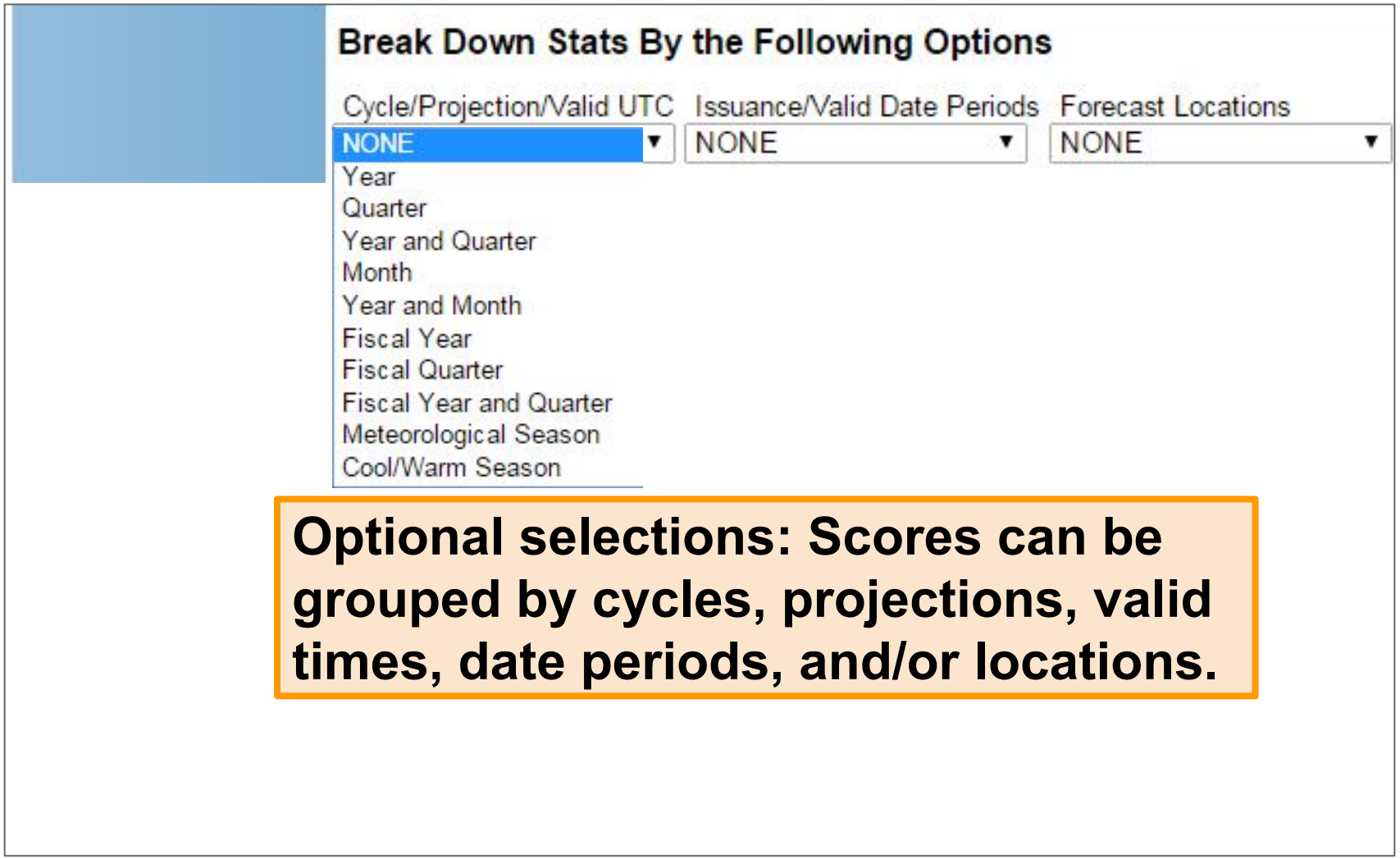


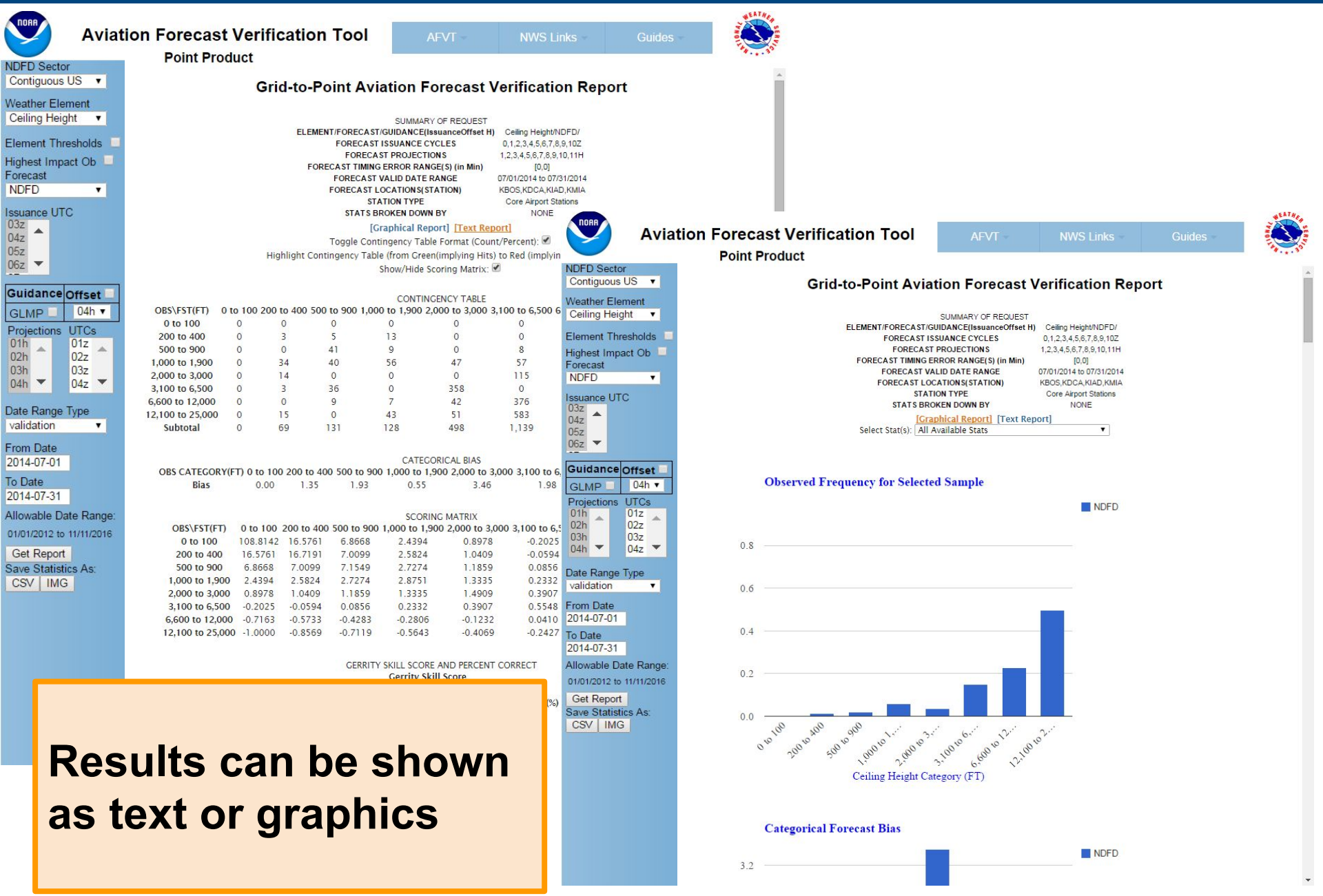
KMIA
KBOS
KIAD
KDCA
KBWI

Break Down Stats By the Following Options

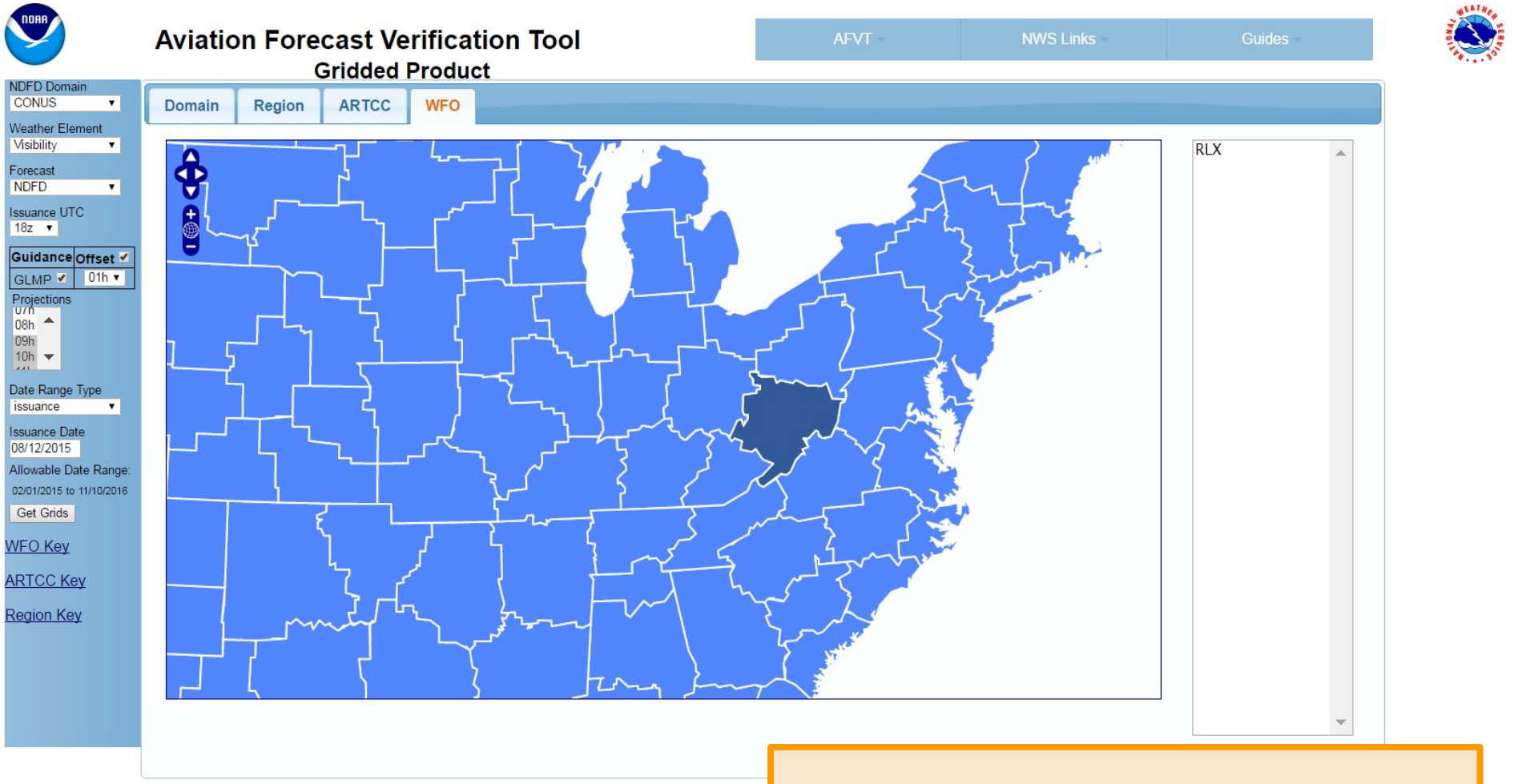
Cycle/Projection/Valid UTC	Issuance/Valid Date Periods	Forecast Locations
NONE	NONE	NONE

Select output format

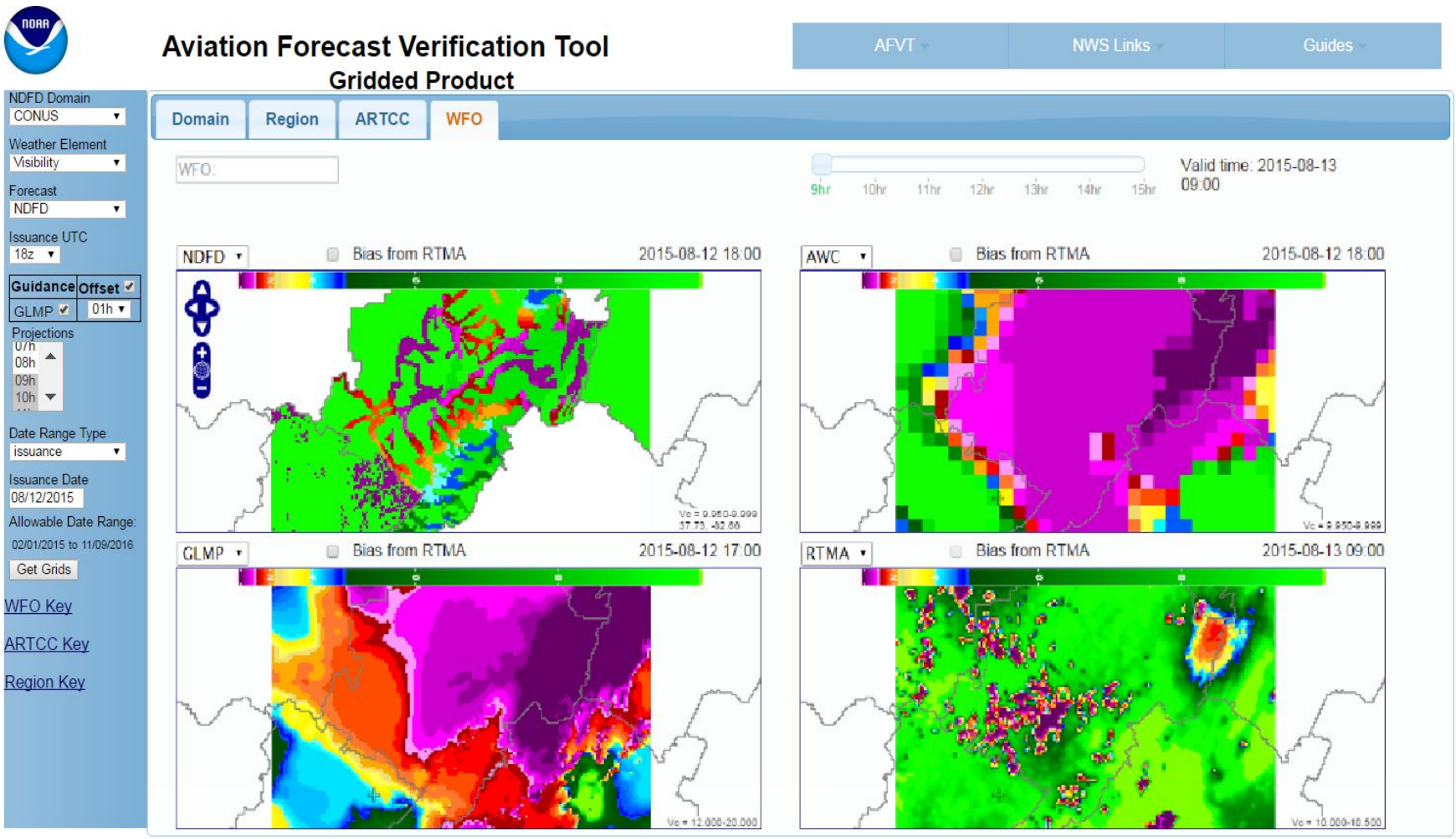

Break Down Stats By the Following Options
Cycle/Projection/Valid UTC
Issuance/Valid Date Periods
Forecast Locations
NONE
NONE
NONE
Year
Quarter
Year and Quarter
Month
Year and Month
Fiscal Year
Fiscal Quarter
Fiscal Year and Quarter
Meteorological Season
Cool/Warm Season
Optional selections: Scores can be grouped by cycles, projections, valid times, date periods, and/or locations.



Results can be shown as text or graphics



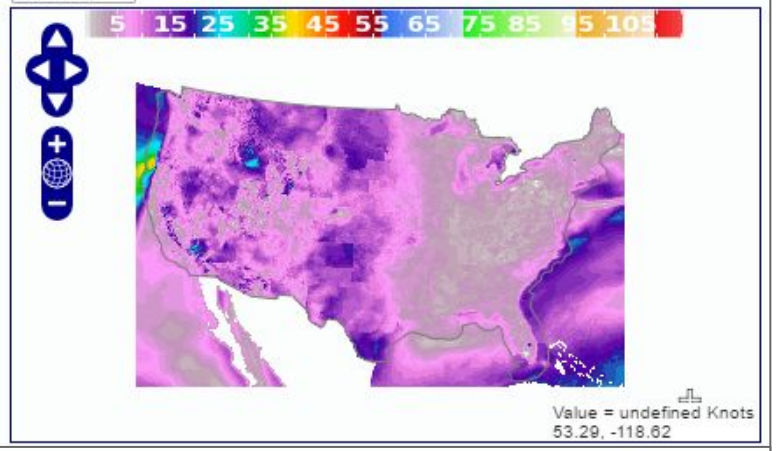
Grid-to-grid interface


Aviation Forecast Verification Tool
Gridded Product
AFVT
NWS Links
Guides
NDFD Domain
CONUS
Weather Element
Visibility
Forecast
NDFD
Issuance UTC
18z
Guidance
Offset
GLMP
01h
Projections
07h
08h
09h
10h
Date Range Type
issuance
Issuance Date
08/12/2015
Allowable Date Range:
02/01/2015 to 11/09/2016
Get Grids
WFO Key
ARTCC Key
Region Key
Domain
Region
ARTCC
WFO
WFO:
9hr
10hr
11hr
12hr
13hr
14hr
15hr
Valid time: 2015-08-13 09:00
NDFD
Bias from RTMA
2015-08-12 18:00
AWC
Bias from RTMA
2015-08-12 18:00
GLMP
Bias from RTMA
2015-08-12 17:00
RTMA
Bias from RTMA
2015-08-13 09:00

Change location
CO

Domain

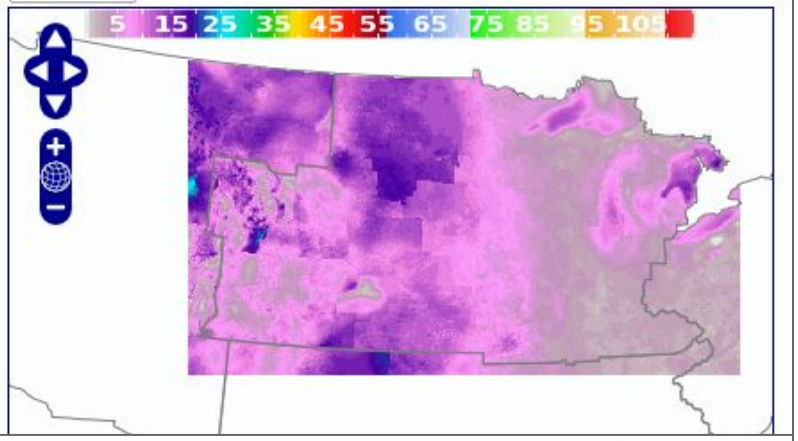
NDFD ▾ Bias Issuance Time: 2016-08-01 00:00



Change location
CR

Region

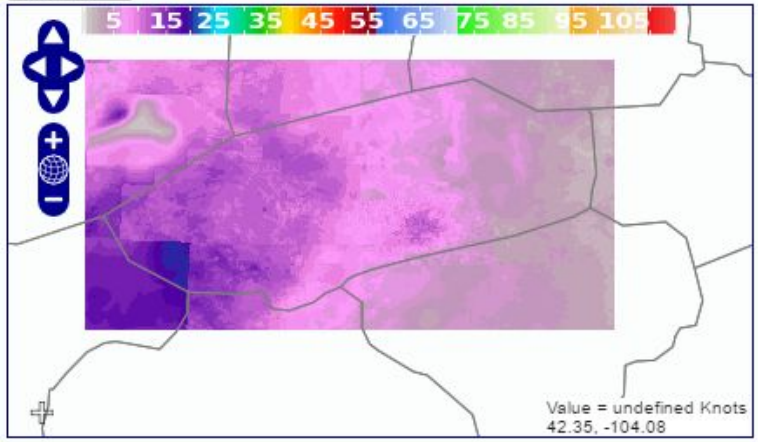
NDFD ▾ Bias Issuance Time: 2016-08-01 00:00



Change location
KANSAS_CITY

ARTCC

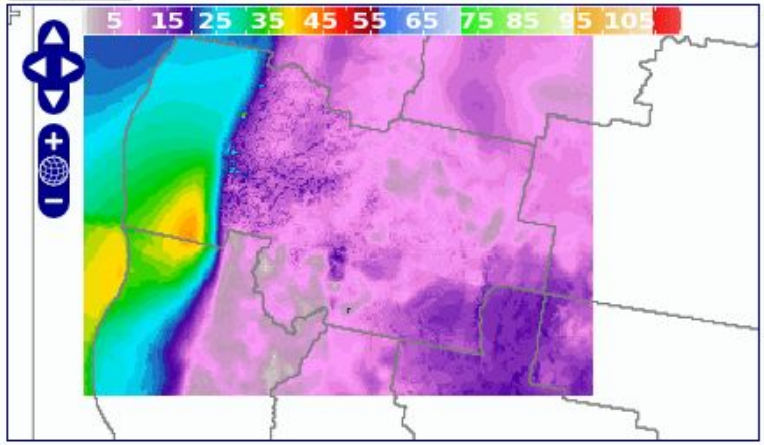
NDFD ▾ Bias Issuance Time: 2016-08-01 00:00



Change location
MFR

WFO

NDFD ▾ Bias Issuance Time: 2016-08-01 00:00



Future Plans

- Additional statistics and tools for gridded map product
  - Monthly grid point by grid point statistics
  - Error distribution charts
  - Time graphs from selections
- Additional weather elements
- Expanding to OCONUS
- Adding National Blend of Models (NBM)
- Transitioning to NWS operations in IDP

Providing Feedback

- Feedback is important!
  - Ask questions and report issues
  - Make recommendations for future development
  - Ensure AFVT provides the key capabilities needed for aviation verification

- How to provide feedback
  - Join the AFVT VLab community
  - Join the AFVT mailing list
  - Contact Tabitha.Huntemann@noaa.gov for information

Questions?

Tabitha.Huntemann@noaa.gov