Eastern Region Activities

Fred McMullen

Sub-Regional Aviation Workshop

WFO Cleveland, OH

22 April 2009

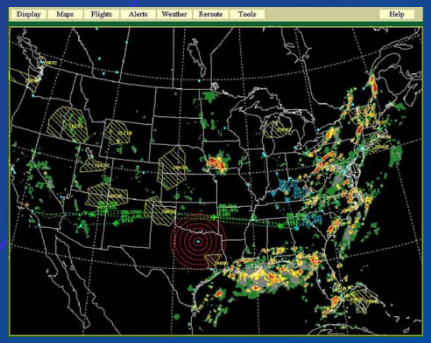
Measuring Weather / Traffic Impact

Local Airport Weather

En-route Convective Weather

The Weather Index expresses severity of weather impact on the NAS, weighted by air transportation service demands

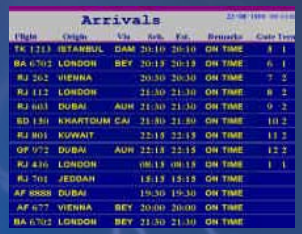
Traffic Demand



National Airspace System (NAS)

Capacity, Safety constraints

ATM, Airline Response Strategies



Operational Outcomes

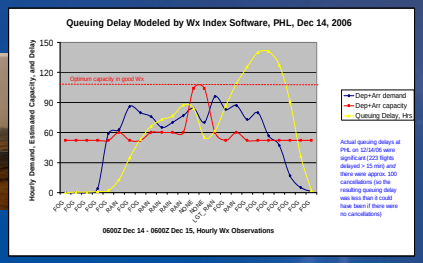
Weather Impacted Traffic Index (WITI)

Quantifies "the hand the NAS was dealt today"

WITI is a weighted sum of three components:

- **<u>En-route Component</u>** reflecting impact of convective weather on routes to/from major airports
- **<u>Terminal Component</u>** for major airports: local weather impact
- **<u>Queuing Delay Component</u>** for same airports reflecting excess traffic demand vs. capacity

Weather is weighted by traffic



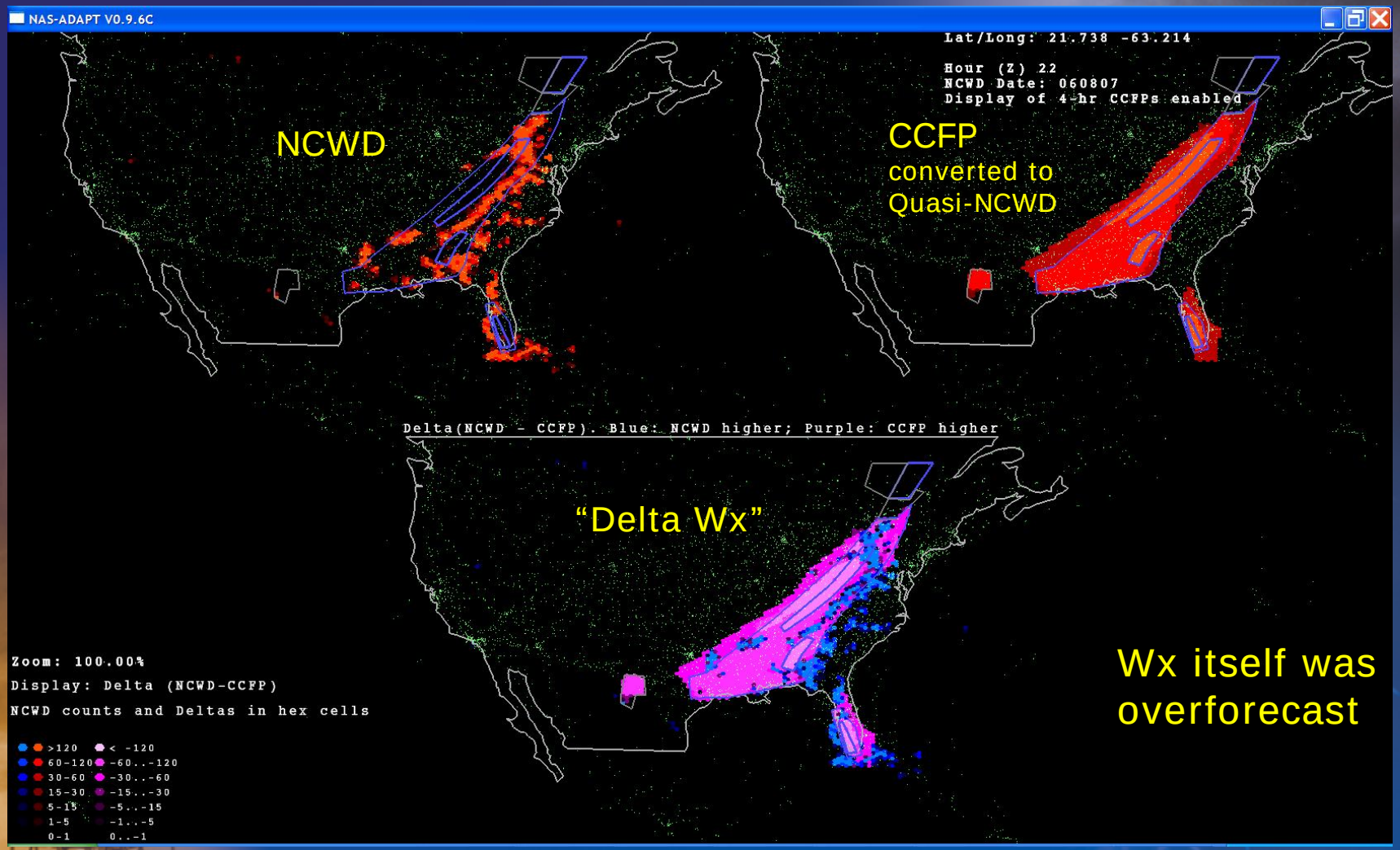
Used by the FAA on a regular basis:

- Measure system performance in an objective manner
- Compare different seasons' Wx/traffic impact with outcomes (e.g. delays)

WITI-FA ("Forecast Accuracy")

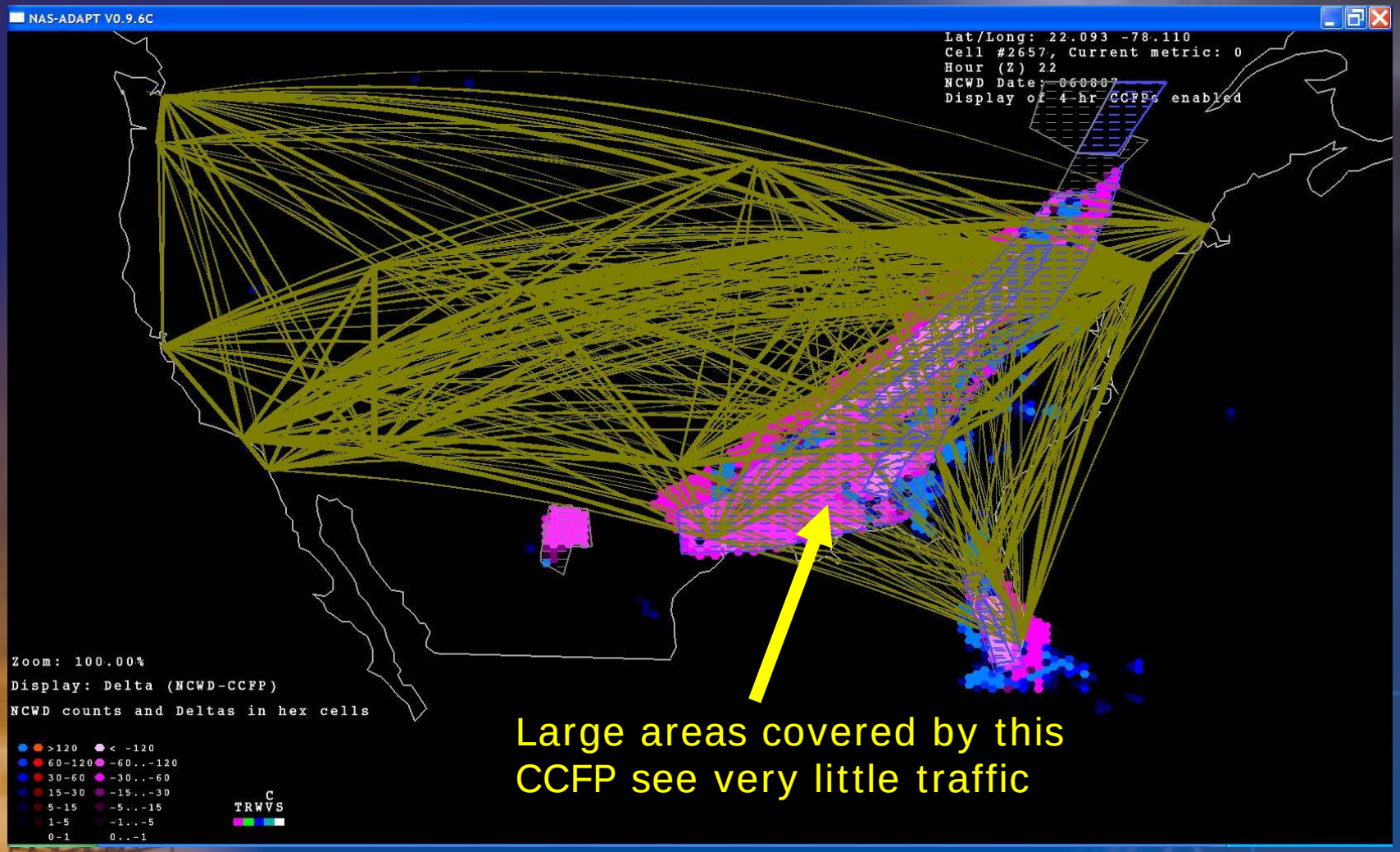
- ***En-route weather***
  - E-WITI uses actual convective Wx data (NCWD)
  - E-WITI-FA uses convective forecast data, (CCFP)
  - Both use the same scheduled traffic on major flows
  - Convective forecast data is converted to "quasi-NCWD" format (probability or intensity of Wx converted to % max NCWD score for hexagonal grid cells)
- ***Terminal weather***
  - T-WITI uses actual surface Wx data (METARs)
  - T-WITI-FA uses forecast data (TAFs)
  - Both use the same scheduled traffic at major airports
  - TAF converted to quasi-METAR form, "rolling look-ahead" stream

“Delta Weather” vs.
“Delta Weather *Impact*” (Delta WITI)



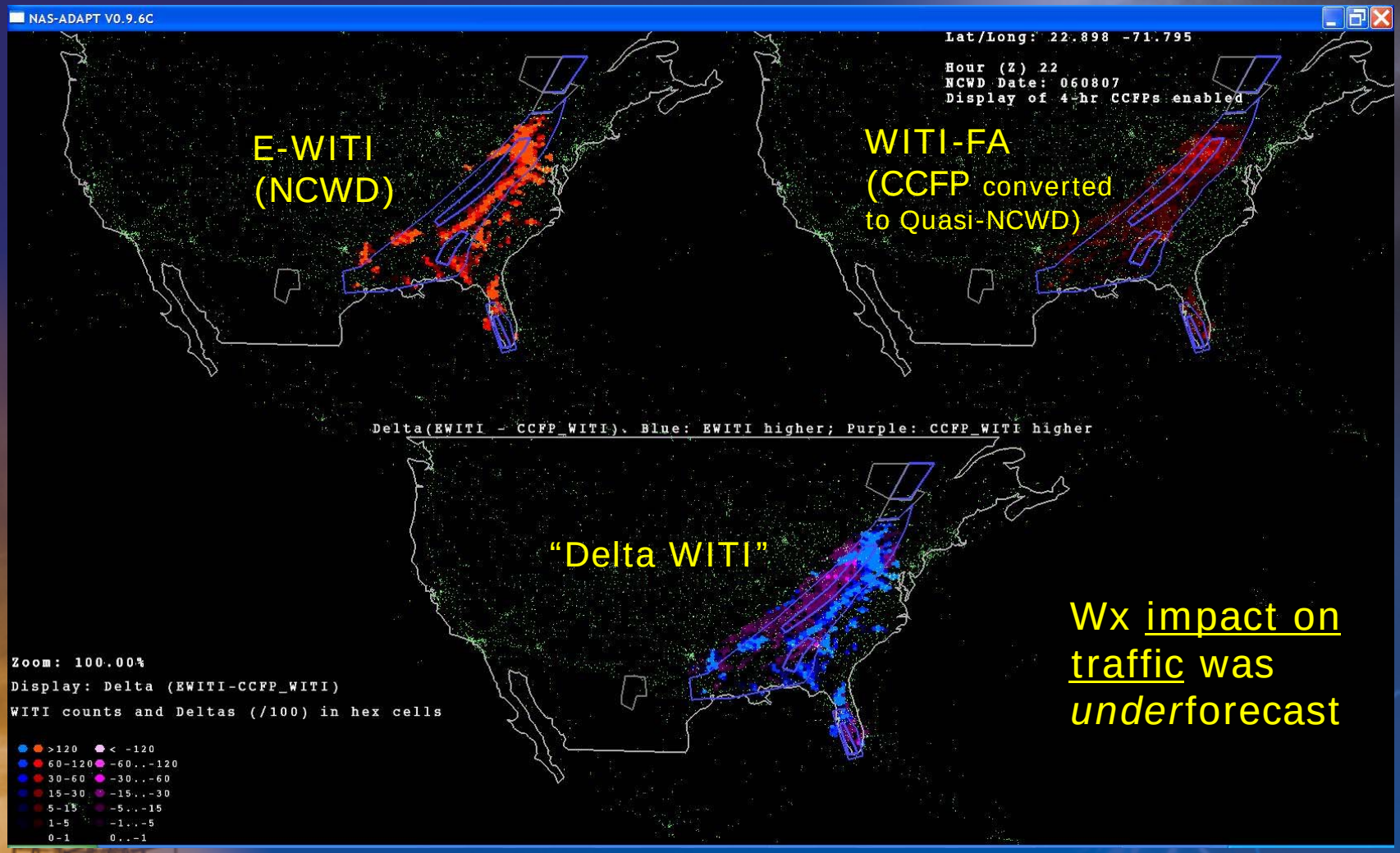
Wx itself was overforecast

“Delta Weather” vs. “Delta Weather *Impact*” (Delta WITI)



Large areas covered by this CCFP see very little traffic

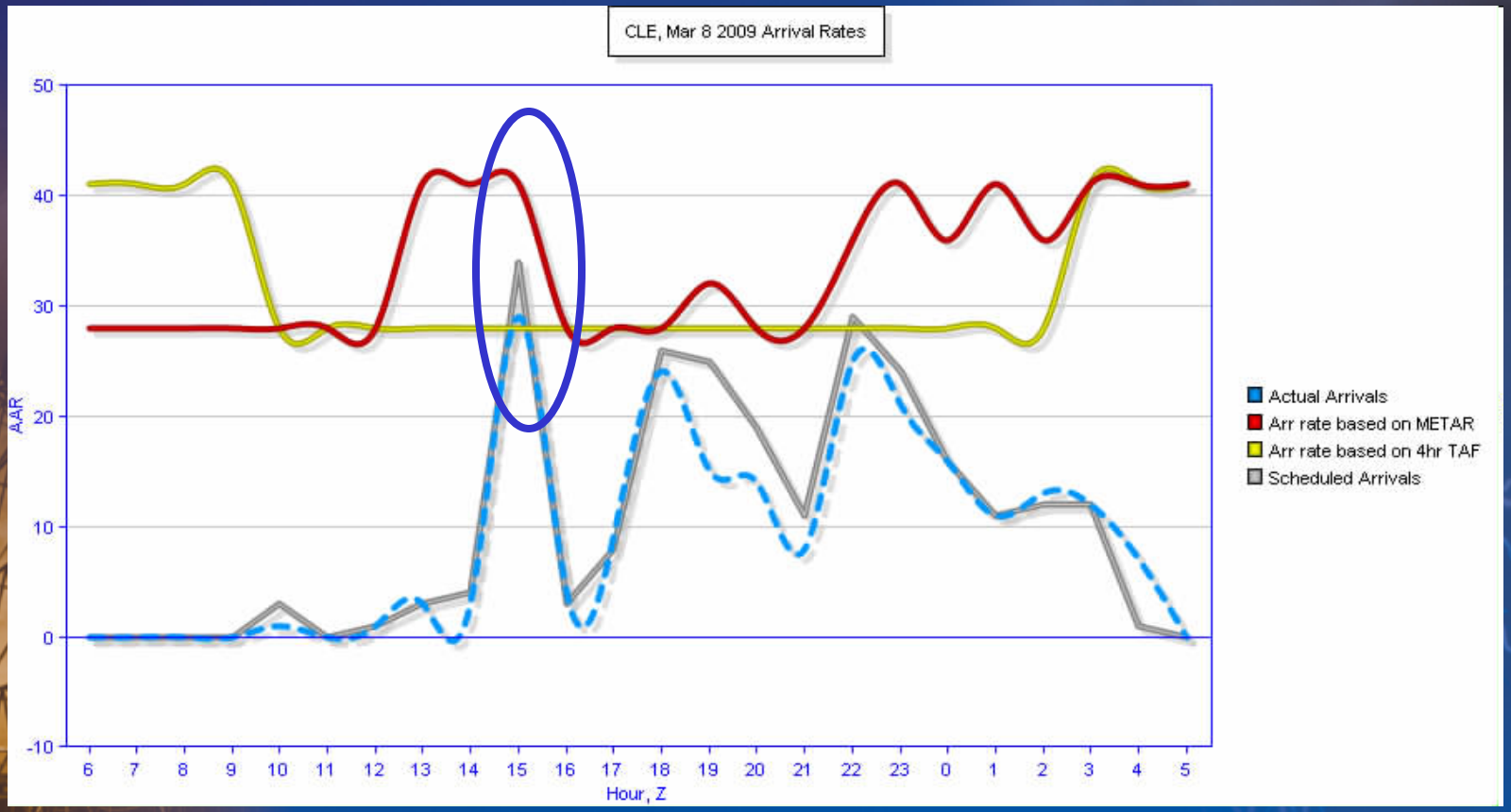
“Delta Weather” vs.
“Delta Weather *Impact*” (Delta WITI)



Wx <u>impact on traffic</u> was *under*forecast

WITI in Action

- TAF pessimistic from 11Z to 15Z
- Impact during 14-15Z push period
- Know your 'Push Times'



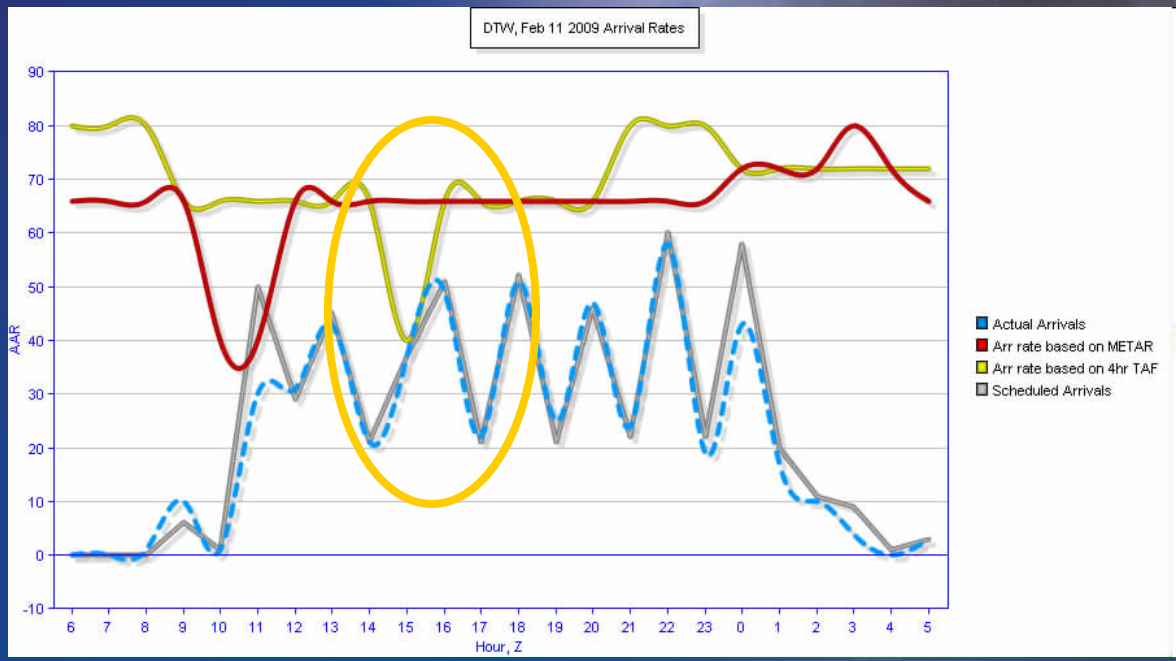
WITI in Action

METAR Based							Departure Rates		Arrival Rates		4hr Lookahead Based						
Hour	Wind Speed	Wind Gusts	Wind Direction	Ceilings	Visibility	Significant Weather	Scheduled	Actual	Scheduled	Actual	Hour	Wind Speed	Wind Gusts	Wind Direction	Ceilings	Visibility	Significant Weather
6Z	4	0	290	4	10	-RA	0	0	0	0	6Z	0	0	-1 (VAR)	722 (UNL)	10	none
7Z	4	0	0	9	9	-RA	0	0	0	0	7Z	0	0	-1 (VAR)	722 (UNL)	10	none
8Z	6	0	350	3	9	none	0	0	0	0	8Z	0	0	-1 (VAR)	722 (UNL)	10	none
9Z	7	0	10	1	0.8	-RABR	2	2	0	0	9Z	5	0	250	35	5	-RABR
10Z	7	0	70	1	2.5	-RABR	10	10	3	1	10Z	8	0	10	4	2	-RABR
11Z	6	0	50	3	2.5	RABR	10	9	0	0	11Z	8	0	10	4	2	-RABR
12Z	7	0	100	3	6	-RA	10	10	1	1	12Z	8	0	10	4	2	-RABR
13Z	7	0	100	44	9	-RA	10	8	3	3	13Z	8	0	10	4	2	-RABR
14Z	5	0	90	32	5	RABR	5	5	4	3	14Z	8	0	10	4	2	-RABR
15Z	6	0	60	33	5	RABR	4	3	34	29	15Z	8	0	10	4	2	-RABR
16Z	8	0	50	3	2.5	+RABR	41	35	3	4	16Z	12	20	120	8	3	-SHRA
17Z	5	0	90	25	2.5	RABR	3	3	8	9	17Z	12	20	120	8	3	-SHRA
18Z	6	0	90	3	2.5	-RA	9	8	36	34	18Z	12	20	120	8	3	-SHRA

- Further investigation shows forecast ceilings were lower than observed.
- Note – this is the only place where TAFs are archived

WITI In Action

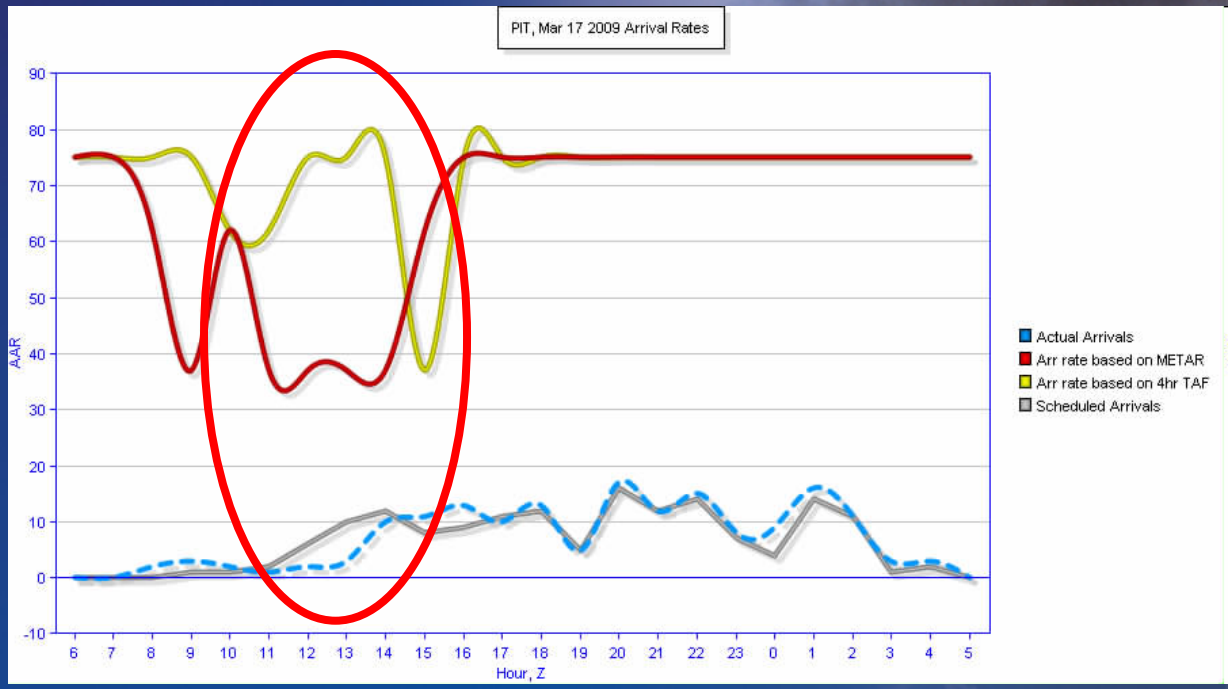
- Ceilings lifted between 16-18Z
- More planes landed then allowed by TAF because conditions were better than forecast



METAR Based							Departure Rates		Arrival Rates		4hr Lookahead Based						
Hour	Wind Speed	Wind Gusts	Wind Direction	Ceilings	Visibility	Significant Weather	Scheduled	Actual	Scheduled	Actual	Hour	Wind Speed	Wind Gusts	Wind Direction	Ceilings	Visibility	Significant Weather
6Z	9	0	220	4	3	BR	0	0	0	0	6Z	0	0	-1 (VAR)	722 (UNL)	10	none
7Z	5	0	180	8	3	BR	0	0	0	0	7Z	0	0	-1 (VAR)	722 (UNL)	10	none
8Z	0	0	0	5	2.5	BR	0	0	0	1	8Z	0	0	-1 (VAR)	722 (UNL)	10	none
9Z	3	0	100	2	1.5	BR	2	3	6	10	9Z	10	0	200	10	4	BR
10Z	5	0	130	1	0.1	FG	26	25	1	1	10Z	10	0	200	10	4	BR
11Z	5	0	140	1	0.1	FG	17	17	50	30	11Z	10	0	200	10	4	BR
12Z	8	0	160	1	0.1	-RABR	31	31	29	31	12Z	10	0	200	10	4	BR
13Z	7	0	160	2	0.5	RABR	39	39	45	43	13Z	10	0	170	7	2	-RABR
14Z	9	0	160	2	2	-RABR	54	53	21	21	14Z	10	0	170	7	2	-RABR
15Z	11	[illegible]	[illegible]	4	2	RABR	19	19	37	37	15Z	5	0	120	[illegible]	1	FGVV001
16Z	8	0	160	22	2	-RABR	39	40	51	49	16Z	7	0	140	7	2	-RABR
17Z	9	0	170	17	5	BR	53	55	21	22	17Z	7	0	140	7	2	-RABR
18Z	7	0	180	16	4	-RABR	21	21	52	51	18Z	7	0	140	7	2	-RABR
19Z	7	0	[illegible]	9	4	-RABR	52	52	21	25	19Z	10	0	[illegible]	[illegible]	4	-RABR

WITI In Action

- Fog stayed in until 16Z
- No impact on traffic, still a good research and case study tool



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6Z	0	0	0	722 (UNL)	3	BR	0	0	0	0	6Z	0	0	-1 (VAR)	722 (UNL)	10	none
7Z	3	0	320	722 (UNL)	3	BR	0	0	0	0	7Z	0	0	-1 (VAR)	722 (UNL)	10	none
8Z	3	0	290	722 (UNL)	2	BRBCFG	0	0	0	2	8Z	0	0	-1 (VAR)	722 (UNL)	10	none
9Z	0	0	0	1	0.3	FG	3	3	1	3	9Z	0	0	0	722 (UNL)	5	BR
10Z	0	0	0	1	0.1	BR	17	16	1	2	10Z	0	0	0	722 (UNL)	2	BR
11Z	5	0	270	1	0.1	FG	13	17	2	1	11Z	0	0	0	722 (UNL)	2	BR
12Z	0	0	0	1	0.1	FG	10	9	6	2	12Z	0	0	0	722 (UNL)	4	BR
13Z	0	0	0	1	0.1	FG	10	4	10	3	13Z	0	0	0	722 (UNL)	4	BR
14Z	0	0	0	1	0.1	FG	10	9	12	10	14Z	0	0	0	722 (UNL)	10	none
15Z	3	0	130	1	0.1	BR	9	9	8	11	15Z	0	0	0	722 (UNL)	1	FG

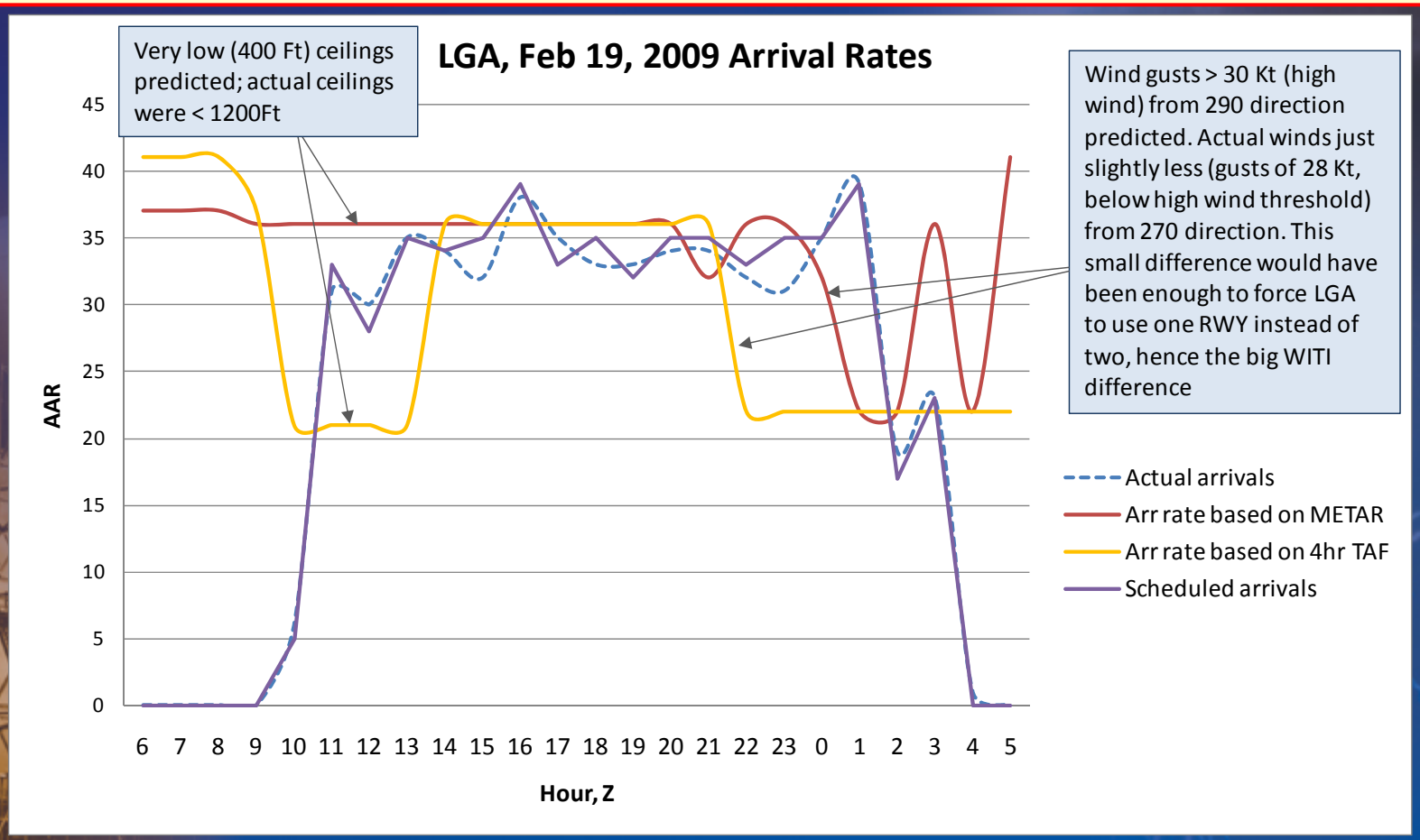
WITI in Action

Eastern Region, LGA, Feb 19, 2009

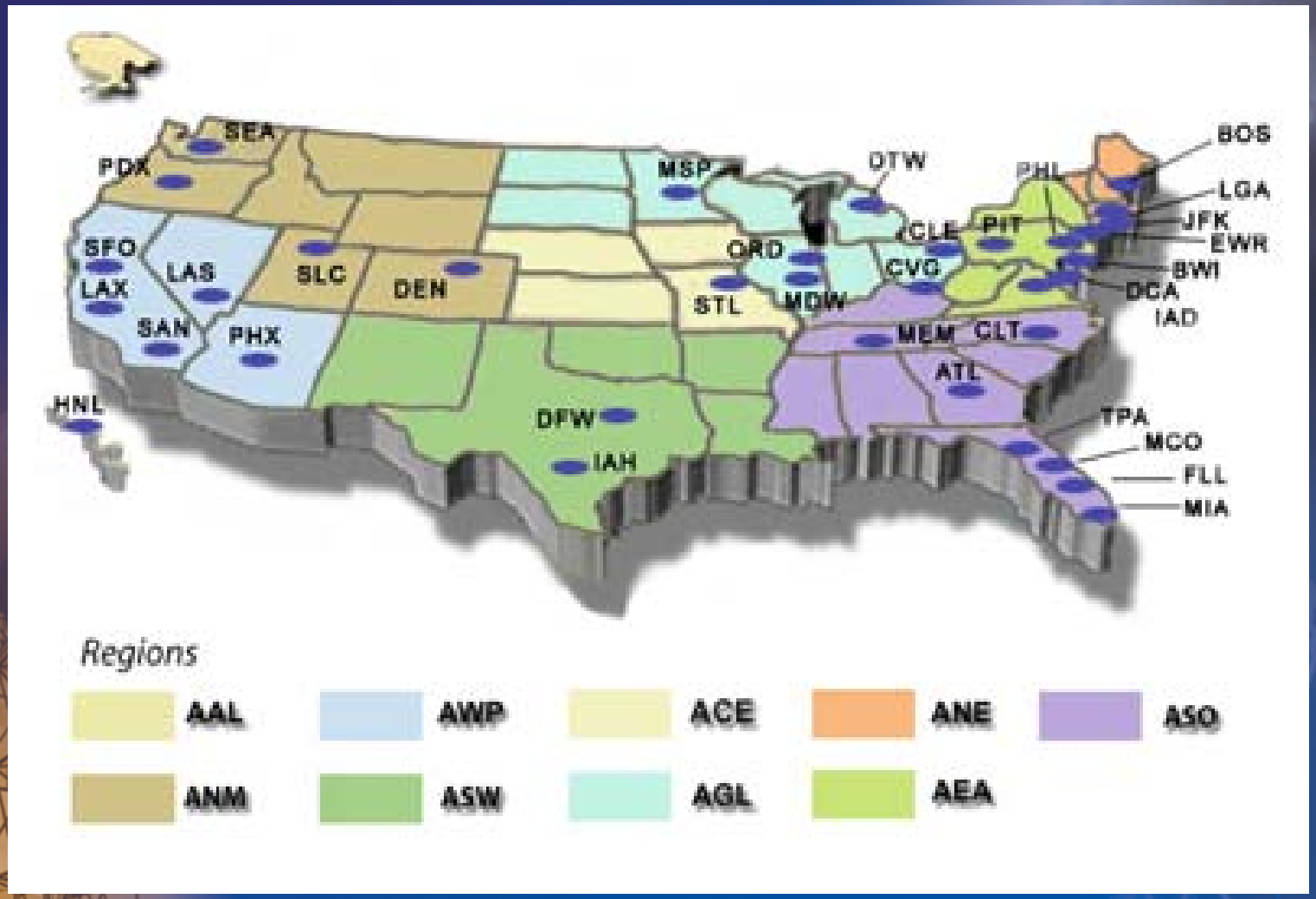
Thursday, February 19, 2009

Strong winds at Northeast airports including LGA

Terminal WITI and WITI-FA for LGA differ significantly – see notes on chart below



T- WITI Sites



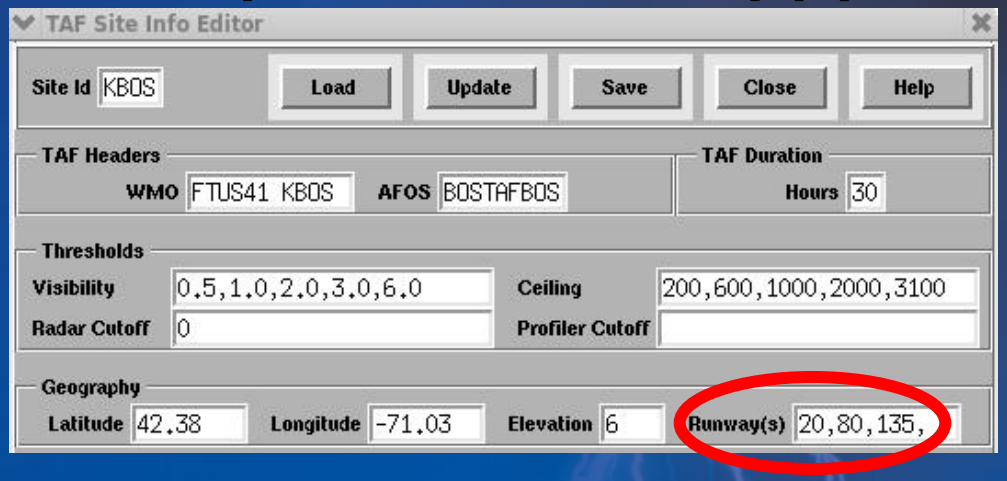
35 OEP Airports

AvnFPS

Operational Impact Capability

TAF Impact Writing

- **A forecast of strong crosswinds at a major hub can cause ground delays. Use BOS as an example.**
  - ***Need runway orientations to calculate wind components orthogonal and parallel to runway(s)***



Runway 4R/22L referenced as [0]
Runway 9/27 referenced as [1]
Runway 15R/33L referenced as [2]

TAF Impact Writing

wind[n].cross = crosswind for runway #n

wind[n].runway = parallel component to runway #n

wind[n].shift = tail-to-head or head-to-tailwind change from last forecast group (T or F)

- **Edit /awips/adapt/avnfps/etc/tafs/KBOS/impact.cfg**

```
[conditions]
items=cond_1,cond_2,cond_3,cond_4
                    :
                    :

[cond_3]
tag=wshft
level=2
text=significant windshift on 15R/33L
expr=wind[2].shift and wind[2].runway>15

[cond_4]
tag=xw
level=3
text=significant crosswind on 15R/33L
expr=wind[2].cross>15
```

```
TAF
KBOS 181720Z 1818/1924 12015KT P6SM SCT040CB
     FM182100 13020G30KT P6SM VCTS BKN030CB
      TEMPO 1821/1822 1SM +TSRA OVC010CB
     FM182230 25020G40KT 6SM +SHRA OVC020
     FM190100 27020G30KT
     FM190500 28020G25KT
     FM191200 30010KT P6SM SKC=
```

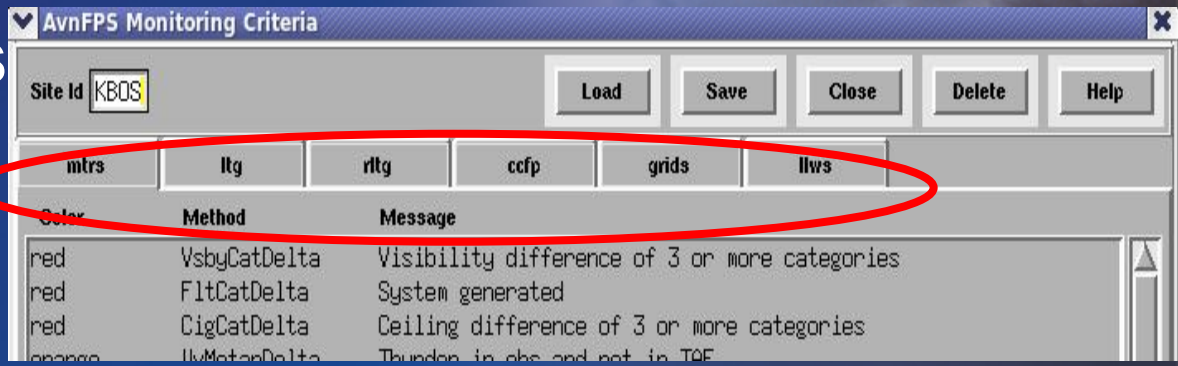
```
--- Impact ---
significant windshift on 15R/33L
```

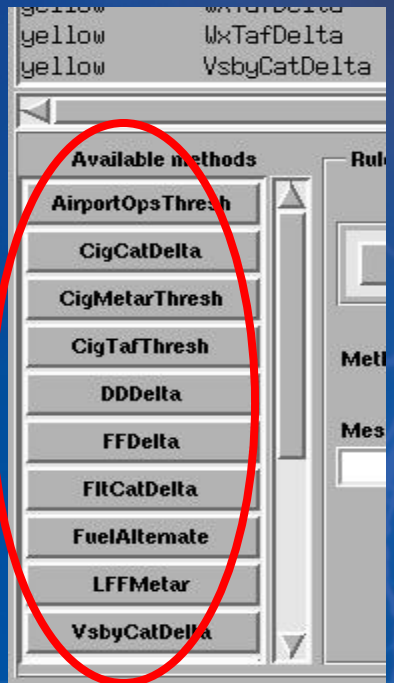
```
TAF AMD
KBOS 141321Z 1413/1518 06015G25KT P6SM SCT015 OVC025
     FM141700 05025G35KT 4SM -RASN BR BKN008 OVC013
      TEMPO 1422/1502 1
     FM150200 03015G20K
      TEMPO 1502/1506 1
```

```
--- Impact ---
Fuel-Alternate
Significant crosswind on 15R/33L
```

Monitoring Customization

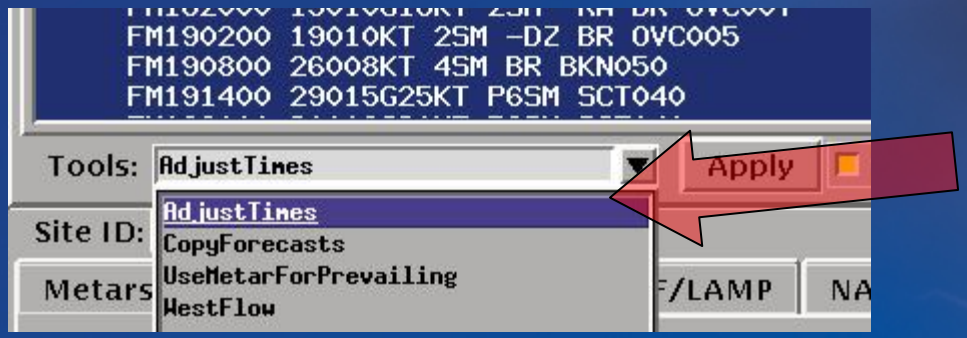
- AvnFPS Rule Editor allows customized rules of many sources
  - *METARs*
  - *Lightning*
  - *LLWS*
  - *CCFP*
- See AvnFPS User's Guide Appendix B for more details





TAF Editor Tools

- Dropping new modules into the /toolpy directory will cause it to show up in the TAF Editor



- More details on writing TAF Editor tools can be found in Appendix F of the AvnFPS User's Guide

Best Practice

- **Routine three hour amendments (at least the OEP Airports)**
  - *Already done for BOS, NYC Metros, CLT*
  - *Avg drop of 0.03 in POD from 0–3 hrs vs 3–6 hrs and 0.05 to 0.12 for sites that do not issue 3hr amd*
  - *PHL and PIT (very soon)*
- **CONSISTENCY between products**
- **Coordinate with CWSUs**
- **CCFP awareness**
- **OUTREACH – OUTREACH**

We have go to them!

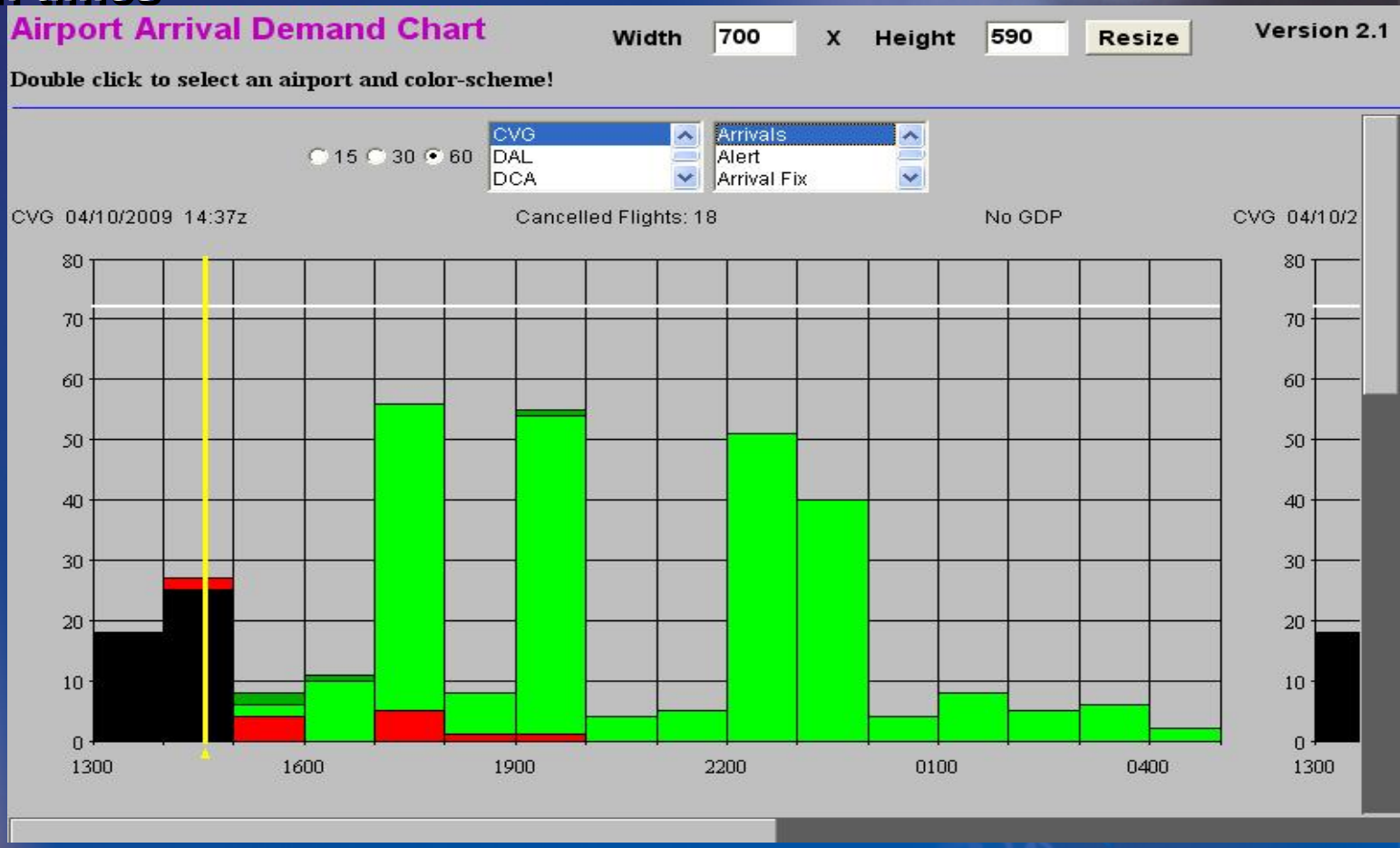
ex) AOPA calendar

Best Practice

- Focus on the first six hours of the forecast
- An average of the guidance is often a good forecast.
- Binghamton TSRA philosophy with CLIMO.
- Research / Case Studies
  - *Level 3 CWSU forecaster exchange / visit*
  - *Level 4 Single Case*
  - *Level 5 Conducts multiple aviation reviews*

Best Practice

- Check Arrival Fix
- Notice push times



http://www.fly.faa.gov/Products/AADC/aadc.html

The Future

- Big jump over the next 15 years (NextGen)
- Aviation services have evolved but not as much as other programs
- TAFs have not changed since 1950s!
- World's first satellite was not launched until 1960

Future

- Text to Grids
- LFM --> 5 KM models
- Dual Pole Radar
- Hourly Forecasts

Future

- NextGen IOC of 2013
  - *Turbulence*
  - *Icing*
  - *Convection*
  - *Ceiling and Visibility*
  - *Wind*
  - *Temperature*
- Feasibility study underway to use LAMP, however prefer WFO data

Future

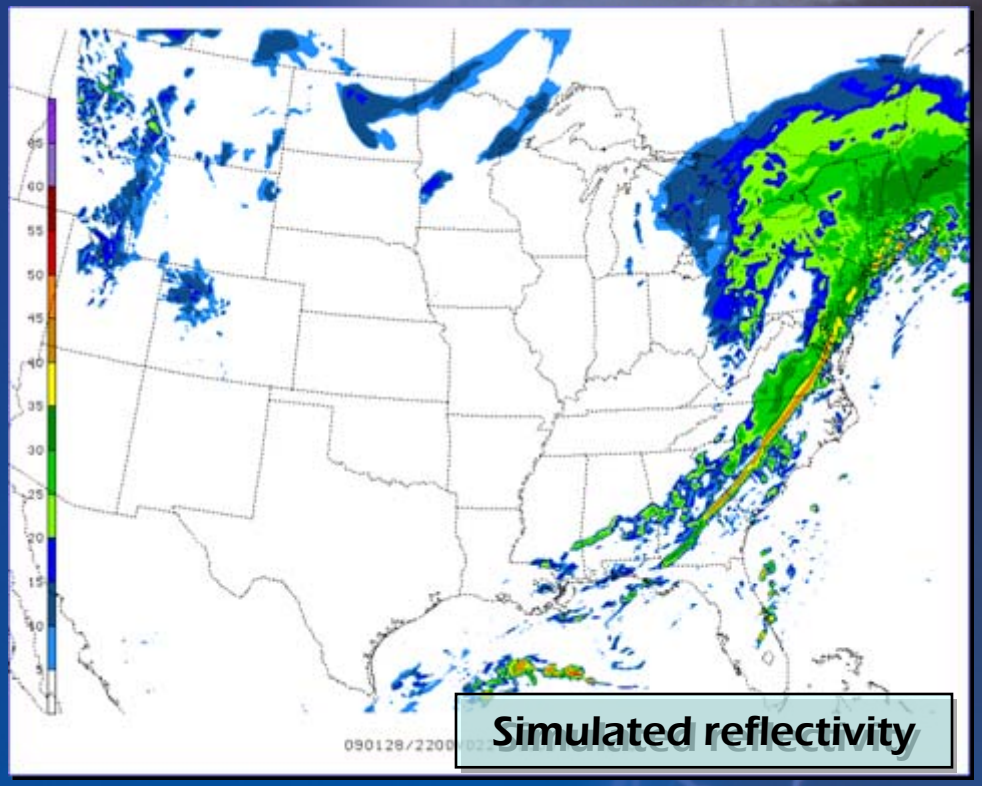
- **Strong Customer Request**
  - *U.S. Coast Guard*
  - *Southwest Airlines*
  - *United Airlines*
  - *Delta Airlines*
  - *AOPA*
  - *Helicopter Pilots*
  - *Ties into DSS*

Remember the last word in our agency name

*National Weather **SERVICE***

Pilots going beyond the basics

- Internet is full of relevant supplemental data
  - *MOS*
  - *Model-based forecasts*
    - Simulated reflectivity
  - *Thermodynamic diagrams*
    - Non-standard convective indices
  - *QPF*
  - *High resolution graphics*
    - Satellite



The End