

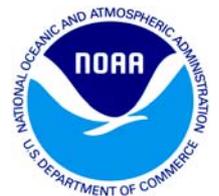
GSD'S Aviation Wx Program

1980 → NextGen

Aviation Wx Forum
16 April 2009

16 April 2009

Aviation Wx Community Forum



Long History of Support for Av Wx

Funded by FAA and NOAA

Provided local wind info for landing/takeoff config at Stapleton Airport (early 1980s)

Built/maintain comprehensive real-time data facility

Rapid Update Cycle (RUC): Recommendation by Aviation Wx Forecasting Task Force (1986)

Developed key met systems for NWS forecasters (e.g., AWIPS, GFE). GSD has much experience understanding and defining forecast process.

Long History (cont.)

Funded by FAA and NOAA

Thin-client applications:

Volcanic Ash Coordination Tool (VACT)

Weather Information Decision Aids (WIDA)

Fire Weather (FX-Net)

Aviation Digital Data Service (ADDS)

Real-time Verification System (RTVS) for aviation

*Funded by FAA and NOAA

Hourly Updated NWP Models

RUC – current
oper model - 13km

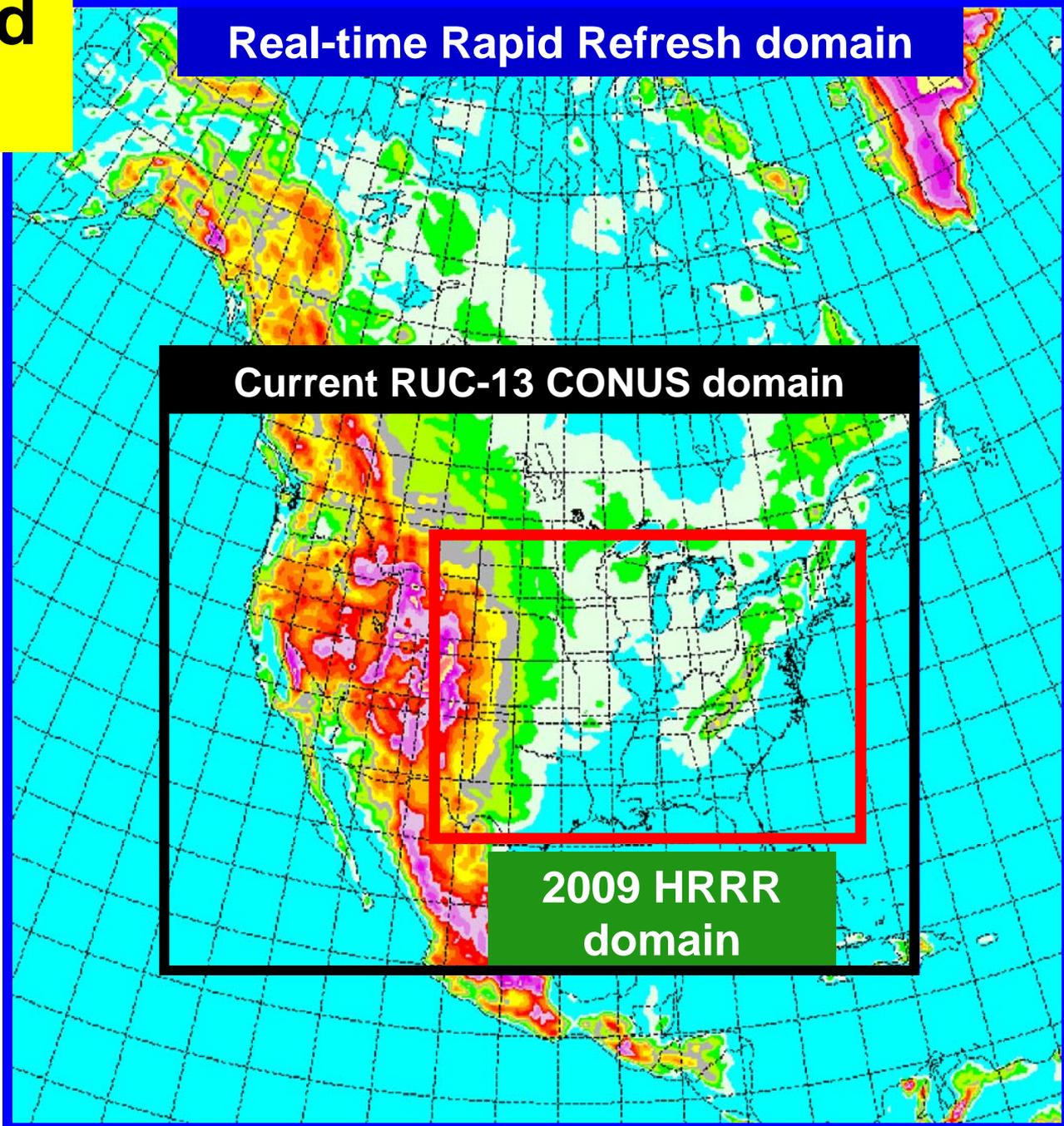
**Rapid Refresh
(RR)** – replace
RUC at NCEP in
2010

**HRRR - Hi-Res
Rapid Refresh
- Experimental 3km
-2009 expansion**

16 April 2009

12-h fcst each hour

Real-time Rapid Refresh domain

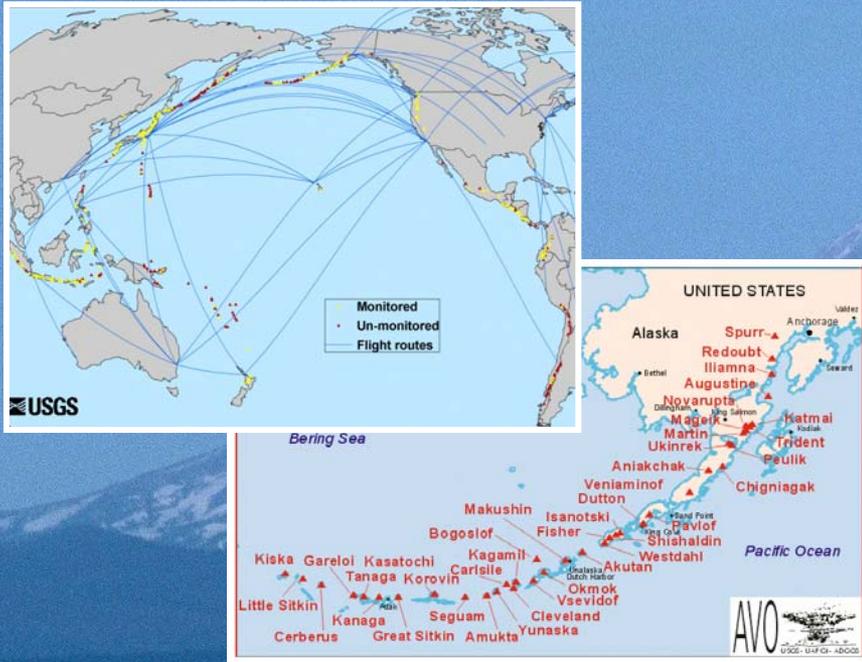


Current RUC-13 CONUS domain

2009 HRRR
domain

Volcanic Ash Coordination Tool

Currently supporting Mt. Redoubt eruptions



USGS photo



Ash reaches flight levels
20-25 times each year
(worldwide)

Mt Redoubt



KLM Flight in 1989 (Mt Redoubt)

All engines failed on descent to Anchorage and plane fell 13K ft before restarting. Came within 1-2 min of crashing.

231 passengers/crew



Damage: \$80M



Cooling Turbine

VACT

VACT enables AK Vol Ash Advisory Ctr (VAAC), ZAN CWSU, and AK Vol Observatory (USGS) to:

view/interact with identical info (e.g., satellite imagery, fcsts generated by ash dispersion models)

collaborate in real-time to ensure that forecasts for ash are fully consistent



CWSU



VAAC



AVO

Benefits of working with Alaska decision-makers.....

Can-do attitude!

Side-trips.



gary.hufford@noaa.gov

Weather Information Decision Aids (WIDA)

Participants:

FAA SW Region
FAA AWRP
DFW CWSU
ESRL/GSD
NWS SR HQ

Funding:

FAA AWRP
NWS HQ
NWS SR HQ



Objectives:

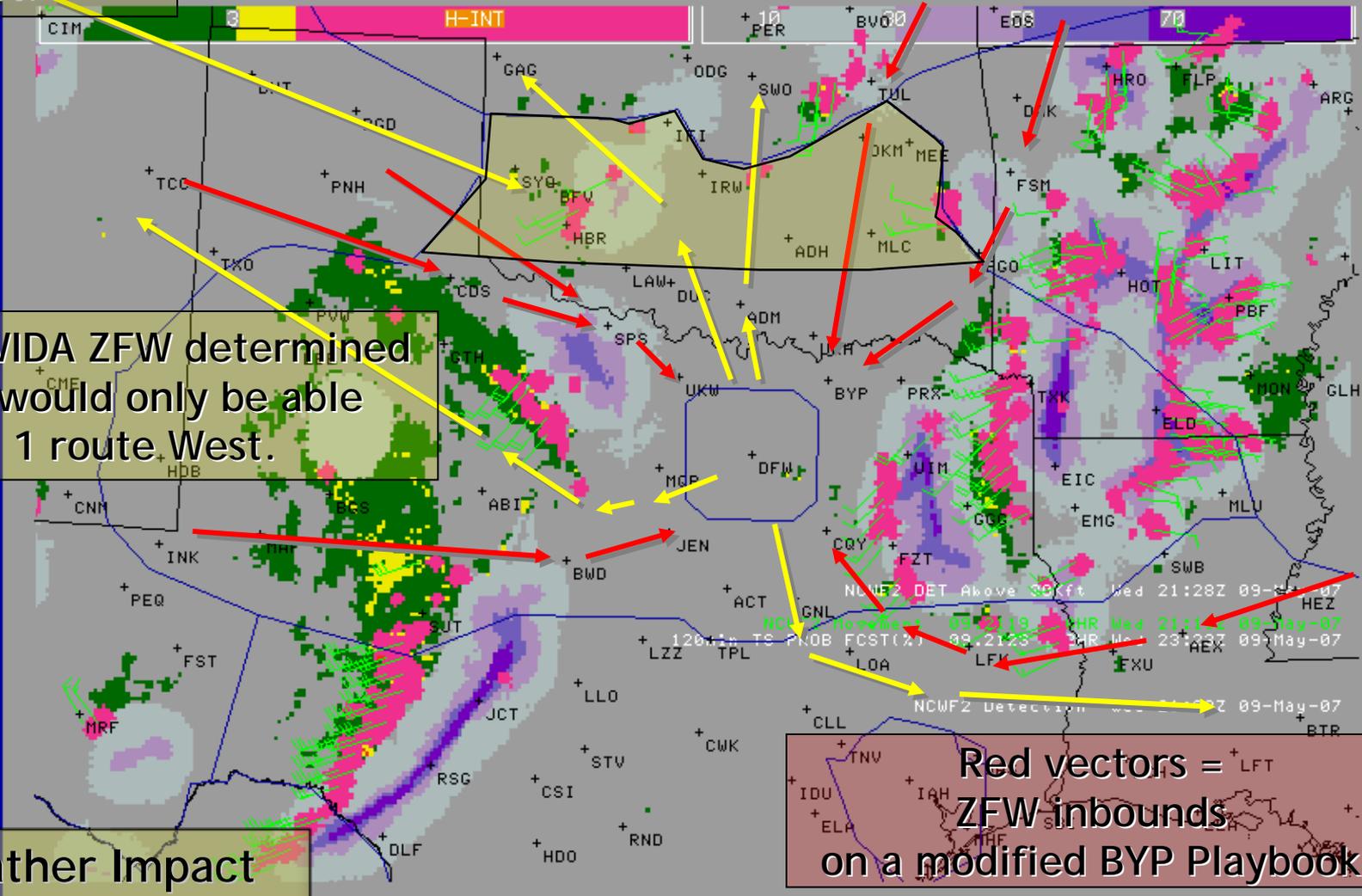
Develop and test concepts for decision aids based on aviation ops info and weather forecasts generated by AWRP algorithms.

Gather feedback from users to assess the utility of these aids to aviation ops. Feedback via trusted partner—CWSU MIC at DFW

Sectors overloaded with Acft.

Tactical Convective Hazards Product Viewer

- ZFW ARTCC**
Click on box to display Overlays:
- States
 - ARTCC Areas
 - Jet Routes
 - VORs
 - DFW TRACON
 - IAH TRACON
 - STAR
-
- Convective Products:**
- Detection
 - 30min TS PROB FCST
 - 60min TS PROB FCST
 - 90min TS PROB FCST
 - 120min TS PROB FCST
 - Movement
 - Above 15Kft
 - Above 30Kft
 - 6h CCFP Text
 - 4h CCFP Text
-
- PACE Weather Impact Decision Aid**
- 6h CCFP
 - 4h CCFP
 - 2h CCFP
-
- ATC application of two hour thunderstorm forecast**
May 9, 2007 21:28Z



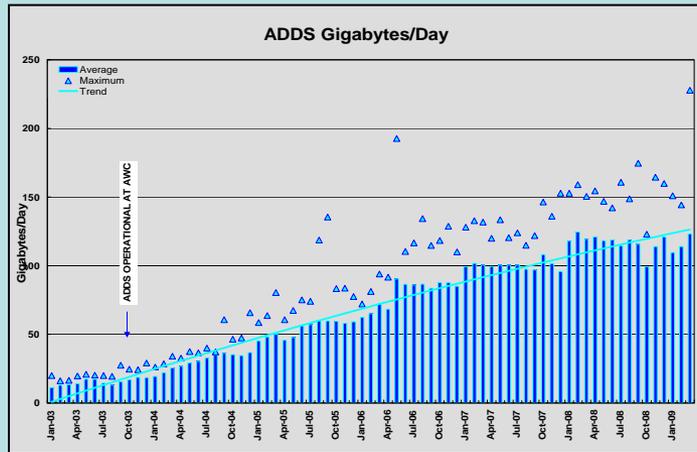
Red vectors = ZFW inbounds on a modified BYP Playbook

Solid red areas = storm tops FL300 or above

Aviation Digital Data Service (ADDS)

It's about the users!

ADDS enables aviation decision-makers to efficiently acquire weather as grids, graphics, or text.



Development Partnership:

GSD worked with NCAR (lead org.) and NWS AWC



Award:

Government Technology Leadership (2000)



Accomplishments:

ADDS runs operationally at NWS AWC image and graphics servers

Text server in ops soon (user specifies constraints; server returns XML & CSV)

GSD's Experience and Expertise

GSD has worked very closely with aviation users and has achieved in-depth understanding of their needs.

- FAA Traffic Managers
- Other aviation users (e.g., pilots, airlines)
- NWS forecasters (CWSUs, WFOs, fire wx)

NextGen Projects*

Overarching Goal:
Enable Common
Weather Picture

NextGen Network-enabled Weather (NNEW)

Weather Info Database (WIDB)

Single Authoritative Source (SAS)

Data assimilation, models, and post-processing

*Funded by NOAA and FAA

NextGen Projects*

Overarching Goal:
Enable Common
Weather Picture

Forecasting Process

Verification: Net-enabled Verif Service (NEVS)

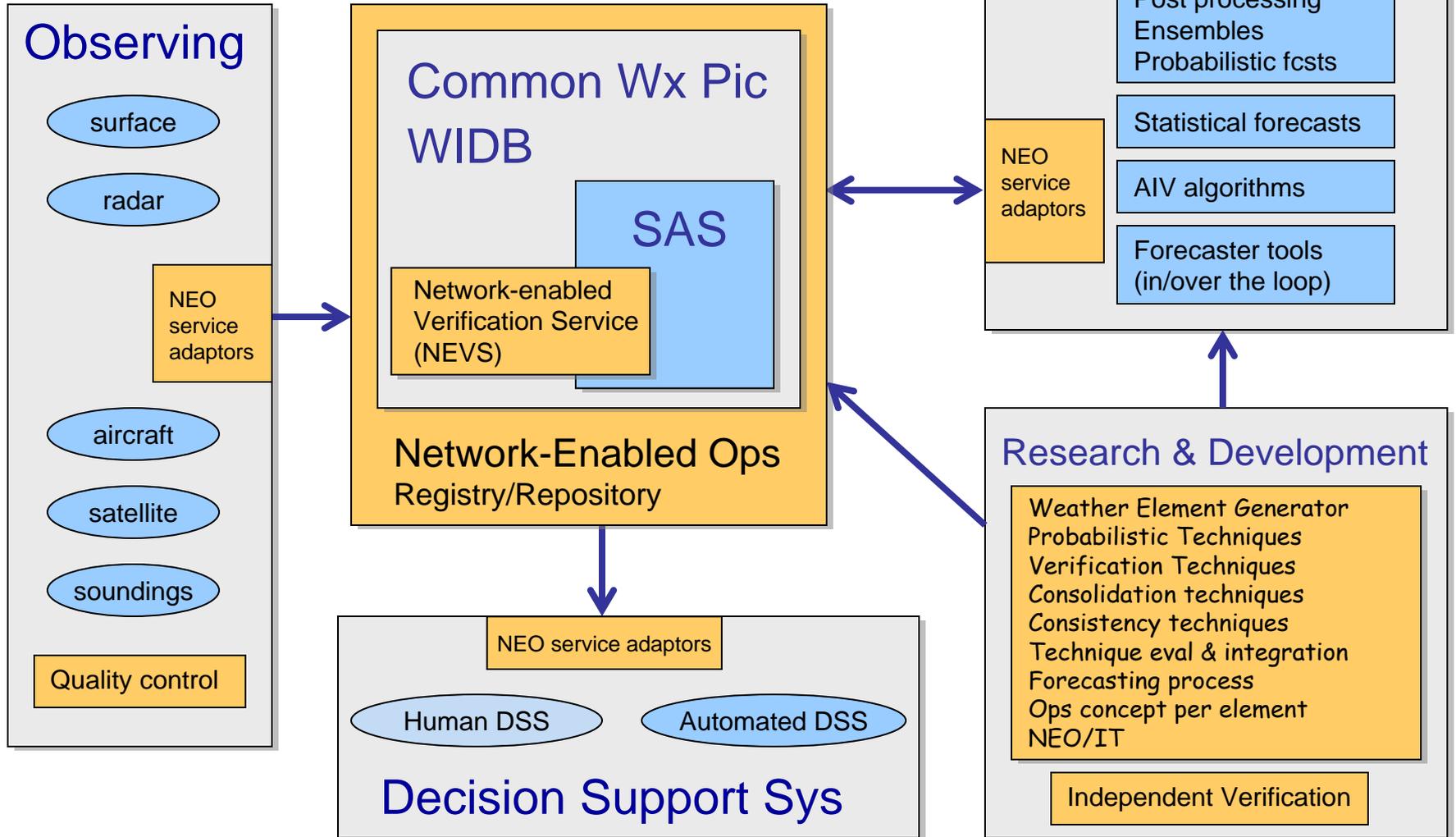
Obs: Met Assim Data Ingest Sys (MADIS)

GSD serving on key JPDO Teams (ITES, EI, Integ)

*Funded by NOAA and FAA

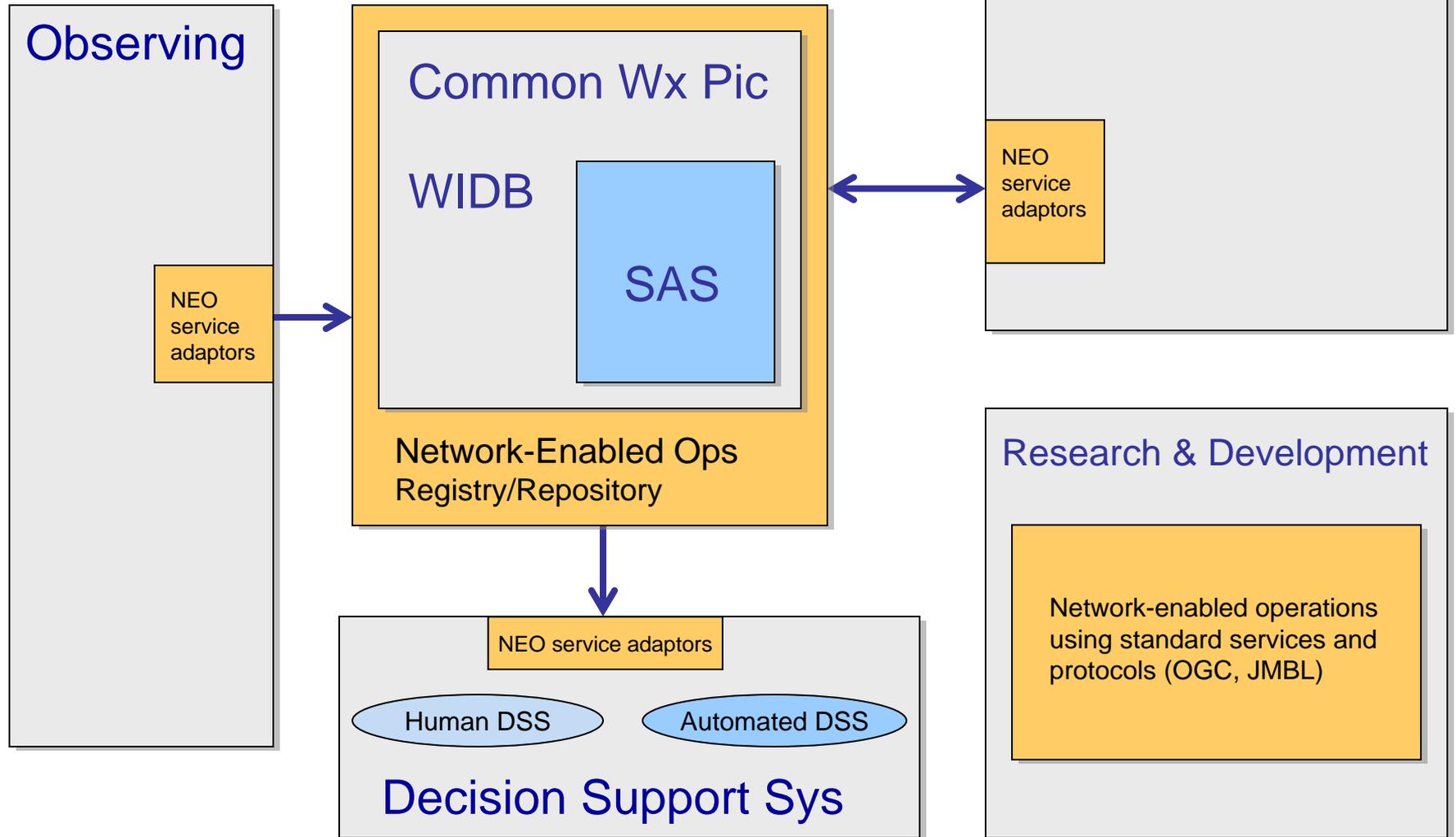
GSD Support for NextGen

GSD tasks in gold



NextGen Weather Enterprise

NEEW tasks in gold



NextGen Network-enabled Ops



"At the heart of the NextGen concept is network-enabled info exchange"

- Foundation for robust, efficient, secure, and timely transport of info
- Scalable: adapts to demands/growth in NAS ops
- Minimal duplication & all decision-makers have identical info (common weather picture)

NNEW Partners & Primary Tasks

Each leads specific efforts & contributes to others.

MIT/LL: Registry/repository, OGC WFS

NCAR: Use cases, OGC WCS

GSD: Data/metadata standards, end-to-end testing, demos, work with FAA Tech Center

MITRE Corp: Architecture



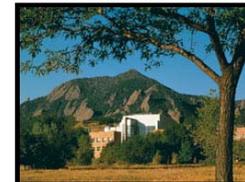
WJHTC NVEC



MIT/LL



NCAR/RAL



NOAA/GSD

NNEW Challenges

Identifying performance rqmnts (JPDO EI team)

Support for legacy systems (WARP, ETMS)

Support for new/evolving systems (TMA, ERAM, FAST)

Defining/using wx "features" for Decision Support Sys

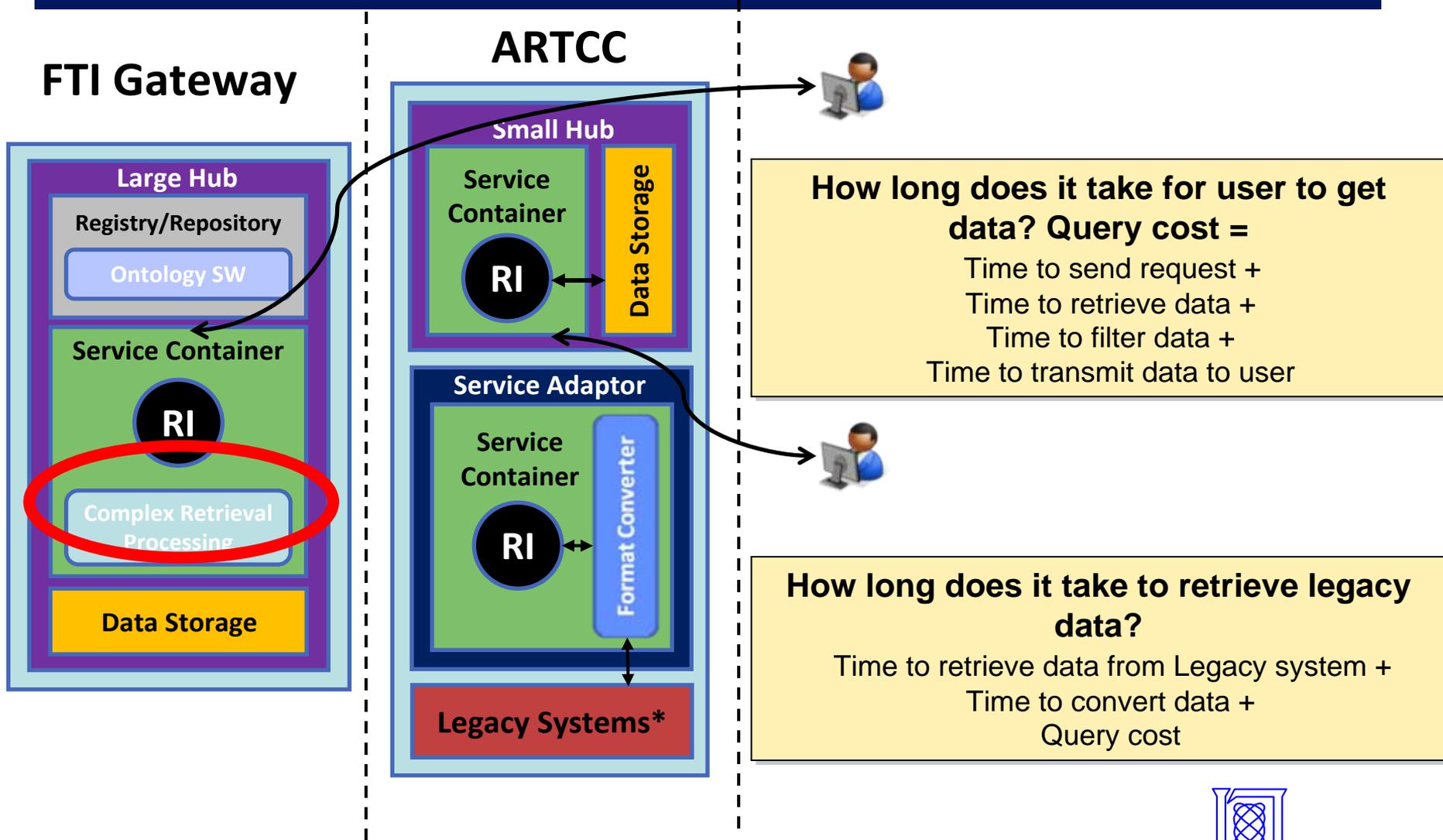
Ensuring adequate performance:

XML is verbose. Will efficient XML help?

Retrieving info from databases

2013 IOC is just around the corner

Runtime Cost of Retrieving Data



How long does it take for user to get data? Query cost =

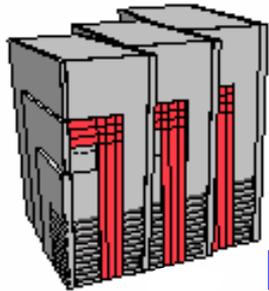
Time to send request +
 Time to retrieve data +
 Time to filter data +
 Time to transmit data to user

How long does it take to retrieve legacy data?

Time to retrieve data from Legacy system +
 Time to convert data +
 Query cost

Radar Assimilation and Model-based *probabilistic* storm guidance

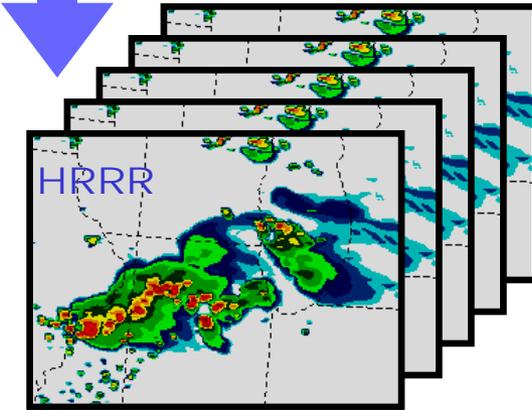
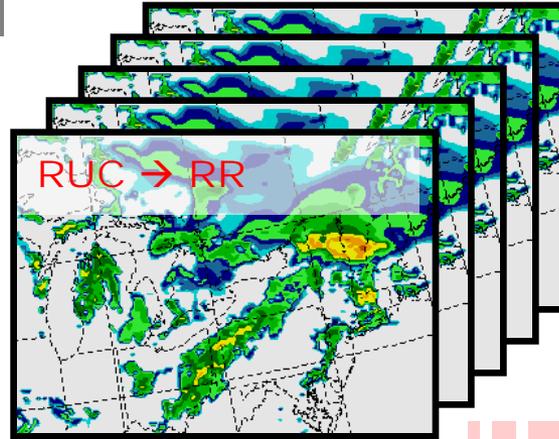
Hourly updating model



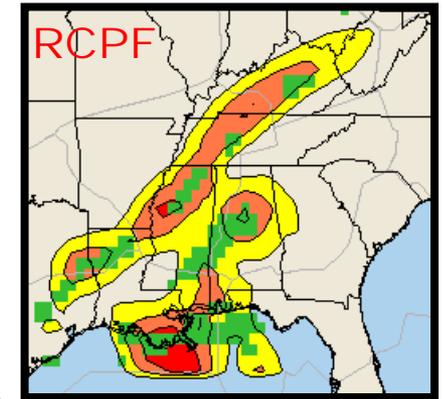
Data Assimilation cycle



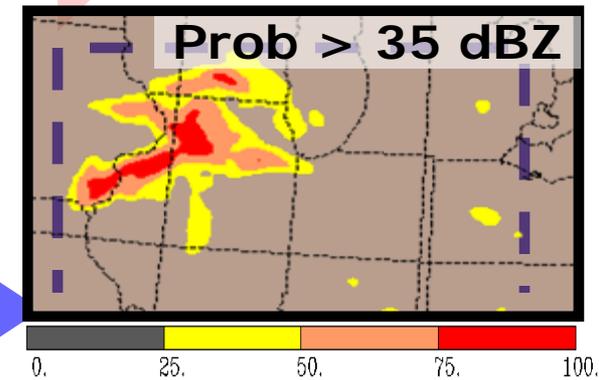
Observations



time-lagged ensembles



Model post-processing



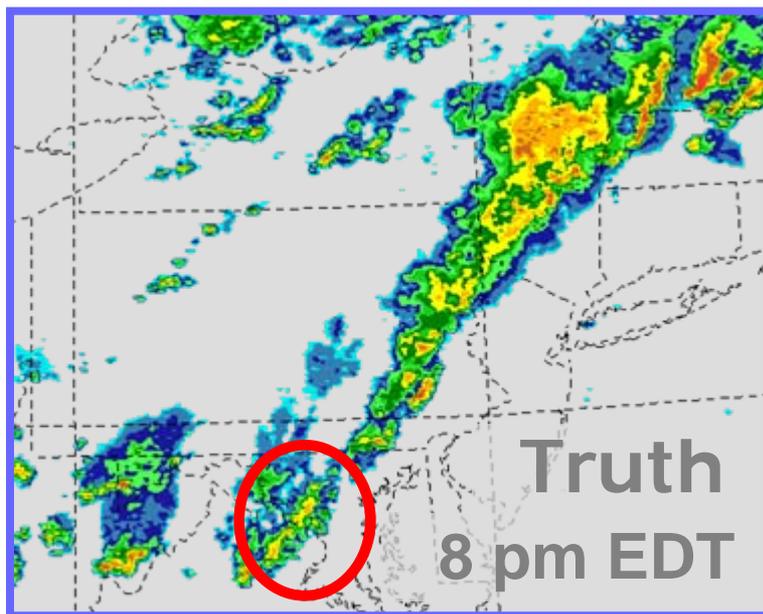
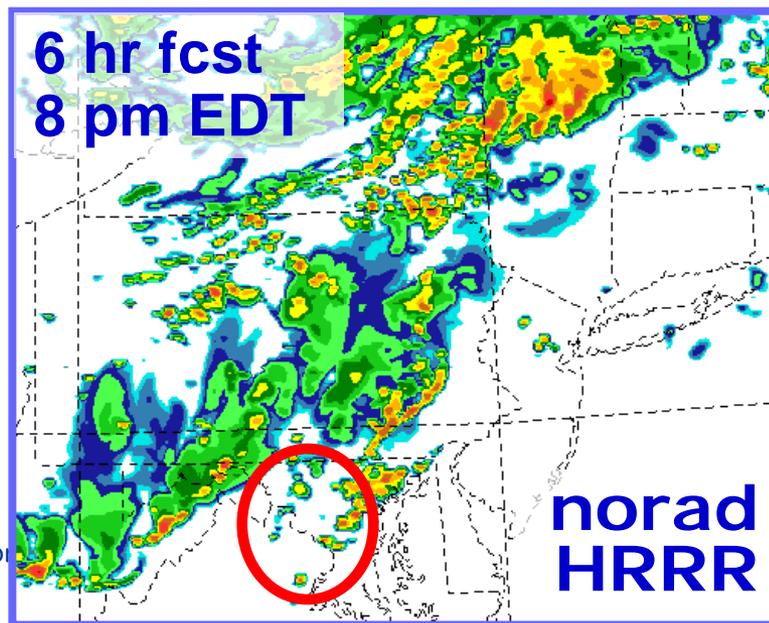
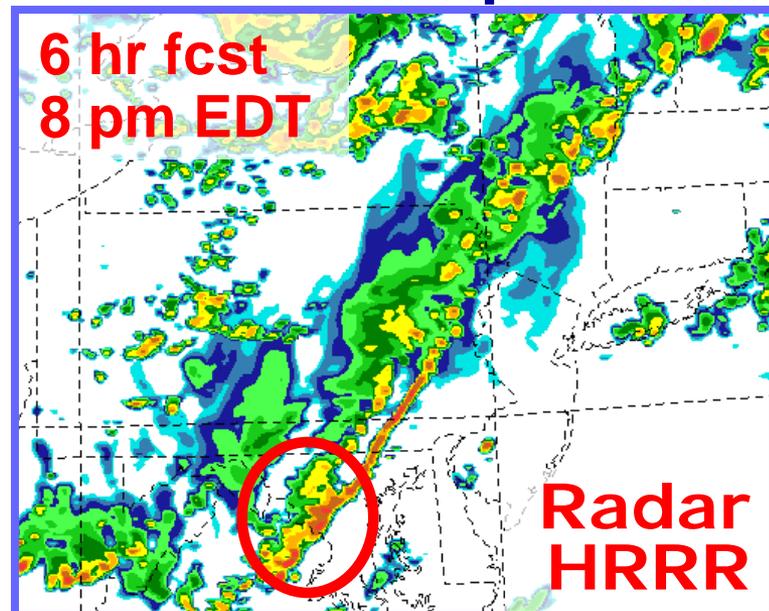
Probability products

(HRRR-based)
HCPF
Storm-scale
probability
information

Real-time HRRR example

High resolution needed for realistic storm structure (storm-types, line gaps, etc.)

Radar assimilation needed for accurate storm locations (and improves structure, etc.)



16 April 2009

Very Short-Range Ensemble Forecasts - **VSREF**

- Updated hourly w/ available members valid at same time

VSREF members

RR – hourly

time-lagged (TL) ensemble members

- 2012 - ensemble RR

ESRL 3km HRRR (incl. TL ensemble)

- 2012 - proposed HRRR at NCEP

- future HRRR ensemble from RR-ens

NAM / NAM ensemble

GFS / GFS ensemble

SREF (updated every 6h)

**VSREF –
Hourly
Updated
Probabilistic
Forecasts
= TL+
ensemble**

VSREF to include subhourly

- merged RCPF/extrap

- similar for icing, turb, etc.

The vision for high-frequency weather models in NextGen

Forecasting Process

Evaluate current forecaster tools

Define role of forecasters in NextGen era and develop tools to support that role.

Objective and subjective assessments

Collaborative effort with MDL and NCAR. Others?

Forecasting Process (cont.)

Objective Assessments:

Quality of forecasts generated with forecasters
"in-the-loop" and "over-the-loop"

Subjective Assessments:

Set up ops systems and scenarios for testing
Use forecasters in tests

Forecasting Process (cont.)

Build end-to-end testbed at GSD*

Leverage experience and infrastructure from previous work (e.g., AWIPS, GFE)

Incorporate current forecaster tools and new tools developed by GSD and partners

Conduct thorough end-to-end testing

Conduct iterative development/evaluation

*coordination is starting with NWS and potential development partners to ensure max utility of approach

Network-enabled Verification Service

Verification when it matters the most to ATM ops

Advanced verif techniques to assess quality of wx fcsts in the context of key aviation ops decisions

Sector approach

Wx Impact Indices

Min-cut strategies

Key planning times (e.g., strategic telecons)

Powerful web interface to efficiently access integrated info from a relational database

NEVS Status

Initial version built and tested

- Proof-of-concept

- End-to-end capability

- Integrates all information on-the-fly

NEVS will support real-time evaluation of CoSPA and other convective algs in June 2009. Users will be able to access and operate NEVS.

Operational version ready for 2013 IOC

GSD Verification Program

Building strong core of verification concepts and engineering infrastructure to meet NextGen rqmnts.

Gaining significant synergy for NextGen by working with JPDO Integration and EI Teams.

Verification techniques and tools will be able to adapt to evolving decision processes and forecast capabilities

NEVS will fulfill NextGen verification requirements and is on target to support IOC.

GSD and Partners are Working to Enhance Efficiency of the NAS



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