

NWS Forecast Grids Served by an NNEW Web Coverage Service

AIXM/WXXM Conference

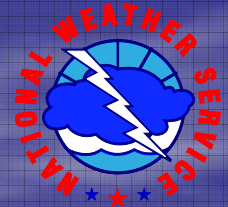
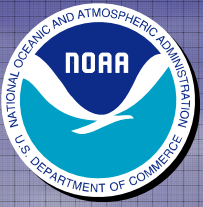
Steve Olson

Meteorological Development Laboratory

Office of Science and Technology

NOAA's National Weather Service

May 4-6, 2010



Acknowledgements

The following individuals have contributed significantly to this work:

- Mark Oberfield
- Daniel Gilmore
- James Wantz
- Po Li
- Chris Adams

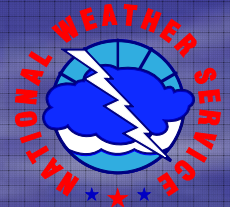
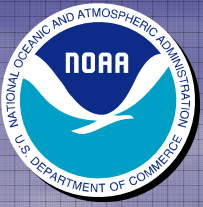
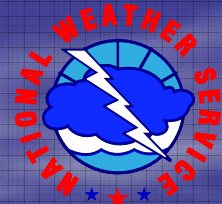
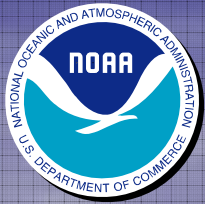


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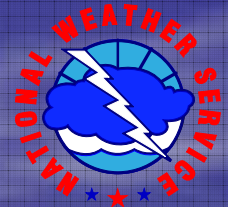
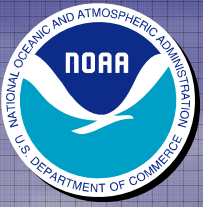


Origins of NextGen Net-Enabled Weather (NNEW)

- Weather accounts for 70% of all air traffic delays within NAS
- The Next Generation Air Transportation System (NextGen) established to modernize technology supporting air traffic.
- Key component of Nextgen is Net-centric 4D Weather Cube ("the Cube").
- NNEW is the FAA-funded program supporting FAA's portion of the Cube

Flight	Gate	Remarks
FR3916	42	Cancelled
FR2372	41	Delayed
FR3002	54	Cancelled
FR232	53	Cancelled
FR901	58	Cancelled
FR434	45	Delayed
FR034	55	Delayed
FR2314	48	Cancelled
FR203	44	Cancelled
FR584	56	

Oh no! My flight is delayed!

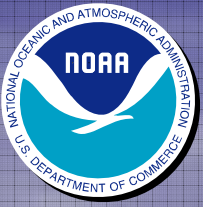


NNEW Specifics

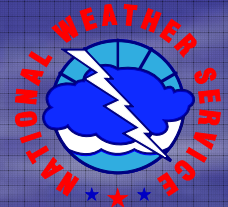
NNEW Goals:

- Provide a common weather picture of observations and short/long-term forecasts
- Consistent/reliable weather information
- Network that's available, secure, usable in real time.
- Use service oriented architecture approach

Bottom Line: Users can access data stream regardless of operating system or how data will be used

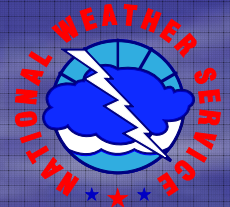
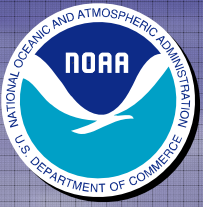


Process for accessing the Cube



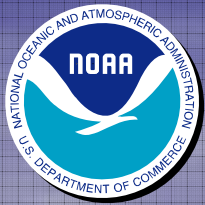
- 2 services are required to access the Cube
 - “Data Discovery” → Registry/Repository (Reg/Rep)
 - “Retrieval” → Data Access Service (WCS/WFS)

NWS offers both the Reg/Rep and WCS aspects

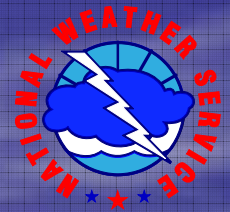


Reg/Rep Service – Data Discovery

- The reg/rep is a centralized location for storing metadata.
- Once metadata are found, reg/rep is the tool that describes the type of “service” and “endpoint” for where to find data.



Reg/Rep Service – Data Discovery (Cont'd)



WellGEO RegRep Admin UI

File View Tools Help

NextGen Metadata Registry/Repository
Weather COI

User ID:
Password:
Login

Search Explore Taxonomies

Search

Federated Query Options:
Local Query:
Select Query:
Find Related Objects:

Query Description:
Match on ANY Parameter:

Source Object ID:
Target Object ID:
Source Object Type:
Target Object Type:
Association Type ID:
Association Type:

Wind Speed NWS_WebCoverageService-01

Simple Detail XML

Object Type:

Name: NWS_WebCoverageService-01
Keywords:

Description:
NWS WCS serving gridded data products.

Related Link:

URL	Description

Endpoints:

URL	Name	Data Sets:										
http://188/wcs	WCSSoap	<table border="1"> <thead> <tr> <th>Name</th> <th>Fields</th> </tr> </thead> <tbody> <tr> <td>Corrective Probability</td> <td>[CorrectiveProbability]</td> </tr> <tr> <td>Wind Direction</td> <td>[WindDirection]</td> </tr> <tr> <td>Wind Gust</td> <td>[WindGust]</td> </tr> <tr> <td>Wind Speed</td> <td>[WindSpeed]</td> </tr> </tbody> </table>	Name	Fields	Corrective Probability	[CorrectiveProbability]	Wind Direction	[WindDirection]	Wind Gust	[WindGust]	Wind Speed	[WindSpeed]
Name	Fields											
Corrective Probability	[CorrectiveProbability]											
Wind Direction	[WindDirection]											
Wind Gust	[WindGust]											
Wind Speed	[WindSpeed]											

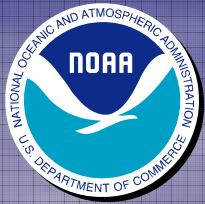
Responsible Organization: Meteorological Development Laboratory Email: Matthew.Peroutka@noaa.gov
Data Access Constraints: restricted
Data Security Constraints: unclassified

Service Model:
ID: Open Relationship

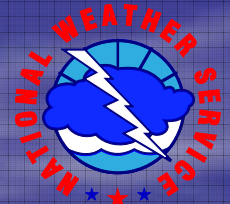
Find Related Objects

Row	Name	Type	Description	Status
2	Wind Direction	Dataset	NDFD wind direction represents the NWS forecaster's forecast for the direction of the wind at the surface	
3	Wind Direction	Dataset	NDFD wind direction represents the NWS forecaster's forecast for the direction of the wind at the surface	
4	Wind Gust	Dataset	NDFD wind gust represents the NWS forecaster's forecast for the speed of the wind gust at the surface	
5	Wind Speed	Dataset	NDFD wind speed represents the NWS forecaster's forecast for the velocity of the wind at the surface	
6	Wind Speed	Dataset	NDFD wind speed represents the NWS forecaster's forecast for the velocity of the wind at the surface	

Reg/Rep display from Wellgeo

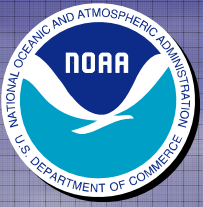


Data Access Service (WCSRI) – Retrieval Step

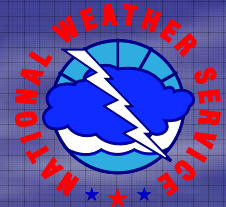


- A Web Service Description Language (WSDL) is used in conjunction with WCSRI.
- WSDL defines how an XML service behaves and instructs clients how to interact with service.
- 3 Simple Object Access Protocol (SOAP) functions used for retrieval using NWS WCSRI.
 - getCapabilities (inputs: None)
 - describeCoverage (inputs: urn)
 - getCoverage (inputs: urn, BoundingBox, TimePeriod, Identifier)

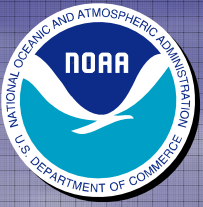
Soapui communicates well with WCSRI



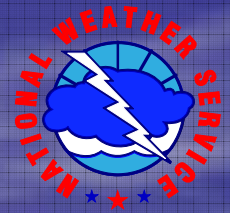
Weather Elements NWS will host for FY10 Capabilities Evaluation



- NWS will host 4 groupings of weather elements for this years NNEW Capabilities Evaluation:
 - National Digital Forecast Database (NDFD) basic weather elements
 - NDFD convective weather elements
 - National Digital Guidance Database (NDGD) weather elements
 - Autonowcaster (ANC) elements

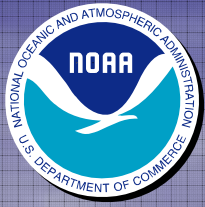


What is NDFD and NDGD?

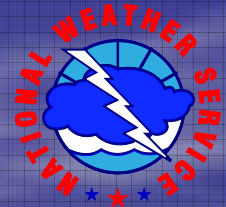


- NDFD contains a seamless mosaic of NWS digital forecasts
 - Allows users and partners to create wide range of text, graphic, and image products
 - Official NWS forecasts
- NDGD contains guidance – not the official NWS forecast
 - Forecasts and observations of sensible weather elements that relate to and supplement the NDFD
 - Digital data that help in the use and interpretation of NDFD such as model probabilities, climatological normals, and NDFD verification scores
 - NDGD is interoperable with NDFD





NWS WCSRI Coverages

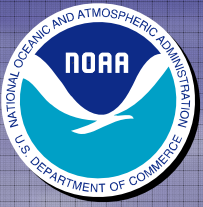


NDFD Basic Weather Elements

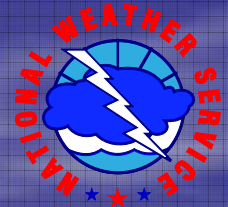
- 12-hour Probability of Precipitation (PoP12)
- Dew Point (Td)
- Maximum Temperature (MaxT)
- Minimum Temperature (MinT)
- Quantitative Precipitation Amount (QPF06)
- Sky Cover (Sky)
- Snow Amount (Snow)
- Temperature (T)
- Wind Direction (WDir)
- Wind Gust (WGust)
- Wind Speed (WSpd)

Definitions of these elements can be found at:

<http://www.nws.noaa.gov/ndfd/definitions.htm>



NWS WCSRI Coverages (Cont'd)

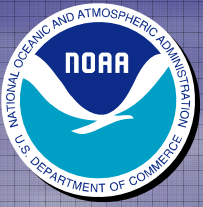


NDFD Convective Hazard Outlook Elements

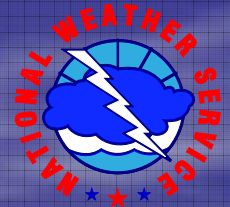
- Convective Hazard Outlook (ConHazO)
- Probability of Tornadoes (PTornado)
- Probability of Hail (PHail)
- Probability of Damaging Thunderstorm Winds (PTstmWinds)
- Probability of Extreme Tornadoes (PXTornado)
- Probability of Extreme Hail (PXHail)
- Probability of Extreme Thunderstorm Winds (PXTstmWinds)
- Total Probability of Severe Thunderstorms (PTotSvrTstm)
- Total Probability of Extreme Severe Thunderstorms (PTotXSvrTstm)

Definitions of these elements can be found at:

<http://www.nws.noaa.gov/ndfd/definitions.htm>



NWS WCSRI Coverages (Cont'd)

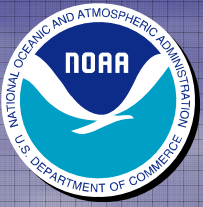


NDGD Elements

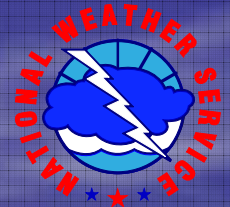
- Official Guidance Products
 - Local Aviation MOS Program (LAMP) Thunderstorm Probabilities
 - LAMP Thunderstorm Best Category
- Experimental guidance product
 - Gridded Observation (GOBS) Temperature
 - GOBS Temperature Error Estimation
 - GOBS Dew Point
 - GOBS Dew Point Error Estimation

Definitions of these elements can be found at:

http://www.nws.noaa.gov/mdl/gfslamp/docs/gfslamp_info.shtml



NWS WCSRI Coverages (Cont'd)

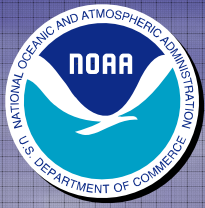


Autonowcaster Products

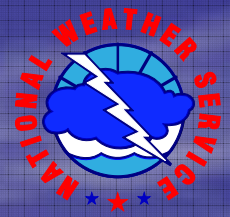
- 3-DWindFiled-Analysis-Ajoint
- 60MinTstormFcst-Autonowcaster
- 60MinTstormInitLikelihood-Autonowcaster
- TstormFcstVerification-Autonowcaster

Definitions of these elements can be found at:

http://www.nws.noaa.gov/mdl/survey/pgb_survey/dev/autonowcaster/docs/ANC2003.pdf



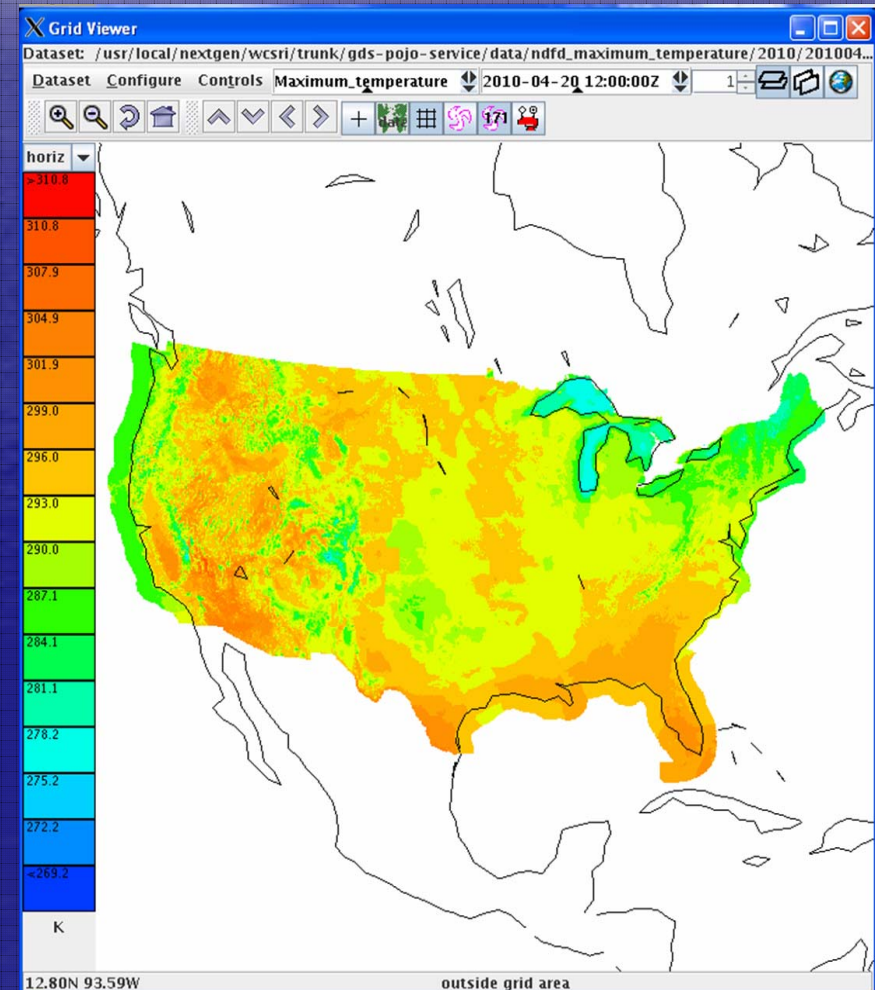
NWS WCSRI Coverages – Example of Maximum Temperature

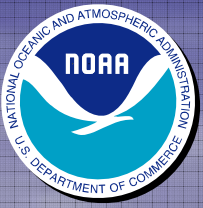


Example of Max Temp (K)
April 20 (valid 12Z)

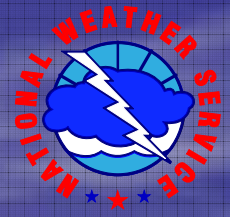
NDFD Maximum Temperature

- Like all NDFD weather elements, represents the official NWS forecast
- Gridded forecasts are issued by WFOs
- Defined for CONUS and OCONUS domains





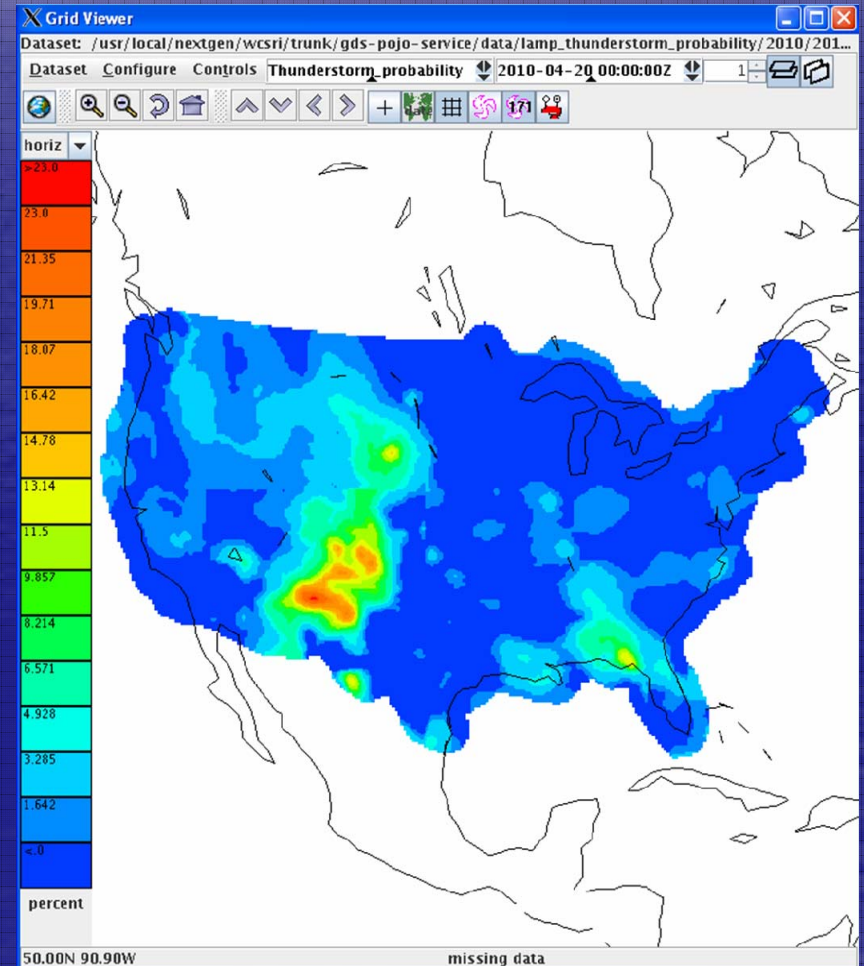
NWS WCSRI Coverages – Example of Thunderstorm Probability

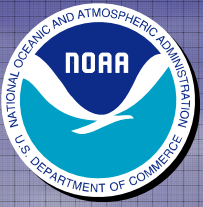


Example of Thunderstorm Probability (%)
April 20 (valid 12Z)

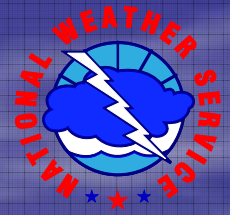
LAMP Thunderstorm Probability

- Localized Aviation MOS Program (LAMP): statistical system which provides forecast guidance for sensible weather elements.
- Guidance product, not official NWS forecast.
- NDGD data relate to and supplement the NDFD





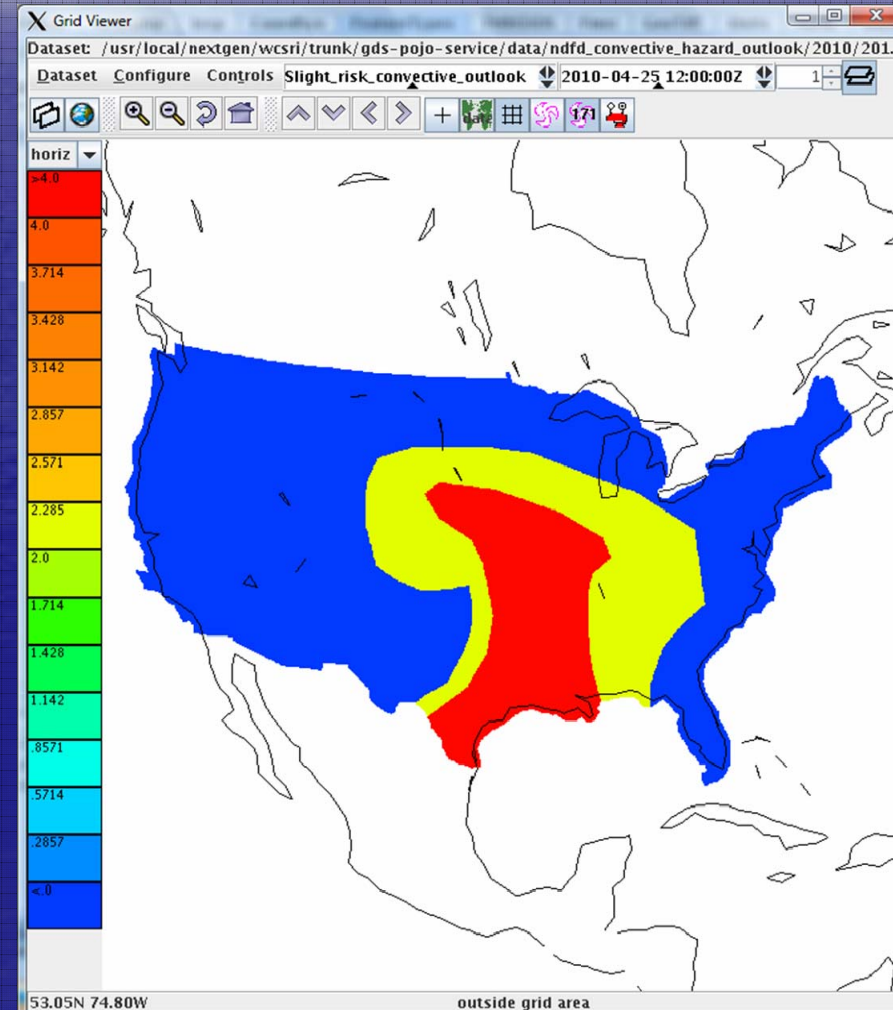
NWS WCSRI Coverages – Example of Convective Hazards

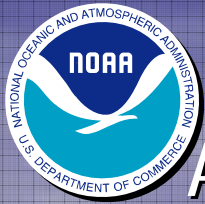


Example of Convective Hazards Outlook (Level)
April 25 (valid 12Z)

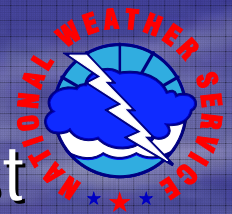
NDFD Convective Hazards Outlook

- Categorical forecast (slight, moderate, or high risk) that specifies perceived level of threat of thunderstorms, severe thunderstorms, hail, damaging winds, and tornadoes.
- Outlooks are issued by the NWS' Storm Prediction Center
- Interpreting convective hazard values:
 - 0= No Thunderstorms Forecasted
 - 2=General Thunderstorms
 - 4=Slight risk
 - 5= $\geq 30\%$
 - 6=Moderate Risk
 - 8=High Risk





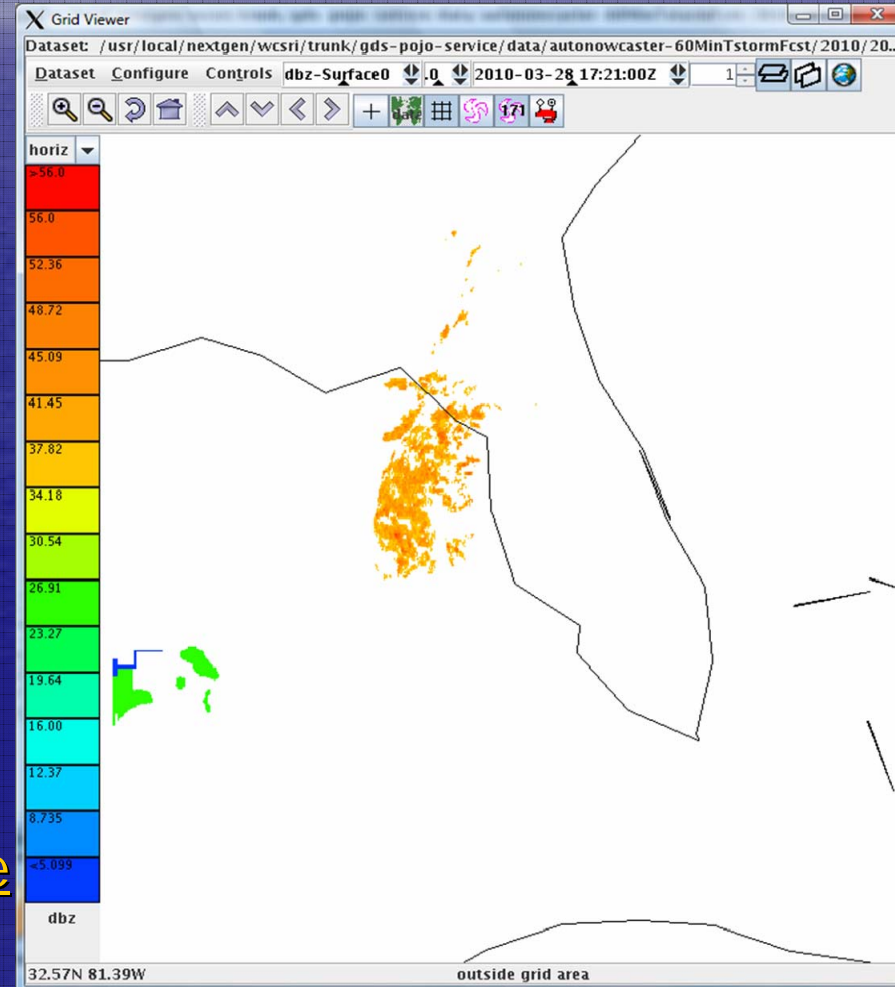
NWS WCSRI Coverages – Example of Autonowcaster 60m Thunderstorm Forecast

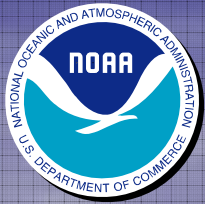


Example of 60 Min Thunderstorm Forecast (dBZ)
March 28 (valid 17:21Z)

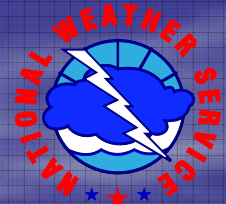
Autonowcaster Thunderstorm Forecast

- 60 minute forecast of convection
- Combines Growth/Decay and Initiation likelihood fields.
- Blue colors are arbitrary thresholds of initiation likelihood.
- Warm colors are Growth/Decay of existing echoes.
- Existing echoes been filtered to remove stratoform precipitation.
- Additional information on ANC can be found at:
http://www.nws.noaa.gov/mdl/survey/pqb_survey/dev/autonowcaster/.





NWS WCSRI Coverages – Future Work



WCSRI Work

- Looking to add capability to providing netCDF-4 "cf" compliant output into grib2 as part of an enhanced WCSRI. Could be an output alternative to netCDF-4

Coverages

- NDFD Basic Weather Elements
 - Weather
- NDGD Elements
 - Gridded LAMP Ceiling Heights and probabilities
 - Gridded LAMP Visibility and probabilities
 - Gridded Obs Wind Direction and Wind Speed