

# WSR-88D and TDWR-SPG Data Status And Plans

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Family Of Services/Partners Meeting

Atlanta, GA





# Overview



- Dual Polarization Modification
- Level II Data and Architecture Refresh
- Level III Products
- WSR-88D Software Plans
- TDWR-SPG Data/Products
- Wind Farms and Weather Radars
  
- Note: There is too much material and detail in this presentation to cover at the FOS meeting. Please consider the information as a resource to help you plan for the exciting planned increases in radar data for radar data users.



# Dual Polarization Modification



- New Dual Pol moments to be generated in RDA:
  - Differential Reflectivity
  - Differential Phase
  - Correlation Coefficient
- New Dual Pol moment to be generated in RPG
  - Specific Differential Phase (Kdp)
- Expected improvements in:
  - Precipitation estimation
  - Data quality
  - Hail detection
  - Rain/snow discrimination
  - Tornado detection



# Dual Polarization Modification

(Continued)



- Major Initial Dual Pol algorithms:
  - Quantitative Precipitation Estimation (QPE)
  - Hydrometeor Classification
  - Melting Layer Detection
- Major Initial New Dual Pol products
  - Quantitative Precipitation Estimation (QPE)
  - Hydrometeor Classification
  - Melting Layer Detection
  - Differential Reflectivity
  - Correlation Coefficient
  - Specific Differential Phase (Kdp)



# Dual Polarization Modification

(Continued)



- Major Program Milestone Start Dates (subject to change):
  - Beta Test at ~5 sites 4CY10
  - Full Deployment 1CY11; end 3CY12
    - Estimate each radar down ~2 weeks
    - Deployment sequence will consider many factors (e.g., climatology, adjacent radar coverage, cost, site input)



# NWS Dual Polarization Plans for Informing Public/Private Users



- Announce deployment sequence and schedule when finalized
- Provide, in advance, as done for Super Resolution data:
  - Sample products
  - Sample Level II data (archive and real time)
  - Draft Interface Control Documents
  - FAQs
  - Technical Implementation Notice by March 2010
- Dual Pol web site: <http://www.roc.noaa.gov/WSR88D/>



# NWS Dual Polarization Level II Data Plans



- Add Dual Pol data (3 additional RDA moments) to Level II Data Collection And Distribution Network for at least NWS sites when Dual Pol deployed
- Goal to distribute Super Resolution and Dual Pol Level II data from non-NWS WSR-88D sites also
  - NWS has submitted FY12 budget initiative request to fund



# Dual Polarization Level II Data



- RDA will always provide
  - Reflectivity data at 250 meter range resolution
  - Velocity and Spectrum Width up to 300 km max range
- Version numbers will indicate type of data
  - NWS WSR-88Ds to provide Version 6
  - DoD and FAA WSR-88Ds to provide Version 4
  - Other Versions in special cases
- Data characteristics vary to comply with NWS comms funding constraints

Build 10 Super-Res	Recombined and delete Dual Pol	Dual Pol w/ Super-Res Disabled	Dual Pol w/ Super-Res Enabled	Recombined Dual Pol
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#	Data Characteristic	RDA Super Res Control		Level II Version Number				
		Disabled	Enabled	3	4	5	6	7
1	Azimuthal resolution on split cuts (deg)	1	0.5	0.5	1	1	0.5	1
2	Azimuthal resolution on batch and above cuts (deg)	1	1	1	1	1	1	1
3	Reflectivity range resolution on split cuts (m)	250	250	250	1000	250	250	250
4	Reflectivity range resolution of batch and above cuts (m)	250	250	1000	1000	250	250	250
5	Reflectivity data included on Doppler split cuts	No	Yes	Yes	No	No	Yes	No
6	Doppler data to 300 km	Yes	Yes	na	No	Yes	Yes	Yes
9	Dual pol data included	Yes	Yes	No	No	Yes	Yes	Yes
7	Dual pol data at 250m range resolution	Yes	Yes	na	na	Yes	Yes	Yes
8	Dual pol data to 300km range	Yes	Yes	na	na	Yes	Yes	Yes
				RDA/RPG Link		LDM Level II		
<b>Volume Average Worst Case Throughput (kbps)</b>		<b>3:1 Compression</b>		<b>4.1:1 Compression</b>				
VCP 12		358	502	158	80	231	329	231
VCP121		250	389	174	80	156	249	156
Allocation		512	768	384	128	384	768	384



# Dual Polarization Level III Status and Plans



- Preparation for Dual Polarization
  - SDUS8i will be used for most Dual Pol products to support a fallback plan of restricting NOAAport distribution if comms load causes unacceptable operational impacts.
  - Reassign products using SDUS8i to SDUS5i (April 2010).
    - DPA Products from WSR-88D RPG or TDWR SPG
      - RADAR HOURLY DIGITAL PRECIPITATION ARRAY (81/DPA)



# Dual Polarization Level III Status and Plans



(Continued)

- Dual Polarization Radar Modification
  - General Status Message will report Dual Pol data enabled
  - Dual Pol Products will be RPCCDS/SBN distributed in Beta Test
  - Assess comms load and impacts during beta test to gain approval and adjust full scale deployment plan (if required)
  - Expect comms throughput of WSR-88D radar products to increase by factor of 2.8
    - Per radar, average hourly product volume via RPCCDS will be approximately 14.5 megabytes (MB) and the average daily volume will be 345.8 MB.
    - When fully implemented, the average daily volume for all 155 WSR-88D radars will be 55.8 gigabytes (GB).
    - Worst case hourly throughput is estimated to reach 53 MB for a single radar and 4.2 GB for all 200 radars.



# WSR-88D Level III Plans

## Dual Polarization



#	PRODUCT	PRODUCT HEADERS		ELEVATION ANGLES (DEGREES)	NWSTG RPCDDS FTP Dir Name	Average Size (Kbytes) *estimate
		RPG HEADER	WMO HEADER			
1	<b>Differential Reflectivity -</b> 0.13 nmi resolution, 162 nmi max range, 256 data levels (0.0625 dB)	159/DZD	SDUS8i cccc N0X xxx	0.5	DS.159x0	58*
2		159/DZD	SDUS8i cccc NAX xxx	0.9	DS.159xa	50*
3		159/DZD	SDUS8i cccc N1X xxx	1.3, 1.5	DS.159x1	45*
4		159/DZD	SDUS8i cccc NBX xxx	1.8	DS.159xb	40*
5		159/DZD	SDUS8i cccc N2X xxx	2.4, 2.5	DS.159x2	36*
6		159/DZD	SDUS8i cccc N3X xxx	3.1, 3.4, 3.5	DS.159x3	30*
7	<b>Correlation Coefficient -</b> 0.13 nmi resolution, 162 nmi max range, 256 data levels (0.00333)	161/DCC	SDUS8i cccc N0C xxx	0.5	DS.161c0	59*
8		161/DCC	SDUS8i cccc NAC xxx	0.9	DS.161ca	55*
9		161/DCC	SDUS8i cccc N1C xxx	1.3, 1.5	DS.161c1	50*
10		161/DCC	SDUS8i cccc NBC xxx	1.8	DS.161cb	45*
11		161/DCC	SDUS8i cccc N2C xxx	2.4, 2.5	DS.161c2	37*
12		161/DCC	SDUS8i cccc N3C xxx	3.1, 3.4, 3.5	DS.161c3	33*
13	<b>Specific Differential Phase -</b> 0.13 nmi resolution, 162 nmi max range, 256 data levels (0.05 deg/km)	163/DKD	SDUS8i cccc N0K xxx	0.5	DS.163k0	7*
14		163/DKD	SDUS8i cccc NAK xxx	0.9	DS.163ka	7*
15		163/DKD	SDUS8i cccc N1K xxx	1.3, 1.5	DS.163k1	7*
16		163/DKD	SDUS8i cccc NBK xxx	1.8	DS.163kb	6*
17		163/DKD	SDUS8i cccc N2K xxx	2.4, 2.5	DS.163k2	6*
18		163/DKD	SDUS8i cccc N3K xxx	3.1, 3.4, 3.5	DS.163k3	5*



# WSR-88D Level III Plans

## Dual Polarization



#	PRODUCT	PRODUCT HEADERS		ELEVATION ANGLES (DEGREES)	NWSTG RPCCDS FTP Dir Name	Average Size (Kbytes) *estimate
		RPG HEADER	WMO HEADER			
19	<u>Hydrometeor Classification</u> - 0.13 nmi resolution, 162 nmi max range, 8bit but only 12 categories	165/DHC	SDUS8i cccc N0H xxx	0.5	DS.165h0	14*
20		165/DHC	SDUS8i cccc NAH xxx	0.9	DS.165ha	13*
21		165/DHC	SDUS8i cccc N1H xxx	1.3, 1.5	DS.165h1	12*
22		165/DHC	SDUS8i cccc NBH xxx	1.8	DS.165hb	11*
23		165/DHC	SDUS8i cccc N2H xxx	2.4, 2.5	DS.165h2	10*
24		165/DHC	SDUS8i cccc N3H xxx	3.1, 3.4, 3.5	DS.165h3	9*
25	<u>Melting Layer</u> - 162 nmi max range, 4 levels (contours)	166/ML	SDUS8i cccc N0M xxx	0.5	DS.166m0	5*
26		166/ML	SDUS8i cccc NAM xxx	0.9	DS.166ma	5*
27		166/ML	SDUS8i cccc N1M xxx	1.3, 1.5	DS.166m1	5*
28		166/ML	SDUS8i cccc NBM xxx	1.8	DS.166mb	5*
29		166/ML	SDUS8i cccc N2M xxx	2.4, 2.5	DS.166m2	5*
30		166/ML	SDUS8i cccc N3M xxx	3.1, 3.4, 3.5	DS.166m3	5*
31	Digital Inst. Precip. Rate(in/hr)	176/DPR	SDUS8i cccc DPR xxx	Elev Angle Not Applicable	DS.176pr	15*
32	Hybrid Scan Hydrometeor Classificati	177/HHC	SDUS8i cccc HHC xxx	Elev Angle Not Applicable	DS.177hh	4*
33	One hour Accum	169/OHA	SDUS8i cccc OHA xxx	Elev Angle Not Applicable	DS.169oh	5*
34	Dig. Accum Array (unbiased)	170/DAA	SDUS8i cccc DAA xxx	Elev Angle Not Applicable	DS.170aa	15*
35	Storm Total Accum	171/STA	SDUS3i cccc PTA xxx	Elev Angle Not Applicable	DS.171st	5*
36	Dig. Storm Total Accum	172/DSA	SDUS8i cccc DTA xxx	Elev Angle Not Applicable	DS.172dt	12*
37	Dig. User-Selectable Accum:3hr/hrly	173/DUA	SDUS8i cccc DU3 xxx	Elev Angle Not Applicable	DS.173u1	12*
38	Dig. User-Selectable Accum:24hr/12Z	173/DUA	SDUS8i cccc DU6 xxx	Elev Angle Not Applicable	DS.173u3	12*
39	Dig. One Hour Difference Accum	174/DOD	SDUS8i cccc DOD xxx	Elev Angle Not Applicable	DS.174od	10*
40	Dig. Storm Total Difference Accum	175/DSD	SDUS8i cccc DSD xxx	Elev Angle Not Applicable	DS.175sd	10*



# Level II Status and Plans



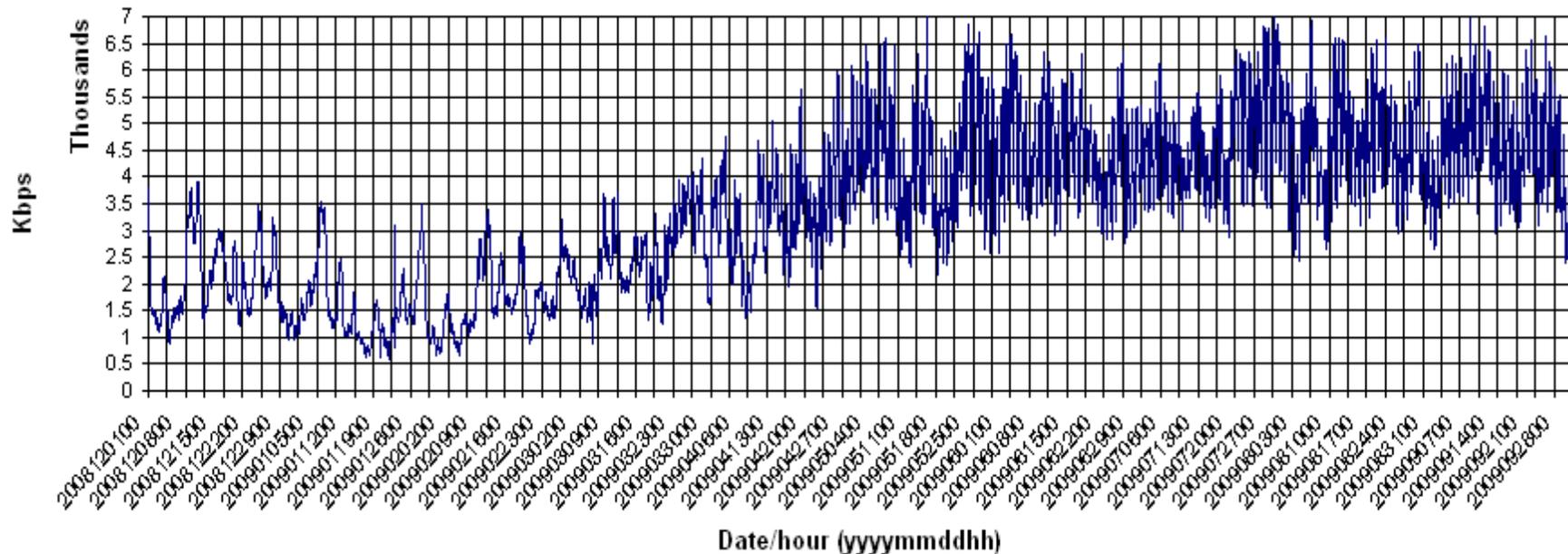
- Sites to be added to network:
  - 4 FAA sites in Hawaii; week of 1 Feb 2010
  - 8 remaining DoD CONUS sites; starting in July 2010 with RPG Build 12 installation
  - Added sites will transmit Recombined Data
  - Reference: TIN (09-051)
- NWS will provide advance notice when/if able to switch Level II data flow from DOD and FAA sites to Super Resolution and/or Dual Pol



# Level II Data Throughput - 2009



Level 2 Collection Total Network Throughput  
December 1, 2008 - September 30, 2009



- 135 Level II Data Sites – 2009 max hourly average near 7 mbps
  - Super-Res from 125 sites
  - Recombined from 9 DoD and 1 FAA sites
- Dual Pol estimated to increase throughput by a factor of 2.3
  - Max Hourly Average: 16 mbps for current network, 415 kbps for single site



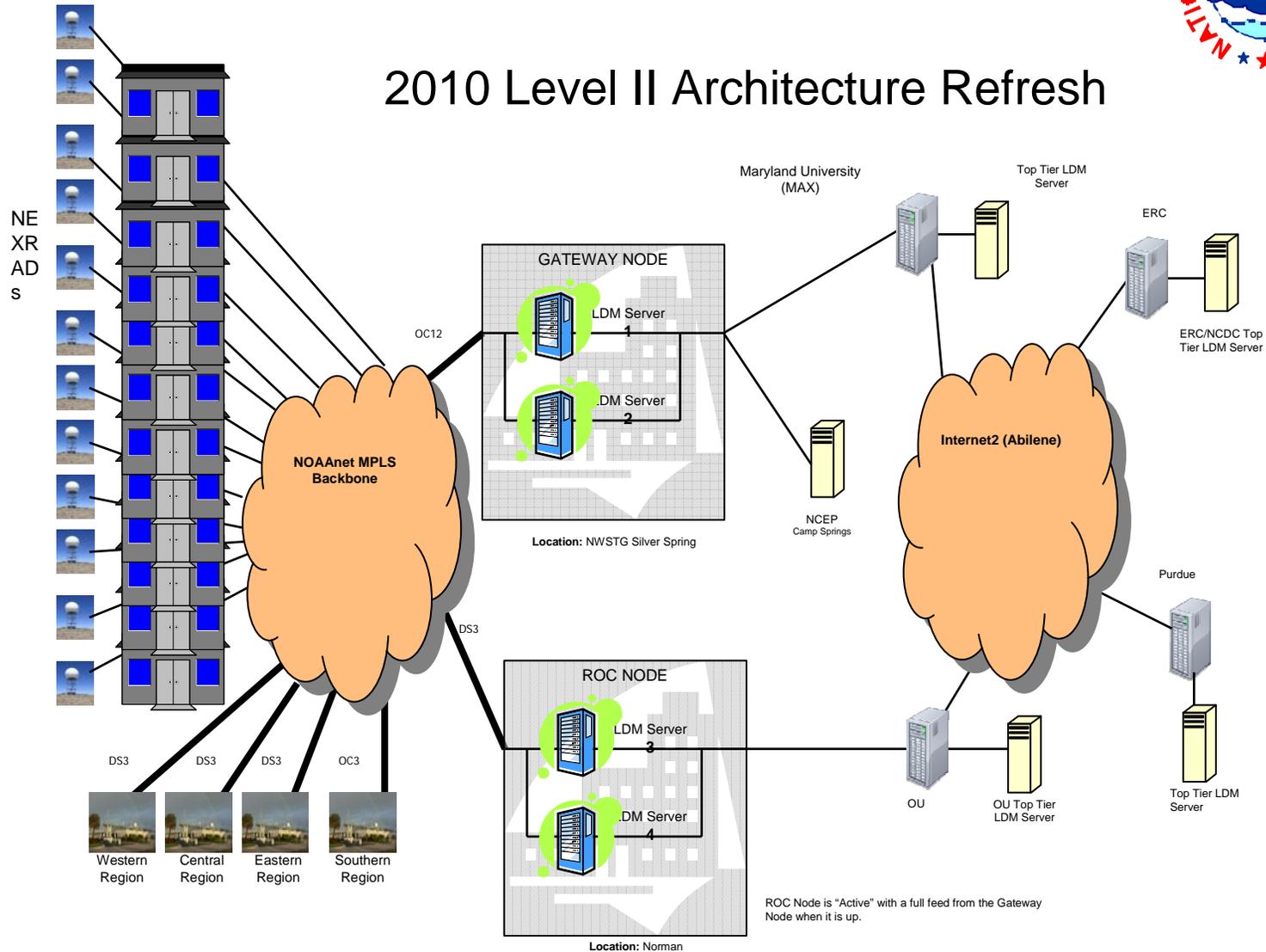
# New Level II Data Collection and Redistribution Architecture



- Main transition tenets
  - Use NOAANet to send data to two national-level aggregation points (redundancy) with 24/7 communications support
    - Primary at NWSTG; backup at Radar Operations Center
      - Use LDM with server auto failover to promote backup to primary within ~5 minutes
      - Replace NWS Regional HQ aggregation points
    - Provide increased data delivery reliability
    - Use same Top Tier sites (Purdue, ERC, and OU)
  - Two Level II data streams available to Internet II users
    - Via MAX at U. of MD and IRADS at OU



# 2010 Level II Architecture Refresh





# Level II New Data Collection and Redistribution Architecture



(Continued)

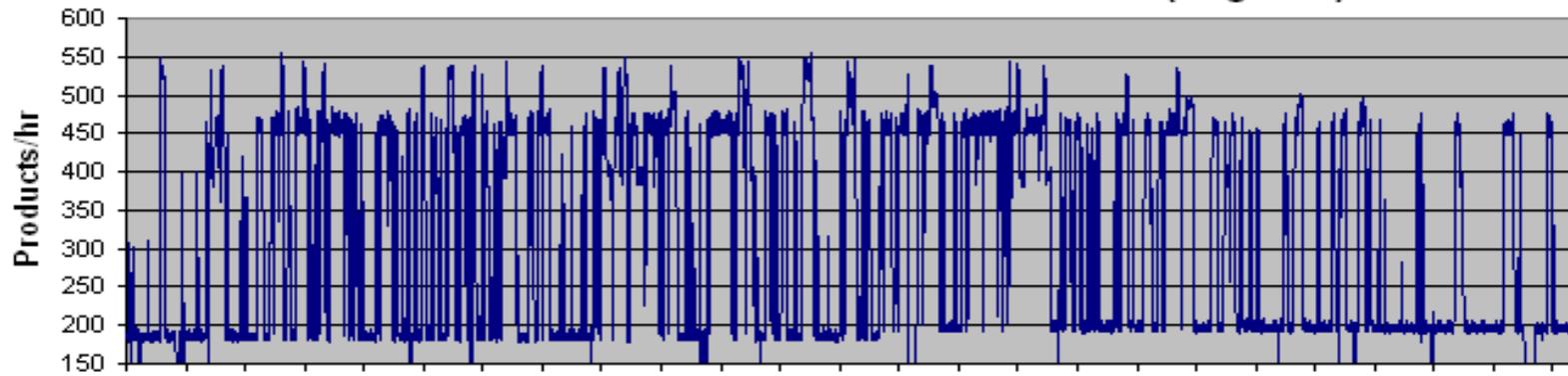
- Transition should be transparent to end users
  - ROC will advise Top Tier Sites of changes they need to make
- Implementation plan
  - Transition sites over a ~3 month period
    - First site, Columbia SC (KCAE) scheduled for 1/20
  - Transition 2 sites/day (T and TH) starting next week
  - Transition 2 sites/day (T, W, TH) starting week of 2/9
  - Transition schedule sent weekly to Top Tiers as with ORDA and posted on ROC web site: (<http://www.roc.noaa.gov>)



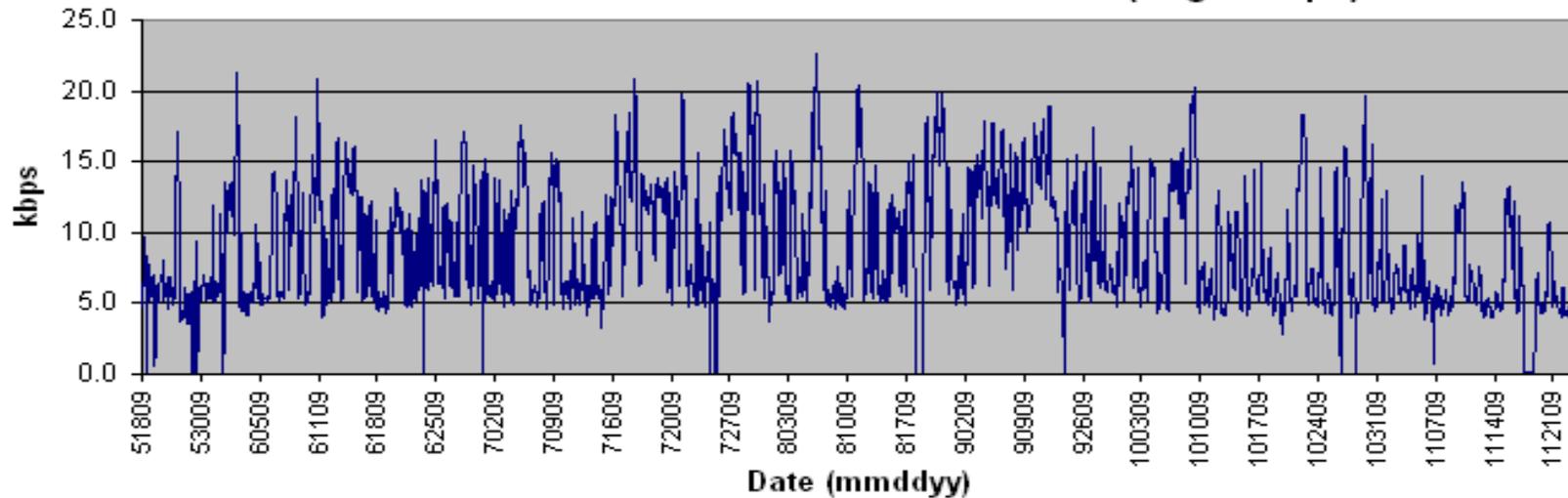
# RPCCCDS - 2009



KTLX Level III Product Collection 5/18/09 - 11/23/09 (Avg=306)



KTLX Level III Product Collection 5/18/09 - 11/23/09 (Avg=9 kbps)

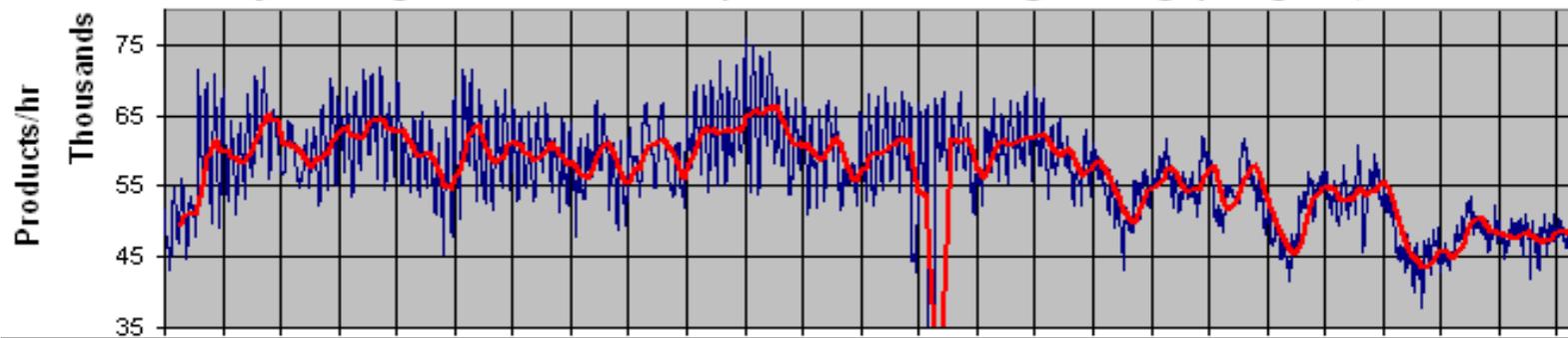




# RPCCCDS - 2009

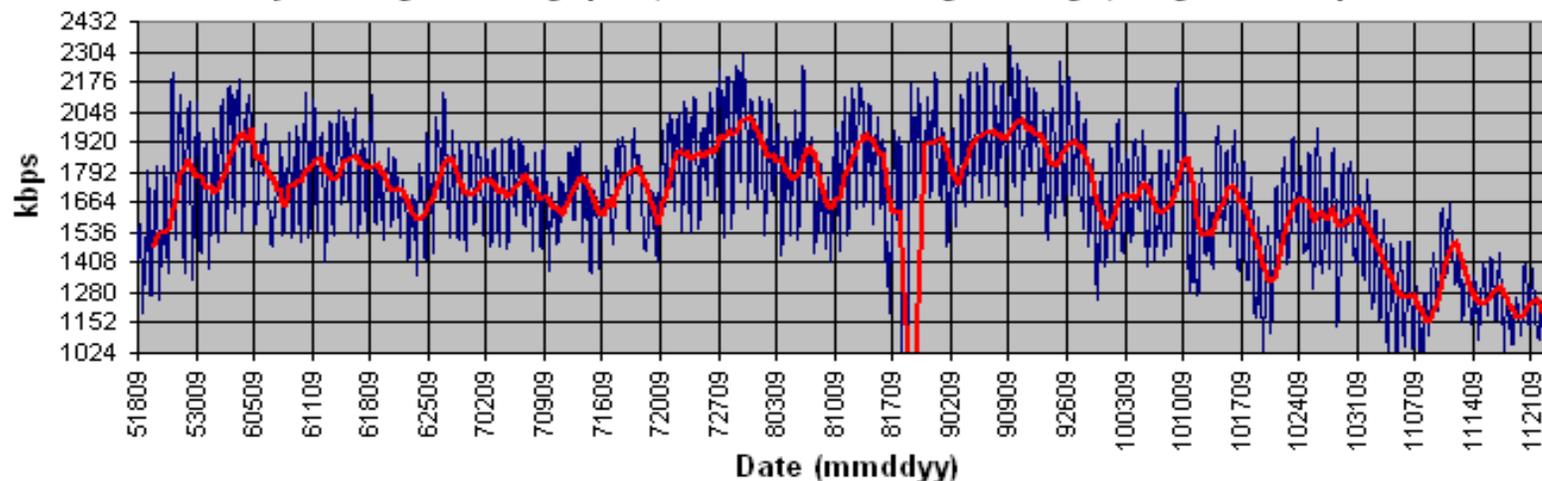
200 Level III sites (155 WSR-88D, 45 TDWR). 5/18/09 - 11/23/09

Hourly Average Product Count (red line is moving average) Avg=56,617



200 Level III sites (155 WSR-88D, 45 TDWR). 5/18/09 - 11/23/09

Hourly Average Throughput (red line is moving average) Avg=1681 kbps





# Level III Plans



- Addition of Higher Resolution WSR-88D products (ref. TIN 09-041)
  - Lowest two angles of elevation base products (February 9, 2010)
  - Add remaining products by April 2010
  - Expect comms throughput of WSR-88D radar products to double
    - Per radar, average hourly product volume via RPCCDS will be approximately 5.2 MB; average daily volume will be 124 MB.
    - When fully implemented, the average daily volume for all 155 WSR-88D radars will be 20 GB.
    - Worst case hourly throughput is estimated to reach 19 MB for a single radar and 1.5 GB for all 155 WSR-88D radars.



# WSR-88D Level III Plans Higher Resolution Products



#	PRODUCT	PRODUCT HEADERS		ELEVATION ANGLES (DEGREES)	NWSTG RPCDCS FTP Dir Name	Average Size (Kbytes) *estimate
		RPG HEADER	WMO HEADER			
1	<b>Base Reflectivity -</b> 0.54 nmi resolution, 248 nmi max range, 256 data levels (0.5 dBZ)	94/DR	SDUS5i cccc N0Q xxx	0.5	DS.p94r0	20
2		94/DR	SDUS5i cccc NAQ xxx	0.9	DS.p94ra	16
3		94/DR	SDUS2i cccc N1Q xxx	1.3, 1.5	DS.p94r1	12
4		94/DR	SDUS2i cccc NBQ xxx	1.8	DS.p94rb	11
5		94/DR	SDUS2i cccc N2Q xxx	2.4, 2.5	DS.p94r2	11
6		94/DR	SDUS2i cccc N3Q xxx	3.1, 3.4, 3.5	DS.p94r3	10
7	<b>Base Velocity -</b> 0.13 nmi resolution, 162 nmi max range, 256 data levels (0.5 or 1.0 m/s)	99/DV	SDUS5i cccc N0U xxx	0.5	DS.p99v0	55
8		99/DV	SDUS5i cccc NAU xxx	0.9	DS.p99va	47
9		99/DV	SDUS2i cccc N1U xxx	1.3, 1.5	DS.p99v1	30
10		99/DV	SDUS2i cccc NBU xxx	1.8	DS.p99vb	29
11		99/DV	SDUS2i cccc N2U xxx	2.4, 2.5	DS.p99v2	27
12		99/DV	SDUS2i cccc N3U xxx	3.1, 3.4, 3.5	DS.p99v3	23
13	High Res Vertical Integrated Liquid	134/DVL	SDUS5i cccc DVL xxx	Elev Angle Not Applicable	DS.134il	7
14	Enhanced Echo Tops	135/EET	SDUS7i cccc EET xxx	Elev Angle Not Applicable	DS.135et	3



# WSR-88D Software Plans



- RPG Build 12 Beta (June 2010), Deployment (July 2010)
- Will support non-Dual Pol and Dual Pol RDAs
- Major changes
  - Legacy Mesocyclone Algorithm and associated products (including M, Product #60) will be deleted (ref: TIN 09-031)
  - Mesocyclone Detection algorithm (MD, Product #141) to use Super Resolution Data (no change in product format)
  - High Resolution Velocity product (DV, Product #99) max range increases from 124nmi to 162 nmi.
  - Dual Pol Data Processing Algorithms and products activated when RDA modified with Dual Pol
  - Automated Volume Scan Evaluation and Termination (AVSET) algorithm activated for use at field test at up to 8 sites starting in July 2010 (ref: upcoming TIN 10-0xx)



# WSR-88D Software Plans

(continued)



- RDA Builds
  - Build 12 will be Dual Pol for single-thread RDAs
  - Build 12.x will be Dual Pol for dual-thread RDAs
  - Build 13 will be government build that merges contractor's dual pol changes with government Build 11, plus security updates and any major fixes
  - Note: Clutter Mitigation Decision (CMD) capability not in Dual Pol RDA Build 12; thus when Dual Pol modification made, no CMD available until RDA Build 13



# TDWR-SPG Status and Plans



- Implementation of real-time collection, distribution, and archive of TDWR-SPGs (Supplemental Product Generator) completed in early 2009
  - SPG emulates RPG function to generate products
  - Reference: TIN 08-85, 16 Oct 08
- FY12 funding requested to add TDWR-SPG Level II real-time collection, distribution, and archive



# Wind Farm – Weather Radar Interaction

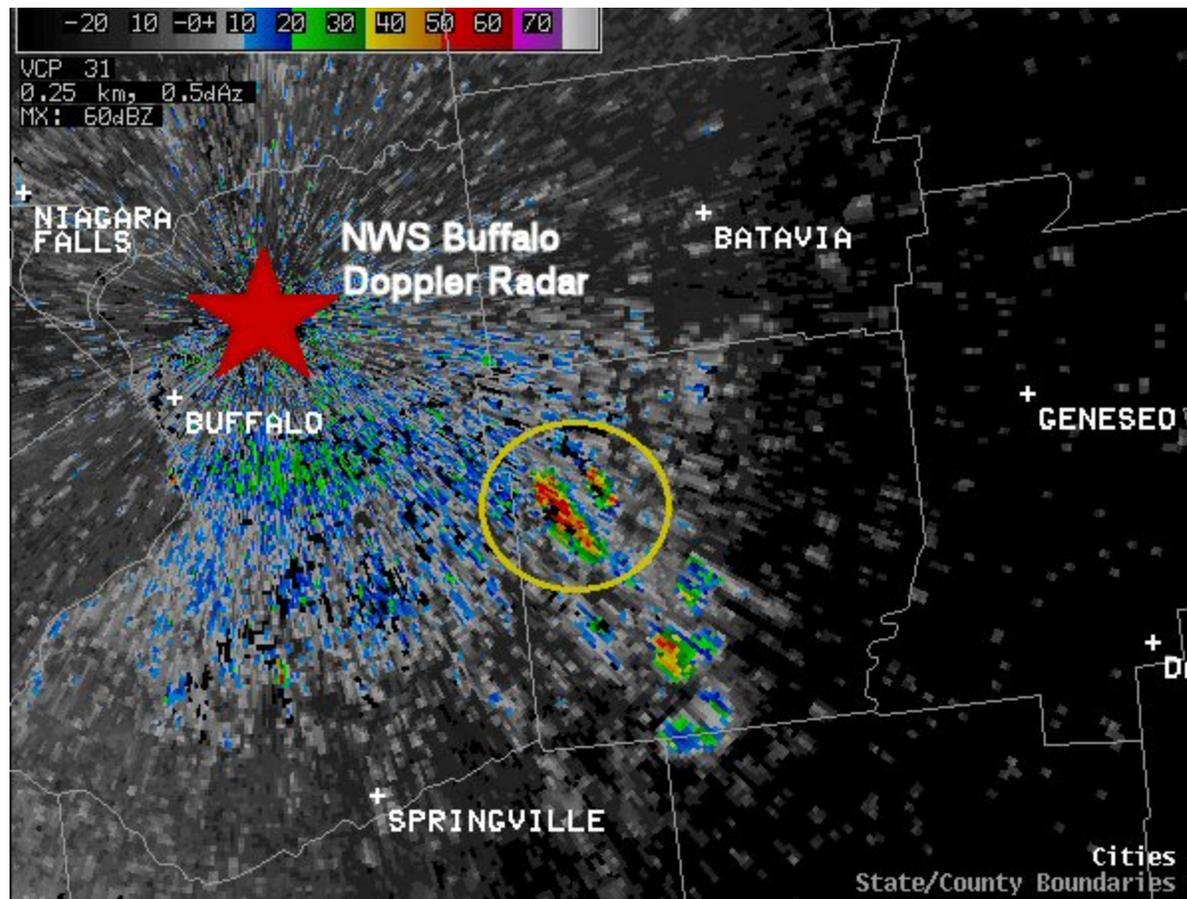


- Background
  - Growing number of wind farms and heights (over 450 ft common) will continue
  - Rotating wind turbine blades cause wind turbine clutter (WTC) for radars
    - Radars see rotating turbine blades as moving targets; conventional clutter filters do not work
    - Impacts all three weather radar moments (R, V, SW)



# Wind Farm – Weather Radar Interaction Example

(Not Impacting WFO Warning Operations)





## Why Discuss Wind Farm – Weather Radar Interaction at FOS Meeting?



- Some public and private sector radar data/product users confuse WTC with meteorological targets
  - Reports of advisories issued by broadcasters/private sector based on WTC when no advisory needed
  - Public inquiring local WFOs on what is wrong with radar/”what is that echo?”



# NWS Suggestions



- Advise your customers of WTC and how to recognize and “work around” the signature
- Provide ROC recommendations on information we can provide radar users to improve awareness and “work arounds”: (<http://www.roc.noaa.gov/WSR88D/Comments.aspx>)
- Check ROC website for more radar – wind farm interaction information: (<http://www.roc.noaa.gov/WSR88D/>)



# Wind Farm – Weather Radar Interaction Bottom Line



- NOAA's NWS
  - Supports renewable energy
  - Reaches out to wind energy industry to inform them of
    - Weather radar locations
    - Potential radar impacts
    - Potential mitigation options for consideration
  - Seeks to help weather radar data users and the wind energy industry co-exist and meet our vital missions in support of the Nation



# Coming WSR-88D Data and Product User Support



- Dual Polarization Information
  - Project Status, Schedules, Sample Data/Products (March 2010), and Interface Control Documents
    - <http://www.roc.noaa.gov/WSR88D/DualPol/Default.aspx>
  - Dual Pol Technology Training Page
    - <http://www.wdtb.noaa.gov/modules/dualpol/>
- Level III products and Interface Control Documents
  - Higher Resolution Level III product samples
  - Dual Polarization Products
  - [http://www.roc.noaa.gov/wsr88d/Level\\_III/Level3Info.aspx](http://www.roc.noaa.gov/wsr88d/Level_III/Level3Info.aspx)
- Common Operations and Development Environment (CODE) for Dual Polarization (Build 12: March 2010)
  - <http://www.weather.gov/CODE88D>



# Additional Information



- Real-Time WSR-88D and TDWR-SPG Transmit/Receive Status:
  - <http://weather.noaa.gov/monitor/radar/>
- NWS Real-Time Level II Data Monitoring Site:
  - <http://weather.noaa.gov/monitor/radar2/>
- Project updates and other Level II information:
  - [http://www.roc.noaa.gov/NWS\\_Level\\_2](http://www.roc.noaa.gov/NWS_Level_2)
- WSR-88D Software/Program updates for product users:
  - <http://www.nws.noaa.gov/tg/rpccds.html>
- WSR-88D software build specific training materials:
  - <http://www.wdtb.noaa.gov/>



# Additional Information

(continued)



- **NCDC Weather Radar Resources:**  
<http://www.ncdc.noaa.gov/oa/radar/radarresources.html>
  - Order WSR-88D Level II and Level III (including TDWR Level III) Archive Data Via FTP
  - Use NCDC Climate Tool Kit to View Level II and Level III Archive Data
  - Obtain radar data information
- **Federal Meteorological Handbook No. 11 (FMH-11) Part A Updated for Build 12 available in June**
  - <http://www.ofcm.gov/homepage/text/pubs.htm>
- **Send follow-up questions to: [Michael.Istok@noaa.gov](mailto:Michael.Istok@noaa.gov) or [Tim.D.Crum@noaa.gov](mailto:Tim.D.Crum@noaa.gov)**