

Volume Scan Strategies for the WSR-74C in Support of Space Launch

Paper 8.13

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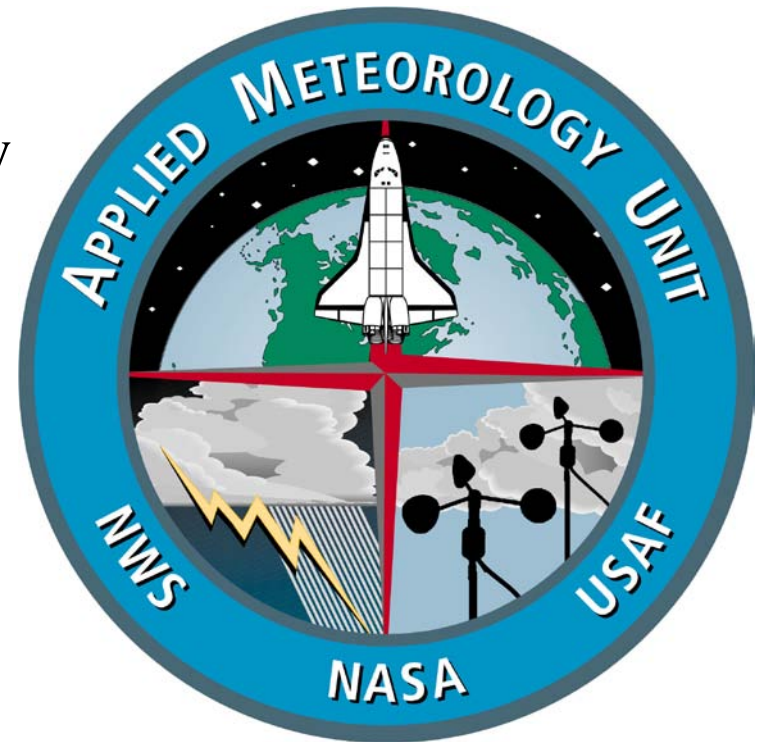
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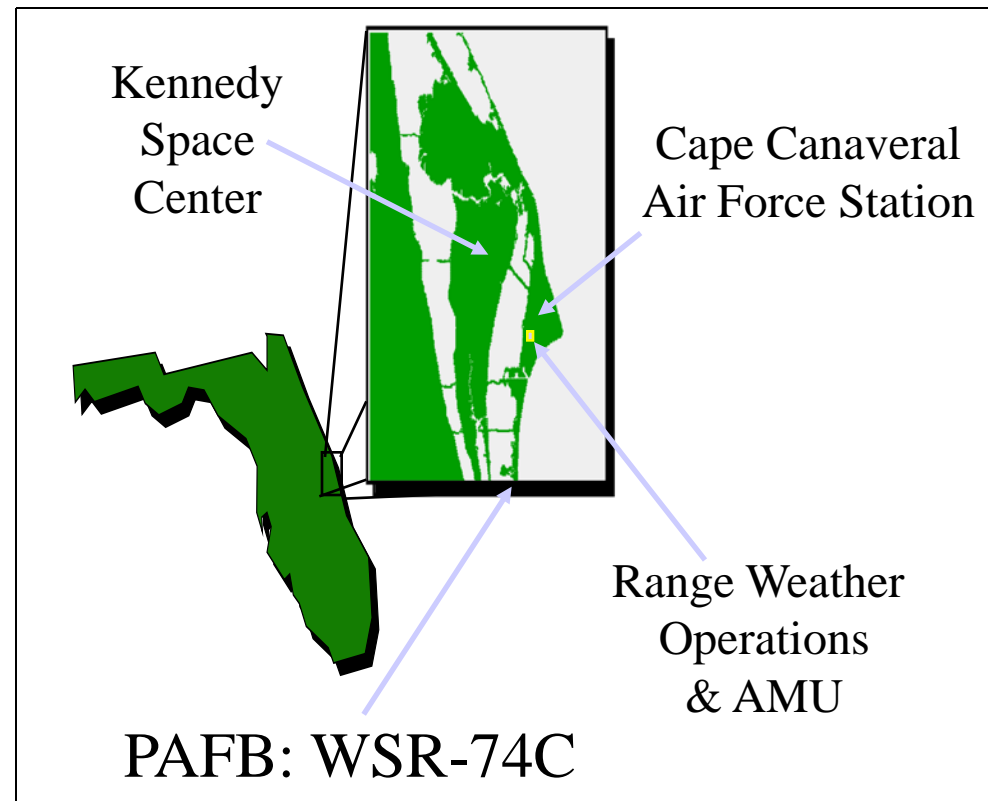
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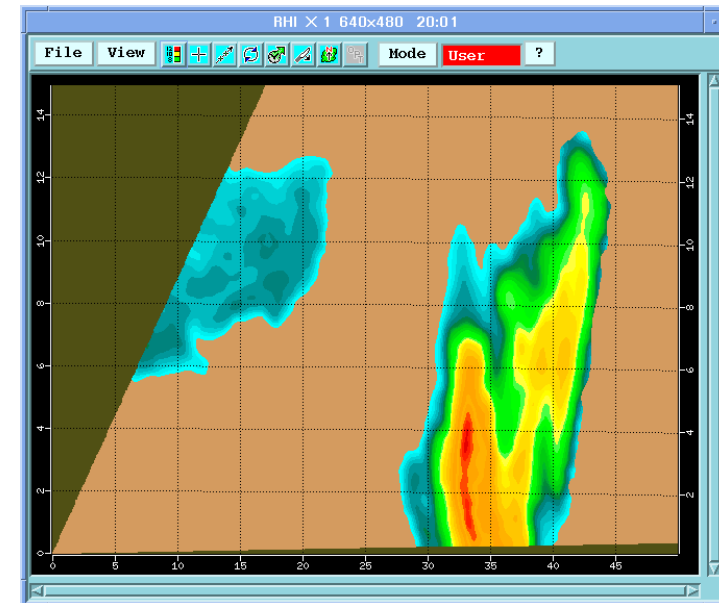
Presentation Outline

- Atmospheric Temperature Profile
- Vertical Resolution
- Radar Scan Strategies
- Product Development
- Summary



Background

- WSR-74C/IRIS Exploitation Task
(Interactive Radar Information System; SIGMET Inc.)
- Importance of 0°C to -20°C layer for cloud electrification
 - 1) Atmospheric temperature profile
 - 2) Gaps between elevation angles
 - 3) Modification of scan strategy
- Product Development
(IRIS User Product Insert)



Local Rules-of-Thumb for Lightning Nowcasting using WSR-74C Reflectivity Products

PHENOMENA	RULES
Cellular Thunderstorm Initial In-Cloud (IC) Lightning	$\geq 37\text{-}44$ dBz, above -10°C by $\geq 3\text{K Ft}$, for 10-20 min
Cellular Thunderstorm Initial Cloud-to-Cloud Lightning	$\geq 45\text{-}48$ dBz, above -10°C by $\geq 3\text{K Ft}$, for 10-15 min
Anvil IC Lightning	≥ 23 dBz, $\geq 4\text{K Ft vertical depth}$, attached to parent Cb
Anvil CG Lightning	≥ 34 dBz, $\geq 4\text{K Ft vertical depth}$, attached to parent Cb
Debris Cloud IC Lightning	Tops $\geq 30\text{K Ft}$, Large volumes of $\geq 23\text{-}44$ dBz above -10°C (<23 dBz needs greater vertical depth , e.g. 23 dBz $\geq 10\text{K Ft}$)
IC Lightning	VIL, above 0°C level > 5 mm, for 15 – 20 min

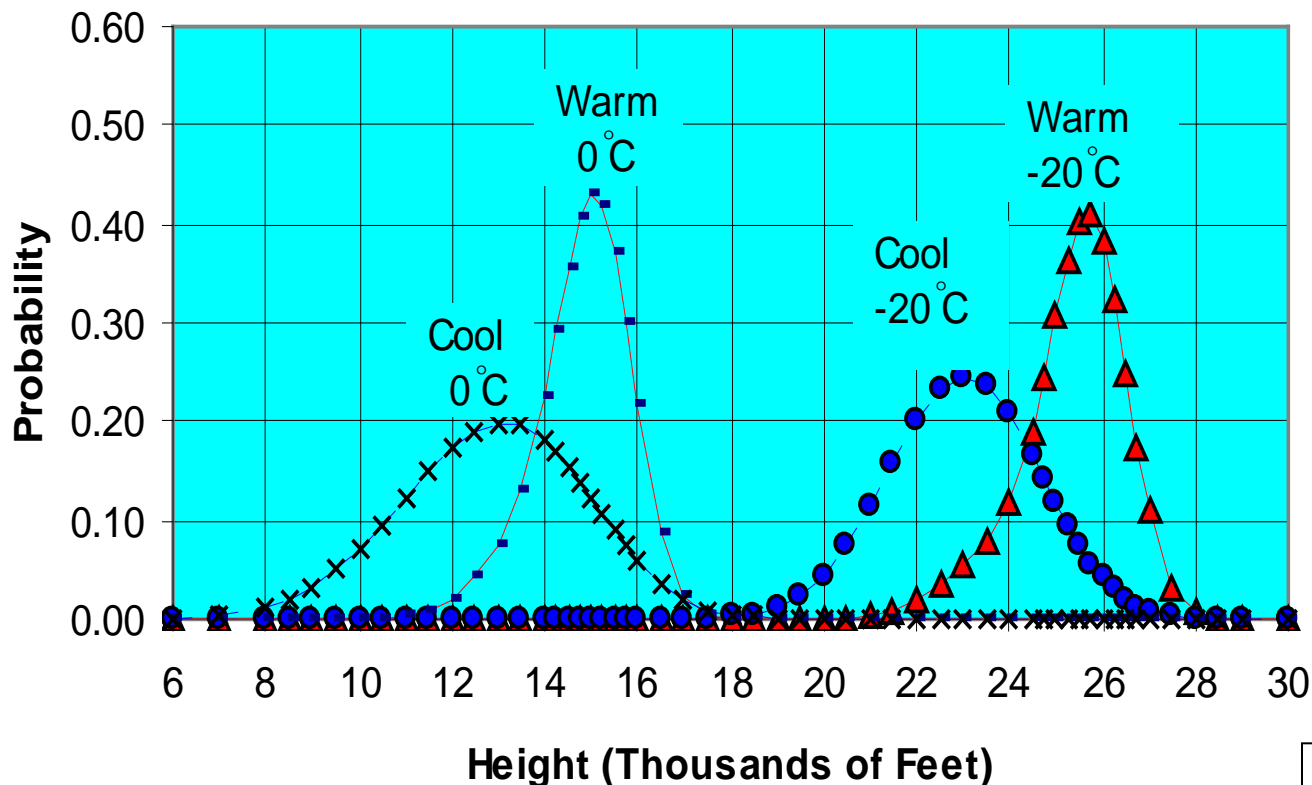
Annual average altitude and thickness of selected temperatures and layers at Cape Canaveral (KXMR) from Range Reference Atmosphere data (RCCMG*).

Temperature (°C)	Height (ft)	Layer Thickness (ft)
+ 10	7737	
		←----- 3232
+ 5	10 969	
		←----- 2888
0	13 857	
		←----- 2749
- 5	16 606	
		←----- 2693
- 10	19 299	
		←----- 2510
- 15	21 806	
		←----- 2320
- 20	24 126	

*Range Commander's Council Meteorology Group



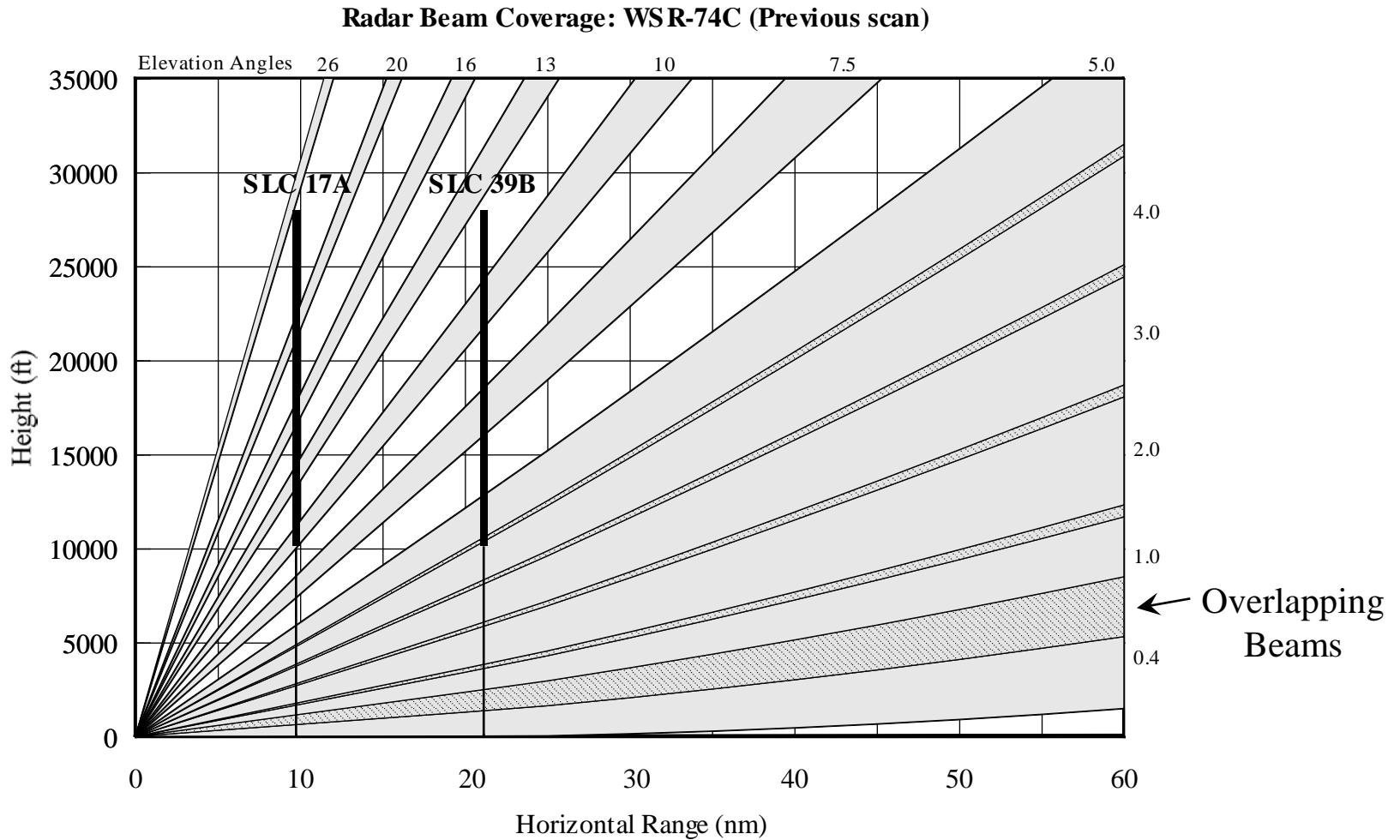
Estimated Probability Distributions of Height of the 0°C and -20°C Isotherms (KXMR)



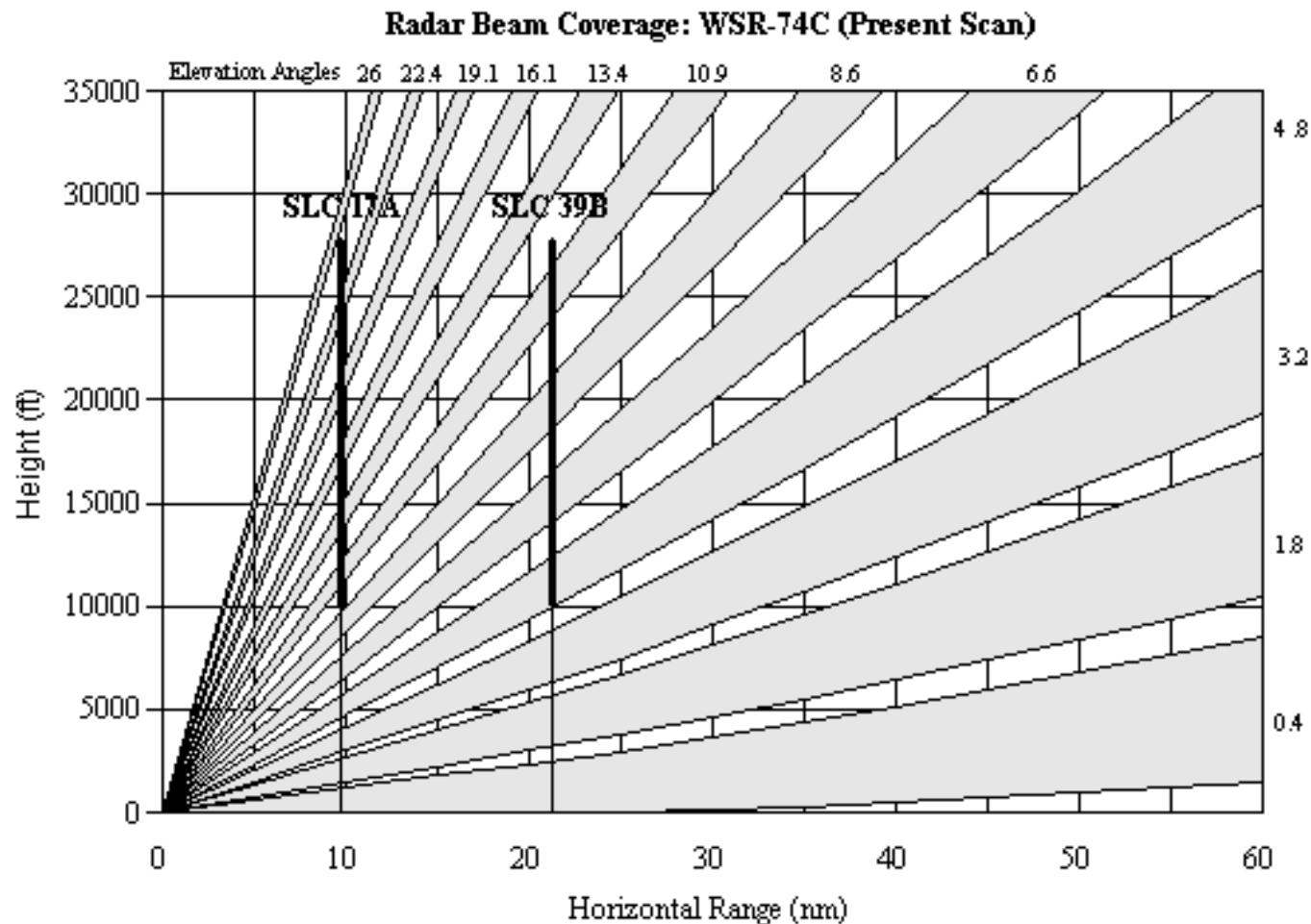
January 1973 –
December 1992

Cool = November, December, January, February, March Warm = May, June, July, August, September

Beam Coverage prior to June 2000

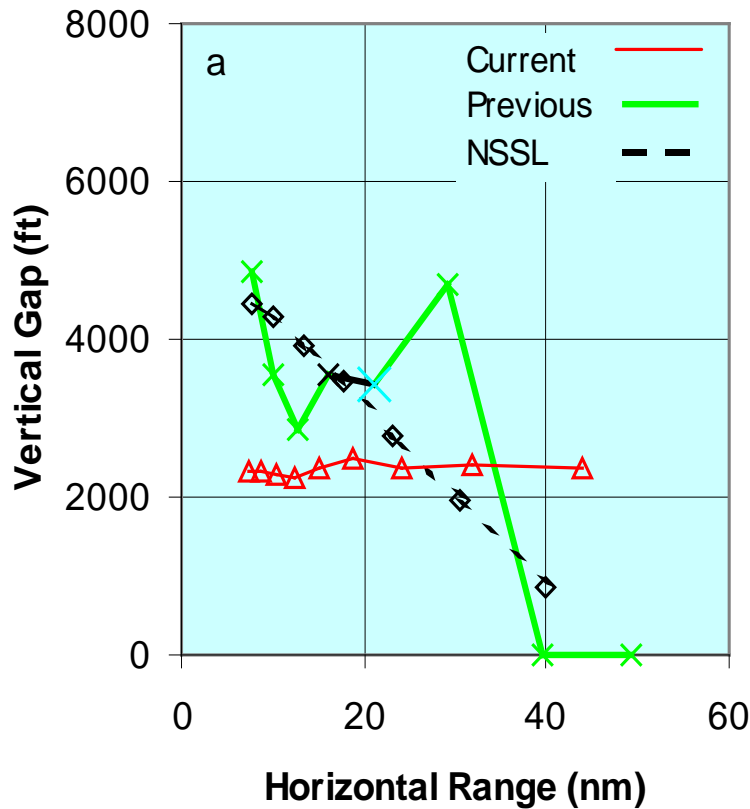


Beam Coverage after June 2000

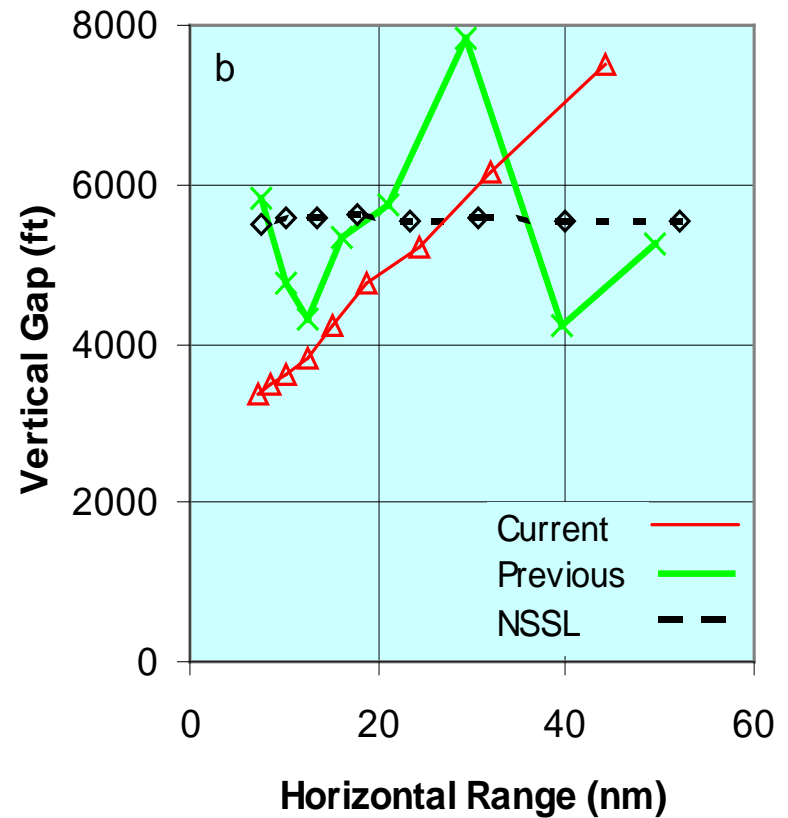


Comparison of Scan Strategies

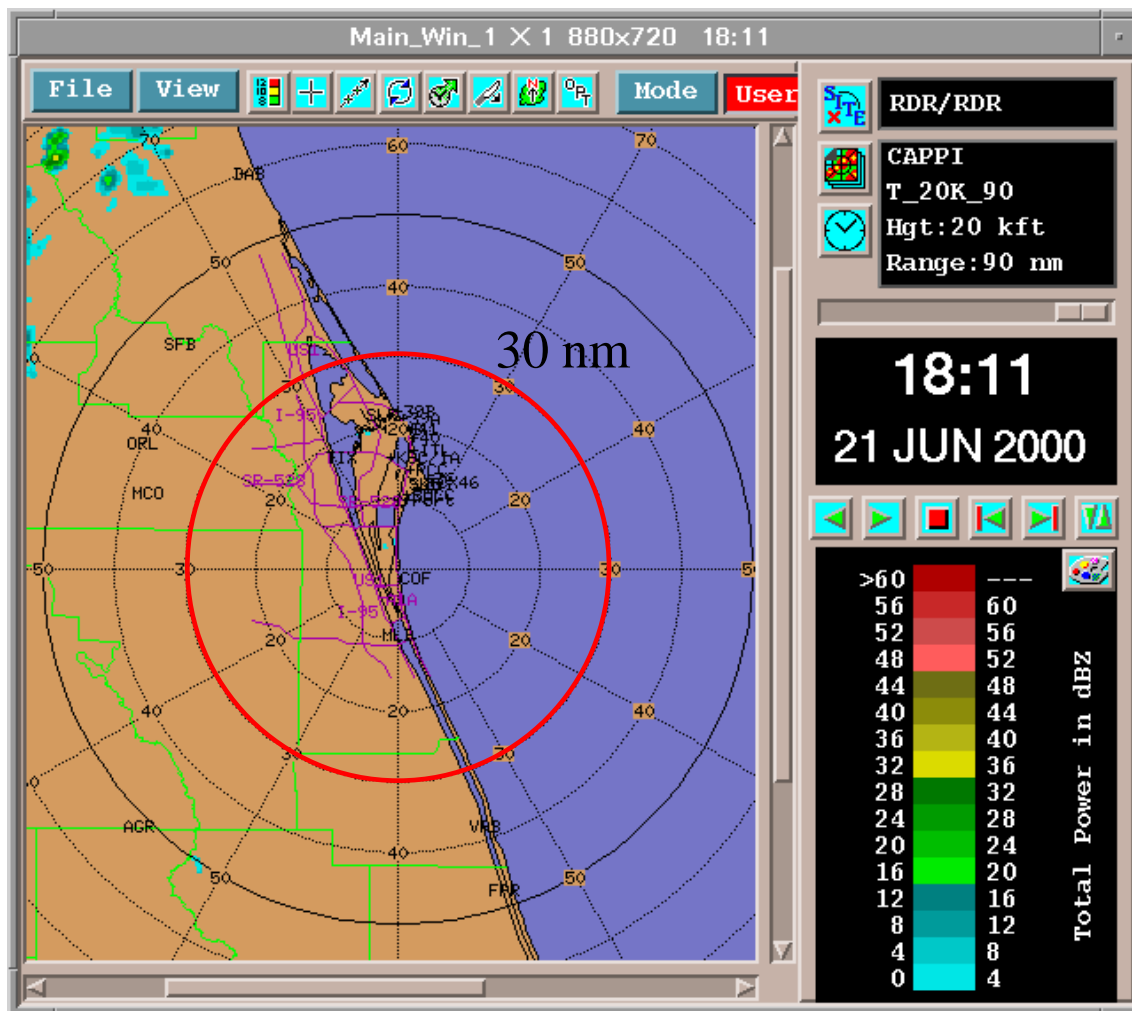
Vertical Gaps between Half-Power Points @ 20,000 ft



Vertical Gaps between Beam Centers @ 20,000 ft



WSR-74C Range Rings over KSC/CCAFA



Products recommended for the RWO IRIS Product Generator.
Implementation may require use of the UPI programming feature in IRIS.

Product	Usage
VIL/Storm Top	Downburst/Wind Gust Potential

$WGP = [20.63 * VIL - 3.125 \times 10^{-6} * TOP^2]^{1/2}$; Stewart (1996)	
Rain Coverage within 20 nm of the SLF	Flight Rules
Height of Maximum dBZ	Downburst/Wind Gust Potential
Cell Based VIL	Downburst
Layered VIL above 0°C level	Lightning

Summary

- WSR-74C Scan Strategy Study
Design, Comparison, Selection, Implementation
- Temperature Profile Study
Annual Average, Seasonal Variability
Radar Applications to Critical 0°C to -20°C Layer
- New IRIS Products under development