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An Unusual Mid-Winter HSLC Event Across Northern Ohio on January 19, 2023

NATIONAL WEATHER SERVICE

May 25, 2023 Douglas Kahn - Meteorologist, NWS Cleveland Patrick Saunders - Meteorologist, NWS Cleveland





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Outline

- Overview of the event.
- Forecast progression.
- Mesoscale environment (incl sounding comparisons).
- Satellite & radar imagery from the event.
- Introduction to "Pseudo" WES-in-the-cloud (NESDIS geoCloud instance in conjunction with the TOWR-S team)



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Quick Facts

- A high shear, low CAPE environment developed across the OH Valley and Lower Great Lakes region on January 19, 2023.
- The environment was most favorable for damaging wind gusts, with limited tornado potential.
- A combination of thunderstorm and non-thunderstorm wind gusts occurred across Ohio.
 - A few occurrences of hail were also found upstream across portions of central Indiana.
- The event was moderately-well forecast, with an SPC slight risk on day 2, followed by an upgrade to an enhanced risk on day 1 (13Z update).
 - There were a lack of thunderstorm reports across the southern half of the enhanced risk area
- WFO ILN launched a special 19Z sounding on January 19, 2023.
 - Relatively clear skies allowed for favorable NUCAPS retrievals across the region.



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The Forecast



SPC forecasts, days 1, 2, and 3 for the overall severe weather risk.



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Surface temperature, dewpoint, and pressure.



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2-hour pressure changes (rises in red & falls in blue).



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3-hour dewpoint changes.



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Low-level (0-3 km) lapse rates (C/km).



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Surface-based CAPE & CIN.



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LCL heights (m AGL).



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SPC Mesoanalysis (21Z)



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Satellite (NUCAPS)

- NUCAPS is an algorithm that is used to process temperature and moisture information from sounders (CrIS & ATMS) onboard the S-NPP and NOAA-20 satellites.
 - NOAA-21 was launched in late 2022 and will replace S-NPP once fully operational (sometime later in 2023?)

PROS	CONS
NUCAPS represents the real atmosphere in partly to cloud-free areas	Data quality poor in cloudy/thick-cloud areas
Can edit the NSHARP sounding as you wish using surface observations	Temporal data is lacking - satellite passes usually between 6-7Z and 18-19Z across the Lower Great Lakes
Good for pre-convective environments, perhaps even for winter weather	Boundary layer smoothing - don't expect to see micro-scale perturbations (6 to 10 levels of temperature data, 4 to 6 levels of moisture data)

NUCAPS Web Viewer



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Satellite (NUCAPS)



NUCAPS availability overlaid with visible satellite (left). NUCAPS availability overlaid with gridded NUCAPS Total Totals, toggled with gridded NUCAPS mid-level (850-700 mb) lapse rates (right). Images courtesy of Scott Lindstrom/CIMSS.

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Satellite (NUCAPS) - Sandusky, OH

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FARCEL	CAPE	CIN	LCL	LI	LFC	EL	Sum2	SRH(m²	/s²) Shear(kt) MnWind	SRW	
SURFACE	e	O	875m	4	М	2870'	SFC-1km	М	М	М	М	
ML 100 mb	Θ	Θ	1236m	4	м	4057'	SFC-2km	м	м	м	м	
FCST SFC	60	Θ	1564m	2	1564m	13306'	SFC-3km	м	м	M	M	
MU (932 mb)	C	Θ	1042m	4	м	3419'	Eff Infl	owM	M	M	M	
EFF LAYER	Θ	Ο	875m	4	М	2870'	SFC-6km		М	М	M	
USER DEF	0	0	1691m	5	М	5548'	SFC-8km		M	м	M	
PW = 0.34in	SCAPE =	0J/k	.g WBZ	= 34	74' WND	G = M	LCL-EL(C	loud Lay	er) M	М	M	
K = 5	DCAPE =	362J	I/kg FZL	= 45	25' ESP	= 0.00	Eff Shea	r(EBWD)	M	M	M	
MidRH = 24%	DownT =	40F	Conv	/T =	58F MMP	= 0.00	BRN Shea	Г =	М			
LowRH = 64%	MeanW =	4.6g/	kg MaxT	= 5	8F NCA	PE =0.00	4-6km SF	Wind =	M			
sfc-3km Agl	LapseRat	e= 21	LC/7.0C/	km S	upercell	.= M	Corfidi	Downshea	r = -9999/-9	1999 kt		
3-6km Agl La	pseRate=	- 19	9C/6.3C/	km S	TP(eff)=	• O.O	Corfidi	Upshear :	= 0/0 kt			
850-500mb La	pseRate=	= 27	70/6.50/	km S	TP(fixed) = 0.0	Bunkers	Right =	-9999/-9	1999 kt		
700-500mb La	pseRate=	- 16	5C/6.4C/	km S	HIP=		Bunkers	Left =	-9999/-9	999 kt		
							STP(eff)	LR =	0.0	1km & 6	Km AGL V	Vind Ba
							LGHAIL =		Θ.Θ	MOSHE = (9.0	
FARCEL	CAPE	CIN	LCL	LI	LFC	EL	Sum2	SRH(m²	/s²) Shear(kt) MnWind	SRW	
SURFACE	437	-10	903m	-1	903m	18769'	SFC-1km	М	М	м	м	
ML 100 mb	105	-12	1335m	1	1335m	14197'	SFC-2km	м	М	м	м	
FCST SFC	156	-2	1432m	1	1432m	15096'	SFC-3km	M	M	M	M	
MU (959 mb)	437	-10	903m	-1	903m	18769'	Eff Infl	owM	M	M	M	
EFF LAYER	413	-2	1083m	-1	1083m	18769'	SFC-6km		м	м	м	
USER DEF	C	0	1691m	5	м	5548'	SFC-8km		м	м	м	
PW = 0.36in	SCAPE =	76J/	kg WBZ	= 34	74' WND	G = M	LCL-EL(loud Lay	er) M	M	M	
K = 5	DCAPE =	430J	I/kg FZL	= 45	25' ESP	= 0.00	Eff Shea	r(EBWD)	M	M	M	
MidRH = 24%	DownT =	40F	Conv	/T =	60F MMP	= 0.00	BRN Shea	Г =	м			
LowRH = 62%	MeanW =	5.lg/	kg MaxT	= 5	9F NCA	PE =0.09	4-6km SF	Wind =	М			
sfc-3km Agl	LapseRat	:e= 24	4C/8.1C/	km S	upercell	.= М	Corfidi	Downshea	r = -9999/-9	1999 kt		
3-6km Agl La	pseRate=	- 19	9C/6.3C/	km S	TP(eff)=	= O .O	Corfidi	Upshear :	= 0/0 kt			
850-500mb La	pseRate=	= 27	7C/6.5C/	km S	TP(fixed) = 0.0	Bunkers	Right =	-99997-9	1999 kt		
700-500mb La	pseRate=	- 16	5C/6.4C/	km S	HIP=	0.0	Bunkers	Left =	-9999/-9	1999 kt		
							STP(eff)	LR =	0.0	1km & 6	km AGL V	Vind Ba
							LGHAIL =		0.0	MOSHE = (9.0	

The top image shows the raw NUCAPS point readout from Sandusky, OH, while the bottom image shows an adjusted data readout using surface observations. Images courtesy of Scott Lindstrom/CIMSS.



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Satellite (NUCAPS) - Wilmington, OH

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· · ·	* NUCAPS Availa	abilfty (Editable)	Road Even The	17:52 25-24-25
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FARCEL	CAPE	CIN	LCL	LI	LFC	EL	Sum2	SRH(m²/s²) Shear(kt)	MnWind	SRW	
SURFACE	40	-9	1111m	3	1211m	10676'	SFC-1km	М	М	м	м	
4L 100 mb	C	- 4	1375m	4	1709m	6783'	SFC-2km	М	М	M	M	
FCST SFC	59	Θ	1628m	2	1628m	11545'	SFC-3km	М	М	M	M	
4U (959 mb)	40	-9	1111m	з	1211m	10676'	Eff Infl	owM	M	M	M	
EFF LAYER	40	-9	1111m	3	1211m	10676'	SFC-6km		М	M	М	
JSER DEF	٥	0	1702m	5	М	5585 '	SFC-8km		м	м	M	
PW = 0.38in	SCAPE =	0J/k	g WBZ	= 409	90' WNE)G = M	LCL-EL(C	loud Layer)	M	м	М	
< = 6	DCAPE =	4403	/kg FZL	= 542	25' ESF	0 = 0.00	Eff Shea	r(EBWD)	M	M	M	
MidRH = 22%	DownT =	42F	Cont	vT =	61F MMF	0 = 0.00	BRN Shea	Г =	M			
LowRH = 61%	MeanW =5	5.2g/	kg Maxi	T = 62	2F NCA	PE =0.02	4-6km SF	R Wind =	М			
sfc-3km Agl	LapseRat	e= 22	20/7.50/	km S	upercell	.= M	Corfidi	Downshear =	-9999/-999	99 kt		
3-6km Agl La	apseRate=	18	C/6.1C/	km S	TP(eff)=	= 0.0	Corfidi	Upshear =	0/0 kt			
350-500mb La	apseRate=	- 26	5C/6.3C/	km S	TP(fixed	() = 0.0	Bunkers	Right =	-9999/-999	99 kt		
700-500mb La	apseRate=	15	C/6.0C/	km S	HIP=	0.0	Bunkers	Left =	-9999/-999	99 kt		
							STP(eff)	LR =	0.0	1km & 6	5km AGL Win	id Ba
							LGHAIL =		0.0	MOSHE =	0.0	
ARCEL	CAPE	CIN	LCL		LFC	EL	Sum2	SRH(m²/s²) Shear(kt)	MnWind	SRW	
FARCEL SURFACE	CAPE 116	CIN 0	LCL 1387m	LI 2	LFC 1387m	EL 13740'	Sum2 SFC-1km	SRH(m²/s² M) Shear(kt) M	MnWind M	SRW M	
FARCEL SURFACE ML 100 mb	CAPE 116 7	CIN 0 -8	LCL 1387m 1458m	LI 2 3	LFC 1387m 1458m	EL 13740' 9147'	Sum2 SFC-1km SFC-2km	SRH(m²/s² M M) Shear(kt) M M	MnWind M M	SRW M M	
FARCEL SURFACE ML 100 mb FCST SFC	CAPE 116 7 54	CIN 0 -8 0	LCL 1387m 1458m 1643m	LI 2 3 2	LFC 1387m 1458m 1643m	EL 13740' 9147' 11545'	Sum2 SFC-1km SFC-2km SFC-3km	SRH(m²/s² M M M)Shear(kt) M M M	MnWind M M M	SRW M M	
FARCEL SURFACE ML 100 mb FCST SFC MU (959 mb)	CAPE 116 7 54 116	CIN 0 -8 0	LCL 1387m 1458m 1643m 1387m	LI 2 3 2 2	LFC 1387m 1458m 1643m 1387m	EL 13740' 9147' 11545' 13740'	Sum2 SFC-1km SFC-2km SFC-3km Eff Infl	SRH(m²/s² M M M owM) Shear(kt) M M M M	MnWind M M M	SRW M M M	
FARCEL SURFACE ML 100 mb FCST SFC MU (959 mb) EFF LAYER	CAPE 116 7 54 116 121	CIN -8 0 0	LCL 1387m 1458m 1643m 1387m 1378m	LI 2 3 2 2 1	LFC 1387m 1458m 1643m 1387m 1378m	EL 13740' 9147' 11545' 13740' 13740'	Sum2 SFC-1km SFC-2km SFC-3km Eff Infl SFC-6km	SRH(m²/s² M M M owM)Shear(kt) M M M M M	MnWind M M M M	SRW M M M M	
FARCEL SURFACE ML 100 mb FCST SFC MU (959 mb) EFF LAYER JSER DEF	CAPE 116 7 54 116 121 0	CIN -8 0 0 0	LCL 1387m 1458m 1643m 1387m 1378m 1378m	LI 3 2 2 1 5	LFC 1387m 1458m 1643m 1387m 1378m M	EL 13740' 9147' 11545' 13740' 13740' 5585'	Sum2 SFC-1km SFC-2km SFC-3km Eff Infl SFC-6km SFC-8km	SRH(m²/s² M M owM) Shear(kt) M M M M M	MnWind M M M M M	SFW M M M M M	
FARCEL SURFACE ML 100 mb FCST SFC MU (959 mb) EFF LAYER JSER DEF FW = 0.38in	CAPE 116 7 54 116 121 0 3CAPE =	CIN -8 0 0 0 7J/k	LCL 1387m 1458m 1643m 1387m 1378m 1378m 1702m g WBZ	LI 3 2 2 1 5 = 409	LFC 1387m 1458m 1643m 1387m 1378m M 90' WNC	EL 13740' 9147' 11545' 13740' 13740' 5585' 06 = M	Sum2 SFC-1km SFC-2km SFC-3km Eff Infl SFC-6km SFC-8km LCL-EL(C	SRH(m²/s² M M owM owM) Shear(kt) M M M M M M	MnWind M M M M M M	ж м м м м м м м м м	
FARCEL SURFACE ML 100 mb FCST SFC MU (959 mb) EFF LAYER JSER DEF FW = 0.38in $\zeta = 6$	CAPE 116 7 54 116 121 0 3CAPE = DCAPE =	CIN -8 0 0 0 7J/k 458J	LCL 1387m 1458m 1643m 1378m 1378m 1702m g WBZ /kg FZL	LI 2 2 1 5 = 409 = 542	LFC 1387m 1458m 1643m 1387m 1378m M 90' WNC 25' ESF	EL 13740' 9147' 11545' 13740' 13740' 5585' 0G = M P = 0.00	Sum2 SFC-1km SFC-2km SFC-3km Eff Infl SFC-6km SFC-8km LCL-EL(C Eff Shea	SRH(m²/s² M M owM owM Cloud Layer)) Shear(kt) M M M M M M M	MnWind M M M M M M M	SFW M M M M M M M M M	
FARCEL SURFACE ML 100 mb FCST SFC MU (959 mb) EFF LAYER JSER DEF FW = 0.38in < = 6 MidRH = 22%	CAPE 116 7 54 116 121 0 3CAPE = DCAPE = DOWNT =	CIN -8 0 0 0 7J/k 458J 42F	LCL 1387m 1458m 1643m 1378m 1378m 1702m g WBZ /kg FZL Con:	LI 2 2 2 1 5 = 409 = 542 vT =	LFC 1387m 1458m 1643m 1387m 1378m M 90' WNC 25' ESF 61F MMP	EL 13740' 9147' 11545' 13740' 5585' OG = M P = 0.00 P = 0.00	Sum2 SFC-1km SFC-2km SFC-3km Eff Infl SFC-6km SFC-8km LCL-EL(C Eff Shea BPN Shea	SRH(m²/s² M M owM cowM Cloud Layer) r(EBWD) r(EBWD)) Shear(kt) M M M M M M M M	MnWind M M M M M M	SR M M M M M M M M	
FARCEL SURFACE ML 100 mb FCST SFC MU (959 mb) EFF LAYER JSER DEF FW = 0.38in < = 6 MidRH = 22% LowRH = 59%	CAPE 116 7 54 116 0 3CAPE = DCAPE = DOWNT = MeanW =5	CIN -8 0 0 0 7 7 458J 42F 5.1g/	LCL 1387m 1458m 1643m 1378m 1378m 1702m g WBZ /kg FZL Con kg Max	LI 2 3 2 2 1 5 5 5 40 7 = 54 2 7 = 54 2 7 = 62	LFC 1387m 1458m 1643m 1387m 1378m M 90' WNE 25' ESF 61F MMF 2F NC&	EL 13740' 9147' 11545' 13740' 13740' 5585' 0G = M P = 0.00 P = 0.00 P = 0.04	Sum2 SFC-1km SFC-2km SFC-3km Eff Infl SFC-6km SFC-8km SFC-8km LCL-EL(C Eff Shea 4-6km SF	SRH(m²/s² M M ow/M 2loud Layer) ir = (EBWD) ir = (Wind =) Shear(kt) M M M M M M M M M	MnWind M M M M M M	SF& M M M M M M M M	
FARCEL SURFACE ML 100 mb FCST SFC MU (959 mb) EFF LAYER JSER DEF FW = 0.38in K = 6 MidRH = 22% MidRH = 55% Sfc-3km Agl	CAPE 116 7 54 121 0 3CAPE = DCAPE = DCAPE = DCAPE = DCAPE = LapseRat	CIN -8 0 0 0 7J/k 458J 42F 5.1g/ e= 2 ²	LCL 1387m 1458m 1643m 1387m 1378m 1702m g WBZ /kg FZL Con kg Max Con	LI 2 3 2 2 1 5 5 2 2 1 5 5 4 0 5 7 = 6 2 ×T = 6 2 ×T = 6 2 ×T = 6	LFC 1387m 1458m 1643m 1387m 1378m M 90' WNC 25' ESF 61F MMF 2F NCA upercell	EL 13740' 9147' 11545' 13740' 13740' 5585' 0G = M 0 = 0.00 APE = 0.04 L = M	Sum2 SFC-1km SFC-2km SFC-3km Eff Infl SFC-6km SFC-6km LCL-EL(C Eff Shea 4-6km SF Corfidi	SRH(m²/s² M M owM 2.oud Layer) r(EBWD) r(EBWD) r(Wind = Downshear =) Shear(kt) M M M M M M M M M - 9999/-999	MnWind M M M M M M M 29 kt	SRW M M M M M M M	
FARCEL SURFACE ML 100 mb FCST SFC MU (959 mb) EFF LAYER JSER DEF W = 0.38in K = 6 MidRH = 22% MidRH = 22% Sfc-3km Agl Sfc-3km Agl	CAPE 116 7 54 116 121 0 3CAPE = DCAPE = DOWNT = MeanW = LapseRat apseRate=	CIN -8 0 0 0 7J/k 458J 42F 5.1g/ e= 2 ² 18	LCL 1387m 1458m 1643m 1378m 1702m g WBZ /kg FZL Con: kg Max C/8.1C/ 8C/6.1C/	LI 2 3 2 2 1 5 40 2 1 5 40 2 1 5 40 2 1 5 40 2 1 5 40 2 1 5 40 2 1 5 40 2 1 5 40 2 1 5 40 2 1 5 40 2 1 5 40 2 1 5 40 5 4 1 5 4 1 5 1 5 4 1 5 1 5 1 5 1 5 1 5	LFC 1387m 1458m 1643m 1387m 1378m M 90' WNC 25' ESF 61F MMF 25 NCA upercell TP(eff)=	EL 13740' 9147' 11545' 13740' 5585' OG = M P = 0.00 PE = 0.04 PE = 0.04 L= M = 0.00	SUM2 SFC-1km SFC-2km SFC-3km SFC-6km SFC-6km SFC-8km LCL-EL(C Eff Shea BRN Shea 4-6km SF Corfidi Corfidi	SRH(m ² /s ² M M owM Cloud Layer) r(EBWD) r = Wind = Downshear = Upshear =) Shear(kt) M M M M M M M -9999/-999 0/0 kt	MnWind M M M M M M 99 kt	SRW M M M M M M	
FARCEL SURFACE ML 100 mb FCST SFC MJ (959 mb) EFF LAYER JSER DEF FW = 0.38in (< = 6 MidRH = 22% LowRH = 52% sfc-3km Agl La 350-500mb La	CAPE 116 7 54 116 121 0 3CAPE = DCAPE = DCAPE = DCAPE = DOWNT = MeanW =5 LapseRate= apseRate=	CIN -8 0 0 0 7J/k 458J 42F 5.1g/ e= 2 ² 18 26	LCL 1387m 1458m 1643m 1378m 1702m g WBZ /kg FZL Con: kg Max (C/8.1C/)C/6.1C/)C/6.3C/	LI 2 3 2 2 1 5 409 7 = 542 7 = 5 409 7 = 5 409 7 = 5 8 5 8 5 8 5 8 5 7 7 5 8 7 8 7 8 7 8 7	LFC 1387m 1458m 1643m 1378m 1378m M 90' WNC 25' ESF 61F MMF 2F NCA upercel TP(eff)=	EL 13740' 9147' 13740' 13740' 13740' 5585' 0 = 0.00 0 = 0.	SUM2 SFC-1km SFC-2km SFC-3km SFC-6km SFC-6km LCL-EL(C Eff Sheat 4-6km SF Corfidi Corfidi Bunkers	SRH(m ² /s ² M M owM owM in EBWD) in = Wind = Downshear = Right =) Shear(kt) M M M M M M M M - 9999/-999 0/0 kt - 9999/-999	MnWind M M M M M M M 29 kt 29 kt	SRW M M M M M M	
FARCEL SURFACE ML 100 mb FCST SFC ML (959 mb) EFF LAYER JSER DEF FW = 0.38in < = 6 MidRH = 22% idRH = 52% sfc-3km Agl La SFO-500mb La 700-500mb La	CAPE 116 7 54 116 121 0 3CAPE = DCAPE =	CIN -8 0 0 7 7 7 458 42F 5.1g/ e= 22 18 26 15	LCL 1387m 1458m 1643m 1378m 1702m g WBZ /kg FZL Con: kg Max' (C/8.1C/ iC/6.3C/ iC/6.3C/ iC/6.0C/	LI 2 3 2 2 1 5 409 = 409 = 542 vT = 62 km S km S km S	LFC 1387m 1458m 1643m 1378m 1378m M 90° WNC 25' ESF 61F MMF 2F NC2 Uppercell TP(eff)xec HIP=	EL 13740' 9147' 11545' 13740' 13740' 5585' 5585' 0G = M 0 = 0.00 0 = 0.00	Sum2 SFC-1km SFC-2km SFC-3km Eff Infl SFC-8km SFC-8km SFC-8km SFC-8km SFC-8km SFC-8km SFC-8km SFC-8km SFC-8km SFC-8km SFC-8km SFC-8km SFC-8km SFC-8km SFC-8km SFC-9km	SRH(m²/s² M M M owM in E Downshear = Upshear = Light = Left =) Shear(kt) M M M M M M -9999/-999 0/0 kt -9999/-999 -9999/-999	MnWind M M M M M M M 99 kt 99 kt	SRW M M M M M M	
FARCEL SURFACE ML 100 mb FCST SFC MU (959 mb) EFF LAYER JSER DEF PW = 0.381n < = 6 MidRH = 22% STC-3Km Agl B-6km Agl La 350-500mb La 700-500mb La	CAPE 116 7 54 121 0 3CAPE = DCAPE = DCAP	CIN -8 0 0 7 7 7 4 5 1 9 2 2 1 8 26 1 9	LCL 1387m 1458m 1643m 1387m 1378m 1378m 1378m 13702m g WBZ Con- Con- Con- Con- Con- Con- Con- Con-	LI 232 2150342 = = 5 = 63555 = = T = Emerence	LFC 1387m 1458m 1643m 1387m 1378m MNE 25' ESF 61F MMP 2F NC& Upercel TP(eff)= TP(fixed HIP=	EL 13740' 9147' 11545' 13740' 13740' 13740' 0585' 06 = M 0 = 0.00 0 = 0.00 4 = 0.04 L= M = 0.0 0 = 0.04 L= M = 0.0 0 = 0.04 L= M = 0.0 0 = 0.00 0	SUM2 SFC-1km SFC-2km Eff Infl SFC-8km SFC-8km SFC-8km SFC-8km SFC-8km SFC-8km SFC-8km SFC-8km SFC-8km SFC-8km SFC-6km	SRH(m ² /s ² M M owM Cloud Layer) r(EBWD) r(E) Shear(kt) M M M M M M -9999/-999 0/0 kt -9999/-999 0.0	MnWind M M M M M 99 kt 99 kt 18m & 6	SRW M M M M M M Skm_AGL Win	id Ba
FARCEL SURFACE ML 100 mb FCST SFC MU (959 mb) EFF LAYER JSER DEF FW = 0.38in $\zeta = 6$ MidRH = 52% LowRH = 52% LowRH = 52% SFC-3Km Ag1 La 350-500mb La 700-500mb La	CAPE 116 7 54 121 0 3CAPE = DCAPE = DOWNT = MeanW =5 AppseRate= appseRate= appseRate=	CIN -8 0 0 7J/k 458J 42F 5.1g/ e= 2 ² 18 26 15	LCL 1387m 1458m 1643m 1378m 1702m g WBZ Conv /kg FZL Conv /kg Max (C/8.1C/)C/6.3C/)C/6.3C/)C/6.0C/	LI 2 3 2 2 1 5 4 3 4 5 4 5 5 5 5 5 5 5 5 5 5 5 5 5 5	LFC 1387m 1458m 1645m 1387m 1378m M 90° WAN 25' ESF 61F MMF 2F NC& Dpercel TP(eff)= TP(eff)=	EL 13740' 9147' 11545' 13740' 13740' 5585' 5585' P = 0.00 P = 0.00 P = 0.00 P = 0.00 P = 0.00 P = 0.00 D = 0.00 D = 0.00 D = 0.00 D = 0.00	SUM2 SFC-1km SFC-2km <u>SFC-3km</u> <u>SFC-6km</u> SFC-6km SFC-8km LCL-EL(C Eff Shea BRN Shea 4-6km SF Corfidi Corfidi Bunkers STP(eff) LGHAIL =	SRH(m ² /s ² M M owM cowM cr(EBWD) rr = Wind = Downshear = Upshear = Right = Left = LR =) Shear(kt) M M M M M M M M -9999/-999 0/0 kt -9999/-999 -9999/-999 0.0	MnWind M M M M M M M M M M M M M M M M M M M	SRW M M M M M M Skm AGL Win 0.0	id Ba
FARCEL SURFACE ML 100 mb FCST SFC MU (959 mb) EFF LAYER JSER DEF FW = 0.38in (< = 6 MidRH = 22% LowRH = 52% sfc-3km Agl La 350-500mb La 700-500mb La	CAPE 116 7 54 116 121 0 3CAPE = DCAPE =	CIN -8 0 0 7J/k 458J 42F 5.1g/ e= 24 18 26 15	LCL 1387m 1458m 1643m 13878m 1702m g WBZ /kg FZL Kg FZL C/8.1C/ iC/6.1C/ iC/6.3C/ iC/6.0C/	L2322150242 = 454 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	LFC 1387m 1458m 1643m 1387m M 1378m M 90' WNC 25' E55 61F MMF 2F NC2 Uppercell TP(effixed TP(effixed TP=	EL 13740' 9147' 13740' 13740' 13740' 5585' 0G = M 0 = 0.00 0 = 0.00 0 = 0.00 0 = 0.00 0 = 0.0 0 = 0.0 0 = 0.0 0 = 0.0	SUM2 SFC-1km SFC-2km Eff Infl SFC-6km SFC-6km SFC-6km SFC-8km LCL-EL(C Eff Shea 4-6km SF Corfidi Bunkers STP(aff) LGHAIL =	SRH(m ² /s ² M M owM Cloud Layer) rr = Cloud Layer Cloud Cloud Cl) Shear(kt) M M M M M M M 9999/-999 0/0 kt -9999/-999 0.0 0.0	MnWind M M M M M M M M 99 kt 1km & 6 NosHE =	SRW M M M M M M Skm AGL Win 5km AGL Win	ıd Ba

The top image shows the raw NUCAPS point readout from Wilmington, OH, while the bottom image shows an adjusted data readout using surface observations. Images courtesy of Scott Lindstrom/CIMSS.



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Satellite (NUCAPS) - Sounding Comparison



The image on the left shows the modified NUCAPS sounding from Sandusky, OH while the image on the right shows the modified NUCAPS sounding from Wilmington, OH. Images courtesy of Scott Lindstrom/CIMSS.



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Surface & Upper-Air Observations

ILN 230119/1900 (Observed)





NDAA/NWS Storm Prediction Cen Norman, Oklaho

WPC surface analysis at 18Z on Jan 19, 2023 (left). The star denotes the observed sounding from WFO ILN at 19Z on Jan 19, 2023 (right).

Sfc-3km Agl Lapse Rate =	7.9 C/km
3-6km Agl Lapse Rate =	5.3 C/km
850-500mb Lapse Rate =	6.6 C/km
700-500mb Lapse Rate =	6.4 C/km



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Other Satellite Imagery



GOES-16 derived lifted index overlaid with infrared satellite (left). GOES-16 derived CAPE overlaid with infrared satellite (right). All satellite products are user-defined scaled down in order to capture the high shear, low CAPE environment. Image courtesy of Scott Lindstrom/CIMSS.



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So What Happened?



Storm reports across the region, including both thunderstorm (blue points) and non-thunderstorm reports (grey points). There were even a few hail reports (green points) upstream across Indiana.



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So What Happened?

- Radar imagery from 21Z on Jan 19, 2023 through 2Z on Jan 20, 2023.
- Loop includes local storm reports and convective warnings.
- Note a lack of convective intensity towards the southern flank of the line.



Radar loop from 415 PM through 9 PM EST, including convective warnings.

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Future WES-in-the-cloud (left monitor)

Radar all-tilt 9-panel procedure for a specific radar, including base & dual-pol products. Can be altered for any radar.

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Future WES-in-the-cloud (left monitor)

Radar 6-panel "all"-tilt procedure for nearest radars.

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Future WES-in-the-cloud (right monitor)

Top left panel, TDWR Z/V. Bottom left panel, MRMS reflectivity (top left), VII (bottom left), MESH track + GLM MFA (top right), GLM FED - user modified + total ENTLN (bottom right). Right panel, user modified IR overlaid with Nighttime Microphysics RGB.

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Summary

- A high shear, low CAPE environment across the OH Valley and Lower Great Lakes region resulted in numerous thunderstorm wind damage reports.
 - The overall reports were perhaps not as widespread as the enhanced risk suggested, given dry air entrainment across the OH Valley which resulted in lower surface dewpoints and thus low-level moisture.
- The MOSHE parameter (especially the gradients, similar to CAPE), proved useful in determining where severe storms may form and persist.
- Relatively clear skies allowed for good-quality satellite retrievals, including NUCAPS.
 - A special 19Z ILN sounding also aided in mesoanalysis, providing a "ground-truth".
- "Pseudo" WES-in-the-cloud showed utility for future replacement of the legacy WES systems at NWS WFOs

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Questions?

A Preliminary Study of Severe Wind-Producing MCSs in Environments of Limited Moisture in: Weather and Forecasting Volume 21

Issue 5 (2006) (ametsoc.org).

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