



Background

- The Convection Morphology Parameter Space Study (COMPASS) was designed to reveal patterns and trends in storm morphology (size, strength, rotation, persistence, etc.) as a function of position within a comprehensive 8D parameter space, using cloud simulations initialized with idealized profiles of T, q and u, v. It is assumed that the local vertical structure of the atmosphere dominates storm behavior.
- Profile parameters are: CAPE, Hodo. Radius, buoyancy profile shape, shear profile shape, LCL, LFC, PW (dictated by LCL T), and free tropospheric RH (FTRH) above the LFC.
- Choose 2 or 3 reasonable high and low values of each parameter, form all permutations, run simulations on each.
- Basic simulation set, using only high FTRH for completeness, s 216 expts. Nomenclature example:
- e2c2m4n2k2f6p3h9, where e denotes CAPE (1=800,2=2000, 3=3200 J/kg), c denotes hodo radius (1=8, 2=12, 3=16 m/s), m denotes buoyancy profile shape, n denotes shear shape, k and f denotes LCL and LFC altitudes (2=0.5, 6=1.6 km, with k2f6 featuring an 0.5 km LCL and 1.6 km LFC, with a moist adiabatic profile between), p denoting LCL T (3=3 cm PW, 6=6 cm PW), and h denoting FTRH.

Methodology

- Run 2-h RAMS simulations on each experiment, examine attributes of all the simulated storms. Used RAMS 3b with 1-moment microphysics, Smagorinsky-Lilly turbulence schemes, with no Coriolis.
- Used 500 m x,y mesh, z mesh stretched thru 20 km, sponge layer up to 24.5 km; dt=3.0 s, all data saved every 5 min.
- Spheroidal warm bubbles with 3K warmth used to initialize.
- All subcloud layers have theta-e independent of z; p3 cases have 321 K, p6 cases have 354 K.
- All subcloud layers have small positive lapse rates of theta, to ensure Ri stays large enough to prevent spontaneous mixout; we have verified that starting profiles are maintained on storm inflow sides of domains for all simulations, so that integrity of all experiments is not compromised by mixout of CAPE, shear, etc.
- Assess and tabulate means and extremes of many storm attributes, with special emphasis on 60 < t < 120 min data.

Results

- Peak WMAX updraft efficiency (UE) can exceed 1.0 in CAPE=800 environments, when compressed b profiles cause latent heat of fusion to boost W at low altitudes, thus boosting WMAX aloft. UE is larger when PW is small.
- At small CAPE, steep lapse rates just above LFC can make the difference between a strong supercell and a non-survivor.
- WMAX steadiness is large when shear is large and PW small.
- ZETA aloft is larger when shear and CAPE are both large. Rotation efficiency vs. SRH is surprisingly large at weak shear and large CAPE, but there SRH is small so ZETA is only moderate. ZETA is also steadiest at large shear, CAPE.
- ZETA at z=0 is largest when shear Is large. Again, surface rotation efficiency is largest at weak shear, large CAPE, but ZETA(0) is smaller and less steady than ZETA aloft, with only a few exceptions.

I	- mi	3n5	m.	5n5	m	2n4	m	4n4	m	1n3	m	3n3
	k616p3	k616p6	k616p3	4616p8	kēfēp3	käfäpä	k8f6p3	k616p6	k6f6p3	k616p6	k6f8p3	kāfāpā
	k2f6p3	k2f8p8	k2f8p3	k2f8p8	k2f6p3	k2f6p6	k2f6p3	k2f6p6	k2f8p3	k2f8p8	k218p3	k2f6p6
	k212p3	k212p6	k212p3	k2f2p8	k2f2p3	k2f2p8	k2†2p3	k212p6	k212p3	k212p8	k212p3	k2f2p8
c3	m	3n3	m	5n3	. m	2n2	m	4n2	- m	11	m	3n1
	k616p3	k616p6	k616p3	k6f6p6	k6f6p3	kéféné	k616p3	k616p6	k616p3	k616p6	k616o3	kõfépő
	k2f6p3	k2f6p6	k2f8p3	k2f6p8	k2f8p3	k2f8p8	kZf6p3	k2f6p6	k2f8p3	k2f8p8	k216p3	k2f8p8
	k212p3	k212p6	k212p3	k2f2p6	k2f2p3	k2f2p6	k212p3	k212p6	k212p3	k212p6	k212p3	k2f2p6
ŀ	m	3n5	m	5n5	m	2n4	m	4n4	m	1n3	m	3n3
	k616p3	k616p6	k615p3	k616p5	k6f6 p3	k6f6p6	k616p3	k616p6	k616p3	k616p6	k616p3	k6f6p6
	k216p3	k218p8	k2f8p3	k2f8p8	k2f8p3	k2f8p8	k216p3	k216p6	k218p3	k2f8p8	k218p3	k2f8p8
	k212p3	k212p6	k212p3	k2 f 2p6	k2f2p3	k2f2p6	k212p3	k212p6	k212p3	k212p6	k212p3	k2f2p6
c2	m3n3		m5n3		m2n2		m4n2		m1n1		m	3n1
	k616p3	k616p6	k818p3	k8/6p6	kőfőp3	k6f6p6	k616p3	k616p6	k6f6p3	kō15pō	k616p3	k6f6p6
	k216p3	k218p8	k2f8p3	k2f8p8	k2f8p3	k2f8p8	k218p3	k218p8	k218p3	k218p8	k216p3	k2f8p8
	k2f2p3	k212p6	k212p3	k2f2p6	k2f2p3	k2f2p6	k212p3	k212p6	k212p3	k212p8	k2f2p3	k2f2p6
ŀ	m	3n5	m	5n5	m	2n4	m	4n4	m	1n3	m	3n3
	k6f6p3	kőfőpő	k818p3	k818p8	k616p3	k6f6p6	k616p3	k6f6p6	kőfőp3	köföpö	k616p3	k616p6
	k216p3	k216p6	k218p3	k218p8	k2f8p3	k2f8p8	k216p3	k216p6	k216p3	k218p6	k218p3	k2f8p8
	k2f2p3	k2f2p 5	k2f2p3	k2f2p8	k2f2p3	k2f2p6	k2f2p3	k2f2p6	k2f2p3	k2f2p8	k212p3	k2f 2p6
CI	m	3n3	m:	5n3	m	2n2	m	4n2	m	1 n 1	m	3n1
	k6f6p3	kőfőpő	k8f8p3	k8f8p8	k8f6p3	k6f6p6	k6f6p3	k6f6p6	k6f6p3	k8f8p8	k6f6p3	k6f6p6
	k216p3	k216p6	k218p3	k218p8	k2f8p3	k2f6p8	k216p3	k216p6	k216p3	k216p6	k216p3	k2f6p6
	k212p3	k212p6	k2f2p3	k2f2p8	k2f2p3	k2f2p8	k212p3	k212p6	k212p3	k2f2p8	k2f2p3	k2f2p8
L			ə1				e2		1		e3	





3B.20. ROADMAPS OF CONVECTIVE STORM ATTRIBUTES AS A FUNCTION OF ENVIRONMENT: PART 1: UPDRAFT OVERTURNING AND ROTATION EFFICIENCY AND STEADINESS

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-												
	m .	3n5	m	5n5	m	2n4	m,	4n4	ш	1 n 3	m	3n3
3	.4	1.8	372.2	260.2	242.7	26.1	343.3	428.2	226.5	37.9	294.3	346.3
2	.8	2.3	482.4	90.7	320.3	298.5	372.2	348	274.3	272.6	481.3	472.5
1	9.8	27.4	418.8	115.8	387.7	48.9	397.4	423.2	592.6	410	426.4	481.3
c3	ET L	3n3	m	5n3	m	2n2	m	4n2	ш	1n1	m	3n1
5		2.3	185.3	63.6	135.1	43.4	270.7	325.1	112.1	64.4	222.6	96.8
7	.4	4.1	253.3	50	238.8	234.8	310.3	394.5	584	104.2	376.8	312.8
2	7.2	25	99.8	55.2	195.3	66.8	399.2	277.3	233.6	197.9	463.3	533.7
		385	m	585		2n4	m	474		1n3	m	3n3
1	.6	1.6	264.7	100.9	146.3	26.4	260.5	300.8	150.8	90.3	241.1	99.8
2	.3	2.9	285.3	51.1	173.3	179.9	318.5	262.4	140.9	103.2	180.4	233.6
4	1.2	40.7	369.5	33.7	177	72.2	440.4	182.1	252.1	184.6	582.2	471.8
c2	-	503	-	503		202		4.7.7		1.01	P1	So1
5	.7	6.4	86.8	9.9	119.5	16.6	165.3	52.8	77.6	40.2	107.4	79.7
2	5.6	6.2	114.8	15.6	163.3	31.8	199.3	210.6	104	42	198.2	147.3
2	4.6	38	100.8	47.7	161.6	56.8	218.7	62.9	154.6	46.7	196.9	35.8
H	m	3n5	m	5n5	m	2n4	m	4n4	m	1 n 3	m	3n3
7	.3	2.1	53.5	15.1	96.4	9.5	124.1	77.4	56.7	30.2	92.1	98.5
1	4.5	0.6	100.1	14.3	144.8	22.9	143.2	125.3	76	40.8	103.4	63
5	1.9	26	68.6	48.4	153.7	96.4	228.9	42.6	185.8	41.5	188.9	55
c1	m	3n3	m	5n 3	m	2n2	m	4n2	m	1n1	m	3n1
1	5.6	7.9	20.4	24.3	61	27	76.1	67.5	59.4	42.9	57.3	67.7
4	3.6	33.4	25.5	29.4	121.1	26.2	93.3	40.3	61.8	33.8	84.4	66.9
4	2.7	38.3	29.3	54.8	48.6 45.2 37.5 35.1				122.6 46.9 177.8 35.4			
	e1			e2				e3				

EXPT NAMES, all expts

Mean peak ZETA (aloft) 60 min to 120 min

m	3n5	m	5n5	m	2n4	m/	4n4	ш	1 n 3	m	3n3
16.3	11.7	280.4	214.5	315.3	251.8	338.1	356.4	342.6	321.5	405.6	434.8
14.3	14.8	288	199.8	299.5	266.5	357	362.7	383.7	405.2	436.1	447.7
19.9	15.3	274.9	178.1	327.6	132.8	328.5	308.1	377	285.8	387.7	402
	2	_	5-3		2-2		4-2		11		Int
137.5	48.7	254.1	173.6	332.8	226.2	347.3	325	333.6	246.3	369.3	345.9
130.9	53.6	253.1	198.1	299.8	272.5	318.9	312.6	295.2	323.4	300.5	369.3
54.4	37.4	143.2	144.7	241.9	134.6	300.3	191.1	289.8	238.8	312	297.3
				_	-		_				
m.	3n5		5n5	m ³	2n4	m-	4n4	ш	1n3	m	3n3
114.4	25.5	260.7	228.5	306.4	189	351.9	329.5	352.6	252.5	300.5	333
106	42.8	257.5	193.4	292.9	270.9	305.6	337.7	313.3	318.7	305	386.6
38.5	30.4	221.4	177.9	226.7	104.8	297.6	183.1	276	177.1	297.9	308.6
-	1.1	-	5	-	1-7		1-7	-	11		Int
49.5	56.1	210.7	129.1	184.9	116.9	270.8	141.9	298.5	118.6	302.5	171.2
100.8	48	205.2	132.1	204.4	133	262.7	190.8	332.8	183.8	341.8	303.4
48.1	56.9	122.2	103.5	119.1	90.2	185.4	97	190.2	114.4	238.4	157.4
					7-4						
42.1	54 54	197.3	115.5	177.7	93.1	211.4	83.3	235.8	115.8	267	194.8
53.4	57.3	204.8	92.7	196.2	123.1	237.7	210.9	262.5	166.1	285.4	200
35.8	53.8	137.7	66.2	109.2	58.4	174.7	108.3	189.8	114.9	203.6	147.1
			10.920 ^{- 86}	1		-			- 10 P	-	1
m.	3n3	m	5n3	m:	Zn2	m-	4n2	m 15 4 7	1n1	m3	5n1
03.0	75.0	104.0	09.4	109.6	108.1	127.0	131.9	154.5	96.5	104	244.8
50.7	7.1 75.8 112.2 72.2				96.7	151.4	131.4	218./	113.9	230.4	200.9
59.7	9.7 56.1 57.3 67.4				82.2	112.7	105.1	180.1	108	140.2	105.3
		225		a2				e3			

MEAN ZETA ALOFT all avate

Mean peak WMAX,

MEAN WMAX, all expts

m5n5 m2n4 m4n4 m1n3 m3n3 21 20.36 55.84 21.95 53.79 45.03 67.47 36.20 67.19 58.0

m2n2 m4n2 m1n1

0.77 18.21 12.31 24.06 6.26 31.84 15.97 43.36 9.27 33.75 26.6

m3n5 m5n5 m2n4 m4n4 m1n3 m3n3

0 2.28 29.59 5.22 27.36 10.49 46.75 29.69 38.16 16.27 52.46 34.

1.56 7.42 2.38 10.67 2.86 18.16 8.63 16.66 5.17 27.43 8.

.91 9.33 2.79 13.58 8.38 20.06 15.09 18.66 9.99 45.11 24.9

25.72 6.52 25.05 10.03 45.76 6.65 52.55 7.71 49.40 14.96

m5n3 m2n2 m4n2 m1n1 m3n1 7.94 2.43 8.97 6.83 14.76 9.77 16.44 5.76 21.02 26.47

2.68 4.11 3.44 6.75 5.10 12.18 7.60 17.12 11.

60 min to 120 min

32		54.4	37.4	143.2	1
26 28 30 32 34 36 38 40 42 44 e1o3m5n5k216p3h9		114.4 106	3n5 25.5 42.8	260.7 257.5	2
† = 120 min Z,'=2.1km, Z,'=5.0km	c2	38.5	30.4	221.4	1
40 ************************************		49.5	56.1	210.7	1
36		48.1	56.9	122.2	1
312 - 30 - 26 -		m 42.1	3n5 54	m 197.3	5r 1
26		55.4 35.8	57.3	137.7	6
42 44 46 48 50 52 54 56 58 60 e1o3m5n3k2f6p3h9 † = 120 min	GI	m 65.6	3n3 66.5	104.6	5
		67.1 59.7	75.8 56.1	57.3	6
				100	_

Z'=2.1km, Z'=2.1km

CAPE=3200, V=16,CURVED, LCL=0.5km UPDRAFT W (Z=2.4 km); Q_R, WIND (Z=0.1 km)



Mean peak ZETA (z=0) 60 min to 120 min MEAN ZETA(0), all expts

		3n5	E CONSTRUCTOR	5n5		2n4	m 4	4n4	m	1 n 3	m	3n3
	1.4	0.9	207.8	66.5	186.2	10.5	195	262.8	170.8	19.7	194.5	212
	1	0.9	201.6	31.9	200.4	95.9	255.9	203.7	213.9	152.7	330.8	359.7
	6.8	7.5	225.4	65.3	313.1	33.5	312.7	279.4	314.3	240.7	323.7	393.1
:3		7_7		- 7								
12	3.2	1.6	116.7	30.8	97.8	29.2	160.9	195.3	83	37.5	163.5	56.9
	4	7	147 3	25.4	165.0	128 4	192.6	278 1	101 7	50 F	127 6	210 1
	4	5	143.5	23.4	105.9	120.4	102.0	230.1	191.5	00.0	127.0	219.1
	11.9	12.3	69.9	29.1	116.6	35.8	246.6	122.8	156.4	113	238.8	277.6
1		3n5	m	5n5	m	2n4	m	4n4	m	1 n 3	m	3n3
	1.1	0.8	155.5	59.9	90.9	18	155.8	225	96.6	38.8	187.9	56.8
	1.3	8.0	153.7	25.9	123.5	91.2	155.4	149.5	91.4	58.1	128.2	150.3
	10.5	14.1	217.3	23.8	113.2	34.1	301.2	88	171.2	54.3	288.9	231.7
:2		1	_	5	_	1-7		1-7	-	11		Int
	2.7	2.4	37.3	3.8	42.9	5.9	101.2	17.1	38.2	12.6	68.9	40.1
	8.4	2.1	74.7	9.5	86.2	17.1	156.2	66	52.4	25.9	108.8	77
	13.4	14.9	31.2	21.9	38.6	11.9	123.5	21.5	46.8	12.3	108.5	18.1
		3.0.5		5.05		2.0.4		47.4		1.03		Se 3
	1.8	0.8	28.5	3.7	21	2.8	73.9	28.6	16.1	8.1	45.4	35.7
	4	0.3	61.1	5.4	43.2	11.5	118.7	60.8	25.7	23.5	78.9	43.6
	17.9	9.5	30.7	15.9	28.8	21.8	111.9	16.7	49.7	15.4	102.4	24.2
c1		1		te t		242		4-7		1 1		Int
	2.8	2.7	5.3	8.4	8.9	4.4	15.3	21.5	14.5	14.1	15.6	45
	6.9	10.9	5.1	9.4	18.5	8.4	17.8	16.5	13.5	21	46.9	28.5
	15	11.7	9.2	10.7	14.1	18.9	12.9	18.2	34.3	23.3	53.1	20.8
			e1 -			1	-7			1.1	-3	

Extreme peak WMAX, 60 min to 120 min:

PEAK WMAX, all expts

Peak updraft efficiency, 60 min to 120 min PEAK WMAX EFF, all expts m3n5 m5n5 m2n4 m4n4 m1n3 m3n3 0.04 0.01 1.04 0.81 0.94 0.46 0.92 0.77 0.91 0.72 0.91 0.81 .04 0.02 0.60 0.33 0.74 0.19 0.73 0.56 0.78 15 0.09 0.35 0.28 0.53 0.17 0.52 0.40 0.67 m3n5 m5n5 m2n4 m4n4 m1n3 .18 0.03 0.95 0.60 0.88 0.53 0.90 0.73 0.84 0.58 3 0.06 0.54 0.34 0.54 0.18 0.65 0.37 0 m3n5 m5n5 m2n4 m4n4 m1n3 m3n3 0.08 0.13 0.77 0.24 0.71 0.44 0.80 0.25 0.71 0.40 0.77 0.48 **12 0.10 0.83 0.18 0.75 0.32 0.88 0.62 0.76 0.38 0.80 0.62** 0 0.14 0.22 0.19 0.39 0.18 0.47 0.19 0.54 0.29 0.59 0 m3n3 m5n3 m2n2 m4n2 m1n1 0.30 0.22 0.37 0.22 0.56 0.42 0.49 0.41 0.55 0.42 0.08 0.16 0.07 0.10 0.26 0.23 0.20 0.12 0.50 0.31



Extreme peak ZETA (aloft) 60 min to 120 min

PEAK ZETA ALOFT, all expts

m5n5	m	2n4	m.	4n4	ш	1 n 3	m	3n3
4 240.6	396.4	319.7	510.3	498.8	505.3	435.7	457.9	566.5
2 280.7	338.7	336	454.5	493.9	547.7	588.1	548.7	581.1
4 200.7	405.3	176.6	391	429.1	614.1	379.3	489.8	503.9
m5n3	m	2n2	m	412		Int	m	3n1
2 263	444.5	271.8	520.5	417.5	471.1	374.4	450.8	504.2
8 239.9	378.1	385.1	448.6	396.6	534.4	441.8	399	466.3
9 170.3	338.2	182	378.3	289.7	361.8	306.6	415.8	525.7
-5-5	-	l n d	-	4-4		1.5		2
6 277.9	369.3	266.2	433.9	411.3	454.1	343.4	395	470.6
5 231.2	331	357.3	507.7	438.8	407.9	375.7	397.5	490.1
6 227.1	327.9	158	413	223.3	350.2	248.5	536.9	416.7
				4-0				
1 160.3	244.7	173.6	339.8	300	370.7	254.2	368.4	261.2
7 162.7	239.1	166.1	337	277.9	452.2	219.1	439.2	444.5
8 129.1	180.2	153.6	271.6	139.6	278.1	206.7	295.6	256.3
		1-4		44		1 . 1		I.I.I
1 196.8	238.5	154.9	262.5	154.1	284.7	236	332.3	432.4
4 138.2	261.8	166.1	331.9	280.1	397.7	263.7	345.2	236.2
2 154.9	204.2	153.9	227.4	140.3	258.9	213.7	315.8	245.6
		202	-	4-17		1.01		Tes 1
2 126.7	220.4	179.7	216.9	211.1	240.5	190.2	210.3	374.2
2 117.9	273	182.4	231.4	301.2	339	203.8	318.9	371.3
4 119.1	192.9	134.5	197.5	181	227.3	211.3	210	196.7
			- 2				- 7	
			82			8	60	

Extreme peak ZETA (z=0) 60 min to 120 min

PEAK ZETA(0), all expts

Peak ZETA (aloft) efficiency vs. SRH 60 min to 120 min

			P	EAK	ZETA EFF, all ex				pts			
	m	3n5	т	5n5	m	2n4	m	4n4	ш	1 n 3	. п	3n3
	0.24	0.14	1.06	0.76	1.68	2.07	2.19	2.10	2.81	5.01	2.42	3.60
	0.17	0.09	1.06	0.87	1.39	1.59	1.91	2.13	3.03	4.28	3.16	3.26
	0.26	0.18	1.77	1.05	1.97	1.91	1.98	2.21	4.74	3.10	3.61	3.37
5	_	2-2	_	5-1	_	2-2	_	4-2	_	11	_	1-1
	2.39	1.58	2.34	2.71	4.96	4.22	4.70	3.99	5.21	30.78	5.34	9.30
	2.35	1.82	2.49	2.24	3.92	4.26	4.51	3.75	6.11	7.11	4.63	5.38
	3.73	1.57	1.94	2.83	5.02	7.68	4.64	4.23	5.70	5.21	5.89	7.05
ł		7_5		F_F		- 4	_	4-4	_	4 - 7		7-7
ł	1.18	0.35	1.56	1.47	3.25	3.22	3.19	3.28	5.80	13.81	4.16	6.21
	0.85	0.39	1.55	1.21	3.03	3.12	3.79	3.59	4.94	5.98	5.77	5.79
	0.97	0.58	2.13	1.90	3.77	3.76	3.77	2.85	4.92	8.60	7.43	5.01
,												
	m	3n3	m	5n3		2n2		4n2	m	1.0.00	m	3n1
	2.22	2.13	4.72	6.15	7.28	7.84	1.69	17.68	14.20	18.08	9.86	16.30
	2.80	2.08	3.90	3.57	6.12	11.08	5.37	4.71	10.67	24.56	10.06	8.83
	4.81	4.04	4.85	7.32	11.36	-99.9	6.24	19.39	12.42	22.59	8.18	18.19
	m	3n5	m	5n5	m	2n4	m	4n4	m	1 n 3	m	3n3
	0.81	1.61	3.00	4.53	7.28	5.23	4.82	7.45	15.72	11.15	9.60	15.17
	1.03	0.94	3.21	2.73	7.43	5.77	6.26	4.90	15.64	22.83	10.56	8.98
	1.80	2.46	3.95	3.38	12.82	3.67	5.34	70.48	14.77	15.15	8.56	22.39
I	m	3n3	m	5n 3	m	Zn2	m	4n2	m	1n1	m	3n1
	6.68	4.85	34.66	10.25	27.27	8.85	12.58	201.1	64.14	253.6	42.05	62.06
	6.94	6.95	11.82	6.21	36.25	27.81	13.26	12.45	89.21	-99.9	17.21	27.85
	21.05	7.88	6.89	28.16	21.25	22.50	17.67	-99.9	22.33	50.80	14.20	35.76
			e1		a2				e3			

Peak ZETA (z=0) efficiency vs. SRH 60 min to 120 min

PEAK ZETA(0) EFF, all expts

6					-2-4 -4-4							
	m	3n5	m	5n5	mi C C T	2n4	m	4n4	m	1 n 3	m	3n3
	0.01	0.01	0.87	0.82	1.03	0.17	1.47	1.81	1.26	0.44	1.55	2.20
	0.01	0.01	1.15	0.28	1.31	1.41	1.56	1.50	1.52	1.98	2.77	2.65
	0.12	0.15	1.56	0.61	1.89	0.53	2.01	2.18	4.57	3.35	3.14	3.22
3		3n3	m	5n3		2n2	т	4n2	m	1n1	m	3n1
	0.07	0.04	1.54	0.65	1.51	0.67	2.44	3.10	1.24	5.30	2.64	1.79
	0.09	0.10	2.08	0.47	2.48	2.60	3.12	3.73	6.67	1.68	4.37	3.61
	0.90	0.41	1.24	0.92	2.90	2.82	4.90	4.05	3.68	3.36	6.56	7.16
1		385	-	55		Ind	-	And		1.03		303
	0.01	0.01	1.26	0.53	1.29	0.32	1.91	2.40	1.93	3.63	2.54	1.32
	0.02	0.02	1.38	0.27	1.58	1.57	2.38	2.15	1.70	1.64	2.62	2.76
	0.34	0.32	2.31	0.28	2.04	1.72	4.02	2.32	3.54	6.39	8.05	5.68
2	31						_	4-7				X-1
	0.14	0.16	1.41	0.38	3.56	0.75	3.74	3.11	2.97	2.86	2.87	4.98
	0.59	0.15	1.73	0.34	4.18	2.12	3.17	3.57	2.45	4.71	4.54	2.93
3	1.50	1.30	3.22	2.70	10.18	-99.9	5.03	8.74	6.90	5.11	5.45	2.54
3		305		505		284		4=4		1.5		3.0.3
	0.09	0.04	0.63	0.35	2.94	0.32	2.28	3.74	3.13	1.43	2.66	3.46
	0.19	0.01	1.11	0.28	4.11	0.80	2.70	2.19	2.99	3.53	3.16	2.39
	0.84	0.46	1.55	1.06	9.65	2.30	5.37	21.39	10.60	2.94	5.12	5.02
1	m	3n3	m	5n3	m	2n2	m	4n2	m	1n1	m	3n1
	0.78	0.33	3.74	1.96	7.55	1.33	4.41	64.24	15.84	57.25	11.46	11.23
	2.30	2.36	1.43	1.55	16.08	3.99	5.35	1.66	16.25	-99.9	4.56	5.02
	9.63	2.89	1.55	12.94	5.35	7.56	3.36	-99.9	12.04	11.27	12.02	6.43
			-1				-2				- 7	



m**3n5** 0.3 0.35

m3n3 0.49 0.58 0.51 0.77 0.64 0.54



0.18 0.34 0.16 0.32 0.35 0.31





Peak updraft steadiness, 60 min to 120 min

WMAX STEADINESS, all expts

-	5=5		2-4		4-4		1.03		3n3
0.84	0.62	0.94	0.76	0.93	0.92	0.94	0.64	0.93	0.9
0.88	0.84	0.96	0.75	0.9	0.88	0.99	0.88	0.95	0.94
0.87	0.9	0.8	0.72	0.71	0.78	0.85	0.67	0.82	0.74
-	5n3		2n2	m	412		1n1		3n1
0.86	0.8	0.92	0.74	0.92	0.9	0.93	0.75	0.95	0.76
0.83	0.86	0.91	0.85	0.91	0.79	0.97	0.75	0.91	0.9
0.9	0.91	0.69	0.68	0.83	0.72	0.81	0.7	0.74	8.0
	E-E	_	7-4	_	4-4	-	1-7	_	7-7
0.84	0.74	0.87	0.56	0.92	0.83	0.92	0.74	0.94	0.67
0.77	0.87	0.9	0.85	0.91	0.86	0.92	0.71	0.77	0.89
0.83	0.80	0.7	0.56	0.77	0.68	0.72	0.59	0.69	0.73
0.05	0.09	0.7	0.50	0.77	0.00	0.72	0.55	0.03	0.75
	5n3	m2n2			4n2	m	1.01	m	3n1
0.83	0.65	0.82	0.46	0.83	0.44	0.69	0.24	0.92	0.46
0.91	0.83	0.85	0.59	0.89	0.54	0.89	0.55	0.9	0.76
0.81	0.72	0.48	0.32	0.63	0.35	0.38	0.42	0.72	0.65
-	585	m	2n4		4=4	m	1n3	m	3n3
0.83	0.67	0.56	0.36	0.87	0.42	0.57	0.24	0.81	0.39
0.89	0.71	0.58	0.52	0.84	0.75	0.63	0.53	0.82	0.69
0.83	0.3	0.44	0.25	0.61	0.72	0.39	0.23	0.58	0.45
m	5n3		2n2	m	412	m	1n1	m	3n1
0.59	0.35	0.27	0.27	0.45	0.5	0.37	0.2	0.59	0.7
0.62	0.31	0.39	0.31	0.65	0.59	0.42	0.3	0.73	0.73
0.48	0.65	0.25	0.23	0.54	0.65	0.3	0.3	0.65	0.71
- 1				- 2				- 7	
a 1				az				6 3	

Peak ZETA (aloft) steadiness 60 min to 120 min

ZETA STEADINESS, all expts

ш	5n5	m	2n4	ш	4n4	п	1 n 3	ш	3n3
0.61	0.89	0.8	0.79	0.66	0.71	0.68	0.74	0.89	0.77
0.65	0.71	0.88	0.79	0.79	0.73	0.7	0.69	0.79	0.77
0.58	0.89	0.81	0.75	0.84	0.72	0.61	0.75	0.79	0.8
<u></u>	E-7		2-2	_	4-2		1-1	· · · ·	7-1
0.91	0.66	0.75	0.83	0.67	0.78	0.71	0.66	0.82	0.69
0.84	0.83	0.79	0.71	0.71	0.79	0.55	0.73	0.75	0.79
0.01	0.00	0.70	0.74	0.70	0.66	0.00	0.70	0.75	0.57
0.91	0.65	0.72	0.74	0.79	0.00	0.0	0.76	0.75	0.57
m	5n5	m	2n4	т	4n4	т	1 n 3	m	3n3
0.8	0.82	0.83	0.71	0.81	0.8	0.78	0.74	0.76	0.71
0.8	0.84	0.88	0.76	0.6	0.77	0.77	0.85	0.77	0.79
0.65	0.78	0.69	0.66	0.72	0.82	0.79	0.71	0.55	0.74
	5n3		2n7	m	412	m	101	m	3n1
0.72	0.81	0.76	0.67	0.8	0.47	0.81	0.47	0.82	0.66
0.79	0.81	0.86	0.8	0.78	0.69	0.74	0.84	0.78	0.68
0.8	0.8	0.66	0.59	0.68	0.69	0.68	0.55	0.81	0.61
			7-4		4 - 4	-	1-7		7-7
0.78	0.59	0.74	0.6	0.81	0.54	0.83	0.49	0.8	0.45
0.71	0.67	0.75	0.74	0.72	0.75	0.66	0.63	0.83	0.85
0.79	0.43	0.54	0.38	0.77	0.77	0.73	0.54	0.64	0.6
			aa		4		4 - 4		7
0.55	0.55	0.5	0.6	0.59	0.62	0.64	0.51	0.78	0.65
0.53	0.61	0.64	0.53	0.65	0.44	0.65	0.56	0.72	0.54
0.44	0.57	0.52	0.61	0.57	0.58	0.79	0.51	0.67	0.54
e1				a2				e 3	

Peak ZETA (z=0) steadiness 60 min to 120 min

ZETA(0)	STEADINESS,	all	expts
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п	5n5	П	2n4	т	4n4	п	1 n 3	т	3n3
0.56	0.26	0.77	0.4	0.57	0.61	0.75	0.52	0.66	0.61
0.42	0.35	0.63	0.32	0.69	0.59	0.78	0.56	0.69	0.76
0.54	0.56	0.81	0.69	0.79	0.66	0.53	0.59	0.76	0.82
	5n3		2n2		4.12		11		3n1
0.63	0.48	0.72	0.67	0.59	0.6	0.74	0.58	0.73	0.59
0.57	0.51	0.69	0.55	0.59	0.6	0.33	0.58	0.34	0.7
0.7	0.53	0.6	0.54	0.62	0.44	0.67	0.57	0.52	0.52
	5n5		2n4	т	4n4	т	1 n 3	т	3n3
0.59	0.59	0.62	0.68	0.6	0.75	0.64	0.43	0.78	0.57
0.54	0.51	0.71	0.51	0.49	0.57	0.65	0.56	0.71	0.64
0.59	0.71	0.64	0.47	0.68	0.48	0.68	0.29	0.5	0.49
			2-2		4-7		11		Int
0.43	0.38	0.36	0.36	0.61	0.32	0.49	0.31	0.64	0.5
0.65	0.61	0.53	0.54	0.78	0.31	0.5	0.62	0.55	0.52
0.31	0.46	0.24	0.21	0.56	0.34	0.3	0.26	0.55	0.51
_			7-4		4-4		1-7	_	7-7
0.53	0.24	0.22	0.29	0.6	0.37	0.28	0.27	0.49	0.36
0.61	0.38	0.3	0.5	0.83	0.49	0.34	0.58	0.76	0.69
0.45	0.33	0.19	0.23	0.49	0.39	0.27	0.37	0.54	0.44
0.26	0.35	0.15	0.16	0.2	0.32	0.24	0.33	0.27	0.66
0.2	0.32	0.15	0.32	0.19	0.41	0.22	0.62	0.55	0.43
0.31	0.2	0.29	0.42	0.34	0.52	0.28	0.5	0.3	0.59
e1	a 1			.7				-3	

Future Work

- * Study sensitivity to finer grids, higher-moment microphysics schemes;
- * More fully explore combinations of LCL and LFC heights;
- * More fully explore sensitivities to other values of total PW;
- * Explore effects of straight hodograph wind profiles;
- * Explore impacts of more complex profile shaping of free tropospheric relative humidity;
- * Add explicit electrification module to allow study of storm flash rates and flash type;
- * Assess reliability of results using ensembles of perturbed initial fields, while retaining the integrity of the parameter space design;
- * Extend approach to LES to study tornado likelihood, character;
- * Extend approach to aerosol, trace species chemistry and its variability (requires adding several new dimensions to the parameter space).

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- For more info, see website sti.usra.edu/COMPASS..
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- This work is dedicated to advisor Dr. Douglas K. Lilly (1929-2018). "Illegitimi non carborundum."