Wind LEVX

WRF VS HARMONIE VS ML

Model Harmonie

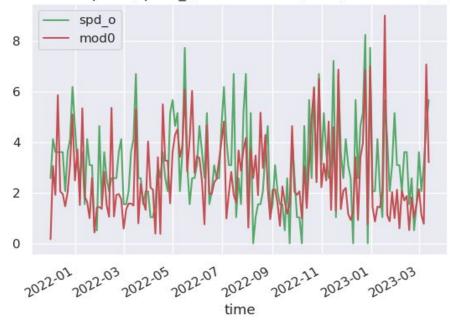
Nearest points

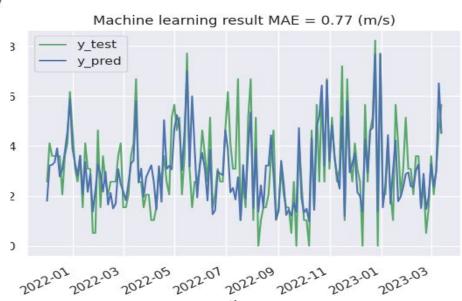


Wind speed

Wind speed

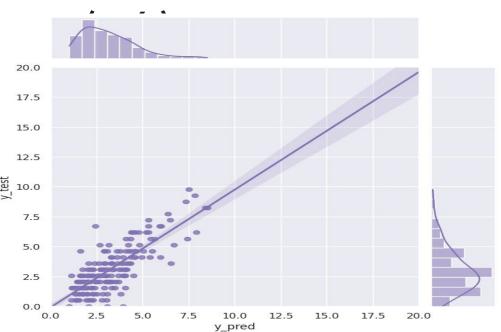
Observed speed (speed_o) Vs Harmonie (mod0) MAE=1.08 (m/s)

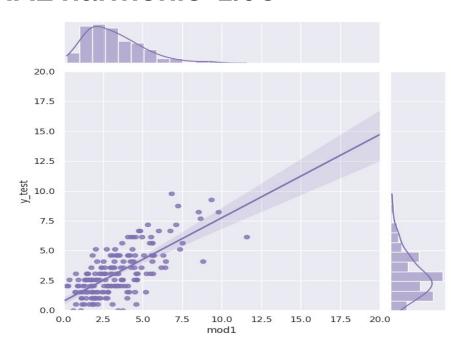


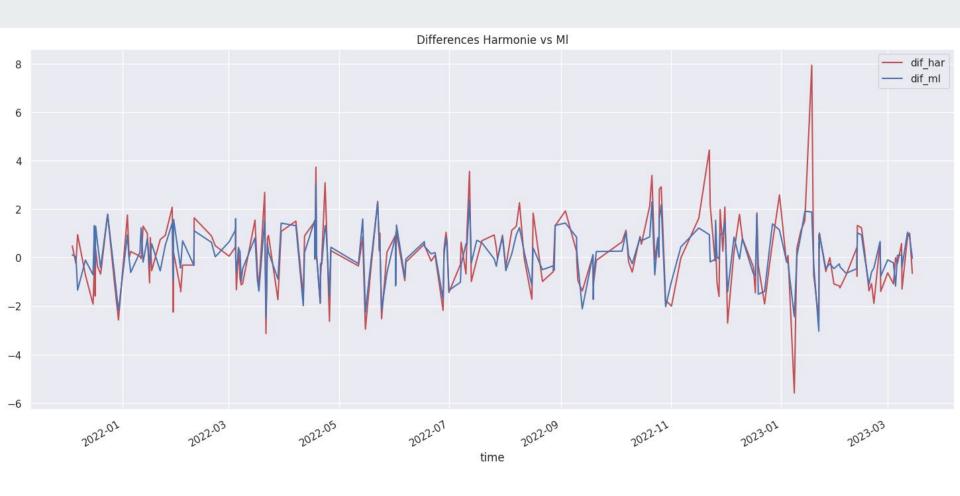


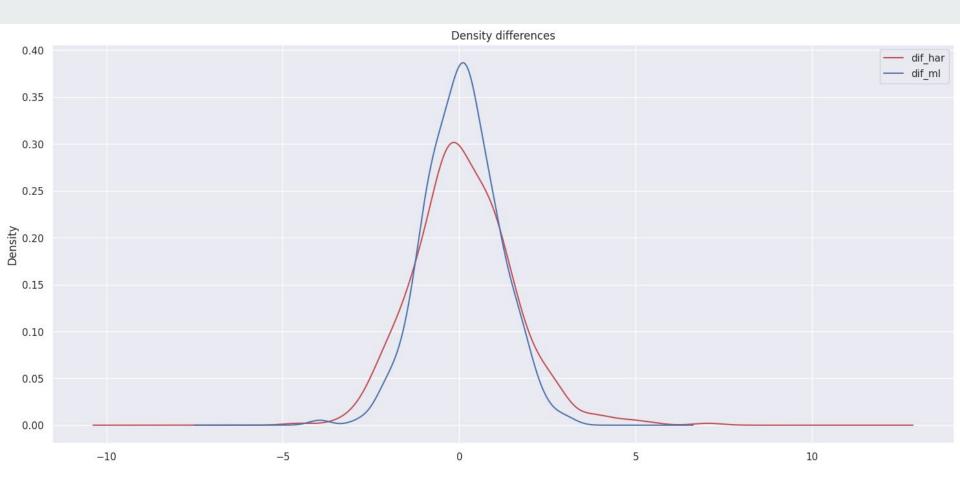
MAE Ml = 0.8 (m/s)

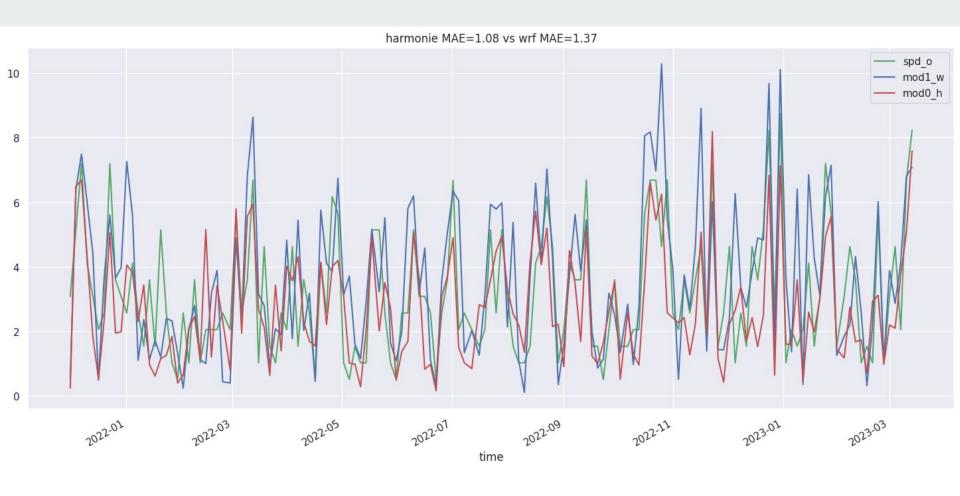
MAE harmonie=1.08

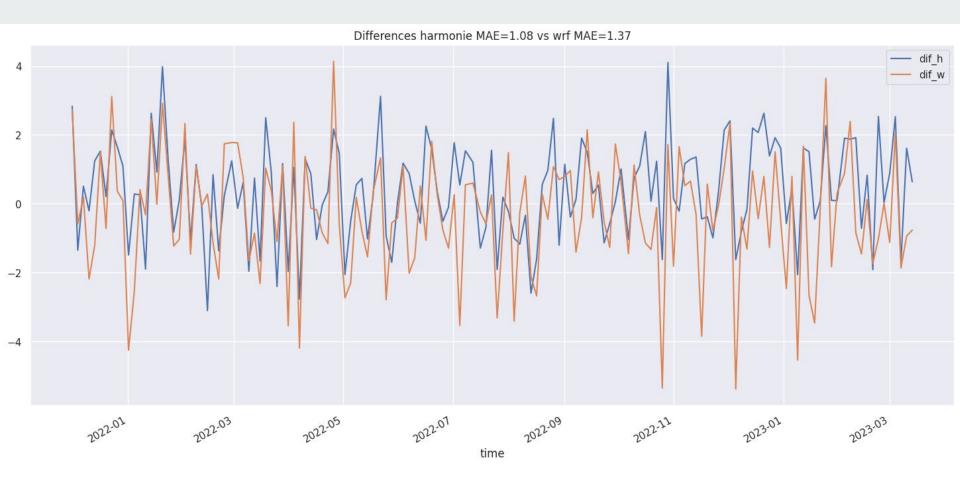


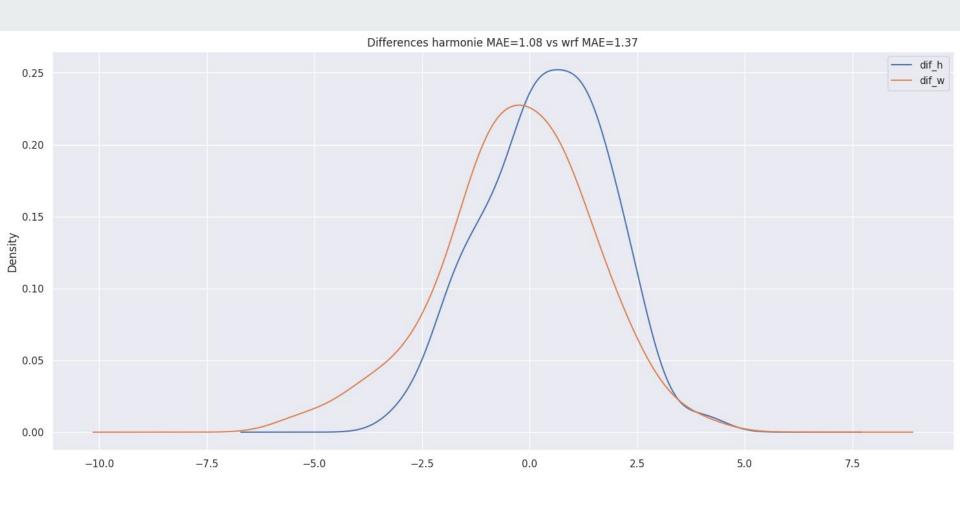


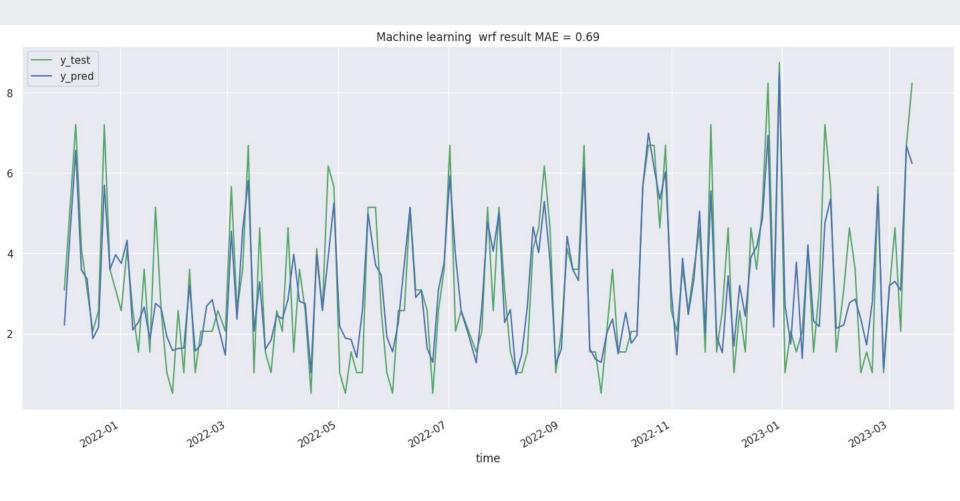


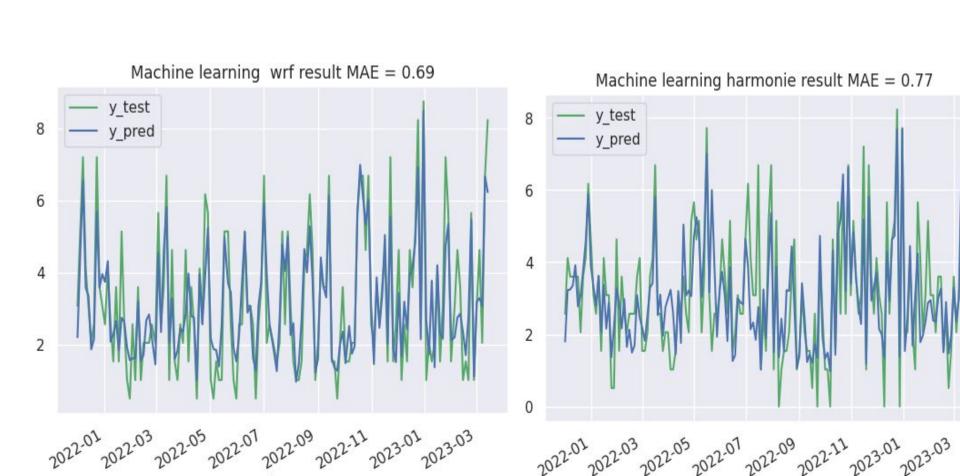












Wind direction

								Cor	ofucie	on ma	atriv	wrf															C-	c '						<u>.</u>							
[0, 20] -	245	72	31	24	19	11	21	30	27	7	1	wri 1	3	13	32	29	57	145	768	[0.00]										natr	ix Ha	- 0		10		70		100	0.000	J	ı
(20, 40] -	-	104	11	18	25	7	4	6	5	2	0	0	1	5	31	16	12	57	536	[0, 20]	200000	59	24	19	19	10000	16	13	11	7	5	3	2	7	53		36500		TO DESCRIPTION		
(40, 60] -		52	21	12	18	4	7	7	0	1	0	0	2	10	32	9	9	26	310	(20, 40]	_	93	12 20	17	7	8	6	5	1	2	1	0	1	3	30 24	+	+	+-	_	_	- 80
(60, 80] -		12	10	10	19	2	3	3	0	1	1	1	0	2	6	1	1	3	91	(40, 60] - (60, 80] -	4	58 16	10000	19	12	6	3	0	0	0	0	0	0	3	3	2	3	-	1000000		-
(80, 100] -	2	7	4	22	19	3	3	3	3	0	0	1	1	1	2	1	0	2	74	(80, 100]		3	7	16	18	9	1	4	0	2	0	0	0	1	1	1	2	+	+		
(100, 120] -	_	0	3	10	11	9	7	5	5	1	1	0	1	1	1	0	0	1	58	(100, 120]	7-251	3	1000	3	11	12	8	12	2	0	0	1	0	2000	1	1	2	- 100	5000		
		1	0	2	7	3	2	3	1	1	1	0	0	1	0	0	0	0	22	(120, 140]	72	1	0	2	3	3	5	4	1	1	0	0	1	1	0	0	0	+	+	-	- 60
(120, 140] -	0	- 68	9		557	1680			300		. = .	- 8	58	1		1,334	- (3)	- 889	2000	(140, 160]	10	1	0	0	4	9	13	17	15	8	2	1	5	6	1	1	0	-	2000	-	
(140, 160] -	\dashv	1	0	1	3	9	12	14	20	4	3	4	3	4	2	0	0	0	81	(160, 180]		0		2	5	5	56	131	138	920	29	18	18	1000	(888)	1	0	- 8	-		
(160, 180] -	1	2	0	2	8	12	46	114	153	56	27	12	9	4	3	3	0	0	452	[=] (180, 200]	2.1	3	1	4	7	21	159	456		236	112	77	44	33		19	-	-	0/20210	4	
ੂੰ (180, 200] - ਰ	1	3	5	10	18	40	119		577	203	94	60	30	18	14	3	3	4	1610	(200, 220]		6	3	8	14	46	139		254	32/10/2	109	97	58	37500	35	0.0000	1000	9	\$25.00 CO		- 40
(200, 220] -		5	3	4	23	32	93	364	315	118	118	81	54	26	21	8	2	4	1274	(220, 240]	20	6	9	8	18	42	130	259	153	64	31	64	92		-	+-	10	11	1029	9	10
(220, 240] -	7	7	11	11	44	38	57	282	201	37	32	65	80	49	19	8	9	4	961	(240, 260]		8	4	5	10	15	44	56	57	26	7	14	50	133	3 201	34	24	7	698	3	
(240, 260] -	8	7	5	7	14	20	23	89	63	9	14	27	43	173	138	15	9	6	670	(260, 280]	-	3	2	5	5	4	6	10	14	2	3	4	16	100	410	88	20	10	704	ļ	
(260, 280] -		3	5	2	7	3	4	15	19	5	6	4	12	175	320	51	20	15	673	(280, 300]	-	1	1	1	1	2	2	1	8	3	1	2	3	22	137	86	25	7	307	1	- 20
(280, 300] -	4	4	0	0	2	4	4	4	5	2	3	2	8	43	137	54	13	4	293	(300, 320]	2	3	1	0	3	1	2	0	0	0	1	1	1	6	51	106	5 23	11	212	2	- 20
(300, 320] -	9	0	0	0	2	1	2	3	4	1	0	0	1	9	69	71	25	5	202	(320, 340]	9	2	1	2	1	3	1	0	0	2	1	0	0	0	26	64	19	19	150	,	
(320, 340] -	9	7	2	1	3	2	0	2	0	2	3	0	0	4	19	46	25	12	137	(340, 360]	92	22	6	7	5	3	1	4	2	0	1	0	1	1	31	54	49	10	6 385	,	
(340, 360] -	73	15	10	6	6	0	3	5	10	1	1	1	0	11	31	43	50	101	367	All -	663	288	105	131	153	211	597	1358	1134	517	304	283	293	428	106	9615	5 332	2 551	1 9032	2	
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	[0, 20]	(20, 40]	(40, 60]	(60, 80]	[00]	[50]	[40]	[09]	[08]	[00]	[023	240]	[097	[083	300]	320]	340]	360]	₹		[0, 20]	(20, 40]	(40, 60]	(60, 80]	(80, 100]	, 12	, 140]	, 160]	, 180]	, 200]	, 220]	, 24	, 26	, 28	, 300]	, 320]	, 340]	, 360]			
	[0,	(20,	(40,	(60,	(80, 100]	(100, 120]	(120, 140]	(140, 160]	(160, 180]	(180, 200]	(200, 220]	(220, 240]	(240, 260]	[260, 280]	(280, 300]	(300, 320]	(320, 340]	(340, 3				(2	7	9)	(80	(100, 120]	(120,	(140,	(160,	(180,	(200,	(220, 240]	(240, 260]	(260, 280]	(280,	(300)	(320,	(340,			
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	ity report				Quality	report wri	point o	
(100, 120] -	6%	20%	9%	(100, 120] -	4%	16%	7%	
(120, 140] -	1%	22%	2%	(120, 140] -	0%	9%	1%	
(140, 160] -	1%	20%	2%	(140, 160] -	1%	17%	2%	
(160, 180] -	12%	29%	17%	(160, 180] -	11%	34%	16%	- 0
(180, 200] -	46%	14%	22%	(180, 200] -	45%	13%	20%	
(20, 40] -	32%	16%	21%	(20, 40] -	34%	19%	25%	
(200, 220] -	36%	8%	13%	(200, 220] -	39%	9%	15%	
(220, 240] -	23%	6%	10%	(220, 240] -	25%	7%	11%	- o
(240, 260] -	17%	7%	10%	(240, 260] -	17%	6%	9%	
(260, 280] -	23%	14%	18%	(260, 280] -	32%	26%	29%	
(280, 300] -	13%	45%	20%	(280, 300] -	16%	47%	23%	
(300, 320] -	17%	50%	26%	(300, 320] -	20%	35%	25%	
(320, 340] -	6%	13%	8%	(320, 340] -	11%	18%	13%	- 0
(340, 360] -	19%	28%	23%	(340, 360] -	26%	28%	27%	
(40, 60] -	19%	6%	9%	(40, 60] -	17%	7%	10%	
(60, 80] -	10%	14%	12%	(60, 80] -	7%	11%	9%	
(80, 100] -	12%	24%	16%	(80, 100] -	8%	26%	12%	- 0
[0, 20] -	35%	28%	31%	[0, 20] -	34%	32%	33%	
accuracy -	16%	16%	16%	accuracy -	18%	18%	18%	
macro avg -	18%	20%	15%	macro avg -	19%	20%	16%	
eighted avg –	28%	16%	17%	weighted avg -	30%	18%	19%	
	precision	recall	f1-score		precision	recall	f1-score	

Confusion matrix (Machine Learning) Confusion matrix Harmonie [0, 20][0, 20] - 232 59 (20, 40] - 26 (20, 401 - 201)(40, 60] - 11 44 319 (60, 80] (80, 100] -(100, 120] -(120, 140] -(140, 160] -(160, 180] -[(180, 200] -109 97 (200, 2201 -(220, 240] -(240, 260] -(260, 280] -(280, 300] -(300, 320] -(320, 340] - 5 (340, 360] -106 385 (340, 360] - 24 340] 160] 220] 240] 260] 300] 320] 360] 40] 60] 80] 100] 120] 140] 180] 200] 280] 60] 80] 120] 140] 160] 180] 200] (80, 100] (40)

(200, (220, (240,

(180)

(280, (300) (320, (340,

(40, 60]

(60, 80]

(80, 100]

(100, 120]

(120, 140]

(140, 160]

(160, 180]

(180, 200]

(200, 220]

(220, 240]

(240, 260]

(260, 280]

(280, 300]

(300, 320]

(320, 340]

(300, (320,

280] 300] 320] 340] 360]

(260,

220] 240]

(220,

40,

(100, (120, (140, (160, (180, - 1000

- 1200

- 800

- 600

- 200

- 0

Precision and entropy harmonie Precision and entropy machine learning [0, 20] - 35% 20% 23% 15% 12% 9% 3% 1% 23% 15% 17% 14% 0% 0% 0% 2% 6% 1% 1% 1% 2% 5% 12% 20% 34% [0, 20] 0% 12% 0% 5% (20, 40] - 18% 41% 24% (20, 40] - 30% 32% 11% 13% 4% 1% 0% 0% 0% 0% 0% 0% 1% 0% 0% 0% 0% 0% 0% 0% 1% 0% 1% 0% 4% 0% (40, 60] - 12% 20% 19% 15% 8% 1% 1% 0% 0% 0% 0% 0% 0% 1% 2% 3% 8% (40, 60] - 8% 19% 38% 17% 0% 0% 0% 0% 0% 0% 1% 0% 1% 0% 0% 0% 2% 0% 1% (60, 80] - 2% 6% 10% 10% 7% 3% 1% 0% 0% 0% 0% 0% 1% 1% (60, 80] - 1% 3% 9% 33% 57% 0% 33% 0% 0% 0% 0% 0% 0% 0% 0% 0% 0% 0% 0% 0% 0% (80, 100] - 1% 12% 12% 0% 0% 0% 0% 0% 1% (80, 100] - 1% 6% 33% 29% 0% 33% 0% 0% 0% 0% 0% 0% 1% (100, 120] - 0% 2% 7% 6% 1% 1% 0% 0% 0% 0% 1% 1% (100, 120] - 0% 0% 0% 0% 0% 0% 1% 0% 0% 0% 0% 0% 0% 0% 2% 0% 0% 0% 50% 33% 0% 0% (120, 140] - 0% 0% 0% 2% 2% 1% 1% 0% 0% 0% 0% 0% 0% 0% 0% 0% 0% 0% 0% (120, 140] - 0% 0% 0% 0% 0% 0% 0% 0% 0% 0% 0% 0% 0% 0% 0% 0% (140, 1601 - 0% 0% 0% 0% 3% 4% 2% 1% 1% 2% 1% 0% 2% 1% 0% 0% 0% 0% 1% (140, 1601 - 0% 0% 0% 0% 0% 0% 0% 19% 2% 0% 1% 0% 0% 3% 0% 0% 1% (160, 180] - 0% 1% 3% 9% 10% 12% 10% 10% 6% 2% 1% 5% (160, 1801 - 0% 3% 0% 0% 0% 0% 25% 15% 3% 1% 1% 1% 0% 0% 0% 0% 5% (180, 200] -1% 1% 1% 3% 5% 10% 27% 34% 37% 15% 8% 2% 0% 19% (180, 200] - 1% 0% 0% 0% 0% 0% 0% 26% 57% 20% 8% 5% 1% 6% 0% 0% 20% 0% 15% (200, 2201 - 1% 2% 15% (200, 220] - 1% 0% 0% 0% 23% 5% 3% 0% 0% 3% 6% 9% 22% 10% 2% 0% 3% 0% 11% 0% 0% 0% 0% 0% 0% 4% 19% 3% 0% 10% (220, 2401 - 1% 2% 9% 6% 12% 20% 22% 19% 13% 12% 10% 31% 14% 4% 2% (220, 240] - 1% 1% 0% 0% (240, 260] - 3% 0% 5% 19% (240, 260] - 0% 3% 4% 4% 7% 7% 7% 4% 5% 5% 2% 19% 1% 0% 0% 0% 0% 0% 0% 2% 6% 1% 8% (260, 280] - 1% 0% 0% 0% 0% 9% 5% 8% (260, 280] - 0% 1% 2% 4% 3% 2% 1% 1% 1% 0% 1% 5% 23% 38% 14% 6% 2% 0% 3% 0% 0% 1% 1% 4% 26% (280, 300] - 1% 1% 0% 3% (280, 300] - 1% 1% 1% 1% 0% 1% 0% 1% 1% 5% 8% 0% 0% 0% 0% 0% 0% 1% 1% 1% 1% 20% 22% 5% 0% 0% 1% 13% 0% 0% 0% (300, 320] - 0% 1% 1% 0% 2% 0% 0% 0% 0% 0% 1% 5% 2% 2% (300, 320] - 1% 0% 0% 0% 0% 0% 0% 1% 20% 0% 0% 0% 0% 2% (320, 340] - 1% 1% 1% 1% 0% 0% 0% 0% 2% 6% 3% (320, 340] - 3% 0% 0% 0% 0% 0% 0% 0% 0% 1% 1% 3% 2% 2% 0% 0% 0% 0% 0% 1% 6% 7% (340, 360] - 14% 8% 5% 0% 4% (340, 360] - 17% 0% 0% 0% 0% 0% 0% 0% 0% 6% 6% 3% 1% 0% 0% 0% 0% 0% 0% 3% 15% 19% 9% 0% 0% entropy/entropy.max - 63% 55% 58% 85% 68% 79% 86% 92% 84% 24% entropy/entropy.max - 57% (40, 60] (60, 80] 360] (20, 40] (60, 80] 160] 180] 200] 220] 240] 260] 280] 280, 300] (300, 320] 340] (340, 360] 180] 200] 220] 240] 260] 280] 300] 340] (40, 60] (80, 100] 100, 120] [120, 140] [80, 100] [120, 140] [140, 160] Climatology (20, 160, (180, 200, 220, 240, 260, 280, 320, (340,140, 160, 180, 200, 220, 240, 260, (320,

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- 0.8

- 0.7

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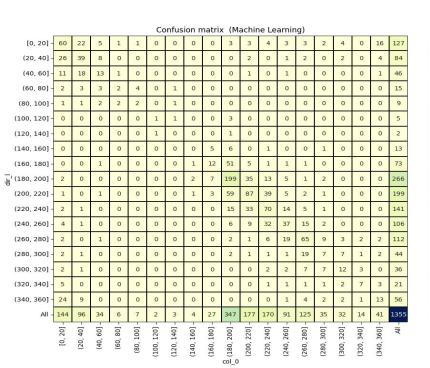
- 0.1

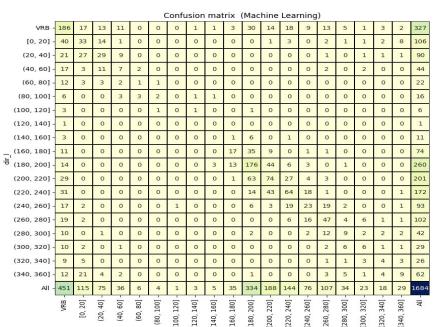
- 0.0

col 0

Quali	ty report	Harmonie	model poir	ı Q	uality rep	ort Machi	ne learning
(100, 120] -	6%	20%	9%	(100, 120] -	50%	20%	29%
(120, 140] -	1%	22%	2%	(120, 140] -	0%	0%	0%
(140, 160] -	1%	20%	2%	(140, 160] -	0%	0%	0%
(160, 180] -	12%	29%	17%	(160, 180] -	44%	16%	24%
(180, 200] -	46%	14%	22%	(180, 200] -	57%	75%	65%
(20, 40] -	32%	16%	21%	(20, 40] -	41%	46%	43%
(200, 220] -	36%	8%	13%	(200, 220] -	49%	44%	46%
(220, 240] -	23%	6%	10%	(220, 240] -	41%	50%	45%
(240, 260] -	17%	7%	10%	(240, 260] -	41%	35%	38%
(260, 280] -	23%	14%	18%	(260, 280] -	52%	58%	55%
(280, 300] -	13%	45%	20%	(280, 300] -	20%	16%	18%
(300, 320] -	17%	50%	26%	(300, 320] -	38%	33%	35%
(320, 340] -	6%	13%	8%	(320, 340] -	50%	33%	40%
(340, 360] -	19%	28%	23%	(340, 360] -	32%	23%	27%
(40, 60] -	19%	6%	9%	(40, 60] -	38%	28%	32%
(60, 80] -	10%	14%	12%	(60, 80] -	33%	13%	19%
(80, 100] -	12%	24%	16%	(80, 100] -	29%	22%	25%
[0, 20] -	35%	28%	31%	[0, 20] -	42%	47%	44%
accuracy -	16%	16%	16%	accuracy -	46%	46%	46%
macro avg -	18%	20%	15%	macro avg -	36%	31%	33%
ighted avg -	28%	16%	17%	weighted avg -	45%	46%	45%
	precision	recall	f1-score		precision	recall	f1-score

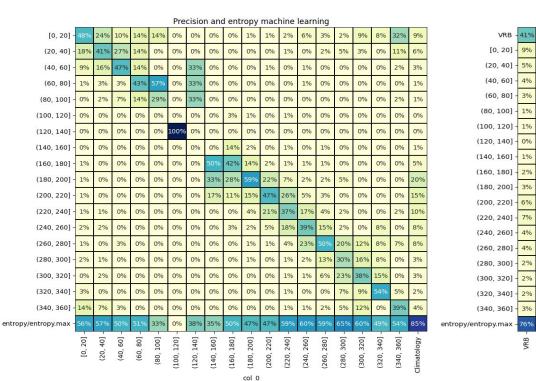
Machine learning Harmonie with and without VRB

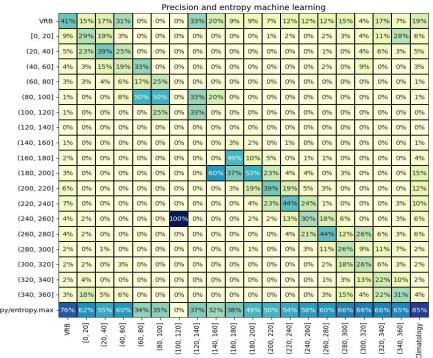




- 200

Machine learning Harmonie with and without VRB





- 0.8

- 0.6

0.2

Machine learning Harmonie with and without VRB

Q	uality rep	ort Machi	ne learning	Q	uality rep	ort Machi	ne learning	
(100, 120] -	0%	0%	0%	(100, 120] -	0%	0%	0%	
(120, 140] -	0%	0%	0%	(120, 140] -	0%	0%	0%	
(140, 160] -	0%	0%	0%	(140, 160] -	0%	0%	0%	
(160, 180] -	42%	21%	28%	(160, 180] -	49%	23%	31%	
(180, 200] -	59%	73%	65%	(180, 200] -	53%	68%	59%	
(20, 40] -	41%	46%	44%	(20, 40] -	39%	32%	35%	
(200, 220] -	47%	45%	46%	(200, 220] -	39%	37%	38%	
(220, 240] -	37%	45%	40%	(220, 240] -	44%	37%	41%	
(240, 260] -	39%	32%	35%	(240, 260] -	30%	25%	27%	
(260, 280] -	50%	56%	53%	(260, 280] -	44%	46%	45%	
(280, 300] -	30%	30%	30%	(280, 300] -	26%	21%	24%	
(300, 320] -	38%	33%	35%	(300, 320] -	26%	21%	23%	
(320, 340] -	54%	33%	41%	(320, 340] -	22%	15%	18%	
(340, 360] -	39%	30%	34%	(340, 360] -	31%	15%	20%	
(40, 60] -	47%	30%	37%	(40, 60] -	19%	16%	18%	
(60, 80] -	43%	20%	27%	(60, 80] -	17%	5%	7%	
(80, 100] -	29%	22%	25%	(80, 100] -	50%	12%	20%	
[0, 20] -	48%	50%	49%	VRB -	41%	57%	48%	
accuracy -	46%	46%	46%	[0, 20] -	29%	31%	30%	
			The state of the s	accuracy -	41%	41%	41%	
macro avg -	36%	31%	33%	macro avg -	29%	24%	25%	
veighted avg -	45%	46%	45%	weighted avg -	40%	41%	39%	
	precision	recall	f1-score		precision	recall	f1-score	