



Wind LEVX

WRF VS HARMONIE VS ML



Model Harmonie

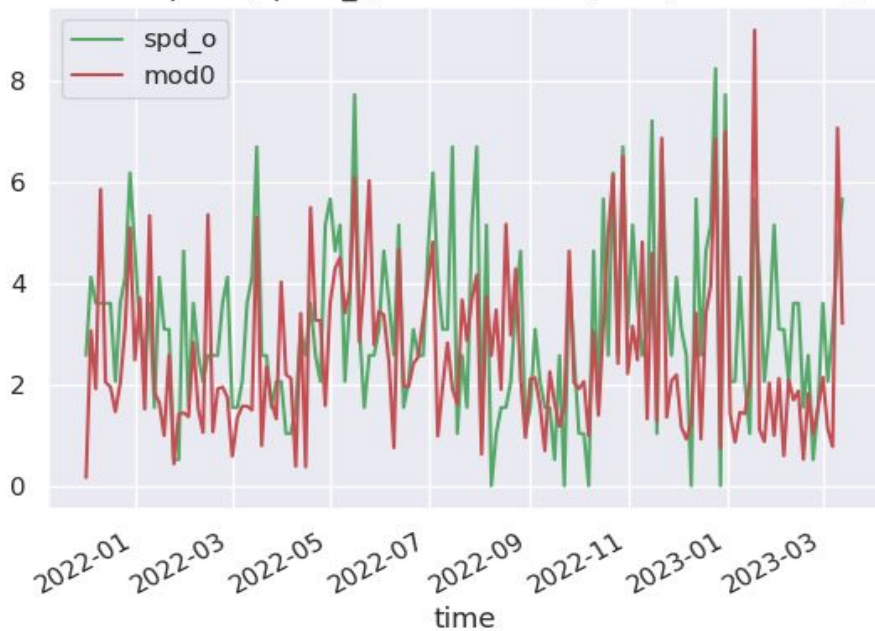
Nearest points



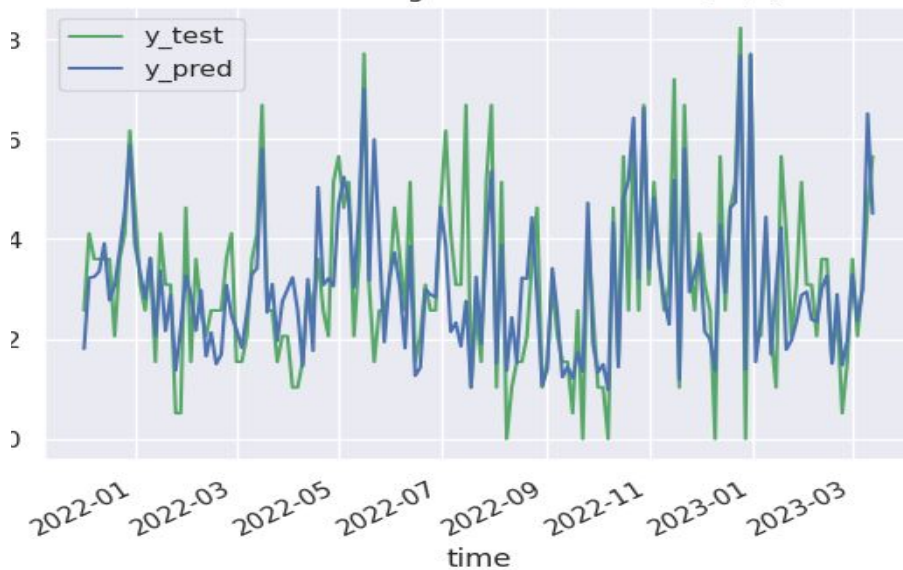
Wind speed


Wind speed

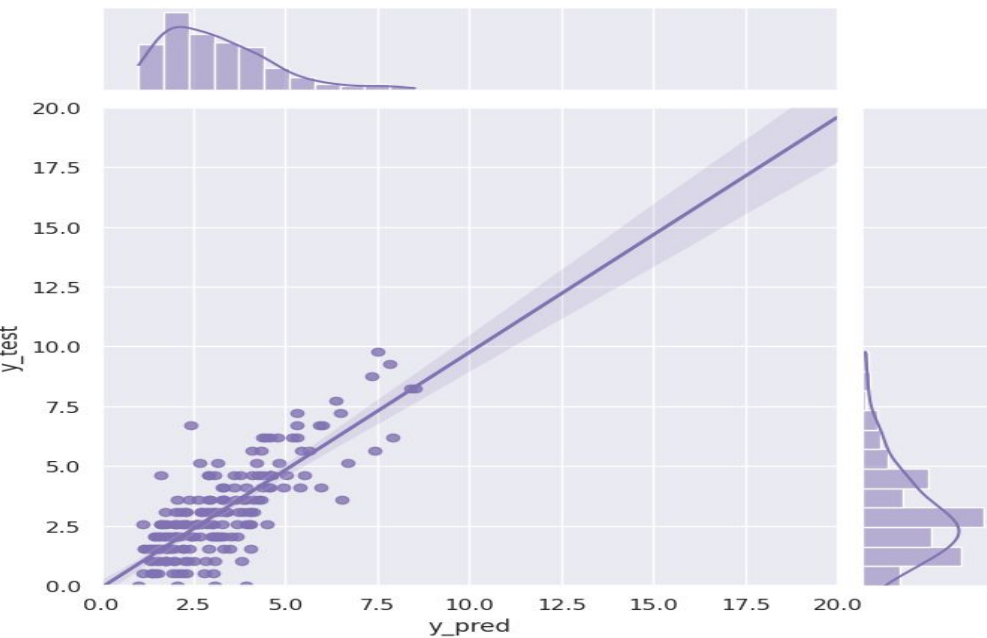
Observed speed (speed_o) Vs Harmonie (mod0) MAE=1.08 (m/s)



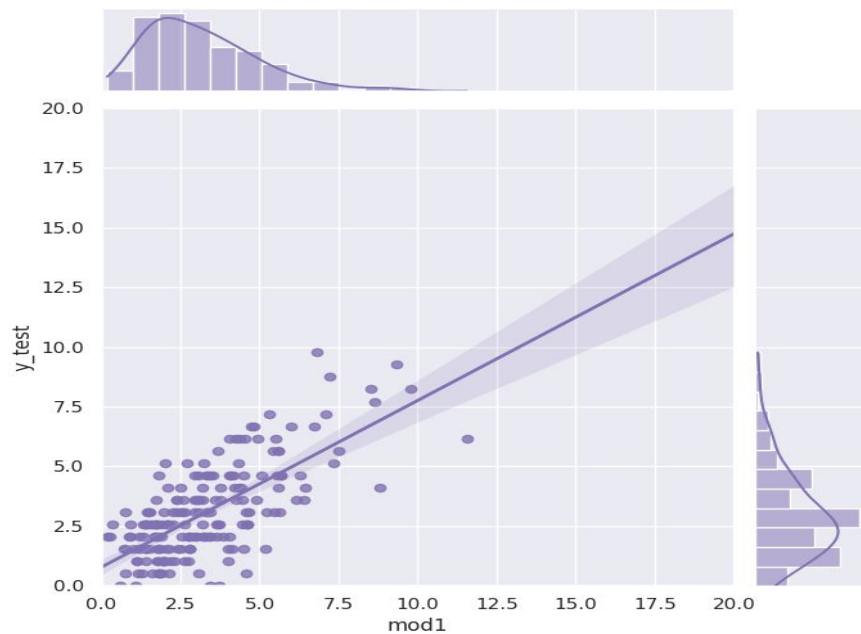
Machine learning result MAE = 0.77 (m/s)




MAE ML = 0.8 (m/s)



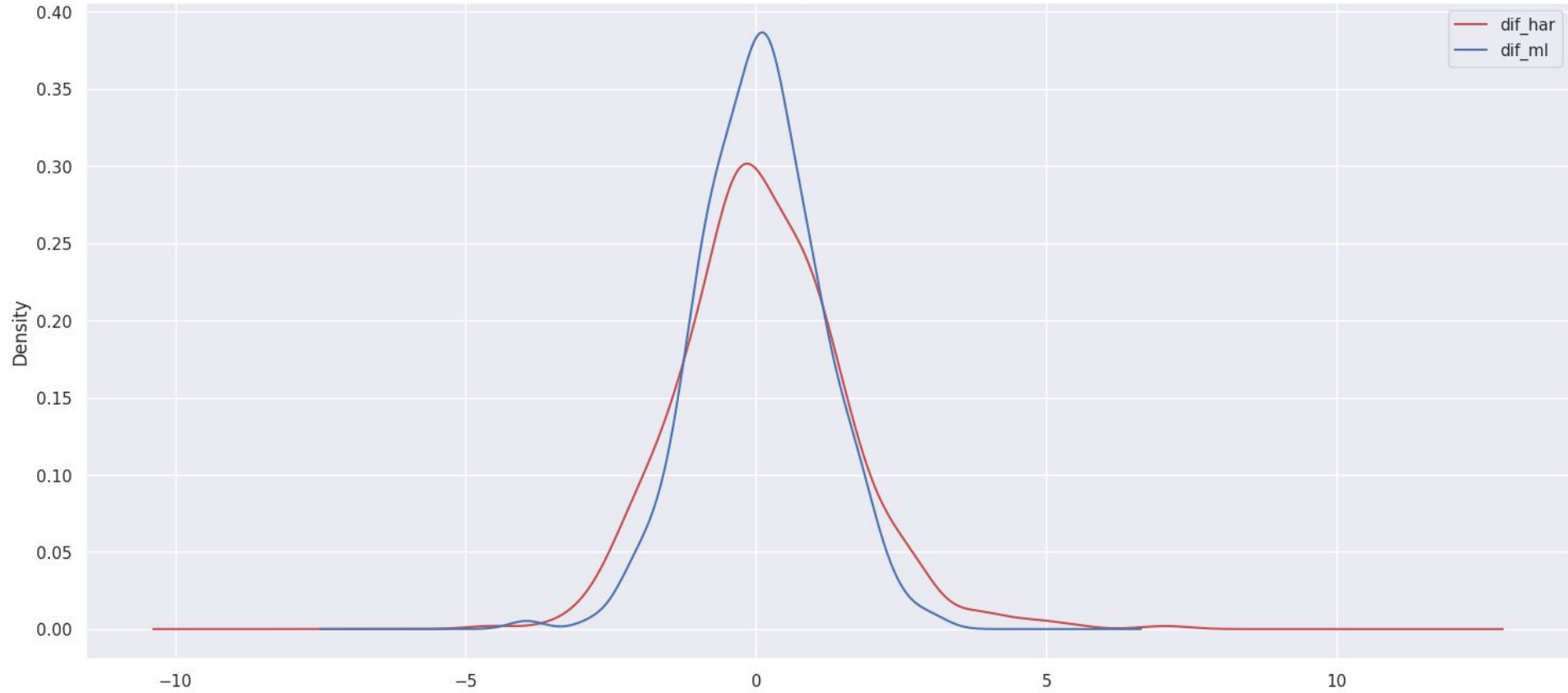
MAE harmonie=1.08



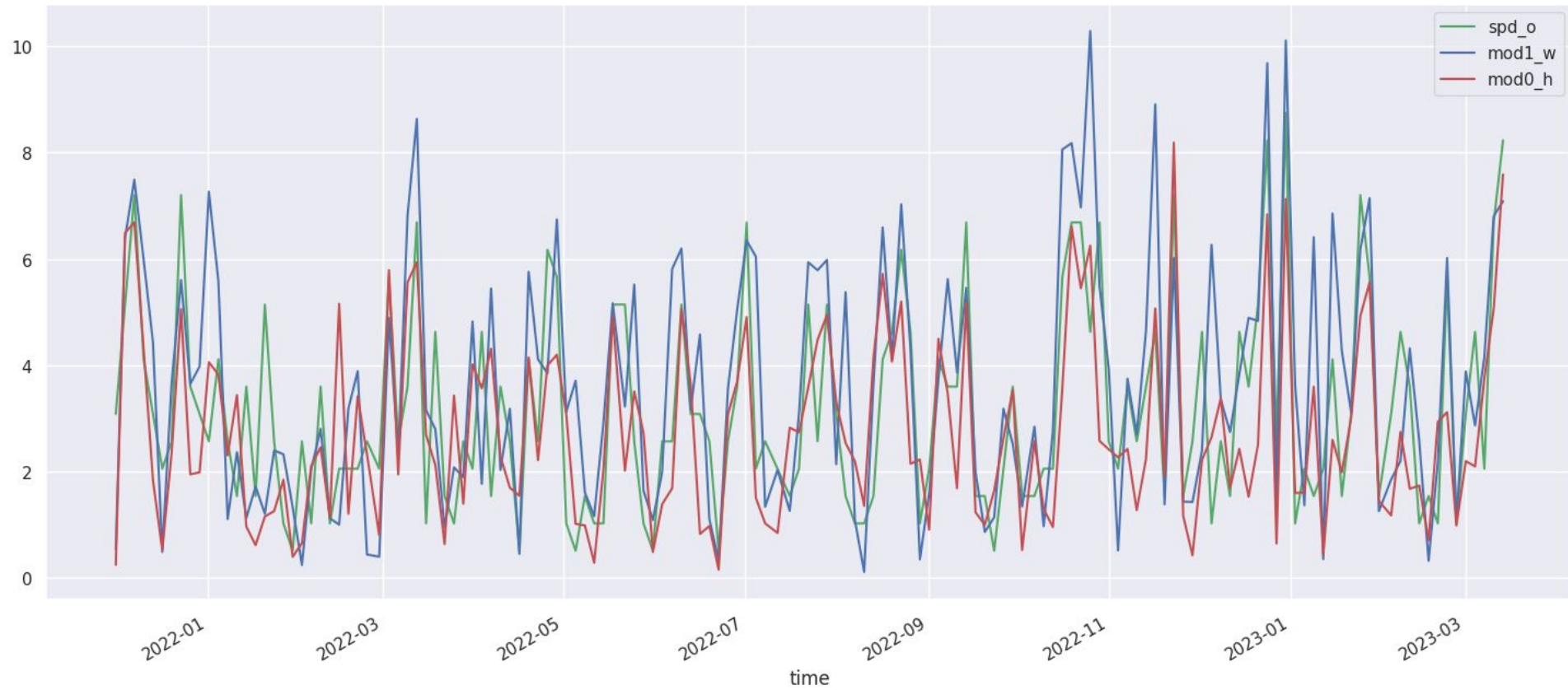
Differences Harmonie vs MI



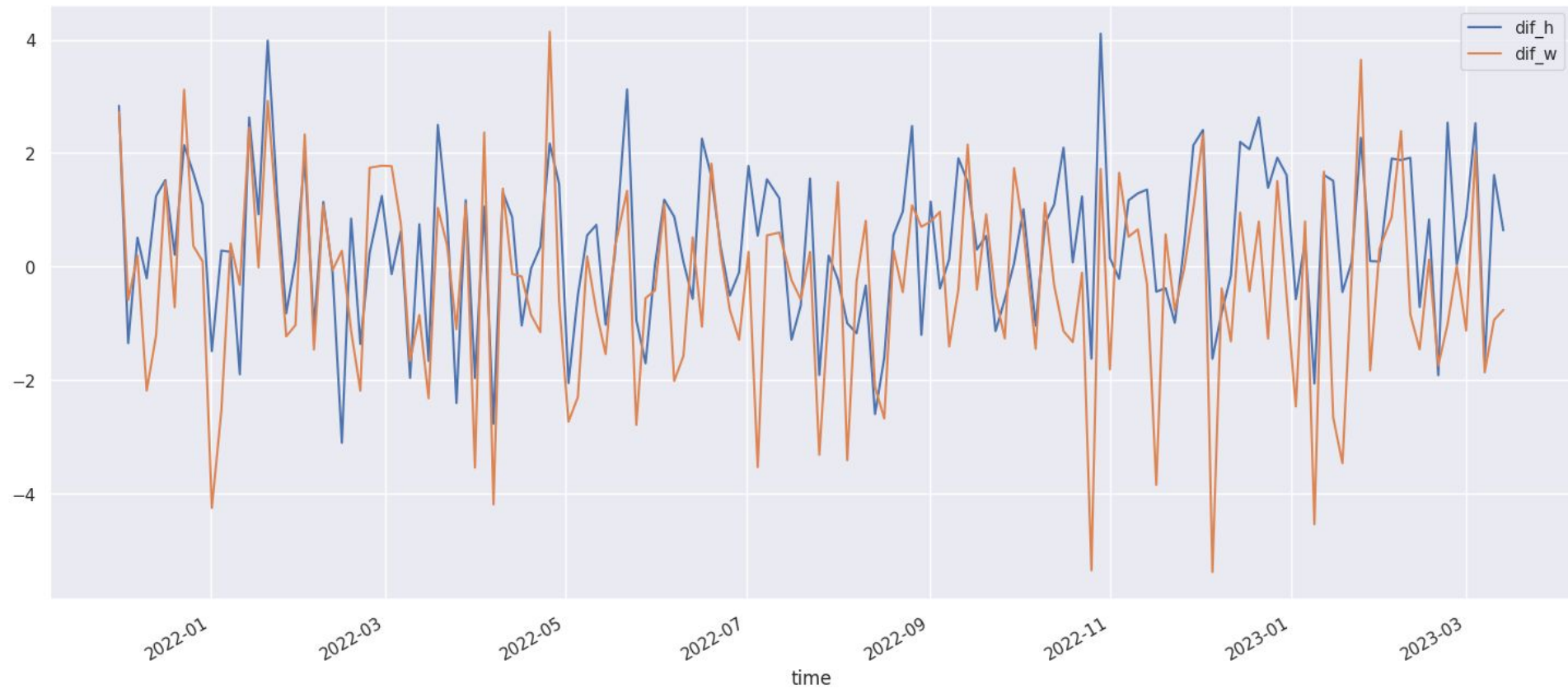
Density differences



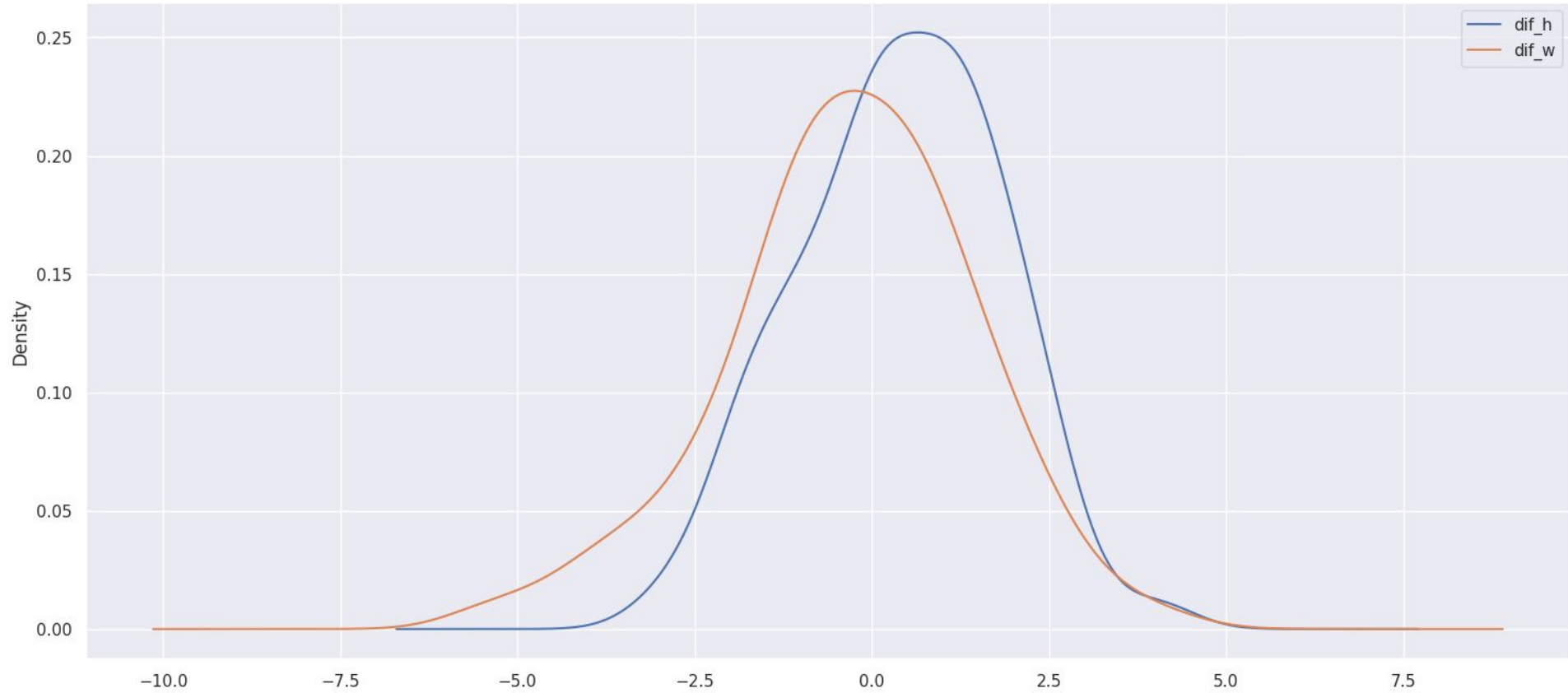
harmonie MAE=1.08 vs wrf MAE=1.37



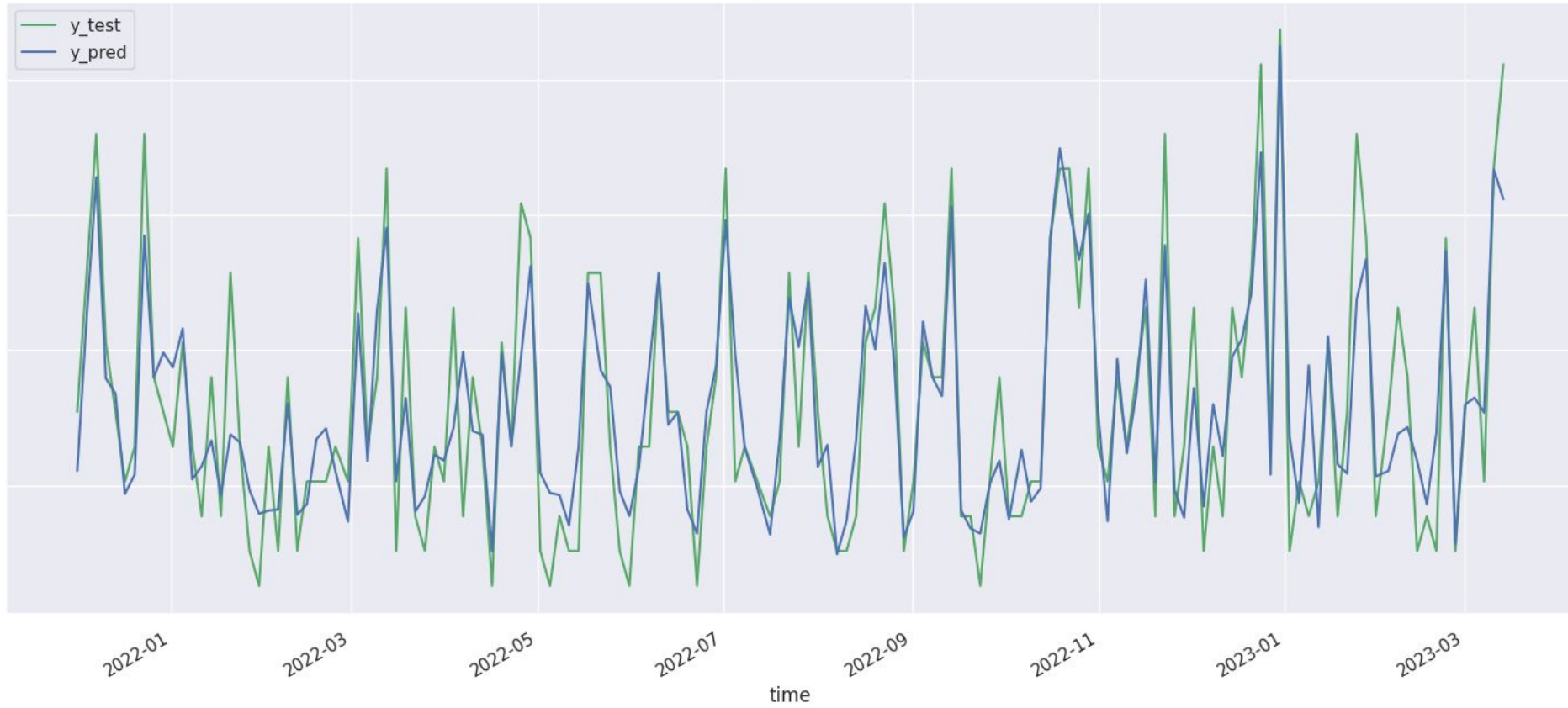
Differences harmonie MAE=1.08 vs wrf MAE=1.37



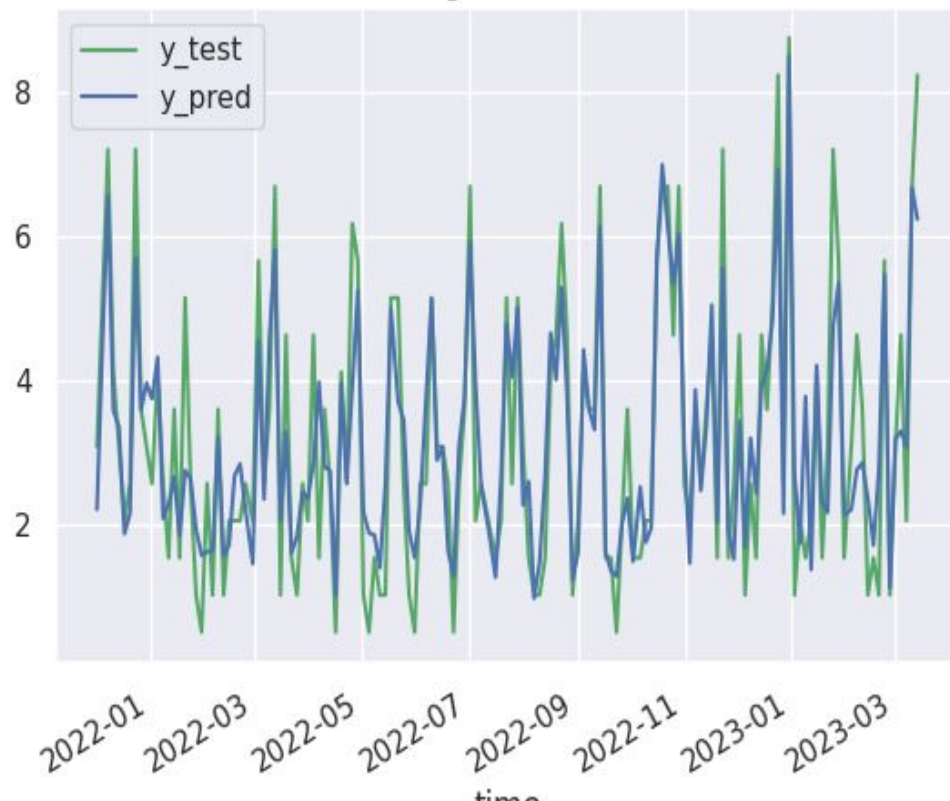
Differences harmonie MAE=1.08 vs wrf MAE=1.37



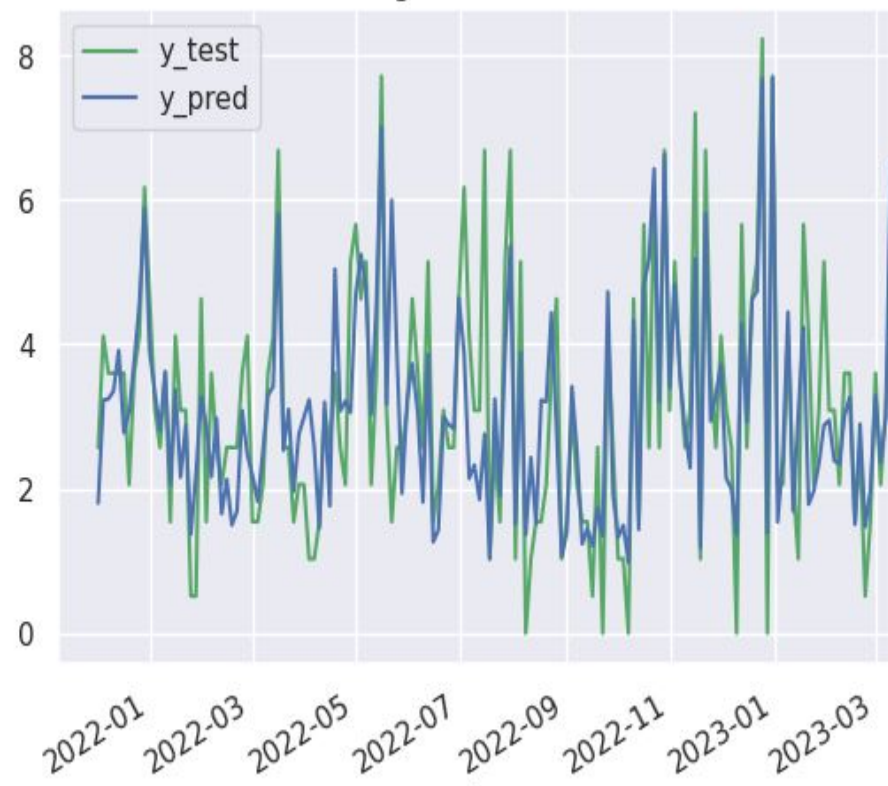
Machine learning wrf result MAE = 0.69



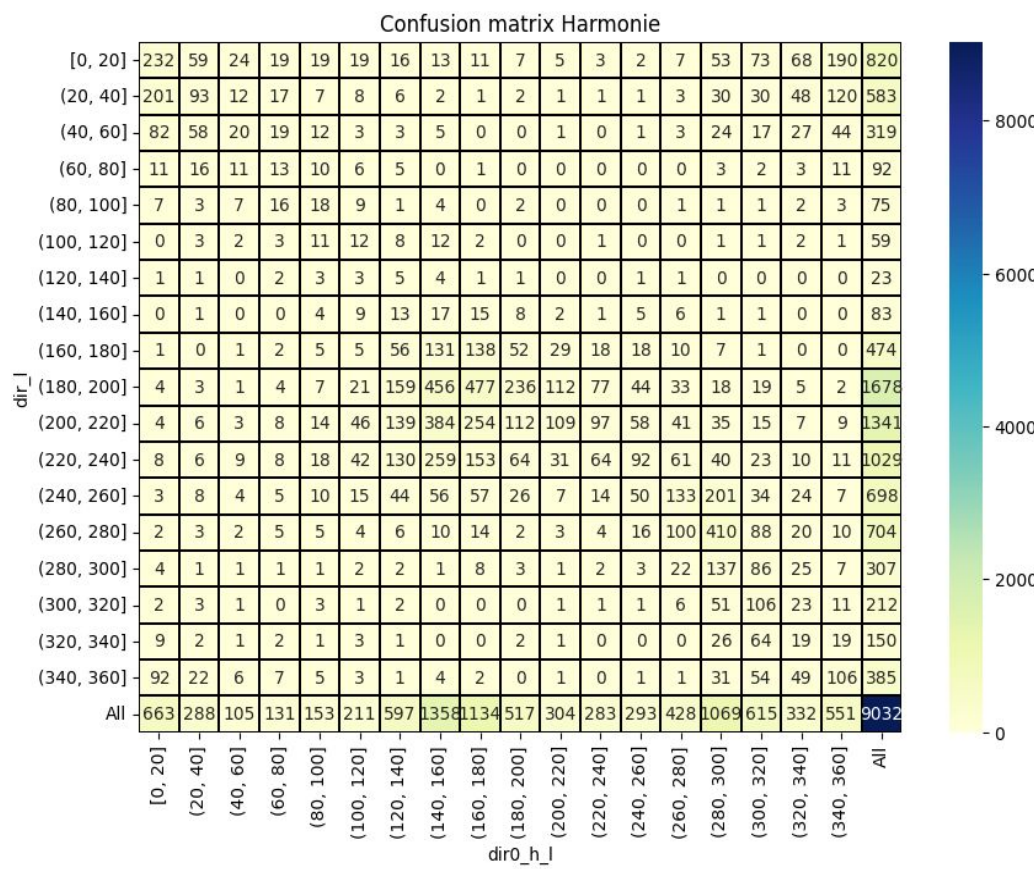
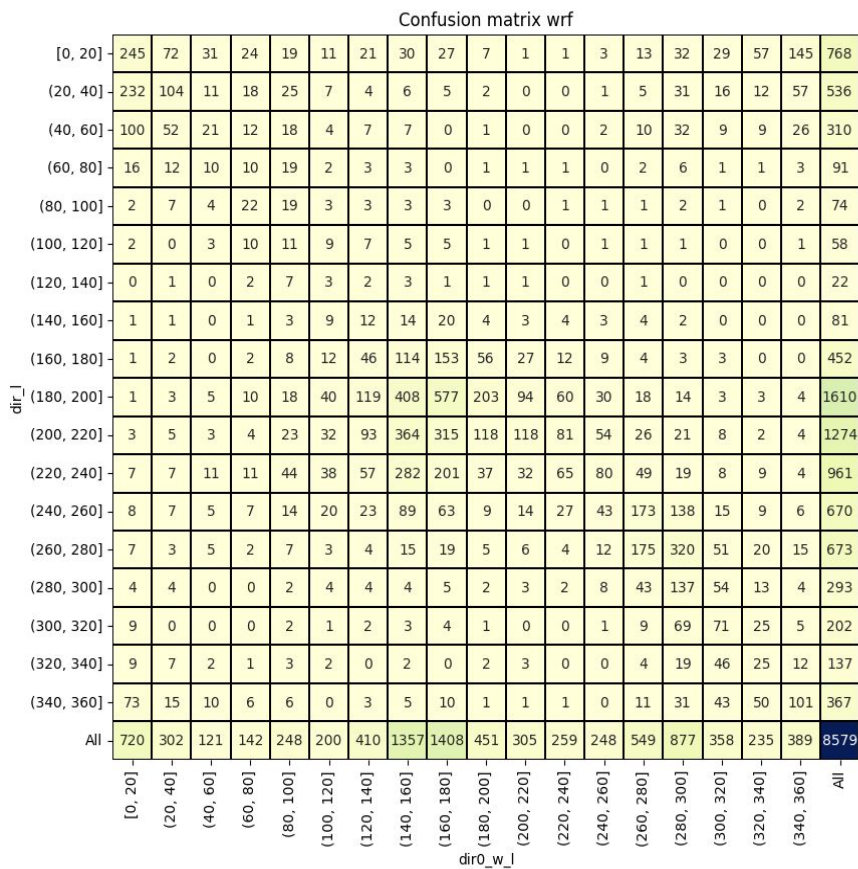
Machine learning wrf result MAE = 0.69



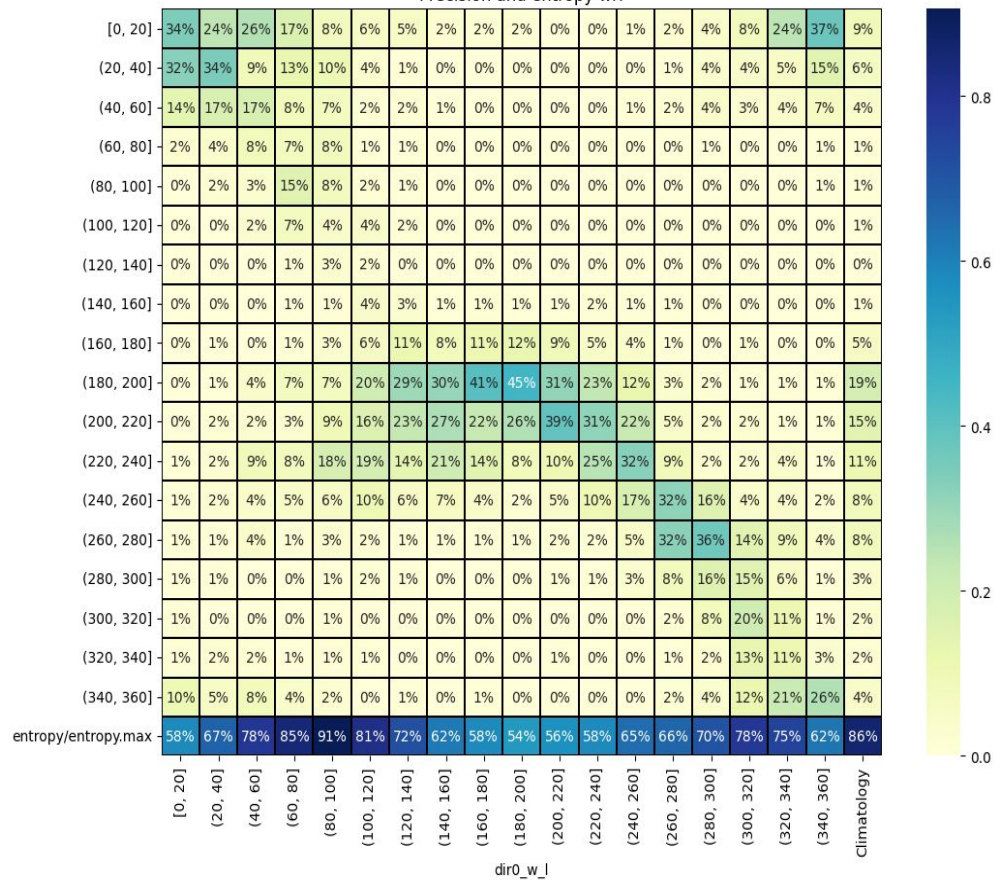
Machine learning harmonie result MAE = 0.77



Wind direction



Precision and entropy wrf



Quality report Harmonie model p

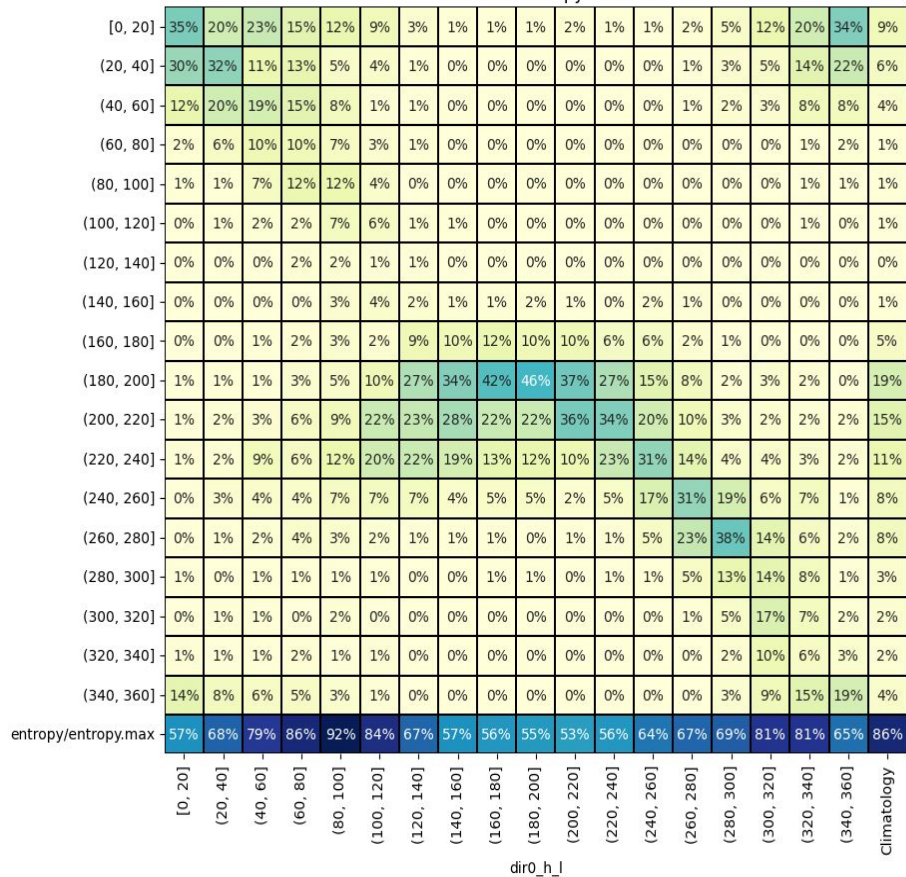
(100, 120]	6%	20%	9%
(120, 140]	1%	22%	2%
(140, 160]	1%	20%	2%
(160, 180]	12%	29%	17%
(180, 200]	46%	14%	22%
(20, 40]	32%	16%	21%
(200, 220]	36%	8%	13%
(220, 240]	23%	6%	10%
(240, 260]	17%	7%	10%
(260, 280]	23%	14%	18%
(280, 300]	13%	45%	20%
(300, 320]	17%	50%	26%
(320, 340]	6%	13%	8%
(340, 360]	19%	28%	23%
(40, 60]	19%	6%	9%
(60, 80]	10%	14%	12%
(80, 100]	12%	24%	16%
[0, 20]	35%	28%	31%
accuracy	16%	16%	16%
macro avg	18%	20%	15%
weighted avg	28%	16%	17%
	precision	recall	f1-score

Quality report wrf point 0

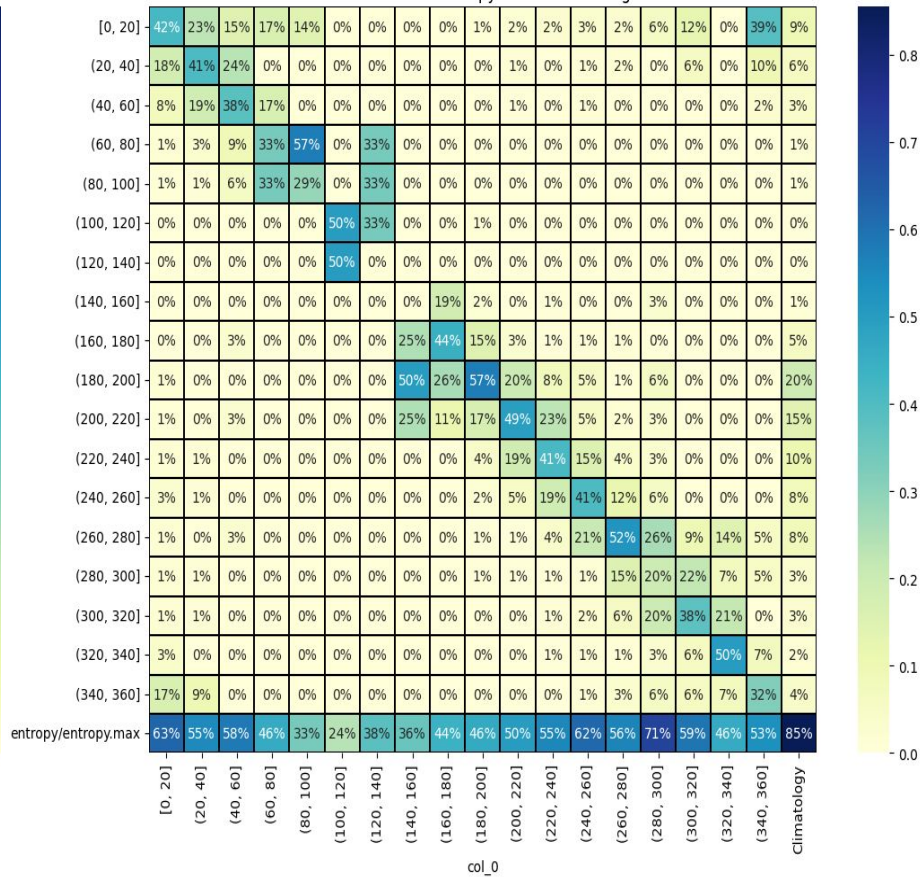
(100, 120]	4%	16%	7%
(120, 140]	0%	9%	1%
(140, 160]	1%	17%	2%
(160, 180]	11%	34%	16%
(180, 200]	45%	13%	20%
(20, 40]	34%	19%	25%
(200, 220]	39%	9%	15%
(220, 240]	25%	7%	11%
(240, 260]	17%	6%	9%
(260, 280]	32%	26%	29%
(280, 300]	16%	47%	23%
(300, 320]	20%	35%	25%
(320, 340]	11%	18%	13%
(340, 360]	26%	28%	27%
(40, 60]	17%	7%	10%
(60, 80]	7%	11%	9%
(80, 100]	8%	26%	12%
[0, 20]	34%	32%	33%
accuracy	18%	18%	18%
macro avg	19%	20%	16%
weighted avg	30%	18%	19%
	precision	recall	f1-score



Precision and entropy harmonie



Precision and entropy machine learning



Quality report Harmonie model poin

(100, 120]	6%	20%	9%
(120, 140]	1%	22%	2%
(140, 160]	1%	20%	2%
(160, 180]	12%	29%	17%
(180, 200]	46%	14%	22%
(20, 40]	32%	16%	21%
(200, 220]	36%	8%	13%
(220, 240]	23%	6%	10%
(240, 260]	17%	7%	10%
(260, 280]	23%	14%	18%
(280, 300]	13%	45%	20%
(300, 320]	17%	50%	26%
(320, 340]	6%	13%	8%
(340, 360]	19%	28%	23%
(40, 60]	19%	6%	9%
(60, 80]	10%	14%	12%
(80, 100]	12%	24%	16%
[0, 20]	35%	28%	31%
accuracy	16%	16%	16%
macro avg	18%	20%	15%
weighted avg	28%	16%	17%
	precision	recall	f1-score

Quality report Machine learning

(100, 120]	50%	20%	29%
(120, 140]	0%	0%	0%
(140, 160]	0%	0%	0%
(160, 180]	44%	16%	24%
(180, 200]	57%	75%	65%
(20, 40]	41%	46%	43%
(200, 220]	49%	44%	46%
(220, 240]	41%	50%	45%
(240, 260]	41%	35%	38%
(260, 280]	52%	58%	55%
(280, 300]	20%	16%	18%
(300, 320]	38%	33%	35%
(320, 340]	50%	33%	40%
(340, 360]	32%	23%	27%
(40, 60]	38%	28%	32%
(60, 80]	33%	13%	19%
(80, 100]	29%	22%	25%
[0, 20]	42%	47%	44%
accuracy	46%	46%	46%
macro avg	36%	31%	33%
weighted avg	45%	46%	45%
	precision	recall	f1-score

Machine learning Harmonie with and without VRB

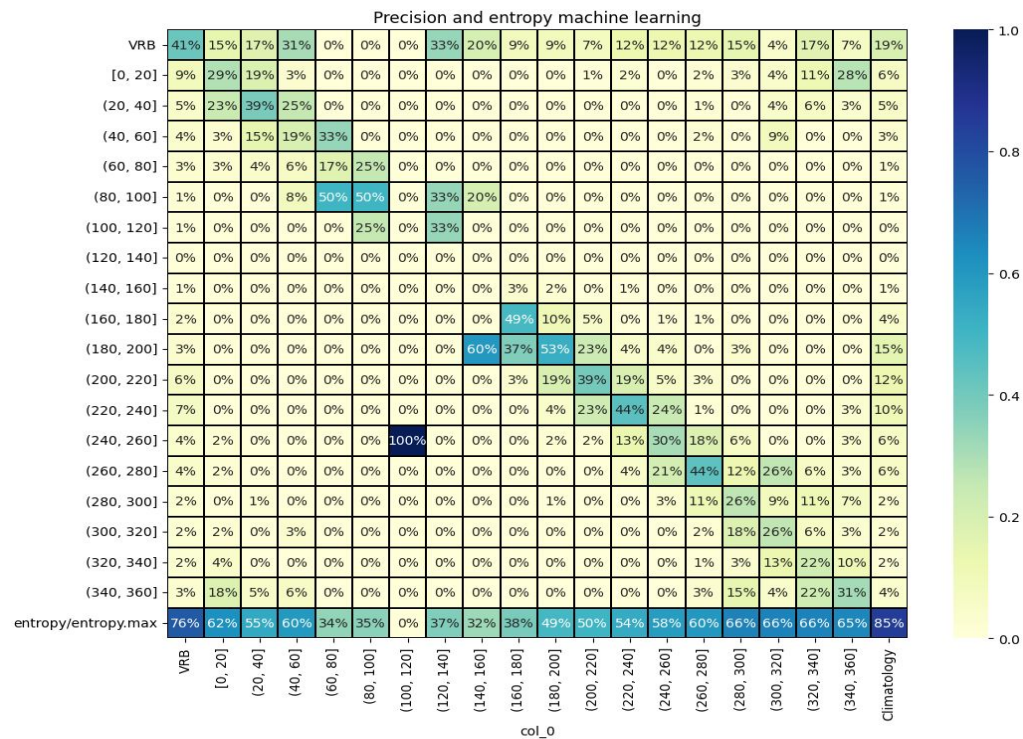
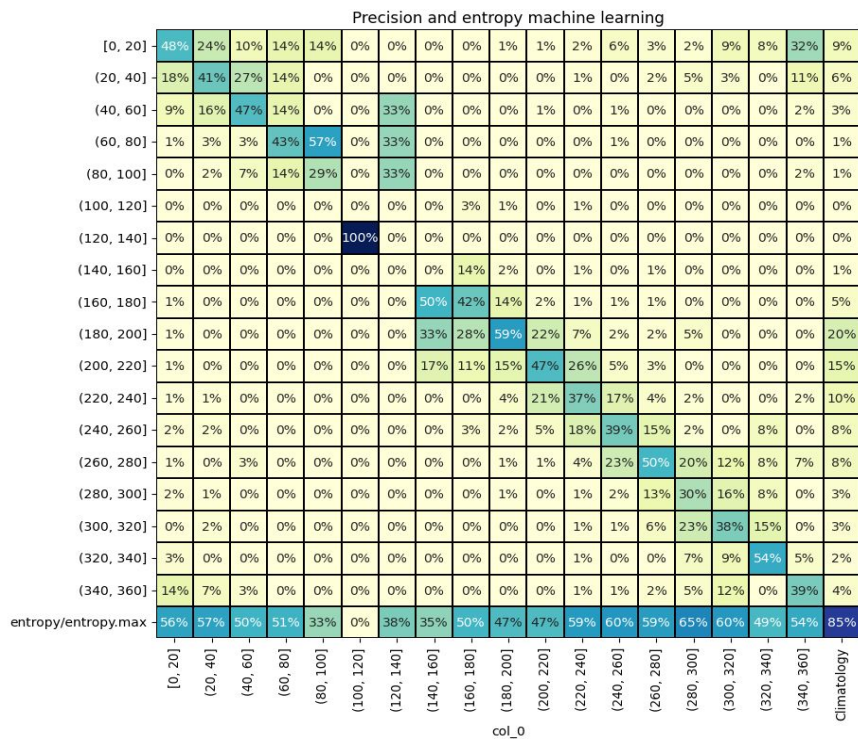
Confusion matrix (Machine Learning)

dir_1 \ col_0	[0, 20]	[20, 40]	[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]	[340, 360]	All
[0, 20]	60	22	5	1	1	0	0	0	0	3	3	4	3	3	2	4	0	16	127
[20, 40]	26	39	8	0	0	0	0	0	0	0	2	0	1	2	0	2	0	4	84
[40, 60]	11	18	13	1	0	0	0	0	0	0	1	0	1	0	0	0	0	1	46
[60, 80]	2	3	3	2	4	0	1	0	0	0	0	0	0	0	0	0	0	0	15
[80, 100]	1	1	2	2	2	0	1	0	0	0	0	0	0	0	0	0	0	0	9
[100, 120]	0	0	0	0	0	1	1	0	0	3	0	0	0	0	0	0	0	0	5
[120, 140]	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	2
[140, 160]	0	0	0	0	0	0	0	0	5	6	0	1	0	0	1	0	0	0	13
[160, 180]	0	0	1	0	0	0	0	1	12	51	5	1	1	1	0	0	0	0	73
[180, 200]	2	0	0	0	0	0	0	2	7	199	35	13	5	1	2	0	0	0	266
[200, 220]	1	0	1	0	0	0	0	1	3	59	87	39	5	2	1	0	0	0	199
[220, 240]	2	1	0	0	0	0	0	0	0	15	33	70	14	5	1	0	0	0	141
[240, 260]	4	1	0	0	0	0	0	0	0	6	9	32	37	15	2	0	0	0	106
[260, 280]	2	0	1	0	0	0	0	0	0	2	1	6	19	65	9	3	2	2	112
[280, 300]	2	1	0	0	0	0	0	0	0	2	1	1	1	19	7	7	1	2	44
[300, 320]	2	1	0	0	0	0	0	0	0	0	0	2	2	7	7	12	3	0	36
[320, 340]	5	0	0	0	0	0	0	0	0	0	0	1	1	1	1	2	7	3	21
[340, 360]	24	9	0	0	0	0	0	0	0	0	0	1	4	2	2	1	13	56	
All	144	96	34	6	7	2	3	4	27	347	177	170	91	125	35	32	14	41	1355

Confusion matrix (Machine Learning)

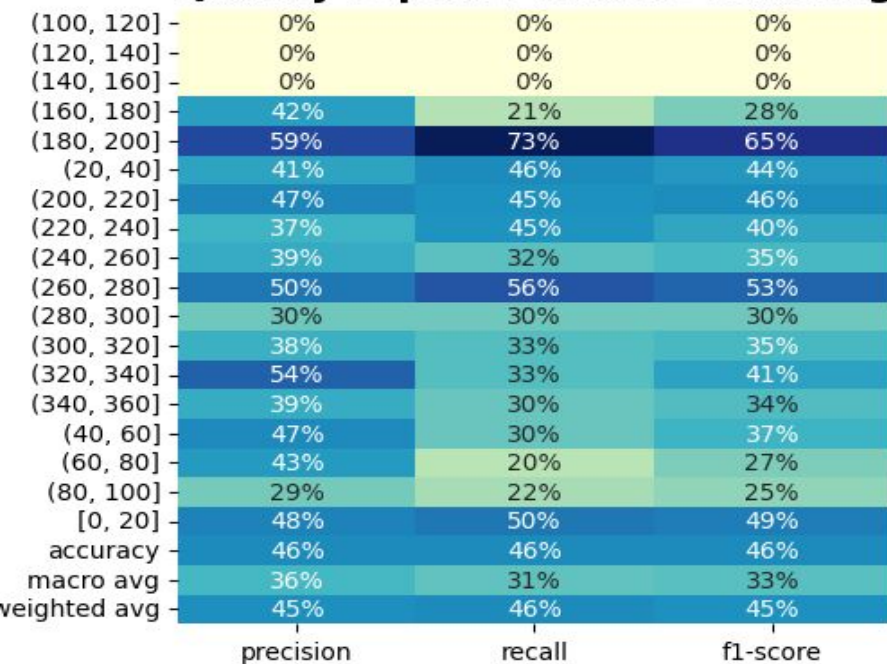
dir_1 \ col_0	VRB	[0, 20]	[20, 40]	[40, 60]	[60, 80]	[80, 100]	[100, 120]	[120, 140]	[140, 160]	[160, 180]	[180, 200]	[200, 220]	[220, 240]	[240, 260]	[260, 280]	[280, 300]	[300, 320]	[320, 340]	[340, 360]	All
VRB	186	17	13	11	0	0	0	1	1	3	30	14	18	9	13	5	1	3	2	327
[0, 20]	40	33	14	1	0	0	0	0	0	0	0	1	3	0	2	1	1	2	8	106
[20, 40]	21	27	29	9	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	90
[40, 60]	17	3	11	7	2	0	0	0	0	0	0	0	0	0	2	0	2	0	0	44
[60, 80]	12	3	3	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	22
[80, 100]	6	0	0	3	3	2	0	1	1	0	0	0	0	0	0	0	0	0	0	16
[100, 120]	3	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	6
[120, 140]	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
[140, 160]	3	0	0	0	0	0	0	0	0	1	6	0	1	0	0	0	0	0	0	11
[160, 180]	11	0	0	0	0	0	0	0	0	17	35	9	0	1	1	0	0	0	0	74
[180, 200]	14	0	0	0	0	0	0	0	3	13	176	44	6	3	0	1	0	0	0	260
[200, 220]	29	0	0	0	0	0	0	0	0	1	63	74	27	4	3	0	0	0	0	201
[220, 240]	31	0	0	0	0	0	0	0	0	0	14	43	64	18	1	0	0	0	1	172
[240, 260]	17	2	0	0	0	0	1	0	0	0	6	3	19	23	19	2	0	0	1	93
[260, 280]	19	2	0	0	0	0	0	0	0	0	0	0	6	16	47	4	6	1	1	102
[280, 300]	10	0	1	0	0	0	0	0	0	0	2	0	0	2	12	9	2	2	2	42
[300, 320]	10	2	0	1	0	0	0	0	0	0	0	0	0	0	2	6	6	1	1	29
[320, 340]	9	5	0	0	0	0	0	0	0	0	0	0	0	0	1	1	3	4	3	26
[340, 360]	12	21	4	2	0	0	0	0	0	0	1	0	0	0	3	5	1	4	9	62
All	451	115	75	36	6	4	1	3	5	35	334	188	144	76	107	34	23	18	29	1684

Machine learning Harmonie with and without VRB



Machine learning Harmonie with and without VRB

Quality report Machine learning



Quality report Machine learning

