Distances from meteorological model points to meteorological station

	lat	lon	lat_st	lon_st	distance
0	42.881499	-8.432536	42.898	-8.418	2.18
1	42.917389	-8.429225	42.898	-8.418	2.34
2	42.879064	-8.383559	42.898	-8.418	3.51
3	42.914952	-8.380220	42.898	-8.418	3.61
4	42.883913	-8.481517	42.898	-8.418	5.40

All meteorological model variables:

```
 ['dir0' 'snow_prec0' 'snowlevel0' 'mod0' 'wind_gust0' 'mslp0' 'temp0'
 'rh0' 'visibility0' 'lhflx0' 'lwflx0' 'conv_prec0' 'prec0' 'swflx0'
 'shflx0' 'cape0' 'cin0' 'cfh0' 'cfl0' 'cfm0' 'cft0' 'HGT5000'
'HGT8500'
 'T5000' 'T8500' 'dir1' 'snow_prec1' 'snowlevel1' 'mod1' 'wind_gust1'
'mslp1' 'temp1' 'rh1' 'visibility1' 'lhflx1' 'lwflx1' 'conv_prec1'
 'prec1' 'swflx1' 'shflx1' 'cape1' 'cin1' 'cfh1' 'cfl1' 'cfm1' 'cft1'
 'HGT5001' 'HGT8501' 'T5001' 'T8501' 'dir2' 'snow_prec2' 'snowlevel2'
 'mod2' 'wind_gust2' 'mslp2' 'temp2' 'rh2' 'visibility2' 'lhflx2'
'lwflx2'
 'conv_prec2' 'prec2' 'swflx2' 'shflx2' 'cape2' 'cin2' 'cfh2' 'cfl2'
 'cfm2' 'cft2' 'HGT5002' 'HGT8502' 'T5002' 'T8502' 'dir3' 'snow_prec3'
 'snowlevel3' 'mod3' 'wind_gust3' 'mslp3' 'temp3' 'rh3' 'visibility3'
 'lhflx3' 'lwflx3' 'conv_prec3' 'prec3' 'swflx3' 'shflx3' 'cape3'
'cin3'
 'cfh3' 'cfl3' 'cfm3' 'cft3' 'HGT5003' 'HGT8503' 'T5003' 'T8503'
'dir4'
 'snow_prec4' 'snowlevel4' 'mod4' 'wind_gust4' 'mslp4' 'temp4' 'rh4'
 'visibility4' 'lhflx4' 'lwflx4' 'conv_prec4' 'prec4' 'swflx4'
'shflx4'
 'cape4' 'cin4' 'cfh4' 'cfl4' 'cfm4' 'cft4' 'HGT5004' 'HGT8504'
'T5004'
 'T8504']
```

Observed labeled variable results

	Total	
(10,12]	9604	14.4%
(12,14]	9359	14.1%
(14,16]	8353	12.5%
(8,10]	8333	12.5%
(16,18]	6876	10.3%
(6,8]	5660	8.5%

	Total	
(18,20]	4543	6.8%
(4,6]	3109	4.7%
(20,22]	3082	4.6%
(22,24]	2117	3.2%
(24,26]	1506	2.3%
(2,4]	1389	2.1%
(26,28]	911	1.4%
(28,30]	556	0.8%
(0,2]	458	0.7%
(30,32]	307	0.5%
(32,34]	154	0.2%
(-2,0]	140	0.2%
(34,36]	70	0.1%
(36,38]	20	0.0%
(-30,-2]	18	0.0%
(38,40]	3	0.0%

Compare meteorological model variables forecasted with observed variables

Model point: 0
(10,12] 16%
(8,10] 15%
(12,14] 14%
(14,16] 11%
(6,8] 10%
(16,18] 8%
(18,20] 6%
(4,6] 5%

(20,22] 4%
(22,24] 3%
(2,4] 3%
(24,26] 2%
(26,28] 1%
(0,2] 1%
(28,30] 1%
(30,32] 0%
(-2,0] 0%
(32,34] 0%
(34,36] 0%
(-30,-2] 0%
(36,38] 0%
Name: temp0_l, dtype: object

Confusion matrix

temp0_l	(-2,0]	(-30,-2]	(0,2]	(10,12]	(12,14]	(14,16]	(16,18]	\
var_o_l								
(-2,0]	34	2	62	0	0	0	0	
(-30,-2]	8	0	8	0	0	0	0	
(0,2]	54	13	170	0	0	0	0	
(10,12]	0	0	0	4861	781	74	10	
(12,14]	0	0	0	3401	4036	759	124	
(14,16]	0	0	0	907	3259	3113	780	
(16,18]	0	0	0	105	859	2591	2452	
(18,20]	0	0	0	3	66	438	1607	
(2,4]	45	6	301	0	0	0	0	
(20,22]	0	0	0	0	10	44	218	
(22,24]	0	0	0	0	2	2	22	
(24,26]	0	0	0	0	0	0	2	
(26,28]	0	0	0	0	0	0	0	
(28,30]	0	0	0	0	0	0	0	
(30,32]	0	0	0	0	0	0	0	
(32,34]	0	0	0	0	0	0	0	
(34,36]	0	0	0	0	0	0	0	
(36,38]	0	0	0	0	0	0	0	
(38,40]	0	0	0	0	0	0	0	
(4,6]	2	0	138	5	0	0	0	
(6,8]	0	0	31	84	1	0	0	
(8,10]	0	0	12	1083	57	2	0	
All	143	21	722	10449	9071	7023	5215	

temp0_l	(18,20]	(2,4]	(20,22]	...	(26,28]	(28,30]	(30,32]	(32,34]	\
var_o_l				...					
(-2,0]	0	38	0	...	0	0	0	0	
(-30,-2]	0	2	0	...	0	0	0	0	
(0,2]	0	159	0	...	0	0	0	0	
(10,12]	0	6	0	...	0	0	0	0	
(12,14]	15	0	3	...	0	0	0	0	
(14,16]	151	0	18	...	0	0	0	0	
(16,18]	698	0	150	...	0	0	0	0	
(18,20]	1640	0	631	...	7	1	0	0	
(2,4]	0	533	0	...	0	0	0	0	
(20,22]	960	0	1261	...	7	2	2	0	
(22,24]	187	0	620	...	26	2	0	0	
(24,26]	20	0	127	...	198	11	0	0	
(26,28]	0	0	15	...	391	87	5	0	
(28,30]	0	0	0	...	226	204	36	1	
(30,32]	0	0	0	...	41	137	108	13	
(32,34]	0	0	0	...	3	39	75	36	

(34,36]	0	0	0	...	1	0	22	30
(36,38]	0	0	0	...	0	0	0	7
(38,40]	0	0	0	...	0	0	0	0
(4,6]	0	627	0	...	0	0	0	0
(6,8]	0	312	0	...	0	0	0	0
(8,10]	0	48	0	...	0	0	0	0
All	3671	1725	2825	...	900	483	248	87

temp0_l var_o_l	(34,36]	(36,38]	(4,6]	(6,8]	(8,10]	All
(-2,0]	0	0	3	1	0	140
(-30,-2]	0	0	0	0	0	18
(0,2]	0	0	55	7	0	458
(10,12]	0	0	80	731	3061	9604
(12,14]	0	0	2	123	896	9359
(14,16]	0	0	0	7	111	8353
(16,18]	0	0	0	0	8	6876
(18,20]	0	0	0	0	0	4543
(2,4]	0	0	416	84	4	1389
(20,22]	0	0	0	0	0	3082
(22,24]	0	0	0	0	0	2117
(24,26]	0	0	0	0	0	1506
(26,28]	0	0	0	0	0	911
(28,30]	0	0	0	0	0	556
(30,32]	0	0	0	0	0	307
(32,34]	0	0	0	0	0	154
(34,36]	16	1	0	0	0	70
(36,38]	12	1	0	0	0	20
(38,40]	3	0	0	0	0	3
(4,6]	0	0	1286	965	86	3109
(6,8]	0	0	1309	2877	1046	5660
(8,10]	0	0	467	2118	4546	8333
All	31	2	3618	6913	9758	66568

[23 rows x 22 columns]

Precision and entropy meteorologic model

temp0_l	(-2,0]	(-30,-2]	(0,2]	(10,12]	(12,14]	\
(-2,0]	0.237762	0.095238	0.085873	0.000000	0.000000	
(-30,-2]	0.055944	0.000000	0.011080	0.000000	0.000000	
(0,2]	0.377622	0.619048	0.235457	0.000000	0.000000	
(10,12]	0.000000	0.000000	0.000000	0.465212	0.086099	
(12,14]	0.000000	0.000000	0.000000	0.325486	0.444934	
(14,16]	0.000000	0.000000	0.000000	0.086803	0.359277	
(16,18]	0.000000	0.000000	0.000000	0.010049	0.094697	
(18,20]	0.000000	0.000000	0.000000	0.000287	0.007276	
(2,4]	0.314685	0.285714	0.416898	0.000000	0.000000	
(20,22]	0.000000	0.000000	0.000000	0.000000	0.001102	
(22,24]	0.000000	0.000000	0.000000	0.000000	0.000220	
(24,26]	0.000000	0.000000	0.000000	0.000000	0.000000	
(26,28]	0.000000	0.000000	0.000000	0.000000	0.000000	
(28,30]	0.000000	0.000000	0.000000	0.000000	0.000000	
(30,32]	0.000000	0.000000	0.000000	0.000000	0.000000	
(32,34]	0.000000	0.000000	0.000000	0.000000	0.000000	
(34,36]	0.000000	0.000000	0.000000	0.000000	0.000000	
(36,38]	0.000000	0.000000	0.000000	0.000000	0.000000	
(38,40]	0.000000	0.000000	0.000000	0.000000	0.000000	
(4,6]	0.013986	0.000000	0.191136	0.000479	0.000000	
(6,8]	0.000000	0.000000	0.042936	0.008039	0.000110	
(8,10]	0.000000	0.000000	0.016620	0.103646	0.006284	

```
entropy/entropy.max  0.418678  0.284290  0.480588  0.407451  0.401318

temp0_l            (14,16]   (16,18]   (18,20]     (2,4]   (20,22]  ...  \
(-2,0]            0.000000  0.000000  0.000000  0.022029  0.000000  ...
(-30,-2]           0.000000  0.000000  0.000000  0.001159  0.000000  ...
(0,2]             0.000000  0.000000  0.000000  0.092174  0.000000  ...
(10,12]            0.010537  0.001918  0.000000  0.003478  0.000000  ...
(12,14]            0.108073  0.023778  0.004086  0.000000  0.001062  ...
(14,16]            0.443258  0.149569  0.041133  0.000000  0.006372  ...
(16,18]            0.368931  0.470182  0.190139  0.000000  0.053097  ...
(18,20]            0.062367  0.308150  0.446745  0.000000  0.223363  ...
(2,4]             0.000000  0.000000  0.000000  0.308986  0.000000  ...
(20,22]            0.006265  0.041802  0.261509  0.000000  0.446372  ...
(22,24]            0.000285  0.004219  0.050940  0.000000  0.219469  ...
(24,26]            0.000000  0.000384  0.005448  0.000000  0.044956  ...
(26,28]            0.000000  0.000000  0.000000  0.000000  0.005310  ...
(28,30]            0.000000  0.000000  0.000000  0.000000  0.000000  ...
(30,32]            0.000000  0.000000  0.000000  0.000000  0.000000  ...
(32,34]            0.000000  0.000000  0.000000  0.000000  0.000000  ...
(34,36]            0.000000  0.000000  0.000000  0.000000  0.000000  ...
(36,38]            0.000000  0.000000  0.000000  0.000000  0.000000  ...
(38,40]            0.000000  0.000000  0.000000  0.000000  0.000000  ...
(4,6]             0.000000  0.000000  0.000000  0.363478  0.000000  ...
(6,8]             0.000000  0.000000  0.000000  0.180870  0.000000  ...
(8,10]             0.000285  0.000000  0.000000  0.027826  0.000000  ...
entropy/entropy.max  0.396768  0.408096  0.440027  0.475898  0.449790  ...

temp0_l            (26,28]   (28,30]   (30,32]   (32,34]   (34,36]  \
(-2,0]            0.000000  0.000000  0.000000  0.000000  0.000000
(-30,-2]           0.000000  0.000000  0.000000  0.000000  0.000000
(0,2]             0.000000  0.000000  0.000000  0.000000  0.000000
(10,12]            0.000000  0.000000  0.000000  0.000000  0.000000
(12,14]            0.000000  0.000000  0.000000  0.000000  0.000000
(14,16]            0.000000  0.000000  0.000000  0.000000  0.000000
(16,18]            0.000000  0.000000  0.000000  0.000000  0.000000
(18,20]            0.007778  0.002070  0.000000  0.000000  0.000000
(2,4]             0.000000  0.000000  0.000000  0.000000  0.000000
(20,22]            0.007778  0.004141  0.008065  0.000000  0.000000
(22,24]            0.028889  0.004141  0.000000  0.000000  0.000000
(24,26]            0.220000  0.022774  0.000000  0.000000  0.000000
(26,28]            0.434444  0.180124  0.020161  0.000000  0.000000
(28,30]            0.251111  0.422360  0.145161  0.011494  0.000000
(30,32]            0.045556  0.283644  0.435484  0.149425  0.000000
(32,34]            0.003333  0.080745  0.302419  0.413793  0.000000
(34,36]            0.001111  0.000000  0.088710  0.344828  0.516129
(36,38]            0.000000  0.000000  0.000000  0.080460  0.387097
(38,40]            0.000000  0.000000  0.000000  0.000000  0.096774
(4,6]             0.000000  0.000000  0.000000  0.000000  0.000000
(6,8]             0.000000  0.000000  0.000000  0.000000  0.000000
(8,10]             0.000000  0.000000  0.000000  0.000000  0.000000
entropy/entropy.max  0.448884  0.445722  0.432318  0.410997  0.302408

temp0_l            (36,38]     (4,6]     (6,8]    (8,10]  Climatology
(-2,0]            0.000000  0.000829  0.000145  0.000000     0.002103
(-30,-2]           0.000000  0.000000  0.000000  0.000000     0.000270
(0,2]             0.000000  0.015202  0.001013  0.000000     0.006880
(10,12]            0.000000  0.022112  0.105743  0.313691     0.144274
(12,14]            0.000000  0.000553  0.017793  0.091822     0.140593
(14,16]            0.000000  0.000000  0.001013  0.011375     0.125481
(16,18]            0.000000  0.000000  0.000000  0.000820     0.103293
```

(18,20]	0.000000	0.000000	0.000000	0.000000	0.068246
(2,4]	0.000000	0.114981	0.012151	0.000410	0.020866
(20,22]	0.000000	0.000000	0.000000	0.000000	0.046299
(22,24]	0.000000	0.000000	0.000000	0.000000	0.031802
(24,26]	0.000000	0.000000	0.000000	0.000000	0.022623
(26,28]	0.000000	0.000000	0.000000	0.000000	0.013685
(28,30]	0.000000	0.000000	0.000000	0.000000	0.008352
(30,32]	0.000000	0.000000	0.000000	0.000000	0.004612
(32,34]	0.000000	0.000000	0.000000	0.000000	0.002313
(34,36]	0.500000	0.000000	0.000000	0.000000	0.001052
(36,38]	0.500000	0.000000	0.000000	0.000000	0.000300
(38,40]	0.000000	0.000000	0.000000	0.000000	0.000045
(4,6]	0.000000	0.355445	0.139592	0.008813	0.046704
(6,8]	0.000000	0.361802	0.416172	0.107194	0.085026
(8,10]	0.000000	0.129077	0.306379	0.465874	0.125180
entropy/entropy.max	0.224244	0.454997	0.446523	0.414039	0.796354

[23 rows x 22 columns]
Quality report meteorologic model

	precision	recall	f1-score	support
(-2,0]	0.237762	0.242857	0.240283	140.000000
(-30,-2]	0.000000	0.000000	0.000000	18.000000
(0,2]	0.235457	0.371179	0.288136	458.000000
(10,12]	0.465212	0.506143	0.484815	9604.000000
(12,14]	0.444934	0.431243	0.437982	9359.000000
(14,16]	0.443258	0.372680	0.404917	8353.000000
(16,18]	0.470182	0.356603	0.405591	6876.000000
(18,20]	0.446745	0.360995	0.399318	4543.000000
(2,4]	0.308986	0.383729	0.342325	1389.000000
(20,22]	0.446372	0.409150	0.426951	3082.000000
(22,24]	0.422497	0.436467	0.429368	2117.000000
(24,26]	0.441734	0.432935	0.437290	1506.000000
(26,28]	0.434444	0.429199	0.431806	911.000000
(28,30]	0.422360	0.366906	0.392685	556.000000
(30,32]	0.435484	0.351792	0.389189	307.000000
(32,34]	0.413793	0.233766	0.298755	154.000000
(34,36]	0.516129	0.228571	0.316832	70.000000
(36,38]	0.500000	0.050000	0.090909	20.000000
(38,40]	0.000000	0.000000	0.000000	3.000000
(4,6]	0.355445	0.413638	0.382340	3109.000000
(6,8]	0.416172	0.508304	0.457647	5660.000000
(8,10]	0.465874	0.545542	0.502570	8333.000000
accuracy	0.437763	0.437763	0.437763	0.437763
macro avg	0.378311	0.337804	0.343623	66568.000000
weighted avg	0.440447	0.437763	0.436141	66568.000000

****

Model point: 1
(10,12] 16%
(8,10] 15%
(12,14] 14%
(14,16] 11%
(6,8] 11%
(16,18] 8%
(18,20] 5%
(4,6] 5%
(20,22] 4%
(22,24] 3%
(2,4] 2%
(24,26] 2%

(26,28] 1%
(0,2] 1%
(28,30] 1%
(30,32] 0%
(-2,0] 0%
(32,34] 0%
(-30,-2] 0%
(34,36] 0%
Name: temp1_l, dtype: object

Confusion matrix

temp1_l	(-2,0]	(-30,-2]	(0,2]	(10,12]	(12,14]	(14,16]	(16,18]	\
var_o_l								
(-2,0]	27	5	70	0	0	0	0	
(-30,-2]	9	0	7	0	0	0	0	
(0,2]	56	12	164	0	0	0	0	
(10,12]	0	0	0	4899	765	54	8	
(12,14]	0	0	0	3607	4072	683	103	
(14,16]	0	0	0	889	3374	3195	664	
(16,18]	0	0	0	104	862	2840	2383	
(18,20]	0	0	0	3	71	496	1825	
(2,4]	51	8	276	0	0	0	0	
(20,22]	0	0	0	0	8	48	320	
(22,24]	0	0	0	0	1	5	42	
(24,26]	0	0	0	0	0	0	3	
(26,28]	0	0	0	0	0	0	0	
(28,30]	0	0	0	0	0	0	0	
(30,32]	0	0	0	0	0	0	0	
(32,34]	0	0	0	0	0	0	0	
(34,36]	0	0	0	0	0	0	0	
(36,38]	0	0	0	0	0	0	0	
(38,40]	0	0	0	0	0	0	0	
(4,6]	6	0	144	6	0	0	0	
(6,8]	0	0	32	61	3	0	0	
(8,10]	1	0	12	971	48	0	0	
All	150	25	705	10540	9204	7321	5348	

temp1_l	(18,20]	(2,4]	(20,22]	...	(24,26]	(26,28]	(28,30]	(30,32]	\
var_o_l				...					
(-2,0]	0	33	0	...	0	0	0	0	
(-30,-2]	0	2	0	...	0	0	0	0	
(0,2]	0	168	0	...	0	0	0	0	
(10,12]	0	2	0	...	0	0	0	0	
(12,14]	13	0	3	...	0	0	0	0	
(14,16]	126	0	10	...	3	0	0	0	
(16,18]	541	0	132	...	1	0	0	0	
(18,20]	1520	0	506	...	10	6	1	0	
(2,4]	0	521	0	...	0	0	0	0	
(20,22]	1126	0	1137	...	44	5	4	0	
(22,24]	265	0	752	...	209	12	1	0	
(24,26]	33	0	198	...	556	103	5	0	
(26,28]	2	0	27	...	380	292	50	1	
(28,30]	0	0	0	...	107	267	150	12	
(30,32]	0	0	0	...	14	68	156	68	
(32,34]	0	0	0	...	1	8	58	72	
(34,36]	0	0	0	...	0	1	3	33	
(36,38]	0	0	0	...	0	0	0	1	
(38,40]	0	0	0	...	0	0	0	0	
(4,6]	0	541	0	...	0	0	0	0	
(6,8]	0	258	0	...	0	0	0	0	

```
(8,10]        0    34       0  ...       0       0       0       0
All        3626  1559    2765  ...    1325     762     428     187

temp1_l  (32,34]  (34,36]  (4,6]  (6,8]  (8,10]   All
var_o_l
(-2,0]         0       0     5      0       0   140
(-30,-2]       0       0     0      0       0    18
(0,2]          0       0    49      9       0   458
(10,12]        0       0    56    587    3233  9604
(12,14]        0       0     2     73     803  9359
(14,16]        0       0     0      5      84  8353
(16,18]        0       0     0      0       5  6876
(18,20]        0       0     0      0       0  4543
(2,4]          0       0   450     79       4  1389
(20,22]        0       0     0      0       0  3082
(22,24]        0       0     0      0       0  2117
(24,26]        0       0     0      0       0  1506
(26,28]        0       0     0      0       0   911
(28,30]        1       0     0      0       0   556
(30,32]        1       0     0      0       0   307
(32,34]       15       0     0      0       0   154
(34,36]       23      10     0      0       0    70
(36,38]        9      10     0      0       0    20
(38,40]        2       1     0      0       0     3
(4,6]          0       0  1343   1001      68  3109
(6,8]          0       0  1292   3048     966  5660
(8,10]         0       0   389   2227    4651  8333
All           51      21  3586   7029    9814 66568

[23 rows x 21 columns]

Precision and entropy meteorologic model
 temp1_l              (-2,0]  (-30,-2]     (0,2]   (10,12]   (12,14]  \
(-2,0]             0.180000  0.200000  0.099291  0.000000  0.000000
(-30,-2]           0.060000  0.000000  0.009929  0.000000  0.000000
(0,2]              0.373333  0.480000  0.232624  0.000000  0.000000
(10,12]            0.000000  0.000000  0.000000  0.464801  0.083116
(12,14]            0.000000  0.000000  0.000000  0.342220  0.442416
(14,16]            0.000000  0.000000  0.000000  0.084345  0.366580
(16,18]            0.000000  0.000000  0.000000  0.009867  0.093655
(18,20]            0.000000  0.000000  0.000000  0.000285  0.007714
(2,4]              0.340000  0.320000  0.391489  0.000000  0.000000
(20,22]            0.000000  0.000000  0.000000  0.000000  0.000869
(22,24]            0.000000  0.000000  0.000000  0.000000  0.000109
(24,26]            0.000000  0.000000  0.000000  0.000000  0.000000
(26,28]            0.000000  0.000000  0.000000  0.000000  0.000000
(28,30]            0.000000  0.000000  0.000000  0.000000  0.000000
(30,32]            0.000000  0.000000  0.000000  0.000000  0.000000
(32,34]            0.000000  0.000000  0.000000  0.000000  0.000000
(34,36]            0.000000  0.000000  0.000000  0.000000  0.000000
(36,38]            0.000000  0.000000  0.000000  0.000000  0.000000
(38,40]            0.000000  0.000000  0.000000  0.000000  0.000000
(4,6]              0.040000  0.000000  0.204255  0.000569  0.000000
(6,8]              0.000000  0.000000  0.045390  0.005787  0.000326
(8,10]             0.006667  0.000000  0.017021  0.092125  0.005215
entropy/entropy.max  0.444595  0.336072  0.490334  0.398988  0.398533

temp1_l            (14,16]   (16,18]   (18,20]     (2,4]   (20,22]  ...  \
(-2,0]            0.000000  0.000000  0.000000  0.021167  0.000000  ...
(-30,-2]          0.000000  0.000000  0.000000  0.001283  0.000000  ...
```

(0,2]	0.000000	0.000000	0.000000	0.107761	0.000000	...
(10,12]	0.007376	0.001496	0.000000	0.001283	0.000000	...
(12,14]	0.093293	0.019260	0.003585	0.000000	0.001085	...
(14,16]	0.436416	0.124159	0.034749	0.000000	0.003617	...
(16,18]	0.387925	0.445587	0.149200	0.000000	0.047740	...
(18,20]	0.067750	0.341249	0.419195	0.000000	0.183002	...
(2,4]	0.000000	0.000000	0.000000	0.334189	0.000000	...
(20,22]	0.006556	0.059835	0.310535	0.000000	0.411212	...
(22,24]	0.000683	0.007853	0.073083	0.000000	0.271971	...
(24,26]	0.000000	0.000561	0.009101	0.000000	0.071609	...
(26,28]	0.000000	0.000000	0.000552	0.000000	0.009765	...
(28,30]	0.000000	0.000000	0.000000	0.000000	0.000000	...
(30,32]	0.000000	0.000000	0.000000	0.000000	0.000000	...
(32,34]	0.000000	0.000000	0.000000	0.000000	0.000000	...
(34,36]	0.000000	0.000000	0.000000	0.000000	0.000000	...
(36,38]	0.000000	0.000000	0.000000	0.000000	0.000000	...
(38,40]	0.000000	0.000000	0.000000	0.000000	0.000000	...
(4,6]	0.000000	0.000000	0.000000	0.347017	0.000000	...
(6,8]	0.000000	0.000000	0.000000	0.165491	0.000000	...
(8,10]	0.000000	0.000000	0.000000	0.021809	0.000000	...
entropy/entropy.max	0.390491	0.414966	0.448553	0.470213	0.464987	...

temp1_l	(24,26]	(26,28]	(28,30]	(30,32]	(32,34] \
(-2,0]	0.000000	0.000000	0.000000	0.000000	0.000000
(-30,-2]	0.000000	0.000000	0.000000	0.000000	0.000000
(0,2]	0.000000	0.000000	0.000000	0.000000	0.000000
(10,12]	0.000000	0.000000	0.000000	0.000000	0.000000
(12,14]	0.000000	0.000000	0.000000	0.000000	0.000000
(14,16]	0.002264	0.000000	0.000000	0.000000	0.000000
(16,18]	0.000755	0.000000	0.000000	0.000000	0.000000
(18,20]	0.007547	0.007874	0.002336	0.000000	0.000000
(2,4]	0.000000	0.000000	0.000000	0.000000	0.000000
(20,22]	0.033208	0.006562	0.009346	0.000000	0.000000
(22,24]	0.157736	0.015748	0.002336	0.000000	0.000000
(24,26]	0.419623	0.135171	0.011682	0.000000	0.000000
(26,28]	0.286792	0.383202	0.116822	0.005348	0.000000
(28,30]	0.080755	0.350394	0.350467	0.064171	0.019608
(30,32]	0.010566	0.089239	0.364486	0.363636	0.019608
(32,34]	0.000755	0.010499	0.135514	0.385027	0.294118
(34,36]	0.000000	0.001312	0.007009	0.176471	0.450980
(36,38]	0.000000	0.000000	0.000000	0.005348	0.176471
(38,40]	0.000000	0.000000	0.000000	0.000000	0.039216
(4,6]	0.000000	0.000000	0.000000	0.000000	0.000000
(6,8]	0.000000	0.000000	0.000000	0.000000	0.000000
(8,10]	0.000000	0.000000	0.000000	0.000000	0.000000
entropy/entropy.max	0.465794	0.457519	0.458014	0.412036	0.422630

temp1_l	(34,36]	(4,6]	(6,8]	(8,10]	Climatology
(-2,0]	0.000000	0.001394	0.000000	0.000000	0.002103
(-30,-2]	0.000000	0.000000	0.000000	0.000000	0.000270
(0,2]	0.000000	0.013664	0.001280	0.000000	0.006880
(10,12]	0.000000	0.015616	0.083511	0.329427	0.144274
(12,14]	0.000000	0.000558	0.010386	0.081822	0.140593
(14,16]	0.000000	0.000000	0.000711	0.008559	0.125481
(16,18]	0.000000	0.000000	0.000000	0.000509	0.103293
(18,20]	0.000000	0.000000	0.000000	0.000000	0.068246
(2,4]	0.000000	0.125488	0.011239	0.000408	0.020866
(20,22]	0.000000	0.000000	0.000000	0.000000	0.046299
(22,24]	0.000000	0.000000	0.000000	0.000000	0.031802
(24,26]	0.000000	0.000000	0.000000	0.000000	0.022623

(26,28]	0.000000	0.000000	0.000000	0.000000	0.013685
(28,30]	0.000000	0.000000	0.000000	0.000000	0.008352
(30,32]	0.000000	0.000000	0.000000	0.000000	0.004612
(32,34]	0.000000	0.000000	0.000000	0.000000	0.002313
(34,36]	0.476190	0.000000	0.000000	0.000000	0.001052
(36,38]	0.476190	0.000000	0.000000	0.000000	0.000300
(38,40]	0.047619	0.000000	0.000000	0.000000	0.000045
(4,6]	0.000000	0.374512	0.142410	0.006929	0.046704
(6,8]	0.000000	0.360290	0.433632	0.098431	0.085026
(8,10]	0.000000	0.108477	0.316830	0.473915	0.125180
entropy/entropy.max	0.275501	0.444507	0.427996	0.399523	0.796354

[23 rows x 21 columns]
Quality report meteorologic model

	precision	recall	f1-score	support
(-2,0]	0.180000	0.192857	0.186207	140.000000
(-30,-2]	0.000000	0.000000	0.000000	18.000000
(0,2]	0.232624	0.358079	0.282029	458.000000
(10,12]	0.464801	0.510100	0.486398	9604.000000
(12,14]	0.442416	0.435089	0.438722	9359.000000
(14,16]	0.436416	0.382497	0.407682	8353.000000
(16,18]	0.445587	0.346568	0.389889	6876.000000
(18,20]	0.419195	0.334581	0.372139	4543.000000
(2,4]	0.334189	0.375090	0.353460	1389.000000
(20,22]	0.411212	0.368916	0.388917	3082.000000
(22,24]	0.391140	0.392064	0.391602	2117.000000
(24,26]	0.419623	0.369190	0.392794	1506.000000
(26,28]	0.383202	0.320527	0.349074	911.000000
(28,30]	0.350467	0.269784	0.304878	556.000000
(30,32]	0.363636	0.221498	0.275304	307.000000
(32,34]	0.294118	0.097403	0.146341	154.000000
(34,36]	0.476190	0.142857	0.219780	70.000000
(36,38]	0.000000	0.000000	0.000000	20.000000
(38,40]	0.000000	0.000000	0.000000	3.000000
(4,6]	0.374512	0.431972	0.401195	3109.000000
(6,8]	0.433632	0.538516	0.480416	5660.000000
(8,10]	0.473915	0.558142	0.512592	8333.000000
accuracy	0.433857	0.433857	0.433857	0.433857
macro avg	0.333040	0.302079	0.308155	66568.000000
weighted avg	0.433294	0.433857	0.430650	66568.000000

****

Correlation observed variable and meterological model threshold: 0.3

	temp_o
rh0	-0.569943
rh1	-0.558436
rh4	-0.558112
rh2	-0.557106
rh3	-0.551336
HGT8502	0.325047
HGT8504	0.330054

```
HGT8501     0.330955
HGT8500     0.331632
HGT8503     0.332432
shflx4      0.428060
shflx2      0.434340
shflx1      0.435452
shflx3      0.440121
lwflx4      0.452511
lwflx1      0.459188
lwflx0      0.463434
lwflx3      0.464730
lwflx2      0.481618
shflx0      0.508040
swflx0      0.549045
swflx4      0.549528
swflx1      0.549529
swflx2      0.549714
swflx3      0.551305
HGT5004     0.578259
HGT5002     0.578493
HGT5001     0.578882
HGT5000     0.578908
HGT5003     0.579774
lhflx2      0.607462
lhflx3      0.608465
lhflx1      0.610963
lhflx4      0.617369
lhflx0      0.644485
T5004       0.660435
T5000       0.660957
T5001       0.661234
T5002       0.661312
T5003       0.661683
T8504       0.746235
T8500       0.747209
T8503       0.748016
T8501       0.748092
T8502       0.749111
snowlevel4  0.806109
snowlevel1  0.809862
snowlevel0  0.810524
snowlevel3  0.811149
snowlevel2  0.816119
temp2       0.956080
temp0       0.957925
temp3       0.958547
temp1       0.959598
temp4       0.962554
```

AI results

```
Confusion matrix
 col_0    (-2,0]  (0,2]  (10,12]  (12,14]  (14,16]  (16,18]
(18,20]  (2,4]  \
row_0
(-2,0]        7      3        0        0        0        0        0
8
```

```
(0,2]          6      9        0        0        0        0        0
20
(10,12]        0      0      558      201       14        1        0
0
(12,14]        0      0      139      623      138       16        2
0
(14,16]        0      0        7      136      501      140       25
0
(16,18]        0      0        0       18      183      371      100
0
(18,20]        0      0        0        4       16       81      267
0
(2,4]          2     10        0        0        0        0        0
71
(20,22]        0      0        0        0        2        7       87
0
(22,24]        0      0        0        0        2        1       10
0
(24,26]        0      0        0        0        1        0        0
0
(26,28]        0      0        0        0        0        0        1
0
(28,30]        0      0        0        0        0        0        0
0
(30,32]        0      0        0        0        0        0        0
0
(32,34]        0      0        0        0        0        0        0
0
(34,36]        0      0        0        0        0        0        0
0
(36,38]        0      0        0        0        0        0        0
0
(38,40]        0      0        0        0        0        0        0
0
(4,6]          4      3        0        0        0        0        0
48
(6,8]          0      0       15        1        0        0        0
4
(8,10]         0      0      196       18        0        0        0
3
All           19     25      915     1001      857      617      492
154

col_0     (20,22]  (22,24]  ...  (28,30]  (30,32]  (32,34]  (34,36]
(36,38]  \
row_0                       ...
(-2,0]          0        0  ...        0        0        0        0
0
(0,2]           0        0  ...        0        0        0        0
0
(10,12]         0        0  ...        0        0        0        0
0
(12,14]         0        0  ...        0        0        0        0
0
(14,16]         1        0  ...        0        0        0        0
0
(16,18]        13        0  ...        0        0        0        0
0
```

(18,20]	62	6	...	1	0	0	0
0							
(2,4]	0	0	...	0	0	0	0
0							
(20,22]	158	40	...	1	0	0	0
0							
(22,24]	65	106	...	1	0	0	0
0							
(24,26]	8	21	...	0	0	0	0
0							
(26,28]	2	0	...	10	2	0	0
0							
(28,30]	1	0	...	30	10	2	0
0							
(30,32]	0	0	...	12	13	3	0
0							
(32,34]	0	0	...	0	5	6	1
2							
(34,36]	0	0	...	0	1	1	3
3							
(36,38]	0	0	...	0	0	0	0
2							
(38,40]	0	0	...	0	0	0	0
1							
(4,6]	0	0	...	0	0	0	0
0							
(6,8]	0	0	...	0	0	0	0
0							
(8,10]	0	0	...	0	0	0	0
0							
All	310	173	...	55	31	12	4
8							

col_0	(38,40]	(4,6]	(6,8]	(8,10]	All
row_0					
(-2,0]	0	0	0	0	18
(0,2]	0	7	2	1	45
(10,12]	0	2	8	171	955
(12,14]	0	0	0	15	933
(14,16]	0	0	0	2	812
(16,18]	0	0	0	0	685
(18,20]	0	0	0	0	441
(2,4]	0	49	7	1	140
(20,22]	0	0	0	0	303
(22,24]	0	0	0	0	227
(24,26]	0	0	0	0	138
(26,28]	0	0	0	0	87
(28,30]	0	0	0	0	61
(30,32]	0	0	0	0	28
(32,34]	1	0	0	0	15
(34,36]	0	0	0	0	8
(36,38]	0	0	0	0	2
(38,40]	0	0	0	0	1
(4,6]	0	145	68	17	285
(6,8]	0	98	355	149	622
(8,10]	0	12	136	486	851
All	1	313	576	842	6657

```
[22 rows x 22 columns]
************************************

Precision and entropy AI
 col_0                   (-2,0]     (0,2]   (10,12]   (12,14]
(14,16]  \
(-2,0]               0.368421  0.120000  0.000000  0.000000
0.000000
(0,2]                0.315789  0.360000  0.000000  0.000000
0.000000
(10,12]              0.000000  0.000000  0.609836  0.200799
0.016336
(12,14]              0.000000  0.000000  0.151913  0.622378
0.161027
(14,16]              0.000000  0.000000  0.007650  0.135864
0.584597
(16,18]              0.000000  0.000000  0.000000  0.017982
0.213536
(18,20]              0.000000  0.000000  0.000000  0.003996
0.018670
(2,4]                0.105263  0.400000  0.000000  0.000000
0.000000
(20,22]              0.000000  0.000000  0.000000  0.000000
0.002334
(22,24]              0.000000  0.000000  0.000000  0.000000
0.002334
(24,26]              0.000000  0.000000  0.000000  0.000000
0.001167
(26,28]              0.000000  0.000000  0.000000  0.000000
0.000000
(28,30]              0.000000  0.000000  0.000000  0.000000
0.000000
(30,32]              0.000000  0.000000  0.000000  0.000000
0.000000
(32,34]              0.000000  0.000000  0.000000  0.000000
0.000000
(34,36]              0.000000  0.000000  0.000000  0.000000
0.000000
(36,38]              0.000000  0.000000  0.000000  0.000000
0.000000
(38,40]              0.000000  0.000000  0.000000  0.000000
0.000000
(4,6]                0.210526  0.120000  0.000000  0.000000
0.000000
(6,8]                0.000000  0.000000  0.016393  0.000999
0.000000
(8,10]               0.000000  0.000000  0.214208  0.017982
0.000000
entropy/entropy.max  0.425975  0.408331  0.335882  0.348887
0.366325

col_0                 (16,18]   (18,20]     (2,4]   (20,22]
(22,24]  ...  \
(-2,0]               0.000000  0.000000  0.051948  0.000000
0.000000  ...
(0,2]                0.000000  0.000000  0.129870  0.000000
0.000000  ...
```

```
(10,12]              0.001621  0.000000  0.000000  0.000000
0.000000  ...
(12,14]              0.025932  0.004065  0.000000  0.000000
0.000000  ...
(14,16]              0.226904  0.050813  0.000000  0.003226
0.000000  ...
(16,18]              0.601297  0.203252  0.000000  0.041935
0.000000  ...
(18,20]              0.131280  0.542683  0.000000  0.200000
0.034682  ...
(2,4]                0.000000  0.000000  0.461039  0.000000
0.000000  ...
(20,22]              0.011345  0.176829  0.000000  0.509677
0.231214  ...
(22,24]              0.001621  0.020325  0.000000  0.209677
0.612717  ...
(24,26]              0.000000  0.000000  0.000000  0.025806
0.121387  ...
(26,28]              0.000000  0.002033  0.000000  0.006452
0.000000  ...
(28,30]              0.000000  0.000000  0.000000  0.003226
0.000000  ...
(30,32]              0.000000  0.000000  0.000000  0.000000
0.000000  ...
(32,34]              0.000000  0.000000  0.000000  0.000000
0.000000  ...
(34,36]              0.000000  0.000000  0.000000  0.000000
0.000000  ...
(36,38]              0.000000  0.000000  0.000000  0.000000
0.000000  ...
(38,40]              0.000000  0.000000  0.000000  0.000000
0.000000  ...
(4,6]                0.000000  0.000000  0.311688  0.000000
0.000000  ...
(6,8]                0.000000  0.000000  0.025974  0.000000
0.000000  ...
(8,10]               0.000000  0.000000  0.019481  0.000000
0.000000  ...
entropy/entropy.max  0.353197  0.403177  0.430476  0.423673
0.332169  ...

col_0                 (28,30]   (30,32]   (32,34]   (34,36]
(36,38]  \
(-2,0]               0.000000  0.000000  0.000000  0.000000
0.000000
(0,2]                0.000000  0.000000  0.000000  0.000000
0.000000
(10,12]              0.000000  0.000000  0.000000  0.000000
0.000000
(12,14]              0.000000  0.000000  0.000000  0.000000
0.000000
(14,16]              0.000000  0.000000  0.000000  0.000000
0.000000
(16,18]              0.000000  0.000000  0.000000  0.000000
0.000000
(18,20]              0.018182  0.000000  0.000000  0.000000
0.000000
```

(2,4]	0.000000	0.000000	0.000000	0.000000	0.000000
(20,22]	0.018182	0.000000	0.000000	0.000000	0.000000
(22,24]	0.018182	0.000000	0.000000	0.000000	0.000000
(24,26]	0.000000	0.000000	0.000000	0.000000	0.000000
(26,28]	0.181818	0.064516	0.000000	0.000000	0.000000
(28,30]	0.545455	0.322581	0.166667	0.000000	0.000000
(30,32]	0.218182	0.419355	0.250000	0.000000	0.000000
(32,34]	0.000000	0.161290	0.500000	0.250000	0.250000
(34,36]	0.000000	0.032258	0.083333	0.750000	0.375000
(36,38]	0.000000	0.000000	0.000000	0.000000	0.250000
(38,40]	0.000000	0.000000	0.000000	0.000000	0.125000
(4,6]	0.000000	0.000000	0.000000	0.000000	0.000000
(6,8]	0.000000	0.000000	0.000000	0.000000	0.000000
(8,10]	0.000000	0.000000	0.000000	0.000000	0.000000
entropy/entropy.max	0.391300	0.430704	0.393773	0.184704	0.433857

col_0	(38,40]	(4,6]	(6,8]	(8,10]	Climatology
(-2,0]	0.0	0.000000	0.000000	0.000000	0.002704
(0,2]	0.0	0.022364	0.003472	0.001188	0.006760
(10,12]	0.0	0.006390	0.013889	0.203088	0.143458
(12,14]	0.0	0.000000	0.000000	0.017815	0.140153
(14,16]	0.0	0.000000	0.000000	0.002375	0.121977
(16,18]	0.0	0.000000	0.000000	0.000000	0.102899
(18,20]	0.0	0.000000	0.000000	0.000000	0.066246
(2,4]	0.0	0.156550	0.012153	0.001188	0.021030
(20,22]	0.0	0.000000	0.000000	0.000000	0.045516
(22,24]	0.0	0.000000	0.000000	0.000000	0.034099
(24,26]	0.0	0.000000	0.000000	0.000000	0.020730
(26,28]	0.0	0.000000	0.000000	0.000000	0.013069

```
(28,30]                  0.0  0.000000  0.000000  0.000000
0.009163
(30,32]                  0.0  0.000000  0.000000  0.000000
0.004206
(32,34]                  1.0  0.000000  0.000000  0.000000
0.002253
(34,36]                  0.0  0.000000  0.000000  0.000000
0.001202
(36,38]                  0.0  0.000000  0.000000  0.000000
0.000300
(38,40]                  0.0  0.000000  0.000000  0.000000
0.000150
(4,6]                    0.0  0.463259  0.118056  0.020190
0.042812
(6,8]                    0.0  0.313099  0.616319  0.176960
0.093435
(8,10]                   0.0  0.038339  0.236111  0.577197
0.127835
entropy/entropy.max      0.0  0.411447  0.336343  0.370606
0.807740

[22 rows x 22 columns]
************************************

Quality report AI
              precision    recall  f1-score      support
(-2,0]         0.368421  0.388889  0.378378    18.000000
(0,2]          0.360000  0.200000  0.257143    45.000000
(10,12]        0.609836  0.584293  0.596791   955.000000
(12,14]        0.622378  0.667738  0.644261   933.000000
(14,16]        0.584597  0.616995  0.600359   812.000000
(16,18]        0.601297  0.541606  0.569892   685.000000
(18,20]        0.542683  0.605442  0.572347   441.000000
(2,4]          0.461039  0.507143  0.482993   140.000000
(20,22]        0.509677  0.521452  0.515498   303.000000
(22,24]        0.612717  0.466960  0.530000   227.000000
(24,26]        0.516484  0.681159  0.587500   138.000000
(26,28]        0.571429  0.459770  0.509554    87.000000
(28,30]        0.545455  0.491803  0.517241    61.000000
(30,32]        0.419355  0.464286  0.440678    28.000000
(32,34]        0.500000  0.400000  0.444444    15.000000
(34,36]        0.750000  0.375000  0.500000     8.000000
(36,38]        0.250000  1.000000  0.400000     2.000000
(38,40]        0.000000  0.000000  0.000000     1.000000
(4,6]          0.463259  0.508772  0.484950   285.000000
(6,8]          0.616319  0.570740  0.592654   622.000000
(8,10]         0.577197  0.571093  0.574129   851.000000
accuracy       0.577588  0.577588  0.577588     0.577588
macro avg      0.499150  0.505864  0.485658  6657.000000
weighted avg   0.579308  0.577588  0.576836  6657.000000
```

meteorological model variables selected:

```
 ['dir0' 'snow_prec0' 'snowlevel0' 'mod0' 'wind_gust0' 'mslp0'
'temp0'
 'rh0' 'visibility0' 'lhflx0' 'lwflx0' 'conv_prec0' 'prec0'
'swflx0'
 'shflx0' 'cape0' 'cin0' 'cfh0' 'cfl0' 'cfm0' 'cft0' 'HGT5000'
```

```
'HGT8500'
 'T5000' 'T8500' 'dir1' 'snow_prec1' 'snowlevel1' 'mod1'
'wind_gust1'
 'mslp1' 'temp1' 'rh1' 'visibility1' 'lhflx1' 'lwflx1' 'conv_prec1'
 'prec1' 'swflx1' 'shflx1' 'cape1' 'cin1' 'cfh1' 'cfl1' 'cfm1'
'cft1'
 'HGT5001' 'HGT8501' 'T5001' 'T8501' 'dir2' 'snow_prec2'
'snowlevel2'
 'mod2' 'wind_gust2' 'mslp2' 'temp2' 'rh2' 'visibility2' 'lhflx2'
'lwflx2'
 'conv_prec2' 'prec2' 'swflx2' 'shflx2' 'cape2' 'cin2' 'cfh2'
'cfl2'
 'cfm2' 'cft2' 'HGT5002' 'HGT8502' 'T5002' 'T8502' 'dir3'
'snow_prec3'
 'snowlevel3' 'mod3' 'wind_gust3' 'mslp3' 'temp3' 'rh3'
'visibility3'
 'lhflx3' 'lwflx3' 'conv_prec3' 'prec3' 'swflx3' 'shflx3' 'cape3'
'cin3'
 'cfh3' 'cfl3' 'cfm3' 'cft3' 'HGT5003' 'HGT8503' 'T5003' 'T8503'
'dir4'
 'snow_prec4' 'snowlevel4' 'mod4' 'wind_gust4' 'mslp4' 'temp4'
'rh4'
 'visibility4' 'lhflx4' 'lwflx4' 'conv_prec4' 'prec4' 'swflx4'
'shflx4'
 'cape4' 'cin4' 'cfh4' 'cfl4' 'cfm4' 'cft4' 'HGT5004' 'HGT8504'
'T5004'
 'T8504']
```

Cross validation:

```
Cross validation:

Splits number: 5
Test size: 0.1

f1_weighted: 0.56 (+/- 0.00)
Accuracy: 0.56 (+/- 0.00)

Scaler: StandardScaler()
PCA: PCA(n_components=125)
AI model: MLPClassifier(hidden_layer_sizes=(150, 50), max_iter=300,
random_state=1)

Library versions

sklearn: 1.0.2
pandas: 1.3.5
numpy: 1.21.6
```