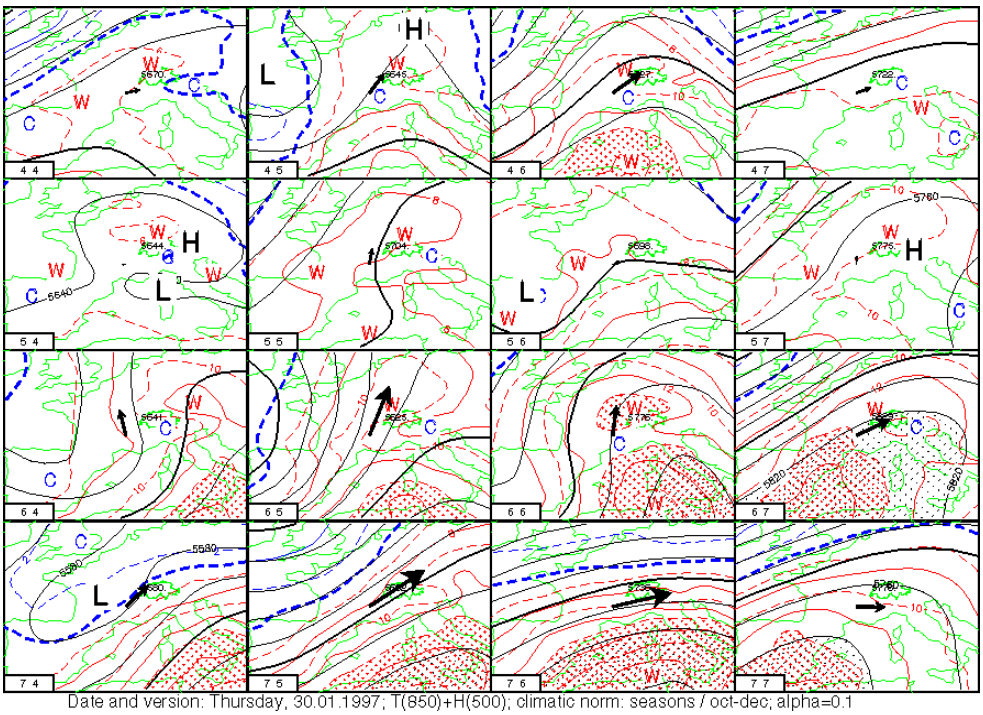
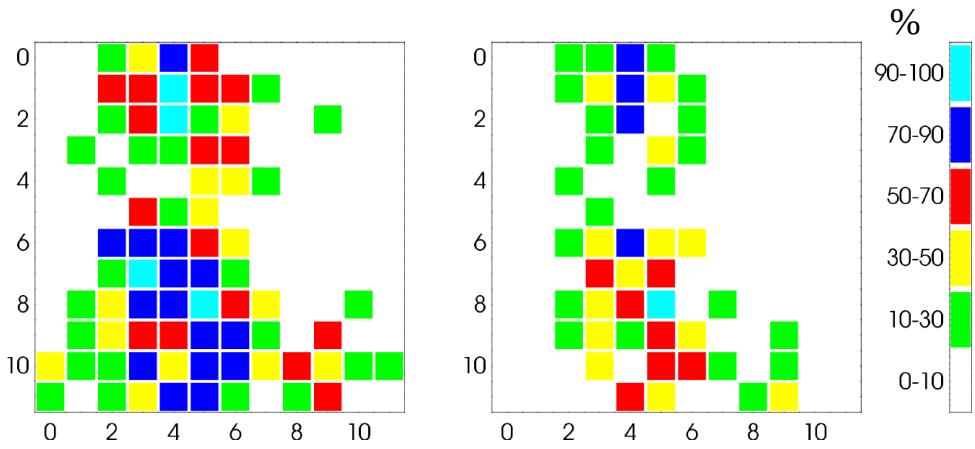
Statistical interpretation of ECMWF EPS

- Classification of weather patterns with an artificial neural network
- Each weather pattern receives a climatological probability for a weather element (rainfall, wind, sunshine,...)



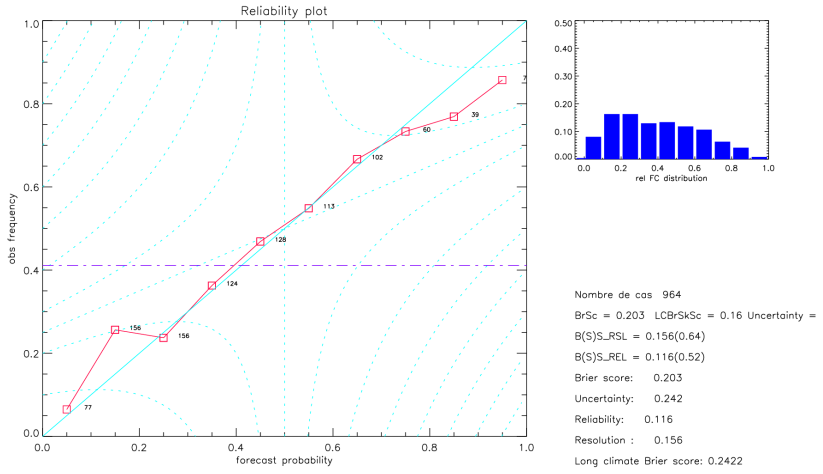
Lugano rain > 1 mm/24h

Lugano rain > 10 mm/24h



Precipitations prob. GE 0.1 mm T+ 144

GENEVA period [ ]



Nombre de cas 964

BrSc = 0.203 LCBrSkSc = 0.16 Uncertainty =

B(S)S_RSL = 0.156(0.64)

B(S)S_REL = 0.116(0.52)

Brier score: 0.203

Uncertainty: 0.242

Reliability: 0.116

Resolution : 0.156

Long climate Brier score: 0.2422

Long climate Brier skill score: 0.1631

Brier reliability skill score: 0.5211

Short climate Brier skill score: 0.2422

Probabilities of severe impact weather

- Show to the neuronal network the predictors (height, temperature, vorticity, vertical, velocity, stability, wind,...) and the predictand (rainfall, wind,...) by the mean of supervised learning.

Supervised learning, preliminary results

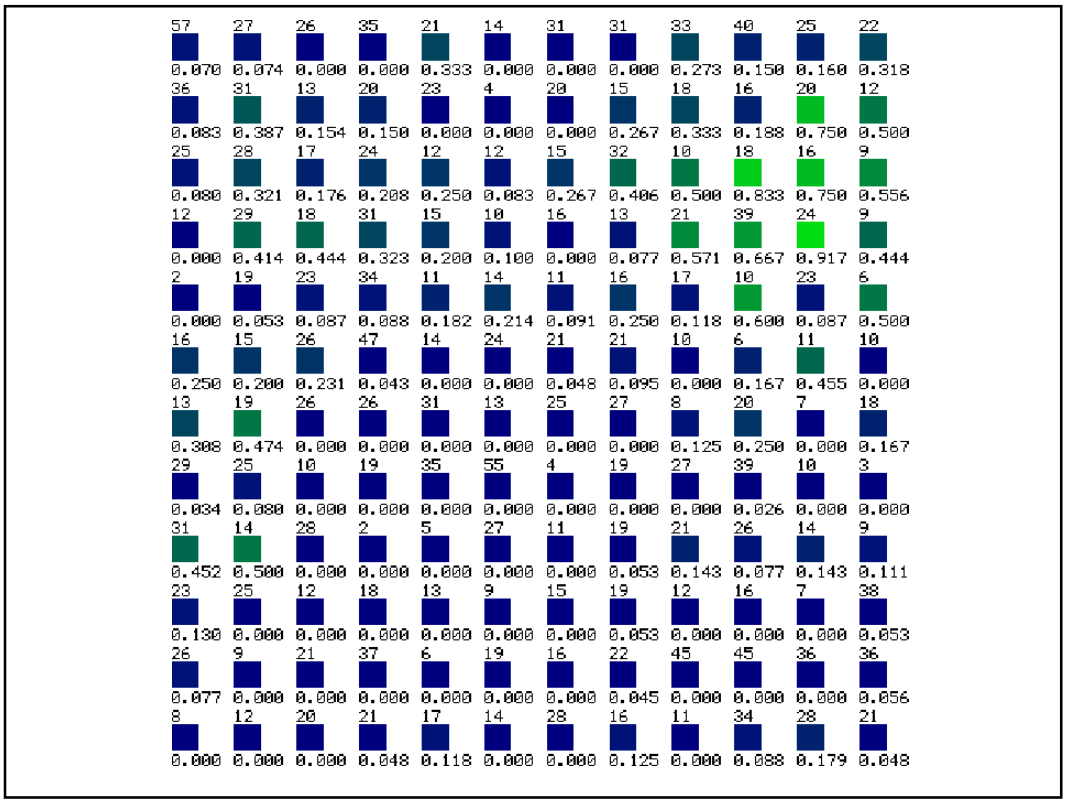
Predictors: H 500 hPa, T850 hPa

Predictand: 24 hour precipitation Lugano

Thresholds: 1, 5, 10, 20, 50 mm

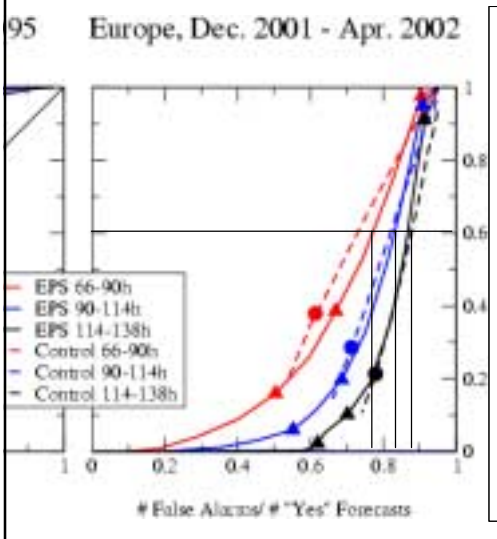
Next figure shows 10mm/24 hours on validation set

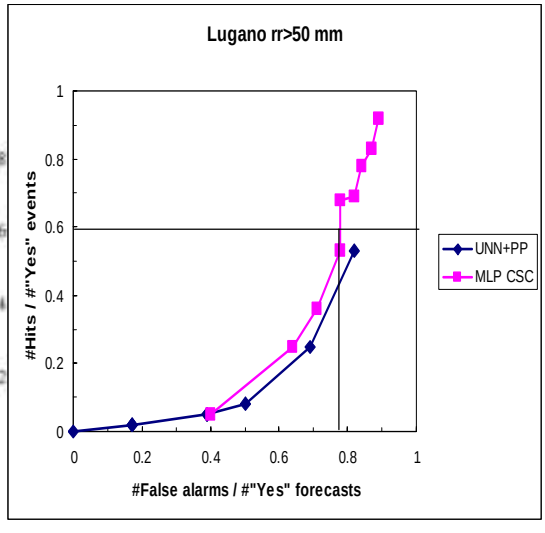
Thanks to Ralf Kretschmar


57 27 26 35 21 14 31 31 33 40 25 22
0.070 0.074 0.000 0.000 0.333 0.000 0.000 0.000 0.273 0.150 0.160 0.318
36 31 13 20 23 4 20 15 18 16 20 12
0.083 0.387 0.154 0.150 0.000 0.000 0.000 0.267 0.333 0.188 0.750 0.500
25 28 17 24 12 12 15 32 10 18 16 9
0.080 0.321 0.176 0.208 0.250 0.083 0.267 0.406 0.500 0.833 0.750 0.556
12 29 18 31 15 10 16 13 21 39 24 9
0.000 0.414 0.444 0.323 0.200 0.100 0.000 0.077 0.571 0.667 0.917 0.444
2 19 23 34 11 14 11 16 17 10 23 6
0.000 0.053 0.087 0.088 0.182 0.214 0.091 0.250 0.118 0.600 0.087 0.500
16 15 26 47 14 24 21 21 10 6 11 10
0.250 0.200 0.231 0.043 0.000 0.000 0.048 0.095 0.000 0.167 0.455 0.000
13 19 26 26 31 13 25 27 8 20 7 18
0.308 0.474 0.000 0.000 0.000 0.000 0.000 0.000 0.125 0.250 0.000 0.167
29 25 10 19 35 55 4 19 27 39 10 3
0.034 0.080 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.026 0.000 0.000
31 14 28 2 5 27 11 19 21 26 14 9
0.452 0.500 0.000 0.000 0.000 0.000 0.000 0.053 0.143 0.077 0.143 0.111
23 25 12 18 13 9 15 19 12 16 7 38
0.130 0.000 0.000 0.000 0.000 0.000 0.000 0.053 0.000 0.000 0.000 0.053
26 9 21 37 6 19 16 22 45 45 36 36
0.077 0.000 0.000 0.000 0.000 0.000 0.000 0.045 0.000 0.000 0.000 0.056
8 12 20 21 17 14 28 16 11 34 28 21
0.000 0.000 0.000 0.048 0.118 0.000 0.000 0.125 0.000 0.088 0.179 0.048


Brier skill score
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
1
5
10
20
50
Threshold (mm)
UNN + PP
MLP CSC


Brier resolution skill score
0.5
0.4
0.3
0.2
0.1
0
1
5
10
20
50
Threshold (mm)
UNN + PP
MLP CSC


95 Europe, Dec. 2001 - Apr. 2002
EPS 66-90h
EPS 90-114h
EPS 114-138h
Control 66-90h
Control 90-114h
Control 114-138h
0
0.2
0.4
0.6
0.8
1
False Alarms/ # "Yes" Forecasts


Lugano rr>50 mm
#Hits / #"Yes" events
#False alarms / #"Yes" forecasts
0
0.2
0.4
0.6
0.8
1
UNN+PP
MLP CSC

Rainfaill Lugano > 50 mm

UNN + PP

prob %	obs	no obs
0- 9	105	14090
10- 19	63	397
20- 29	38	106
30- 39	6	10
40- 49	0	0
50- 59	6	6
60- 69	0	0
70- 79	0	0
80- 89	5	1
90- 99	0	0

MLP CSC

PredProbRange	obs	no obs
[0.00,0.10[	5	2417
[0.10,0.20[	5	128
[0.20,0.30[	3	80
[0.30,0.40[	5	55
[0.40,0.50[	1	40
[0.50,0.60[	9	34
[0.60,0.70[	10	58
[0.70,0.80[	6	24
[0.80,0.90[	12	25
[0.90,1.00]	3	2

Perspectives

- Use predictors more related to rainfall (humidity, vertical velocity,…)
- Use regional mean, or better regional maximal rainfall
- Translate to ECMWF EPS
- Assess strengths and weaknesses of LEPS, EFI, ANN