Results of recent Aladin verification

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Motivation

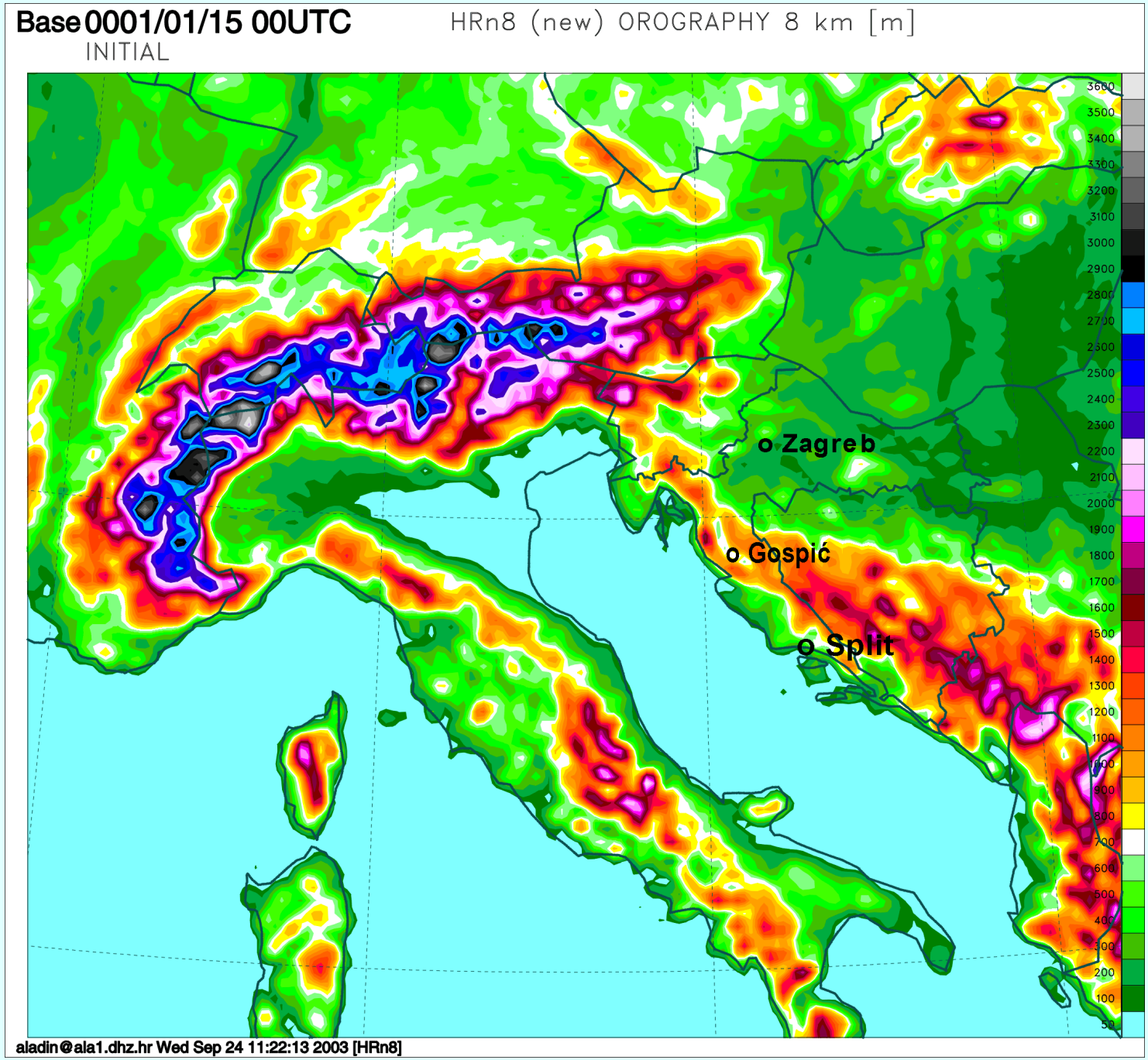
- evaluate skill for “new” Aladin Croatia model
- compare scores with other models - Aladin Lace model and ECMWF global model

Aladin

- Aladin Lace started in 1996 in Prague
- from 2003 run in Zagreb, Croatia
- Aladin Cro started in 2000 in Zagreb

Aladin Croatia

- runs operationally for 00 and 12 UTC
- boundary conditions from Aladin Lace
- smaller domain
- resolution reduced to 8 km
- dynamical adaptation of wind field to 2 km


Base 0001/01/15 00UTC
INITIAL
HRn8 (new) OROGRAPHY 8 km [m]
Zagreb
Gospić
Split
3600
3500
3400
3300
3200
3100
3000
2900
2800
2700
2600
2500
2400
2300
2200
2100
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
50
aladin@ala1.dhz.hr Wed Sep 24 11:22:13 2003 [HRn8]

variables and scores

- temperature - ME, MAE, RMSE, SS
- precipitation - bias, KSS, HSS, ETS
- wind - mean values, stdev, correlation coeff

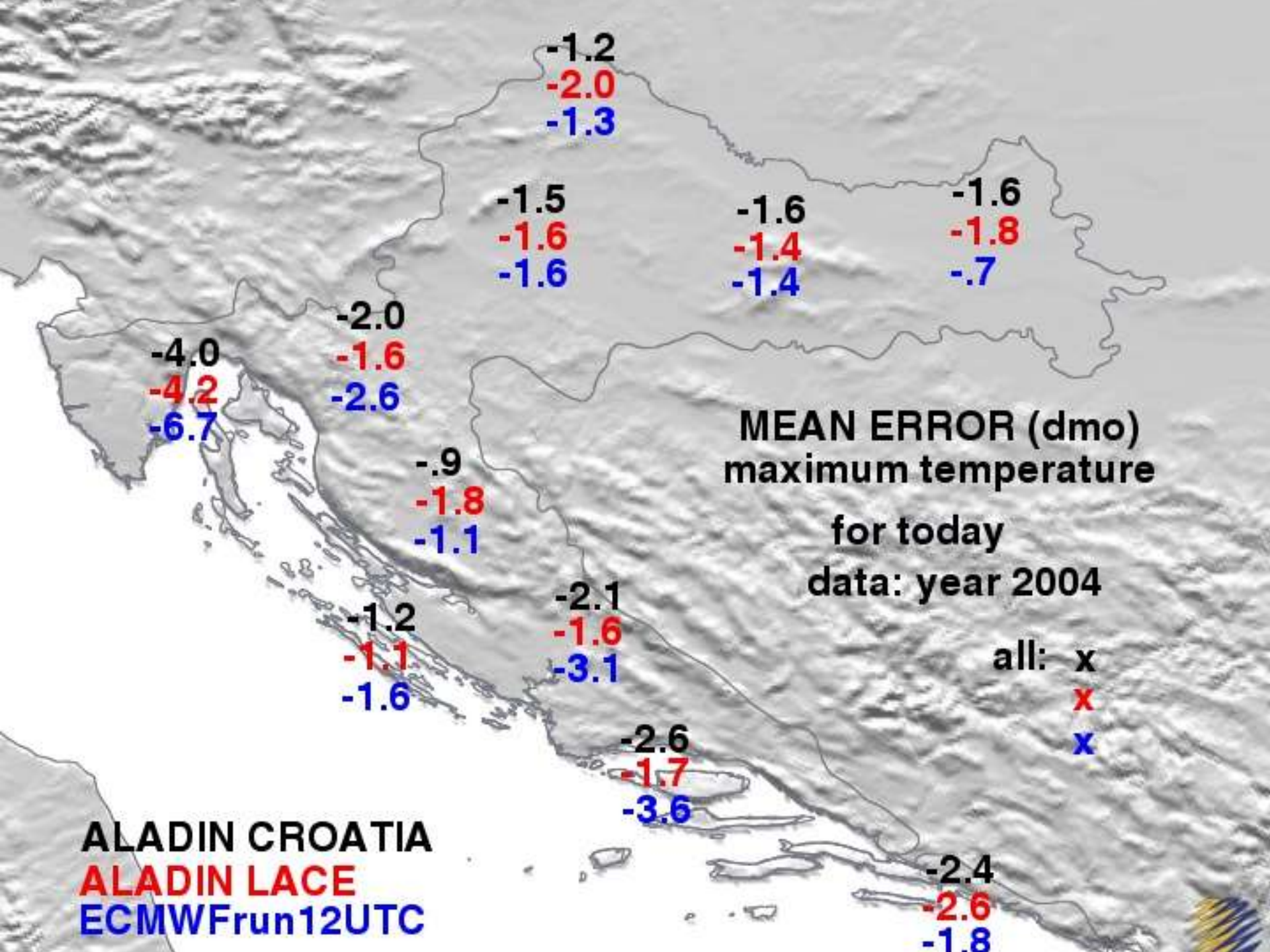
Wilks, D.S., 1995: *Statistical Methods in the Atmospheric Sciences: an Introduction*

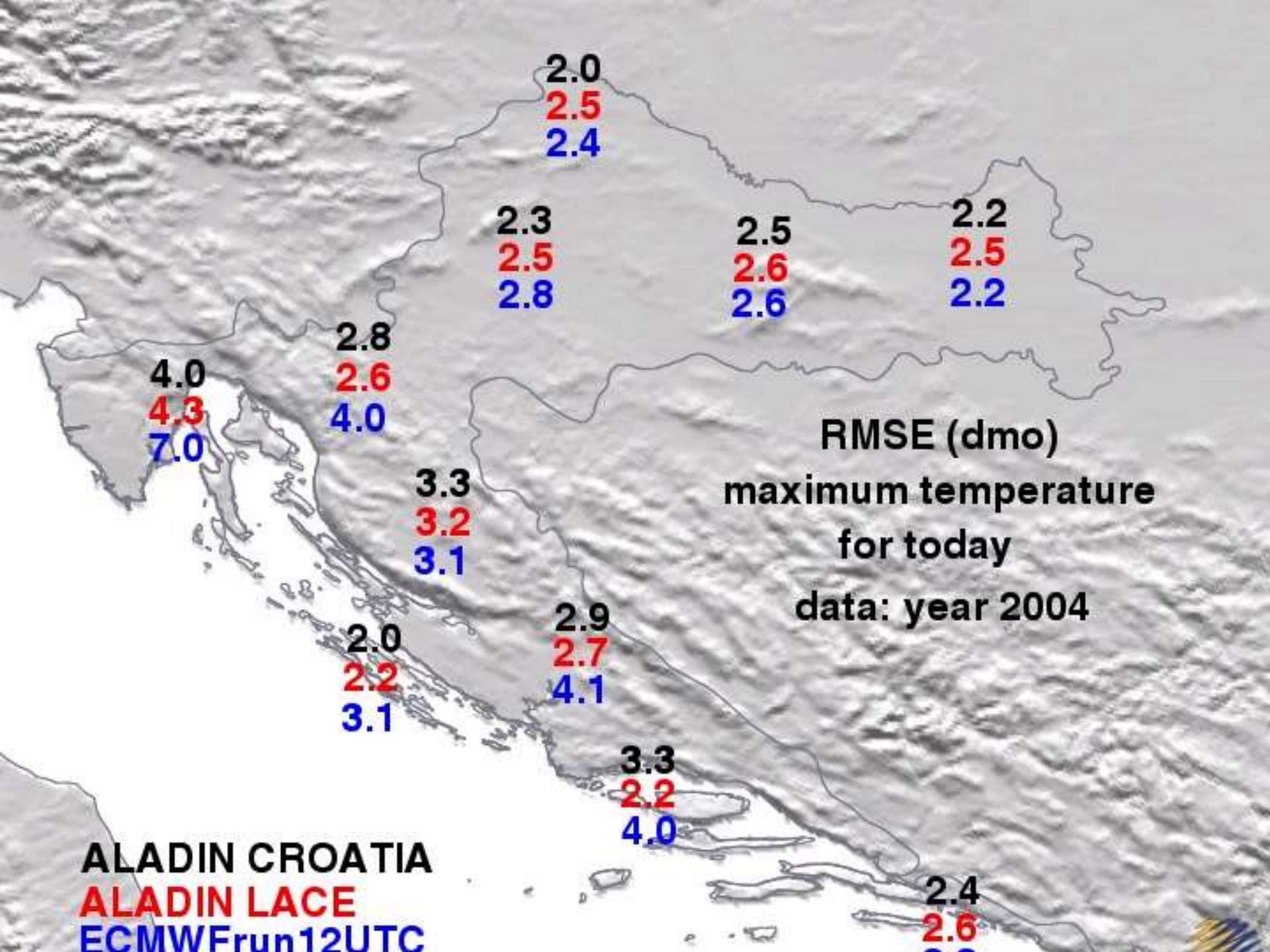
Nurmi, P., 2003: *Recommendations on the verification of local weather forecasts*, ECMWF Technical Memorandum No. 430

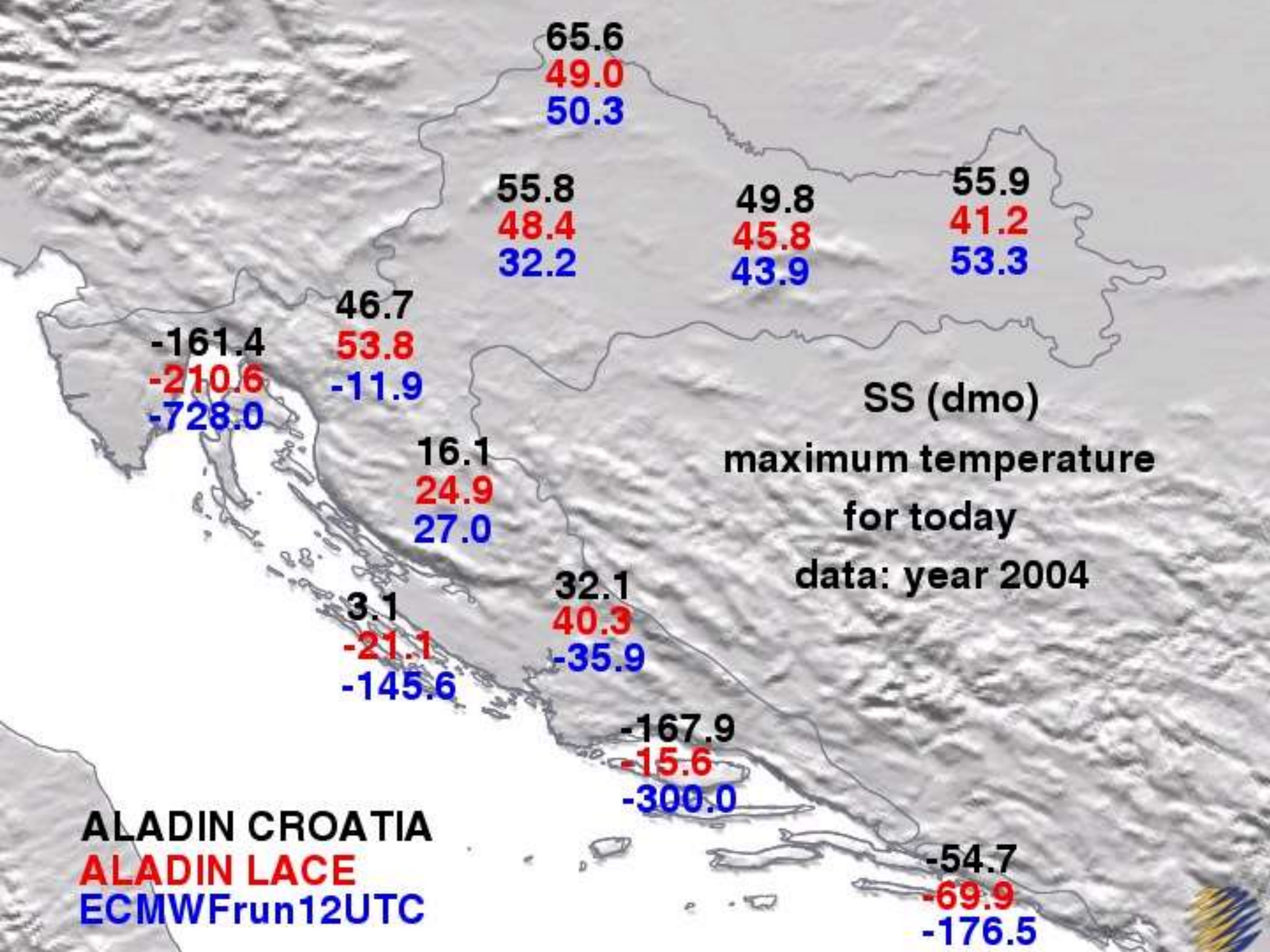
Temperature

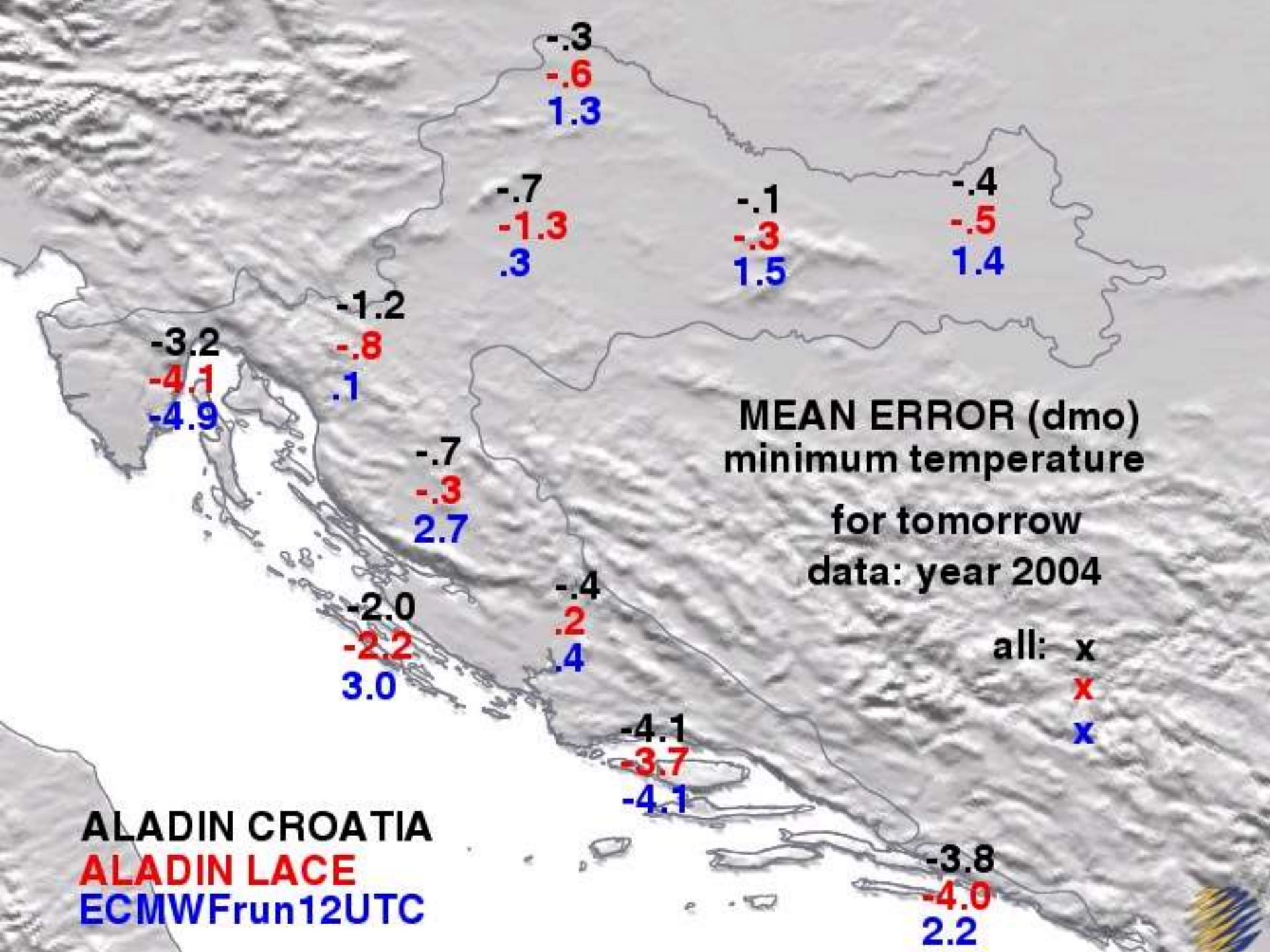
- 2m temperature for today and tomorrow

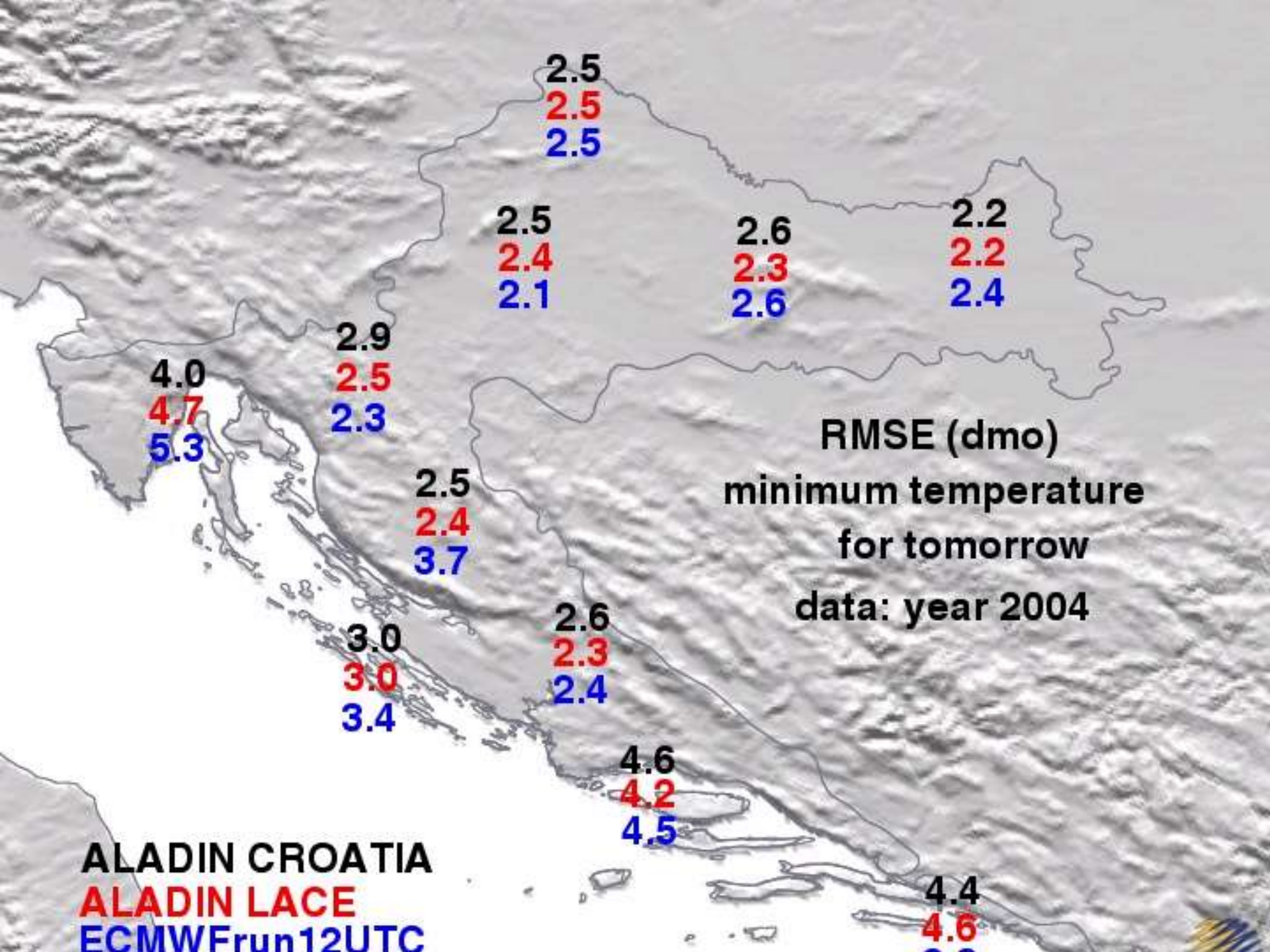
- scores
  - ME
  - MAE
  - RMSE
  - SS (over climatology or persistence)

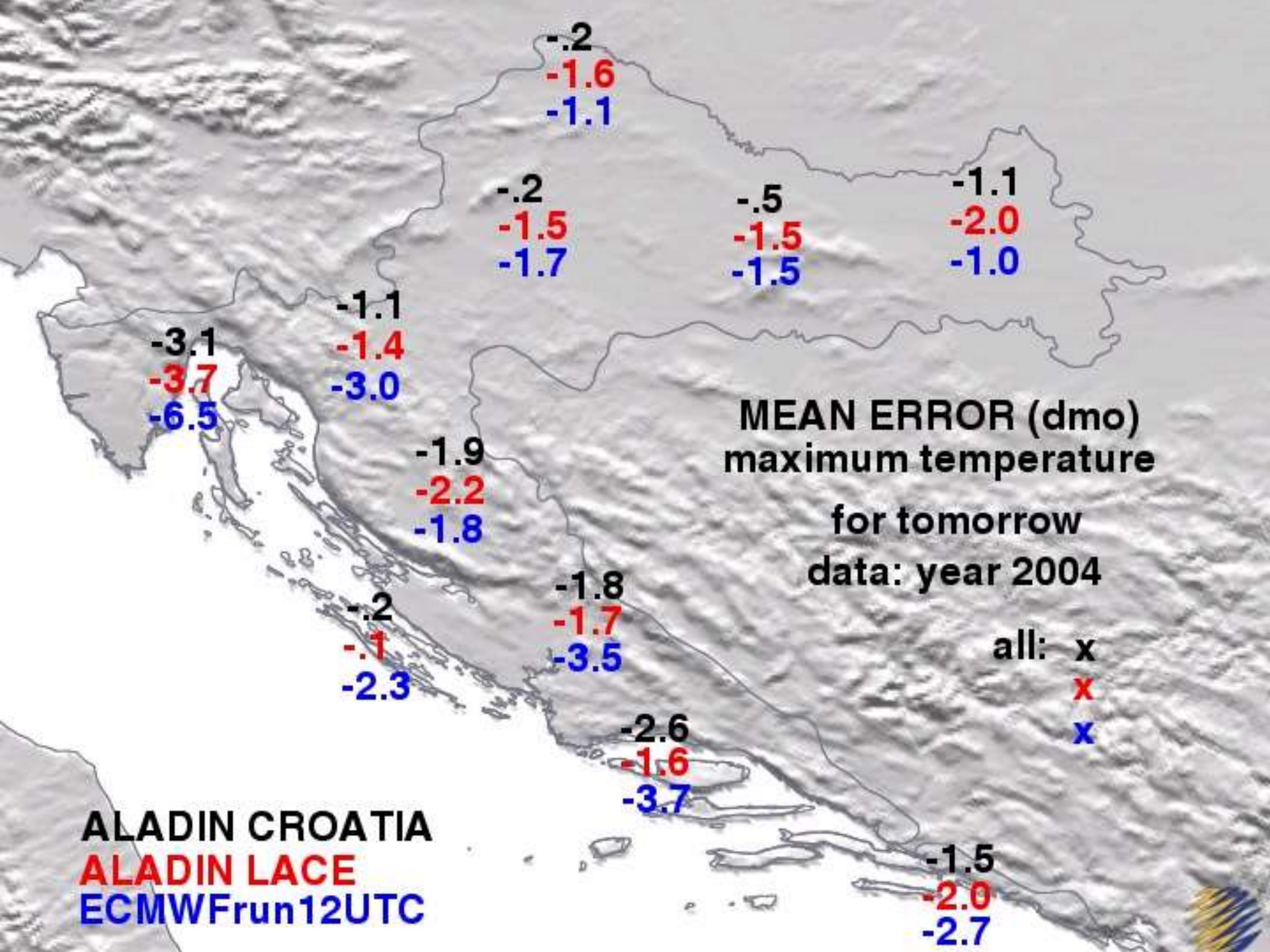

-1.2
-2.0
-1.3
-1.5
-1.6
-1.6
-1.6
-1.4
-1.4
-1.6
-1.8
-.7
-2.0
-1.6
-2.6
-4.0
-4.2
-6.7
-.9
-1.8
-1.1
-2.1
-1.6
-3.1
-1.2
-1.1
-1.6
-2.6
-1.7
-3.6
-2.4
-2.6
-1.8
MEAN ERROR (dmo)
maximum temperature
for today
data: year 2004
all: x
x
x
ALADIN CROATIA
ALADIN LACE
ECMWFrun12UTC

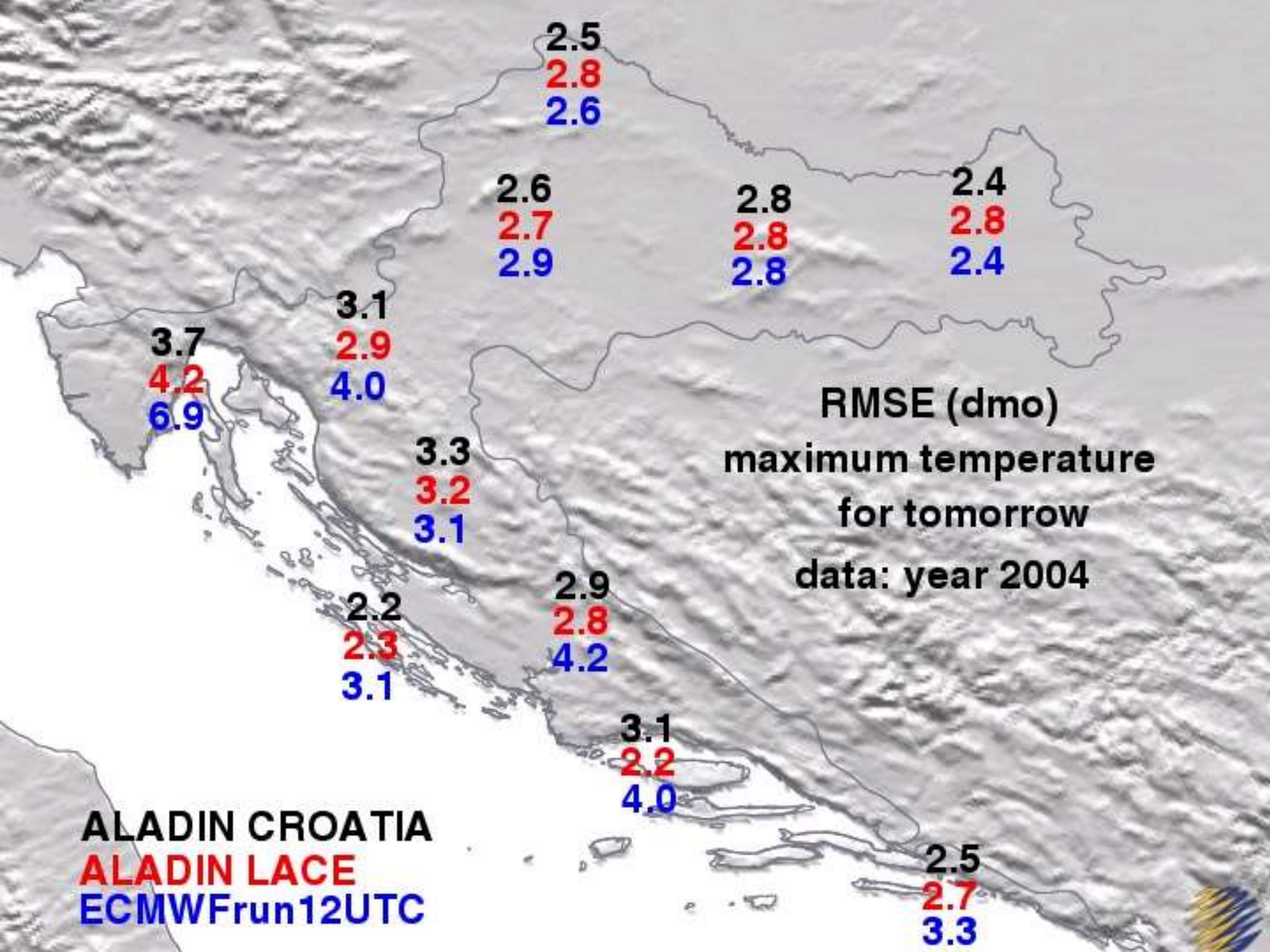

2.0
2.5
2.4
2.3
2.5
2.8
2.6
2.6
2.2
2.5
2.2
4.0
4.3
7.0
2.8
2.6
4.0
3.3
3.2
3.1
RMSE (dmo)
maximum temperature
for today
data: year 2004
2.0
2.2
3.1
2.9
2.7
4.1
3.3
2.2
4.0
2.4
2.6
ALADIN CROATIA
ALADIN LACE
ECMWFrun12UTC

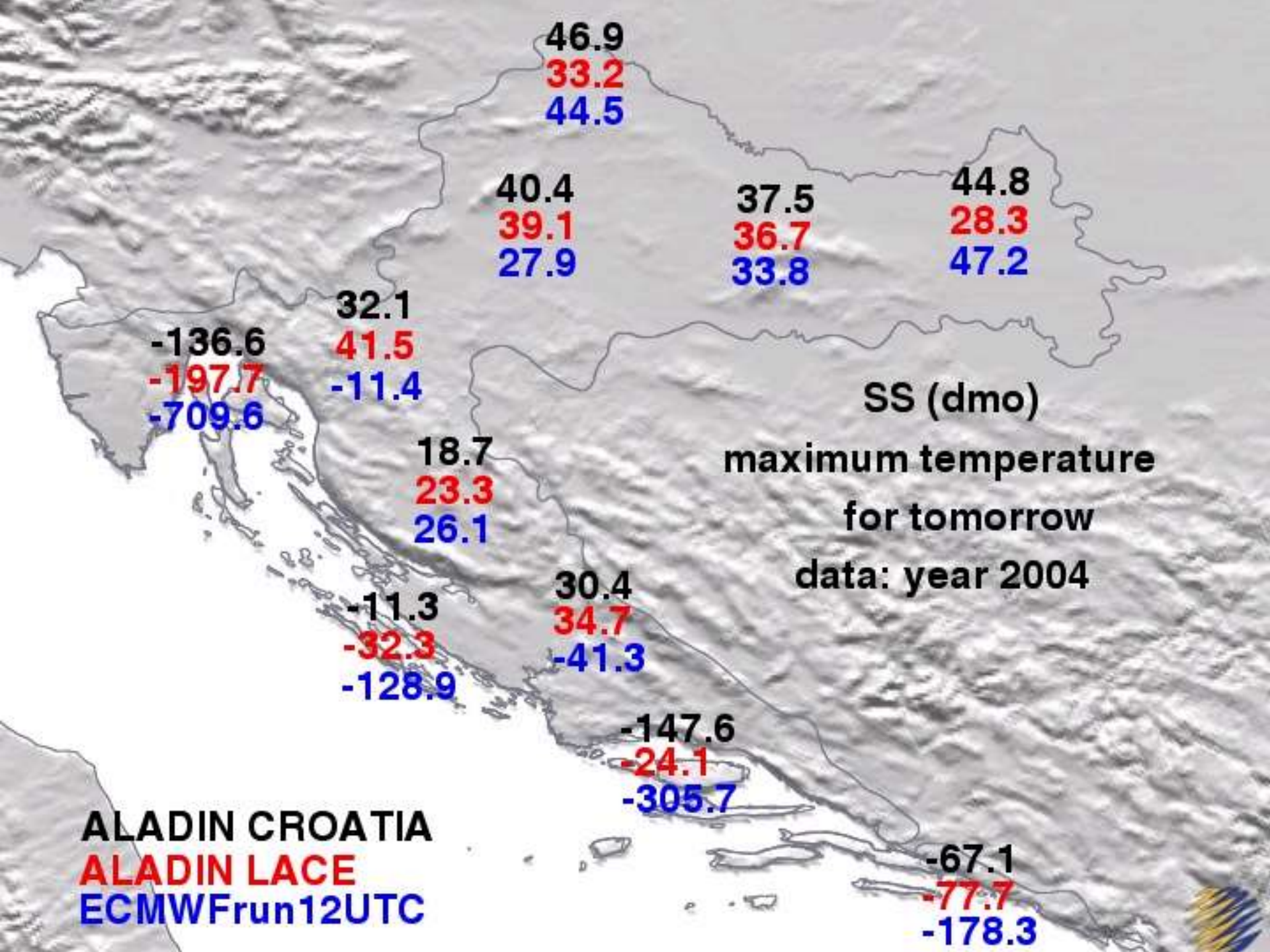

65.6
49.0
50.3
55.8
48.4
32.2
49.8
45.8
43.9
55.9
41.2
53.3
46.7
53.8
-11.9
-161.4
-210.6
-728.0
16.1
24.9
27.0
SS (dmo)
maximum temperature
for today
data: year 2004
32.1
40.3
-35.9
3.1
-21.1
-145.6
-167.9
-15.6
-300.0
-54.7
-69.9
-176.5
ALADIN CROATIA
ALADIN LACE
ECMWFrun12UTC

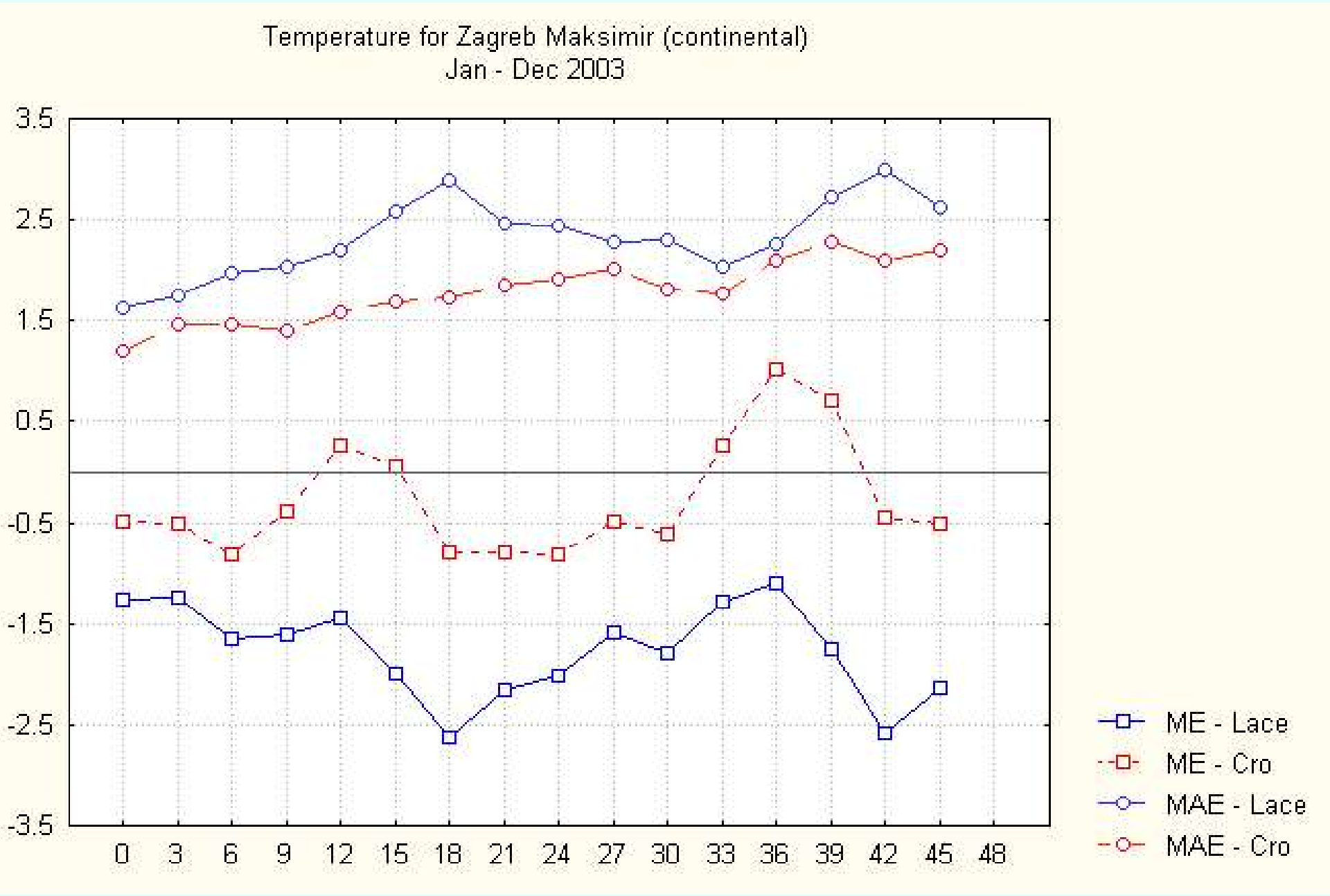

-.3
-.6
1.3
-.7
-1.3
.3
-.1
-.3
1.5
-.4
-.5
1.4
-1.2
-.8
.1
-3.2
-4.1
-4.9
-.7
-.3
2.7
-.4
.2
.4
-2.0
-2.2
3.0
-4.1
-3.7
-4.1
-3.8
-4.0
2.2
MEAN ERROR (dmo)
minimum temperature
for tomorrow
data: year 2004
all: x
x
x
ALADIN CROATIA
ALADIN LACE
ECMWFrun12UTC

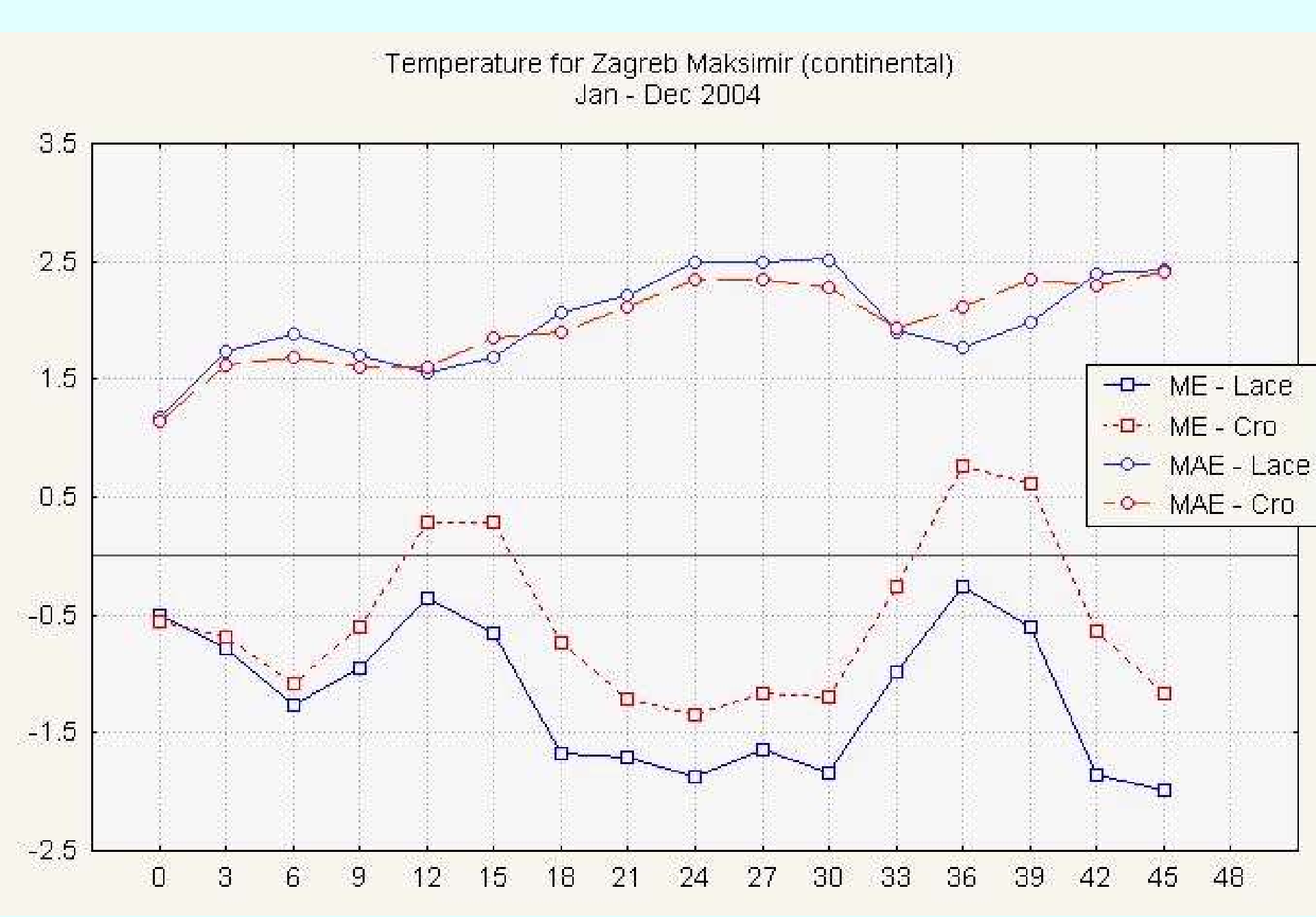

2.5
2.5
2.5
2.5
2.4
2.1
2.6
2.3
2.6
2.2
2.2
2.4
2.9
2.5
2.3
4.0
4.7
5.3
2.5
2.4
3.7
2.6
2.3
2.4
3.0
3.0
3.4
4.6
4.2
4.5
4.4
4.6
RMSE (dmo)
minimum temperature
for tomorrow
data: year 2004
ALADIN CROATIA
ALADIN LACE
ECMWFrun12UTC

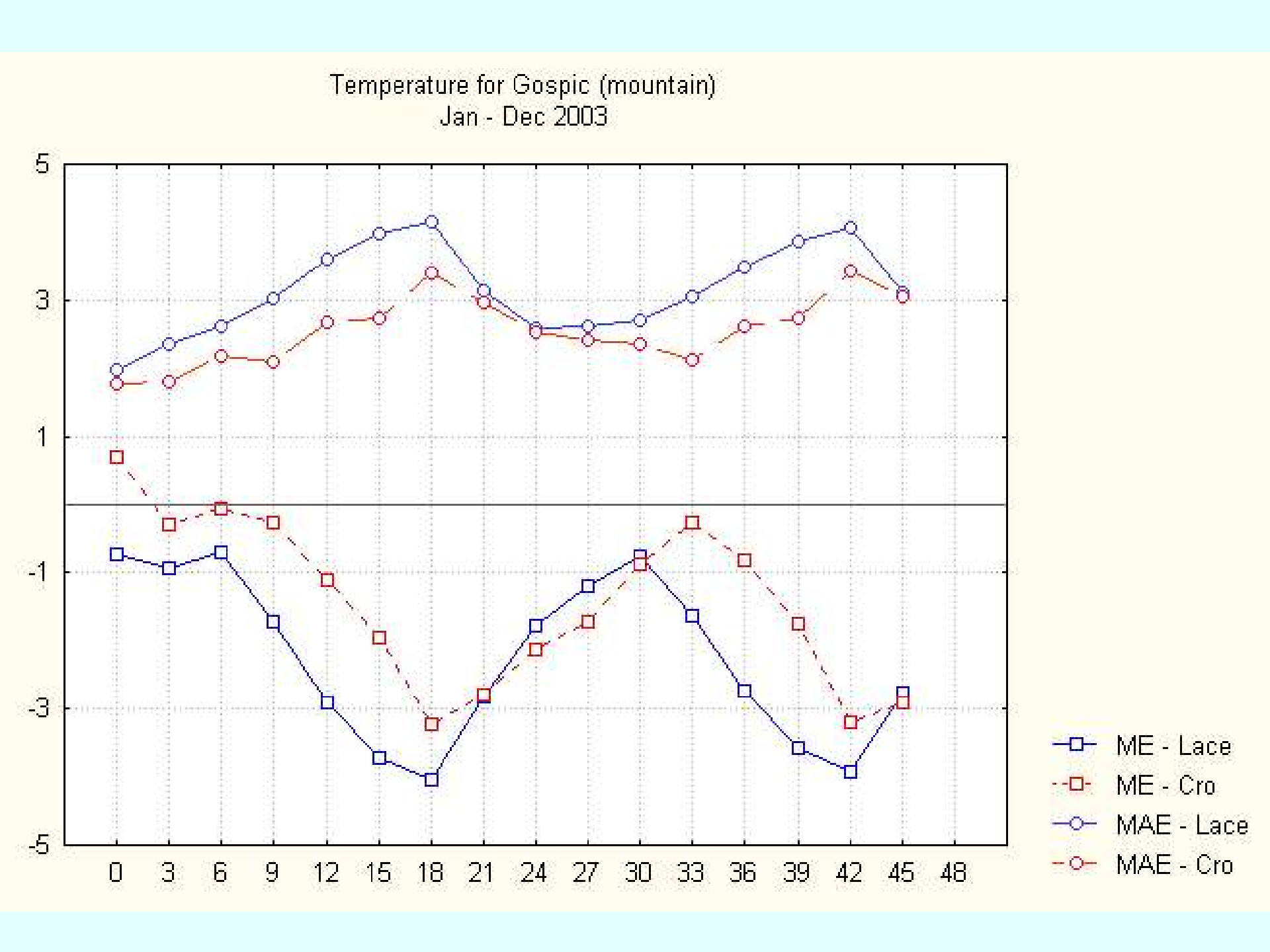

-.2
-1.6
-1.1
-.2
-1.5
-1.7
-.5
-1.5
-1.5
-1.1
-2.0
-1.0
-1.1
-1.4
-3.0
-3.1
-3.7
-6.5
-1.9
-2.2
-1.8
-1.8
-1.7
-3.5
-.2
-.1
-2.3
-2.6
-1.6
-3.7
-1.5
-2.0
-2.7
MEAN ERROR (dmo)
maximum temperature
for tomorrow
data: year 2004
all: x
x
x
ALADIN CROATIA
ALADIN LACE
ECMWFrun12UTC

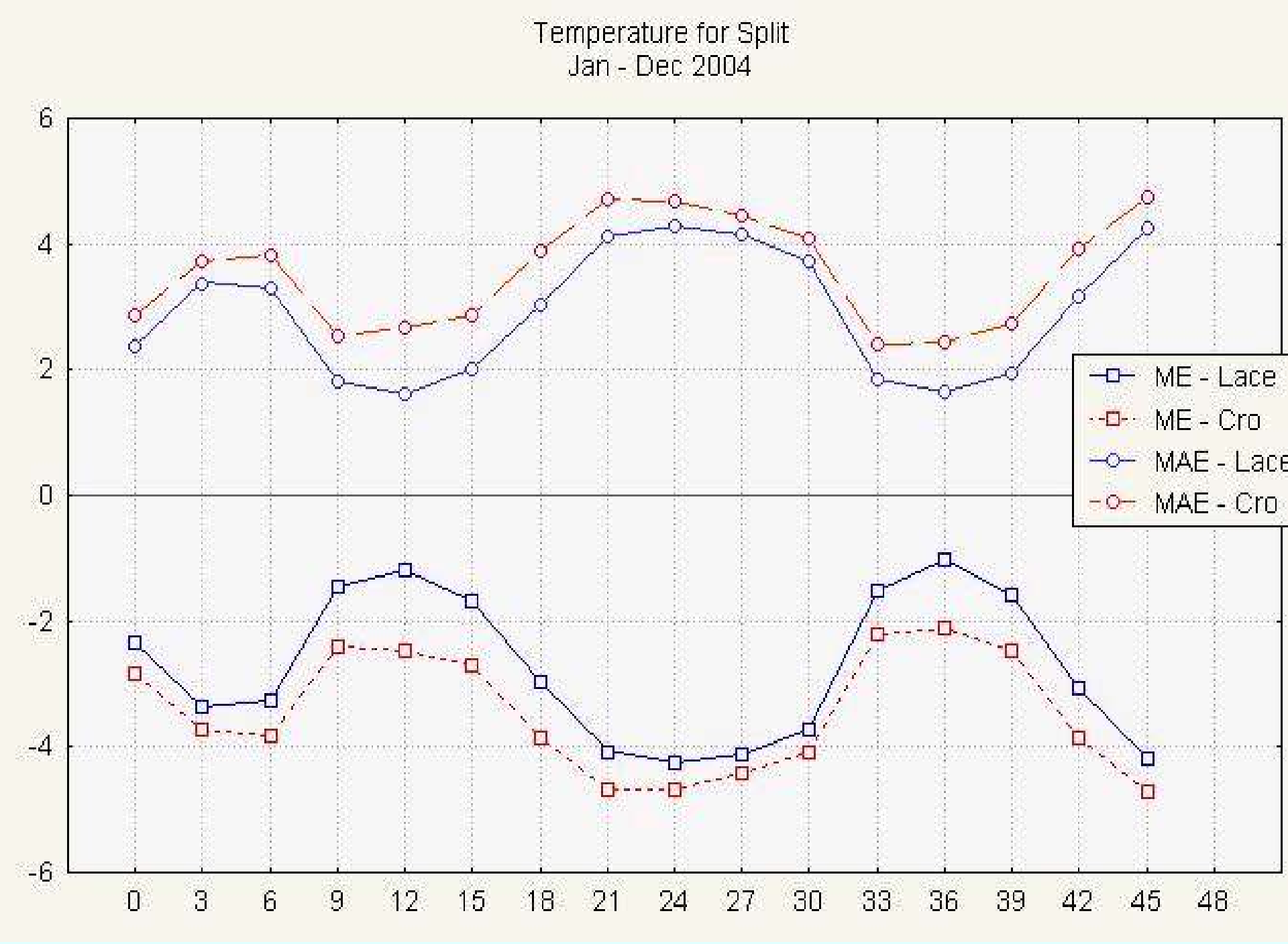

2.5
2.8
2.6
2.6
2.7
2.9
2.8
2.8
2.8
2.4
2.8
2.4
3.1
2.9
4.0
3.7
4.2
6.9
3.3
3.2
3.1
2.9
2.8
4.2
2.2
2.3
3.1
3.1
2.2
4.0
2.5
2.7
3.3
RMSE (dmo)
maximum temperature
for tomorrow
data: year 2004
ALADIN CROATIA
ALADIN LACE
ECMWFrun12UTC


46.9
33.2
44.5
40.4
39.1
27.9
37.5
36.7
33.8
44.8
28.3
47.2
32.1
41.5
-11.4
-136.6
-197.7
-709.6
18.7
23.3
26.1
SS (dmo)
maximum temperature
for tomorrow
data: year 2004
30.4
34.7
-41.3
-11.3
-32.3
-128.9
-147.6
-24.1
-305.7
-67.1
-77.7
-178.3
ALADIN CROATIA
ALADIN LACE
ECMWFrun12UTC


Temperature for Zagreb Maksimir (continental)
Jan - Dec 2003
3.5
2.5
1.5
0.5
-0.5
-1.5
-2.5
-3.5
0
3
6
9
12
15
18
21
24
27
30
33
36
39
42
45
48
ME - Lace
ME - Cro
MAE - Lace
MAE - Cro


Temperature for Zagreb Maksimir (continental)
Jan - Dec 2004
3.5
2.5
1.5
0.5
-0.5
-1.5
-2.5
0
3
6
9
12
15
18
21
24
27
30
33
36
39
42
45
48
ME - Lace
ME - Cro
MAE - Lace
MAE - Cro


Temperature for Gospic (mountain)
Jan - Dec 2003
5
3
1
-1
-3
-5
0
3
6
9
12
15
18
21
24
27
30
33
36
39
42
45
48
ME - Lace
ME - Cro
MAE - Lace
MAE - Cro


Temperature for Split
Jan - Dec 2004
6
4
2
0
-2
-4
-6
0
3
6
9
12
15
18
21
24
27
30
33
36
39
42
45
48
ME - Lace
ME - Cro
MAE - Lace
MAE - Cro

Precipitation

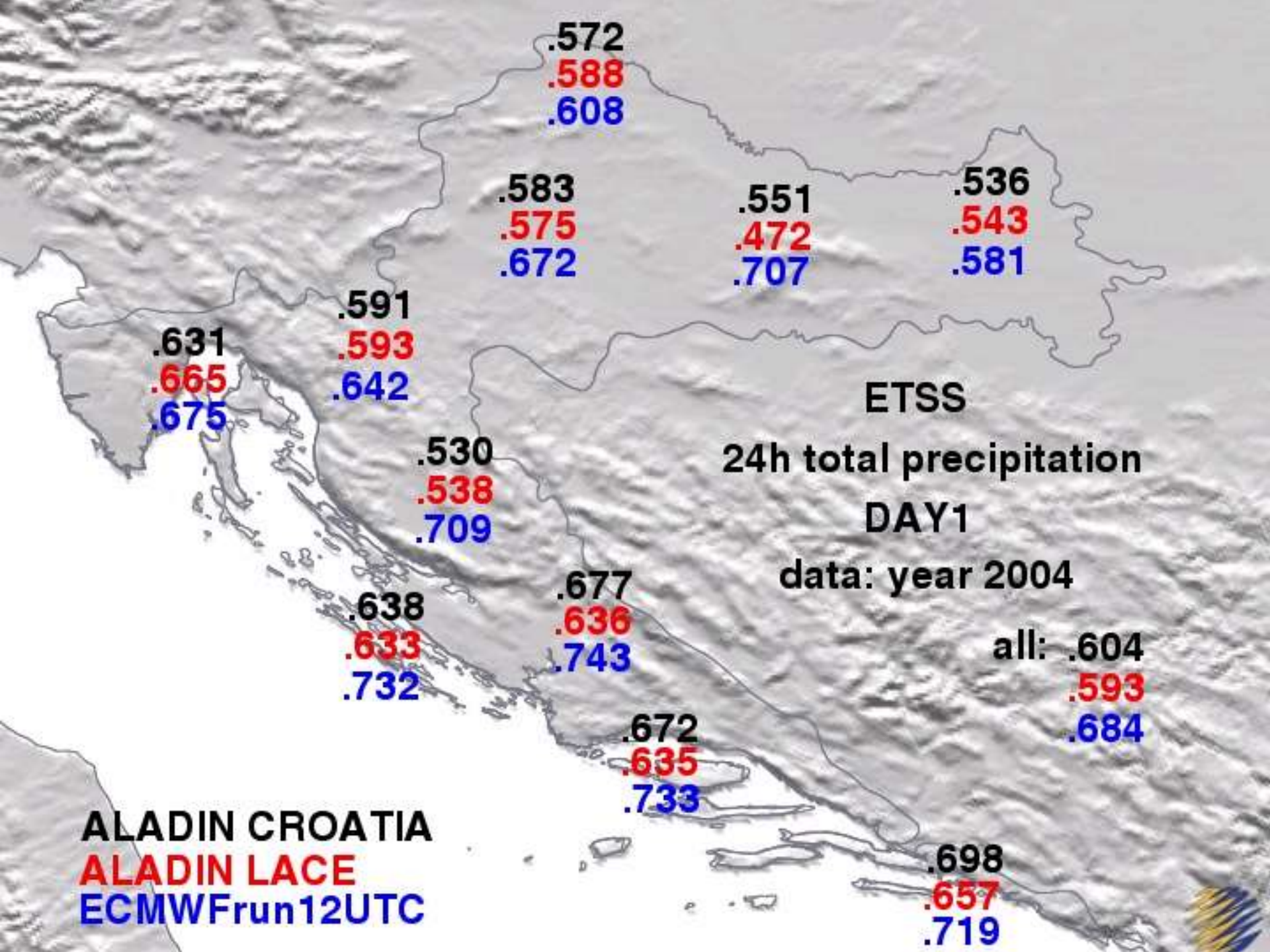
- 24 hour, 6 hour and 3 hour precipitation

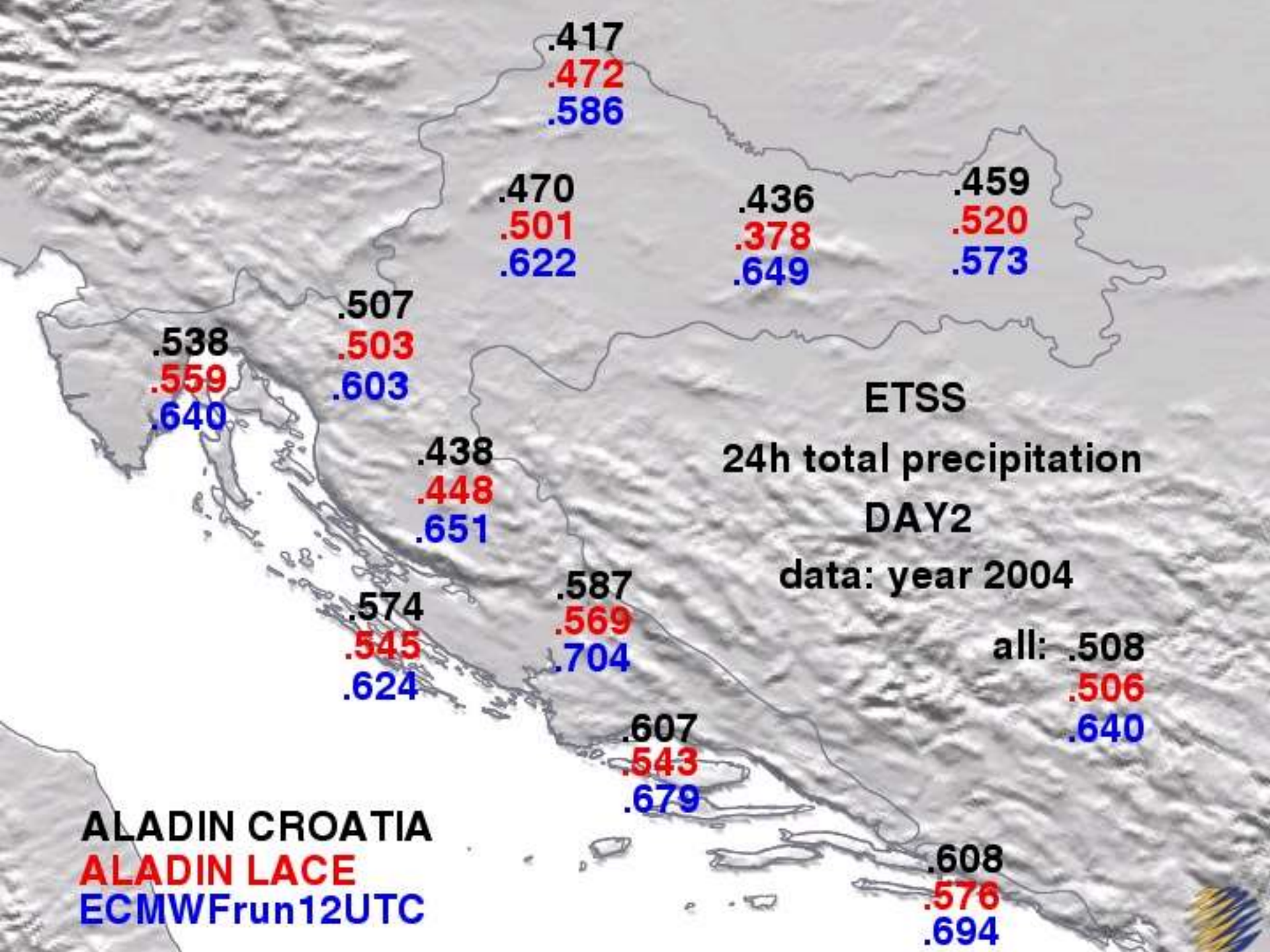
- scores:
  - bias
  - KSS (Hansen Kuipers Skill Score)
  - HSS (Heidke Skill Score)
  - ETS (Equitable Threat Score)

Skill Scores

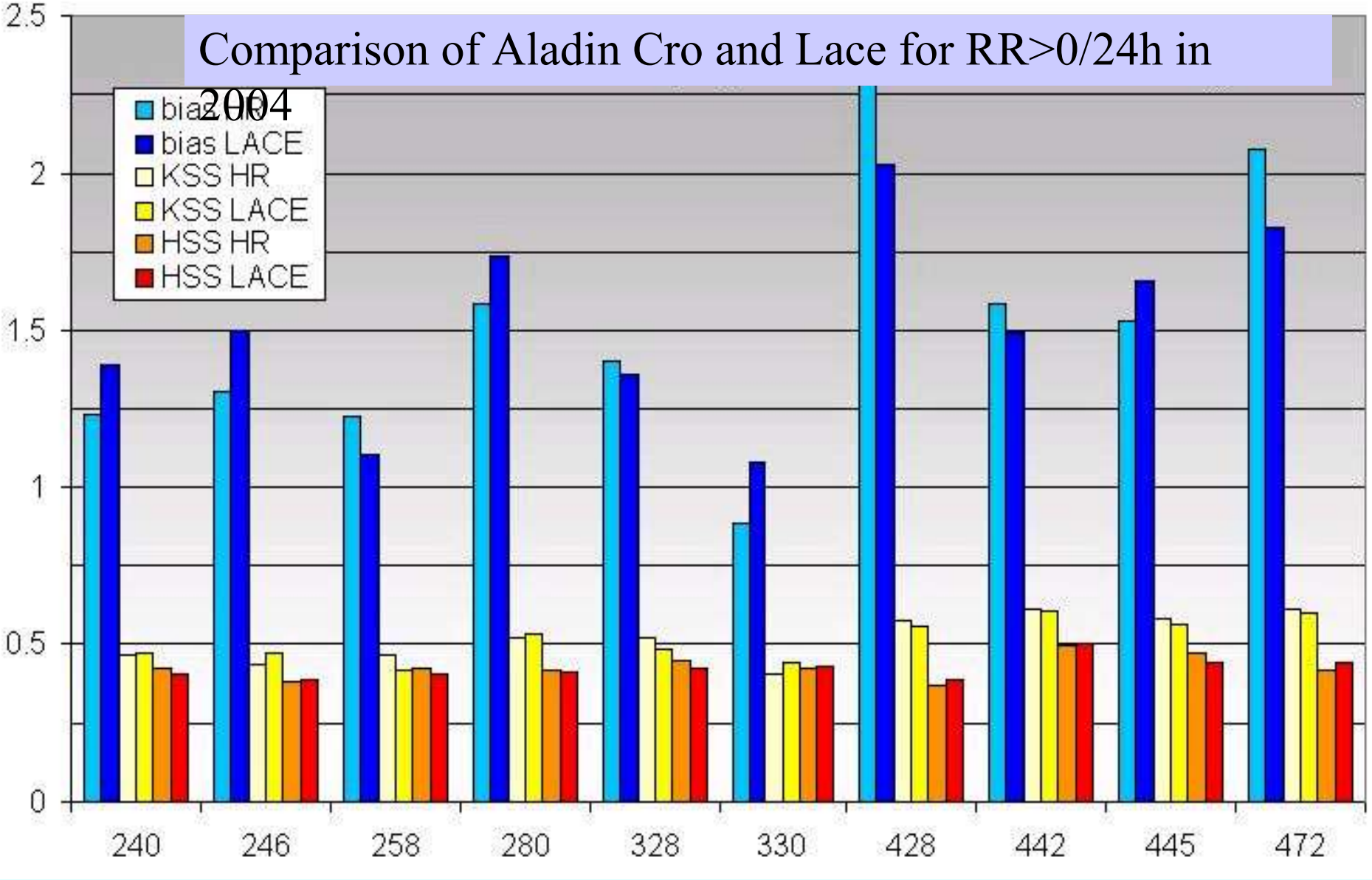
- range mostly from – infinity to 1
  or from – 1 to 1

- SS=0 zero skill (climatology, persistency…)
- SS=1 perfect forecast

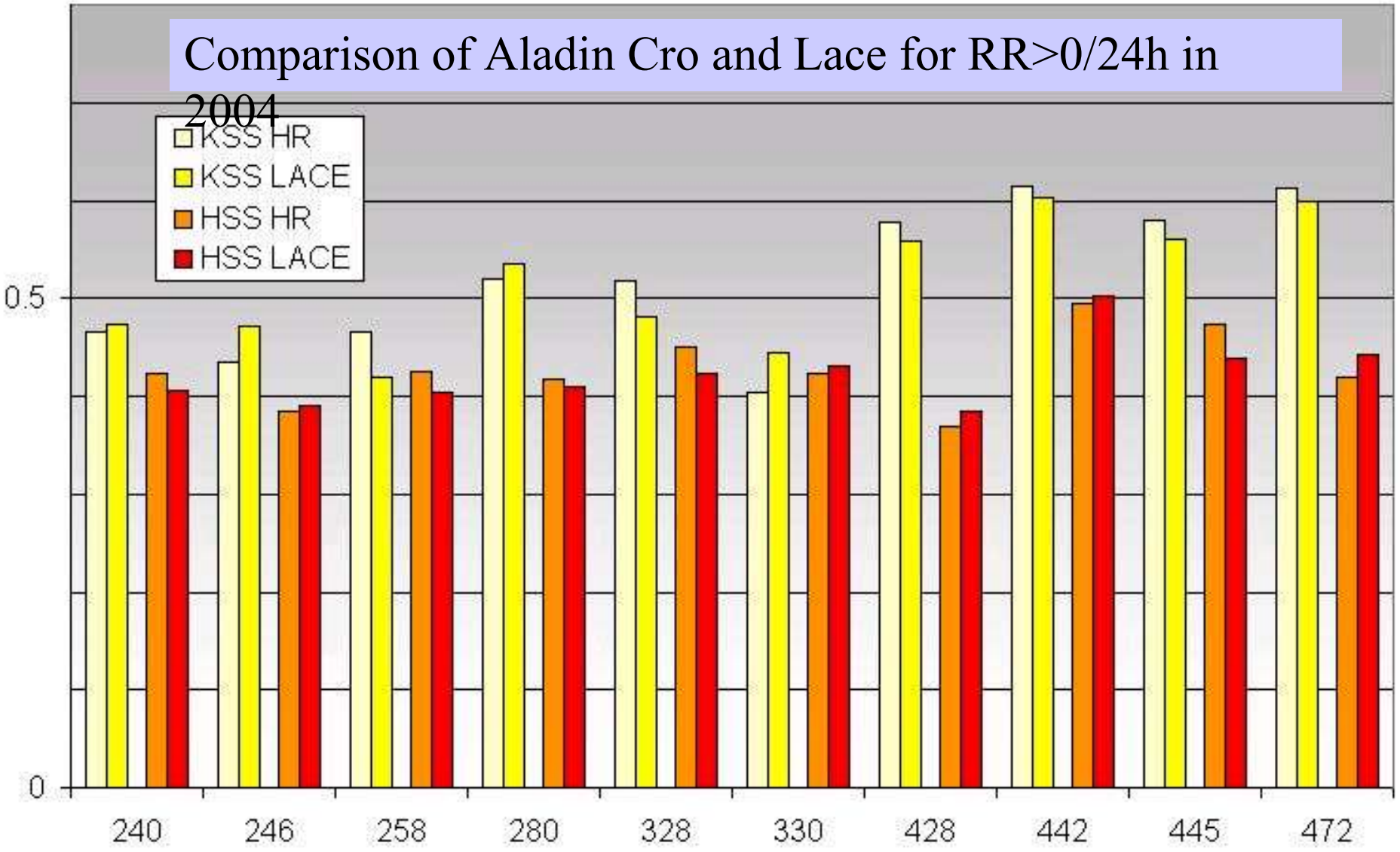

.572
.588
.608
.583
.575
.672
.551
.472
.707
.536
.543
.581
.591
.593
.642
.631
.665
.675
.530
.538
.709
.677
.636
.743
.638
.633
.732
.672
.635
.733
.698
.657
.719
ETSS
24h total precipitation
DAY1
data: year 2004
all: .604
.593
.684
ALADIN CROATIA
ALADIN LACE
ECMWFrun12UTC

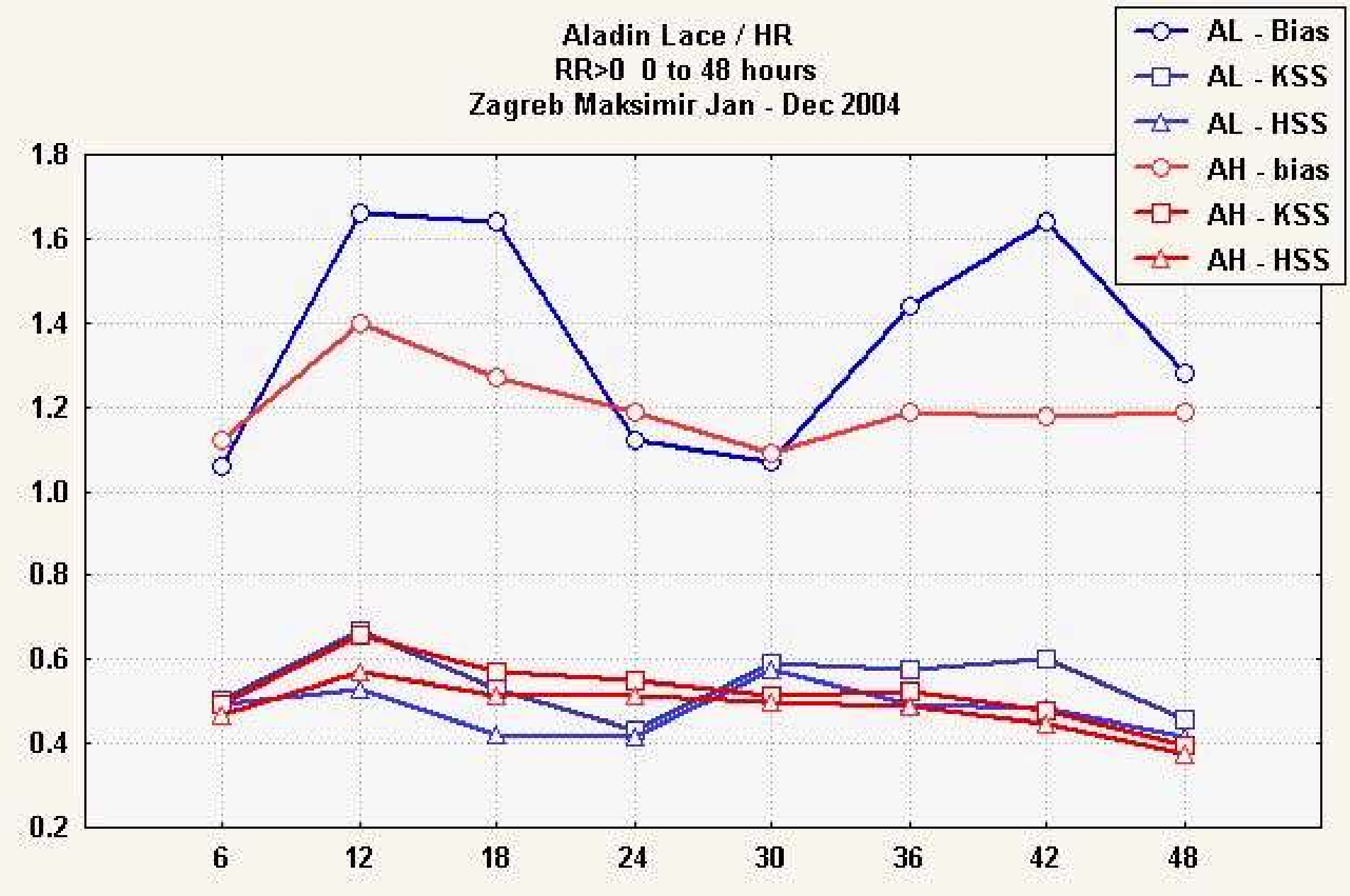

.417
.472
.586
.470
.501
.622
.436
.378
.649
.459
.520
.573
.507
.503
.603
.538
.559
.640
.438
.448
.651
.587
.569
.704
.574
.545
.624
.607
.543
.679
.608
.576
.694
ETSS
24h total precipitation
DAY2
data: year 2004
all: .508
.506
.640
ALADIN CROATIA
ALADIN LACE
ECMWFrun12UTC

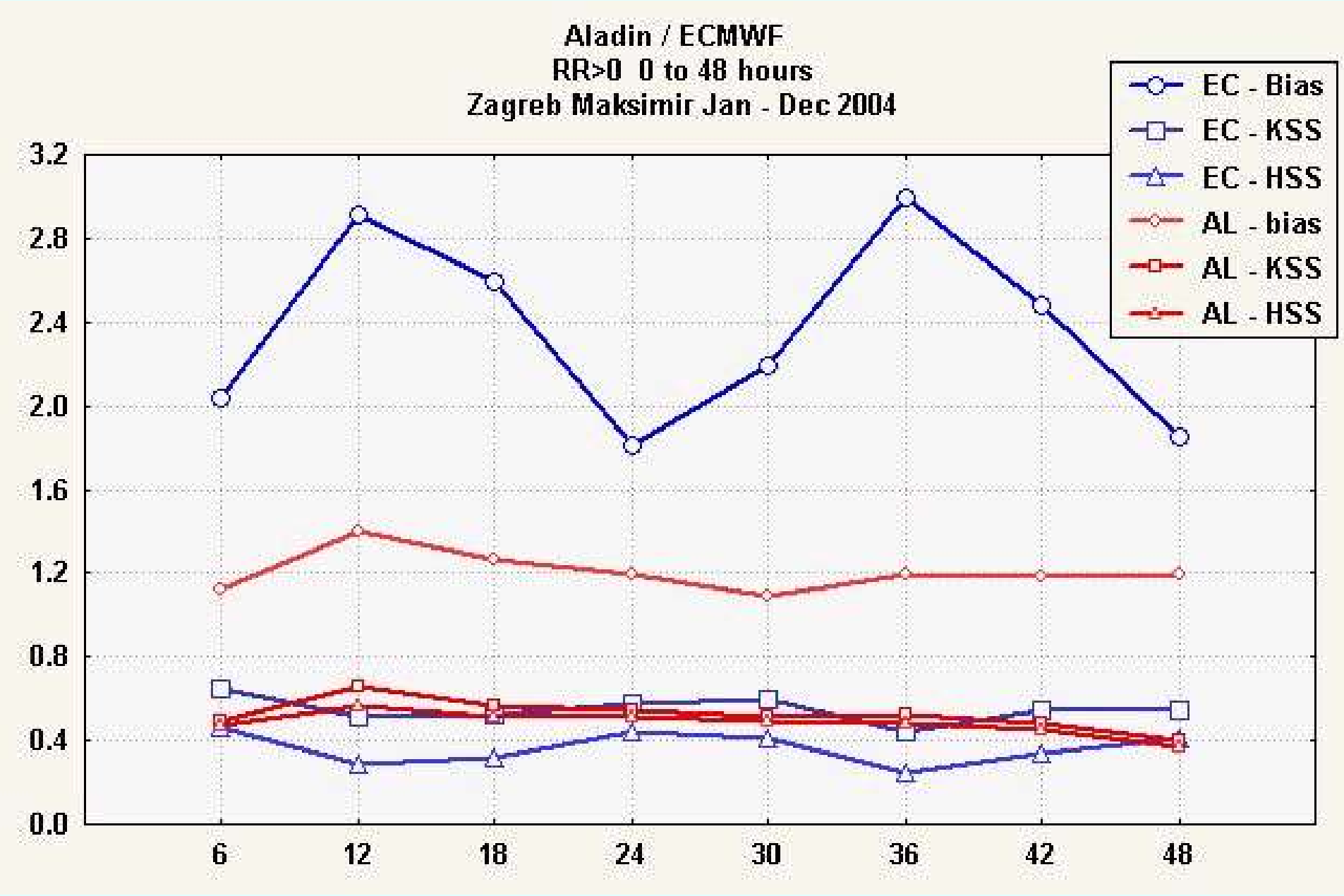
Comparison of Aladin Cro and Lace for RR>0/24h in 2004

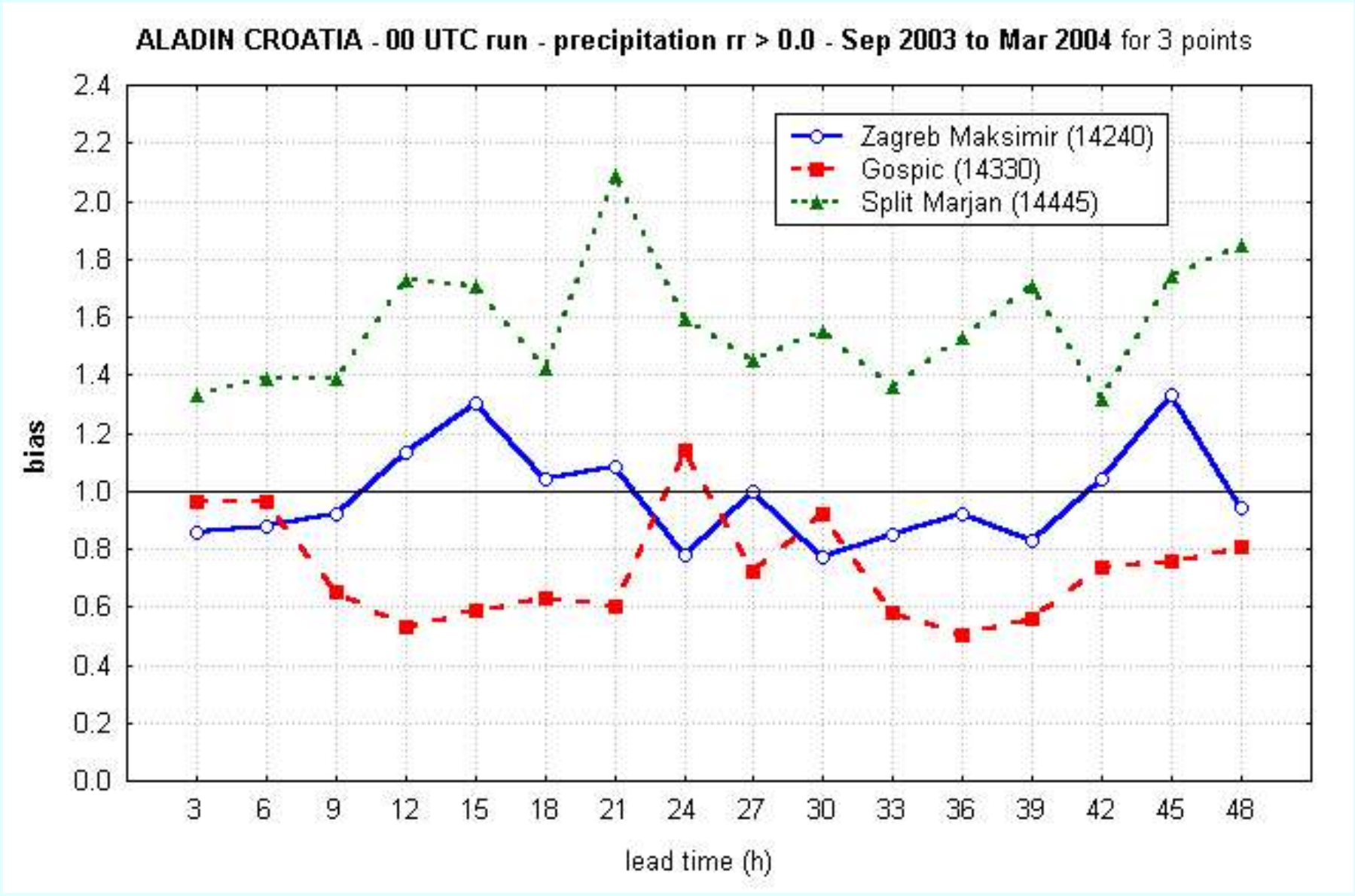


Comparison of Aladin Cro and Lace for RR>0/24h in 2004

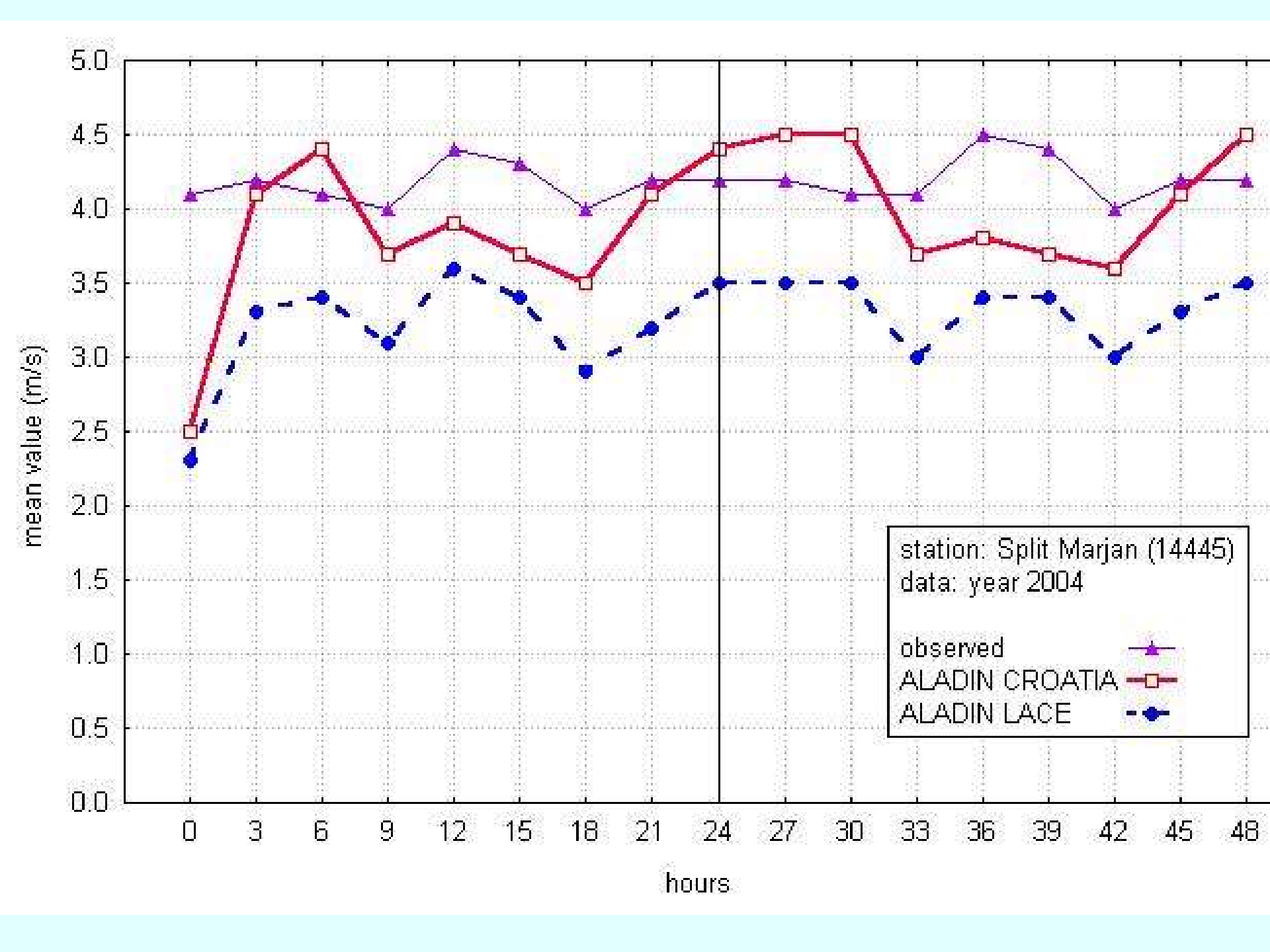


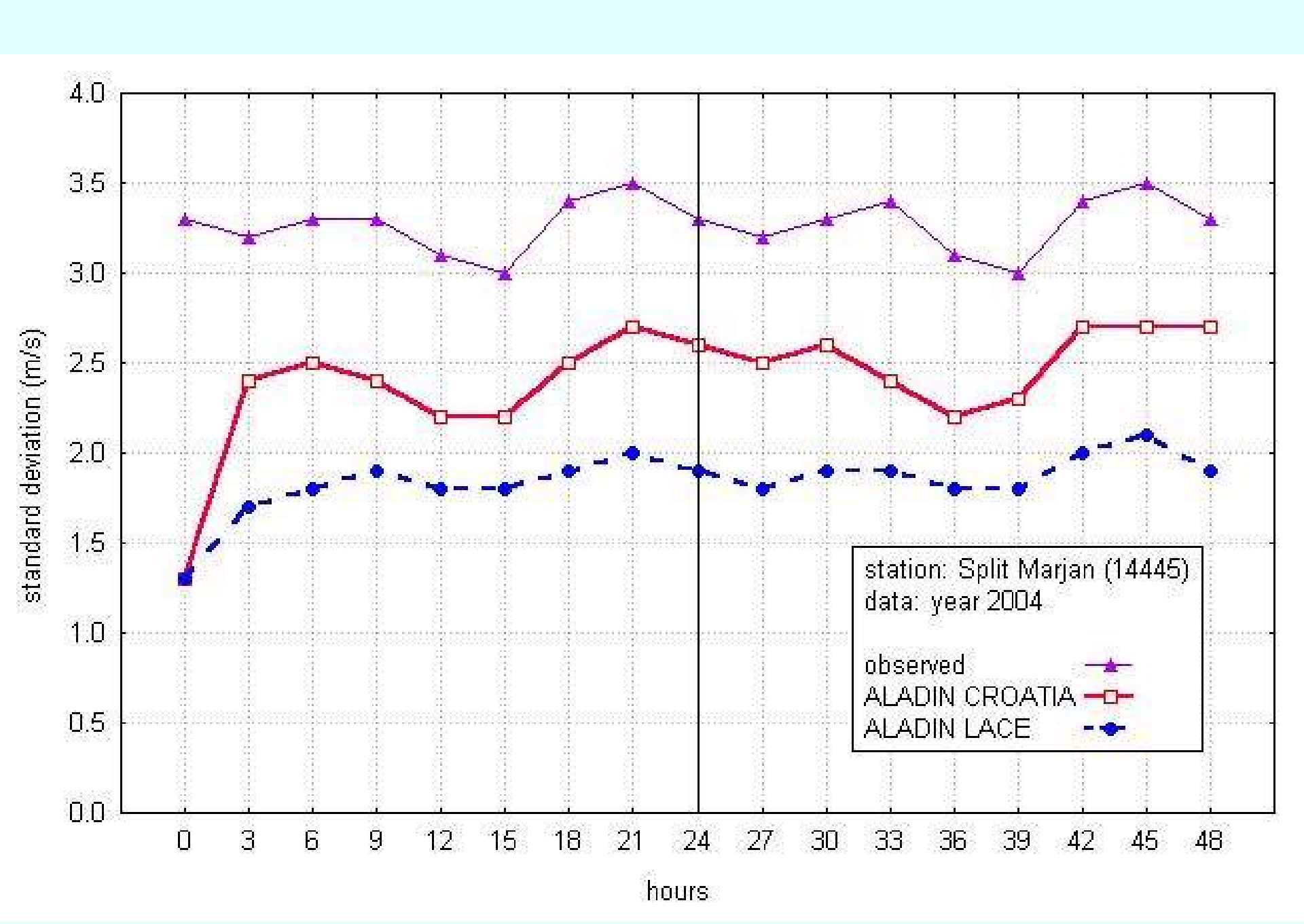

Aladin Lace / HR
RR>0 0 to 48 hours
Zagreb Maksimir Jan - Dec 2004
AL - Bias
AL - KSS
AL - HSS
AH - bias
AH - KSS
AH - HSS
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
6
12
18
24
30
36
42
48

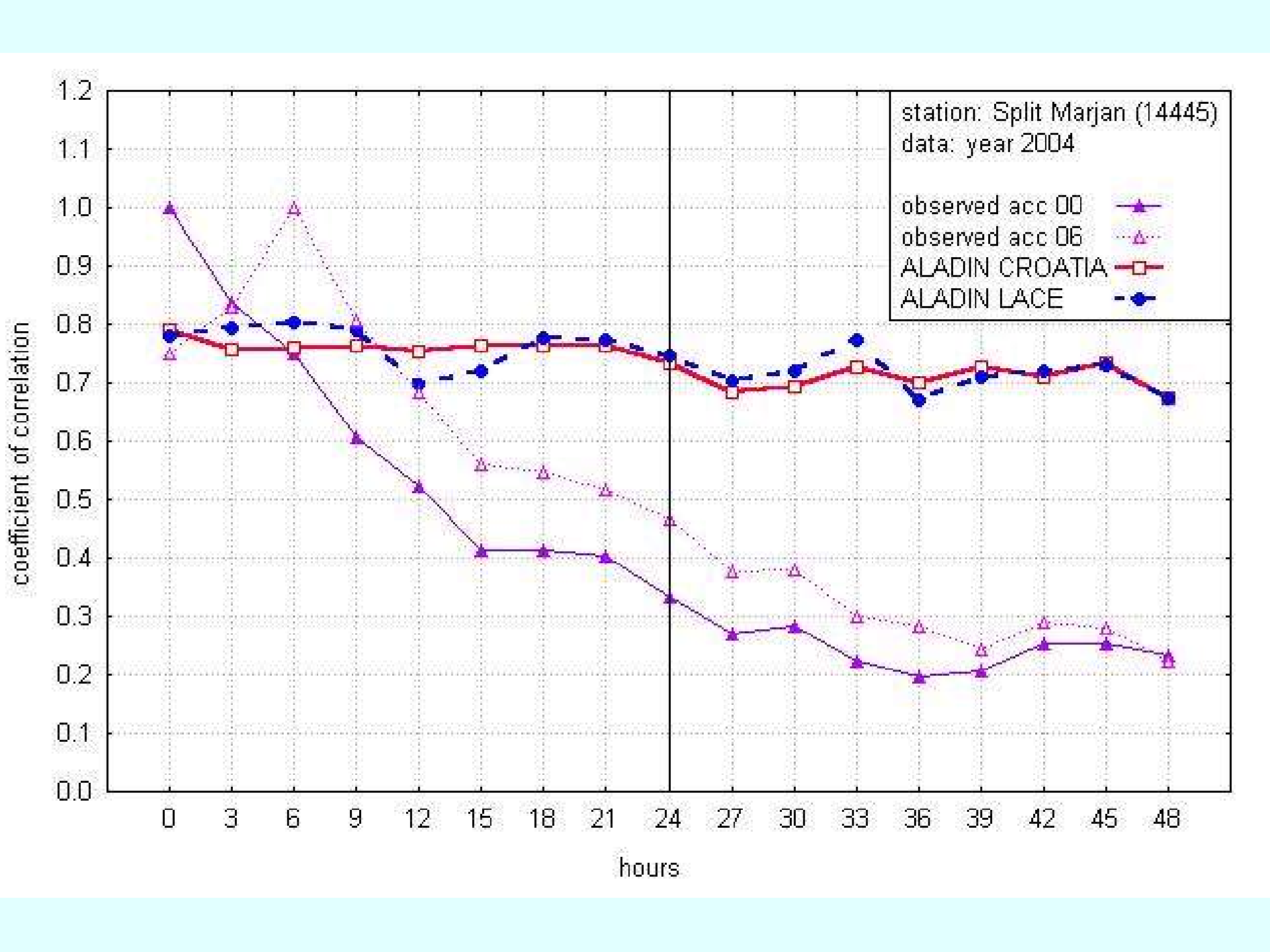

Aladin / ECMWF
RR>0 0 to 48 hours
Zagreb Maksimir Jan - Dec 2004
EC - Bias
EC - KSS
EC - HSS
AL - bias
AL - KSS
AL - HSS
3.2
2.8
2.4
2.0
1.6
1.2
0.8
0.4
0.0
6
12
18
24
30
36
42
48

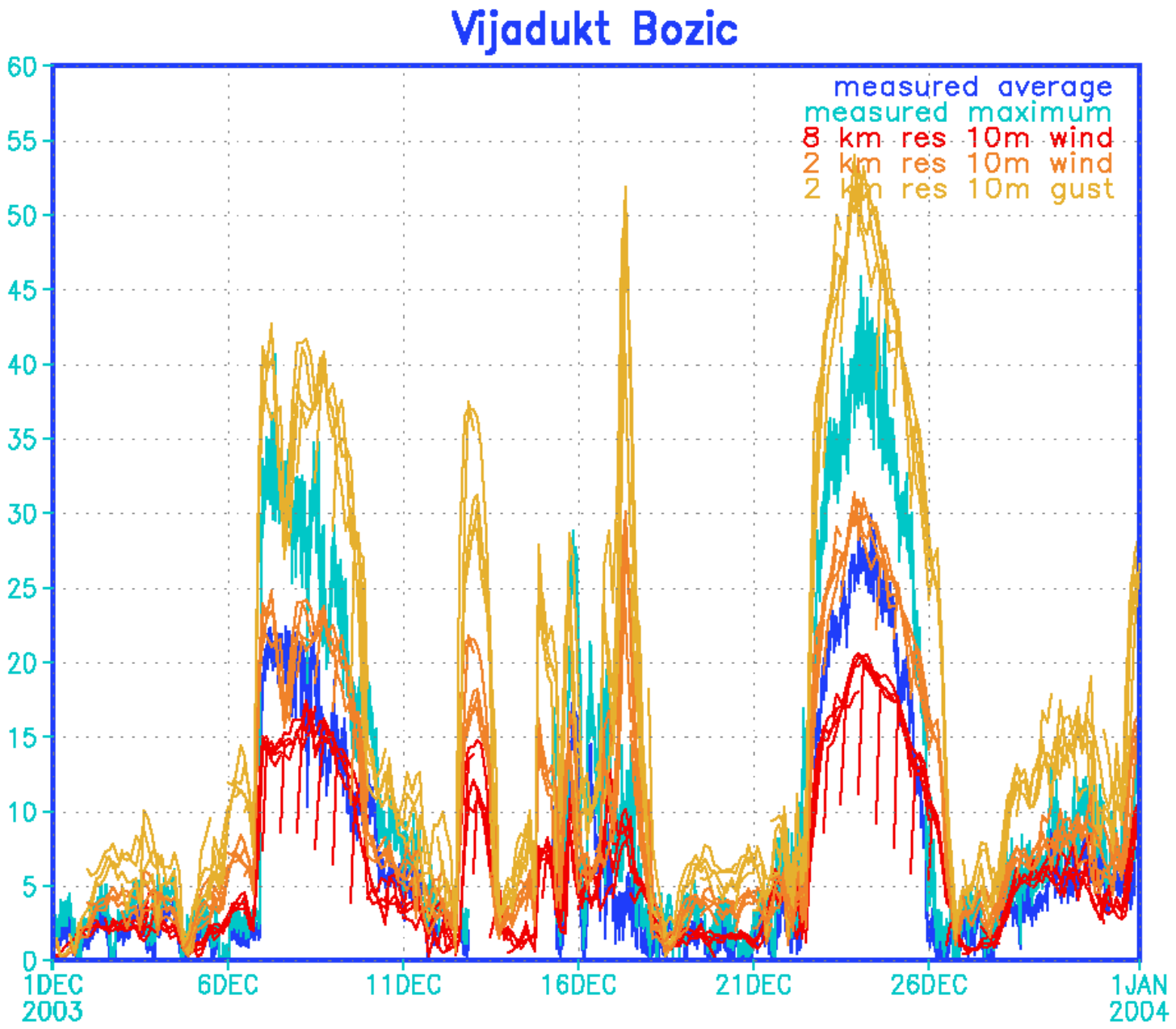

ALADIN CROATIA - 00 UTC run - precipitation rr > 0.0 - Sep 2003 to Mar 2004 for 3 points
Zagreb Maksimir (14240)
Gospic (14330)
Split Marjan (14445)
bias
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
3
6
9
12
15
18
21
24
27
30
33
36
39
42
45
48
lead time (h)

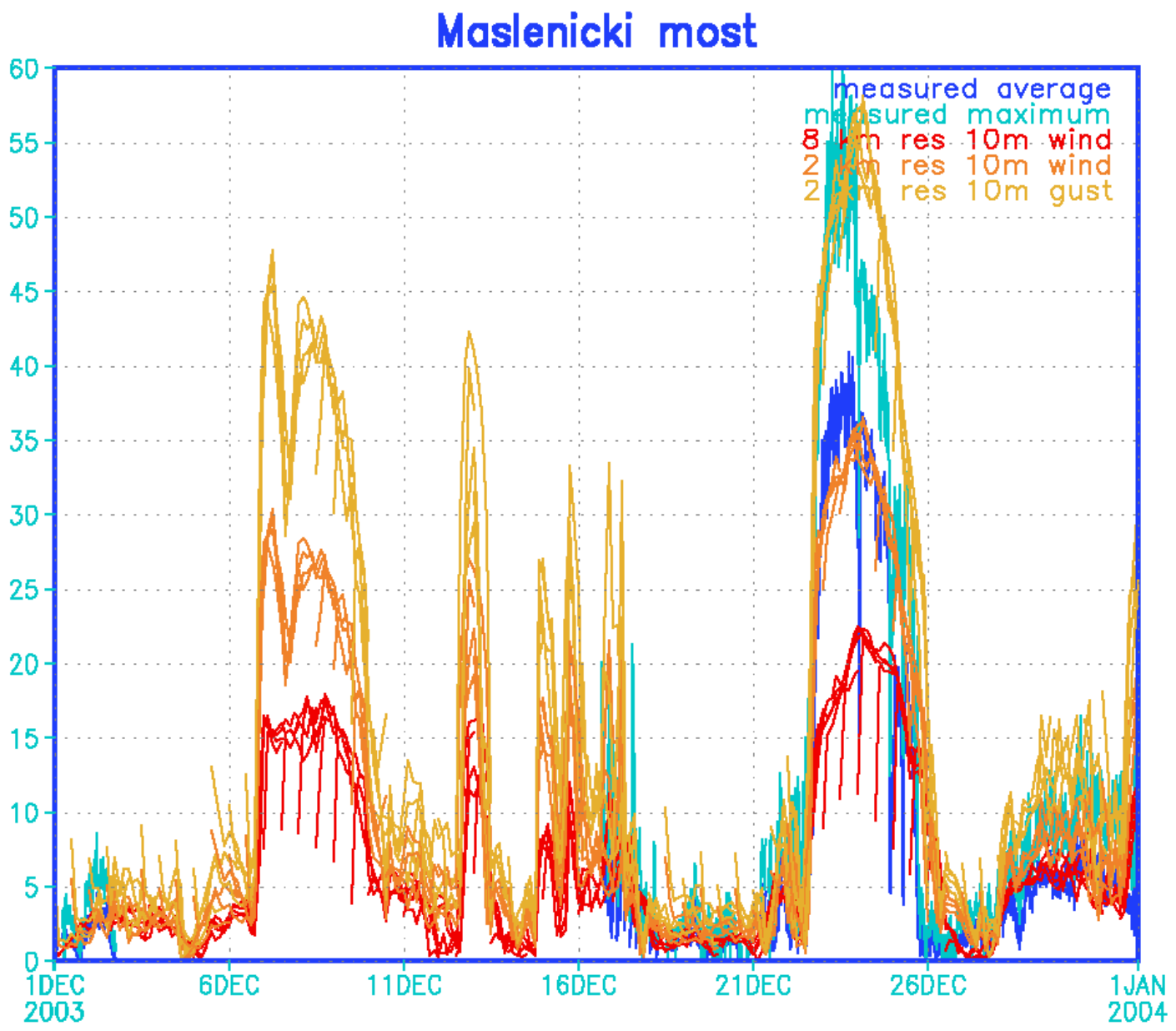
Wind


mean value (m/s)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
3
6
9
12
15
18
21
24
27
30
33
36
39
42
45
48
hours
station: Split Marjan (14445)
data: year 2004
observed
ALADIN CROATIA
ALADIN LACE


4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
standard deviation (m/s)
0
3
6
9
12
15
18
21
24
27
30
33
36
39
42
45
48
hours
station: Split Marjan (14445)
data: year 2004
observed
ALADIN CROATIA
ALADIN LACE


station: Split Marjan (14445)
data: year 2004
observed acc 00
observed acc 06
ALADIN CROATIA
ALADIN LACE
coefficient of correlation
hours
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
3
6
9
12
15
18
21
24
27
30
33
36
39
42
45
48


Vijadukt Bozic
measured average
measured maximum
8 km res 10m wind
2 km res 10m wind
2 km res 10m gust
60
55
50
45
40
35
30
25
20
15
10
5
0
1DEC
2003
6DEC
11DEC
16DEC
21DEC
26DEC
1JAN
2004


Maslenicki most
measured average
measured maximum
8 km res 10m wind
2 km res 10m wind
2 km res 10m gust
60
55
50
45
40
35
30
25
20
15
10
5
0
1DEC
2003
6DEC
11DEC
16DEC
21DEC
26DEC
1JAN
2004

Conclusions

- Problems:

- overestimating precipitation (“too wet”)
- significant daily variation of ME for temp

Conclusions (contd…)

- scores show **general improvement** in time and particularly compared to original Aladin Lace model
- temperature better biased
- reduced daily variation of temperature bias
- dynamical adaptation of wind field better predicts strong wind gusts, especially for katabatic processes at the coast (bura)

Future…

- new features (ver precipitation against radar measurements, …)
- establish a verification package that will run operationally (monthly, seasonaly, yearly)

Thank you for your
attention !