Stable boundary layer model intercomparison

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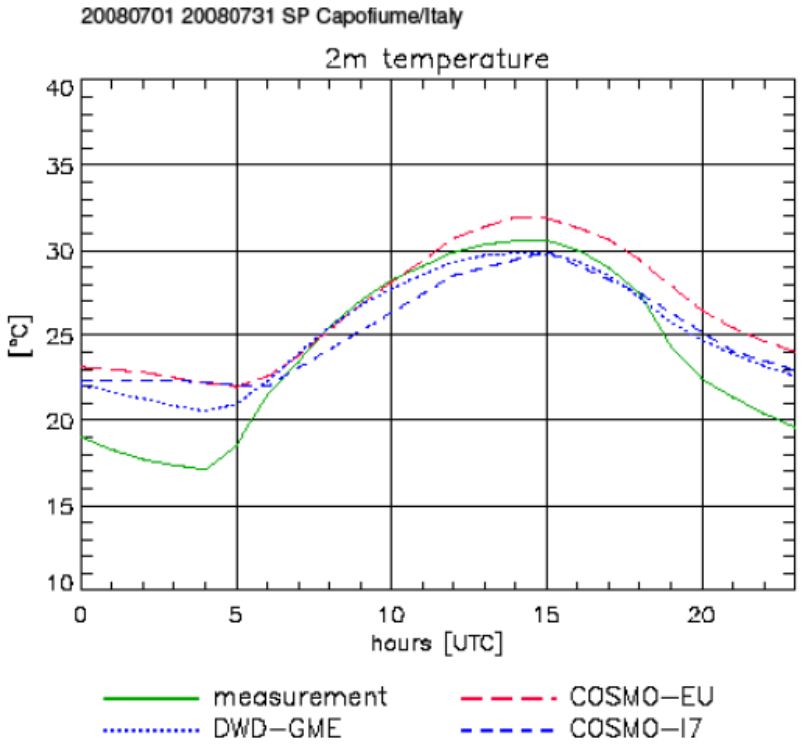
….just a simple example to show how data exchange can be useful in diagnosing systematic errors

COSMO has problem with the diurnal cycle, more evident in warm climate

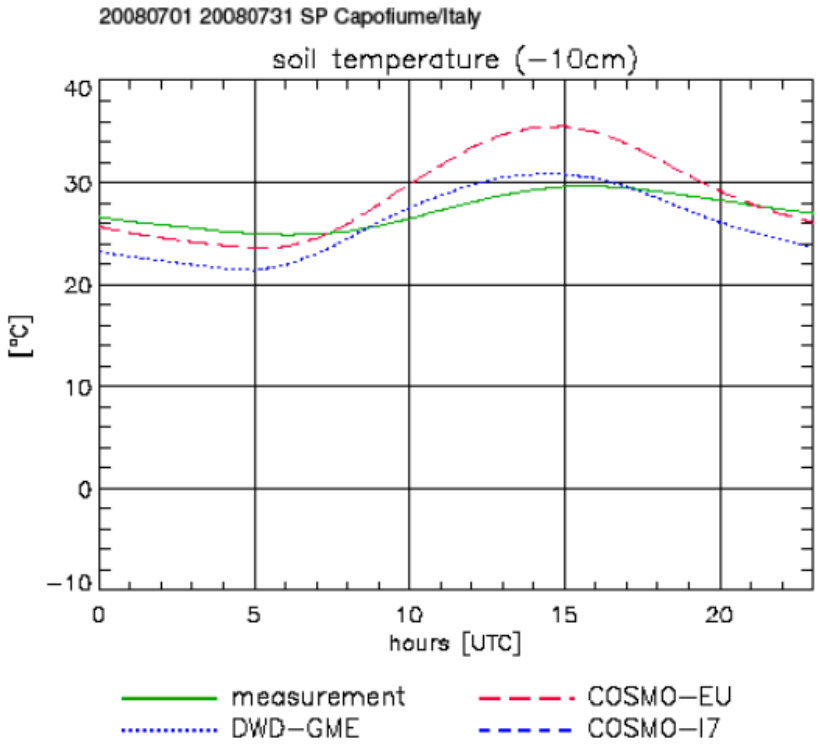
SP Capofiume: July 2008

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

2-m temperature



Soil temperature (-10cm)

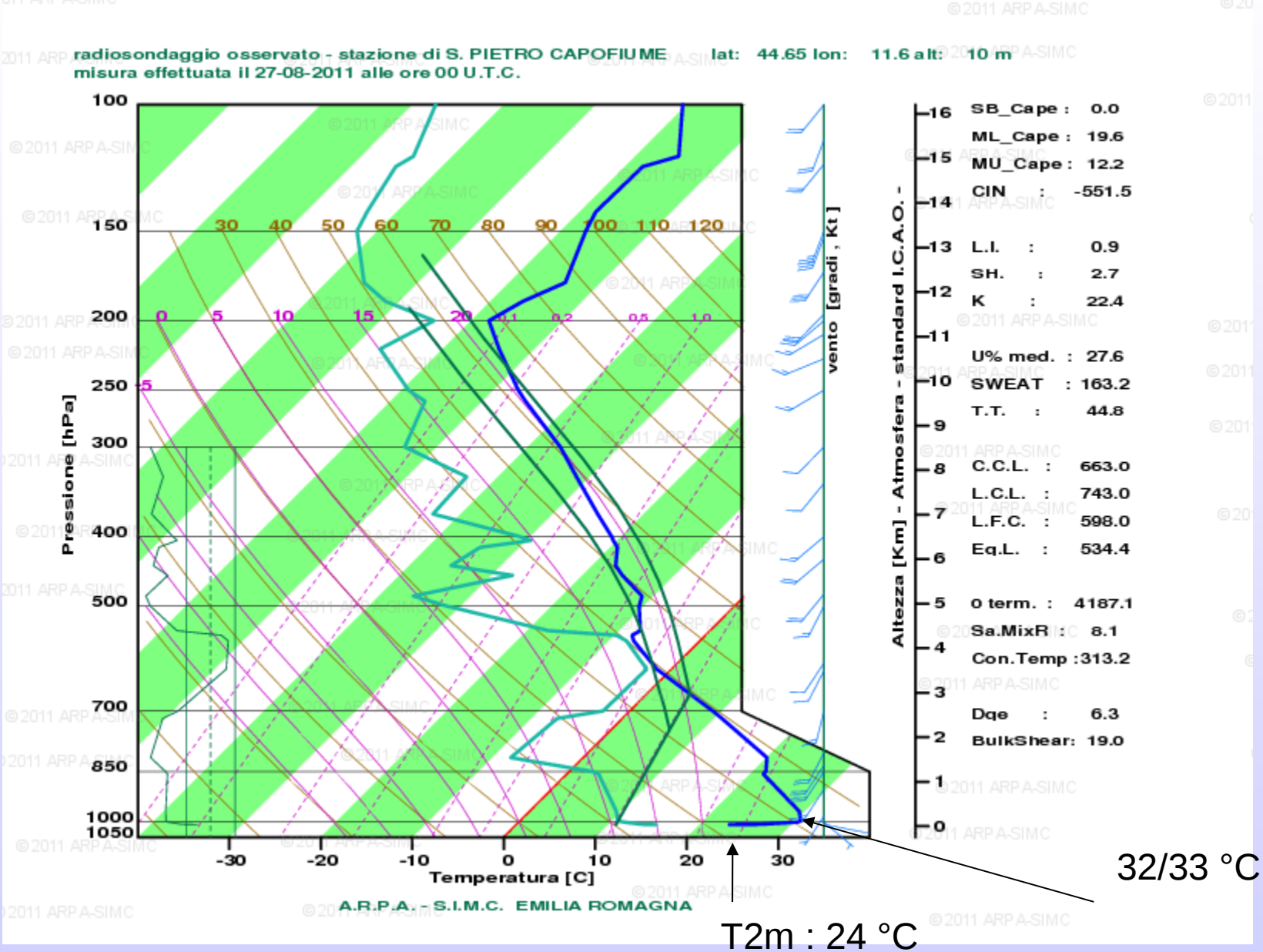


Monthly mean diurnal cycle of the soil temperature at 10 cm depth. Its amplitude is overestimated, i.e. the (surface) ground heat flux is overestimated.

As a consequence the diurnal cycle of the surface temperature is underestimated.

2 summer case studies with a shallow inversion

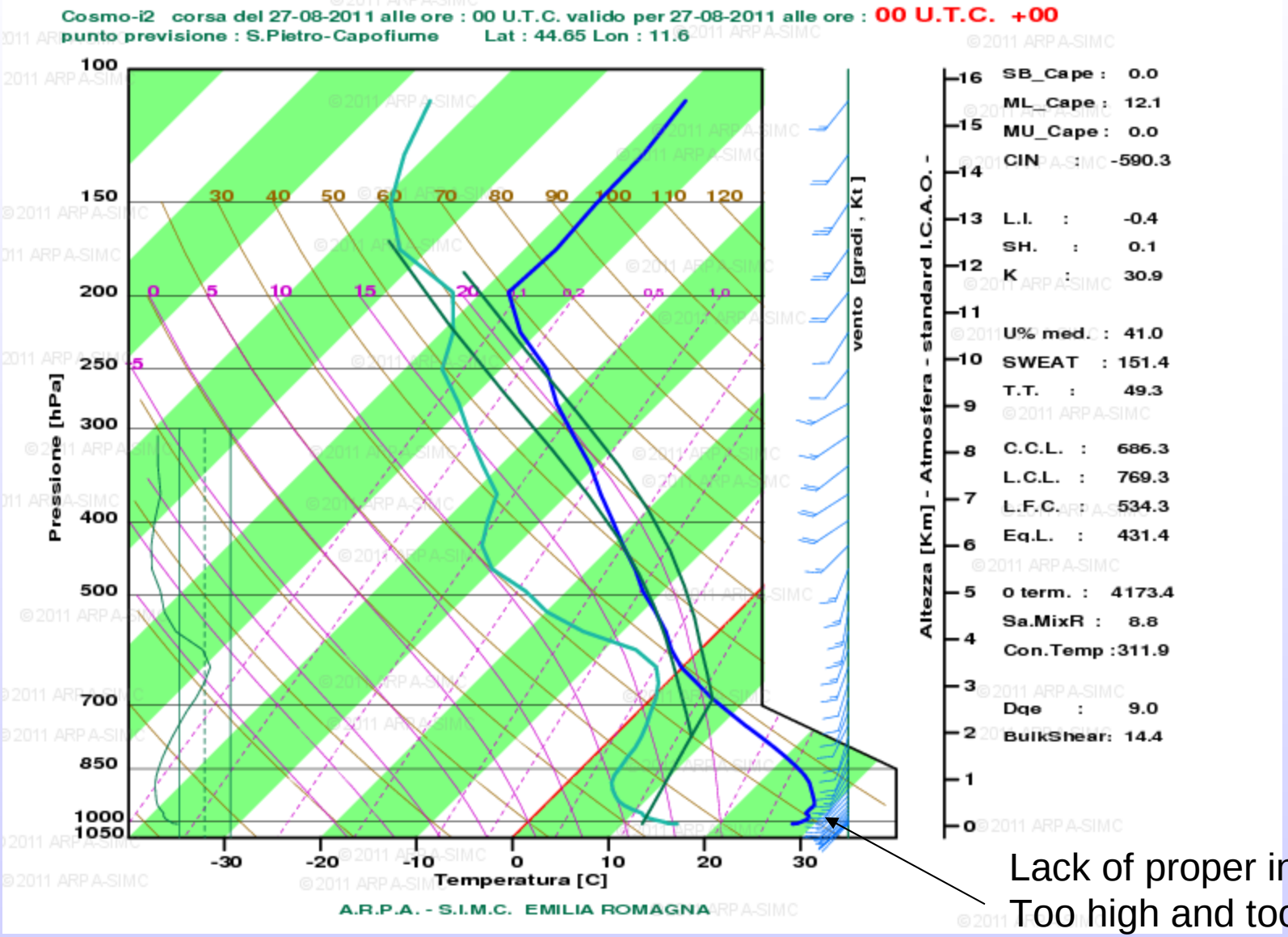
27/08/2011 case study: observed sounding at S. P. Capofiume (SPC)



32/33 °C

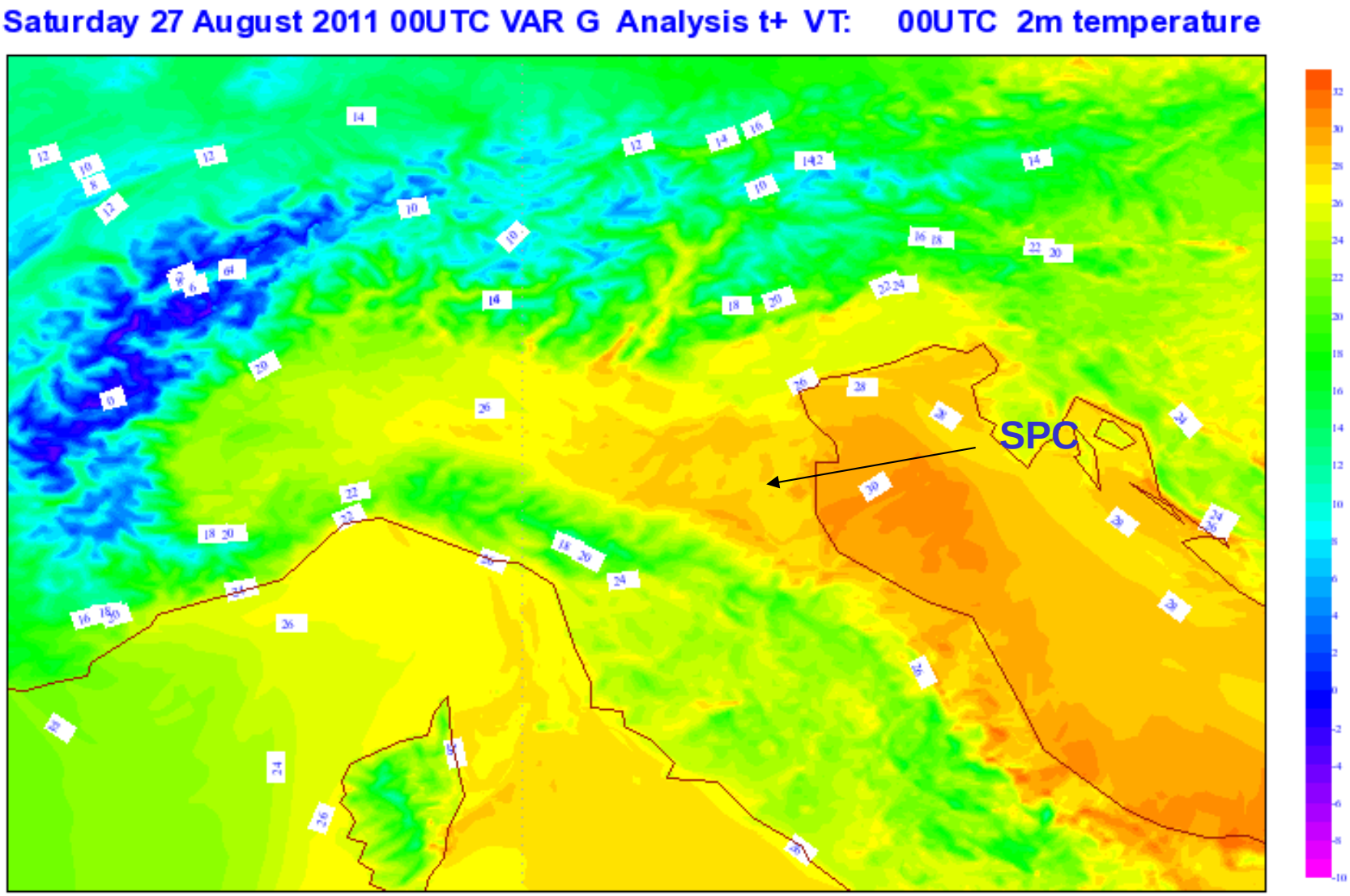
T2m : 24 °C

Simulated vertical profile from the COSMO I2 analysis for S. P. Capofiume

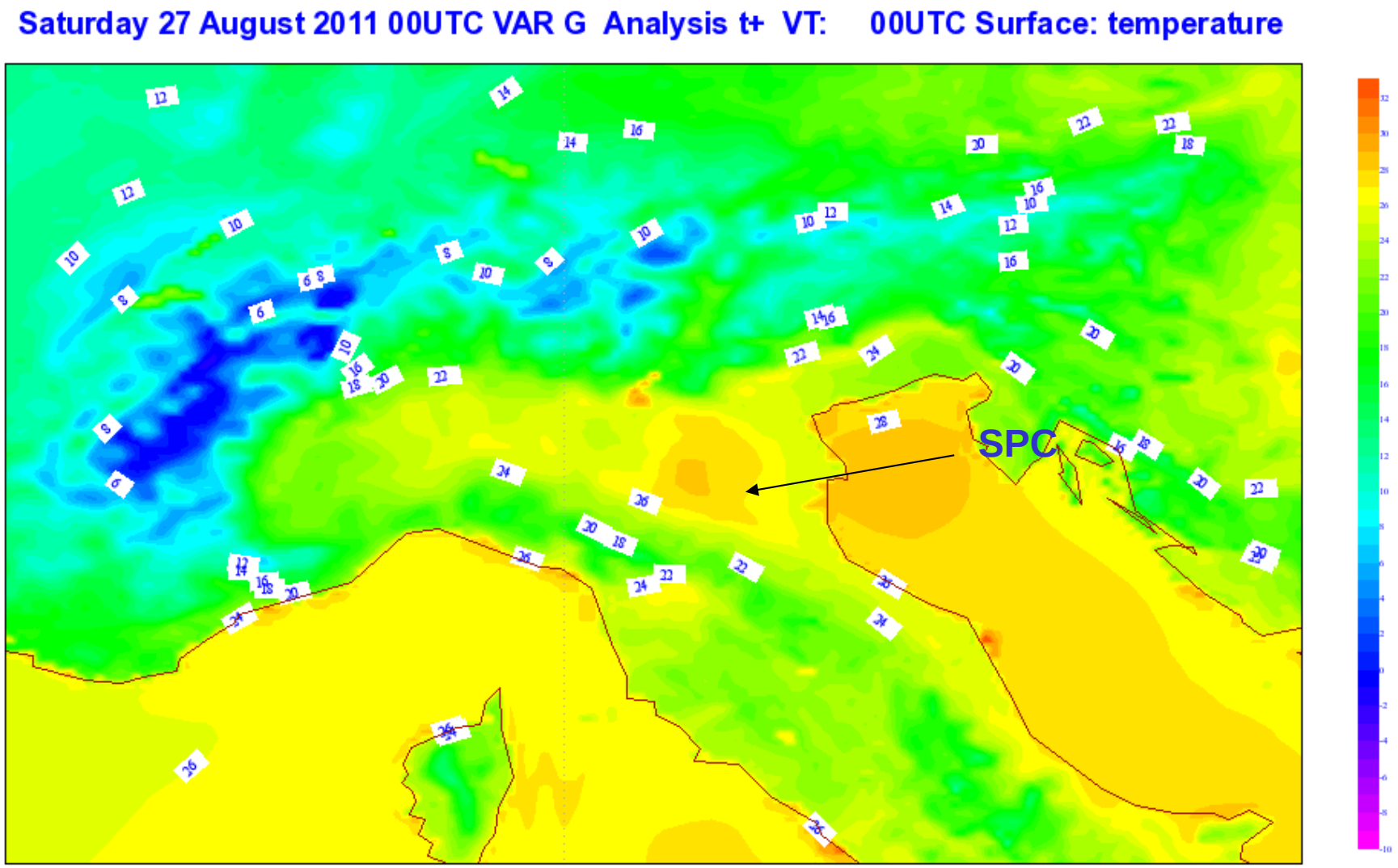


Lack of proper inversion
Too high and too weak.

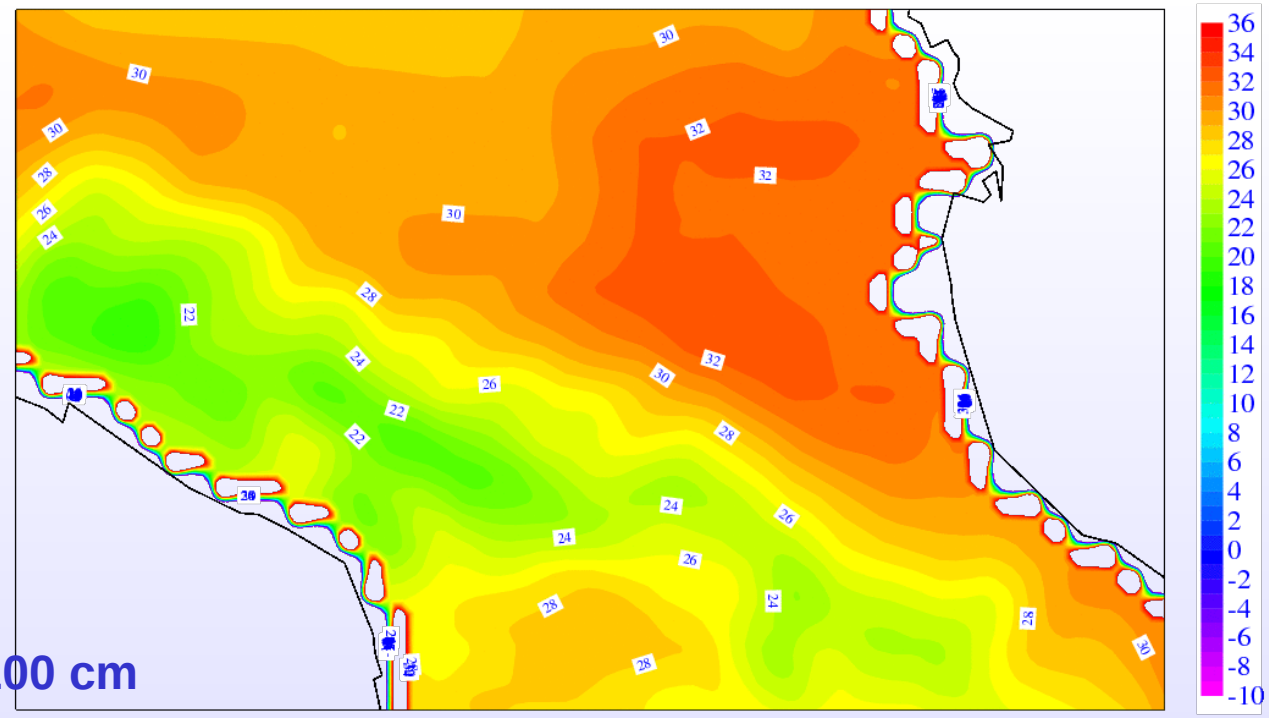
ANALYSIS of COSMO I2 – 2Tm



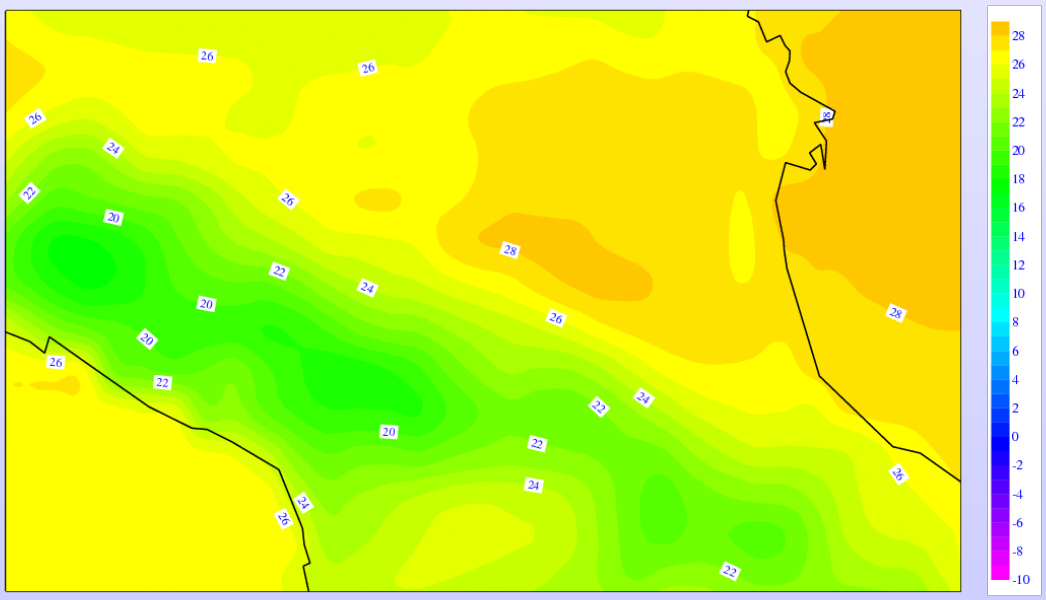
ANALYSIS of COSMO I7 (ic IFS) – soil temperature, first level



COSMO Tground @-41cm

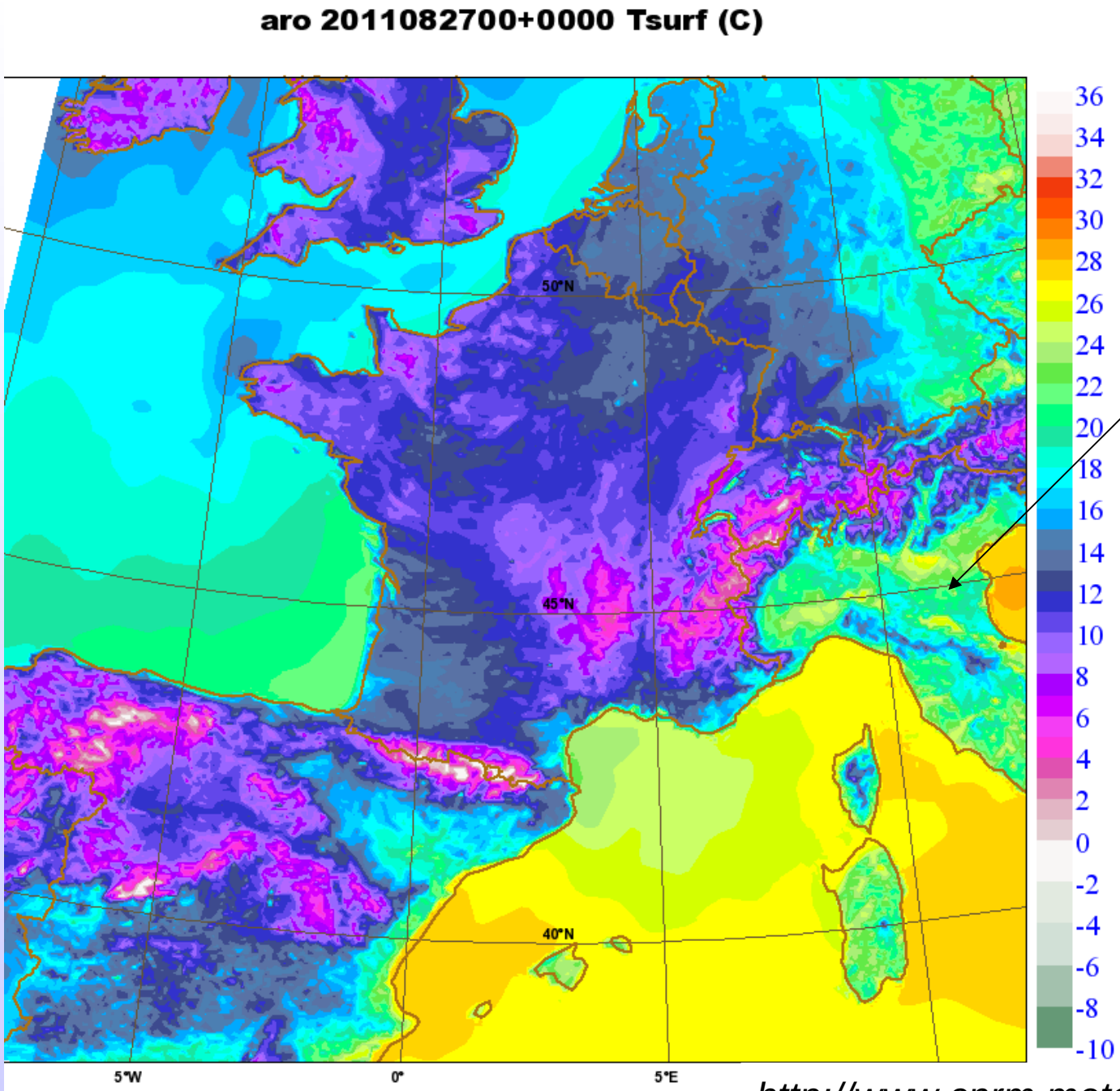


ECMWF Tground @-28 /-100 cm



Ground Obs SPC 27/08/2011

T1 (-10 cm)	29.4 °C
T2 (-25 cm)	29.7 °C
T3 (-45 cm)	27.8 °C
T4 (-70 cm)	26.3 °C
T5 (-100 cm)	20.2 °C

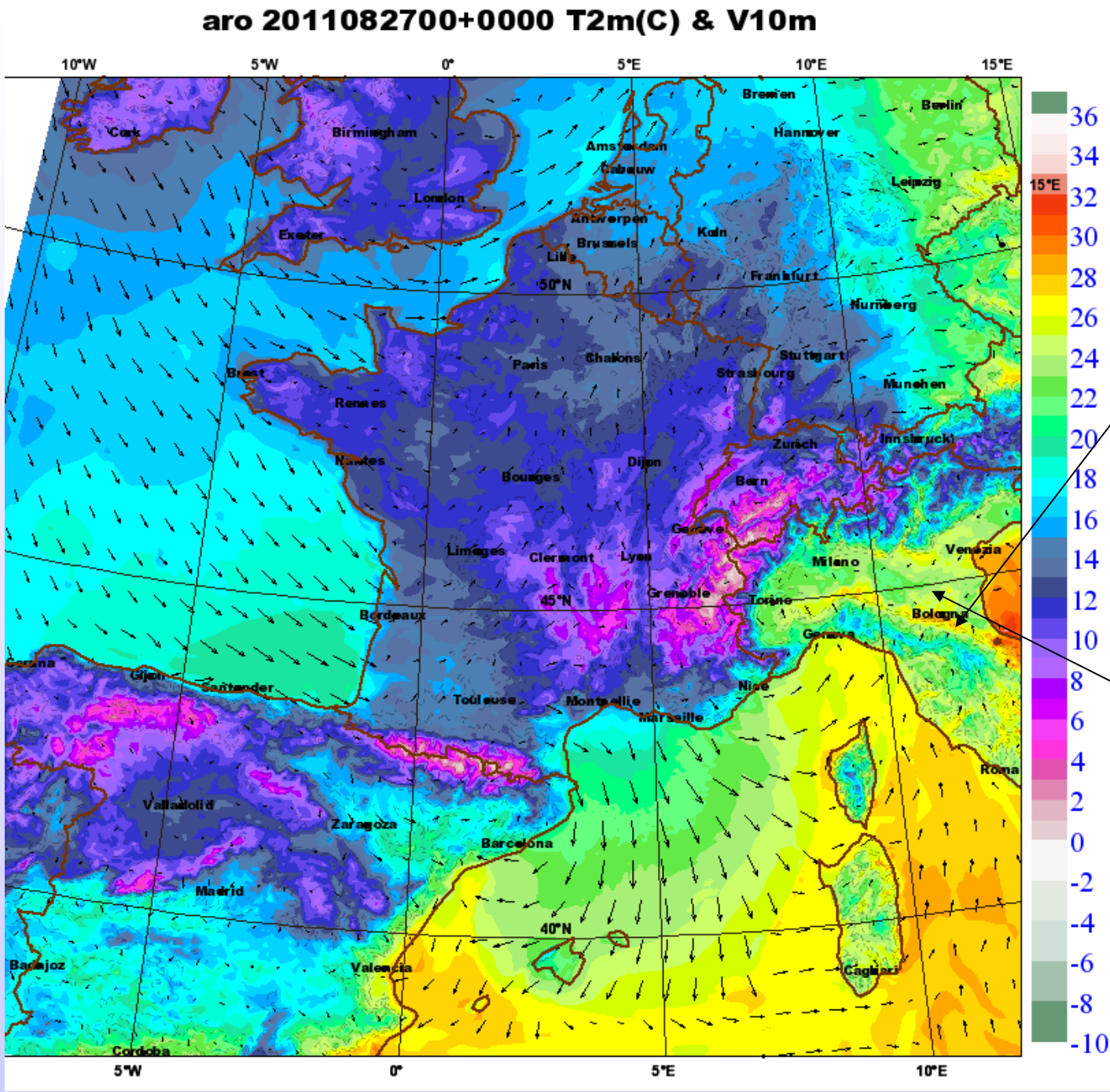


AROME surface soil temperature

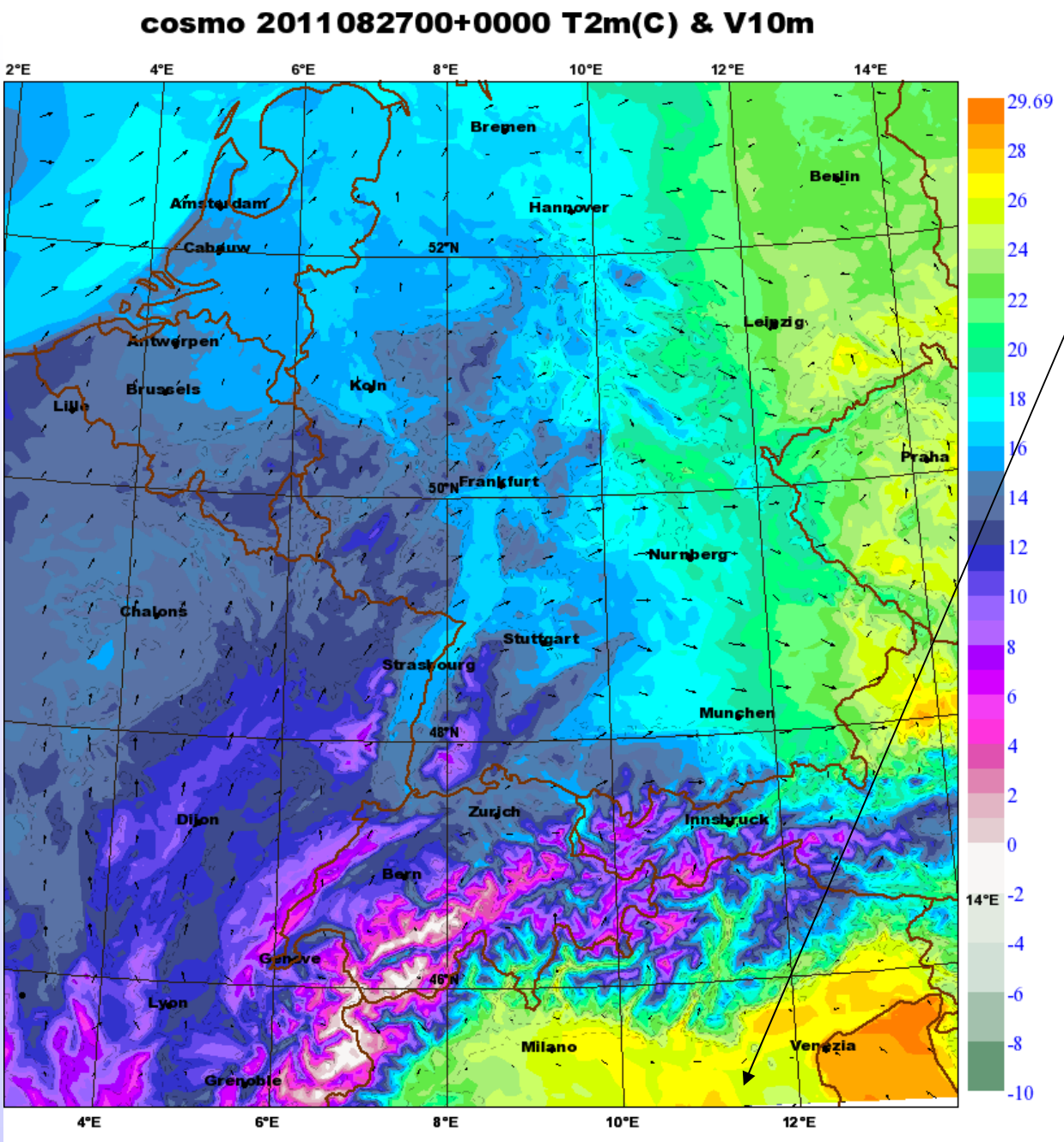
- Surface is generally much colder

- Greater variability

http://www.cnrm.meteo.fr/arome/prod/tt.html

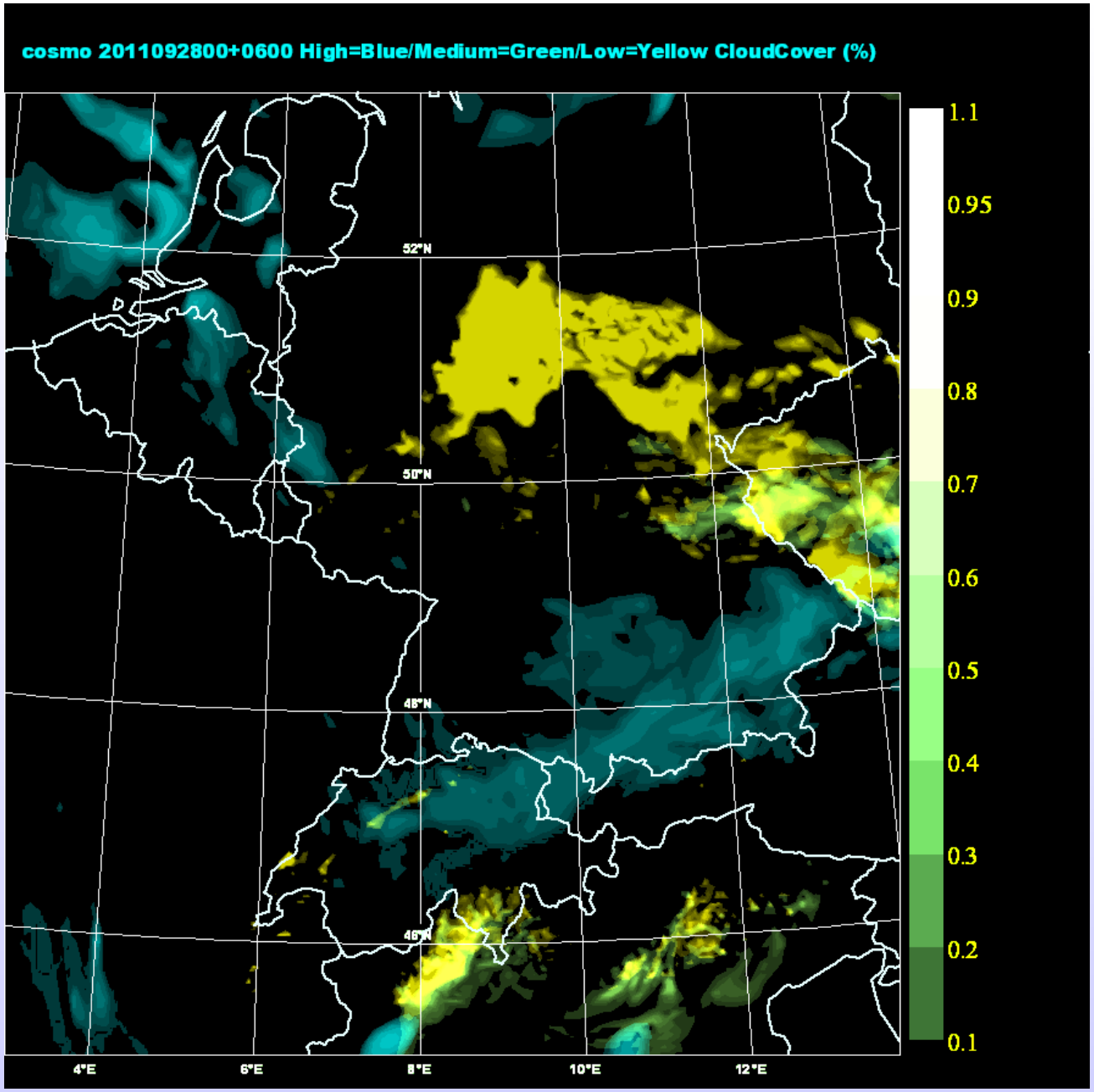


Light SO winds have manteined very high night temperature on the hills downwind the appennines, successfully captured by arome. In the inner Po valley a shallow inversion was present with lower T2m has also shown by sounding at S. Pietro Capofiume in prev. slide.



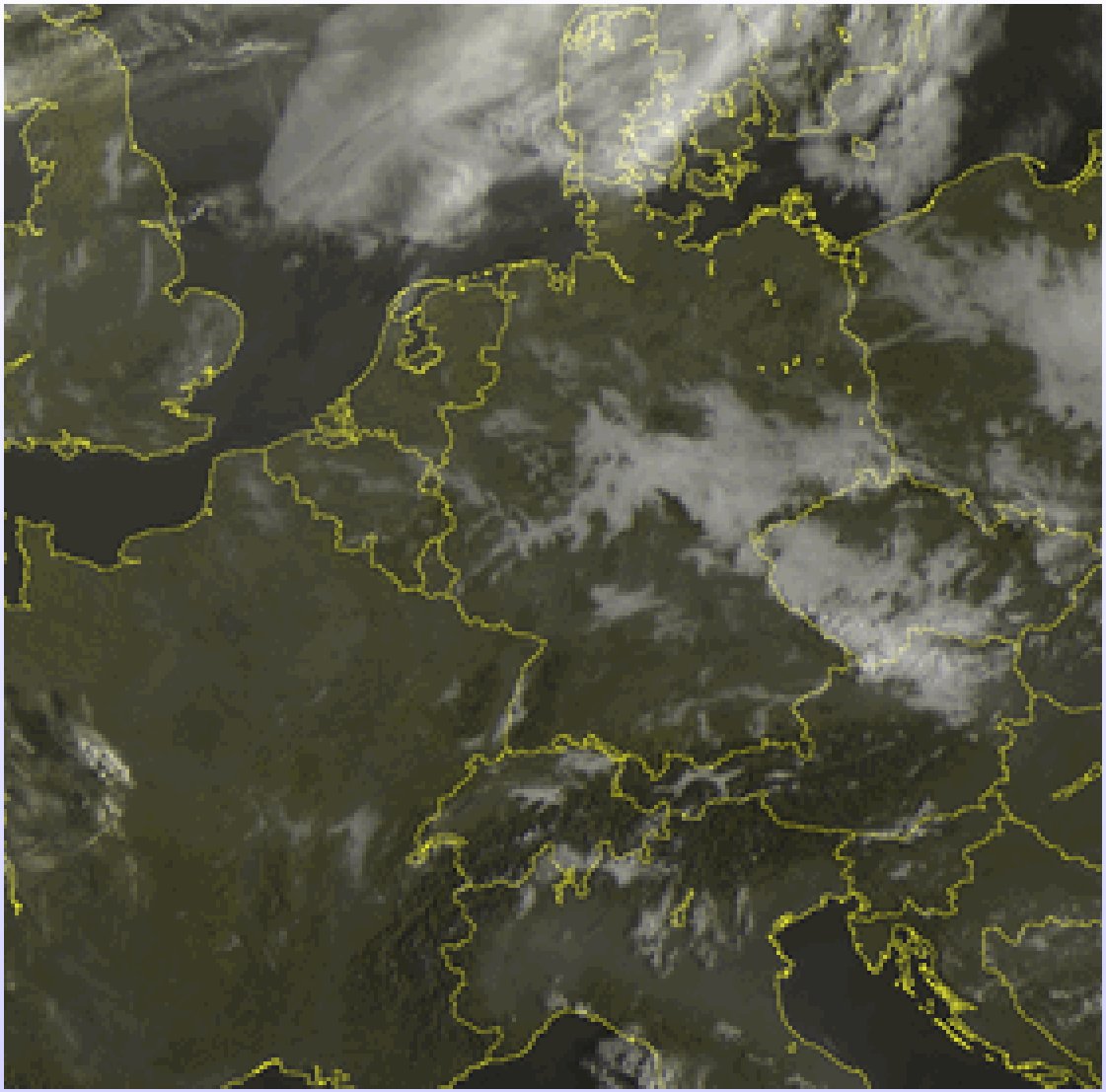
COSMODE for the same
date (same model, different initialisation)
….qualitatively it looks also
too warm in the Po-valley area

A September case with diffuse shallow inversions over central Europe

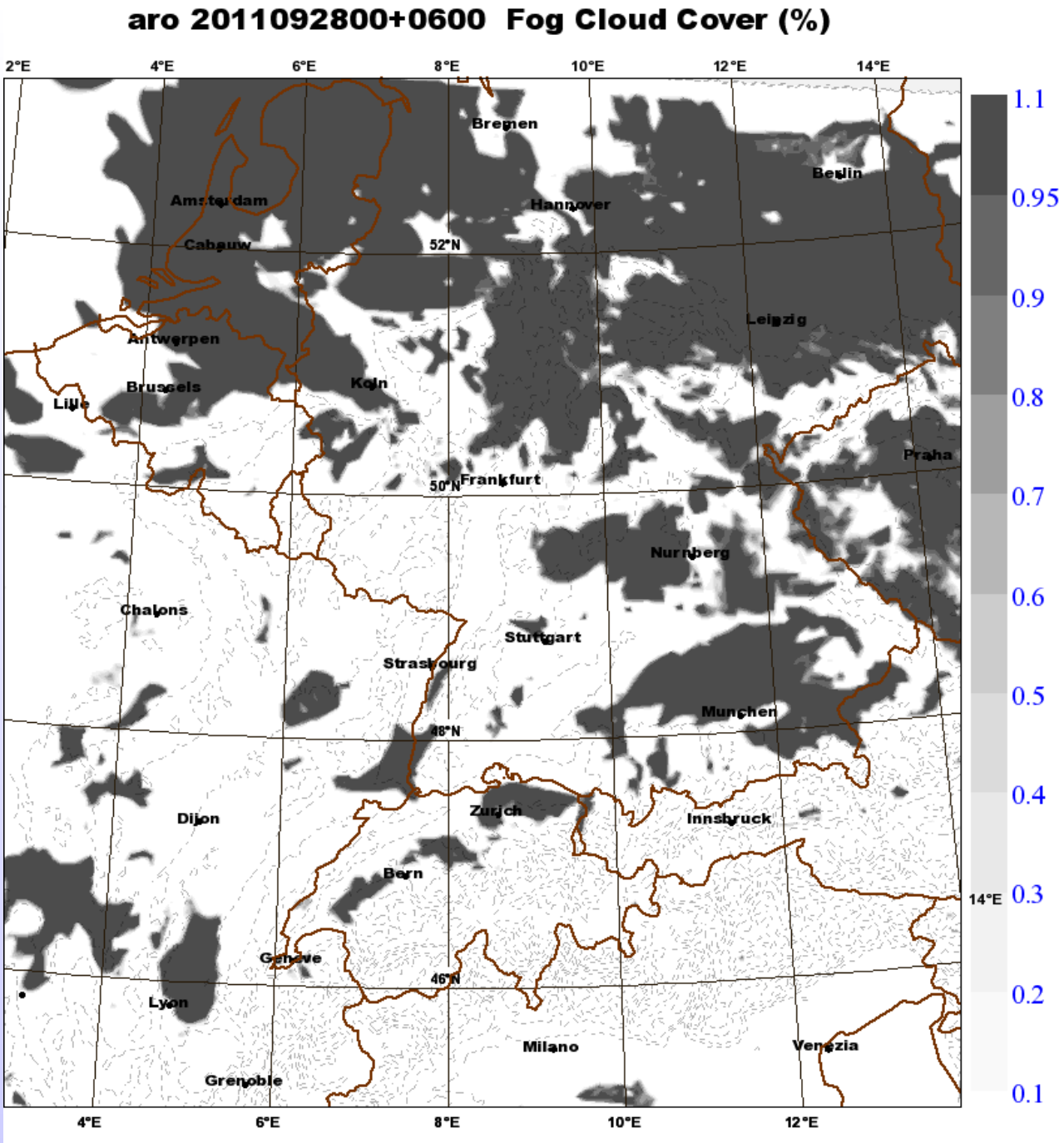


COSMO DE cloud cover

Anticyclonic stable conditions.
Scattered low clouds.

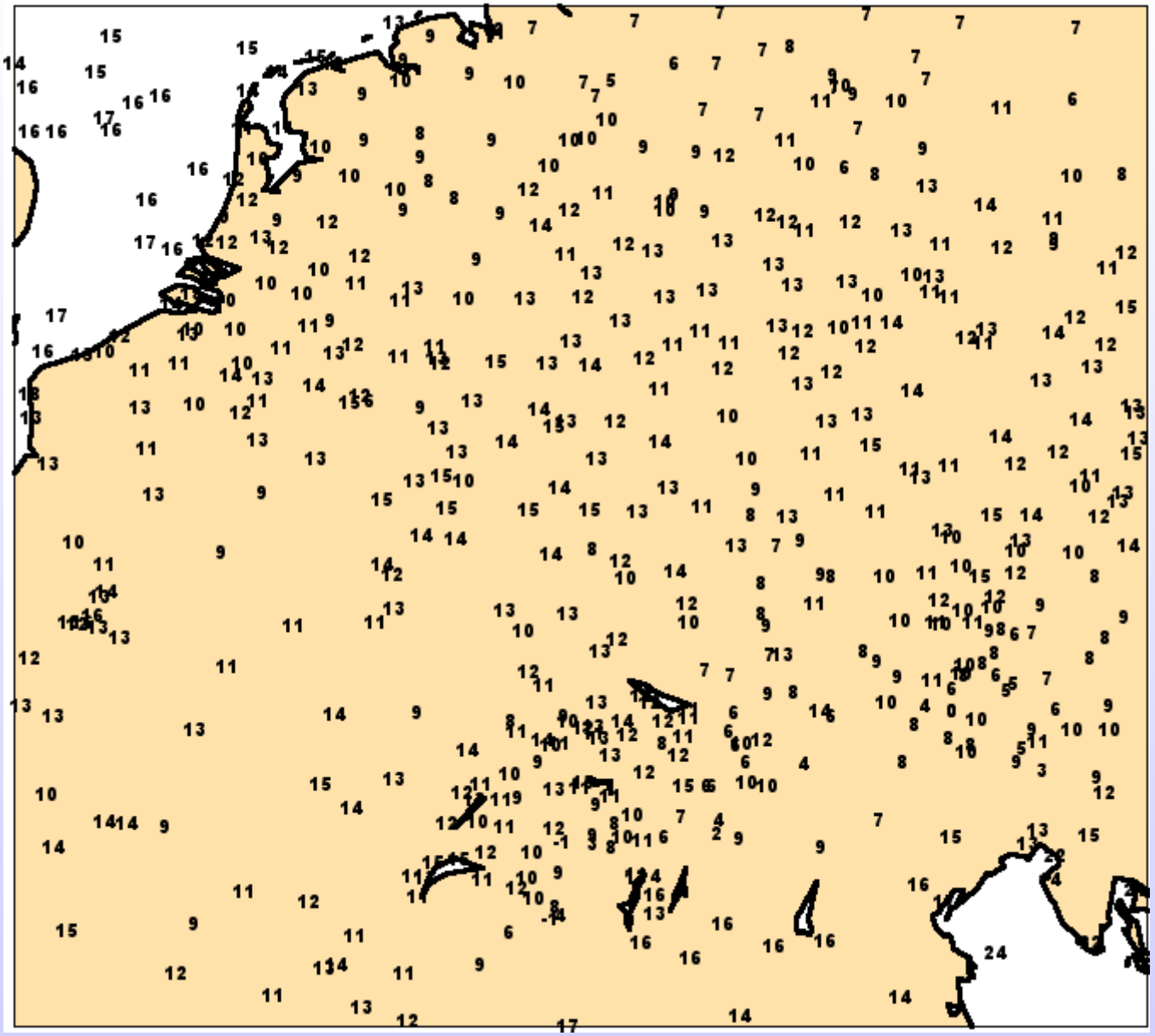


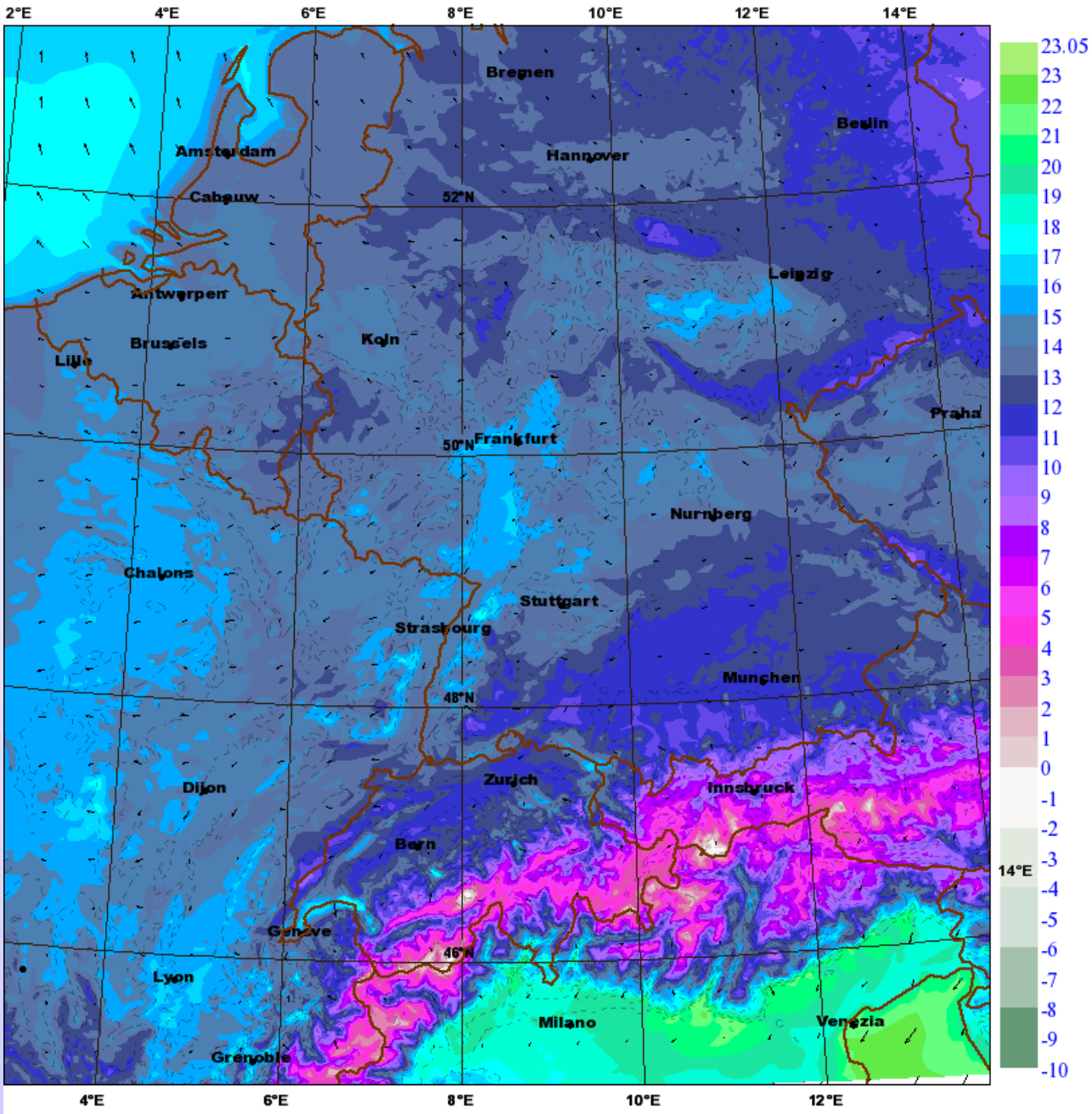
7 UTC



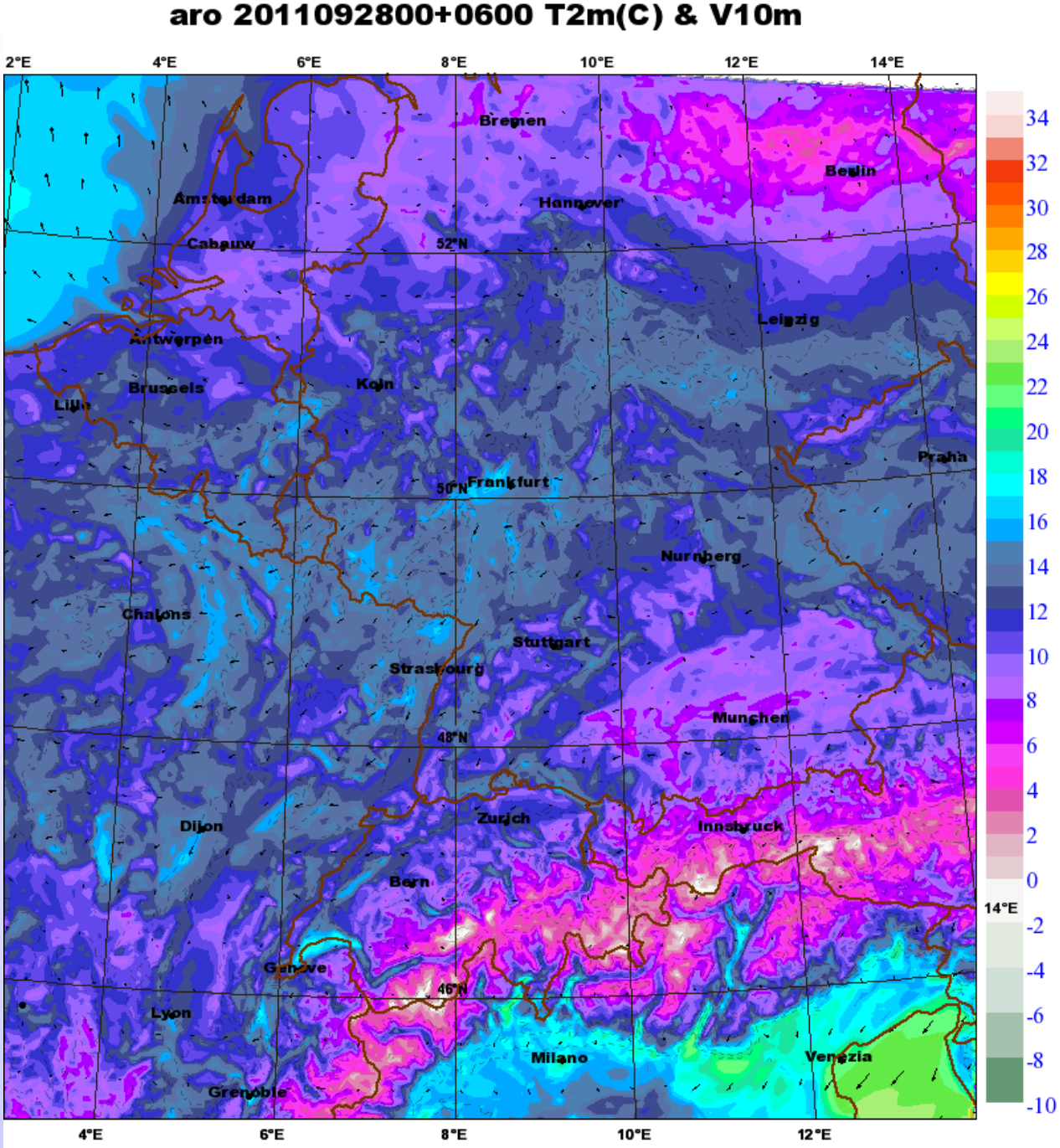
AROME fog cloud cover

Obs: Wednesday 28 September 2011 06UTC Surf:synop

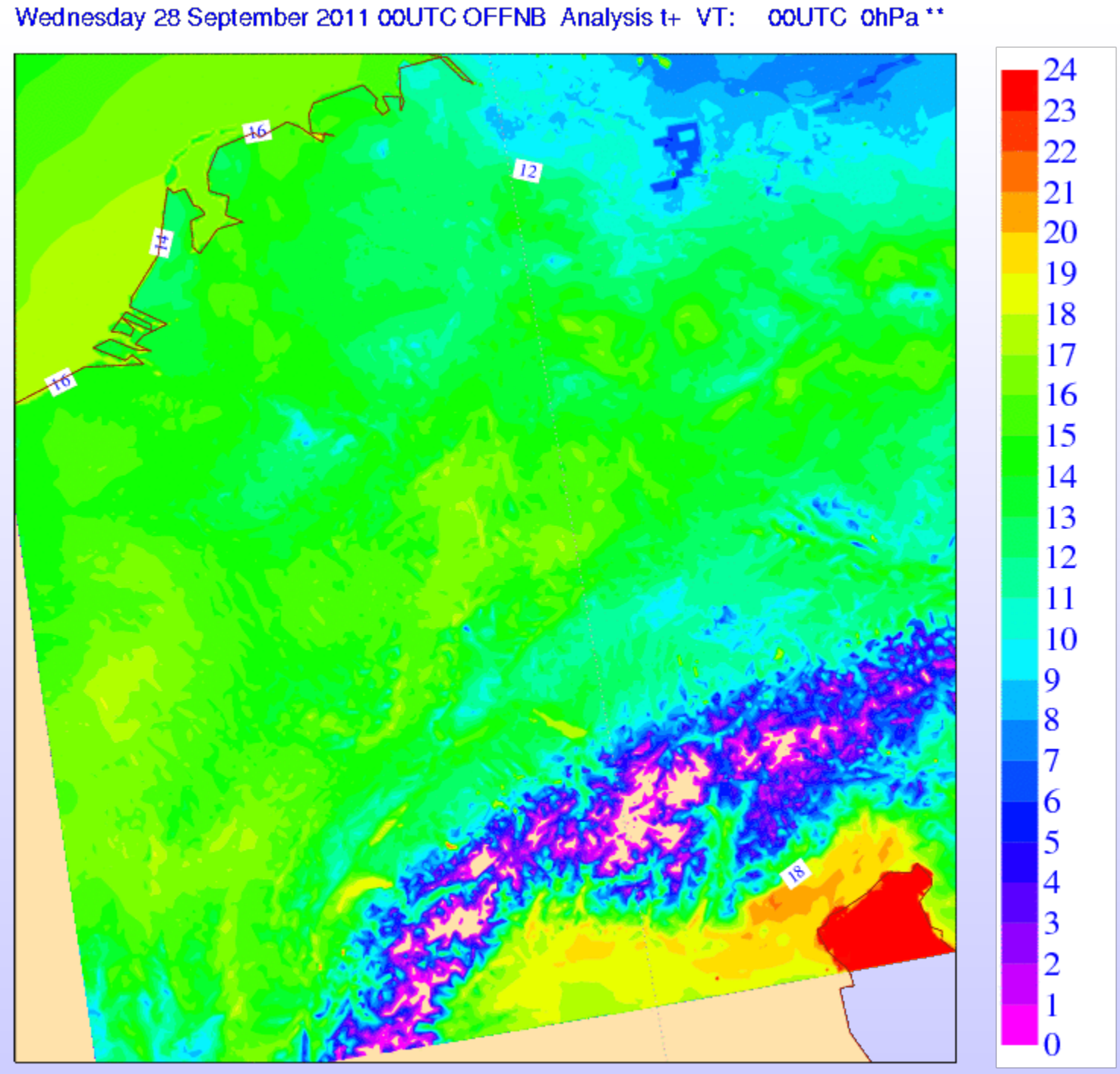




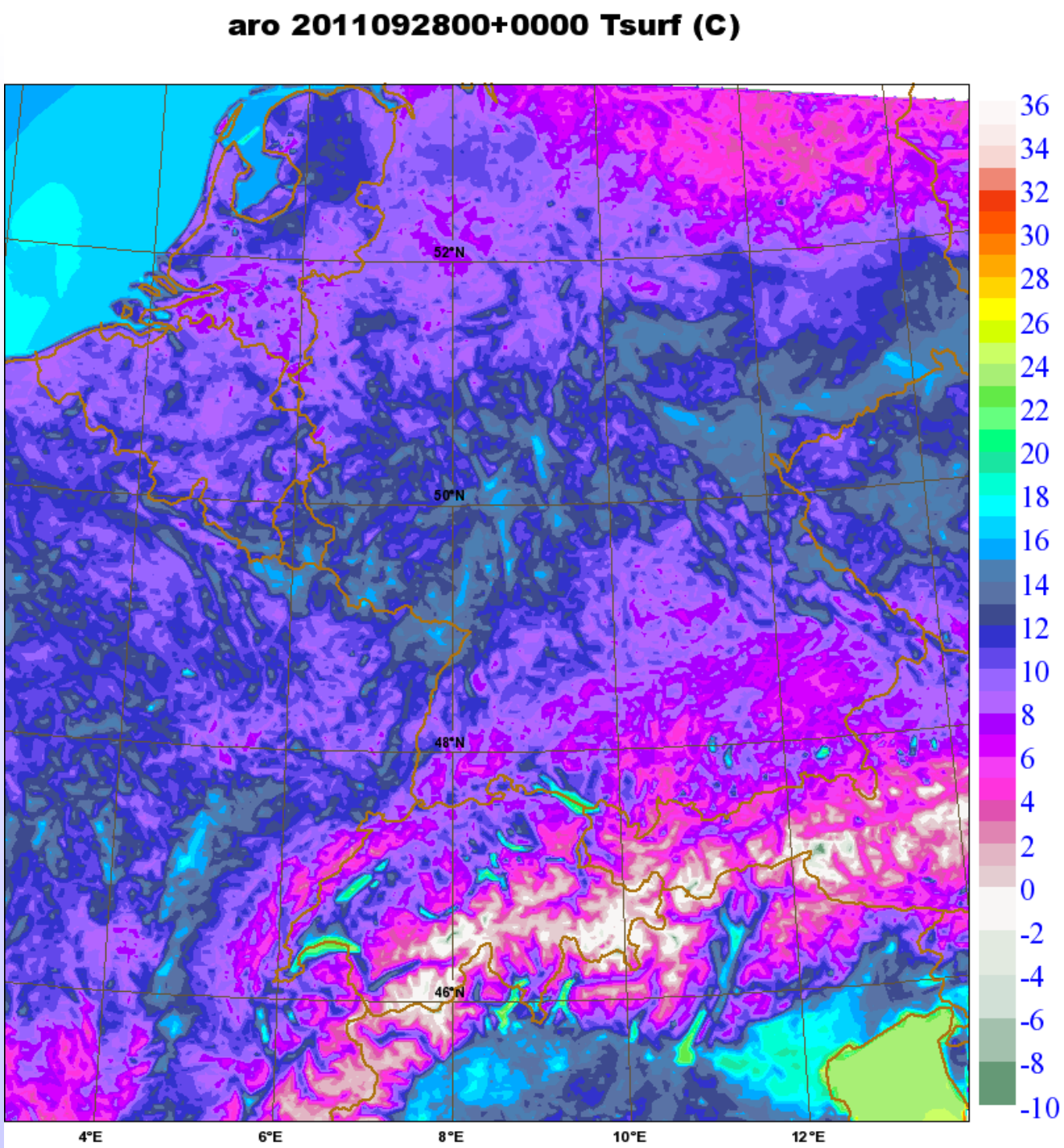
COSMO is about 5 degrees warmer compared with obs over N-Germany and Netherlands



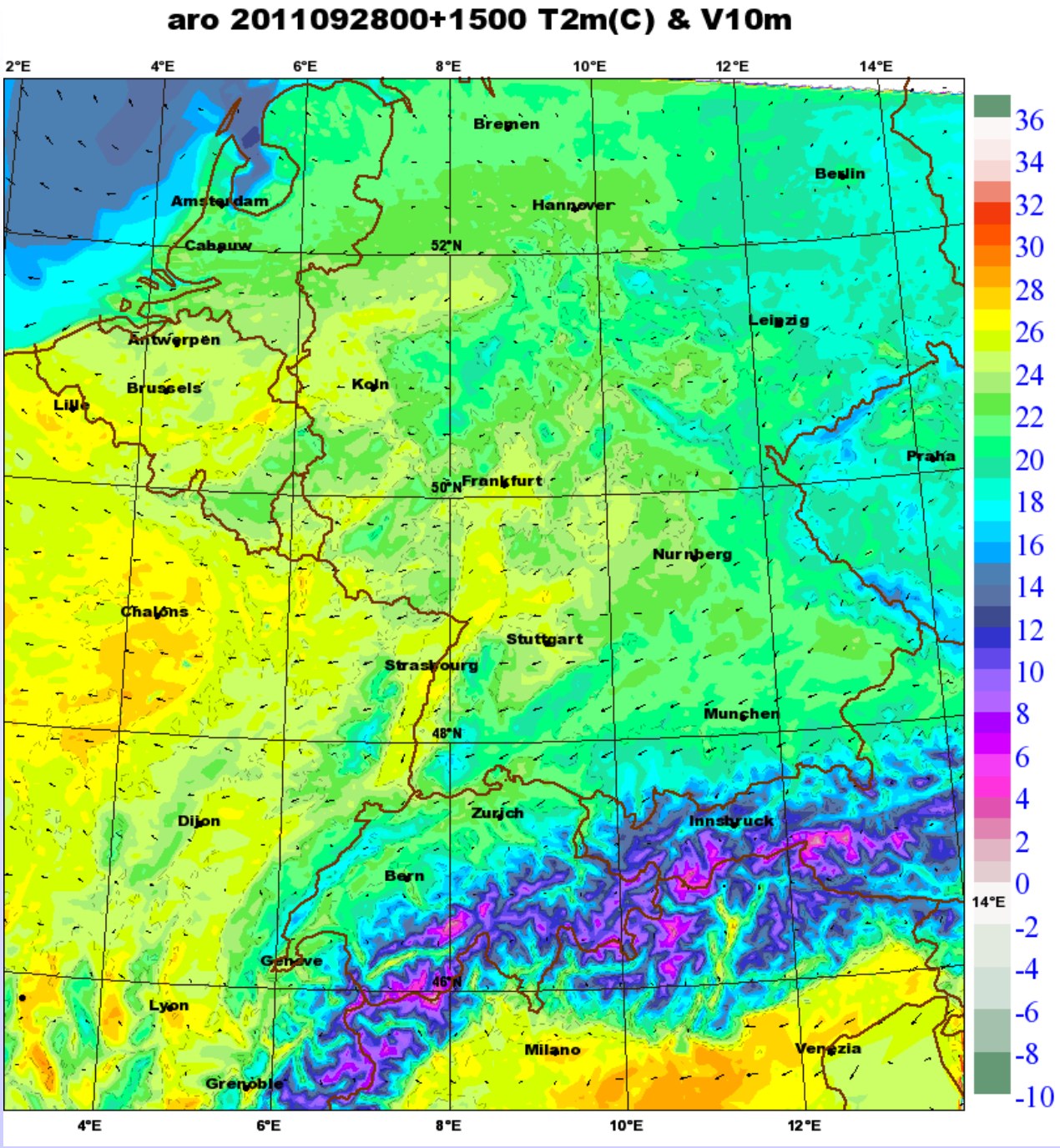
LARGER variability in the T2m temperature field in AROME



COSMO DE
surface temperatu
-Tground-

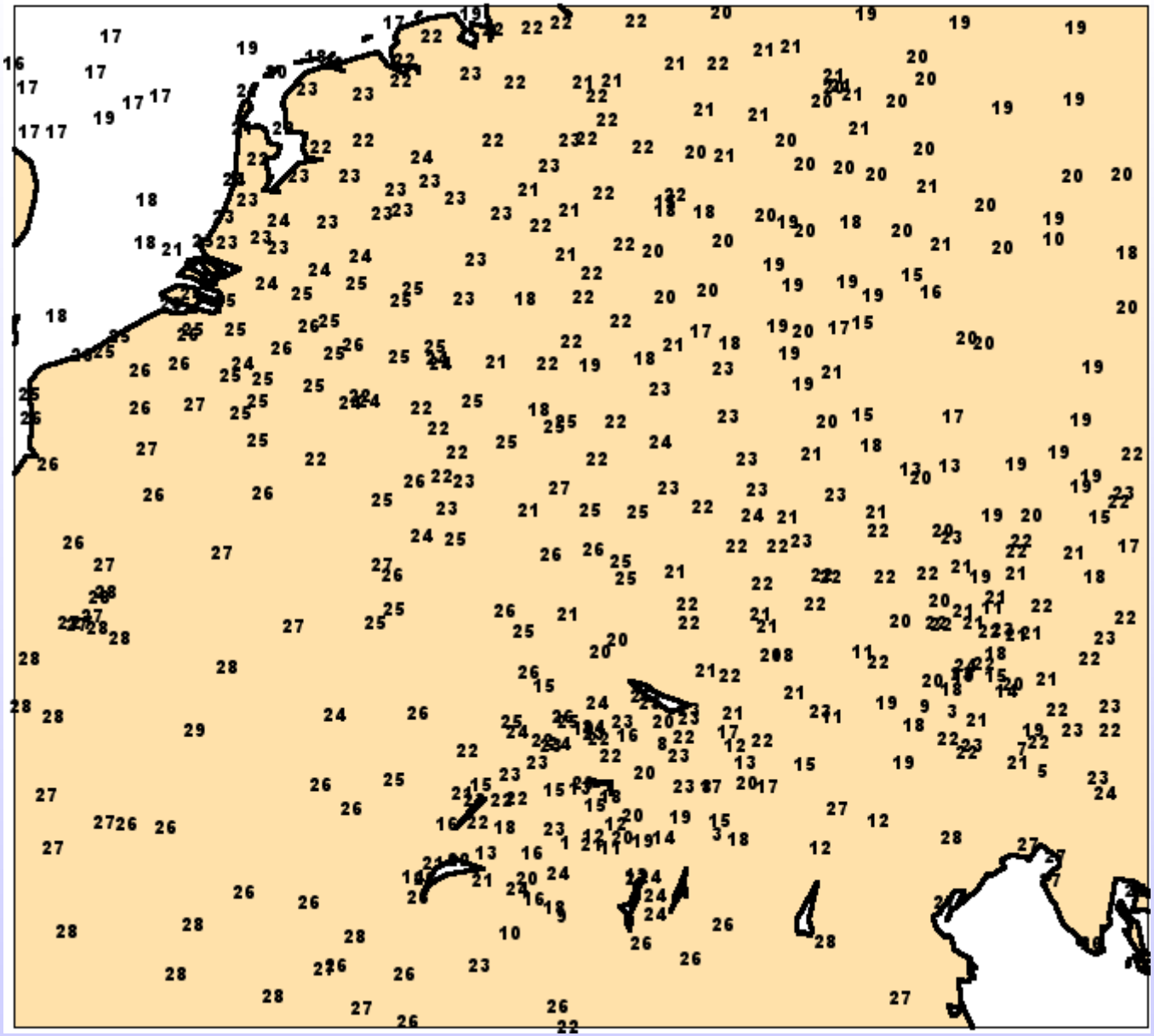


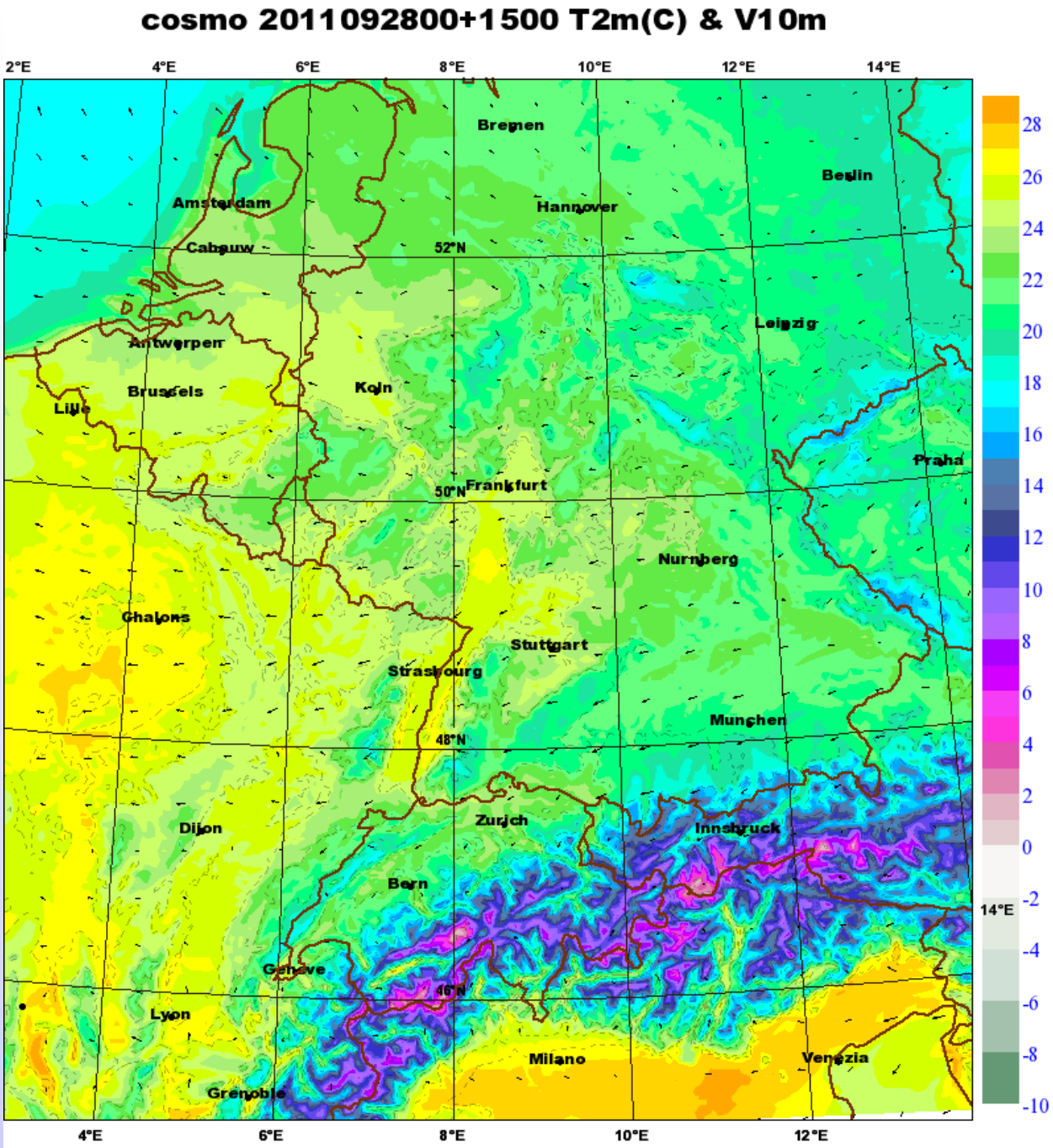
AROME
surface temperature
-Tskin or Tground??



Concerning maximum temperatures the differences are not so large as in the minimum.

Obs: Wednesday 28 September 2011 15UTC Surf:synop




cosmo 2011092800+1500 T2m(C) & V10m
2°E
4°E
6°E
8°E
10°E
12°E
14°E
Bremen
Berlin
Amsterdam
Hannover
Cabauw
52°N
Leipzig
Antwerpen
Brussels
Koln
Lille
Praha
50°N
Frankfurt
Nurnberg
Chalons
Stuttgart
Strasbourg
Munchen
48°N
Zurich
Innsbruck
Dijon
Bern
14°E
Geneve
46°N
Lyon
Milano
Venezia
Grenoble
4°E
6°E
8°E
10°E
12°E
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10

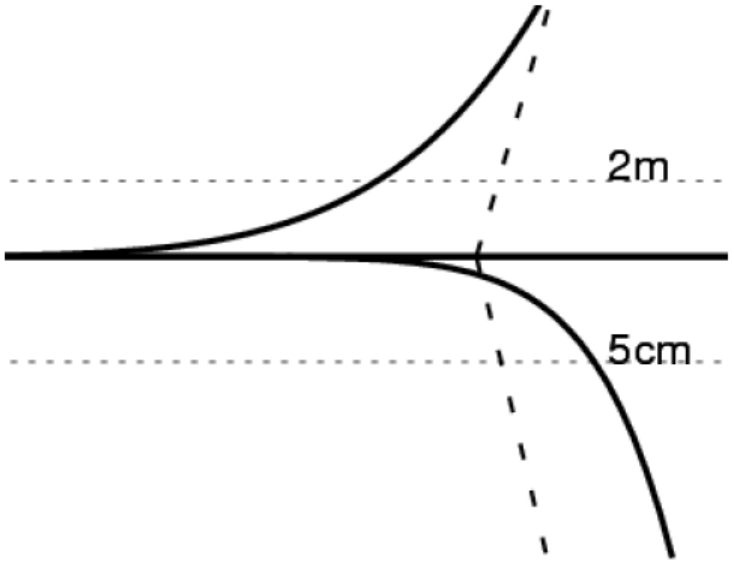
Too diffusive atmosphere, too conducive soil

Cosmo vs. Lindenberg data (20081001-20090531)

A long term analysis shows a too diffusive atmosphere and a too conductive soil (at least at Lindenberg).

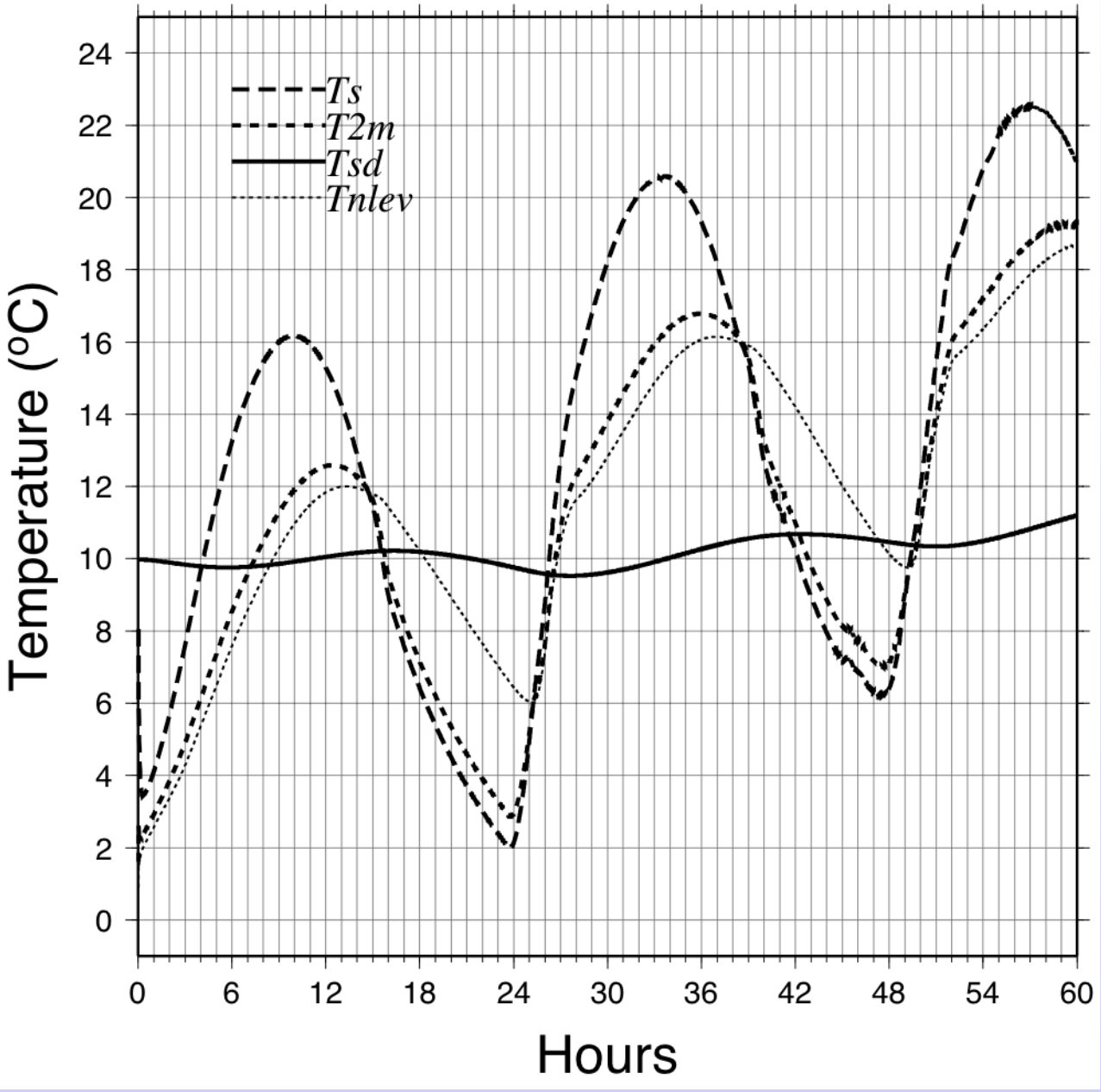
E.g. in a stable stratified PBL we can expect a schematic temperature profile near the surface:

Model: Dashed
Observations: Solid line



If we use the two meter temperature difference to correct the soil temperature we risk to make the soil temperature bias even bigger. We have to be careful to the correction parameters.

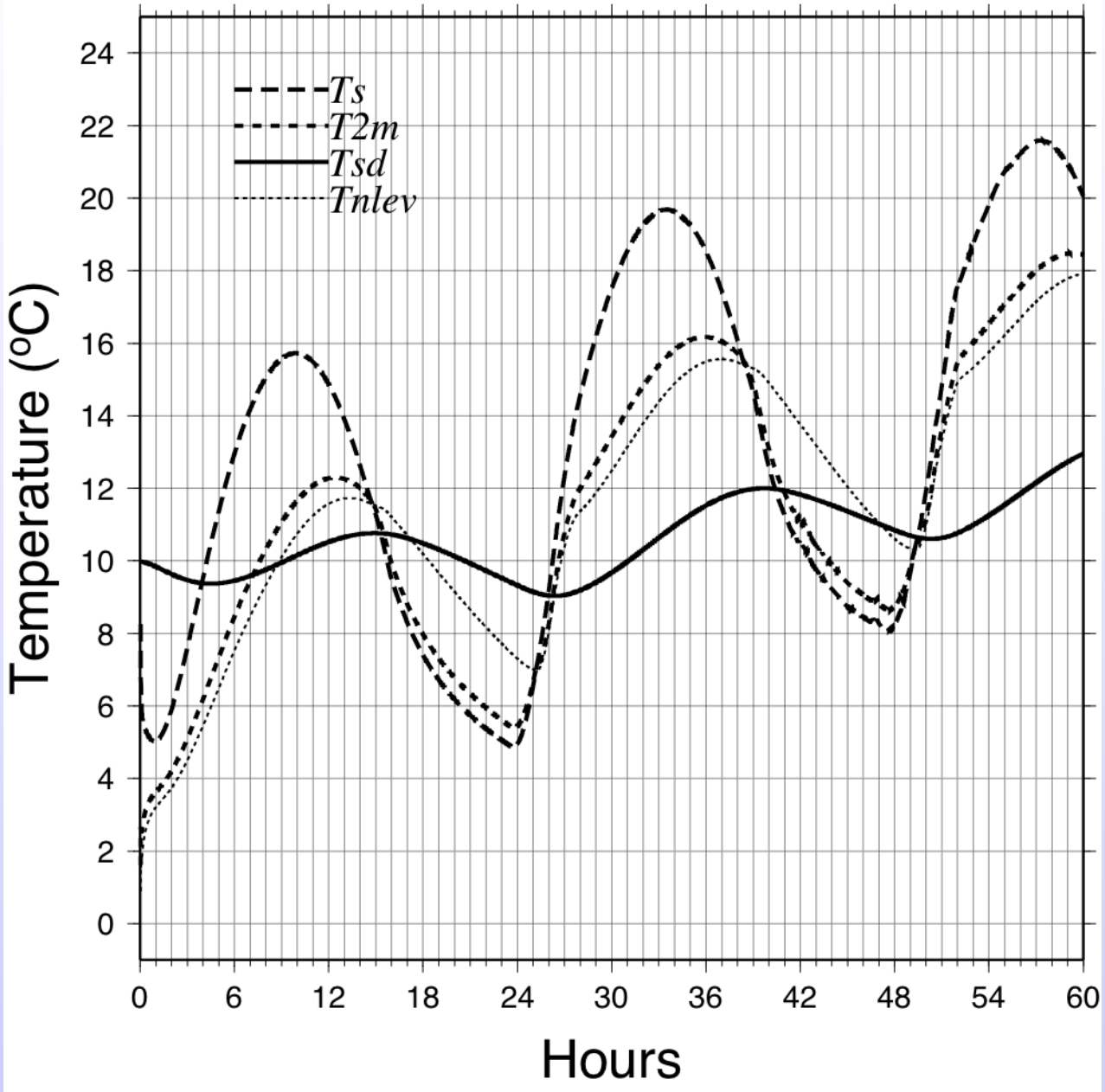
surfcond_5_0.3



IDEALISED SENSITIVITY TO HEAT CONDUCTIVITY INCREASE. HIRLAM SINGLE COLUMN SOIL MODEL.

CONTROL

surfcond10_5_0.3



IDEALISED SENSITIVITY TO HEAT CONDUCTIVITY INCREASE. HIRLAM SINGLE COLUMN SOIL MODEL.

CONTROL*10