Assimilation of GPS − derived Integrated Water Vapour − OSE with aLMo

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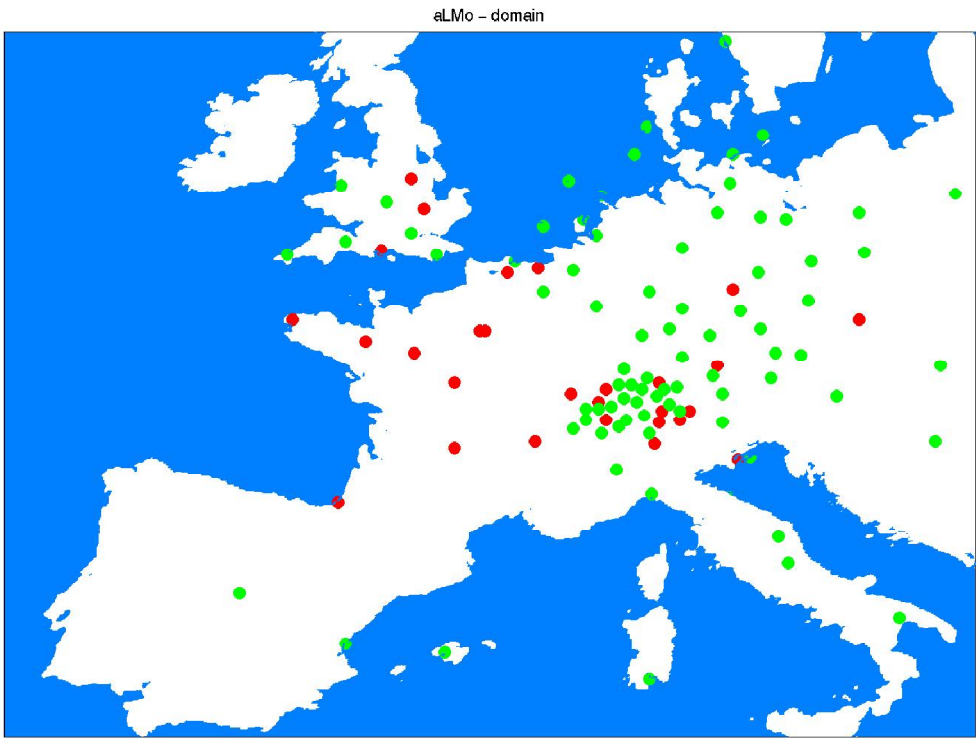
Experimental set−up

Period :

- A00 : 9 − 23 September 2001 (preliminary study)
- AFF01 : 9 − 13 September 2001 (active period)
- AFF02 : 10 − 13 January 2002 (winter high + stratus)
- AFF03 : 18 − 24 June 2002 (summer convection)

Observing systems:

- **Reference** : synop, temp, pilot, aircraft and dribu
- **GPS** : + about 110 (AFF) and 80 (A00) GPS sites
  - GFZ, GOPE, LPT and ASI (A00) processing center
  - Germany (22), Switzerland (25), Italy (7), UK (9)
  - France (10) only for AFF03 experiment
  - reports 15, 30, 60 min



Experimental set−up

aLMo :

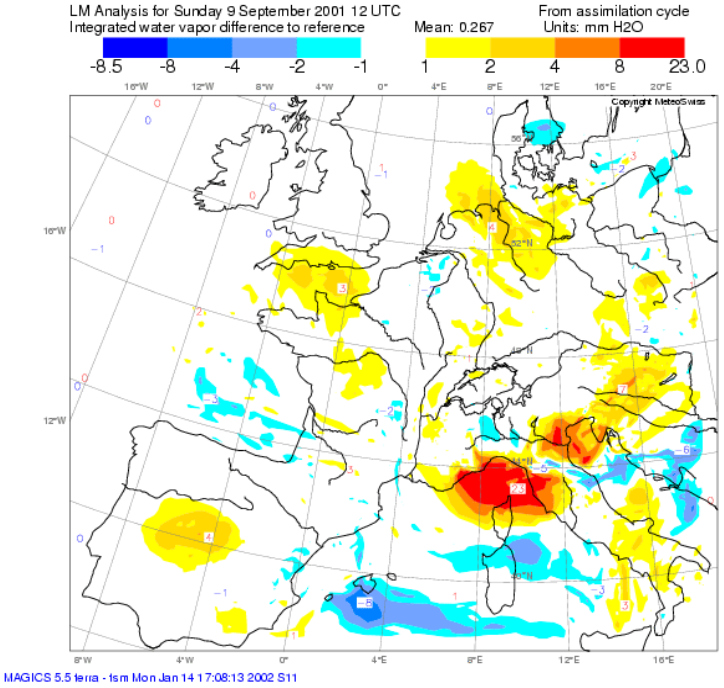
- 385 x 325 mesh, ~ 7 km horizontal resolution ; 45 vertical levels
- aLMo nested in ECMWF global model
- Same lateral boundary conditions for both sets of experiments
- Analysis (A) run and two 30 hour forecasts (FF) at 00 and 12 UTC

Assimilation :

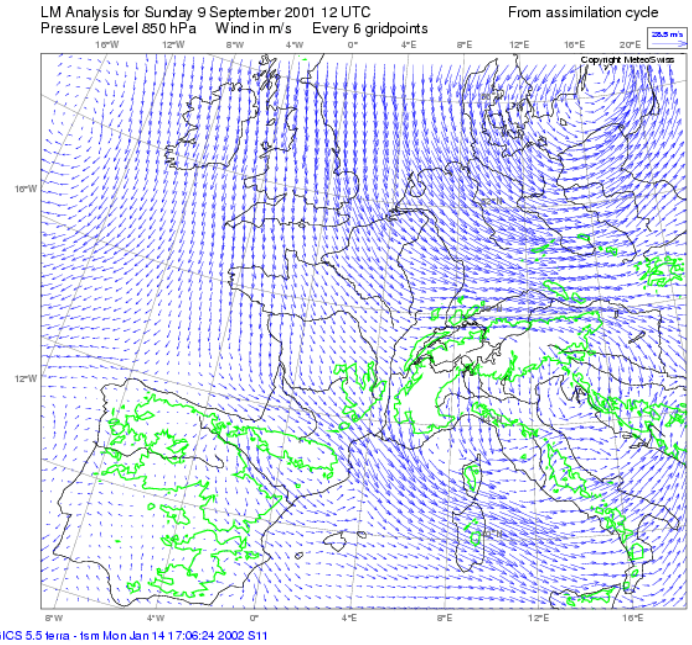
- First, ZTD is converted in Integrated Water Vapour following Bevis et al. (1992) using the model temperature and surface pressure.
- Second, GPS IWV is compared with aLMo IWV and an IWV ratio (GPS versus aLMo) is calculated.
- Third, using this ratio the model specific humidity profile is shifted from the surface up to 300 hPa (Kuo et al. 1993).
- Fourth, the model specific humidity increments are spread laterally using an autoregressive horizontal weight function with a typical scale of 35 km (70 km for A00).

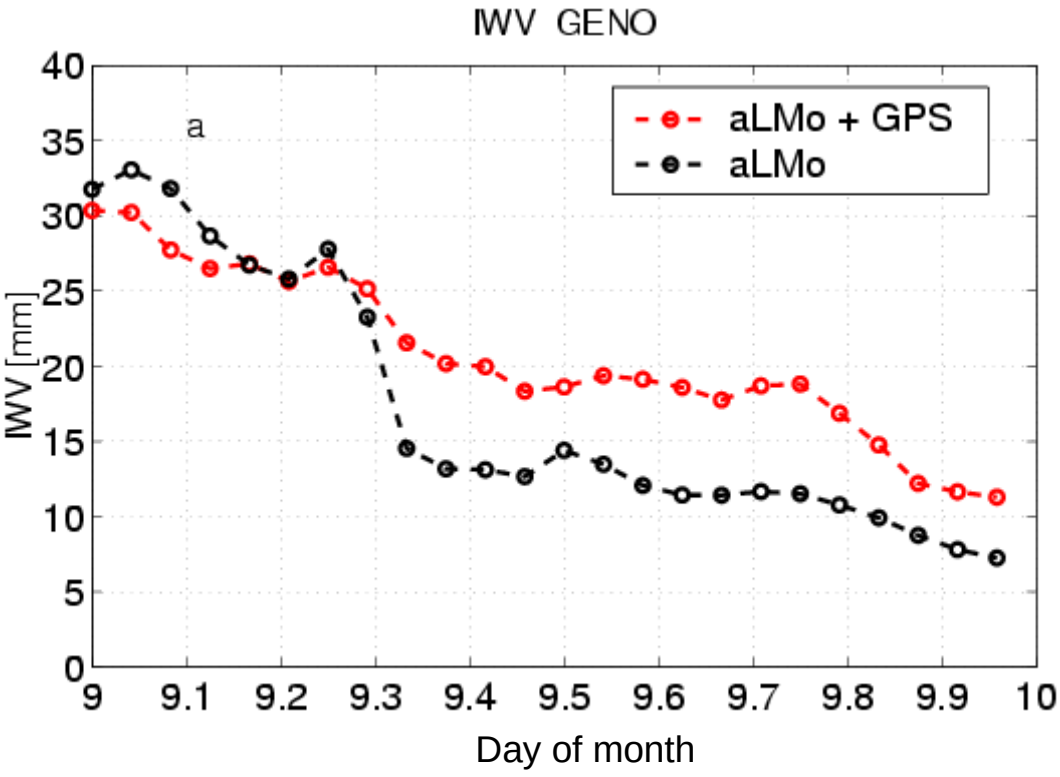
A00 : Genoa, 9.IX.2001 12 UTC

IWV GPS−REF



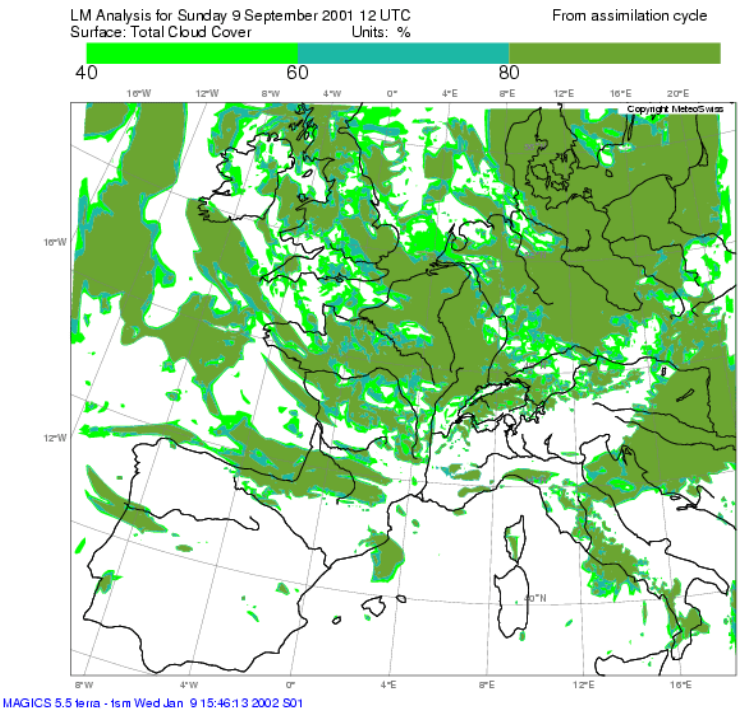
850 hPa wind



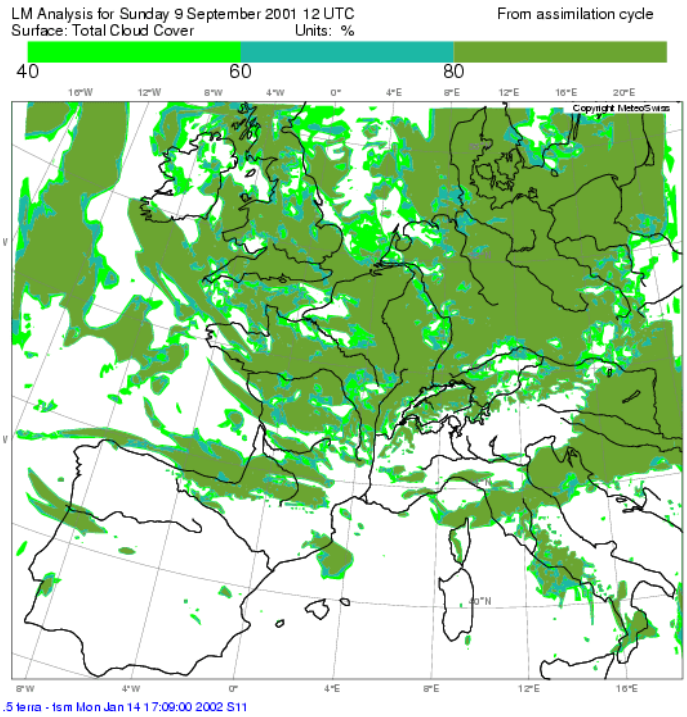


A00 : Genoa, 9.IX.2001 12 UTC CLCt

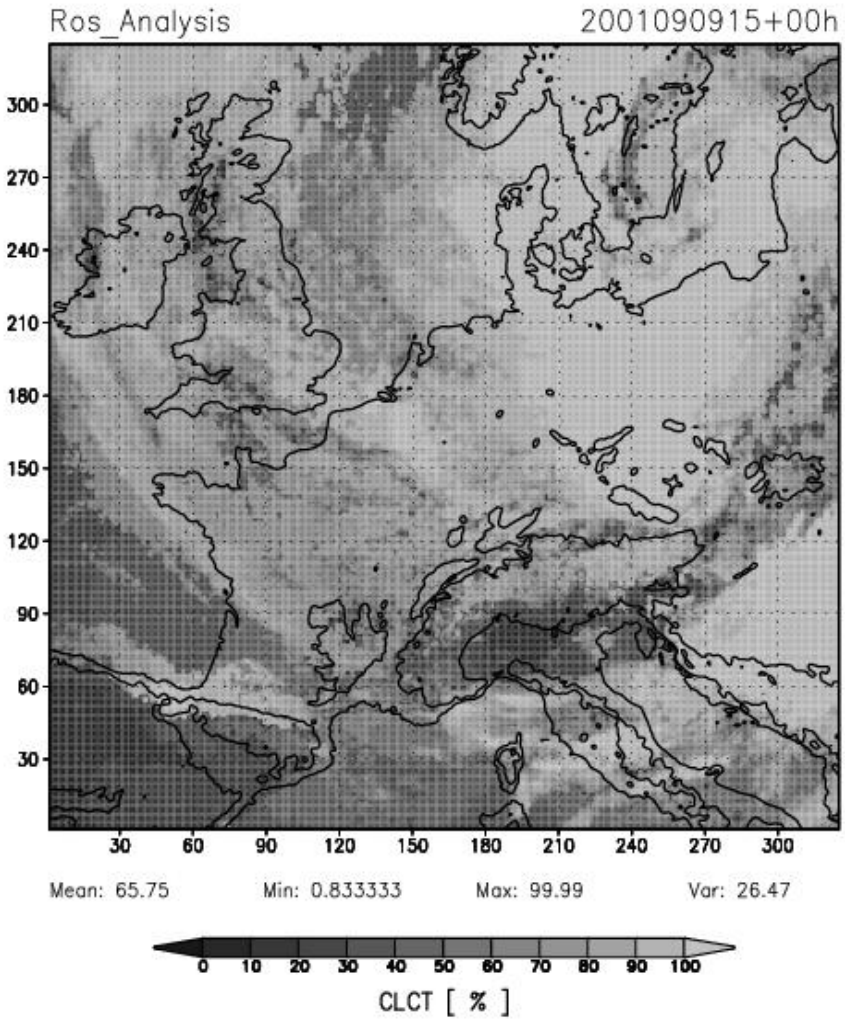
REF



+GPS

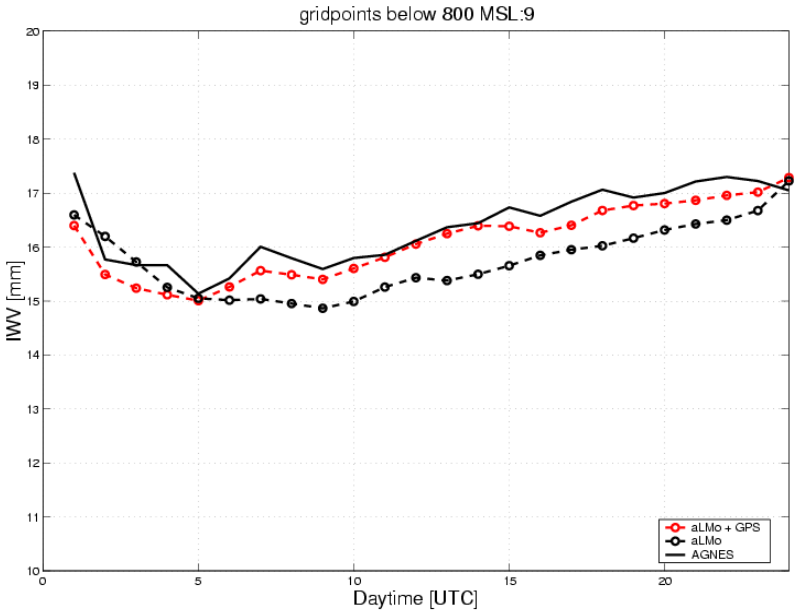


OBS

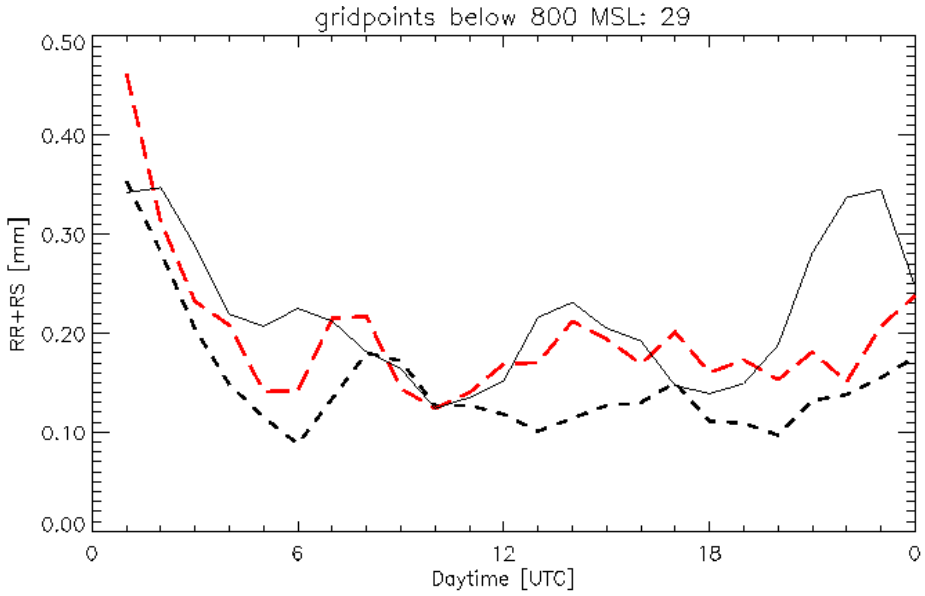


A00 : daily cycle Switzerland

IWV



RR



********** REF **********

Contingency tables of LM /ANETZ−precipitation

Score: Bias : below 800 m

threshold [mm/6h] at:	0.1	2.0	10.0
0h.. 6h	102.9	69.9	110.0
6h..12h	84.8	92.3	33.3
12h..18h	111.2	76.0	50.0
18h..24h	89.2	58.3	9.1
6h..24h	93.5	73.3	20.6

********** + GPS **********

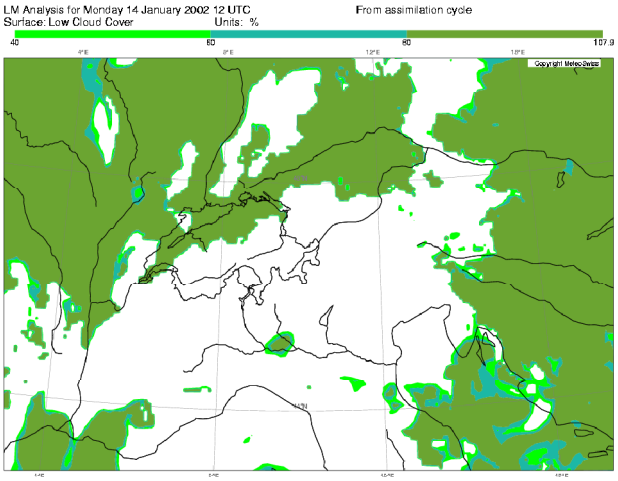
Contingency tables of LM /ANETZ−precipitation

Score: Bias : below 800 m

threshold [mm/6h] at:	0.1	2.0	10.0
0h.. 6h	84.8	89.3	240.0
6h..12h	101.4	106.2	100.0
12h..18h	140.8	113.3	66.7
18h..24h	105.4	66.7	27.3
6h..24h	113.4	92.4	47.1

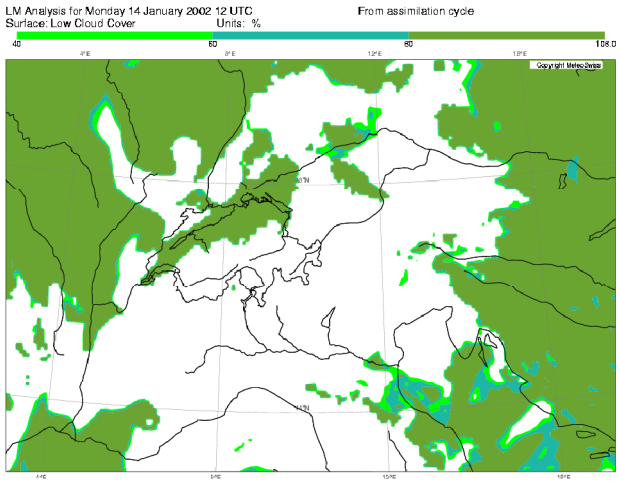
A02 and F02 low stratus : 14.I.2002 12 UTC

A02 : CLCl



MAGICS5.5 terra - tam Sat Jul 20 14:01:51 2002 S0a

A02 + GPS : CLCl



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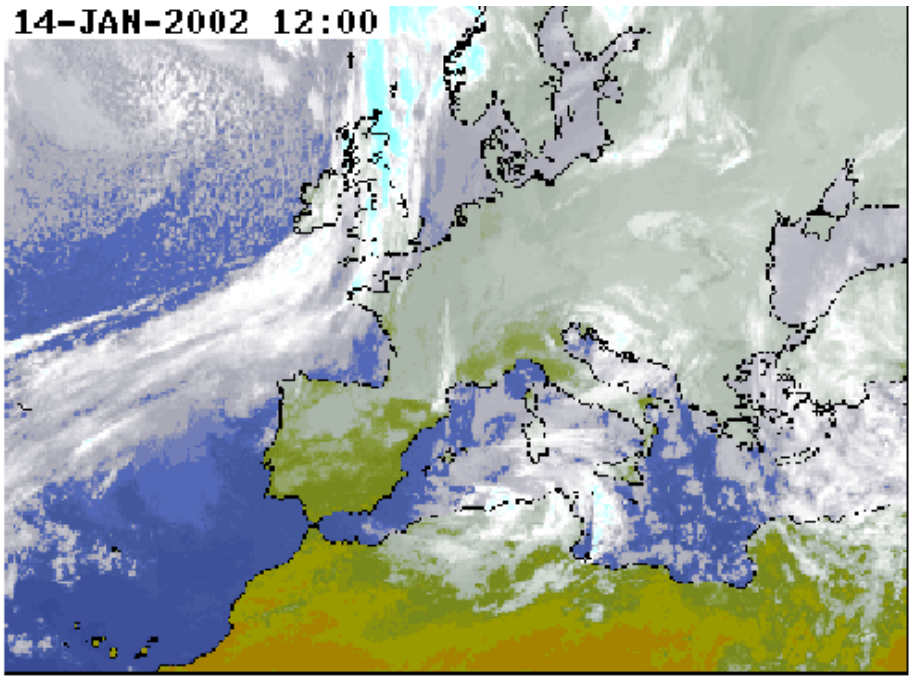
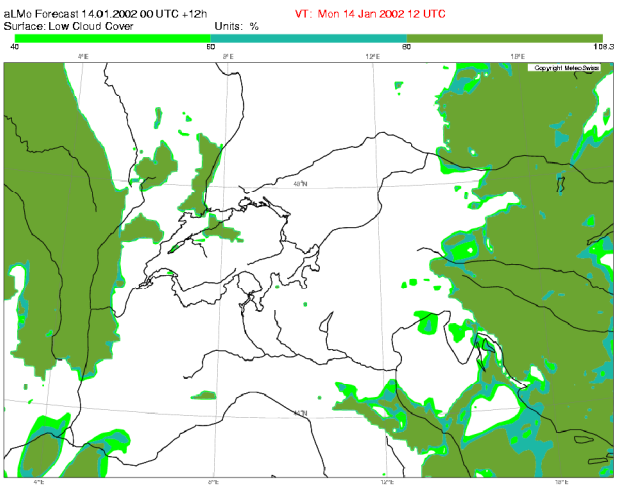
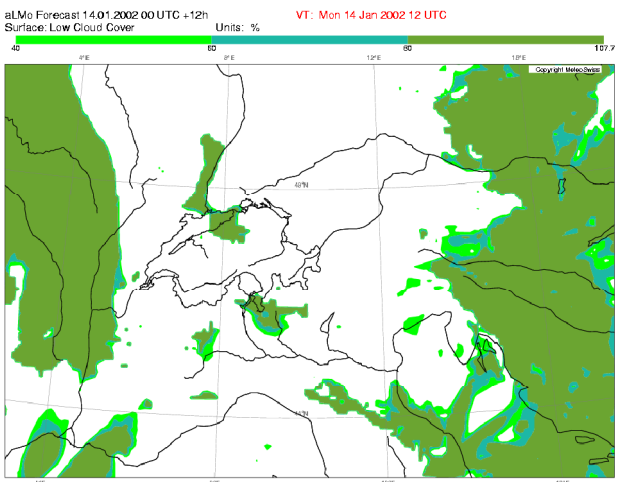


F02 : CLCl +12h



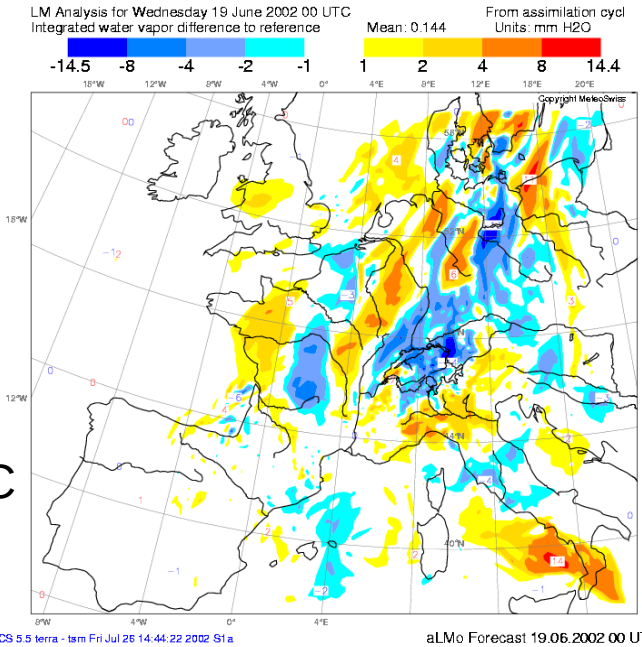
MAGICS5.5 terra - tam Thu Jul 25 17:36:12 2002 S0b

F02 + GPS : CLCl +12h



AGICS5.5 terra - tam Sat Jul 27 16:30:21 2002 S1b

A03 and F03 : 19.VI.2002 00,12 and 24 UTC



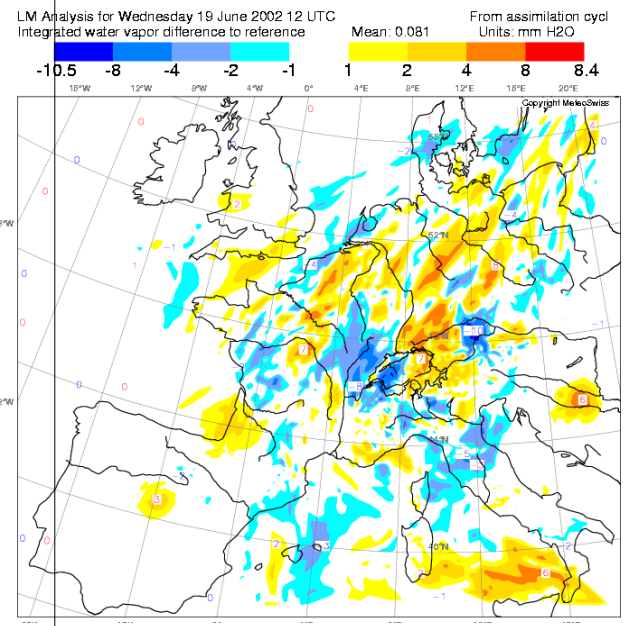
MAGICS 5.5 terra - tsm Fri Jul 26 14:44:22 2002 S1a

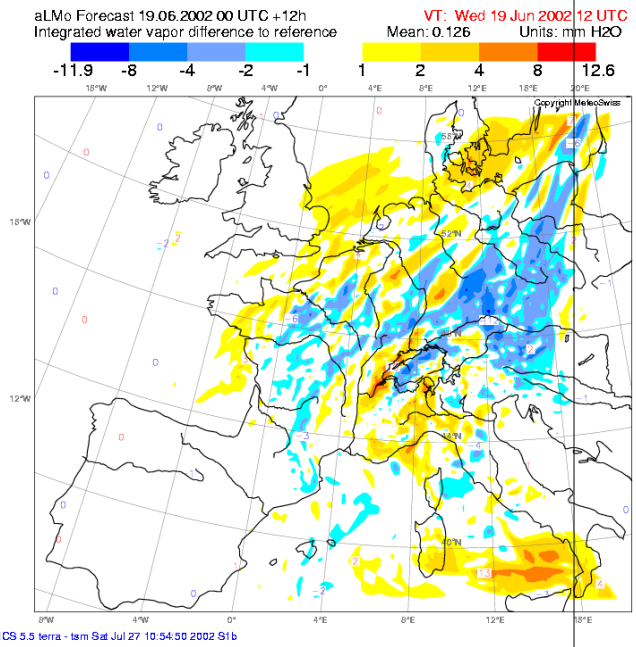
A03 : IWV diff

24 UTC 12 UTC

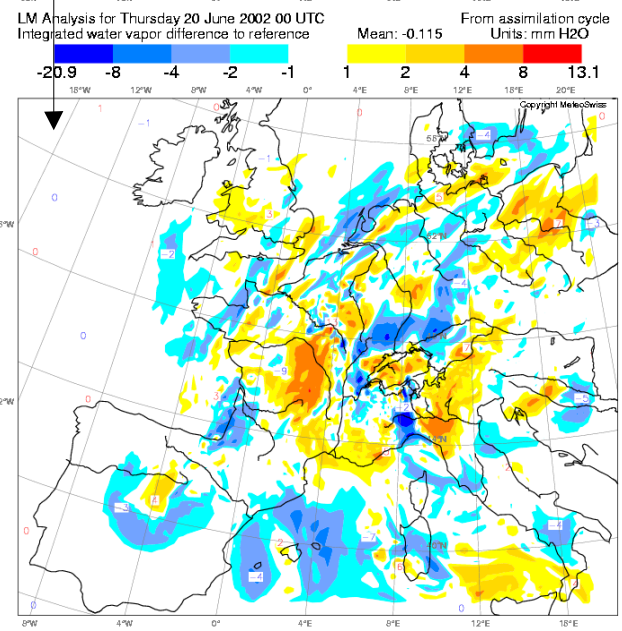
F03 : IWV diff

+12h +24h

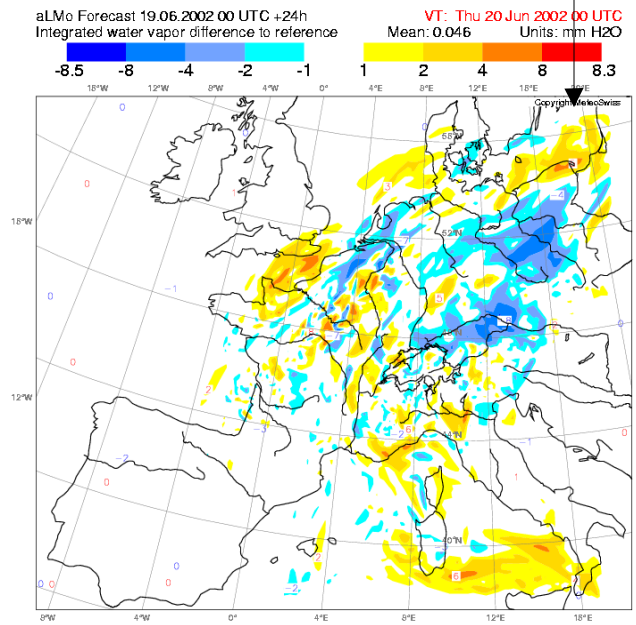




MAGICS 5.5 terra - tsm Sat Jul 27 10:54:50 2002 S1b



MAGICS 5.5 terra - tsm Fri Jul 26 17:41:08 2002 S1a



MAGICS 5.5 terra - tsm Sat Jul 27 11:18:31 2002 S1b

Summary

- Despite the large gap in the GPS network (Spain, Italy) strong impact on the assimilation and forecast
- Tendency to increase the IWV in day time, better daily cycle over Switzerland
- Observed positive impact on precipitation and cloud cover in the preliminary experiment (A00)
- Possibly negative impact on winter low level cloud

Outlook:

- Detailed evaluation of summer convection experiment (AFF03)
- Investigation of the vertical profiles for winter inversion experiment
- Statistical evaluation of the three experiments
- Use GPS gradients for modulation of the shape of the model structure function
- Test the impact of GPS slant path
- Evaluate ways for obtaining profiles (GPS tomography in combination with other observations)