

Impact of radar reflectivity assimilation in KENDA: the Italian experiment

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Introduction

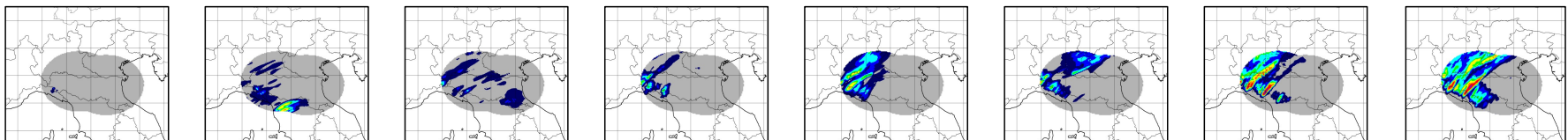
The ODIM HDF5 reader has been implemented in the Radar Forward Operator

The KENDA assimilation cycle has been implemented at CINECA on the basis of the BACY scripts

It was already implemented at ECMWF under SMS

The system has been tested on two flood cases; the Parma case is shown here

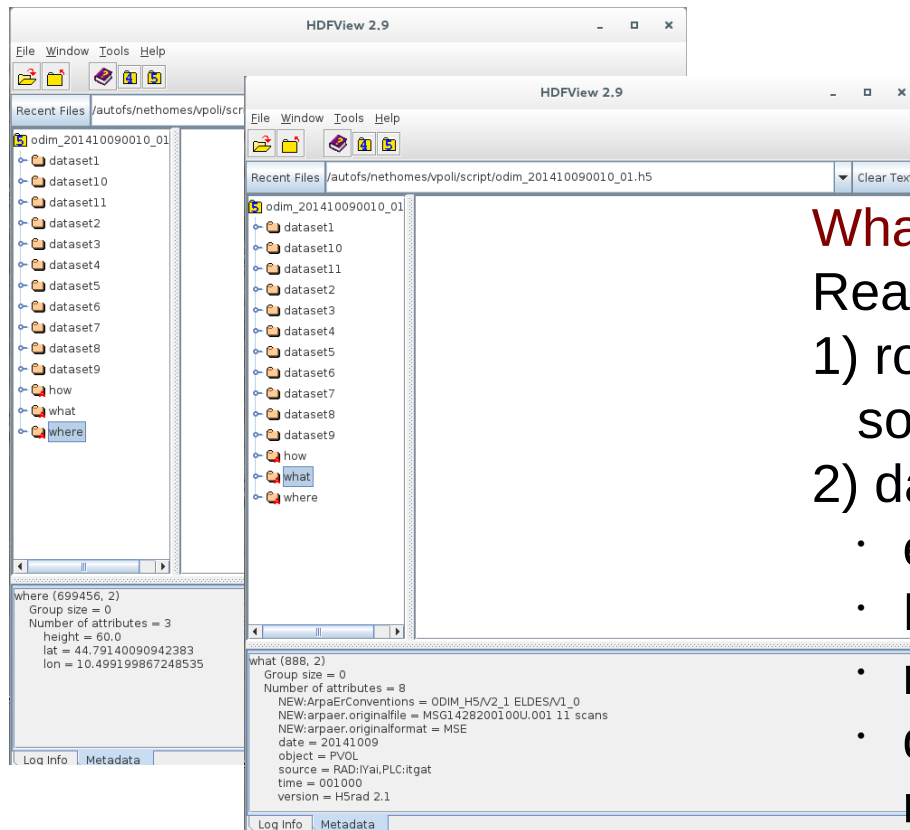
Preliminary results obtained by assimilating the two radars of ARPA-SIMC will be shown



What's new in the radar forward operator (EMVORADO)?

An ODIM HDF5 reader has been implemented in the Radar Forward Operator

The only additional requirement is the HDF5 fortran library installed
(tests were made with the release 1.8.13)



What the HDF5 reader does?

Read attributes recursively in the structure:

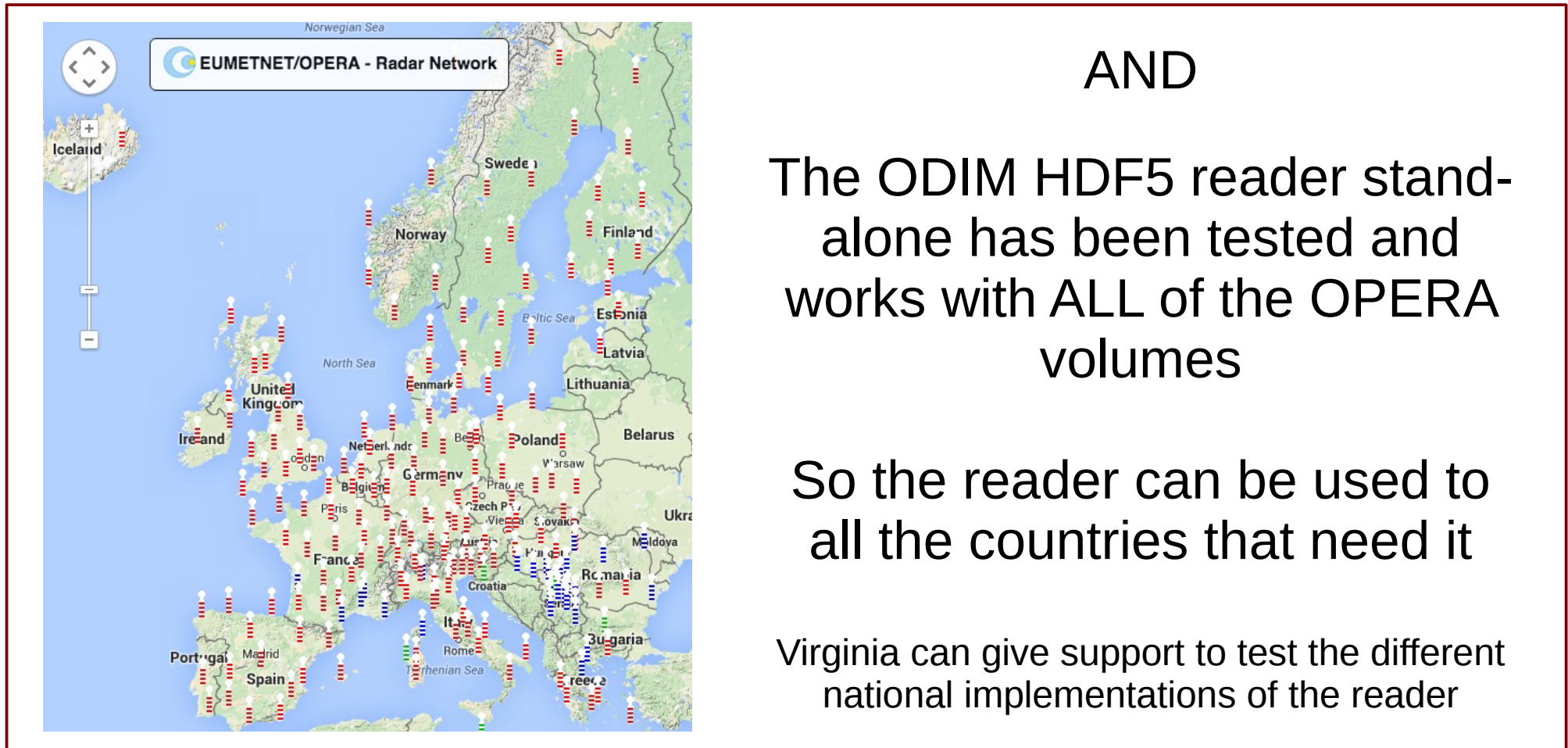
- 1) root attributes: lat, lon, height, date, time, source
- 2) datasets attributes:
 - elevation angle (elangle)
 - Number of range bins in each ray (nbins)
 - number of azimuth in the object (nrays)
 - distance in meters between two successive range bins (rscale)

Read datasets from all elevations

Which countries can use the ODIM HDF5 reader?

In the radar forward operator each country has a distinct management.

At the moment the reader has been completed for Italy



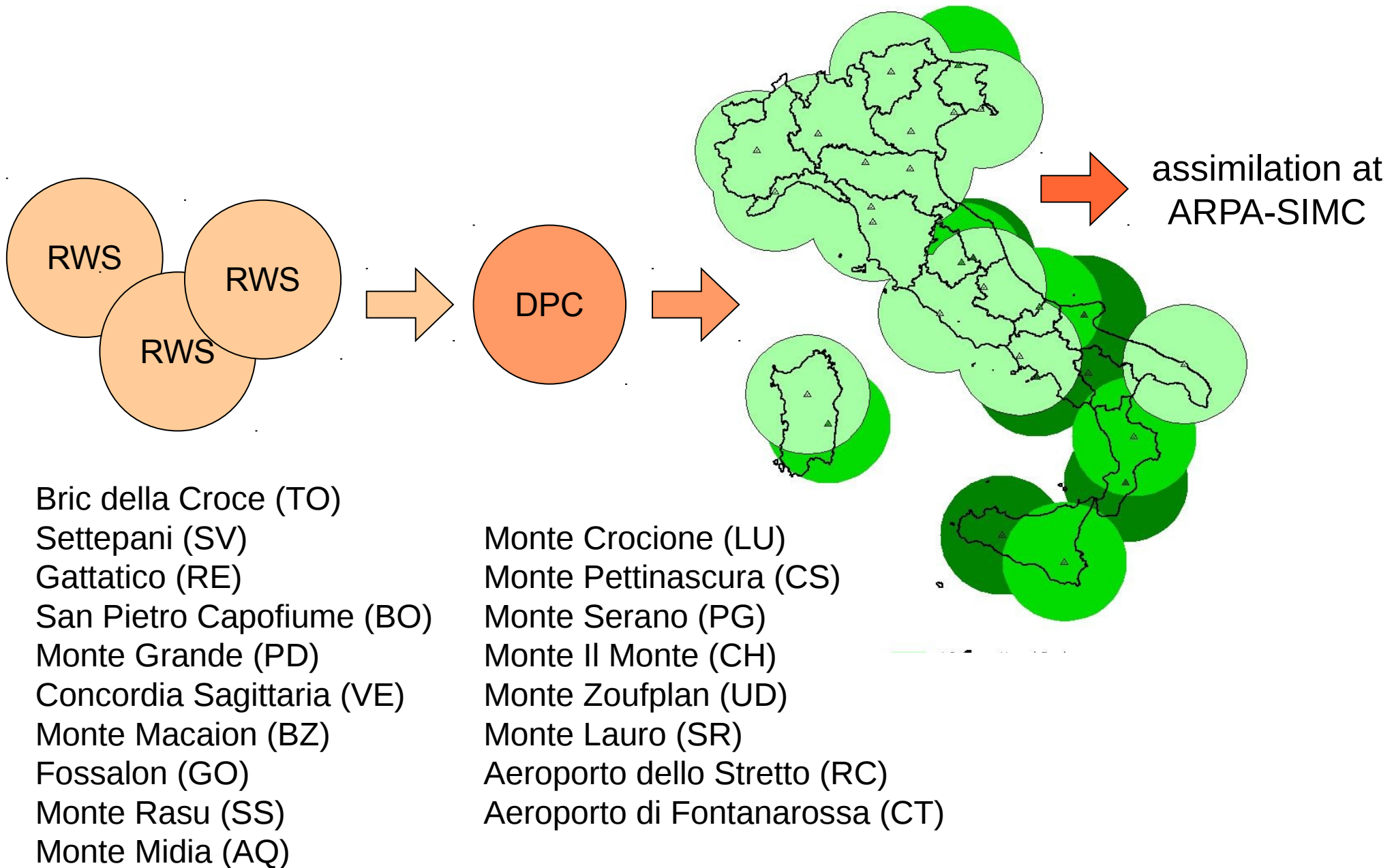
AND

The ODIM HDF5 reader stand-alone has been tested and works with ALL of the OPERA volumes

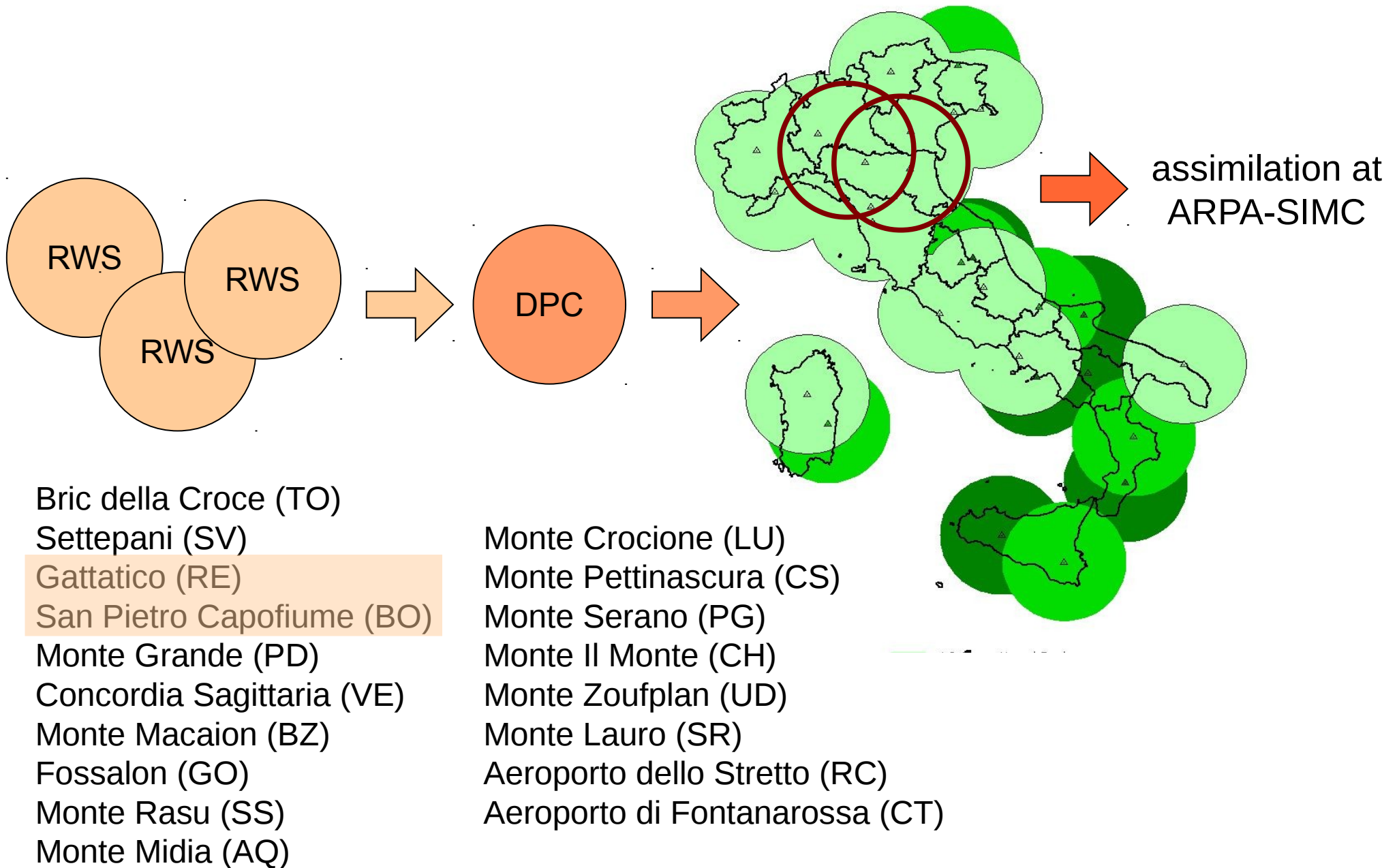
So the reader can be used to all the countries that need it

Virginia can give support to test the different national implementations of the reader

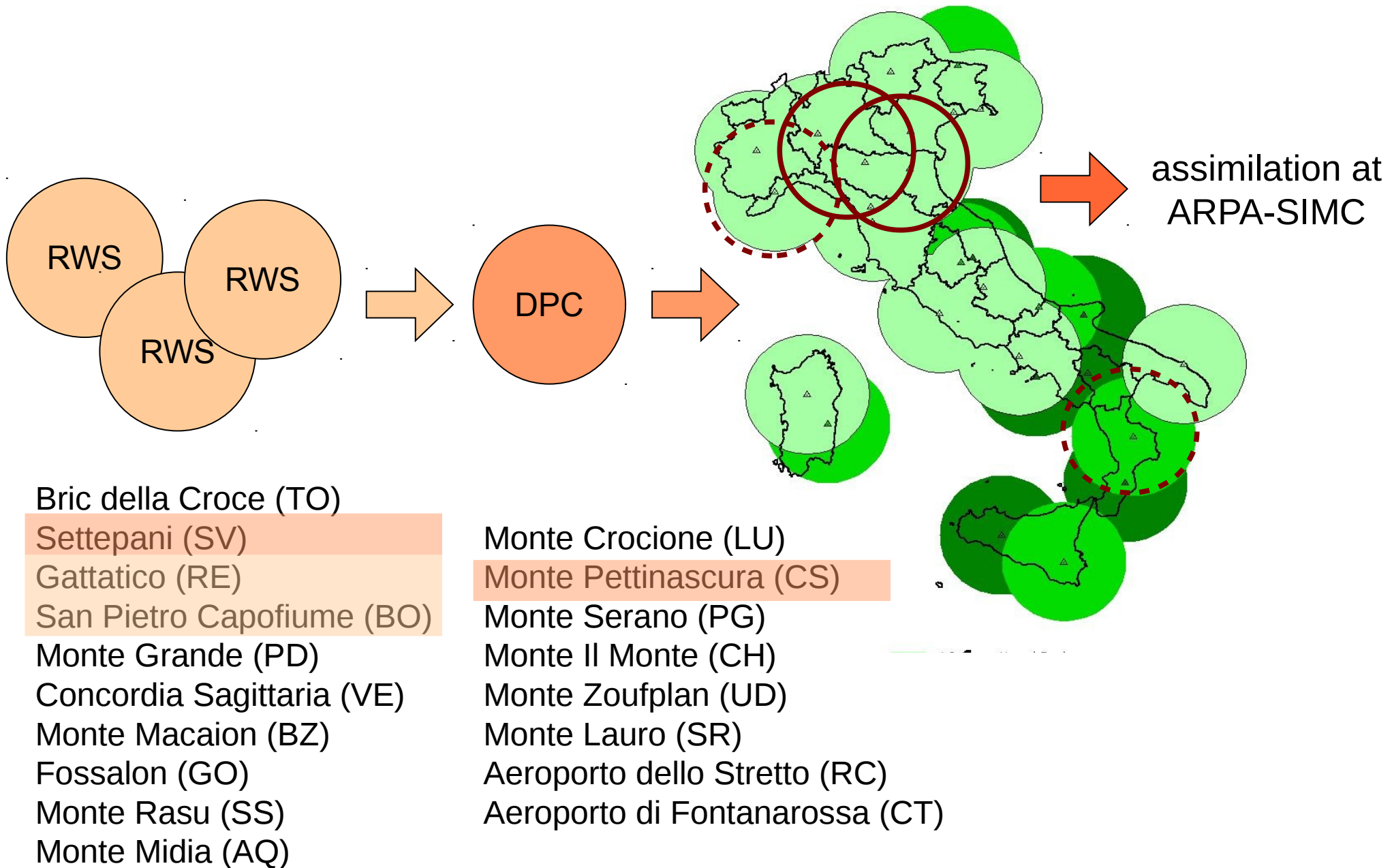
The Italian radar network



Polar volumes used in assimilation: present

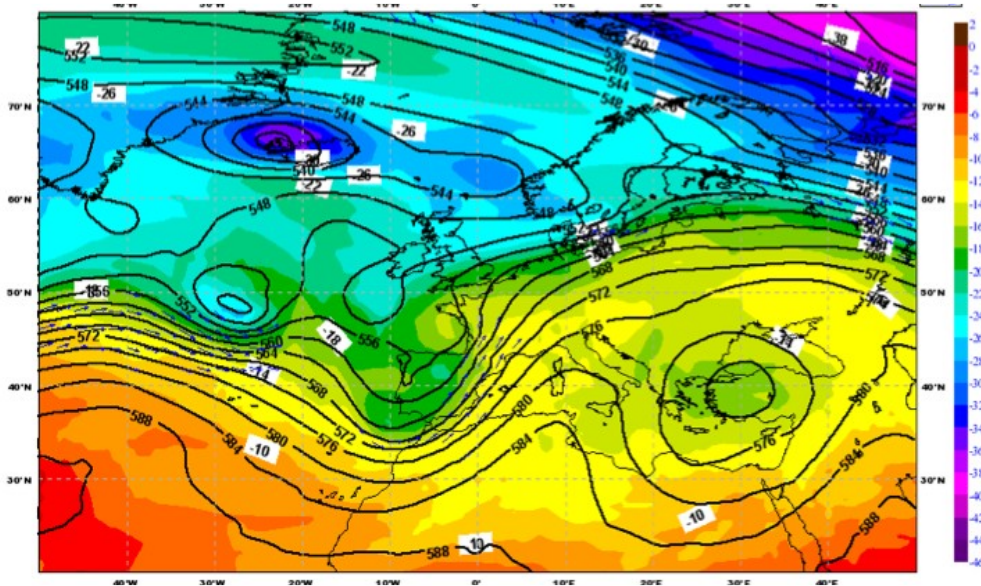


Polar volumes used in assimilation: near future

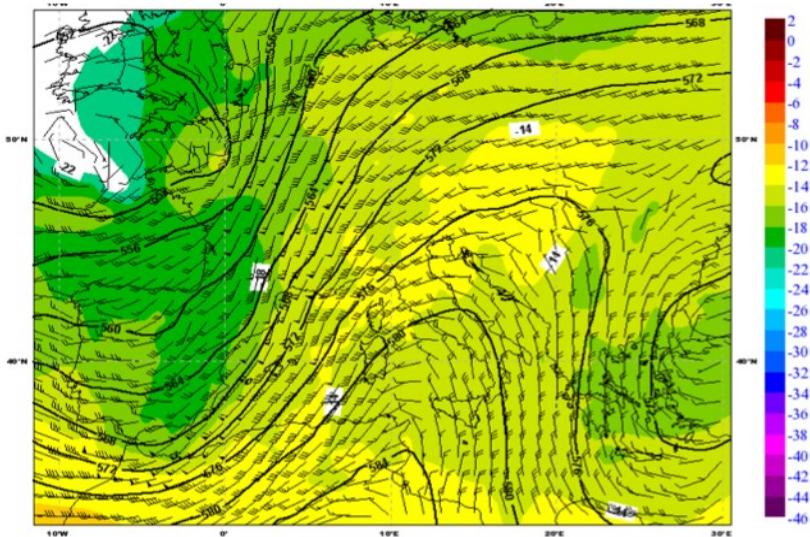


Case study: Parma flood

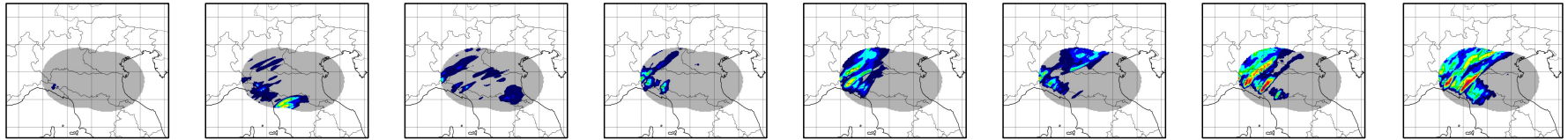
12/10/2014 12 UTC



13/10/2014 00 UTC



Case study set up



12/10/2014
12 UTC

13/10/2014
00 UTC

13/10/2014
12 UTC

CONV

Cosmo 2.8 km, 50 levels

CONV+RADAR

Cosmo 2.8 km, 50 levels

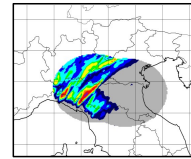
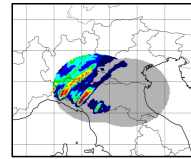
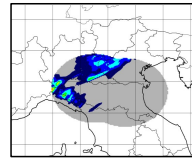
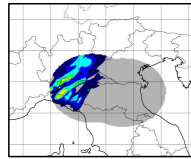
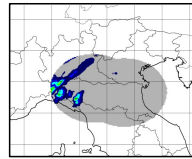
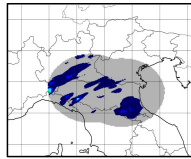
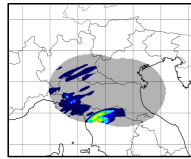
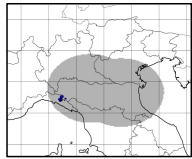
Radar forward operator:

- No-reflectivity: set all values below 5 dBZ to 5 dBZ
- Superobbing: 20 km

KENDA

- 3 hourly cycle
- BCs from ECMWF ENS (also ICs for the cold start), 32 km horizontal resolution
- 20 members

After 24 hours...



12/10/2014
12 UTC

13/10/2014
00 UTC

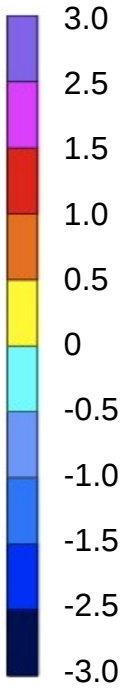
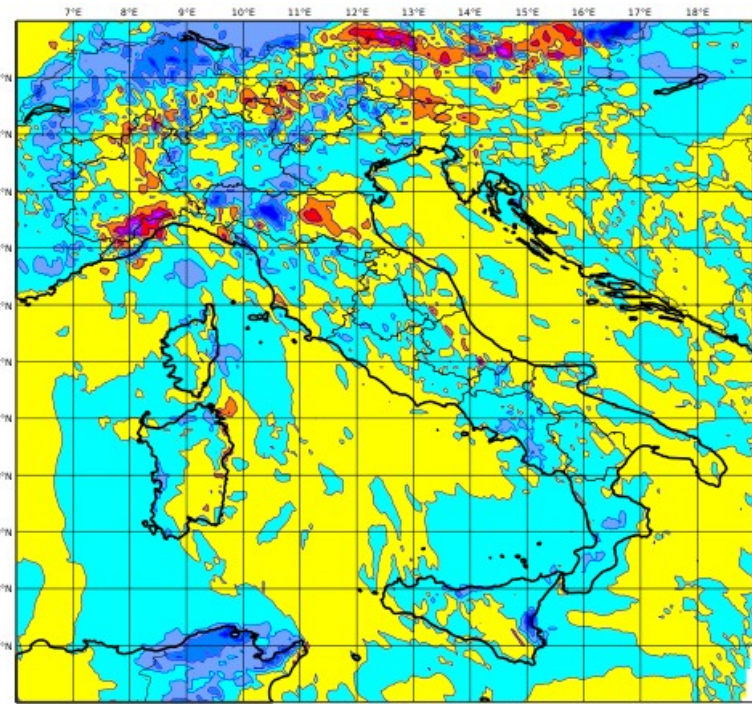
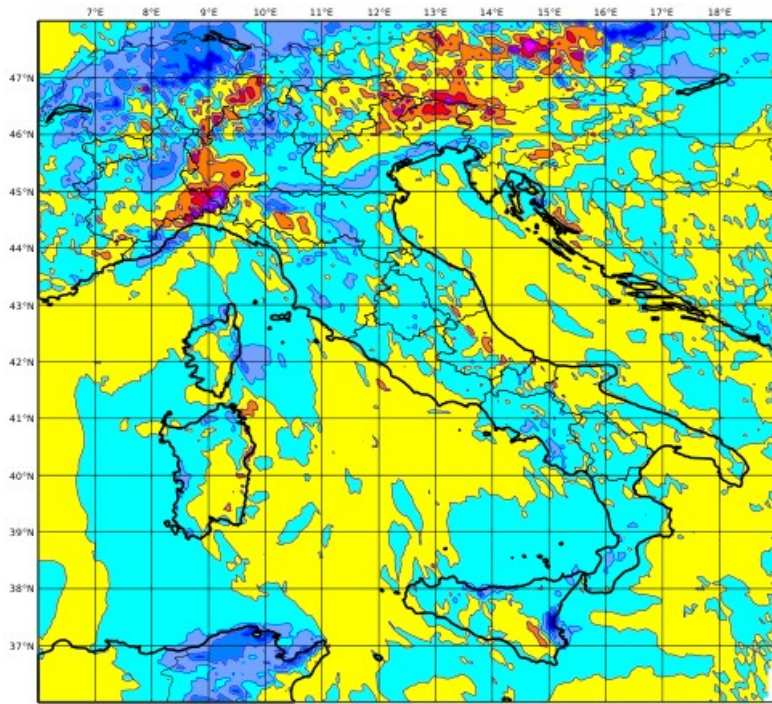
13/10/2014
12 UTC



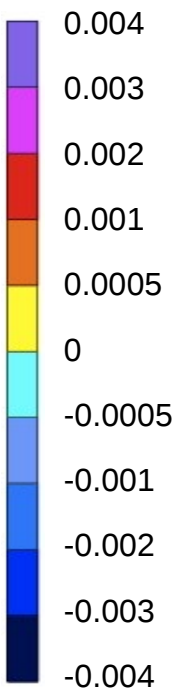
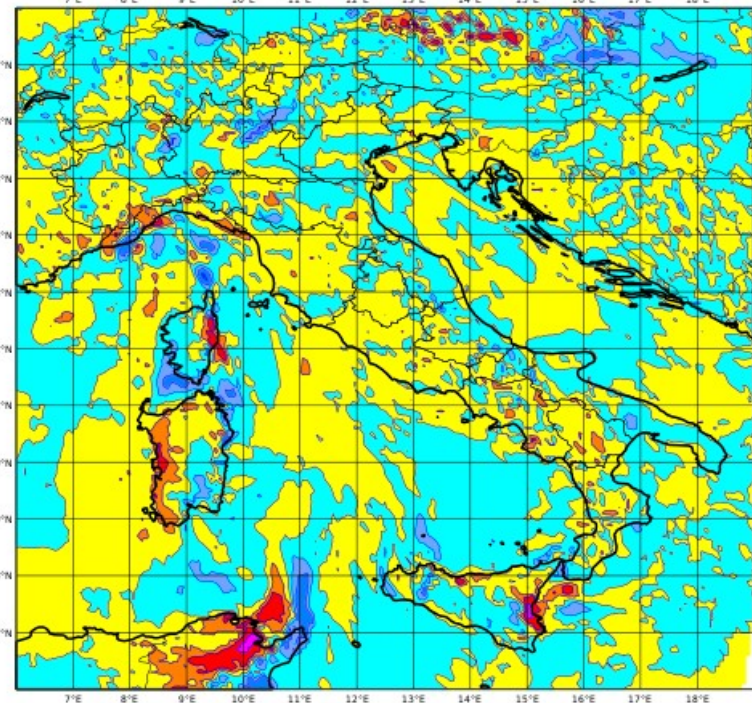
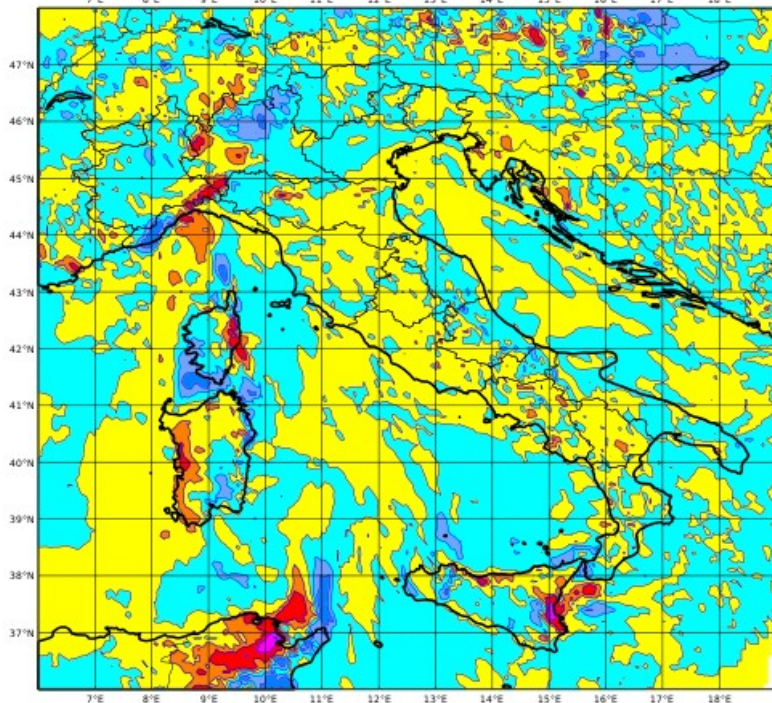
CONV. OBS

CONV. OBS + RADAR

T – level 50



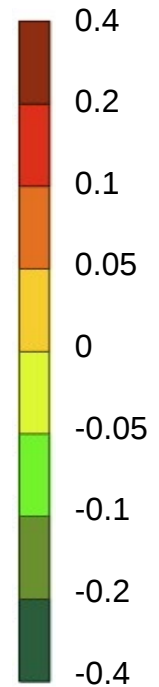
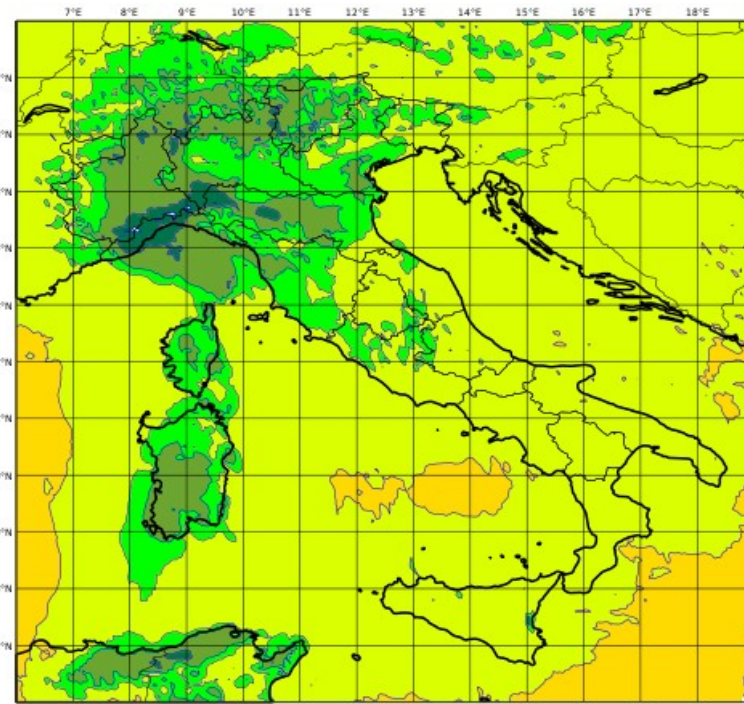
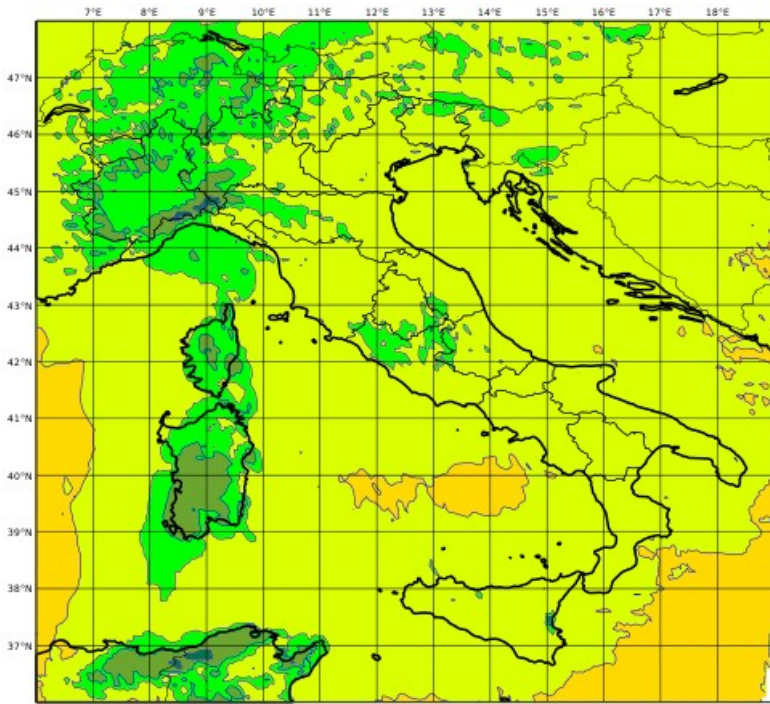
Q – level 50



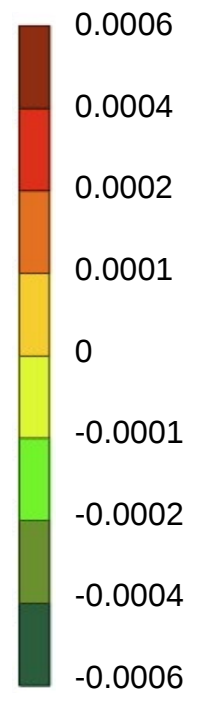
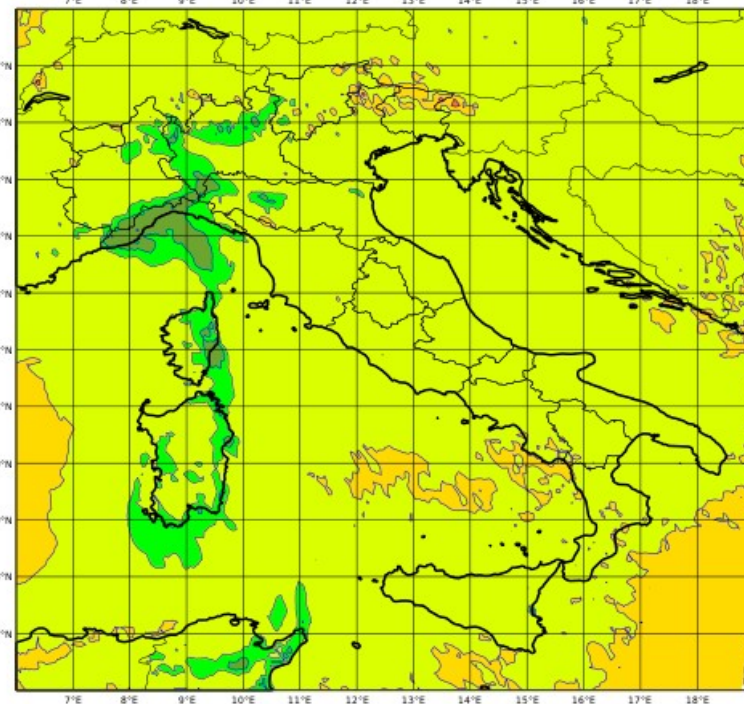
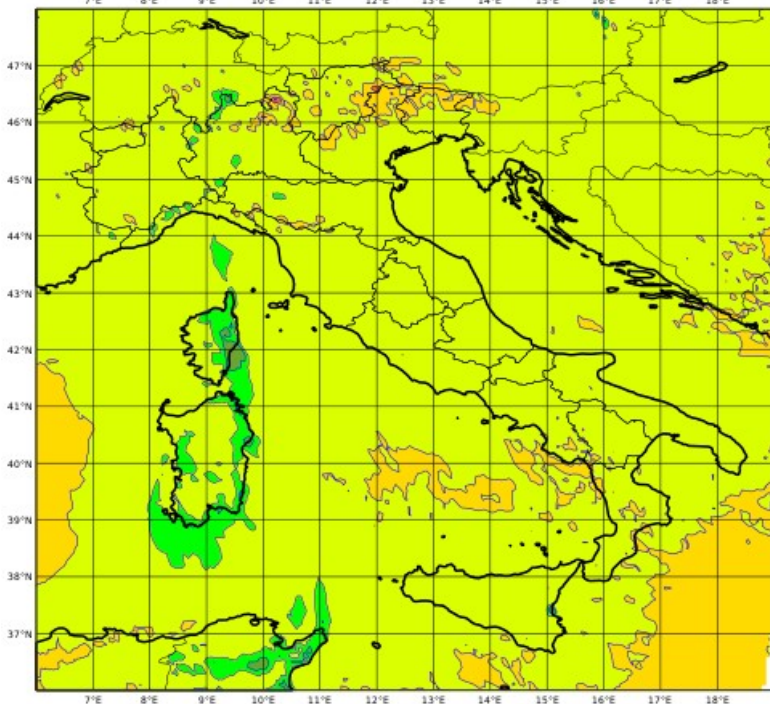
CONV. OBS

CONV. OBS + RADAR

T – level 50



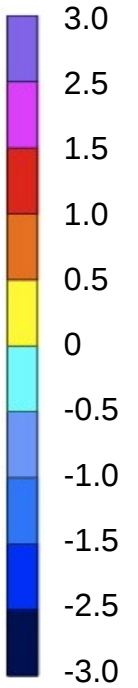
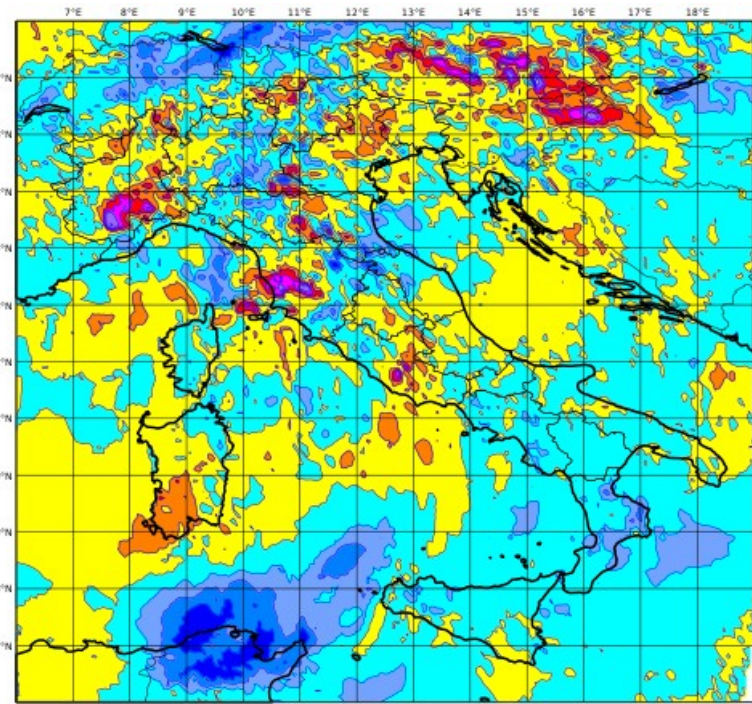
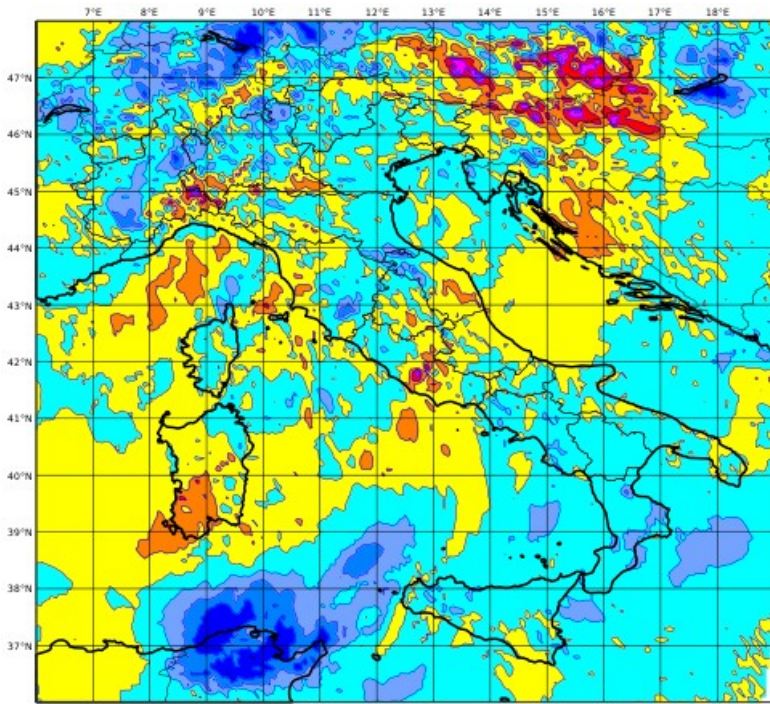
Q – level 50



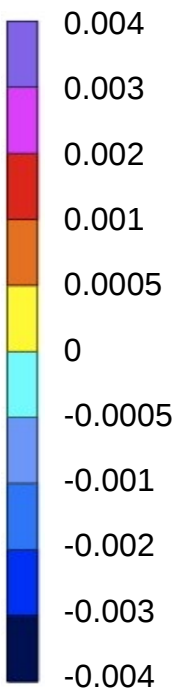
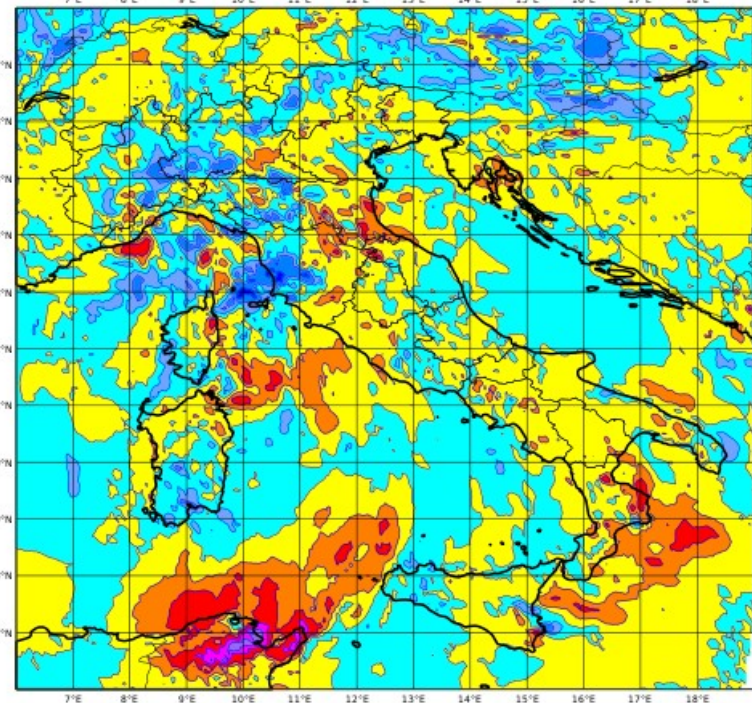
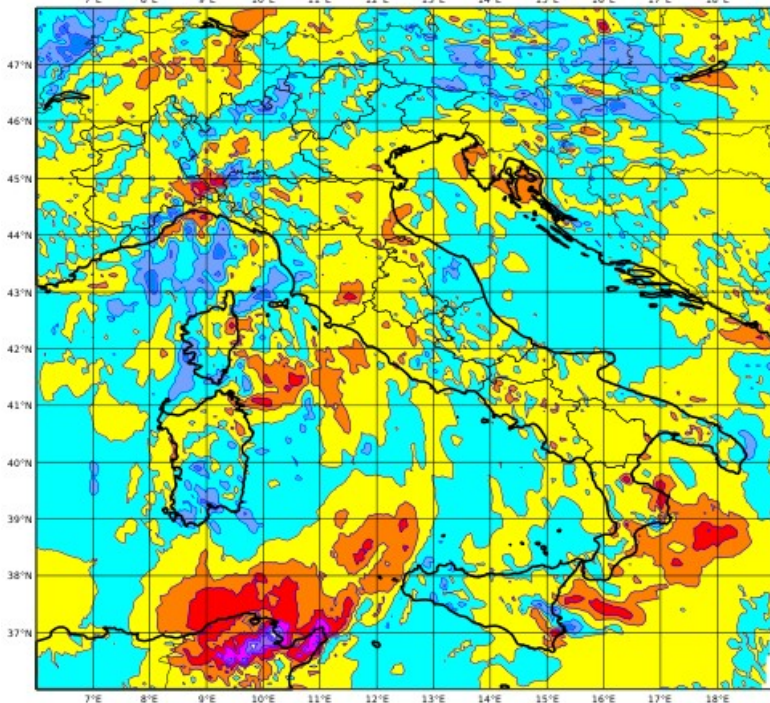
CONV. OBS

CONV. OBS + RADAR

T – level 40



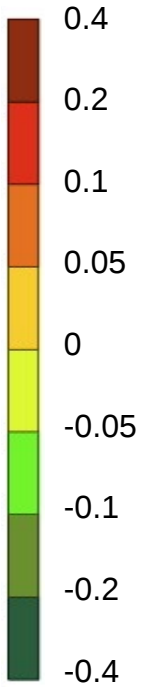
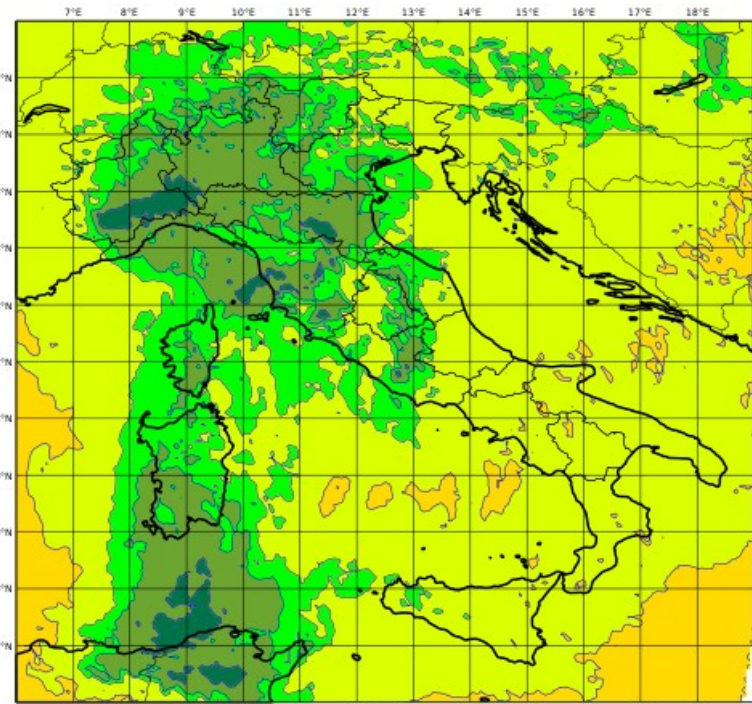
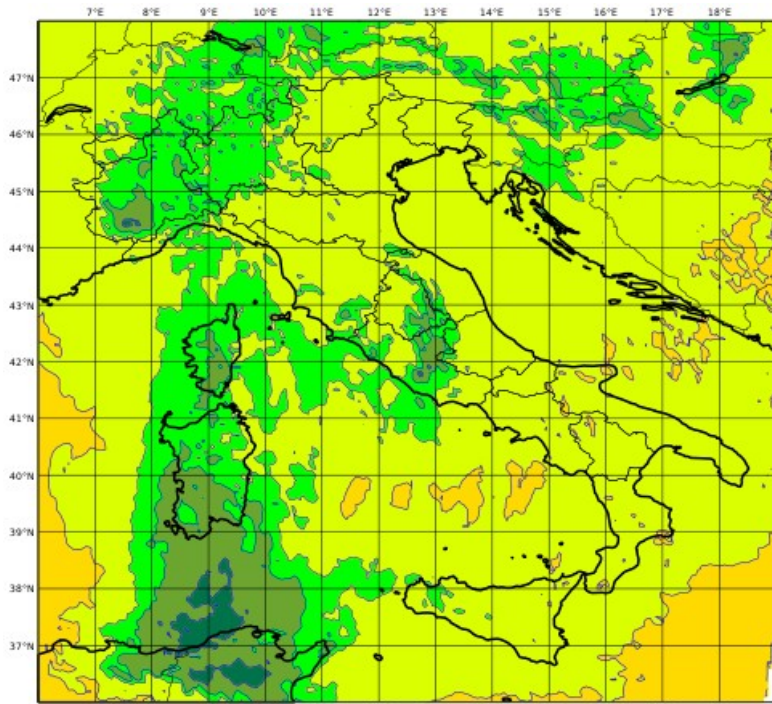
Q – level 40



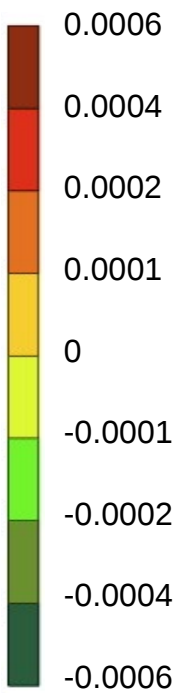
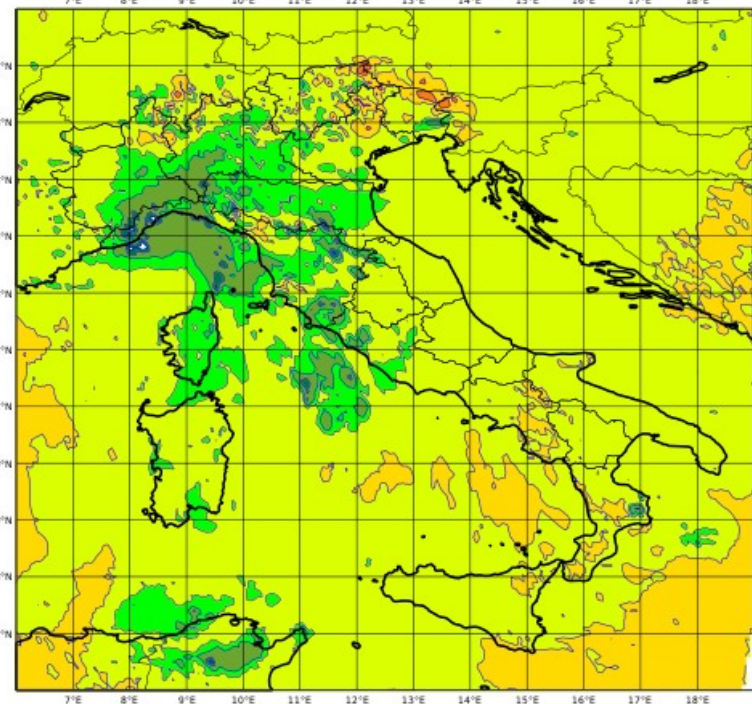
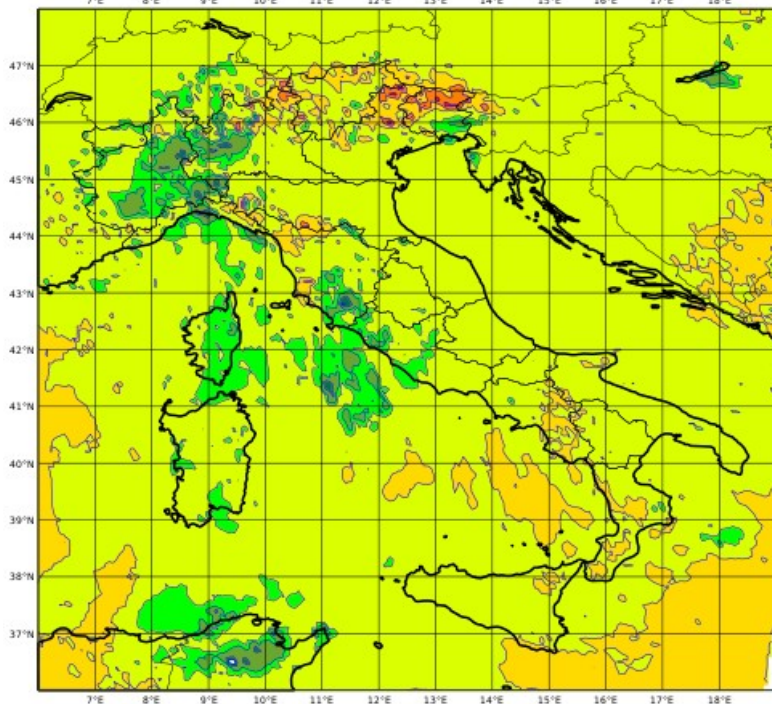
CONV. OBS

CONV. OBS + RADAR

T – level 40



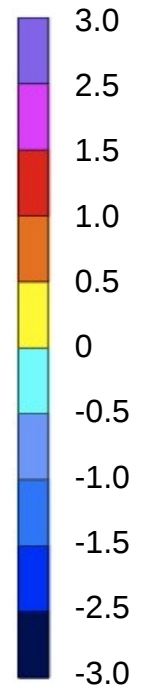
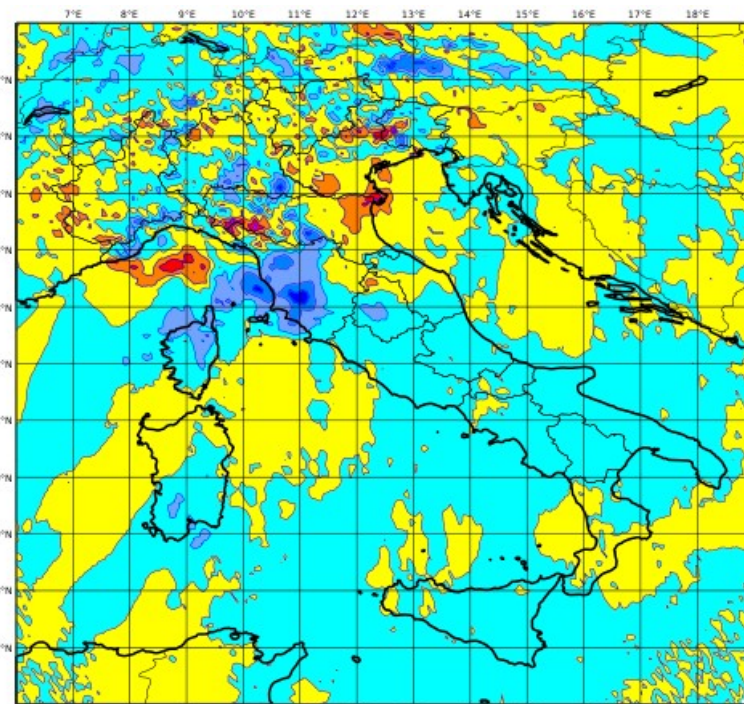
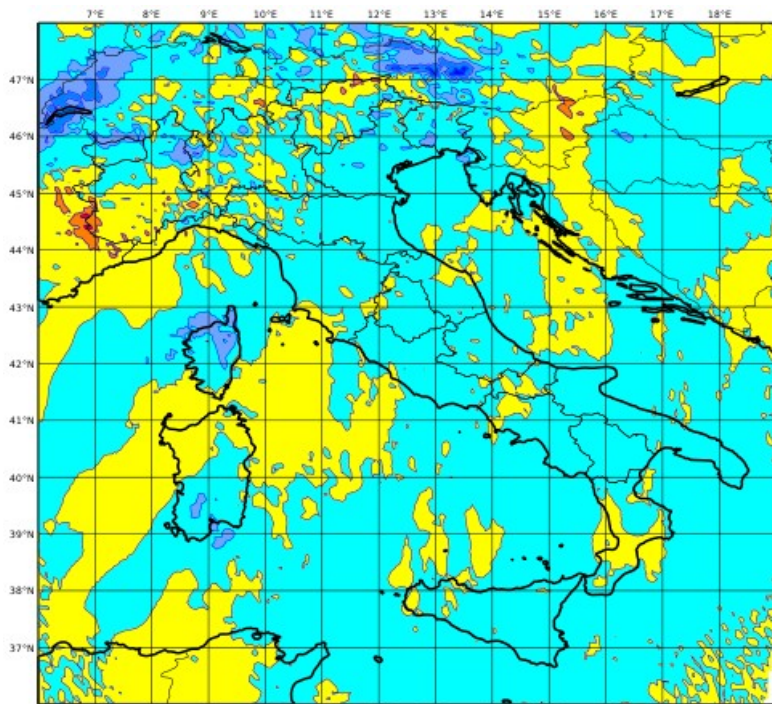
Q – level 40



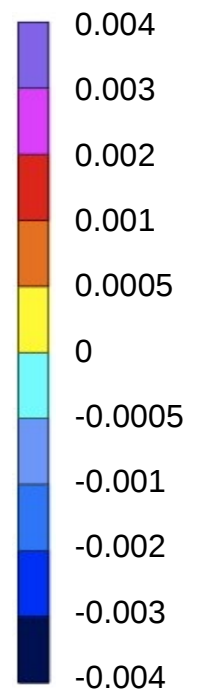
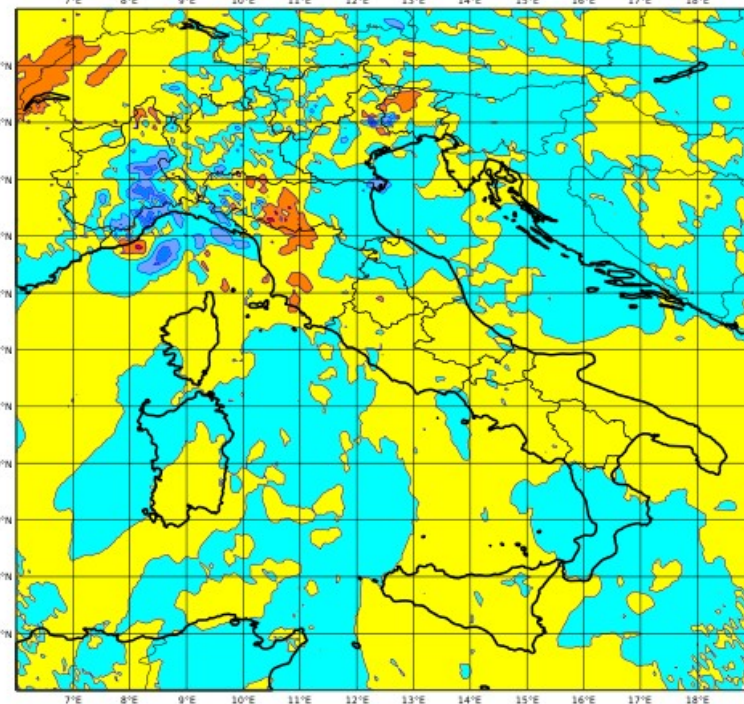
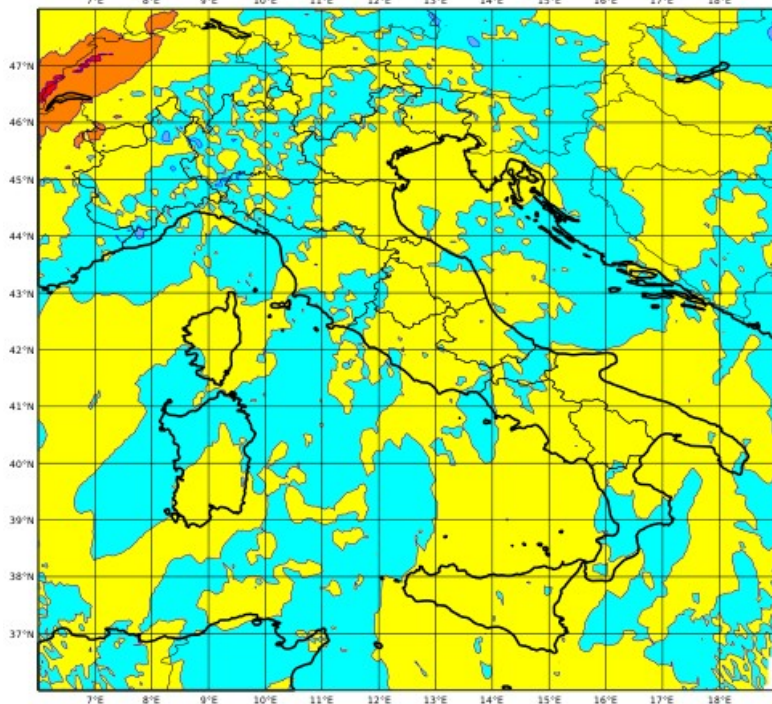
CONV. OBS

CONV. OBS + RADAR

T – level 30



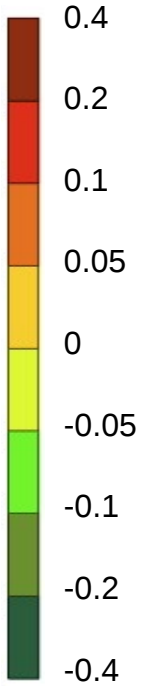
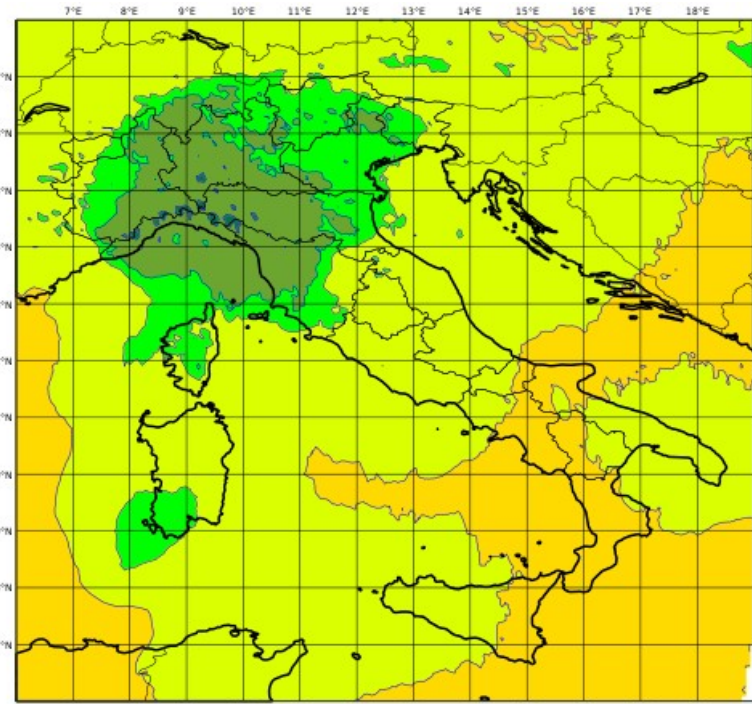
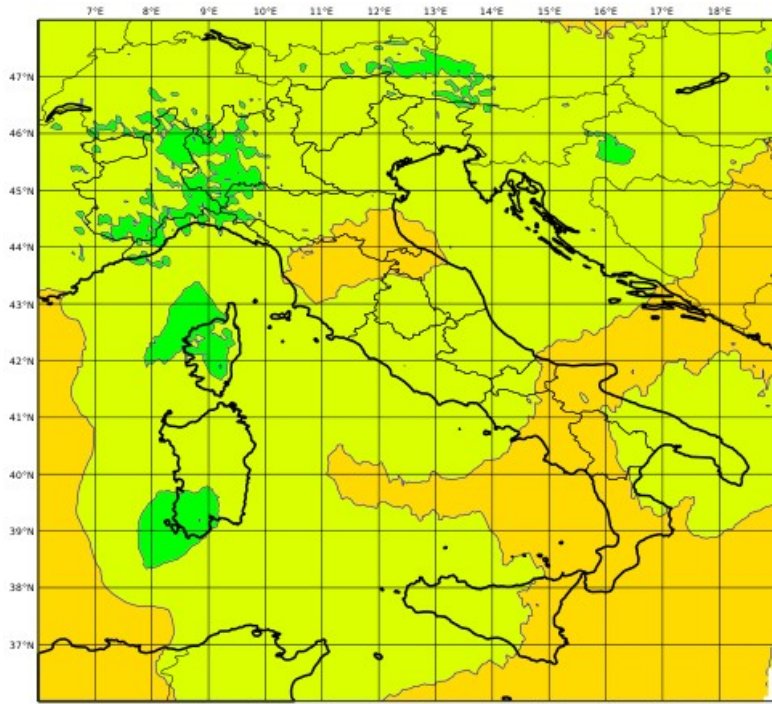
Q – level 30



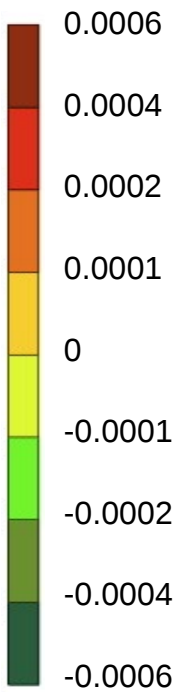
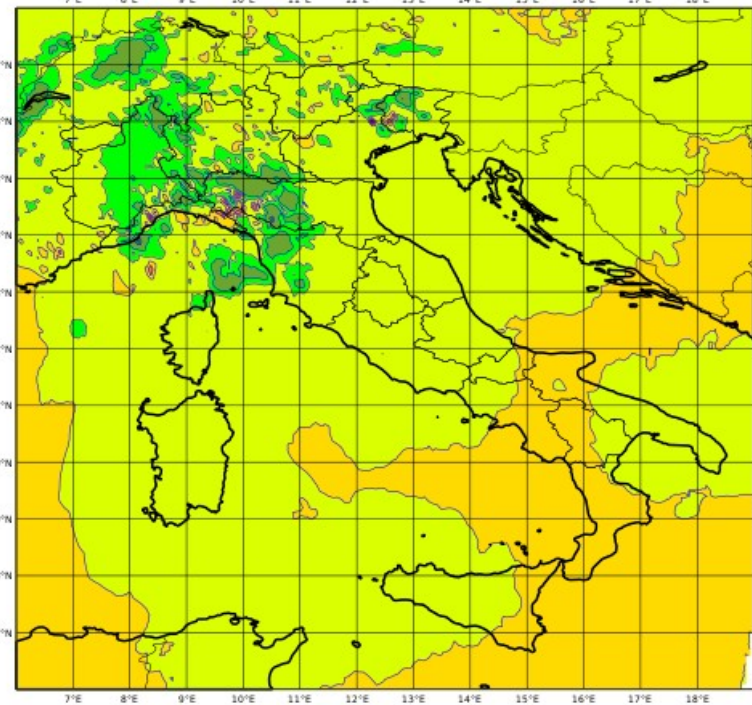
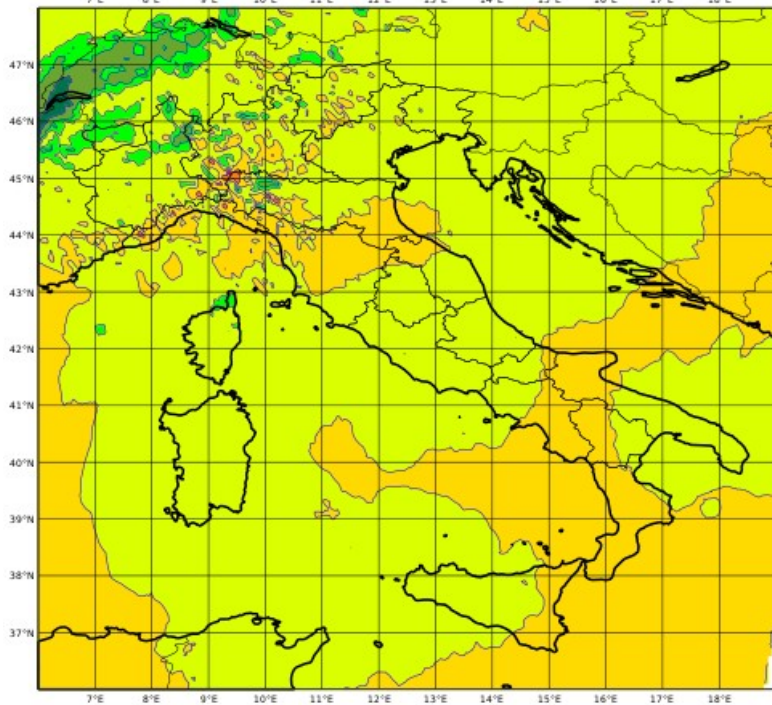
CONV. OBS

CONV. OBS + RADAR

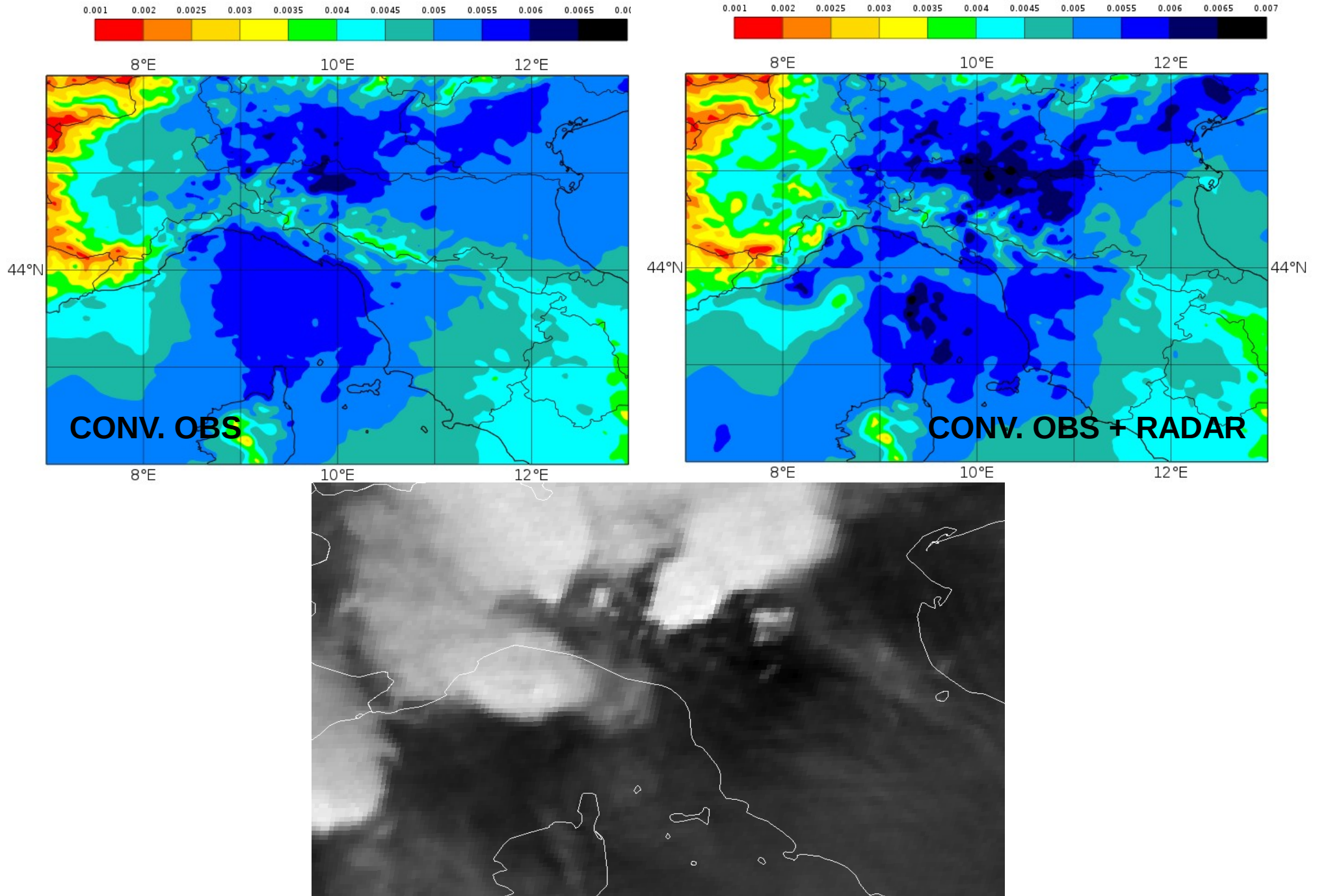
T – level 30



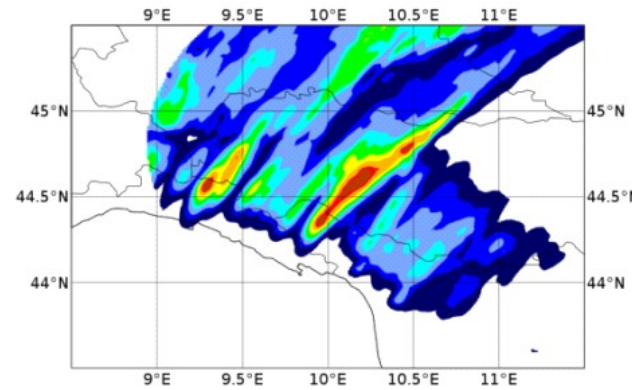
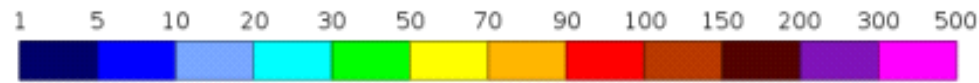
Q – level 30



Impact of radar assimilation in KENDA on the analysis (ens mean)

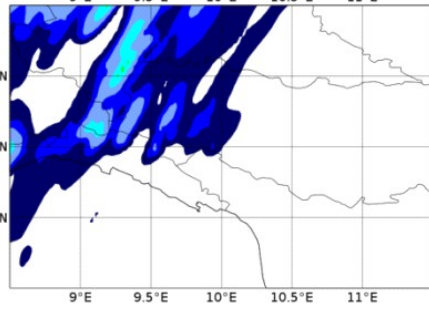
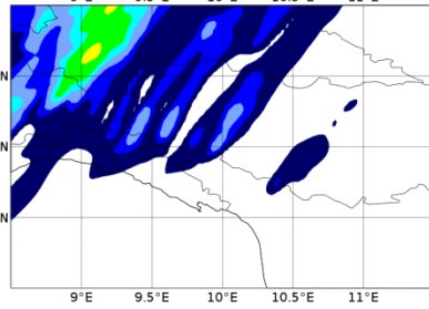
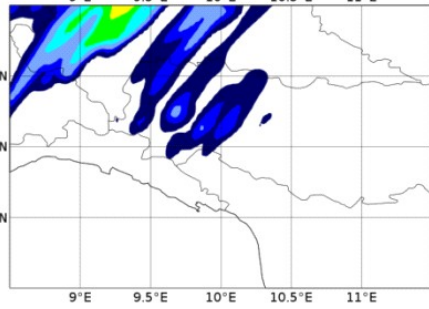
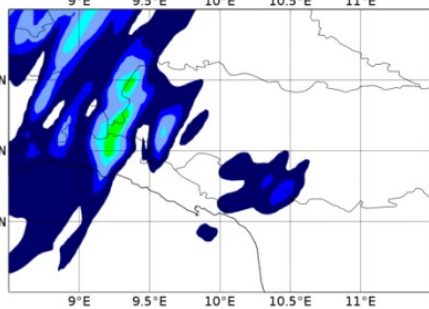
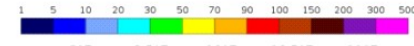


Impact of radar assimilation in KENDA on a +3 hour forecast



OBSERVED
PRECIPITATION
ESTIMATED BY
RADAR

CONV. OBS

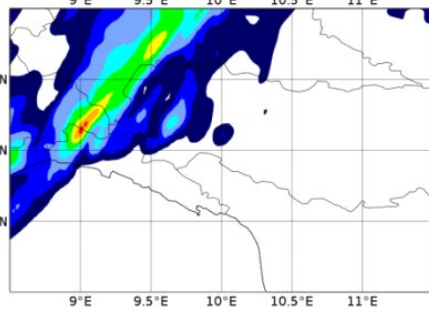
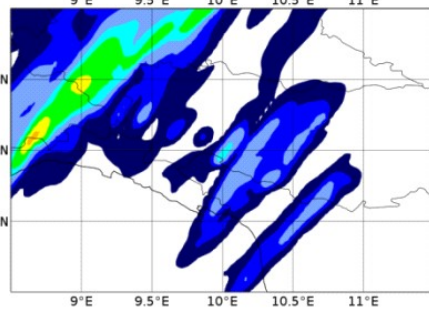
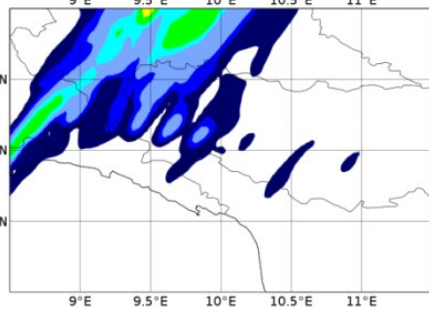
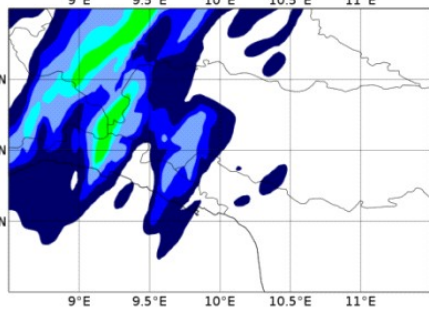


mem 3

mem 4

mem 5

mem 16



CONV. OBS + RADAR

Conclusions and future work

An ODIM HDF5 reader has been implemented in the Radar Forward Operator (and should be implemented for all of the countries that need it)

It was tested on a 24 hours long case study

The use of only two radar has an impact on the analysis

To do:

Code parallelization and optimization

Tests very soon with other radars from the Italian network

Forecast runs starting from KENDA analysis to understand the impact over precipitation field

Statistical analysis of KENDA outputs: CONV vs. CONV+RADAR

Level	Height (m)	Pressure (hPa)
50	10	1000
40	800	900
30	3000	670
20	7000	400
10	13500	150
1	21500	35

RFO namelist

```
&RADARSIM_PARAMS  
  ldebug_radsim=.true.,  
  lout_geom=.false.,  
  louttradwind=.false.,  
  loutdbz=.true.,  
  lqc_flag=.false.,  
  itype_refl_glob=3,  
  lextdbz=.false.,  
  llookup_mie=.false.,  
  lfall=.false.,  
  lonline=.false.,  
  lside=.false.,  
  lsmooth=.false.,  
  lweightdbz=.false.,  
  lascii_output=.false.,  
  lascii_as_fortran_binary=.false.,  
  lfdbk_output=.true.,  
  lreadmeta_from_netcdf=.true.,  
  lequal_azi_alldatasets=.true.,  
  itype_supobing=1,  
  ...  
/
```

KENDA namelist

lh = 80.0 ! (50)horizontal localisation length scale (km)
lv = 0.3 ! (0.2)vertical localisation length scale (ln p)(0.3/10.0)

adap_rho = F !adapt. rho infl (F/T)
adap_R = T ! use adap. R-corr. (local, ens space)

!=====

! RADAR observation operator

!=====

&RADAR_OBS

use_refl = 11 ! (11=active) 4=notused, 7=passive radar reflectivity usage flag

use_radvel = 4 ! (11=active) 4=notused radial velocity usage flag

! iprintout = 0 ! (0=no) steering of printout

! split_rprt = F ! (T) create separate record for each radar observation

! join_rprt = F ! (T) join separate records before statistics output

! dealias_fg = T ! (T) dealias radial wind (by first guess)

! chk_alias = 2. ! (2.) check dealiasing (compare to spread)

! ofg_alias = 0.2 ! (0.7) check dealiasing (compare to o-fg)

/

!=====

! RULES for obs

!=====

&RULES

comment = 'specific parameters for RADAR'

type = 1024 ! modtype RADAR

o%v_loc = 0.3

o%h_loc = 16.0

!! uv%ekf_pass = 1

/