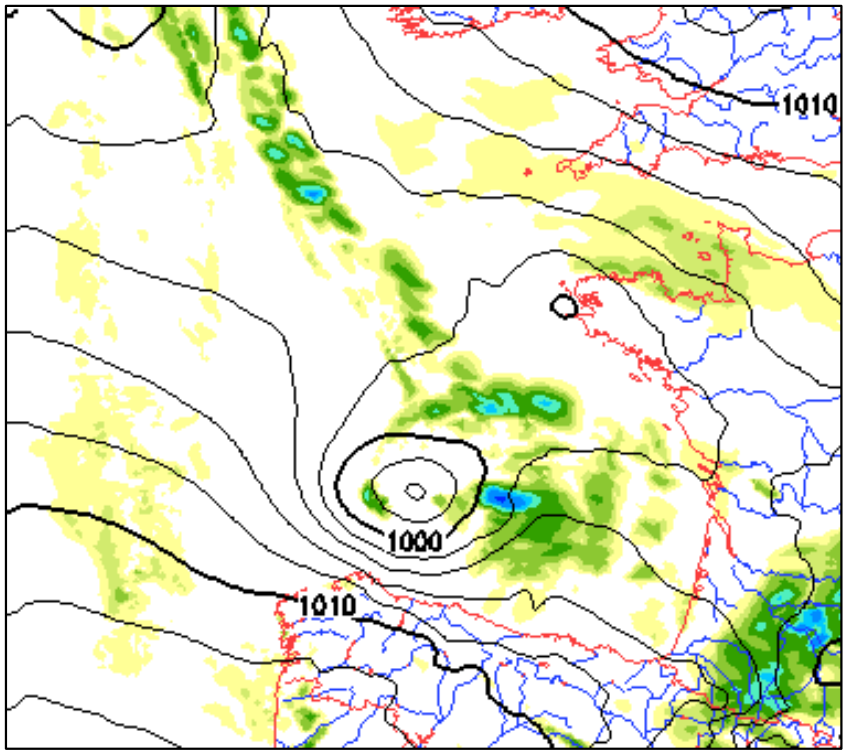
quality control of surface pressure p_s :

Deutscher Wetterdienst

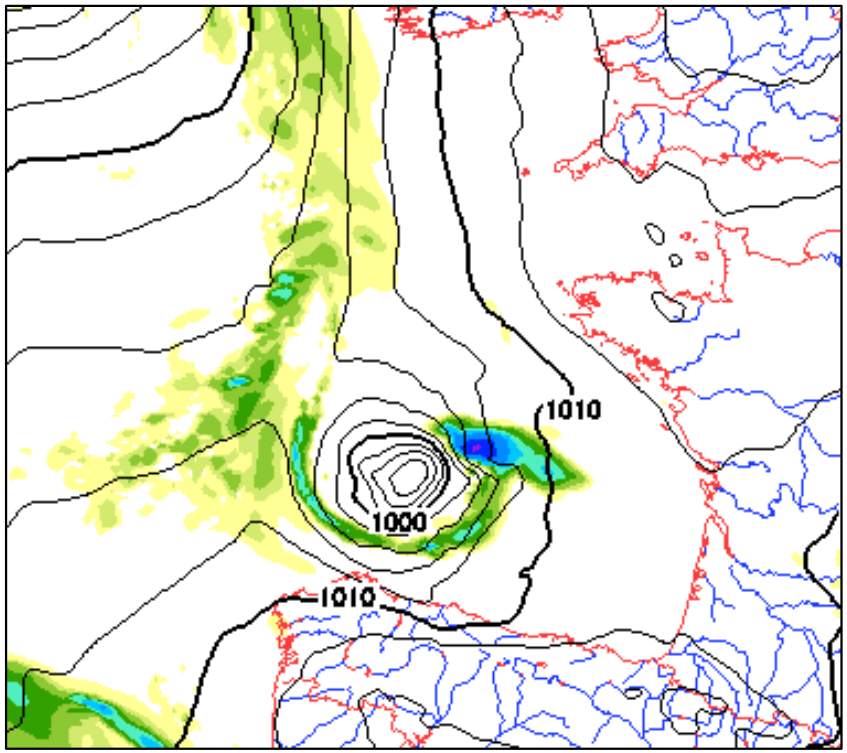
The problem: strong erroneous lows in COSMO-EU pressure analyses and forecasts in 3 cases within past the 3 years due to erroneous single buoys;

now a new case (complaint by our forecasters) :

analysis for 30 March 2013, 0 UTC



analysis for 31 March 2013, 0 UTC



all plots by Klaus Stephan

reason: assimilation of erroneous observations from buoy 62557

- 'spatial consistency check' (SCC):

  improve estimate for truth (given by current model field $p_s(\mathbf{x}_k,t)$ in 'threshold QC') by adding analysis increment $\Delta p_{s_k}^{scc}$ derived from observation increments only from surrounding observations (within ~ ±1 hr)

→ reject obs p_{s_k} if :

$$\left| p_{s_k} - \left(p_s(\mathbf{x}_k,t) + \Delta p_{s_k}^{scc} \right) \right| > p_s^{thr_{scc}}$$

→ Modification done for COSMO V4_22 :

'**no-TCC**': SCC without checking temporal consistency of obs
(i.e. obs at ±1 hr from same station not used to derive ad-hoc ana. incr. $\Delta p_{s_k}^{scc}$)

→ Impact: strongly positive in case 1, moderately positive in case 2
with strong errors remaining

not positive in case 3, and also problem in new case 4 as shown

- '**LBC-QC**' :

  perform additional checks using the fields of the steering model (e.g. GME), which provides the lateral boundary conditions (LBC), as estimate for truth

$$\left| p_{s_k} - p_s^{LBC}(\mathbf{x}_k, t) \right| > p_s^{thr_{LBC}}$$

$$p_s^{thr_{LBC,const}} = 1.4 \cdot p_s^{thr_{const}}$$

  modified 'spatial consistency check' (LBC-SCC) :

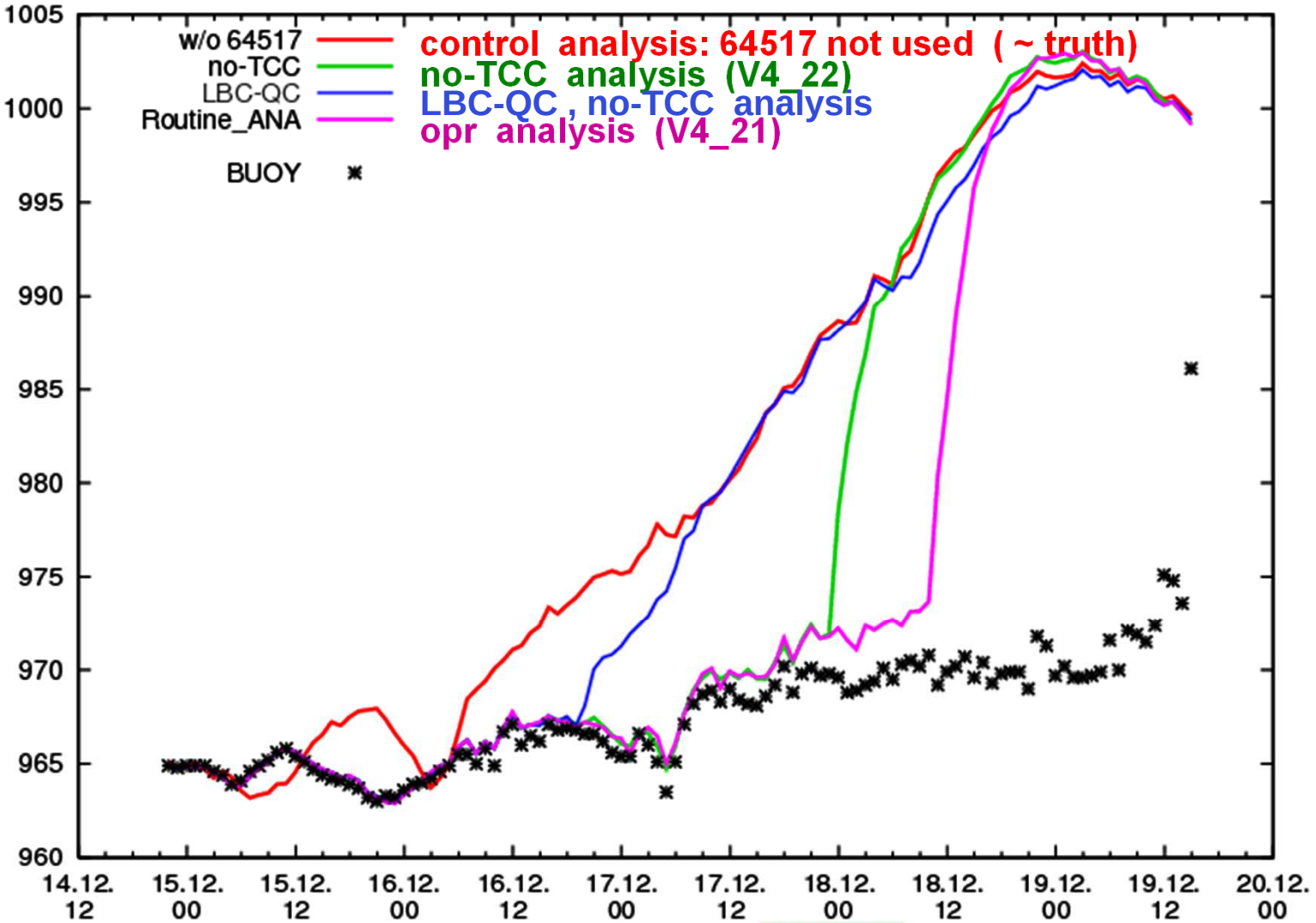
$$\left| p_{s_k} - \left(p_s^{LBC}(\mathbf{x}_k, t) + \Delta p_{s_k}^{scc,LBC} \right) \right| > p_s^{thr_{scc,LBC}}$$

quality control of surface pressure p_s : case 2 : 15 - 19 Dec. 2011

Deutscher Wetterdienst

surface pressure

(at the location of buoy 64517)



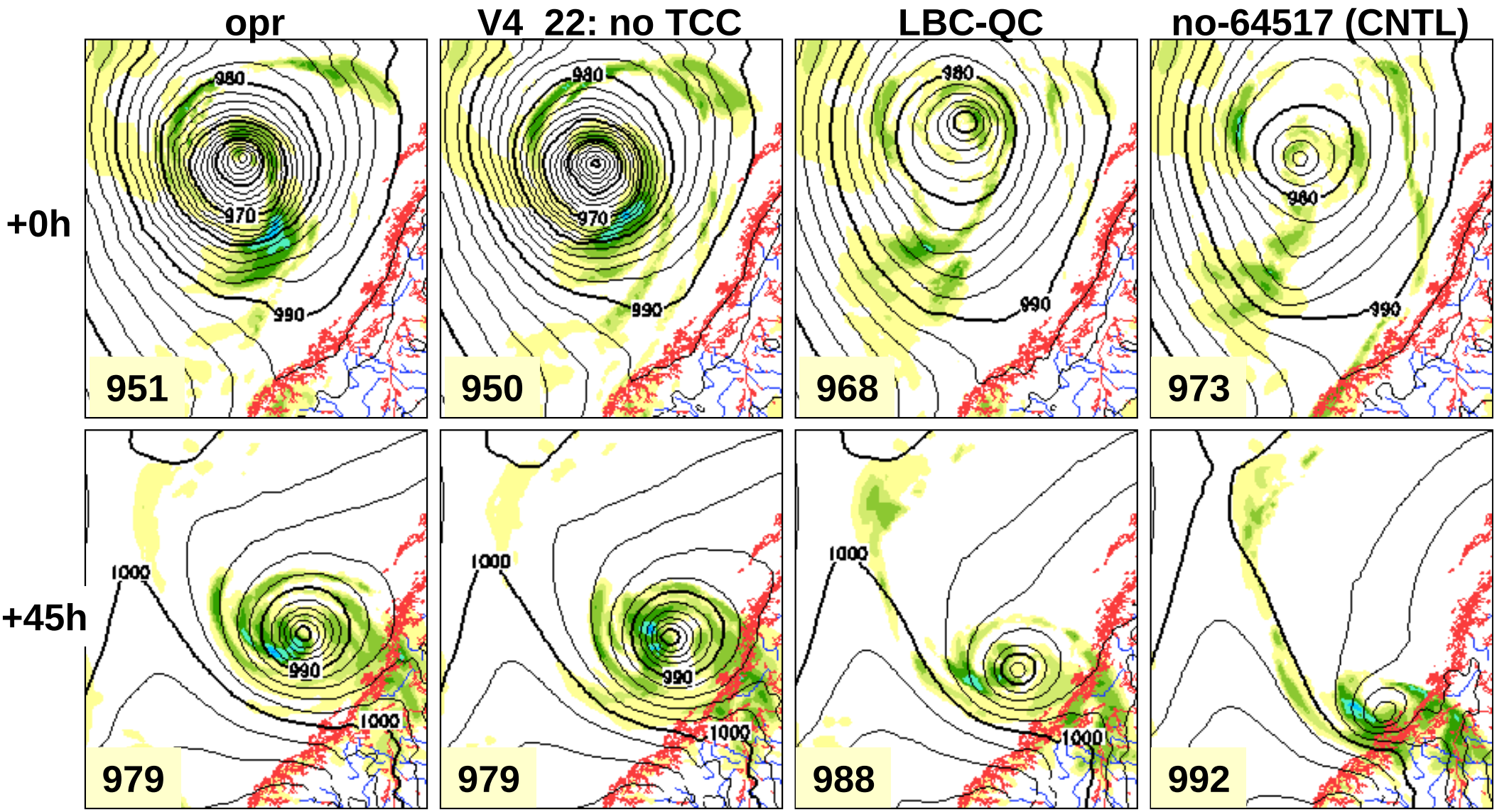
→ **strong improvement by LBC-QC !**

first obs rej. 15 Dec. 19 UTC
all obs rej. from 16 Dec. 13 UTC
(most obs accepted in between)

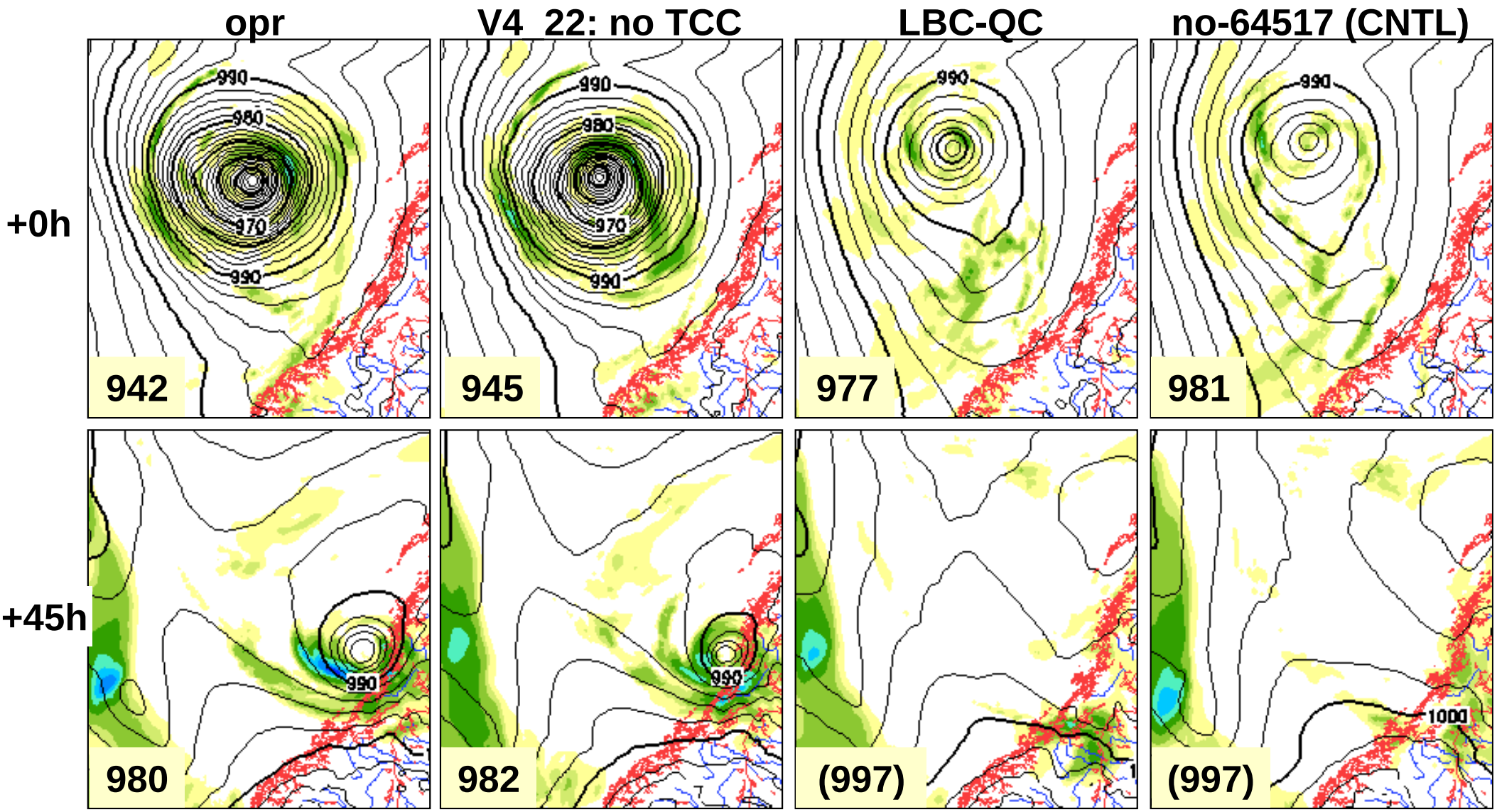
LBC-QC rej. 16 Dec 20 UTC

SCC rej. 18 Dec 0 UTC

SCC rej. 19 Dec 10 UTC



→ **strong improvement !**



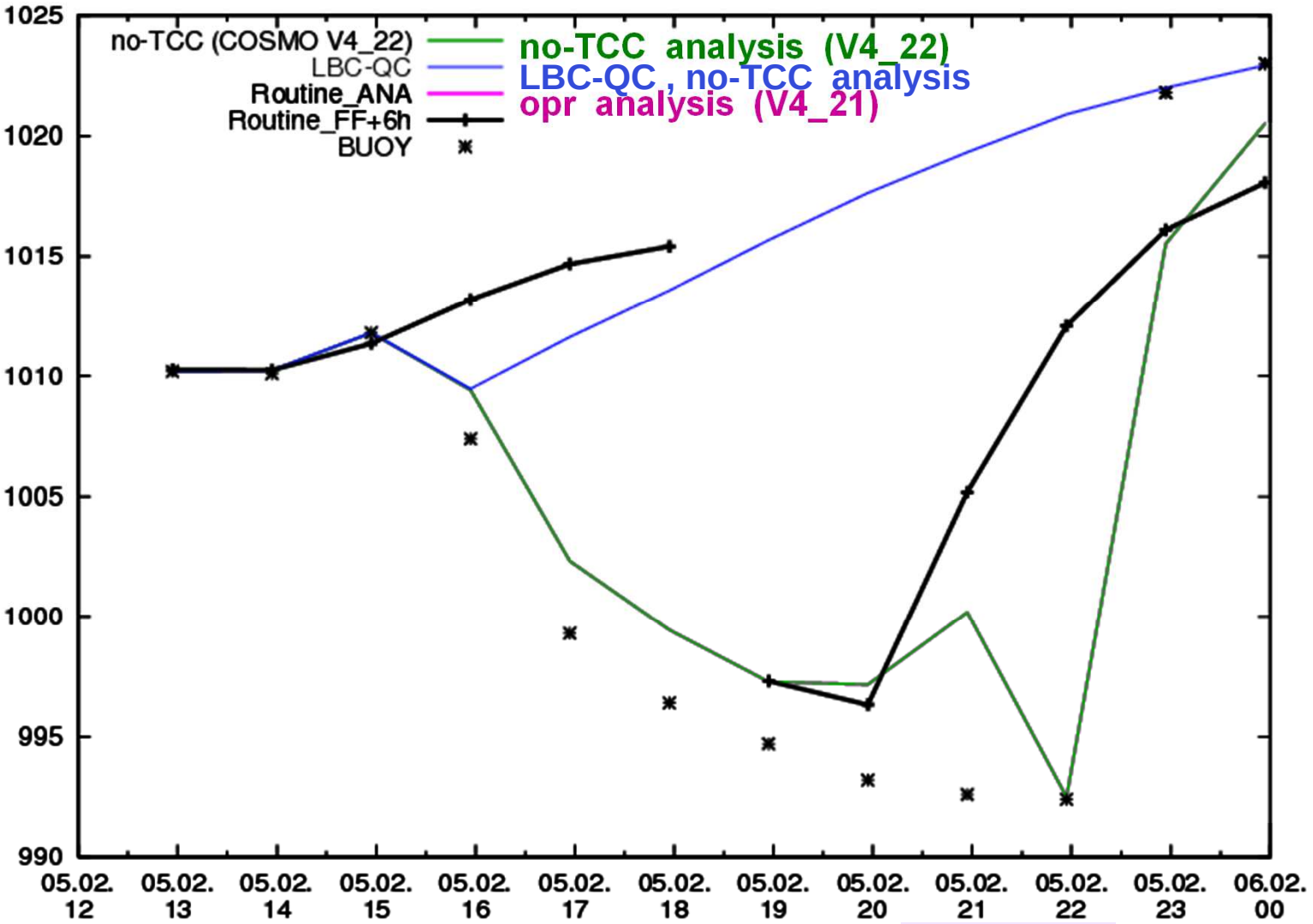
→ **strong improvement !**

quality control of surface pressure p_s : case 3 : 5 Feb. 2012

Deutscher Wetterdienst

surface pressure

(at the location of buoy 64617)



→ strong improvement by LBC-QC !

rejected 21, 22 UTC

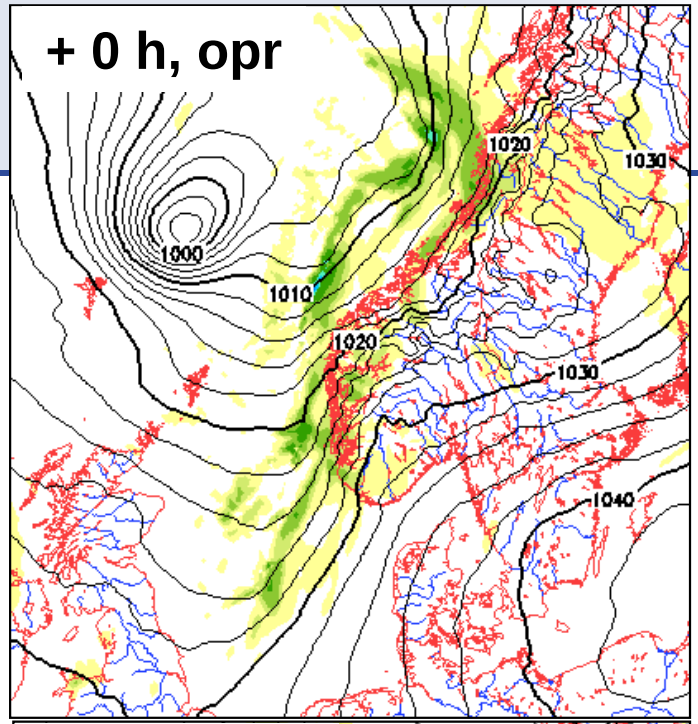
case 3 :
5 Feb. 2012

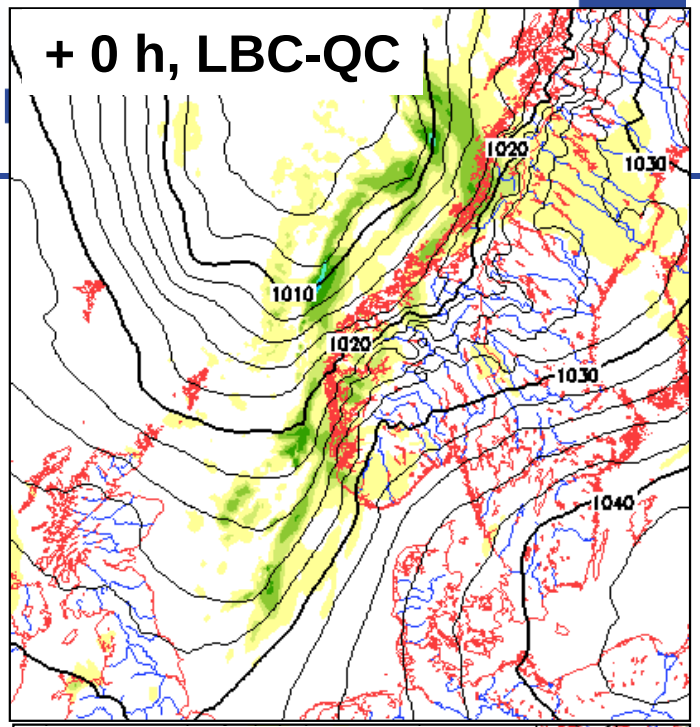
forecast run starting at 5 Feb. 2012, 18 UTC

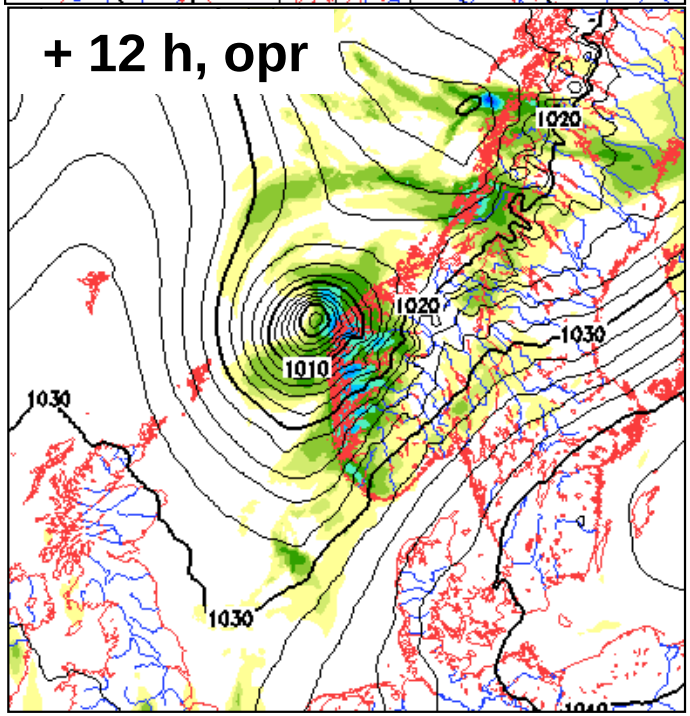
→ **opr same as V4_22: 64617 accepted until 20 UTC, rejected 21, 22 UTC**

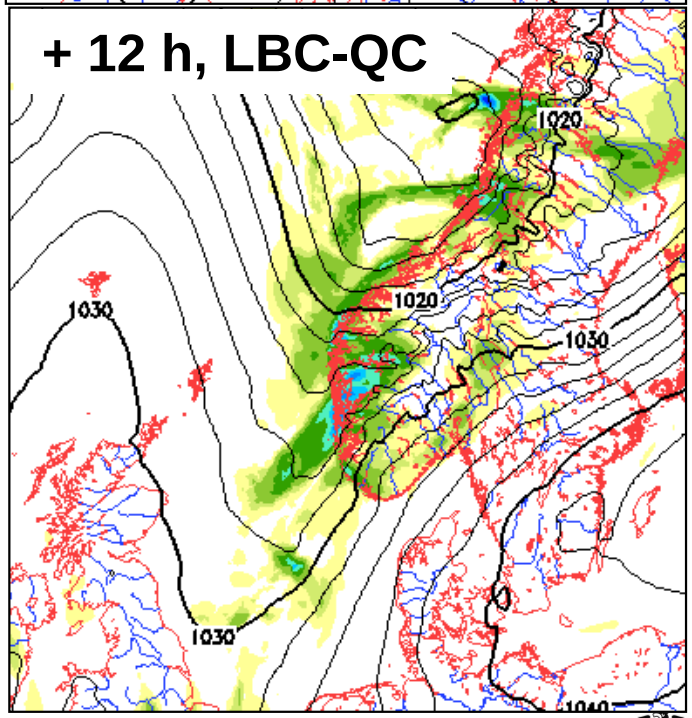
→ **LBC-QC: all erroneous obs of 64617 (16 – 22 UTC) rejected**

→ **problem solved completely**







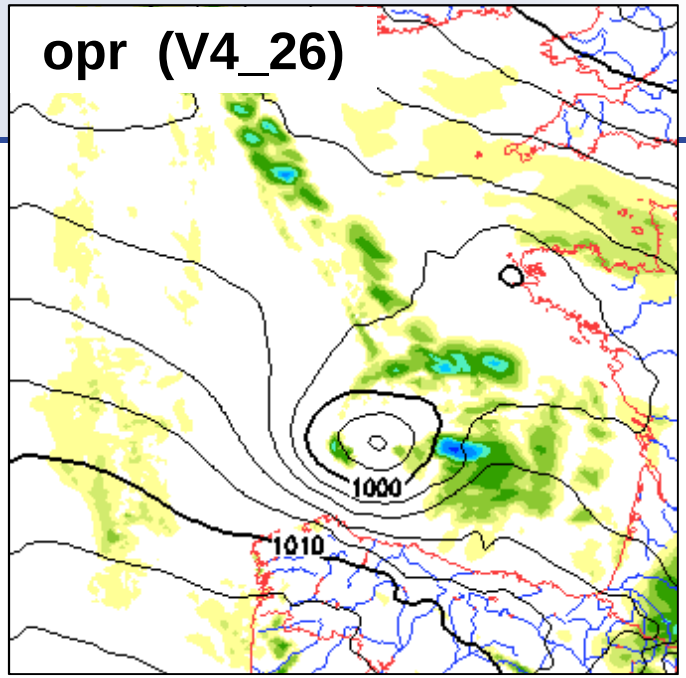


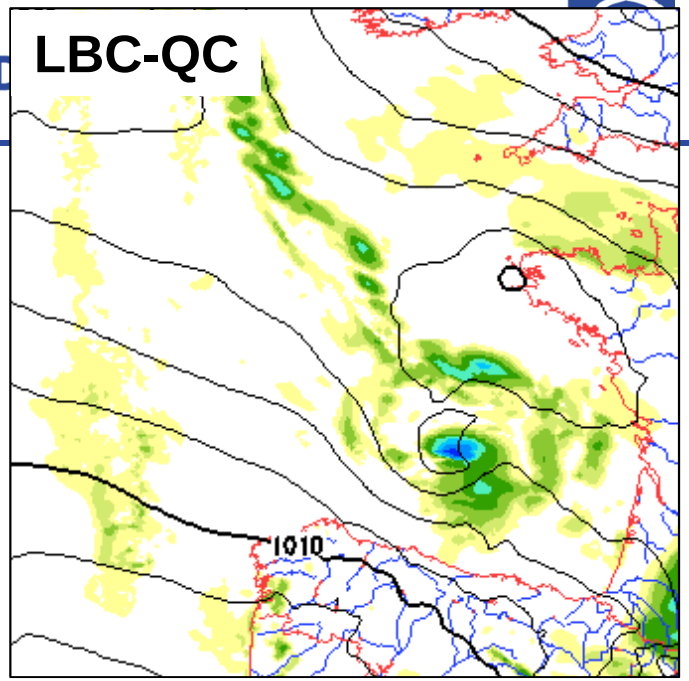
new case 4 : 30 / 31 March 2013

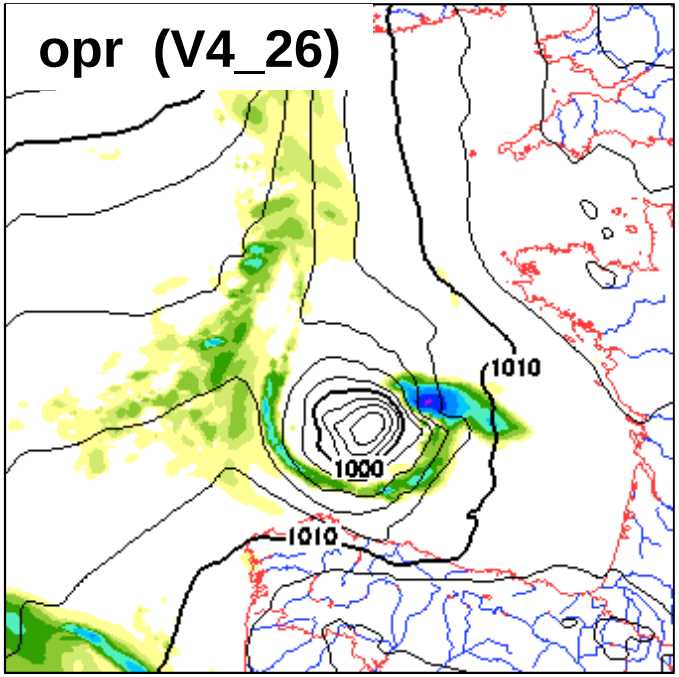
analysis for 30 March, 0 UTC

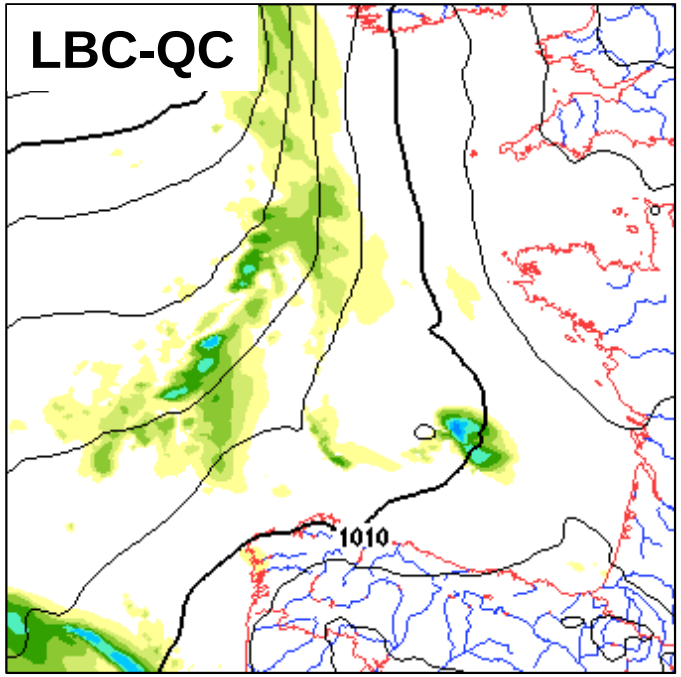
→ **LBC-QC:**
obs of 62557 with largest errors rejected
→ **problem solved almost completely**

analysis for 31 March, 0 UTC









check against 'lateral boundary fields'

- strong improvement in cases 2 – 4 with sequences of erroneous pressure obs from a single buoy, which led to strong analysis errors (small improvement in case 1 which was already strongly improved by V4_22 modifications)

- very little impact in 2-week test (16 April – 1 May 2012, incl. cyclonic cases) (verif. against radiosondes) , as expected and required

- Christmas Storm 26 Dec. 1999 (danger to reject correct observations !) : negative impact negligible , as required

  (9 - 12 UTC: 4 obs rejected by LBC-QC, but finally accepted by LBC-SCC
  12 UTC: 1 obs 'behind the storm' rejected by LBC-QC, but no differences betw. experiment / control in model surface pressure at obs location)

Further changes included

- substantial technical changes for modular observation operators and quality control (except for spatial consistency checks), which have already been introduced in the 3DVAR package
- somewhat more relaxed conditions on required variables and variable names in NetCDF observation input files
- minor bug fixes (mainly in the quality control, e.g. the spatial consistency check or for passive humidity obs of upper-air single-level reports);

  minor improvements in control messages
- possibly new option for reading observations from feedback files (this is required for OSSE in PP KENDA, implemented and tested except for the MPI-communication part, which is currently being written by Andreas Rhodin)