

Status of AROME news since Bratislava '05

*based on contributions from CNRM GMAP & GMME teams, Lab. Aérologie,
aladinists*

1. System & workforce
2. Model & software
3. Assimilation
4. The Future

1. Multiscale NWP in 2007/2008

AROME on small domains
resolution **2.5km**
forecast ranges 1-24h + nowcasting

↑
coupling

ALADIN/ALARO on big domains
resolution close to **10km**
forecast ranges 6-48h + ensembles

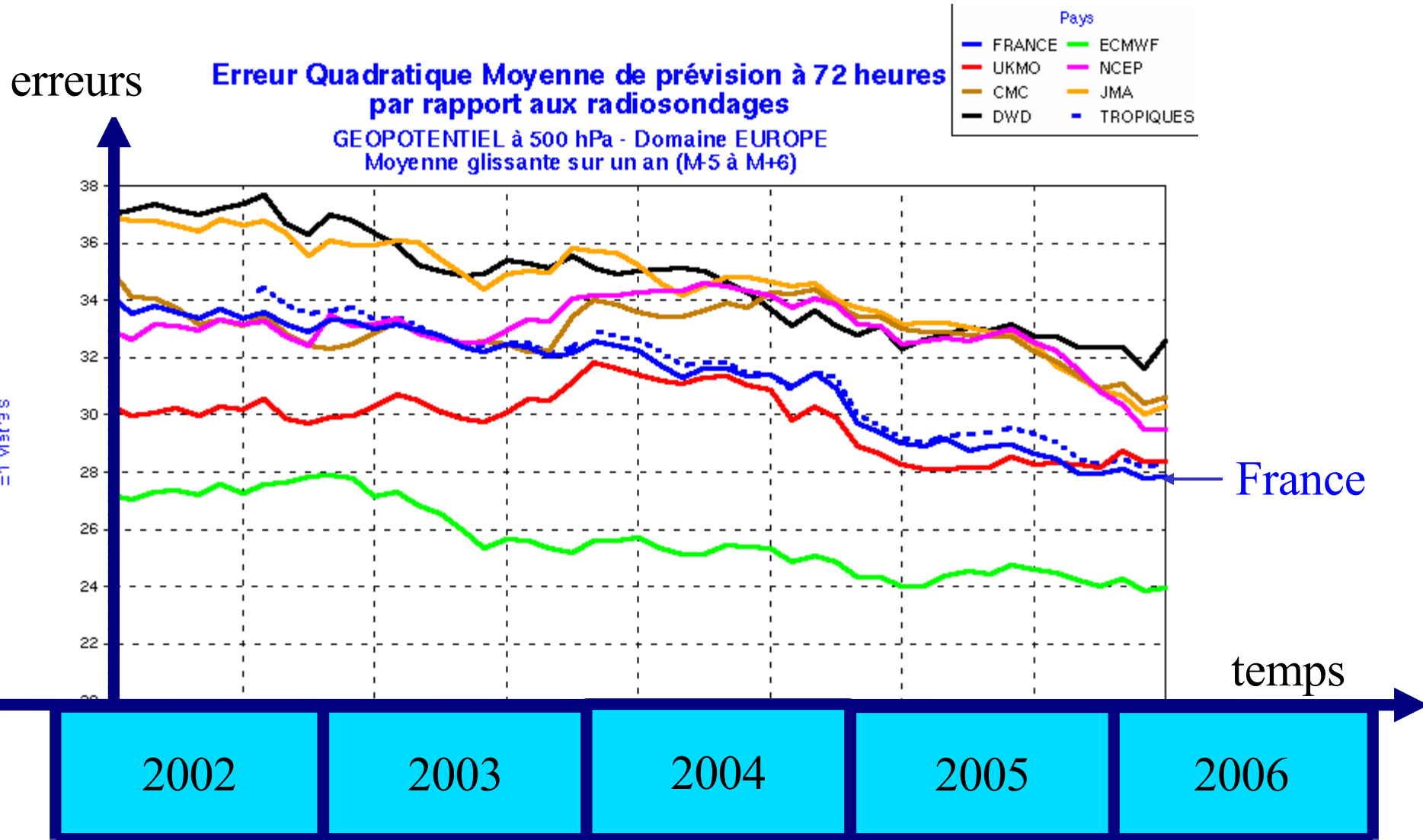
↑ ↑
coupling

ARPEGE global
resolution **15km** (T539)
ranges up to 3 days + ensembles

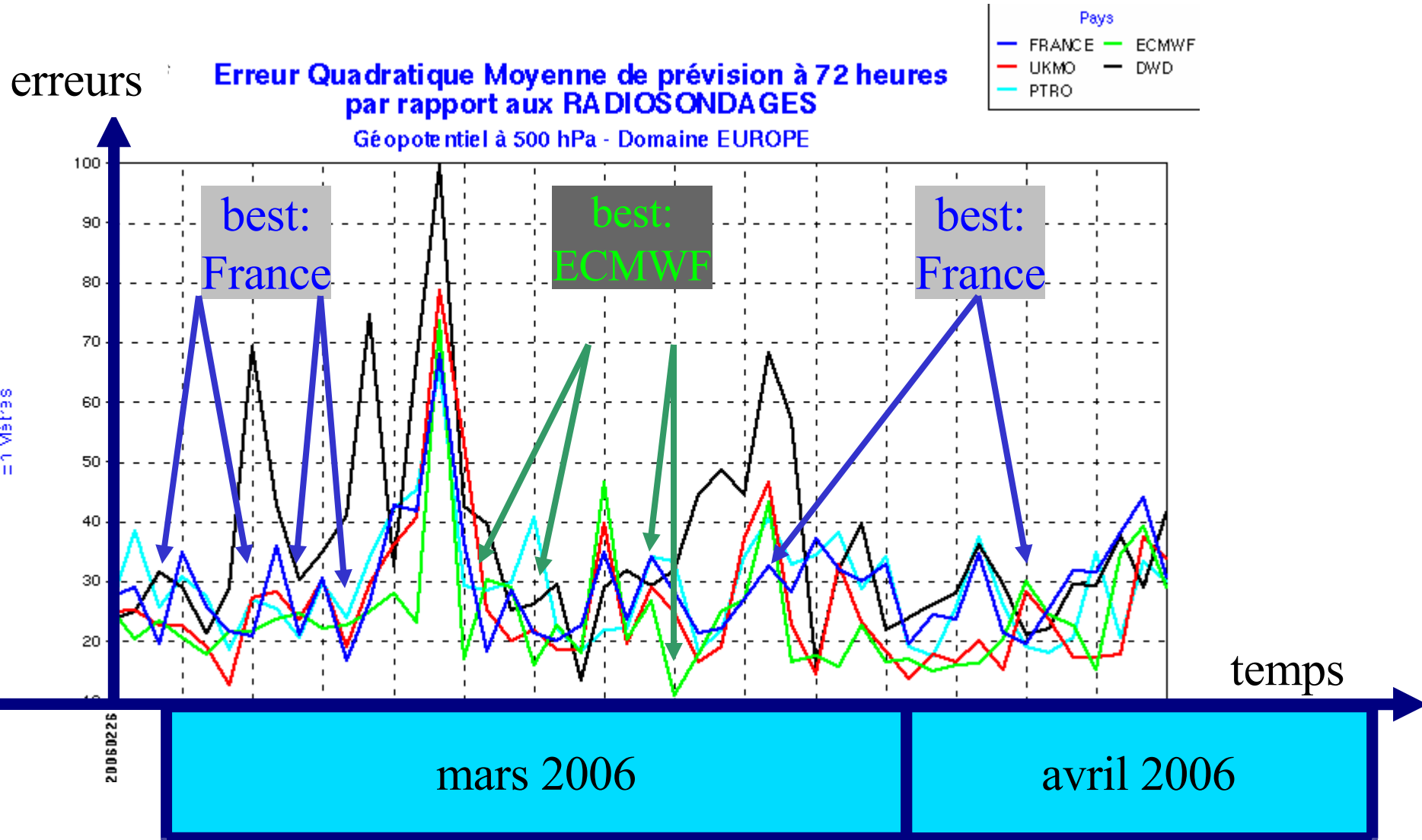
ECMWF's IFS
resolution 25km,
up to 7 days + ensembles

ARPEGE forecast quality, lately

*in 2006: L46, much improved radiation & clouds
(see Y. Bouteloup's talk)*

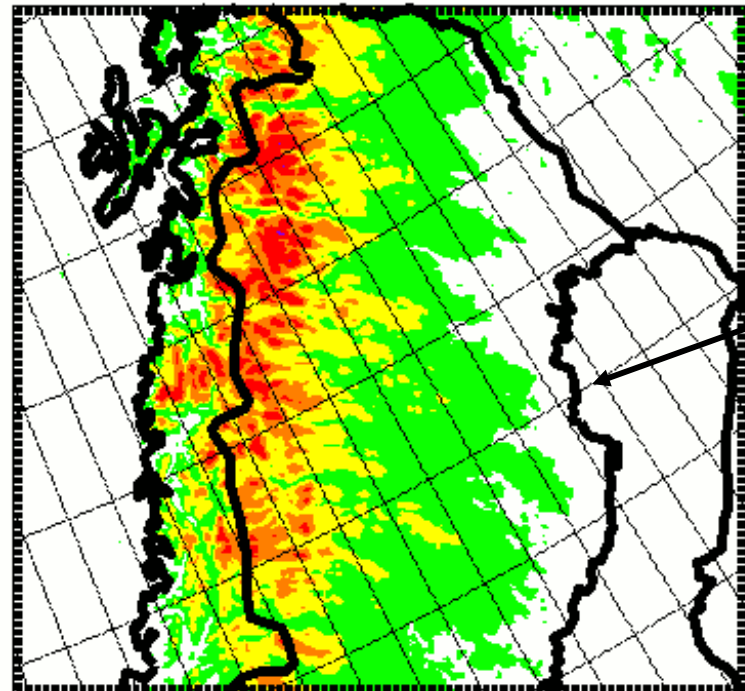


No global model is always the best



System & workforce

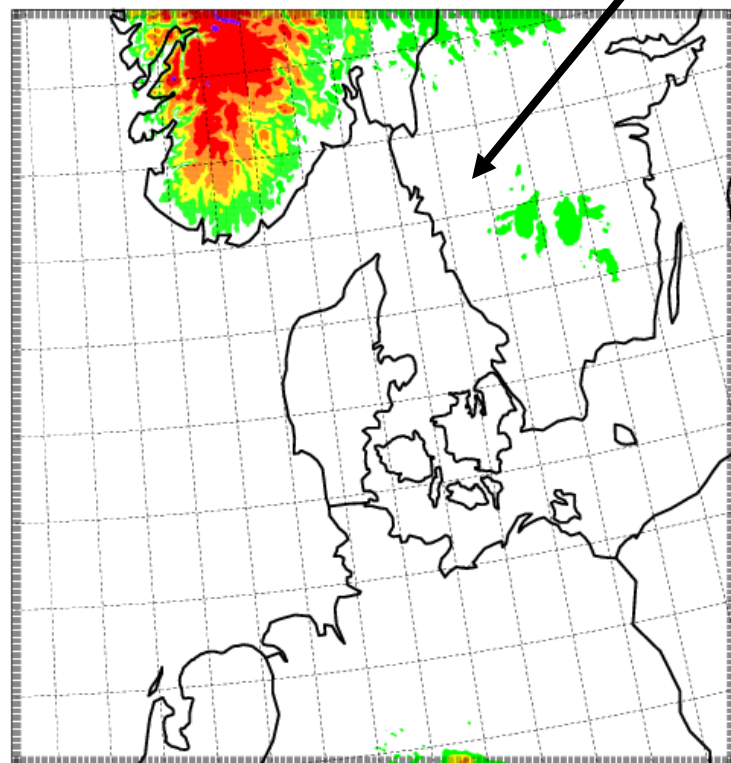
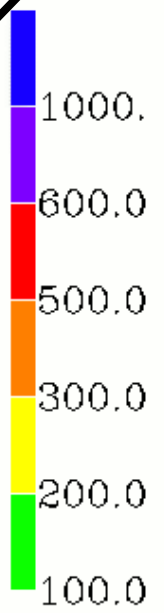
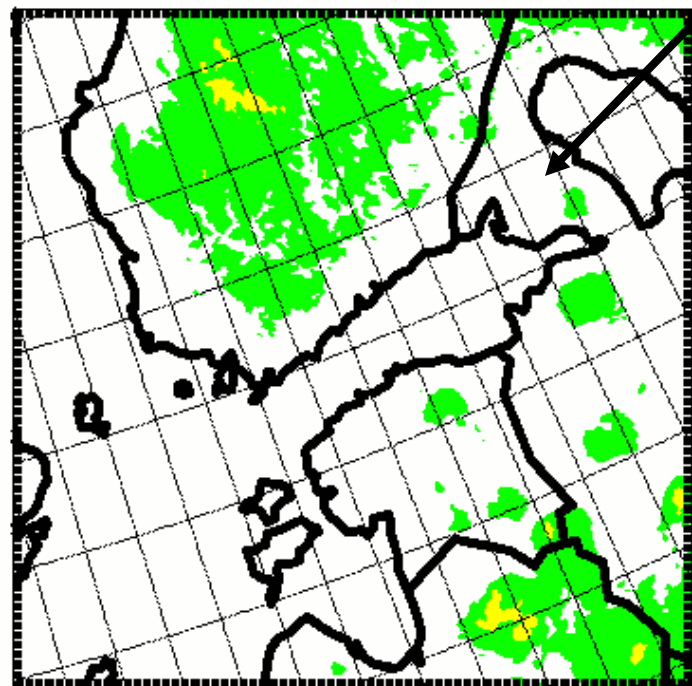
- Arome NWP-oriented modelling: mostly in **GMAP** team: embedding (clim files, 927, postprocessing, DDH diags, Surfex interfacing, APLXXX interface), case studies with forecasters. *see talk by G. Hello & JD. Gril, T. Kovacic*
- Arome **assimilation**: common with ALADIN 3DVar, plus radar work.
- Arome **upstream R&D**: mostly in GMME. Current priority on improving clouds (shallow convection, 3MT, fog) and SURFEX. *see talks by S. Malardel, E. Martin, L. Kraljevic*
- **the rest of NWP in Toulouse**: roughly 10% on ARPEGE/ALADIN, 10% on AROME/MésoNH, 80% on transversal activities (software, assimilation, Aladin support) - *see P. Pottier's statistics and Aladin web site*
- **Aladin partners'** contribution: NH cleaning, code phasing, phys/dyn interfacing. Most Aladin work is good for Arome. *e.g. see talk by J. Vivoda*
- Increasing **deported testing** of Arome in several Aladin & Hirlam centres (Denmark, Sweden, Finland, Norway, Hungary, Austria, Czech Rep...) *see talk by L. Kullmann*



Sweden : 270x288, 2.5km, ?L

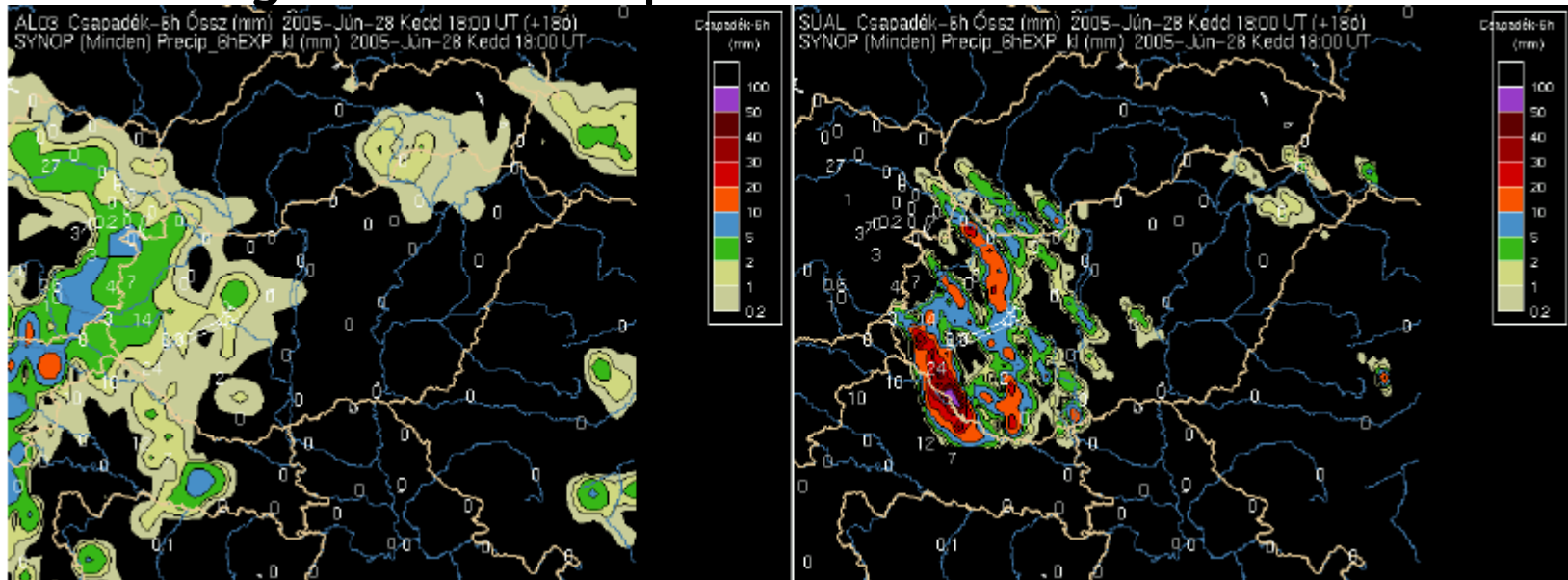
Finlande : 384x324,
2.5km, ?L

Danemark : 400x384,
2.5km, ?L



New Arome domains

Hungary (Laszlo Kullmann) :
on IBM regatta at Budapest.

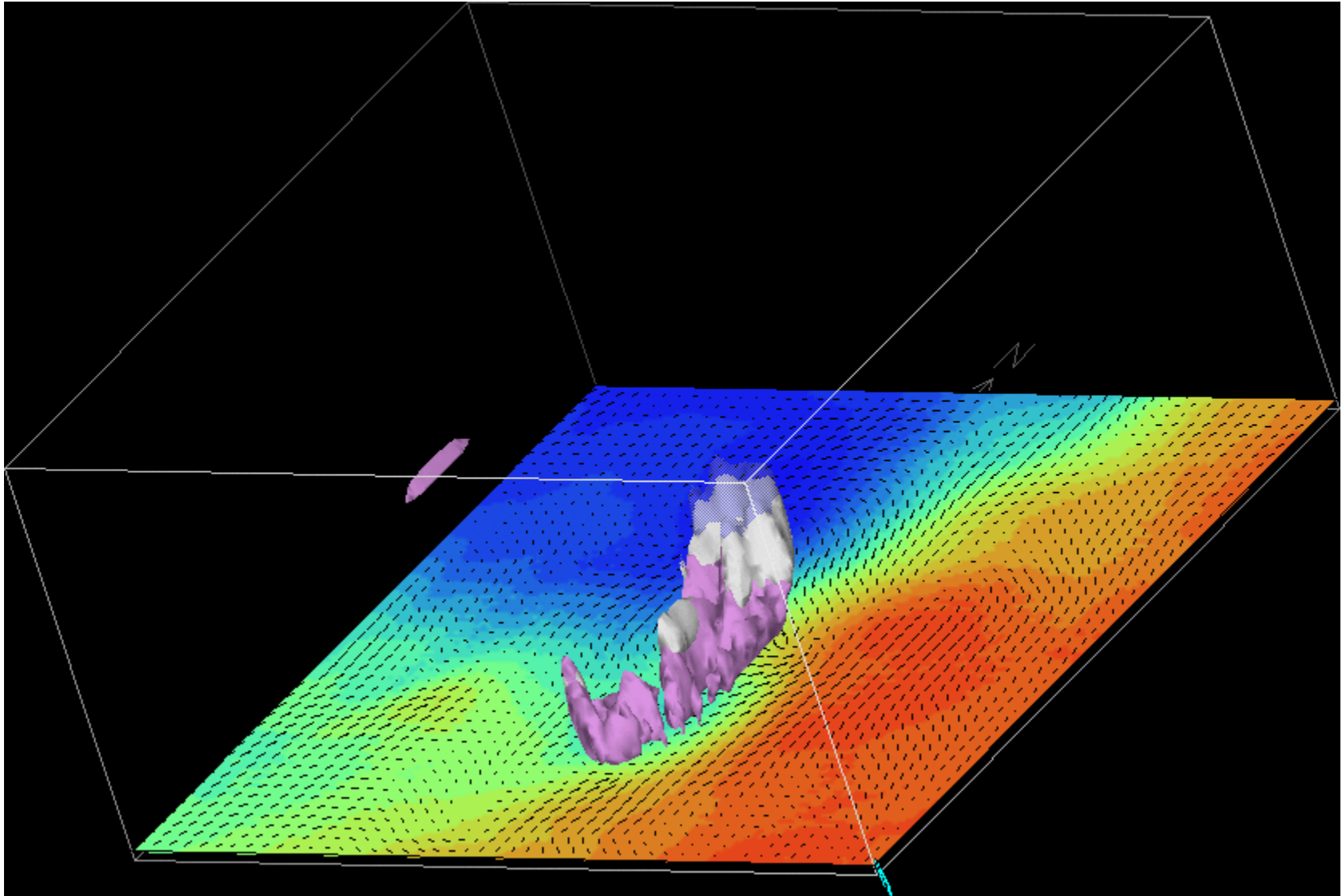


2. Model work

- **Prototype** is fully included in the joint cycles (with MésoNH & SURFEX bits) and available at ECMWF (gmkpack) *see talk by Ryad El Khatib*
- **One year of successful daily runs** over various weather types, tests on ocean, T1 storm, snowstorms, AMMA, precipitation studies...
- **Thematic studies** on fog, ocean fluxes, wind power, shallow clouds, snowfalls, mountain weather
- activated use of **SLHD** (still tricky dyn in deep valleys)
- activated **subgrid cloudiness**
- activated **KFB shallow convection** (still needs improvement)
- developed **flux budget diagnostics, Arome FullPOS,**
- developed **full interactive chemistry, dust & aerosols option**
- **bugfixes** on soil initialization, physiographies, NH cleaning

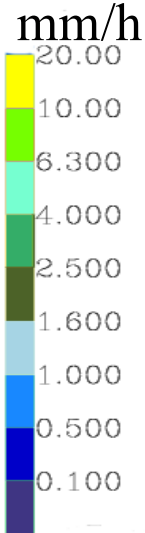
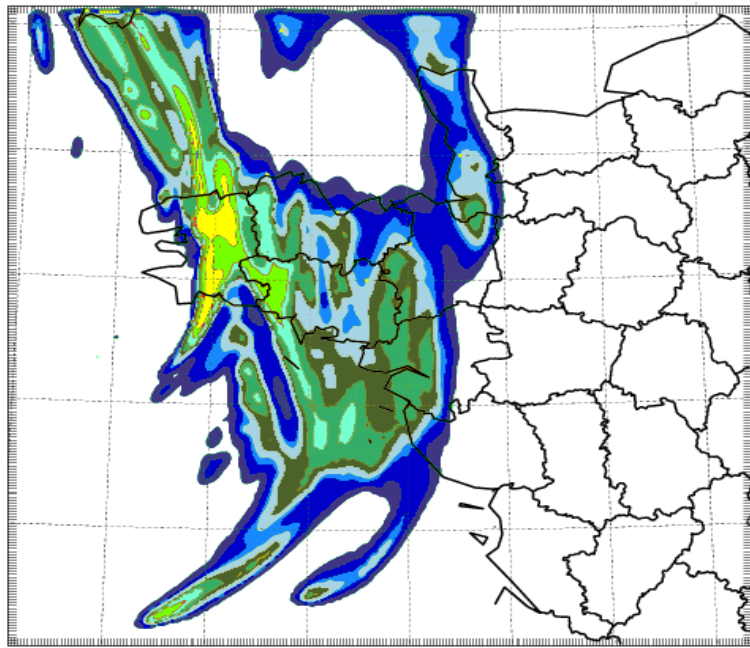
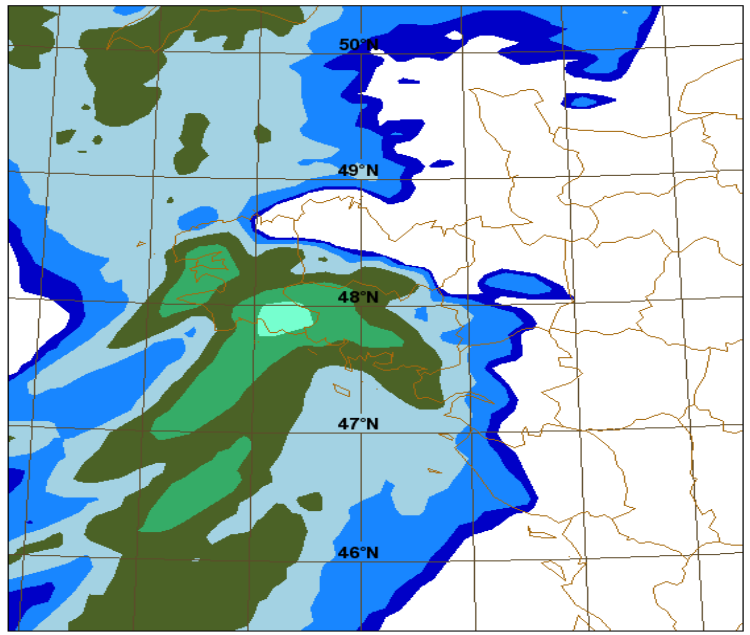
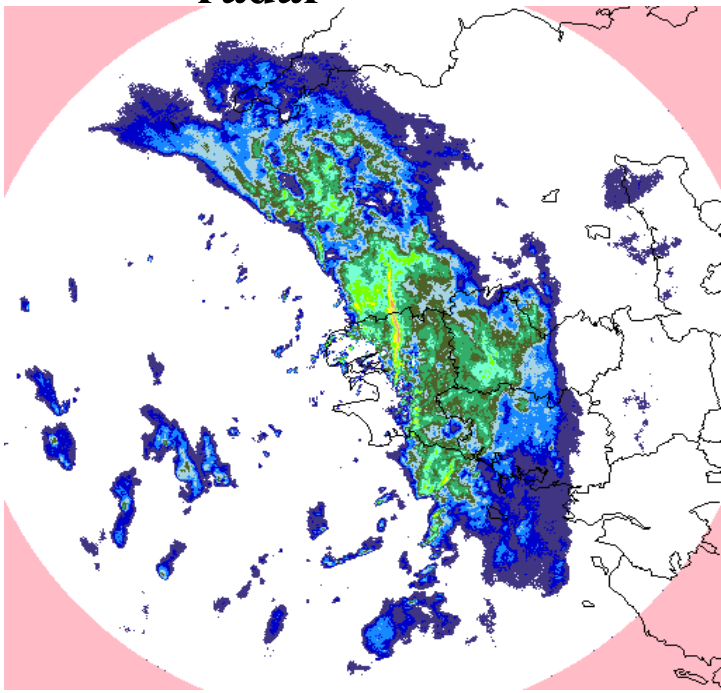
Resolved convection in Arome (04-08-94, 15 à 18h UTC)

couleurs: glace, eau nuageuse, pluie

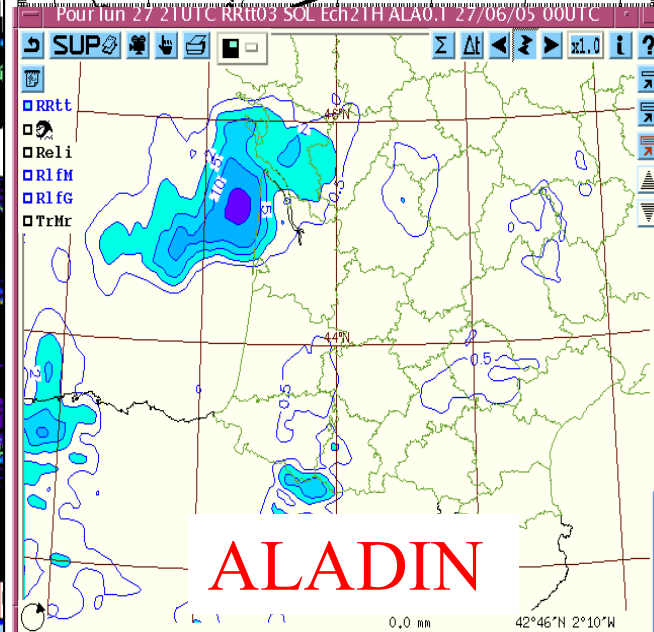
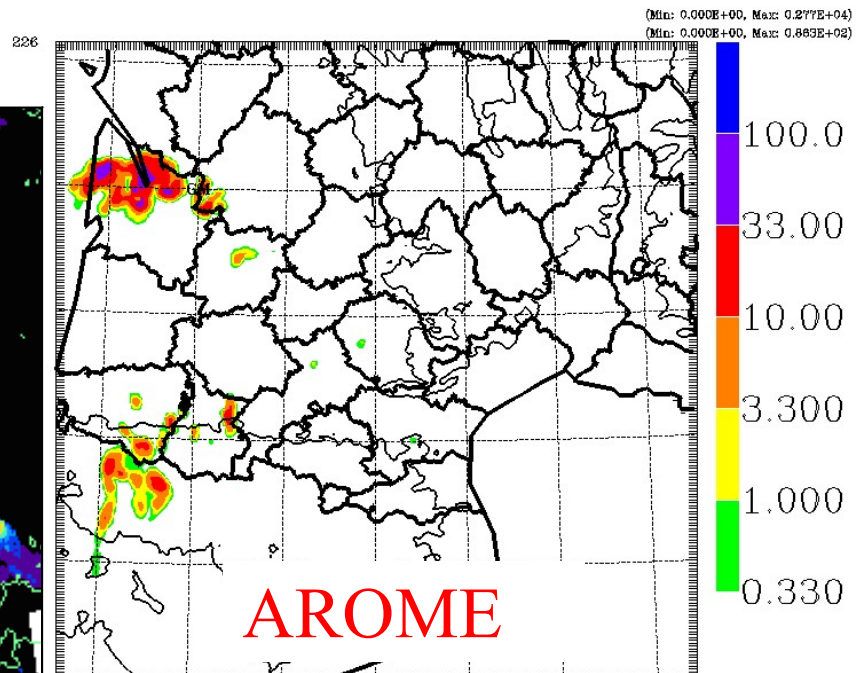
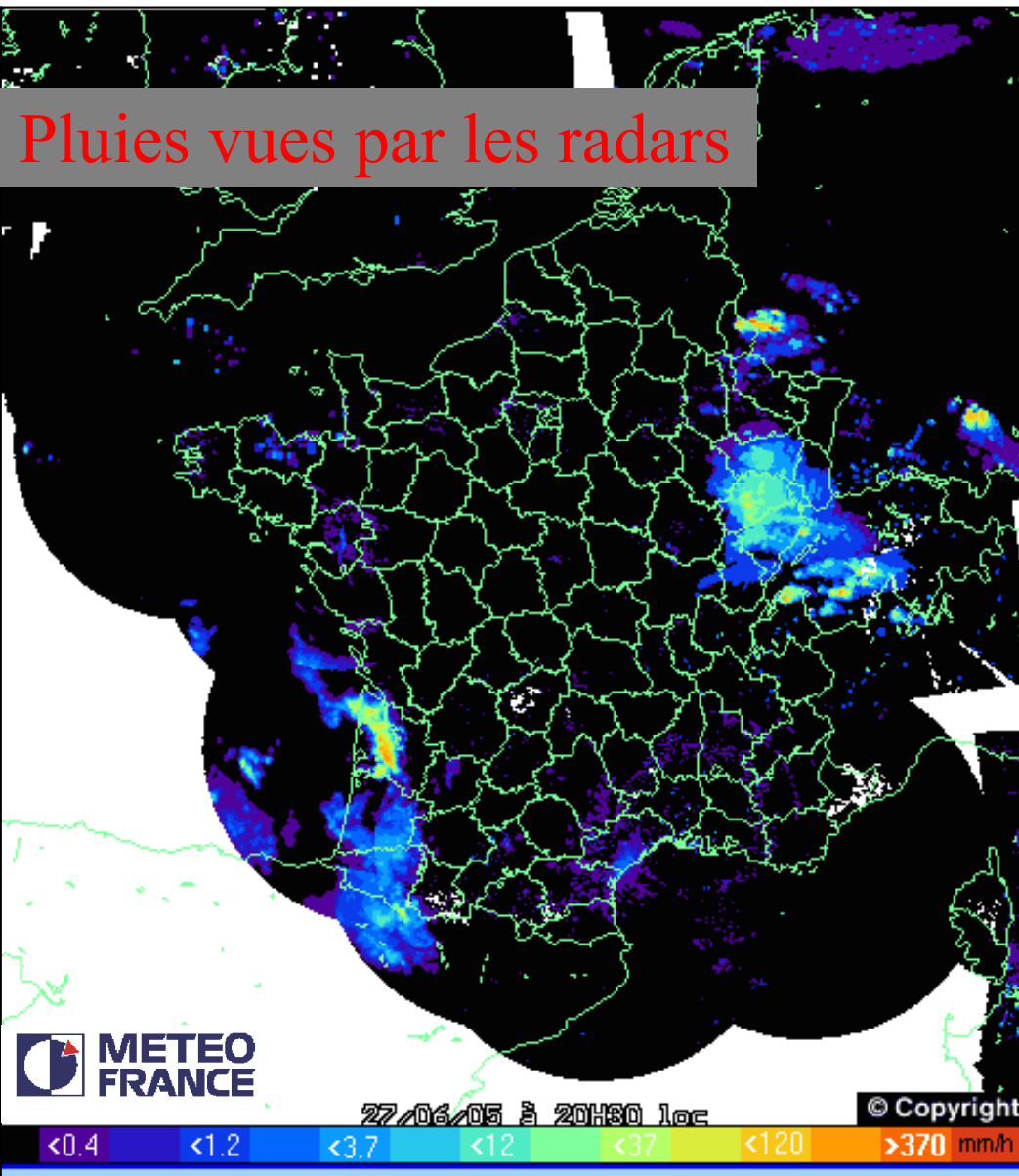


Winter synoptic weather: ALADIN (top) vs AROME (bottom)

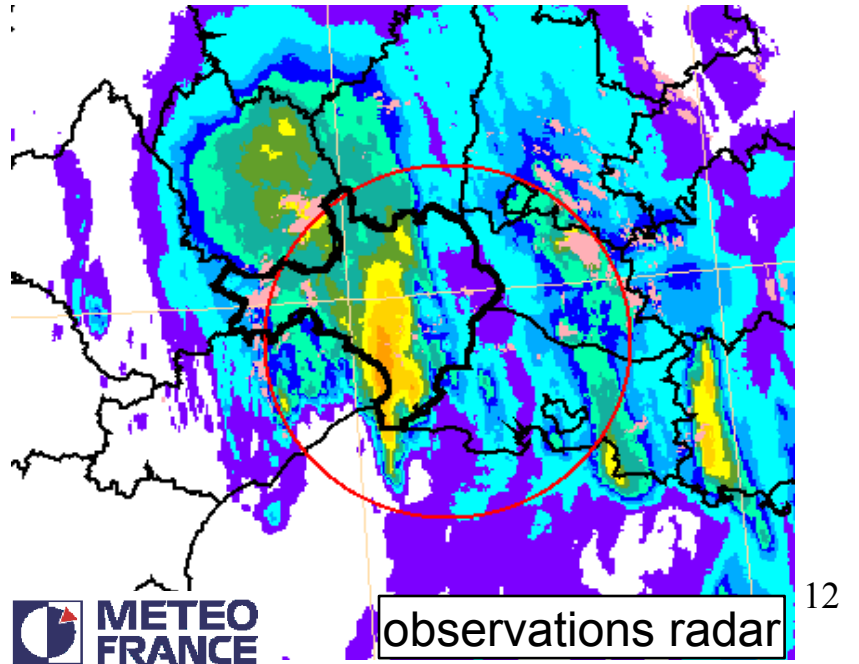
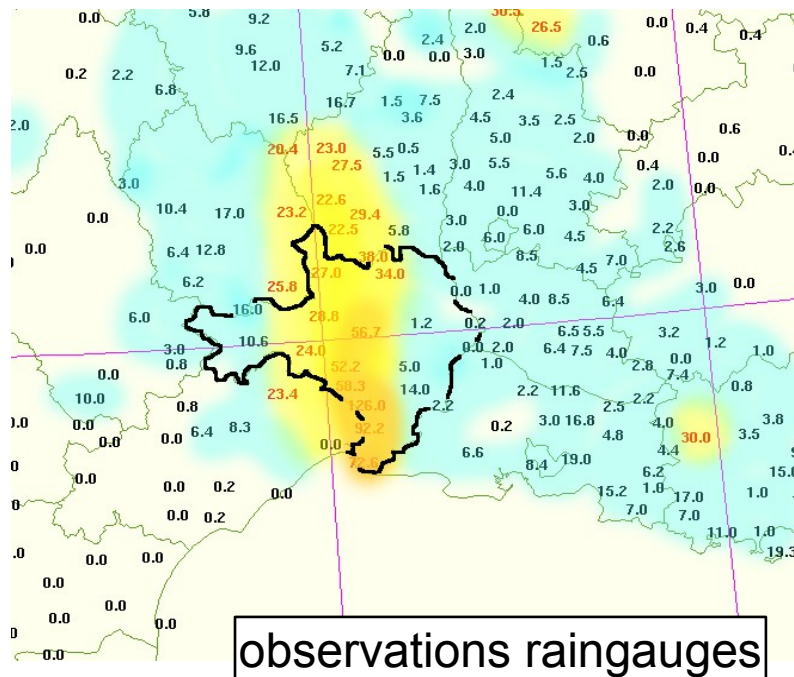
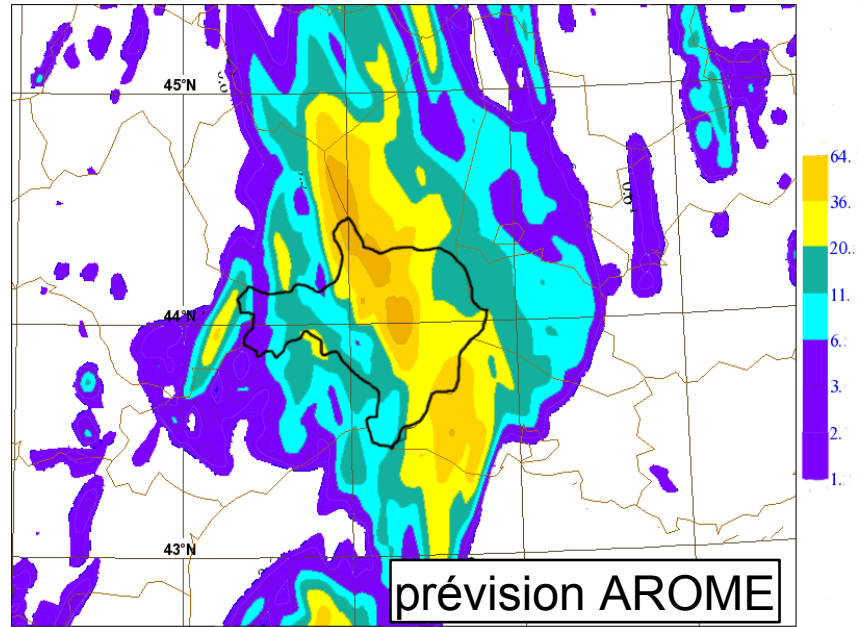
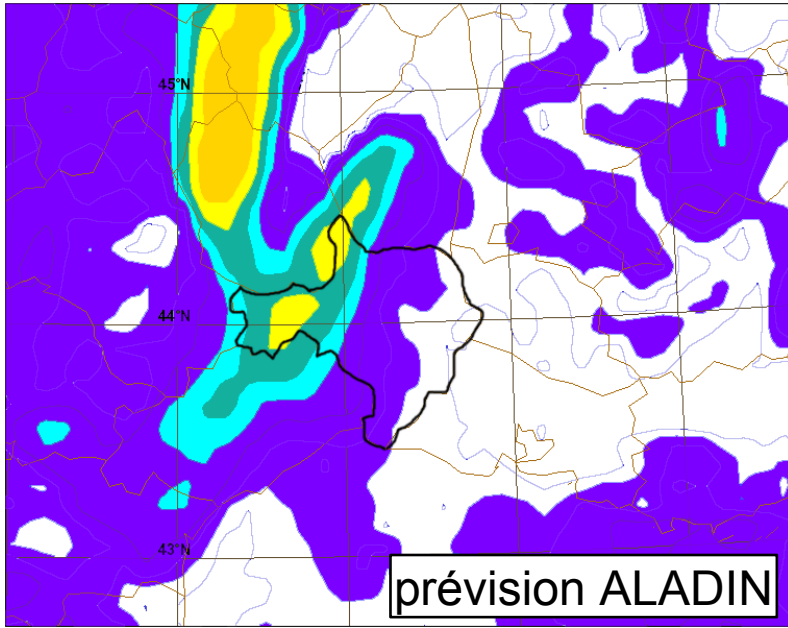
radar



Real-time AROME forecast of isolated thunderstorm (27/6/2005)

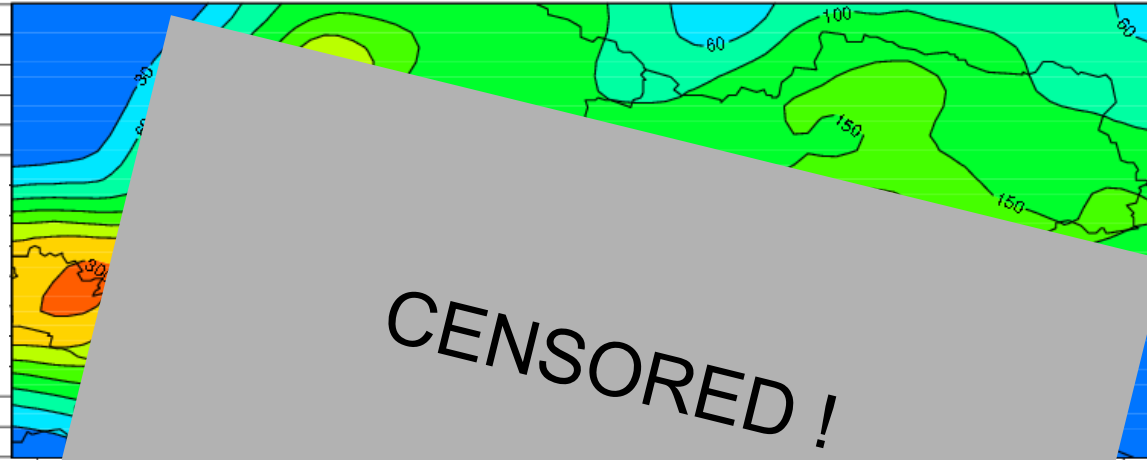


Mediterranean flash flood event on 6/9/2005



Verification: Hydrological validation

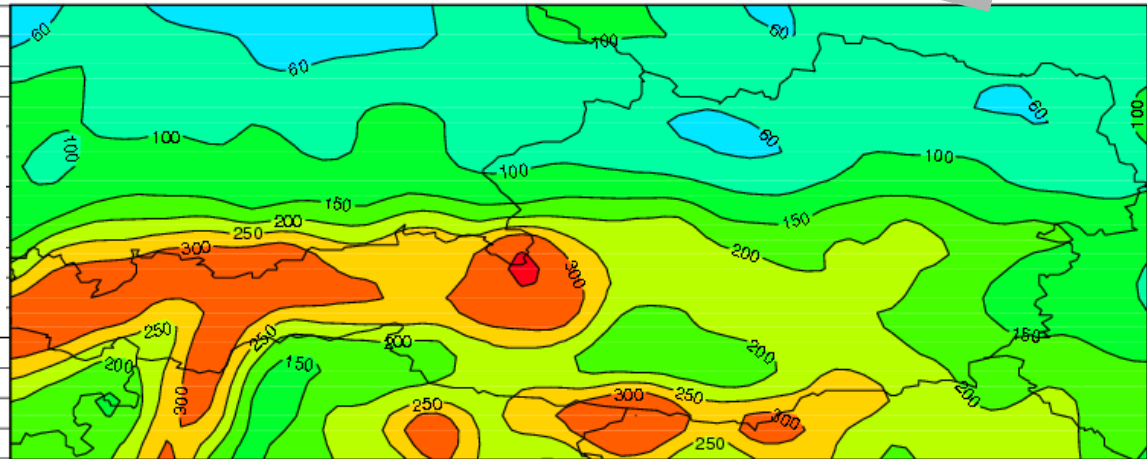
Observations



Prévisions
ALADIN



Prévisions
AROME
(prototype)



CENSORED !
see talks by
E. Bazile & T. Haiden

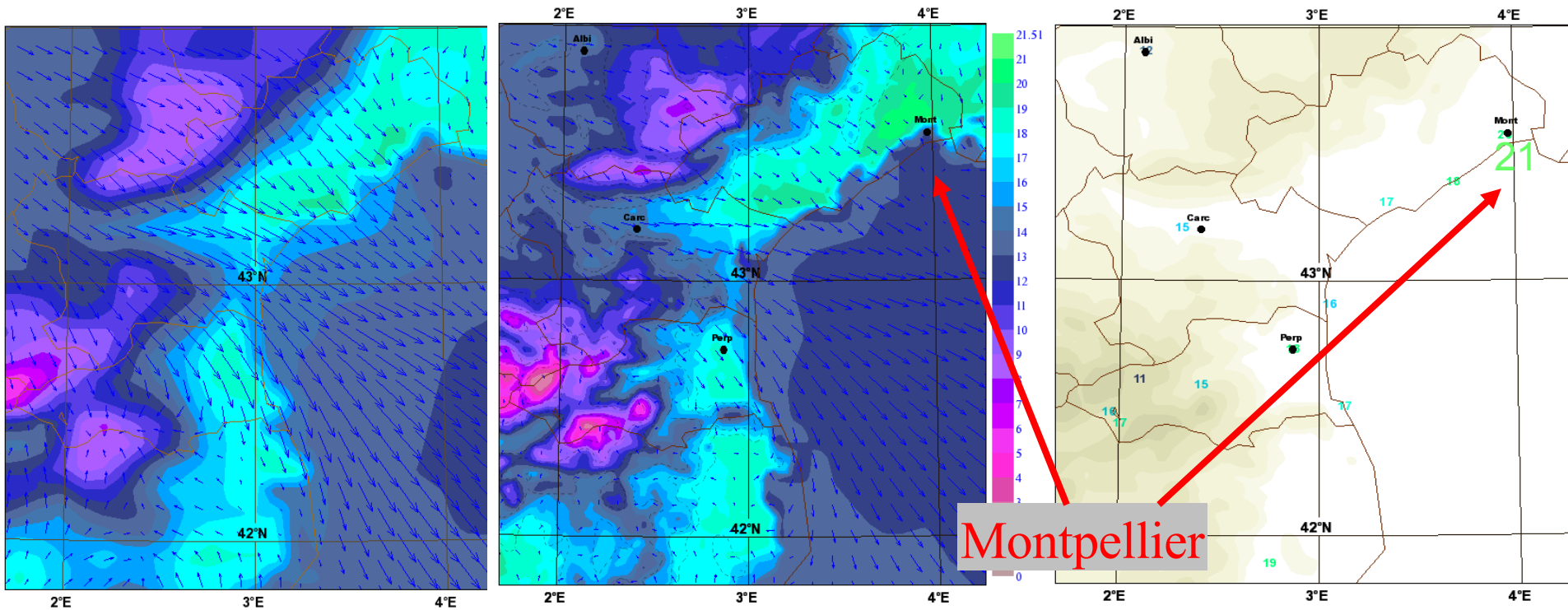
1-month
precip over
Austria
(work done
with ZAMG)

T2m validation on ALADIN (left) and AROME (right)

Aladin 2006041300+1200 T2m (C) & V10m

Aro 2006041300+1200 T2m (C) & V10m

Obs 2006041300+1200 Obs T2m (C)

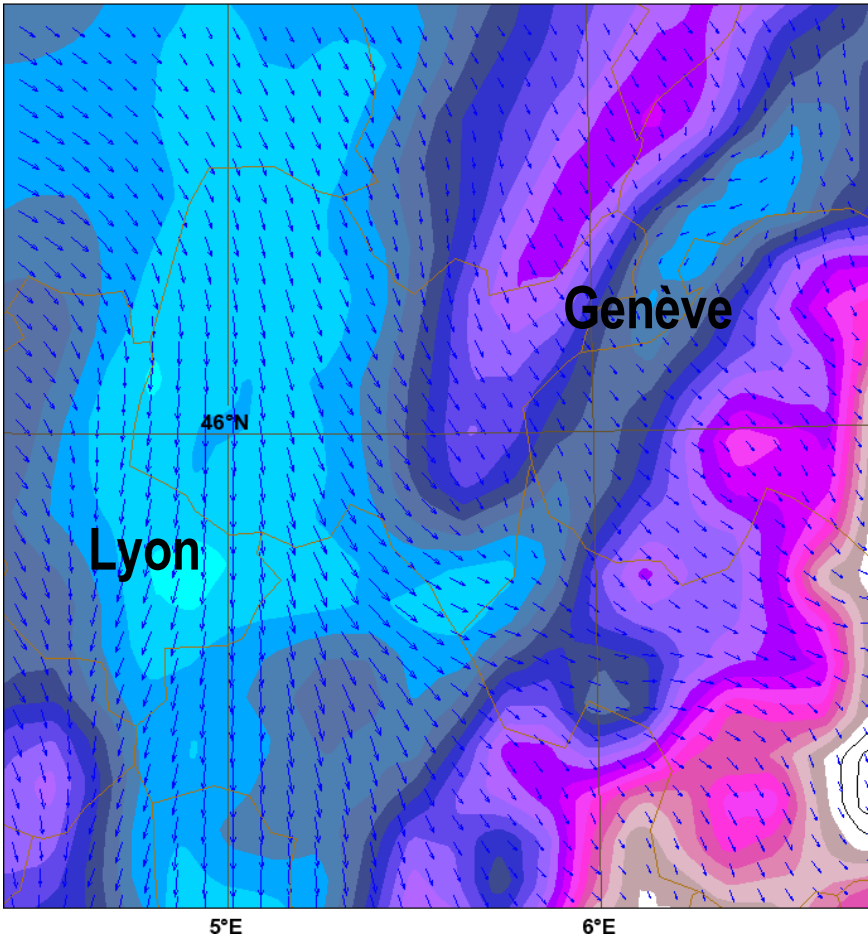


vérité terrain

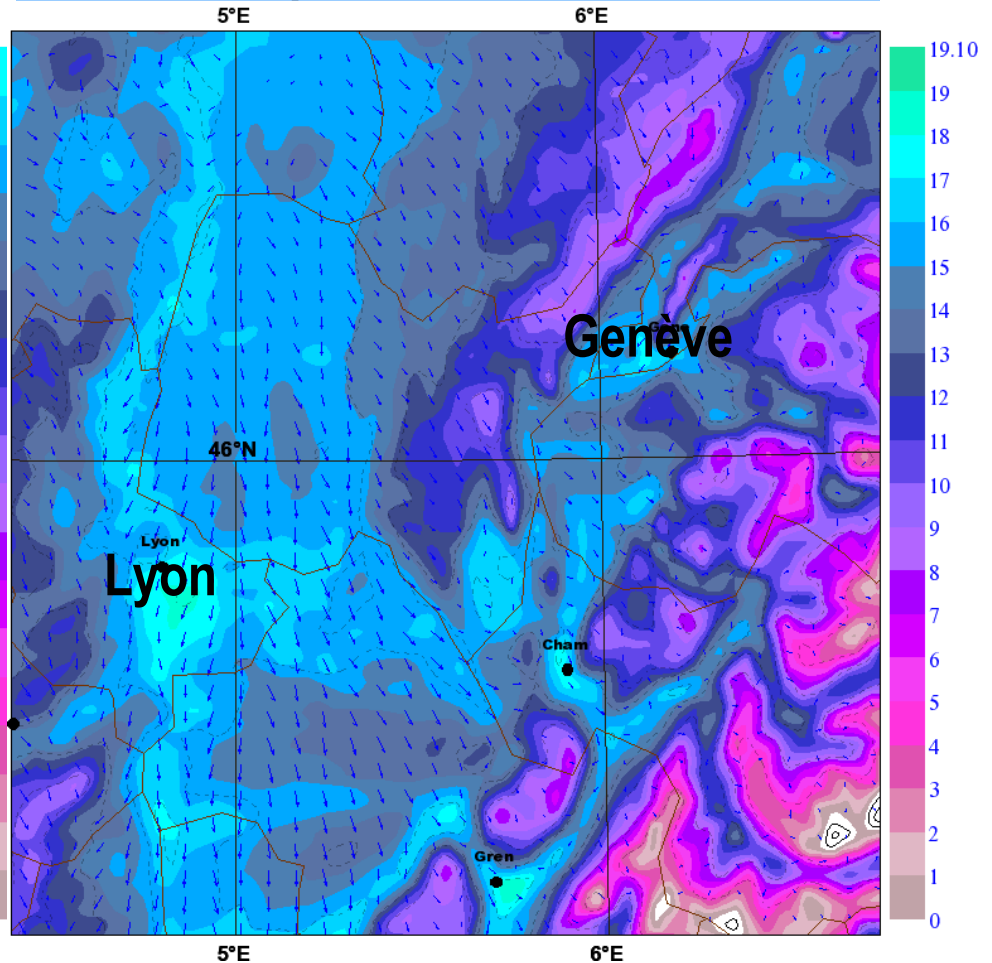
Better in valleys, on mountains, in big cities

T/wind in mountain regions (Alps)

Températures d'Aladin



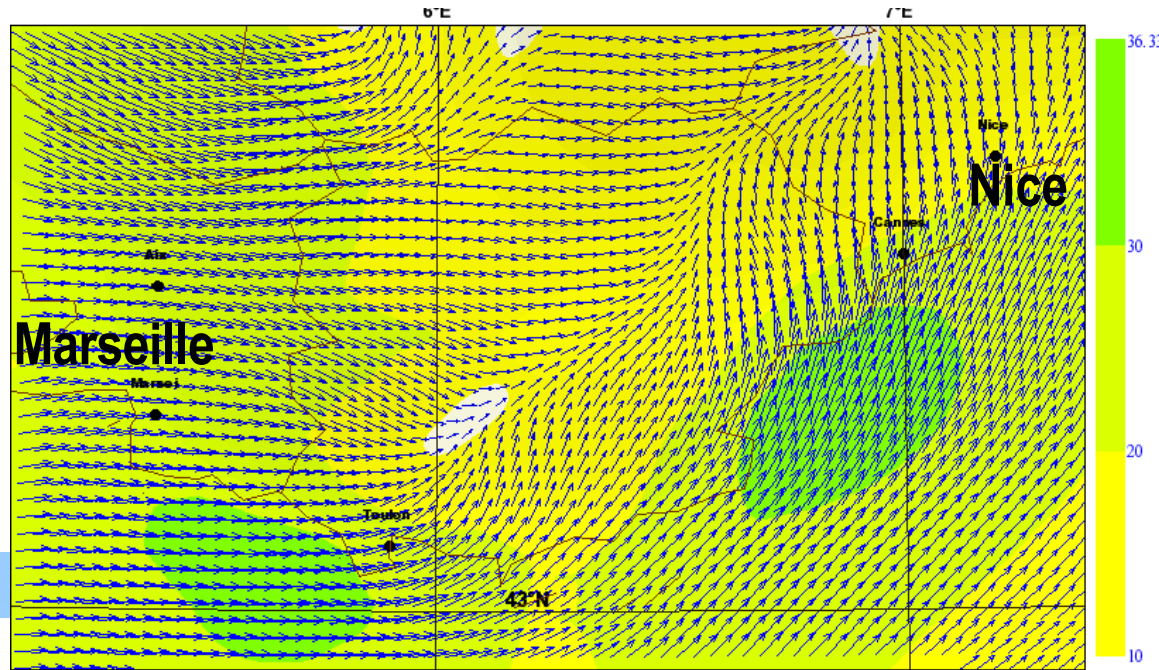
Températures d'Arome



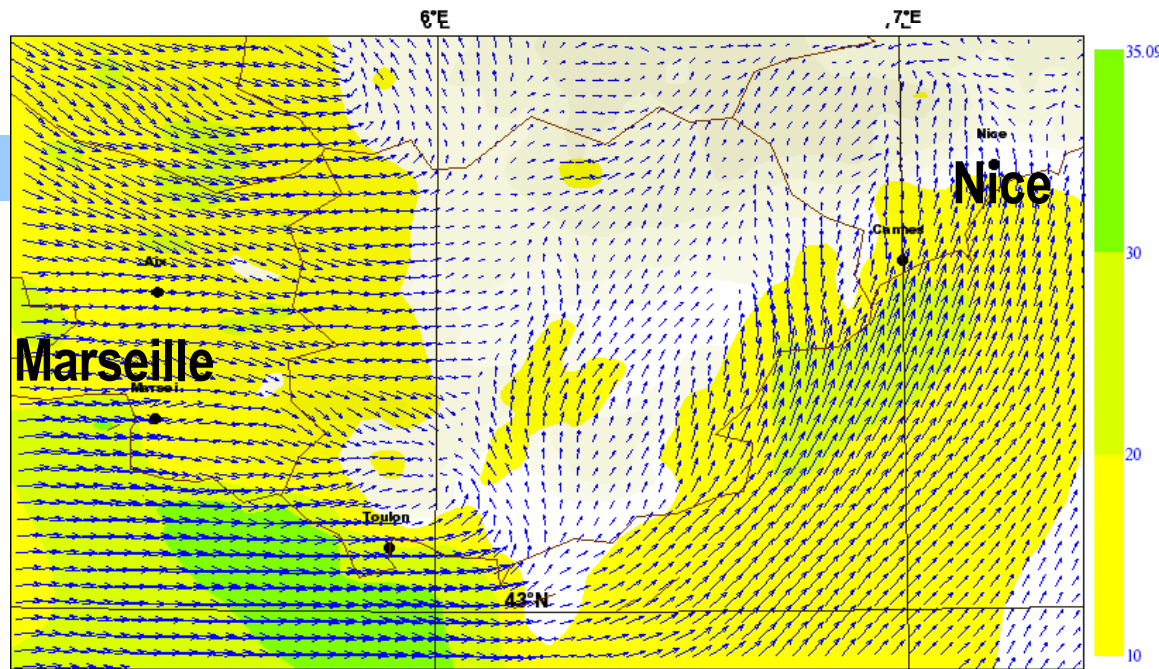
Better wind modelling:

application on forest fires, pollution events, air quality, coastal ocean modelling, air traffic safety

Aladin

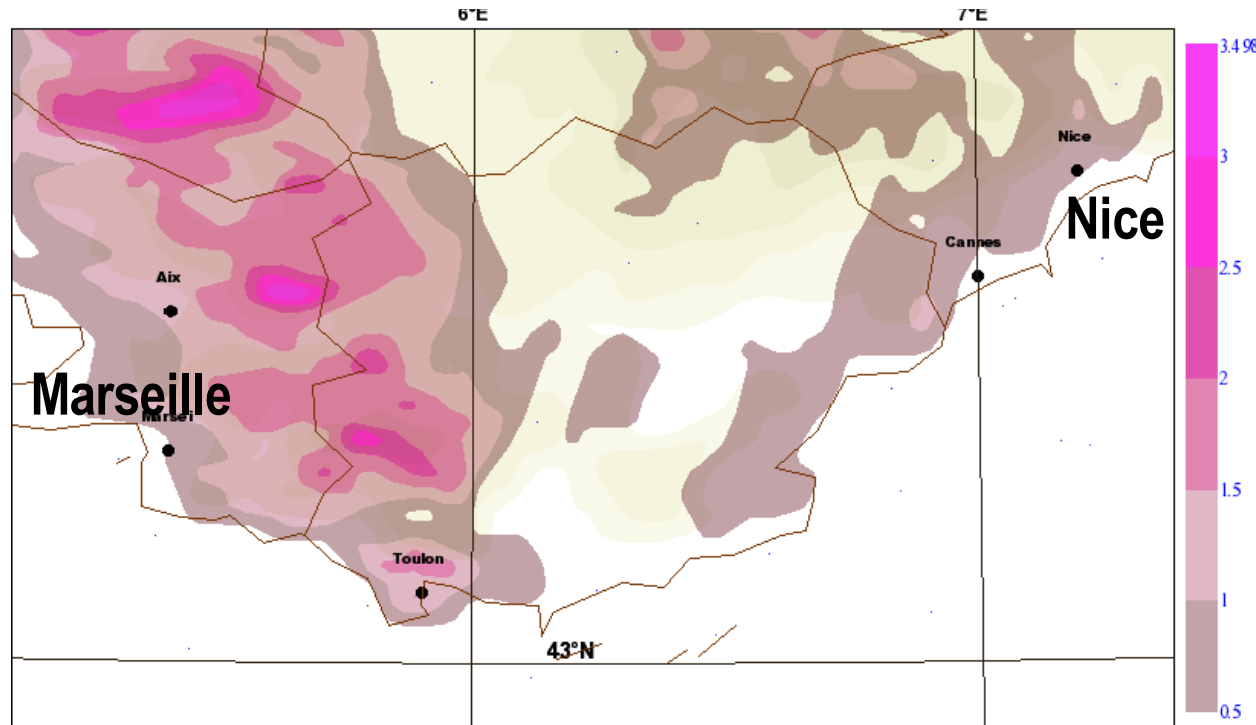


Arome

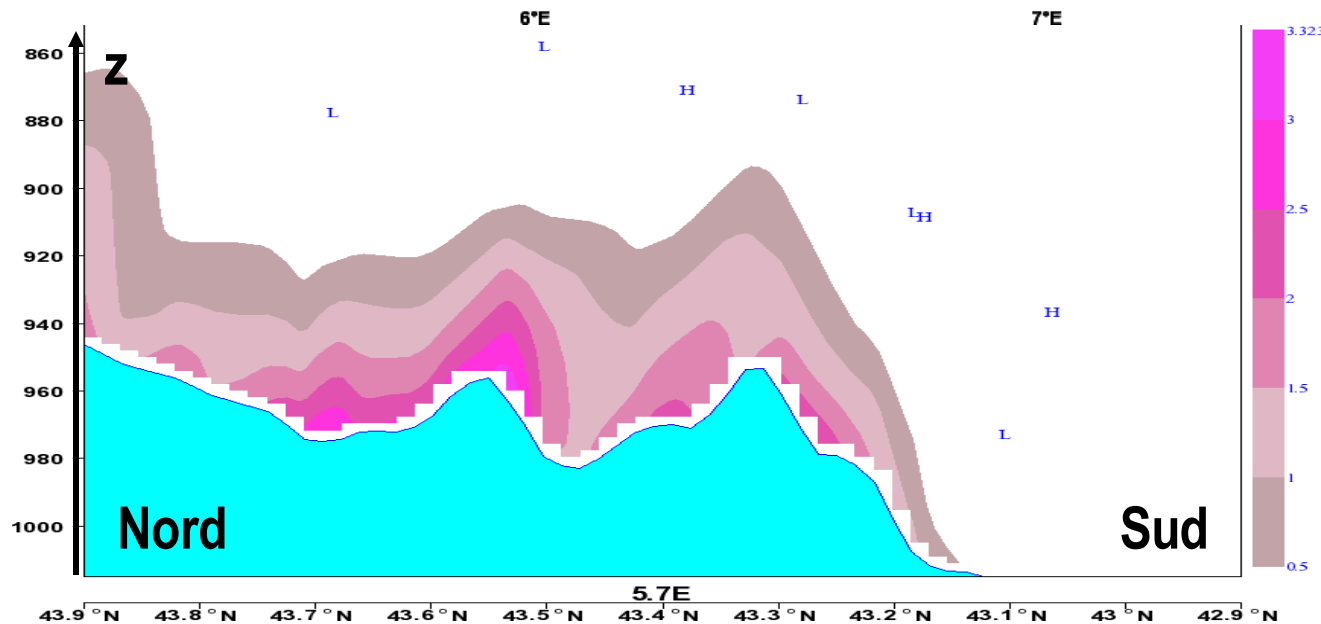


New AROME product: 3D TKE with NH effects

Turbulence at 140m
above ground

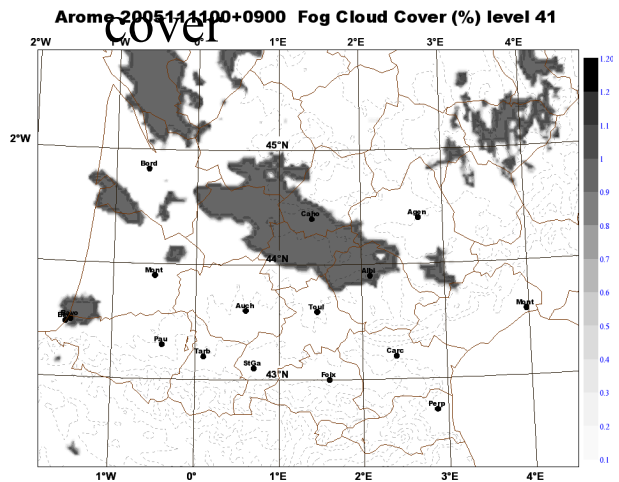


vertical
cross-section

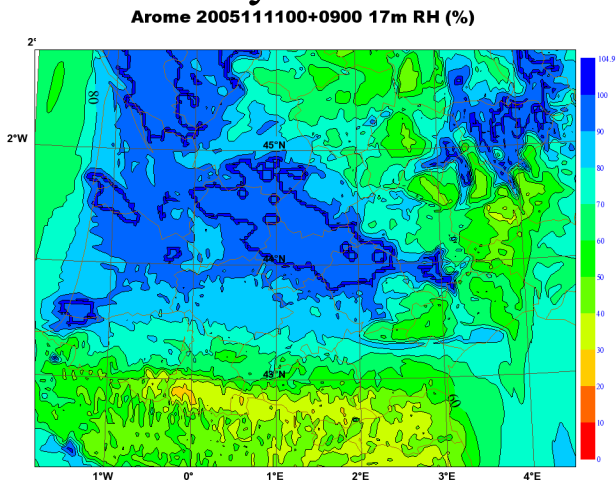


Validation of fog forecast by AROME

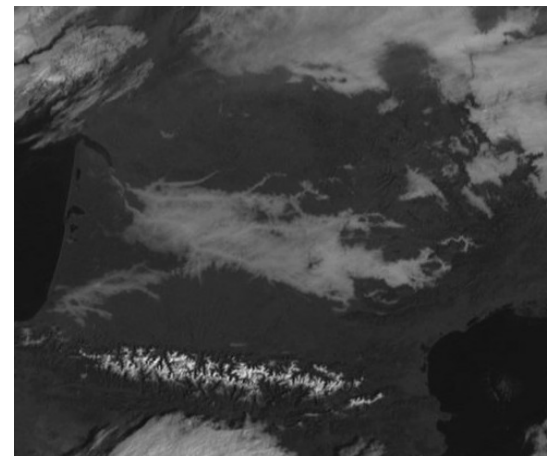
Arome low cloud cover



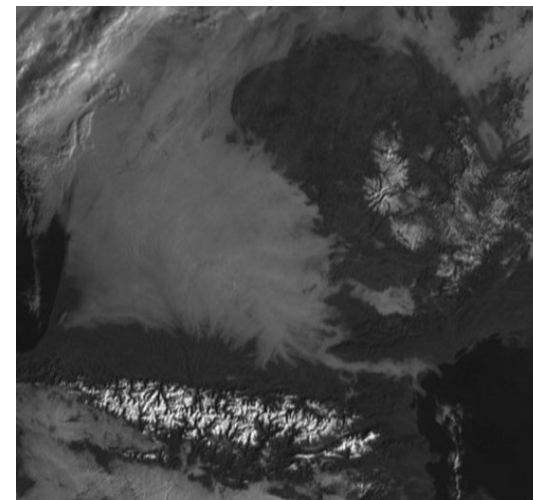
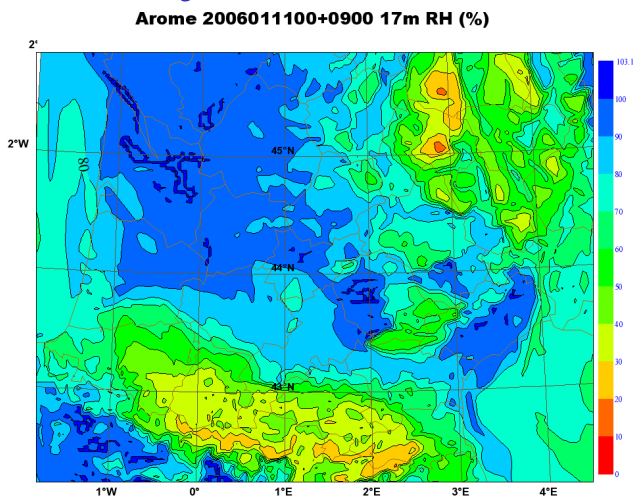
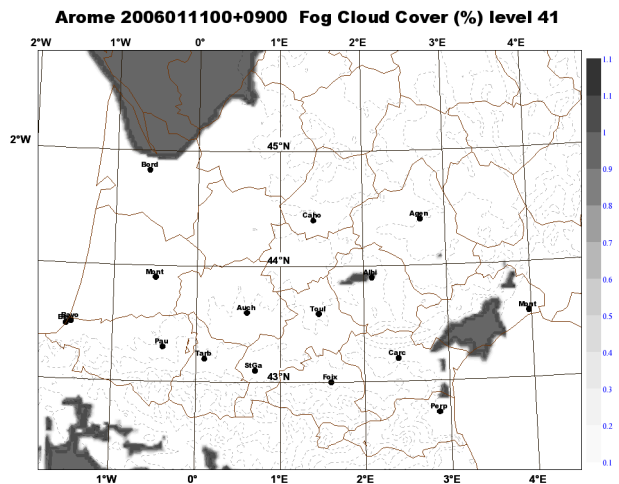
11 nov. 2005 Humidity Arome



MSG satellite



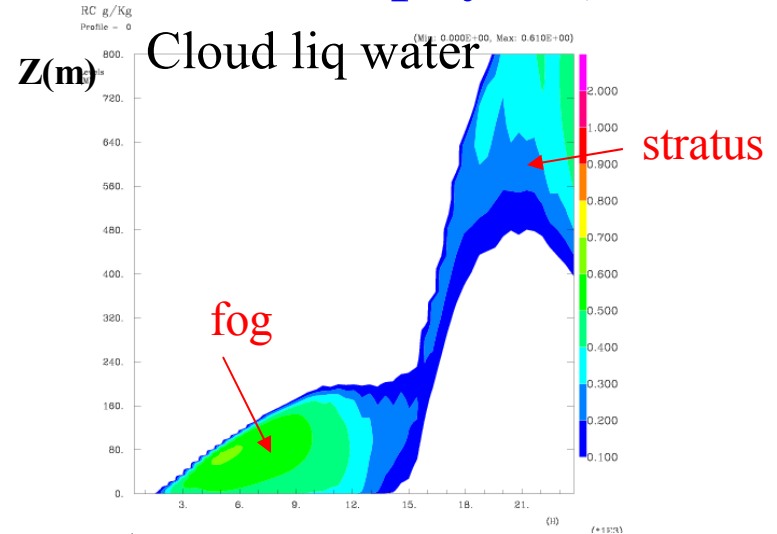
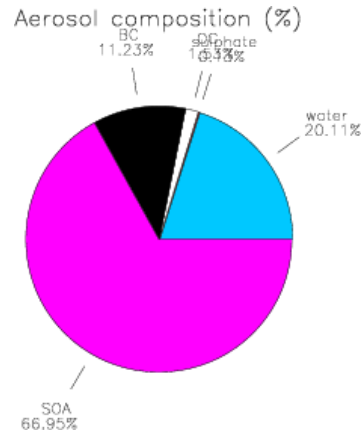
11 janv. 2006



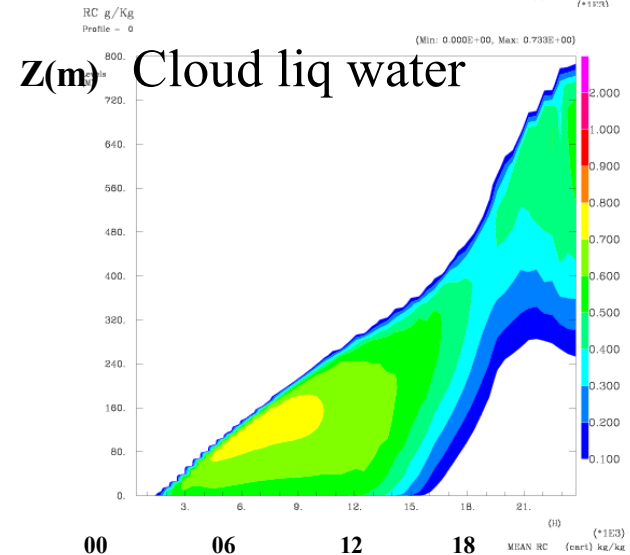
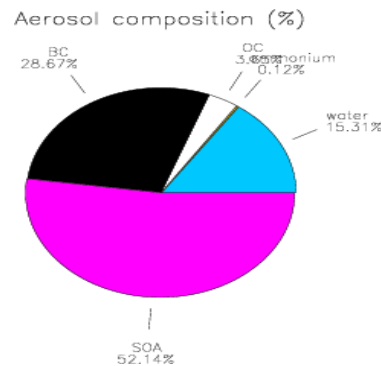
Fog sensitivity to the aerosol specification

(research tests with Méso-NH & ORILAM physics)

**countryside
aerosols**



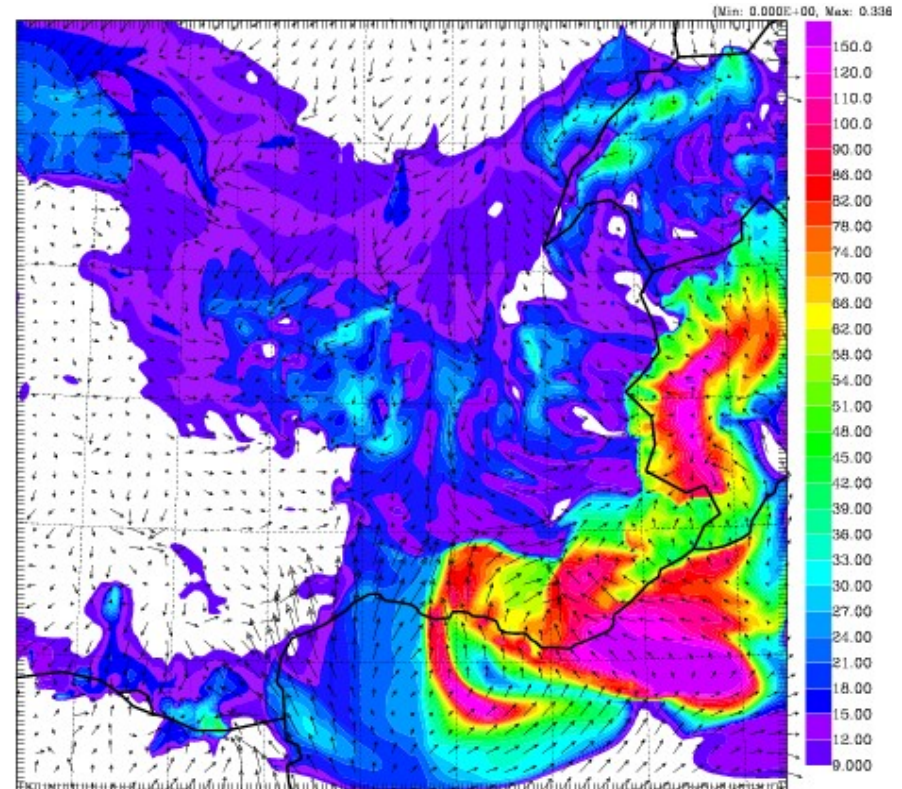
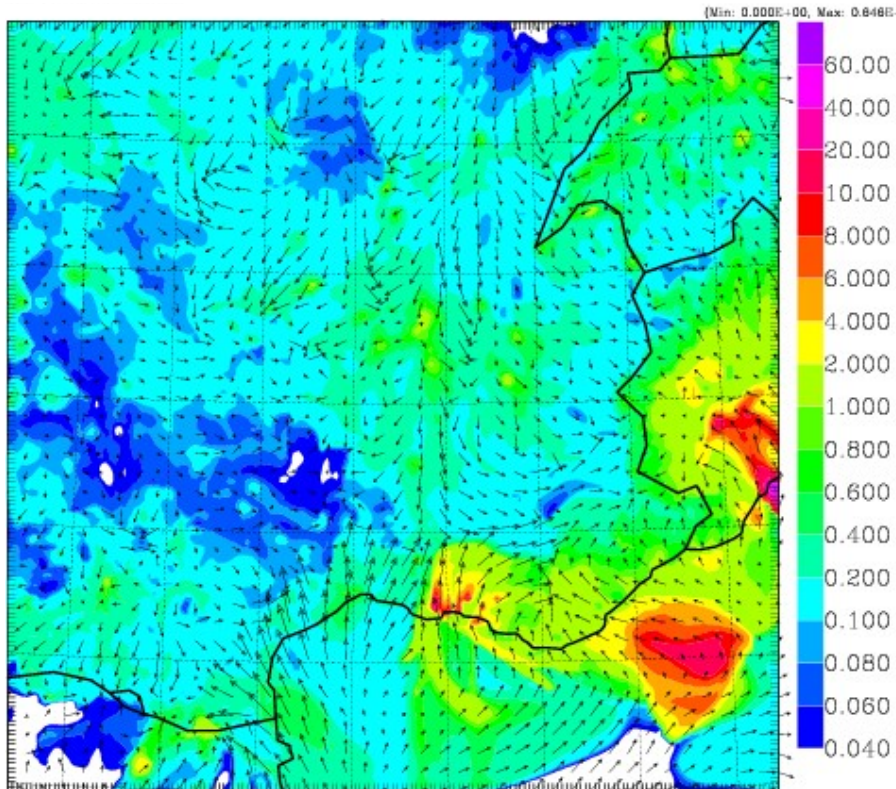
urban aerosols



Air pollution : ESCOMPTE field exp. (AROME/CHEMISTRY)

NOx

O3

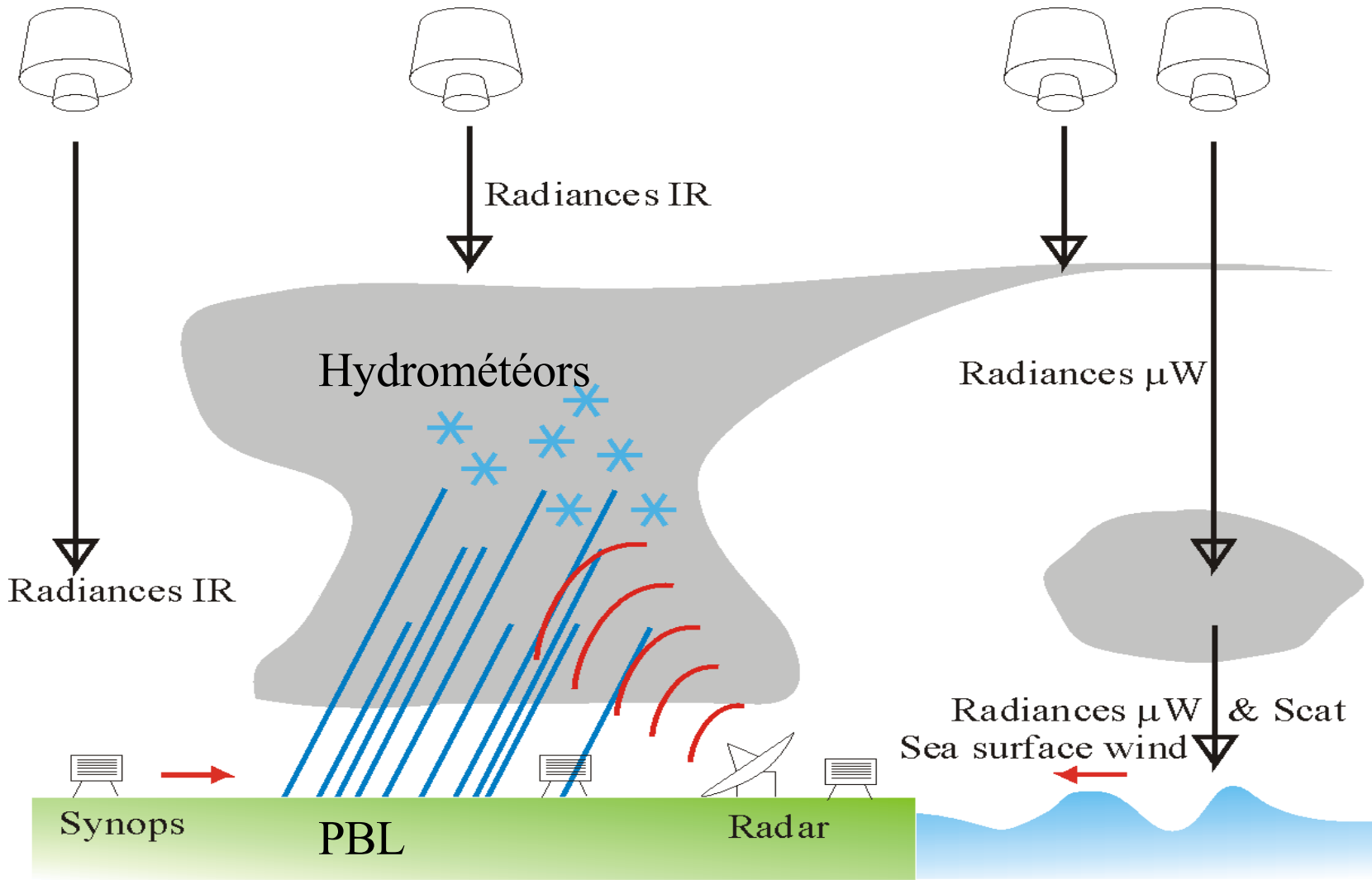


**Low-level fields : 24 June 2001 at 14 UTC
(38 hours of simulation)**

3. Assimilation work

- **ALADIN 3DVar** now operational in France, Hungary, Africa, proven beneficial impact *see C. Fischer*
- **hybrid Méso-NH/3DVar** assimilation tests on Mediterranean convection showed good behaviour but need to improve Jb
- successful **Arome 3DVar 2.5km hourly assimilation** tests show very good impact, even with fixed obs network
- **3DVar diagnostic analysis**, hi-res in PBL. Supersedes CANARI
- need to calibrate 2.5km native Jb using ensemble of Arome runs
- **radar reflectivity** work is proceeding: Bayesian inversion technique, work on data management
- growing **Doppler radar** team in Toulouse. Screening works.
- ground zenithal **GPS** assimilation works.
- more work planned on **scripts** (OLIVE interface), high-resolution use of radiances, bogus cloud data. (*P. Brousseau, E. Sevault*)

Conceptual model of data assimilation for convective scales



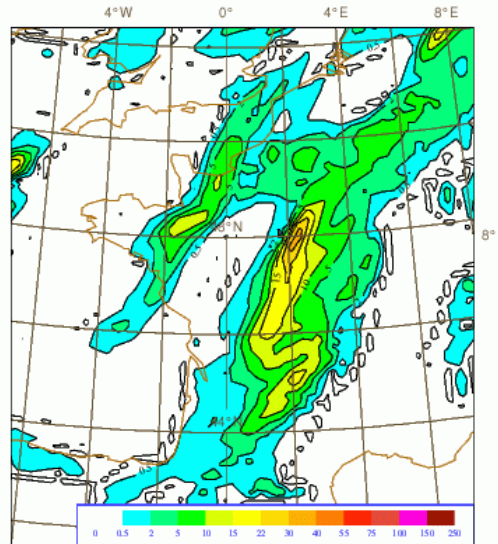
Impact of 3DVar assimilation on ALADIN forecasts: frontal convection

only works if enough hi-res obs e.g. radiances

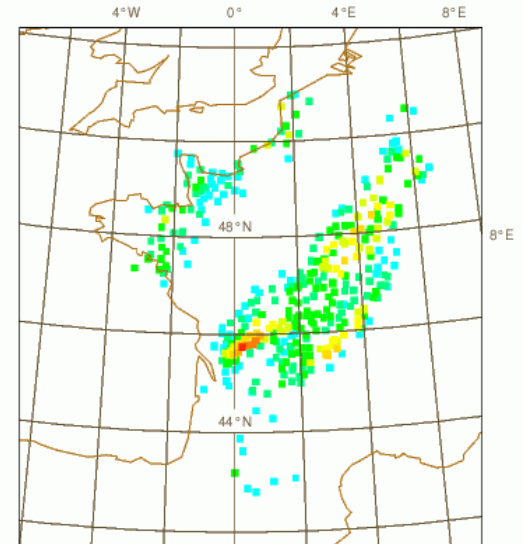
see talk by C.Fischer etc.

2004/07/18 12UTC
RR P12 – P6

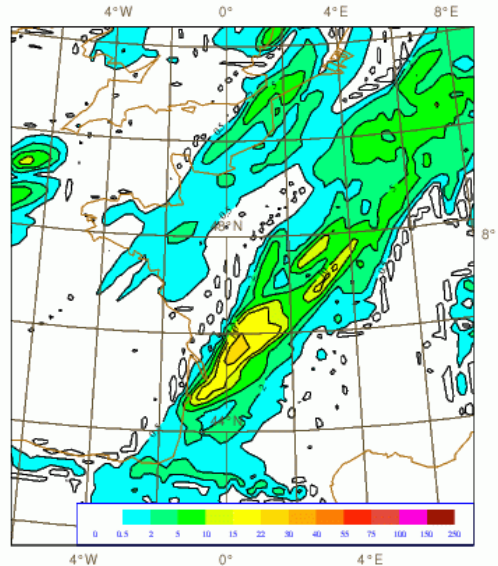
no assimilation



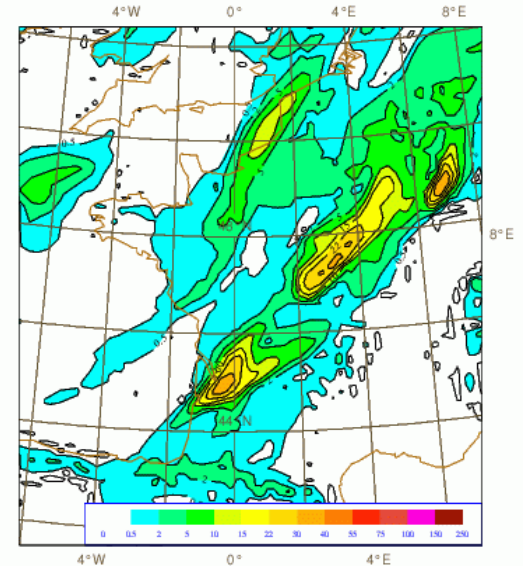
observations



with assimilation

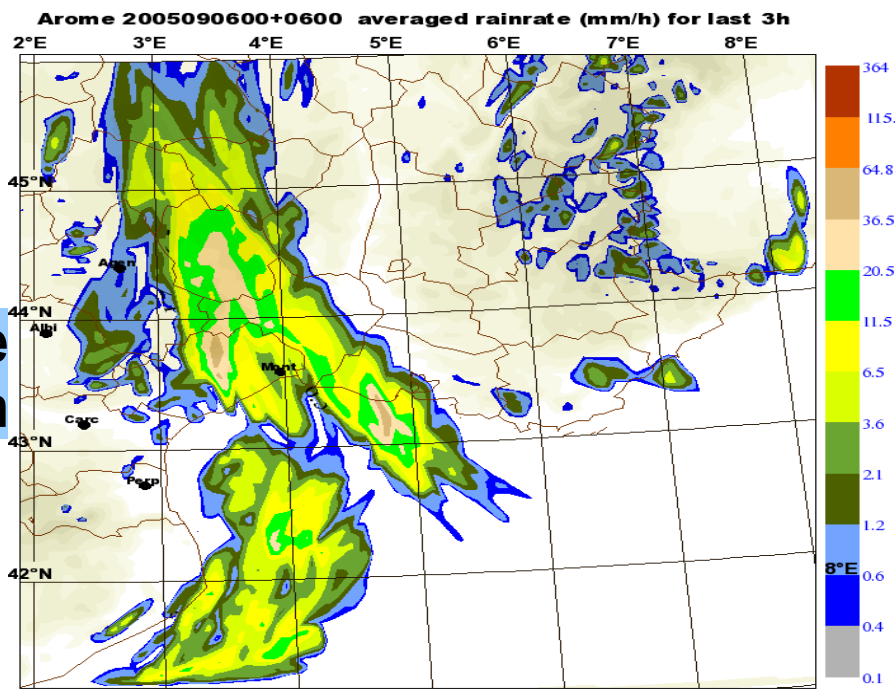


assim with Météosat radiances

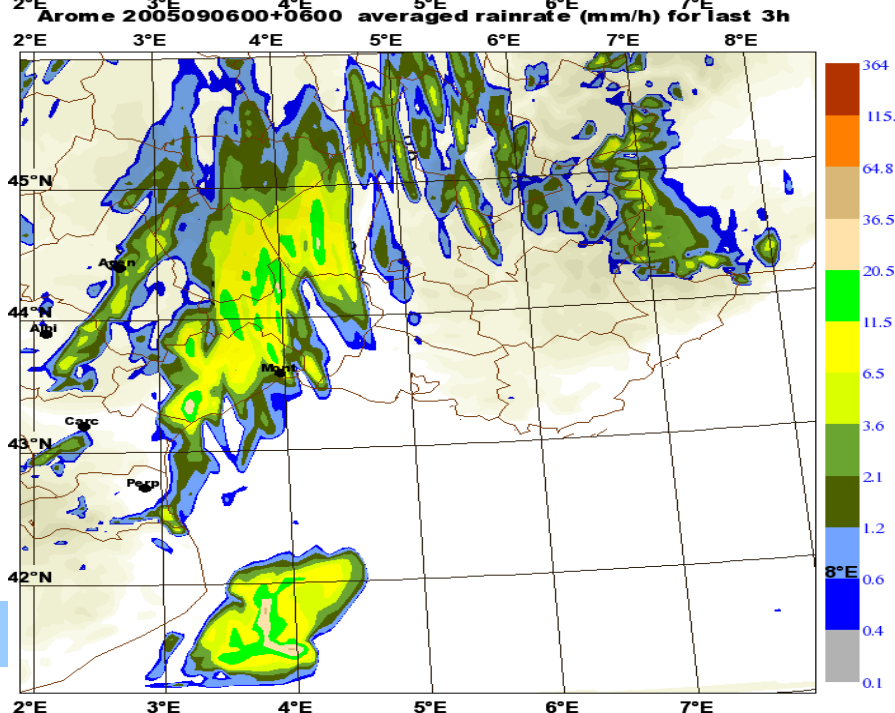
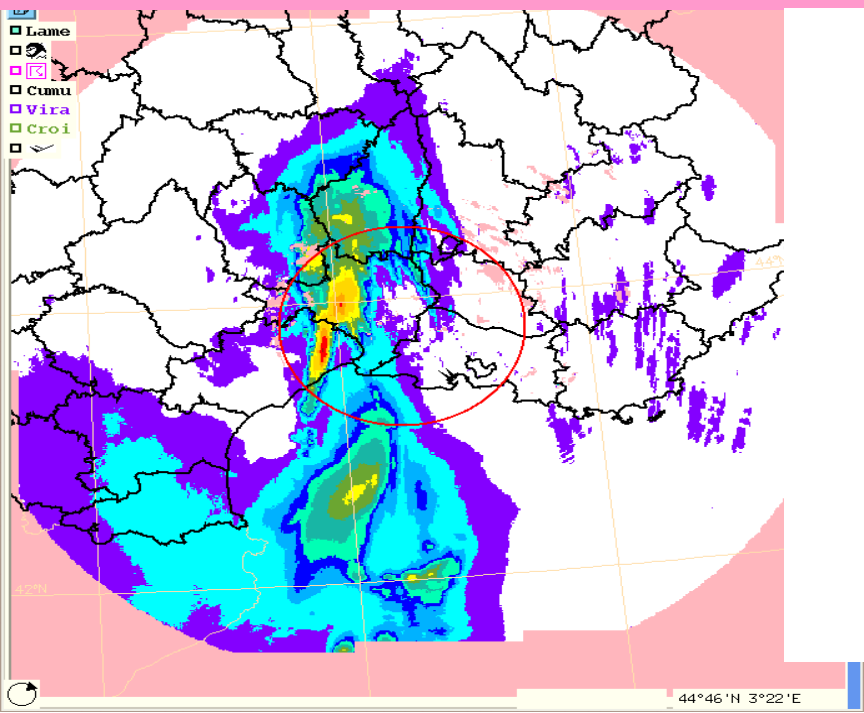


4-h extreme precip forecasts: impact of assimilation

pluies du modèle Arome
no assimilation



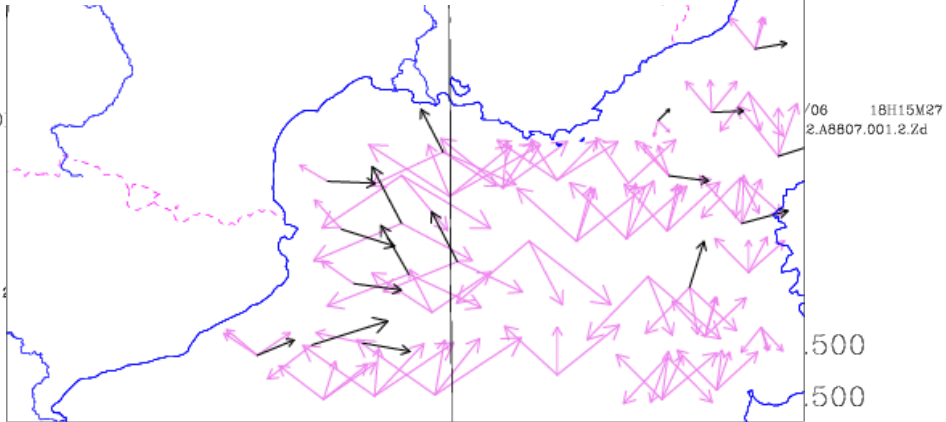
vérité radar



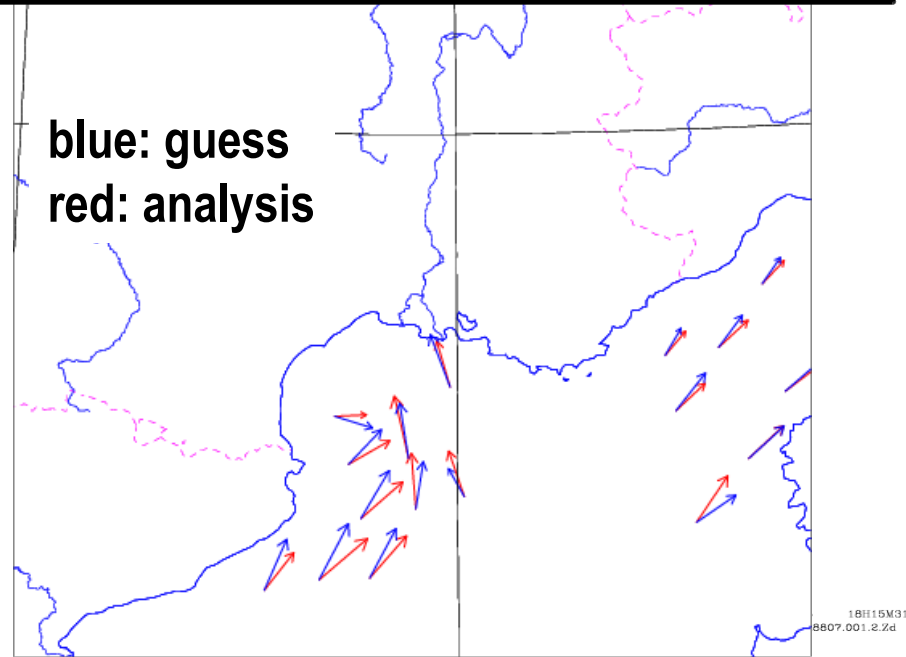
forecast with assimilation

Quikscat wind assimilation

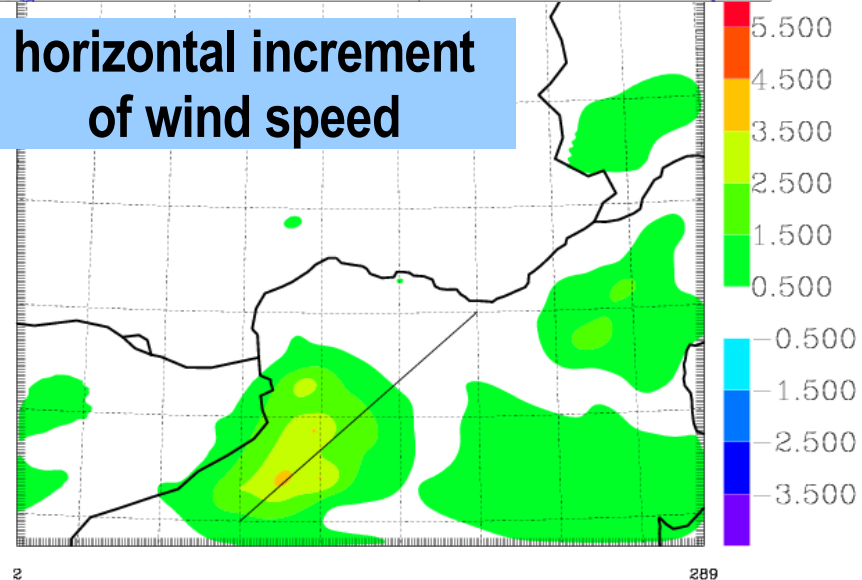
pink: observations, received
 black: observations, active



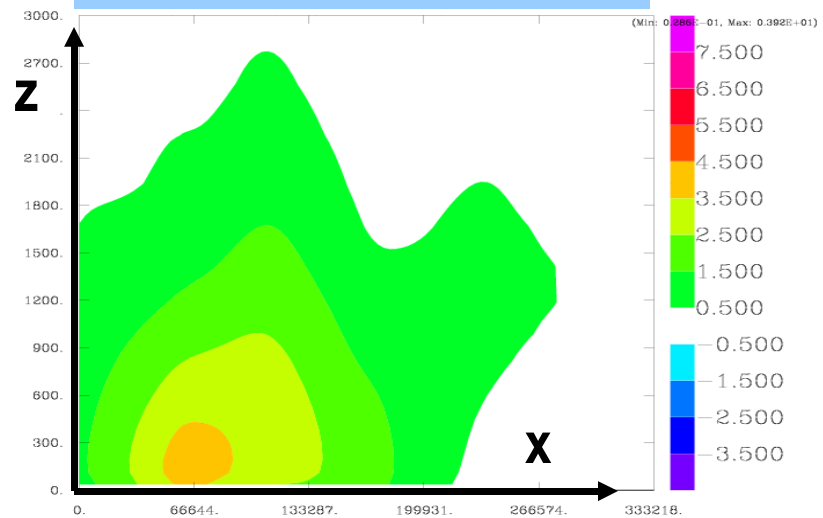
blue: guess
 red: analysis



horizontal increment
 of wind speed



vertical increment xsect



MUMVM (AEORQ.2.ABB07.001.2d.Z)(21600.) - MUMVM (AEORS.2.ABB07.001.2.Zd)(21600.)

DATE MOD. 2002/ 9/ 8 0H 0M 0S DATE CUR. 2002/ 9/ 8 0H 0M 0S
 DATE EXP. 2002/ 9/ 8 0H 0M 0S DATE SEC. 2002/ 9/ 8 0H 0M 0S LAMBERT

MUMVM K= 2

MUMVM (AEORQ.2.ABB07.001.2d.Z)(21600.) - MUMVM (AEORS.2.ABB07.001.2.Zd)(21600.)

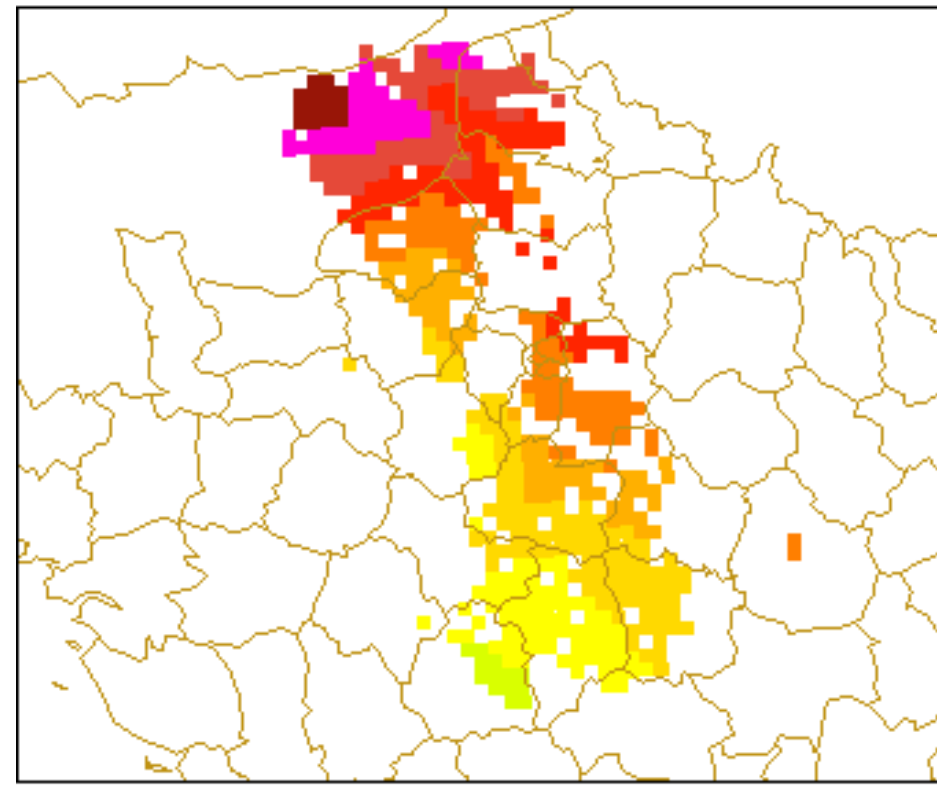
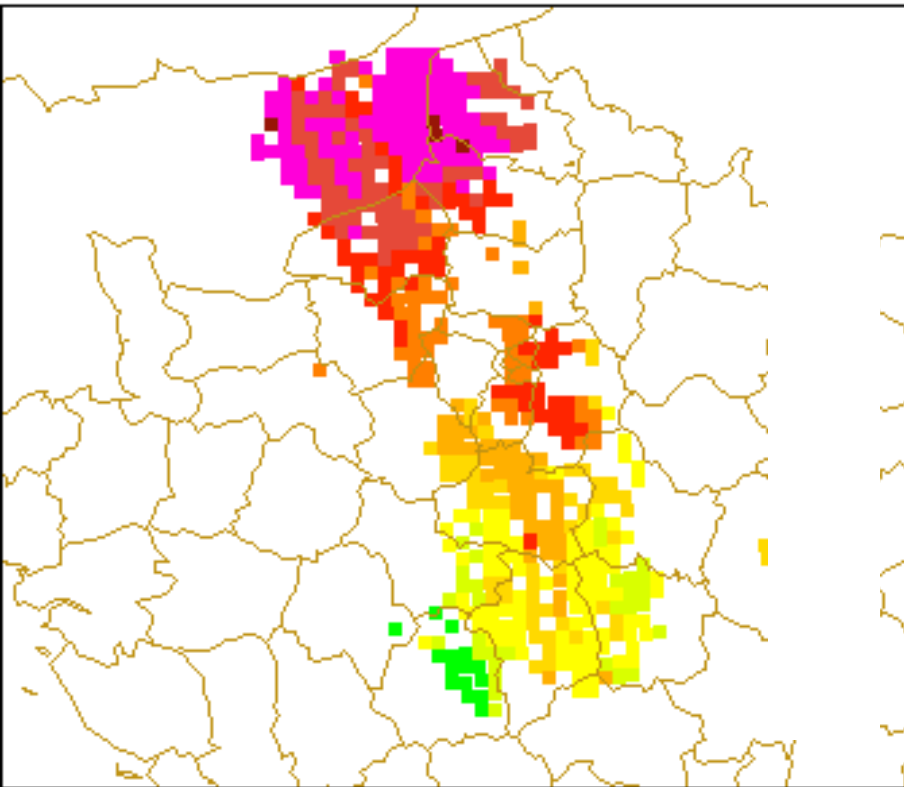
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 DATE EXP. 2002/ 9/ 8 0H 0M 0S DATE SEC. 2002/ 9/ 8 0H 0M 0S LAMBERT

MUMVM

Doppler radar observation operator: radial wind component in the PBL

observed

ALADIN guess



4. The future (i.e. 2006/2007)

- **computer optimization (NEC, IBM, Linux)**
- **data assimilation:** used for all daily runs, compute improved Jb
- short-range hourly forecasts for nowcasting
- test of Saharian dust modelling & SURFEX advanced features
- increase vertical resolution for fog & low clouds
- even more coupling file compression
- even more work on radar & satellite cloud data
- continuing **phys/dyn interface cleaning (for all new devs.)**
- development of **3MT deep convection** with ALARO (*see L Gérard*)
- improvement of Soares EDMF new **shallow convection**
- **critical review of all physics schemes & more verification**
- *preparing the post-AROME work: adaptive discretization, vertical slopes, 3D turbulence, interactive gridnesting, better large-scale coupling, mesoscale predictability, 4DVar/KF, toolbox of physics, merge with ALARO & HARMONIE ?*