Status, plans & interactions of AROME

– Objectives and constraints

– Status

– Latest plans

– Méso-NH and HIRLAM aspects

– The ALADIN/AROME transition problem: a small institute's point of view ?

Why AROME ?

- ALADIN is a useful model but not evolving quickly enough to meet user needs at kilometric scales and short ranges.
- Research CRMs demonstrate large improvements to cloud/precip forecasting – at a price: dx<3km, NH and explicit microphysics.
- Growing competition from MM5, WRF, UM, LM, ECMWF – including data assimilation : a threat to the **survival of national NWP**. Customers do not care about models, only products.
- Untapped potential from mesoscale obs: sounders, radars, surface networks, etc.
- CPU is getting cheaper: we must use it.
- Separating NWP work from research institutes is wasting manpower and expertise: it's **bad for everyone**

Arome deliverables

- Provide substantial **added value** over global models for short-range forecasts of **precipitation, actual weather, extreme weather**
- Justify funding of high-resolution regional observations
- Analyses & forecasts for **hydrology, air quality, nowcasting**
- **Optimal interaction with scientific community** on NWP modelling and research data assimilation tools

Arome constraints in Météo-France

- Start operational production with dx<3km over mainland France (range 36h, assimilation of hourly data) in 2008
- Hence, preoperational tests must start in 2006, first experiments need to run in 2004: **very tight schedule !**
- Choice: use as much as possible of Aladin software, except physics from Méso-NH (no competing package available in Aladin)
- Arome model will be 30-100 times more expensive than Aladin, but much cheaper than Méso-NH or MM5
- Most of the **physics development to be done using Méso-NH expertise in the short term**
- All other developments to **have maximum Aladin compatibility and expertise: assimilation, dynamics, predictability, coupling, maintenance**
- Arome experimentation & validation **work shared between NWP and scientific teams**

Arome ingredients

- See many papers in Newsletter, ECMWF/Hirlam seminar, etc.
- **Data assimilation is 99% pure Aladin**, only at higher resolution (+ cloud initialization issue)
- **Model is 90% pure Aladin**: Aladin-NH dynamics, 80 Méso-NH-specific physics routines, external surface code
- Important parametrisations: prognostic microphysics (5 species), prognostic TKE turbulence, new radiation, new surface (+ future schemes)
- Resolution: dx=2.5km, L80, rectangular linear truncation, dt=1mn
- Assimilation requires **FGAT**, high resolution Jb and emphasis on MSG, radar & low-level data.
- A new computer will be needed in Météo-France
- Research assimilation using 3DVar/Méso-NH hybrid tool
- **Validation facilities** are still insufficient (clouds, precip, weather)
- Strong demand for a **portable system** and **Nowcasting** products

Arome people

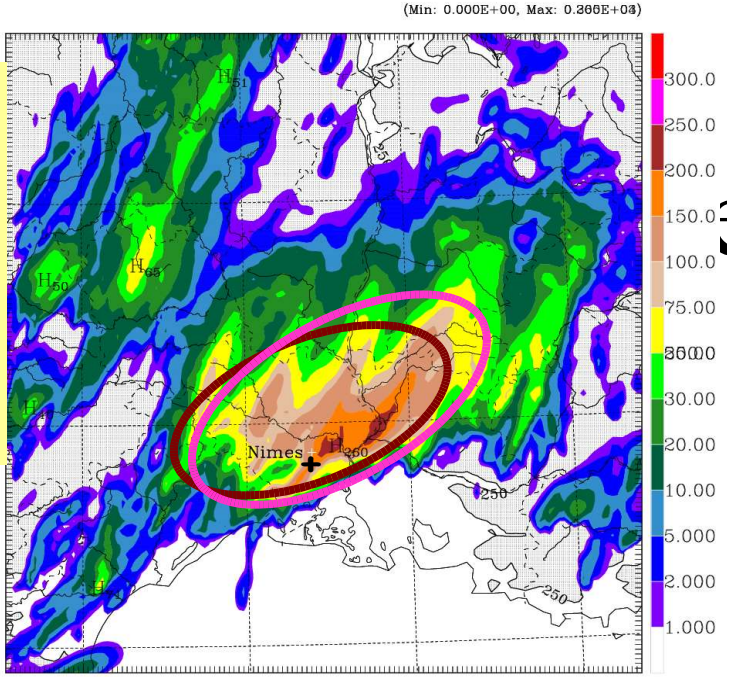
- New permanent staff allocated by Météo-France on top of Arpège and Aladin staff i.e. **no slowing down of Aladin-1 work**
- **Sylvie Malardel:** physics (Méso-NH side)
- **Yann Seity:** model (Aladin side) and phasing
- **Frédéric Duret:** experimentation tools and support for research users
- **Eric Wattrelot:** radar data assimilation
- **Ludovic Auger:** high-resolution analysis and observations (50% on nowcasting applications)
- [**François Bouttier:** interim project manager]
- [**Gwenaëlle Hello/Jean-François Geleyn**: Aladin/Arome transition international issues]
- [a dozen of students and part-time helpers mainly in GMAP and GMME (mesoscale research group)]

Arome status on 10 Feb 2004

- Arome model prototype **completely validated in 1D** column mode
- Full 3D code runs with microphysics and 1D turbulence (squall line case), compares well with Méso-NH
- Externalised ISBA surface will be finalised in April
- Hybrid research assimilation is being done on Mediterranean flood cases and African JET experiment in GMME (ongoing Jb improvements)
- MSG radiances are going preoperational in Aladin 3DVar in April
- Real radar development is starting in March
- Aladin 3DVar is integrated inside the OLIVE tool

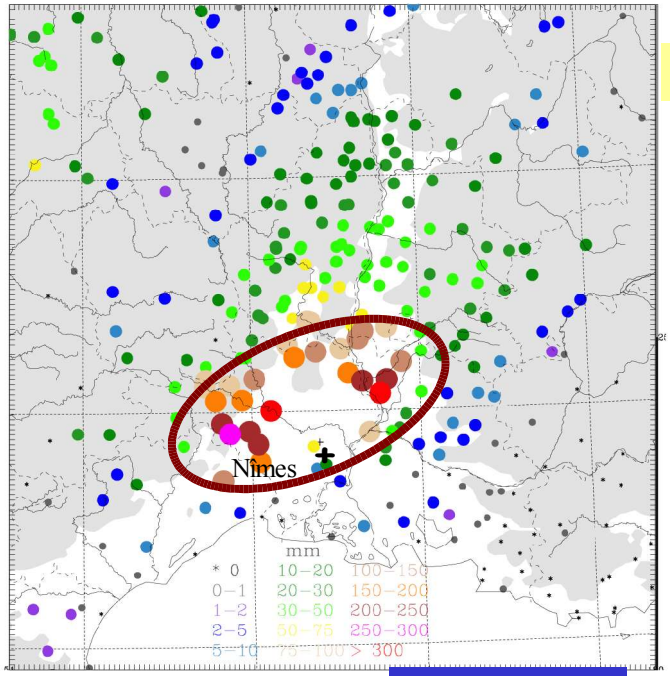
TESTING OF MESOSCALE ANALYSIS IMPACT (V. DUCROCQ, DEC 2004)

Initial conditions : mesoscale analysis (surface obs, radar, satellite) for 12UTC, 8th Sept. 2002



MESO-NH (2.5km)

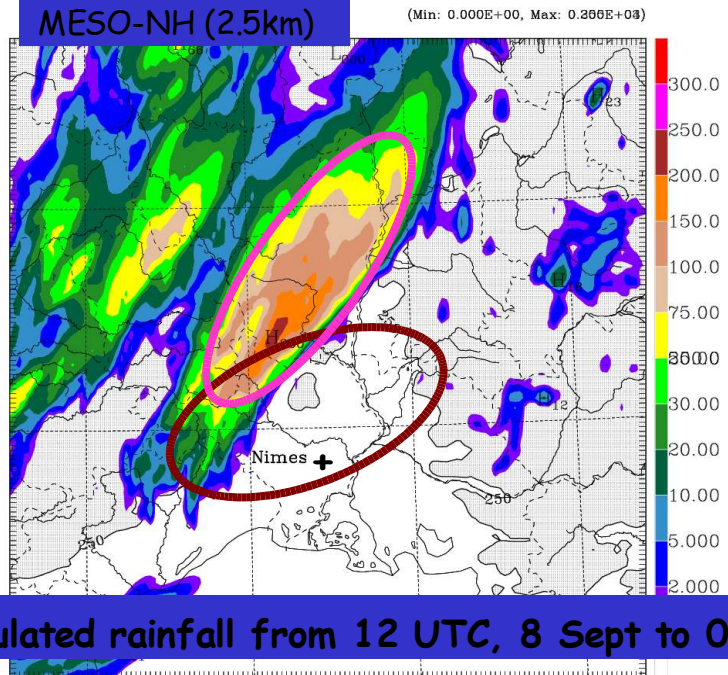
Raingauges



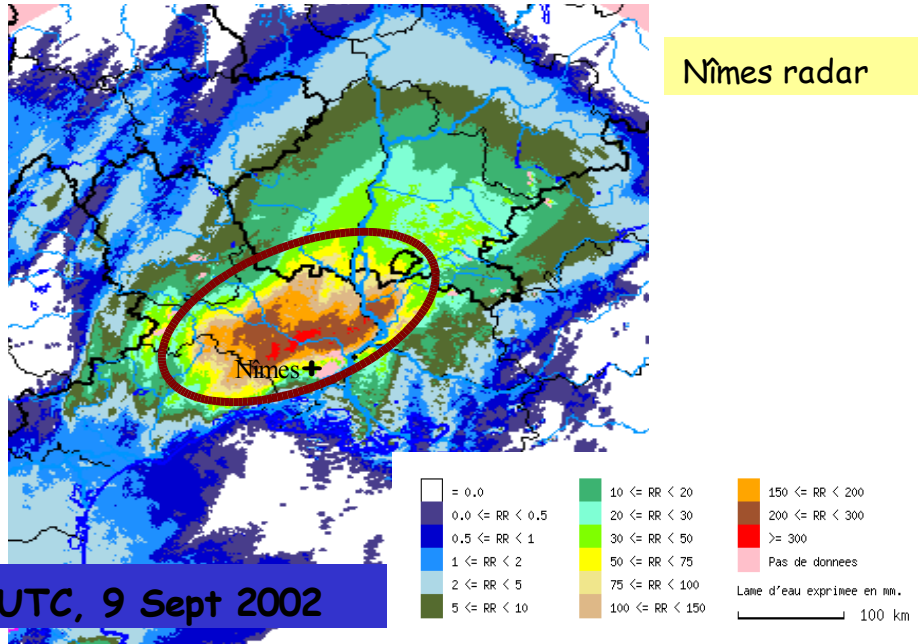
Observations

Ducrocq et al, 2003

Initial conditions : large scale ARPEGE analysis for 12UTC, 8th Sept. 2002

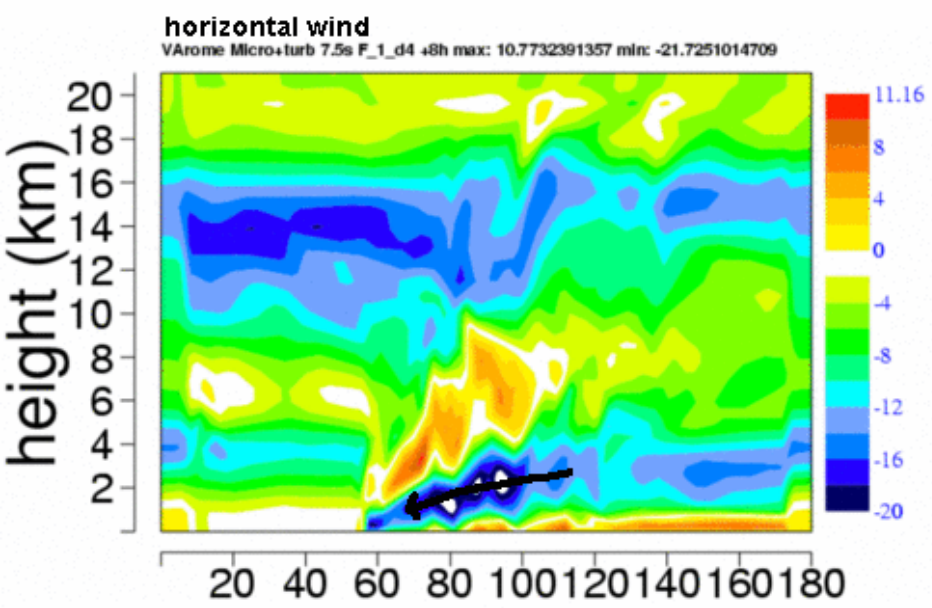


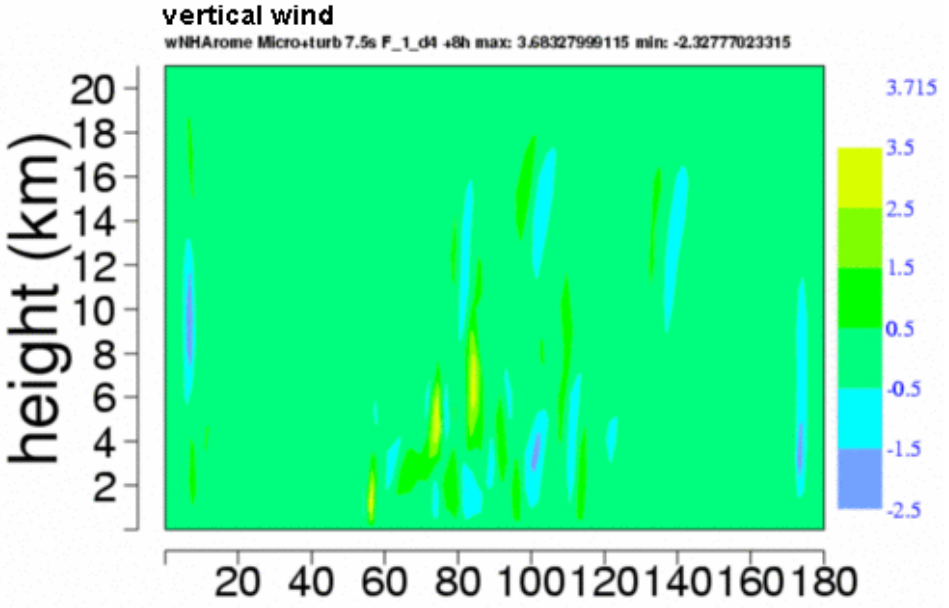
Nîmes radar

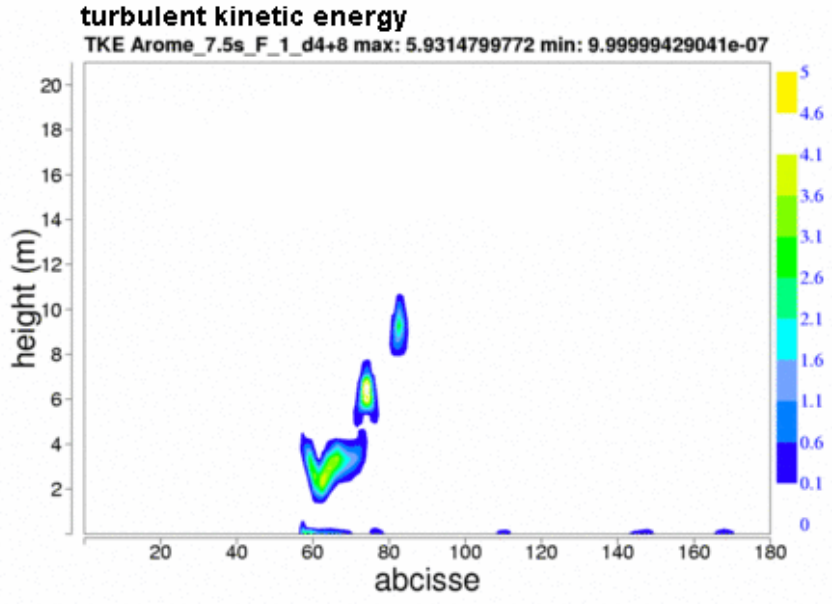


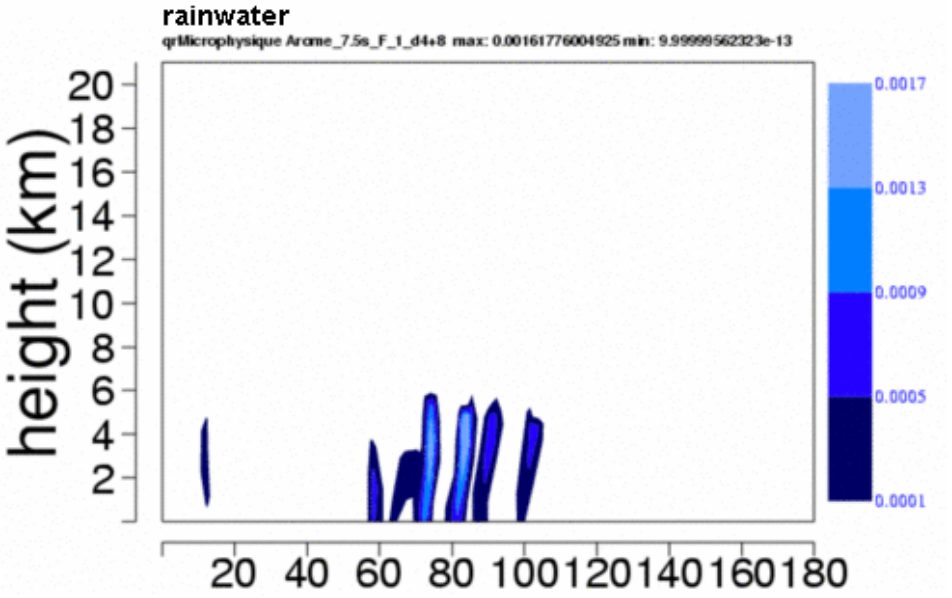
12-h accumulated rainfall from 12 UTC, 8 Sept to 0 UTC, 9 Sept 2002

Test-run of Arome: academic squall line (Y.Seity, Feb 2004)









Arome current plans

- First model prototype runs this winter, benchmarked & improved before **research release** end 2004
- First version of radar assimilation and cloud analysis, autumn 2004
- Intercomparisons with UM and WRF, early 2005
- **First Aladin backphasing,** early 2005
- Physics added/tuned in 2005/2006: 3D turbulence, shallow clouds, coupling with chemistry and 3D coastal ocean model, cleaning of physics interface
- Official **research release in 2006** (AMMA, MAP FDP, scientific cooperations)
- NWP-oriented validation and optimization in 2006/2007
- **Operational-grade version not ready until mid-2007**

The Méso-NH aspects

- Arome will heavily rely on Méso-NH activities on physics & assimilation until it is a mature model with its own experts
- **Expertise & manpower** on most Arome physics is so far available only in Méso-NH community: GMME, Laboratoire d'Aérologie. But they are open to scientific cooperation with Aladin partners. It would be beneficial to the future Arome NWP quality.
- Méso-NH is used in small labs, even on Linux PCs
- Méso-NH has **experimentation tools** that are missing in Aladin: **gridnesting, turbulence** diagnostics, **LES simulation** mode, research-oriented **graphics.**
- In-depth studies of **case studies**, **field experiments**, **instrumented sites**, that NWP teams can't do.
- In touch with a **wide scientific & NWP community** outside Aladin
- Examples : cloud **turbulence**, orographic **convection,** ice **microphysics**, **chemistry** & aerosols, **ocean fluxes, radar** physics

The HIRLAM variable

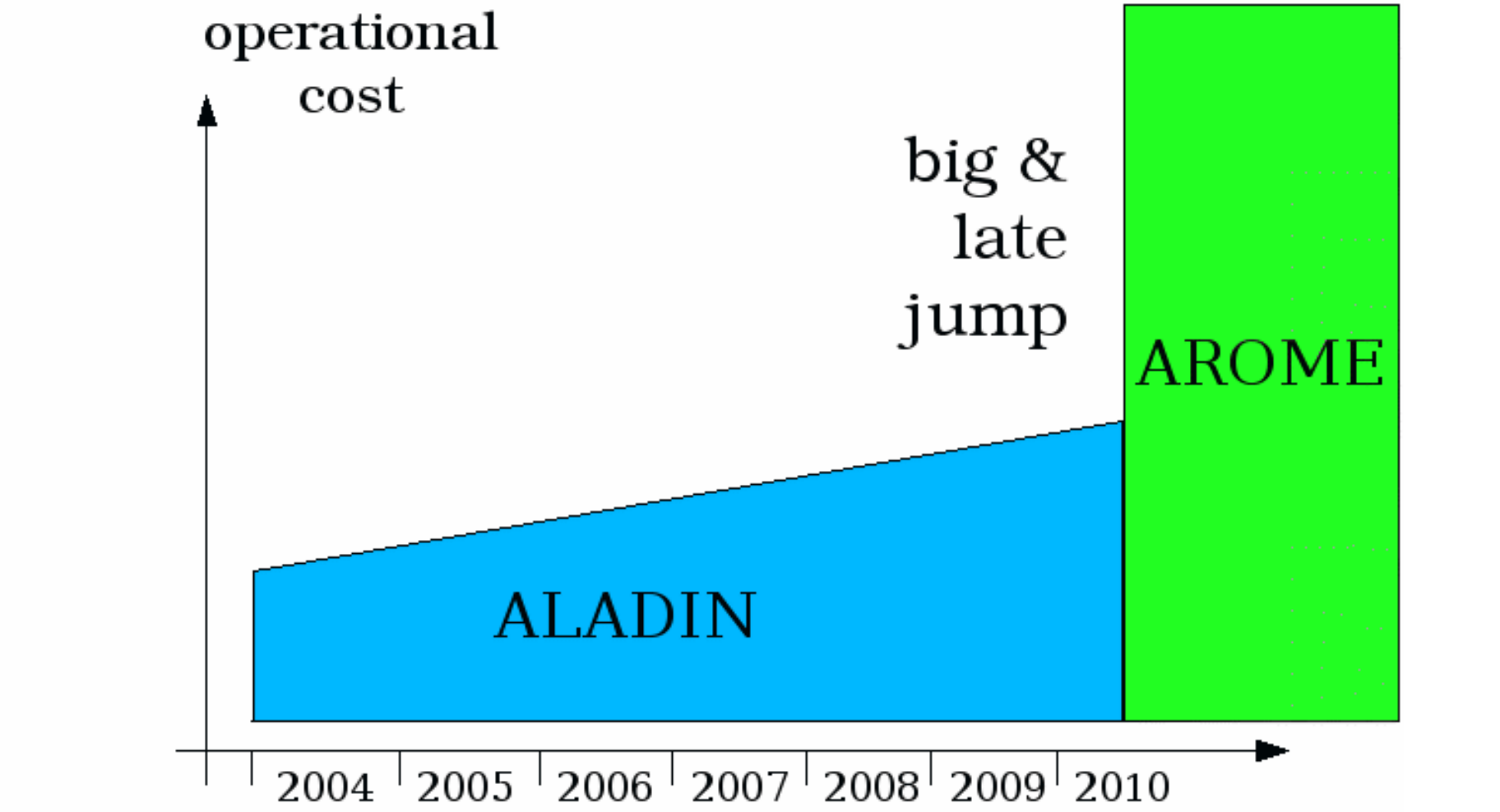
- The Hirlam group is really interested in Aladin-NH dynamics and Arome collaboration
- But they have not yet decided on a real software cooperation
- They are sure they want to keep the HIRLAM name
- Their motivation: compatibility with ECMWF software, especially in assimilation
- Our interest: more manpower on physics, Doppler radar, mesoscale satellite data
- **Problem:** (even !) more time spent on work coordination, phasing, political arguments, overheads
- Has potential to produce **the world's best mesoscale NWP** system if it works – with a job for all of us

The Aladin/Arome transition

- Given my computer upgrade schedule, how to run the best national NWP model every year ?
- Météo-France has the same problem and a long-term approach has been preferred
- 3 different paths to choose from: put the effort on Aladin, on Arome, or Alaro
- Alaro still lacks a critical mass of manpower (3 to 5 people) to exist

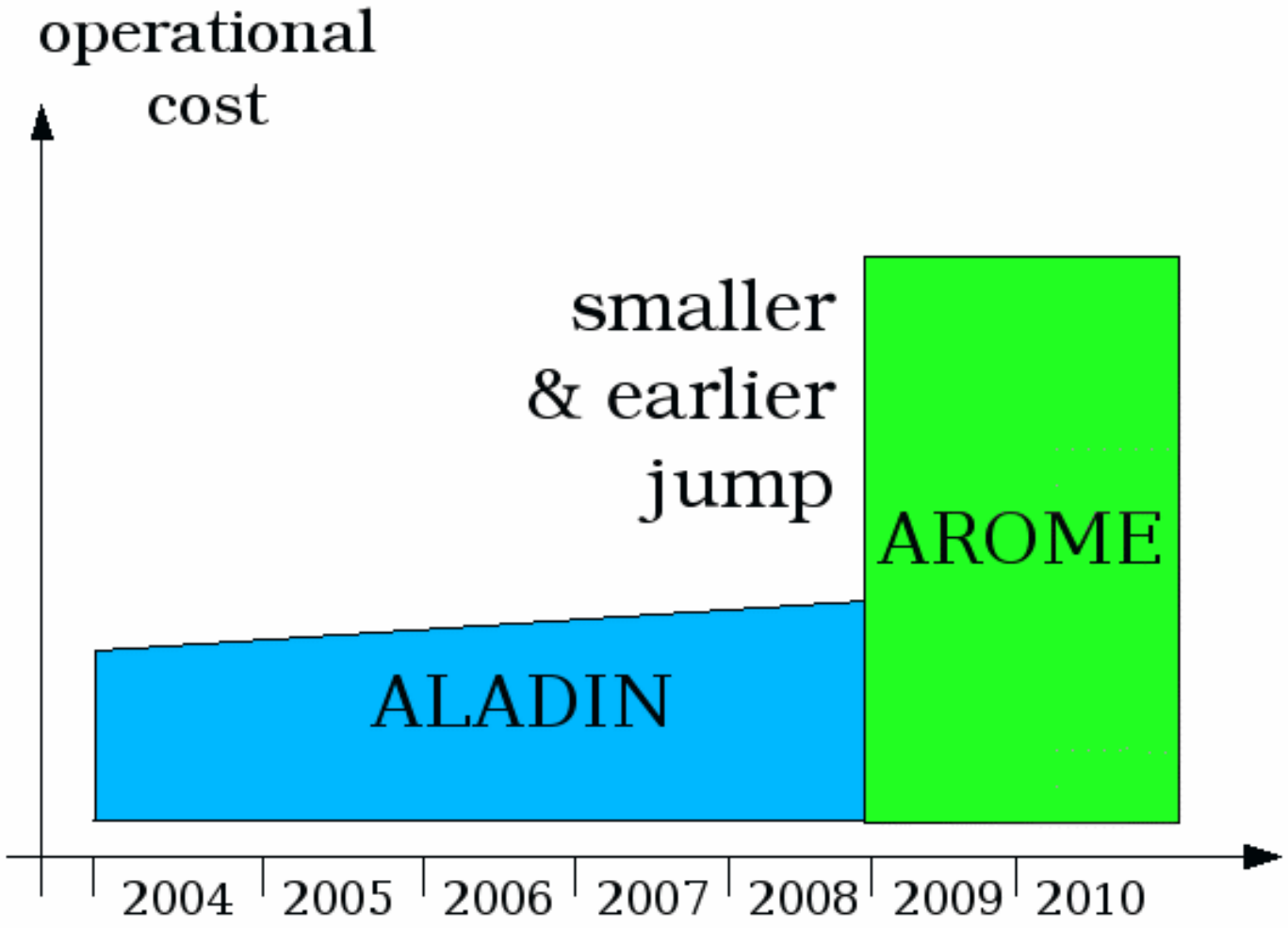
With max effort on Aladin:

business-as-usual, best for short term, others will prepare Arome for you



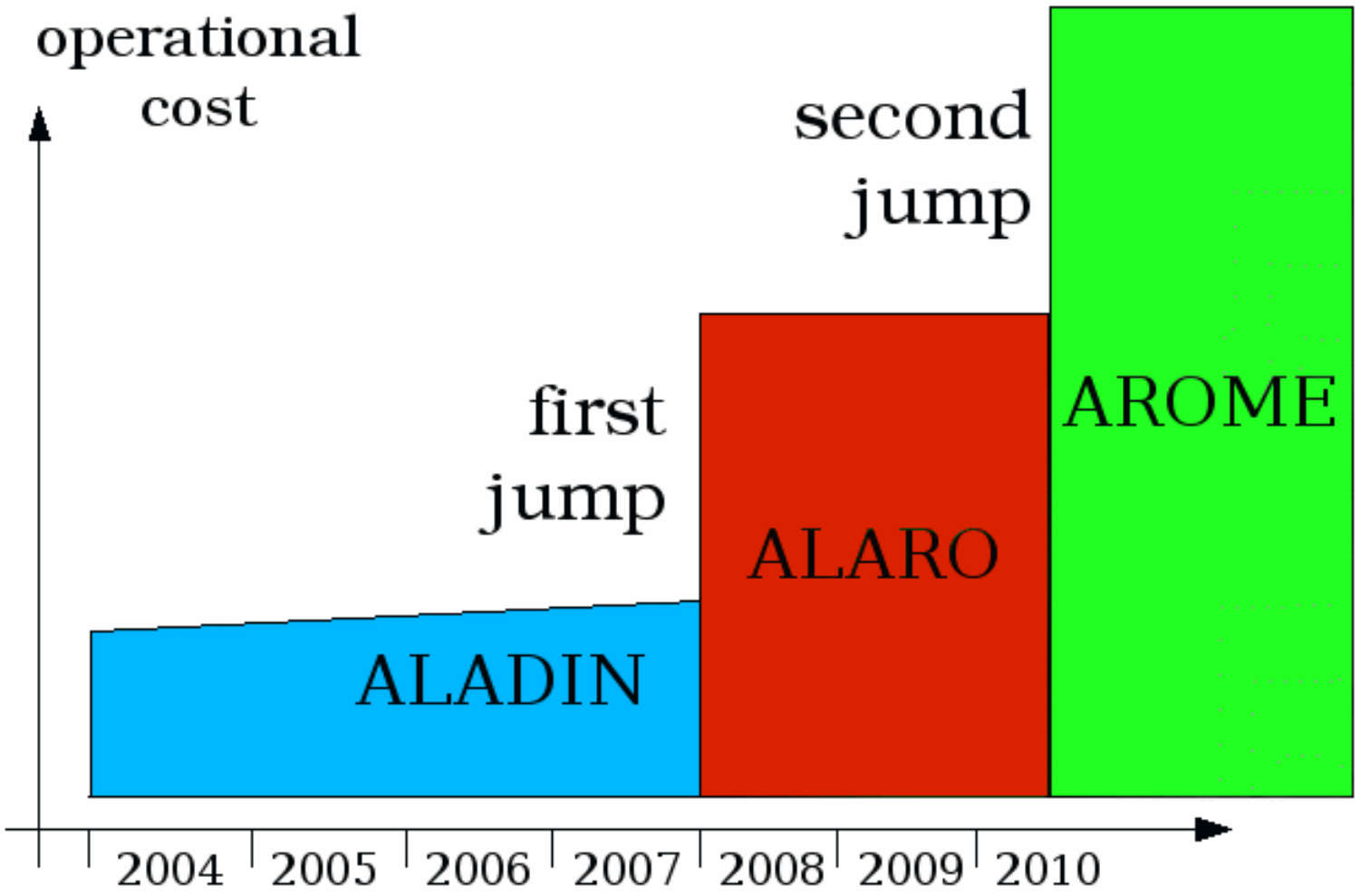
With max effort on Arome:

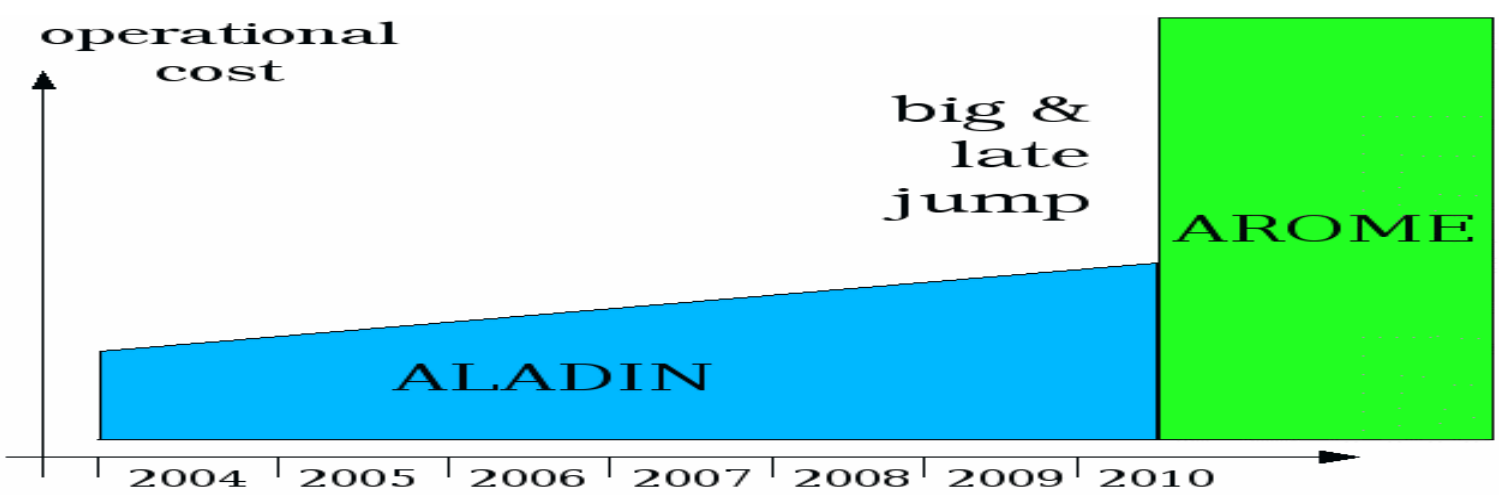
radically new tool, best for long term, Aladin will improve through Arpege/Arome work



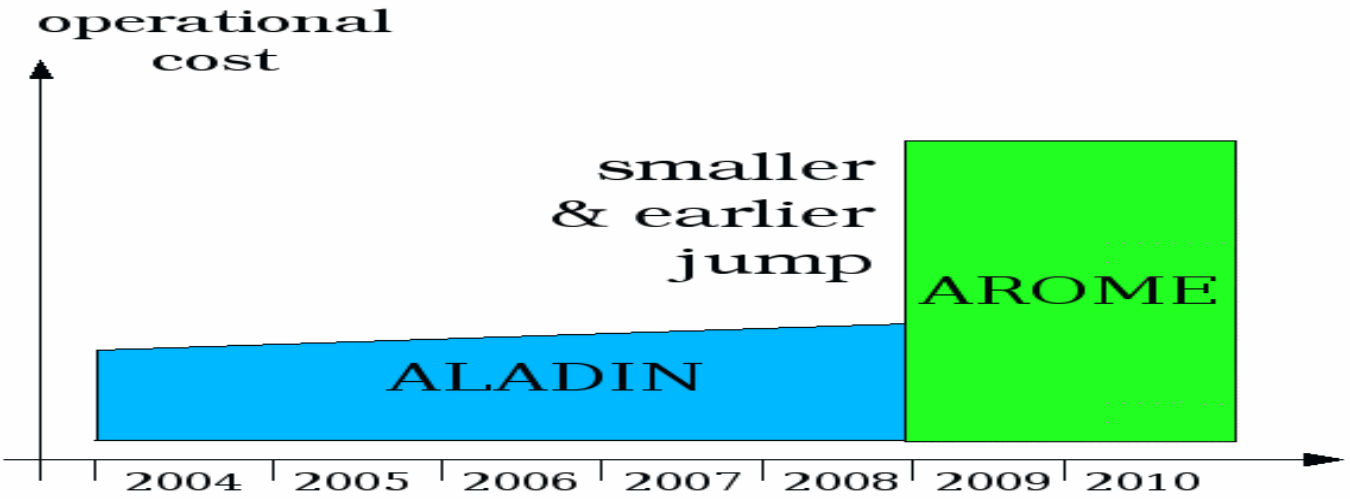
With max effort on Alaro:

create a 3rd model to reduce the ‘jumps’, best for medium-term.

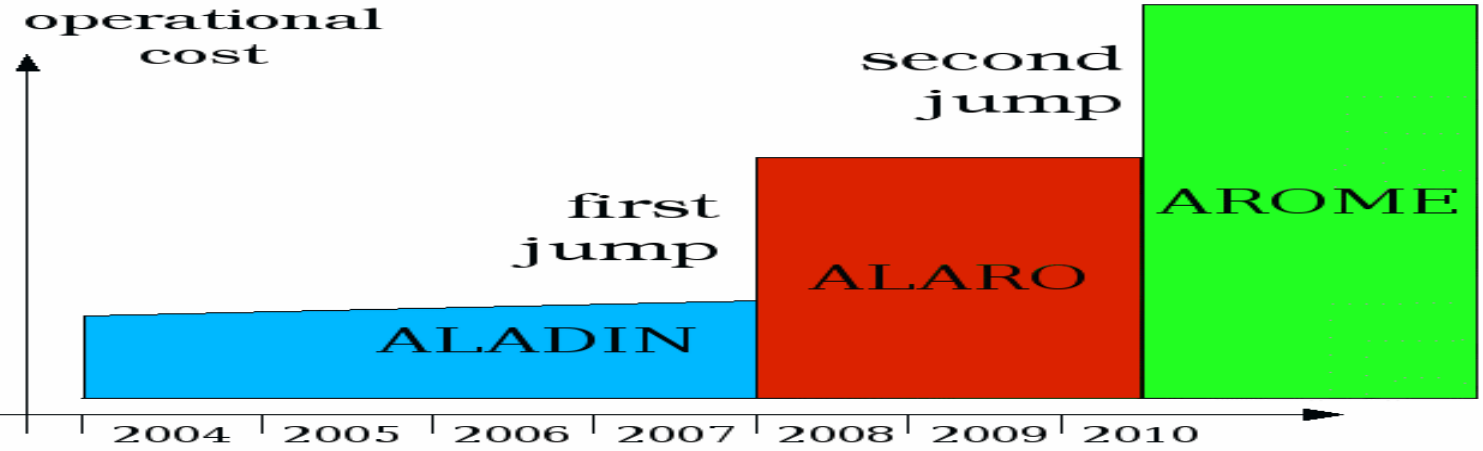




Effort
on
Aladin



on
Arome



on
Alaro

The obvious (?) reality

If you invest more into one project, it will become shorter, scientifically better and computationally more efficient.

Manpower is limited: we have to save on some projects to make others work better.