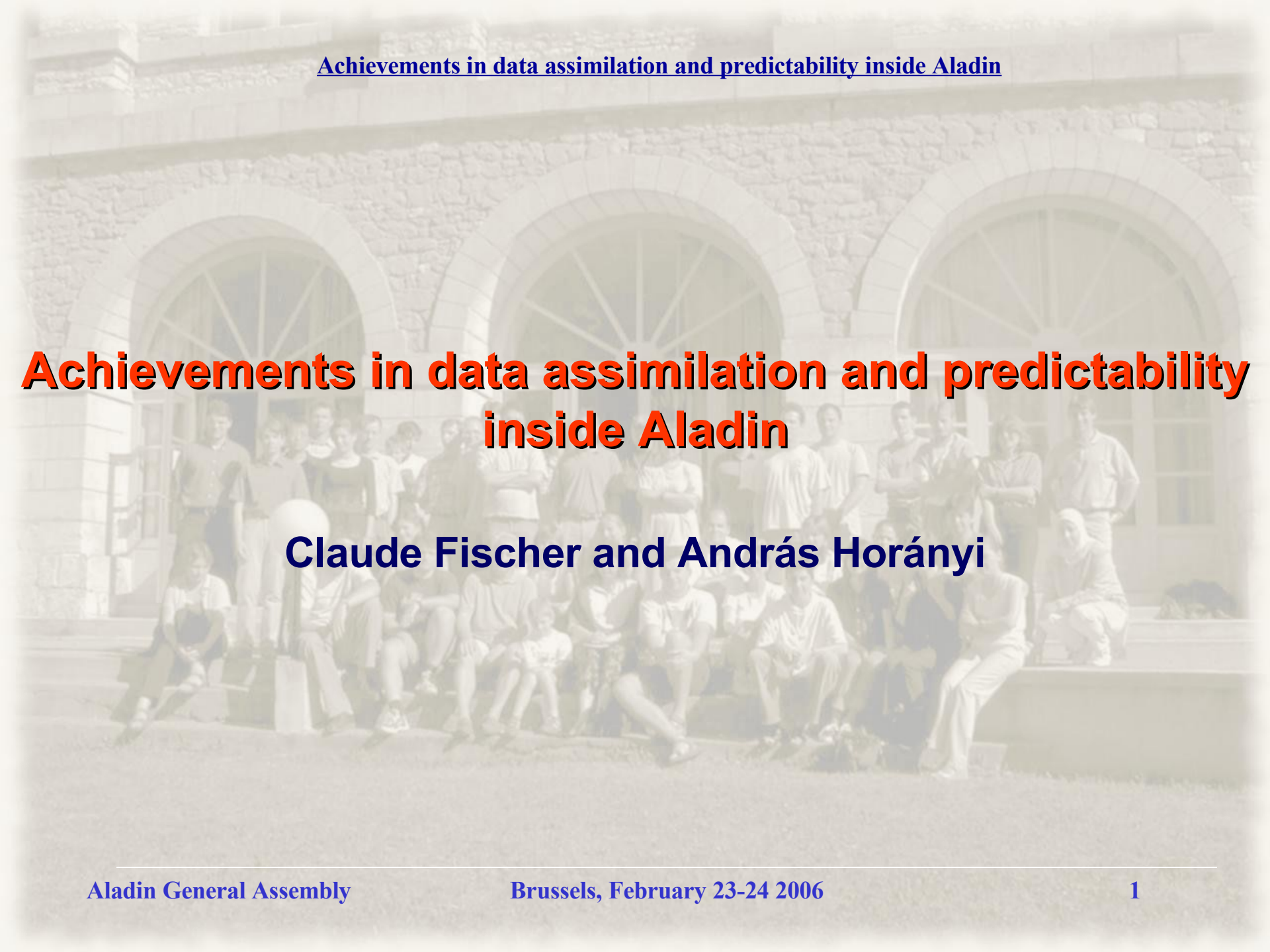
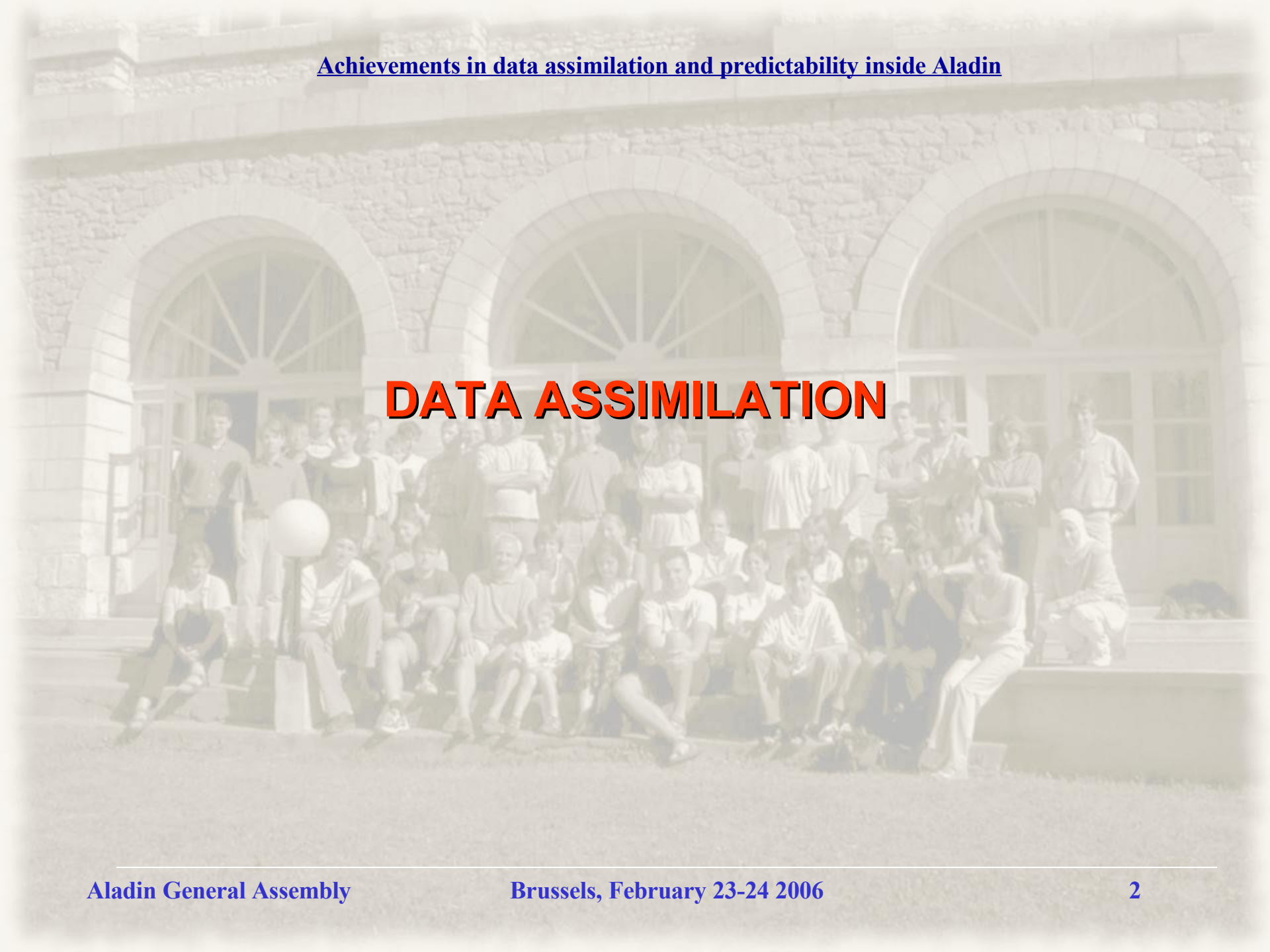


Achievements in data assimilation and predictability inside Aladin

Claude Fischer and András Horányi



DATA ASSIMILATION

History (focusing on 3D-VAR) and networking

- 1996: very first code developments
- 1999: first stable 3D-VAR tests in Toulouse
- 2000: installation in Budapest (2001 in Casablanca)
- 2005: operational variational data assimilation in Hungary and France; daily tests in Morocco
- Dispatched research collaborations

Main principles for the development

- 3D-VAR heavily relies on the IFS/Arpège code, which represents about 80-90 % of it
- Many scientific ideas have been inherited from the IFS (IFS-Arpège/Var development: about 200-250 men.months between 1991 and 2003)
- Maintenance through the classical « phasing » exercise in Toulouse
- « old » data assimilation tool: « CANARI » (also for surface fields)

Variational system: some details

- Continuous assimilation cycle, 6 hour frequency, long cut-off assimilation cycle and short cut-off production, coupled with Arpège
- Observations:
  - Surface pressure, SHIP winds, synop T2m and RH2m
  - Aircraft data
  - Satellite-derived motion winds
  - Drifting buoys
  - Soundings (TEMP, PILOT)
  - Satellite radiances: AMSU-A, AMSU-B, HIRS, Meteosat-8 SEVIRI
  - Scatterometer winds
- Digital filter initialisation

Operational 3DVAR at the Hungarian Met Service

Assimilation results v/s the spin-up version

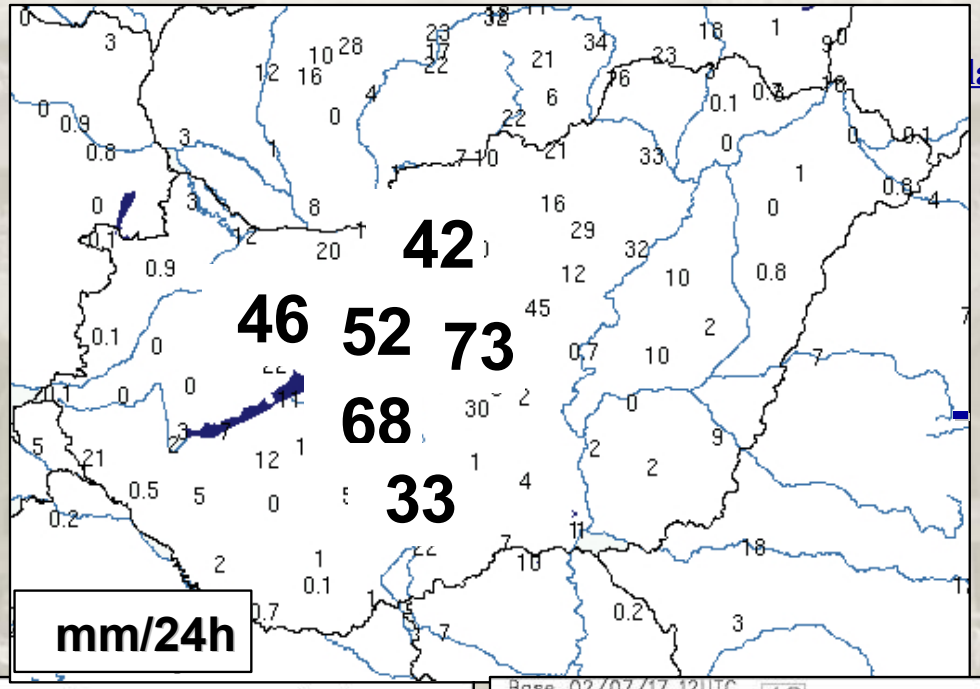
Objective scores:

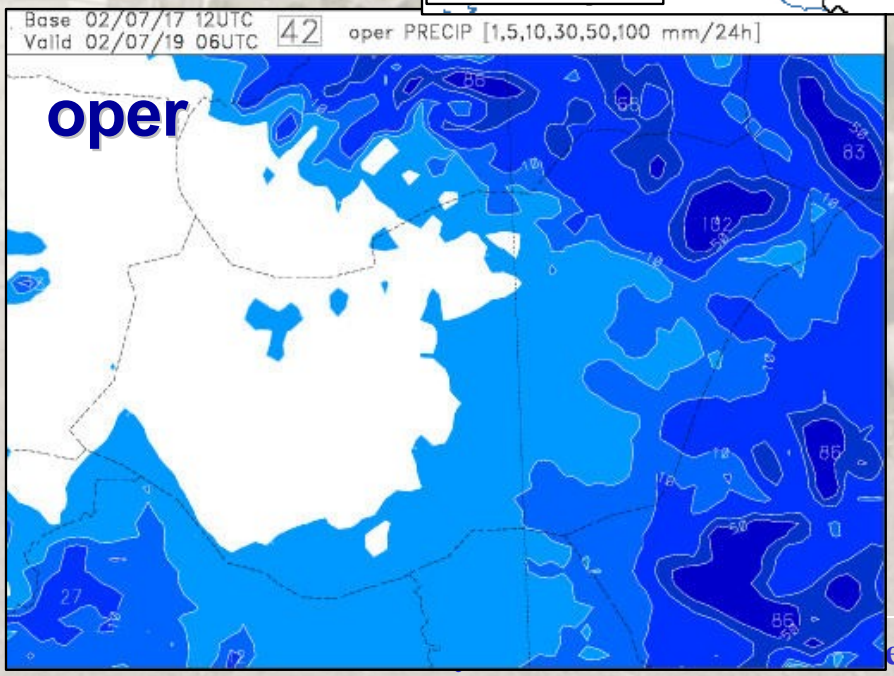
- generally small improvement for temperature and wind
- neutral impact/improvement on high level's geopotential
- degradation in low level's geopotential and MSLP BIAS
- mixed impact on humidity

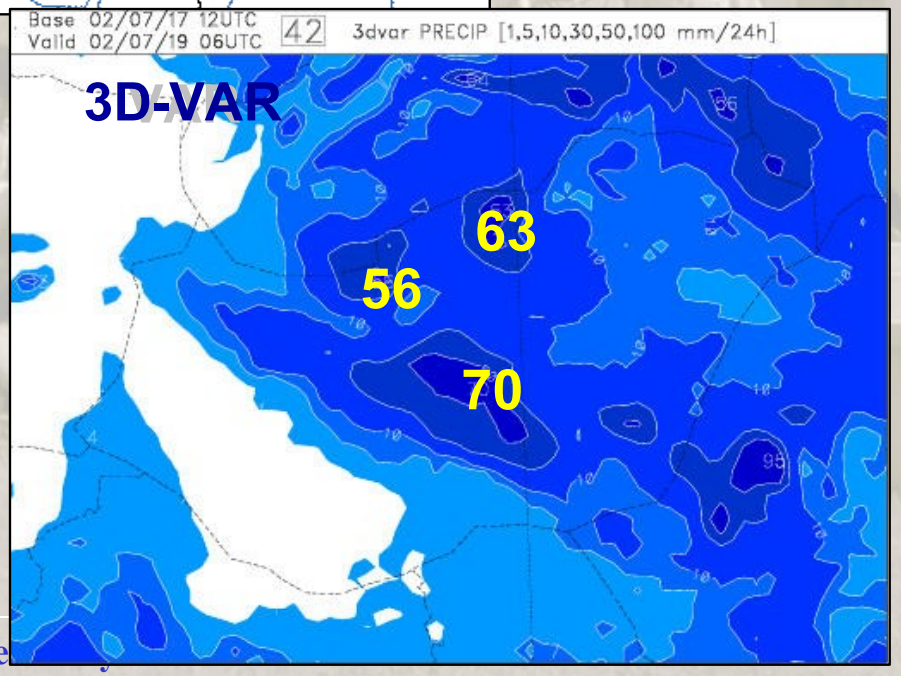
Subjective evaluation:

- improvement in T2m (0-24h)
- improvement in precipitation (0-48h)
- degradation (0-24h) / neutral impact (24-48h) in cloudiness
- neutral impact on wind

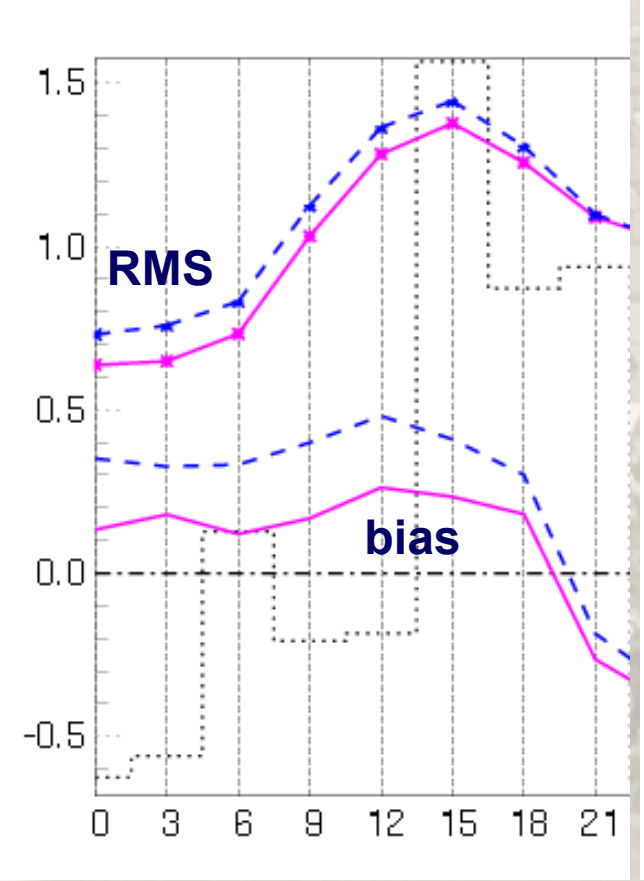
ladin


42
46
52
73
68
33
mm/24h

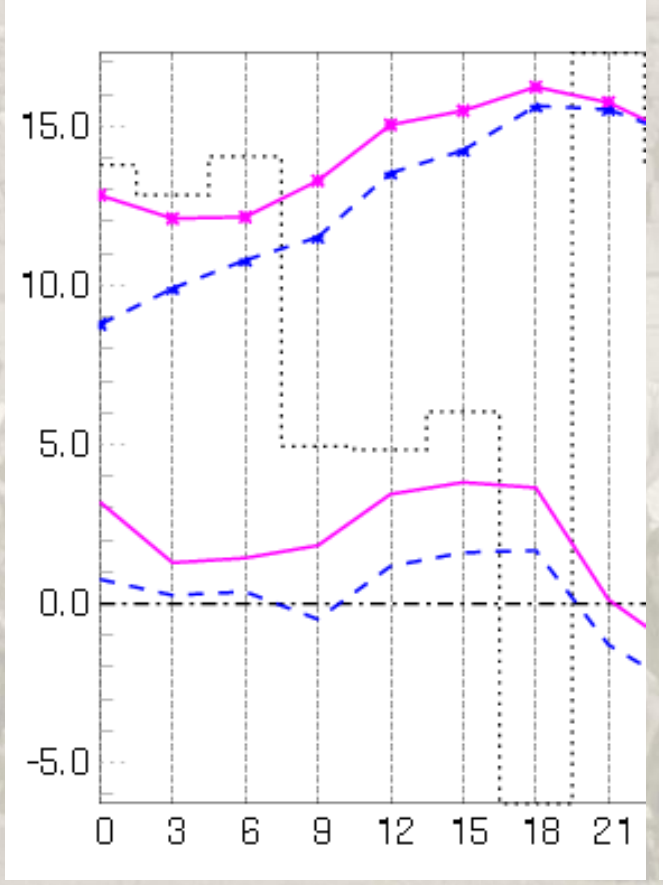

Base 02/07/17 12UTC
Valid 02/07/19 06UTC
42
oper PRECIP [1,5,10,30,50,100 mm/24h]
oper


Base 02/07/17 12UTC
Valid 02/07/19 06UTC
42
3dvar PRECIP [1,5,10,30,50,100 mm/24h]
3D-VAR
63
56
70

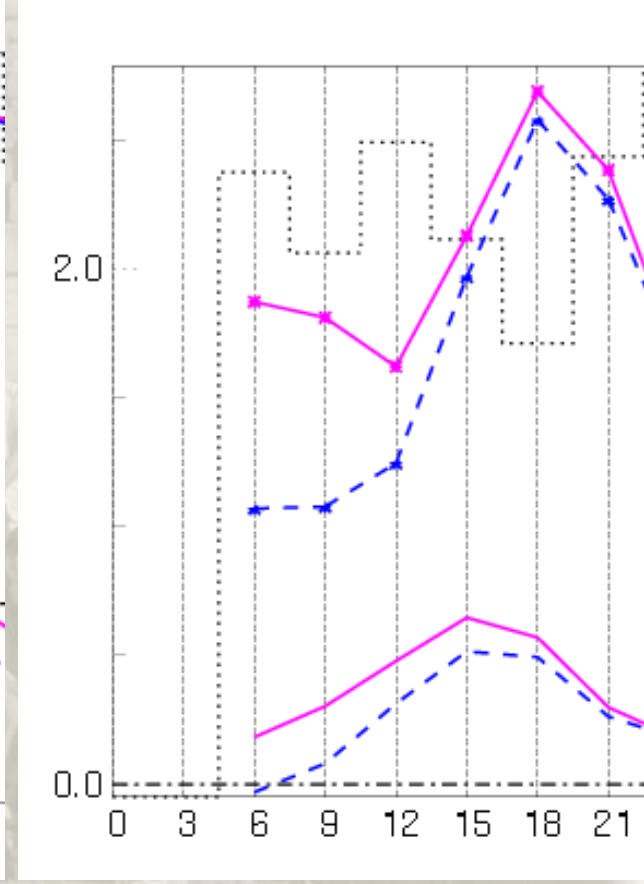
Operational implementation in Aladin-France: 3D-VAR versus Dyn. Adapt.



Mean sea level pressure



2m relative humidity



3 hour cumulated precipitations

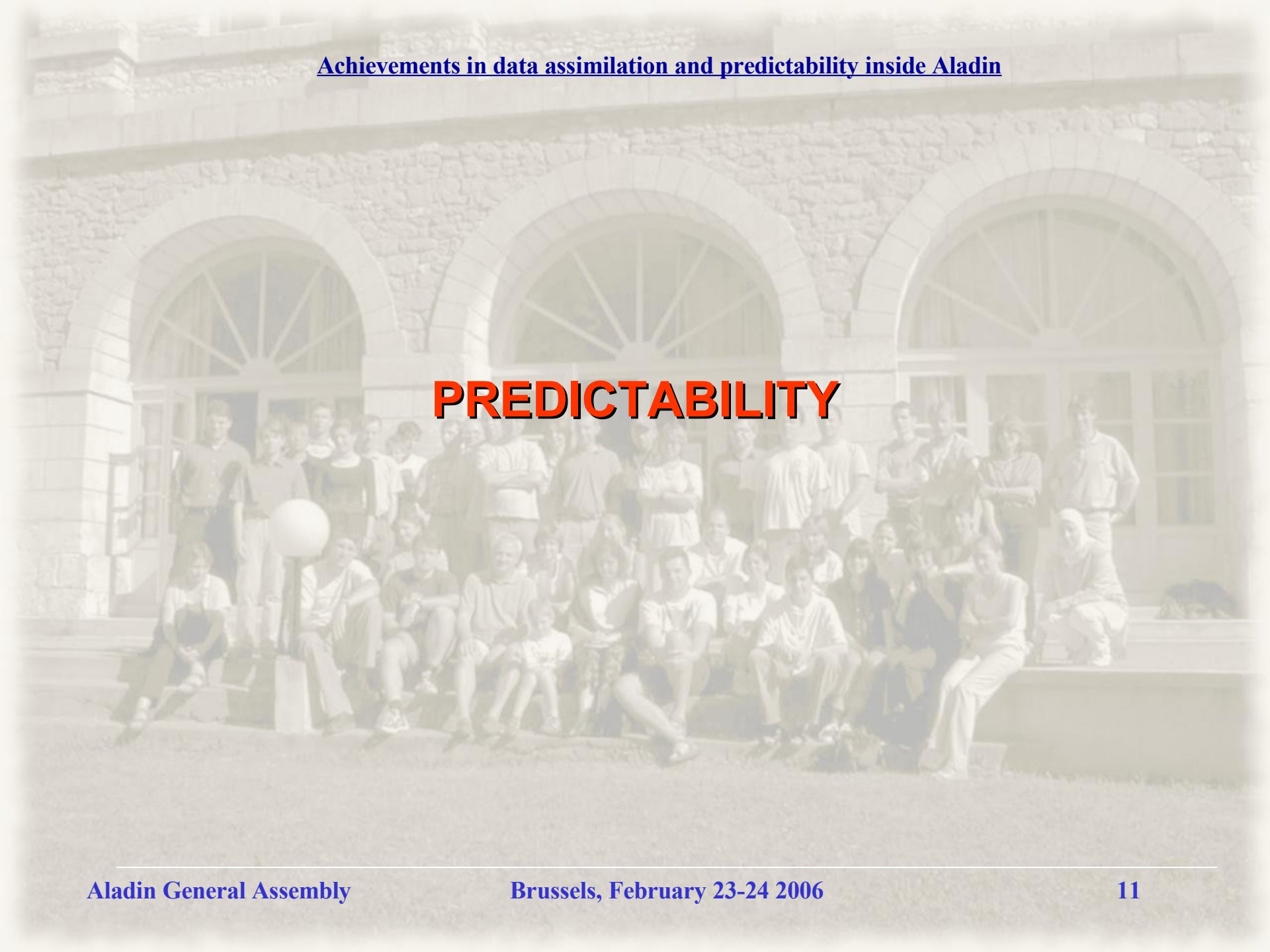
Resource and expertise requirements

- Raw observational database
- Observation pre-treatment
- ODB
- The model application(s):
  - Screening
  - Minimisation
  - Observation operators, « B » matrix, understanding of algorithms and results

=> Demands staff with high-level technical skills (about 3 men.year plus the IT)

Outlook

- Installation in other centres (could require more transversal coordination)
- Keep the recognized scientific level of R&D in decentralized mode
- Keep the focus on Arome data assimilation system
- Convergence with Hirlam: master the convergence process, then benefit from the « union »



PREDICTABILITY

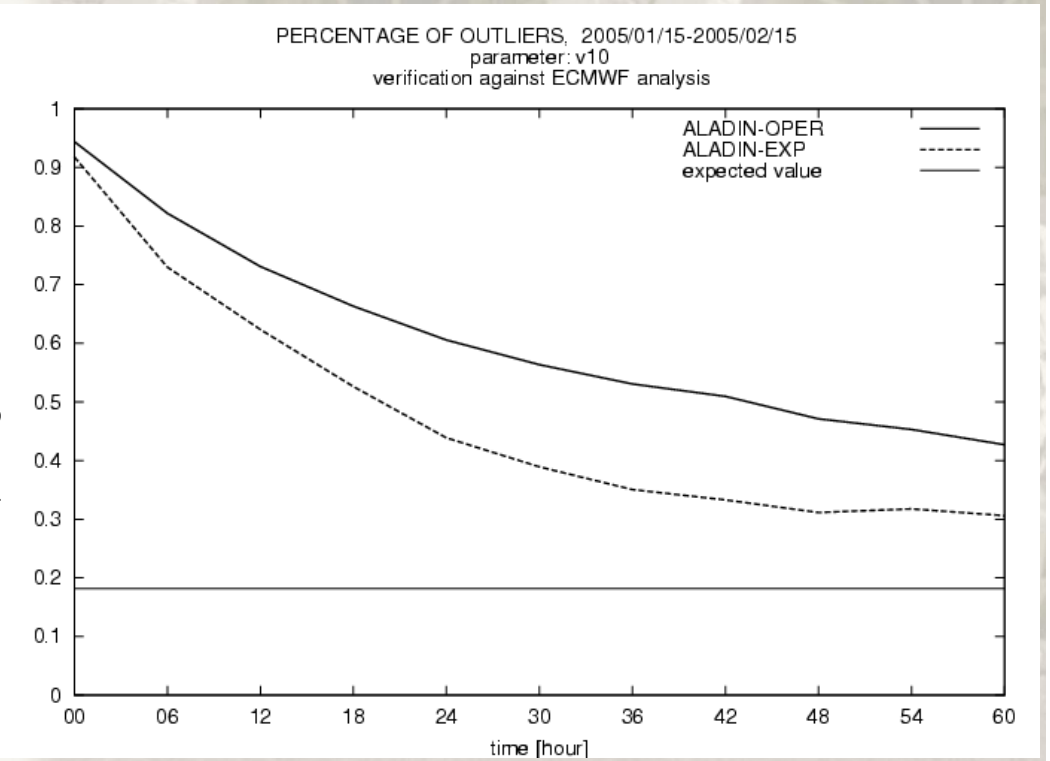
PREDICTABILITY: BACKGROUND

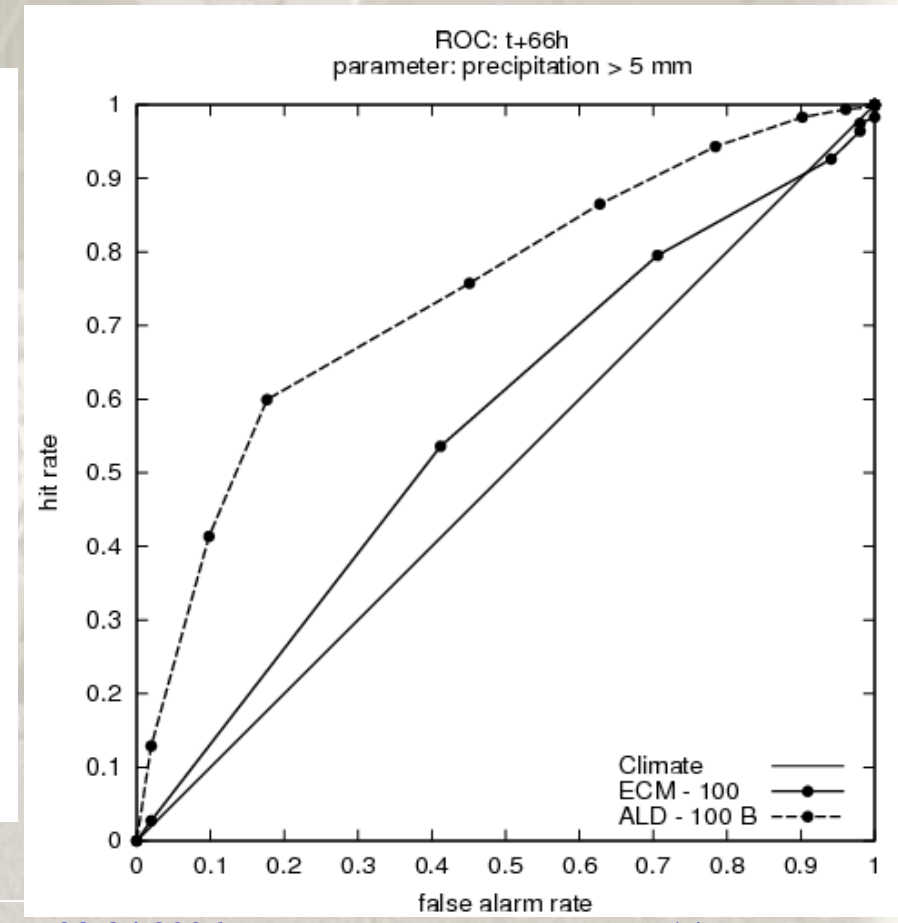
- PEACE system operational at Météo France
  - ARPEGE based short range ensemble system
  - Computation of initial perturbations by singular vectors
  - 10 + 1 members
  - 60 hours integration
- ECMWF EPS system
  - IFS based medium range ensemble system
  - 50 + 1 members
  - 10 days integration
- Breeding method used at NCEP

PREDICTABILITY: METHODS

- Direct downscaling of the PEACE system (Hungary)
  - Sensitivity of global singular vectors to the target domain and time
- Direct downscaling of ECMWF EPS system (Croatia, Hungary)
- Computation of initial (breeding) perturbations (Austria)

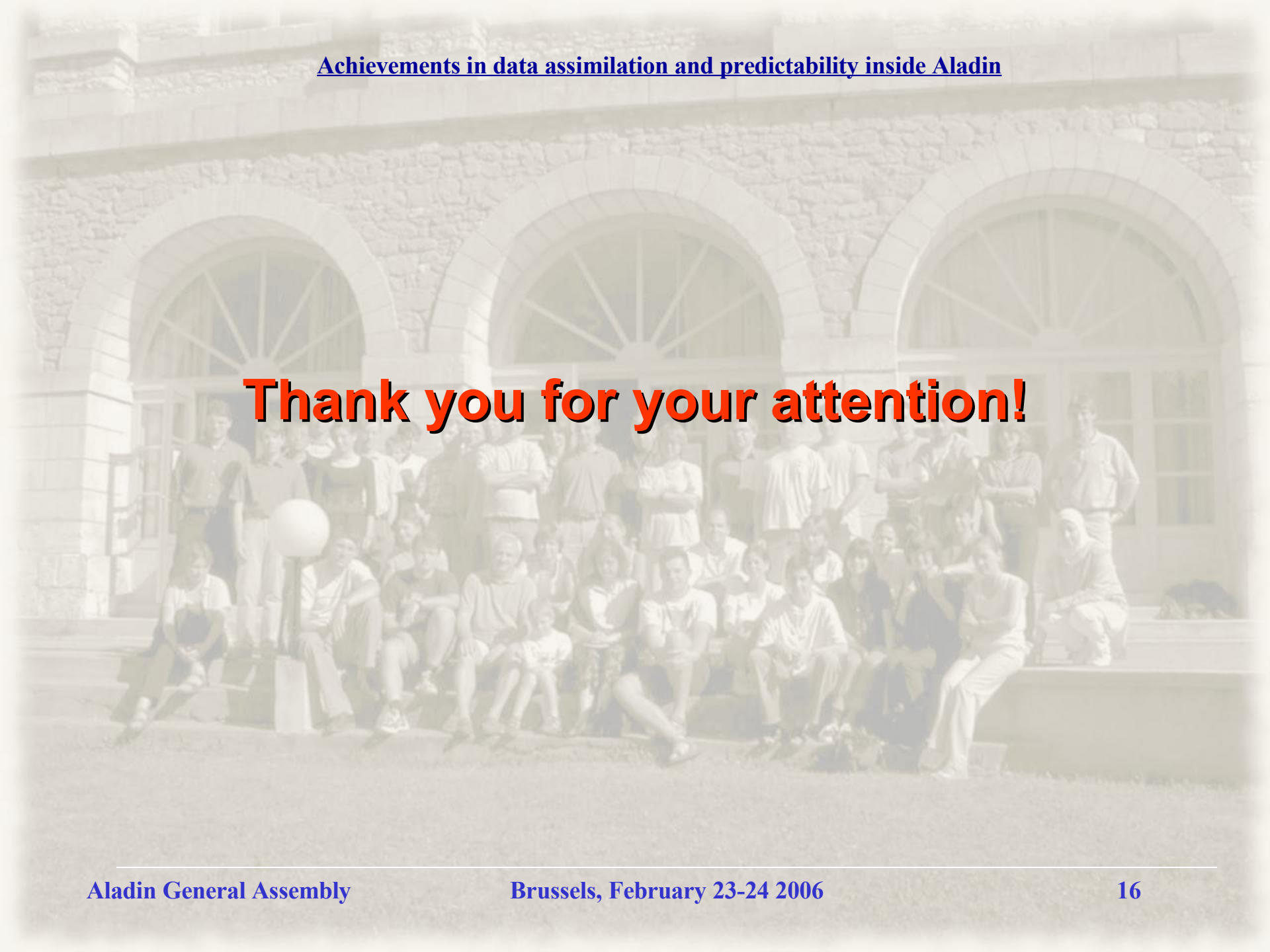
PREDICTABILITY: SOME RESULTS (PEACE AND IFS DOWNSCALING)





PREDICTABILITY: OUTLOOK

- Only the first steps are done until now
- Very careful scientific planning is a must!
- Need for more concerted actions together with HIRLAM
- Interaction with data assimilation: analysis errors as driving information to the ensemble systems and the ensemble uncertainties in the model as feedback for the data assimilation systems



Thank you for your attention!