

Prévision d'Ensemble **ARPEGE**

operational and ongoing work

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METEO FRANCE
Toujours un temps d'avance

PEARP2

(operational)



PEARP2 – operational

- PEARP2 uses ARPEGE
- Running at 06UTC with a 72h range and 18UTC with a 108h range
- A control run and **34** operational members

- Initial perturbations :

- dry singular vectors on 4 different areas >

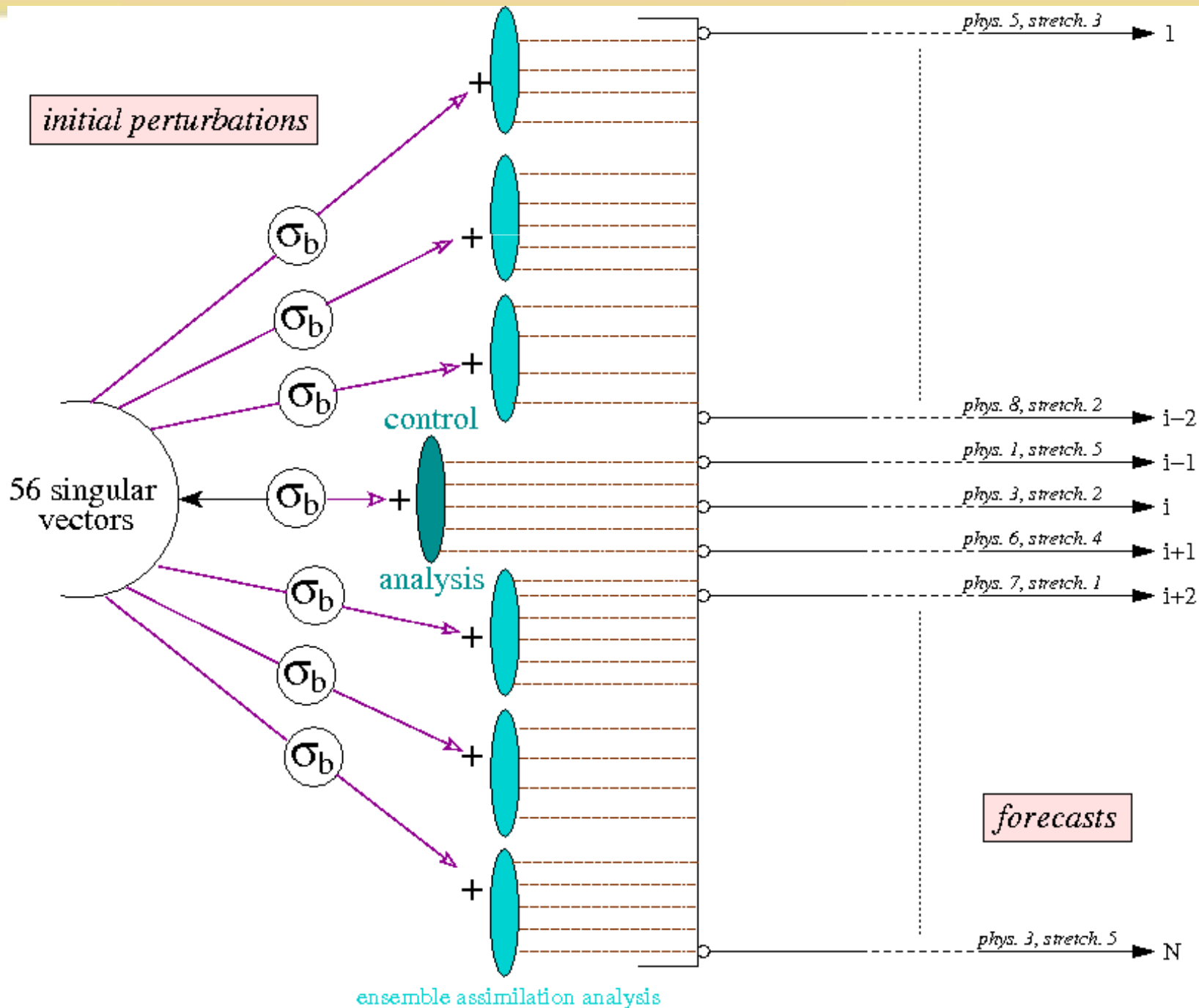
	OTI (h)	resolution
EURAT	12	T195
HNC and HS	24	T144
TROP	12	T144

- using the 6 analyses computed by **A**EARP (Assimilation Ensemble ARPege)

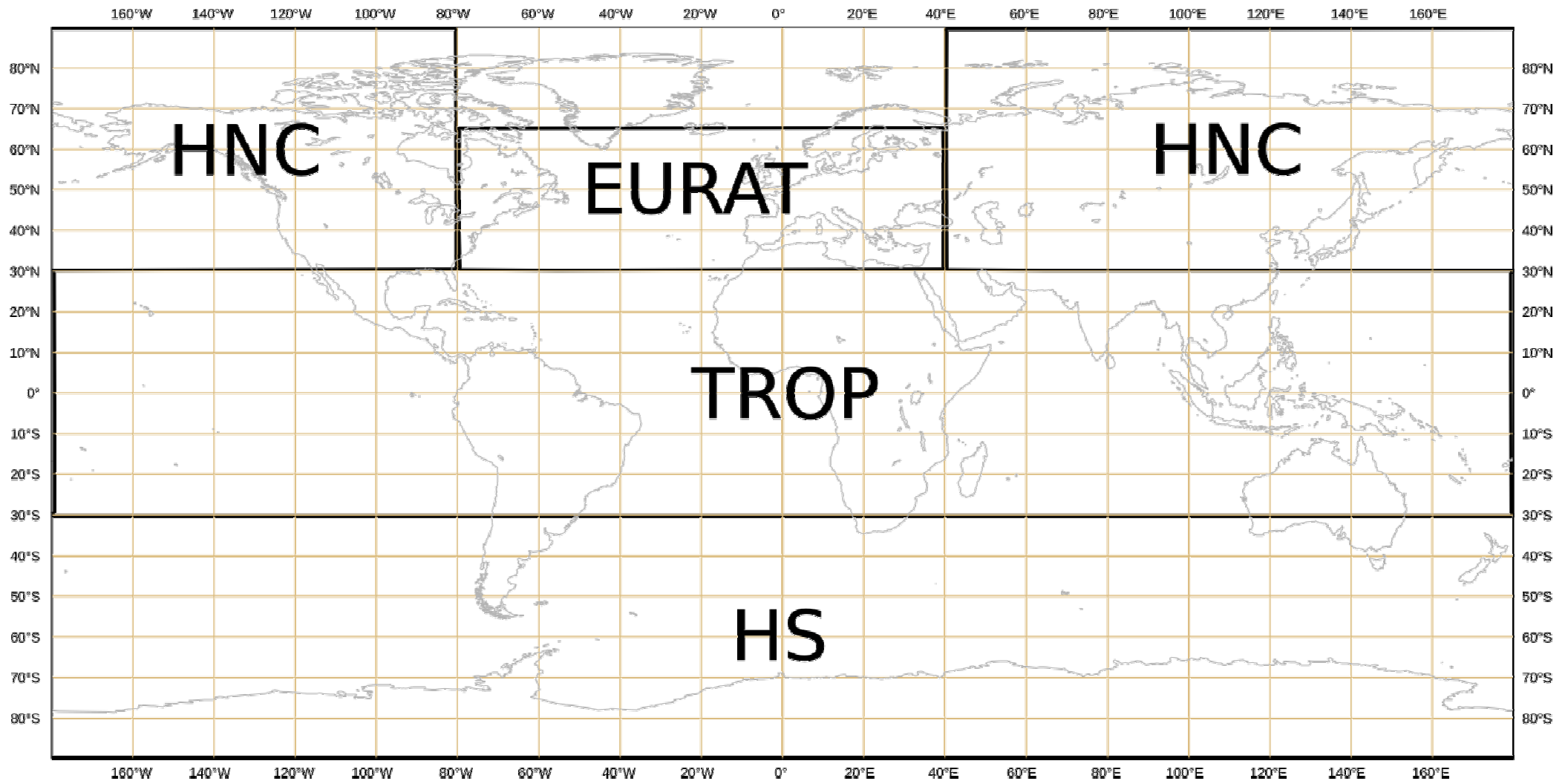
- scaled to an amplitude size using error variances background of the day consistent with 4D-Var assimilation cycle

- **Model perturbations** : multi-physics (7 physics +ARPEGE operational physical package)
- Resolution PEARP2 T358L55 C2.4 (~23km over France)

PEARP2 – operational

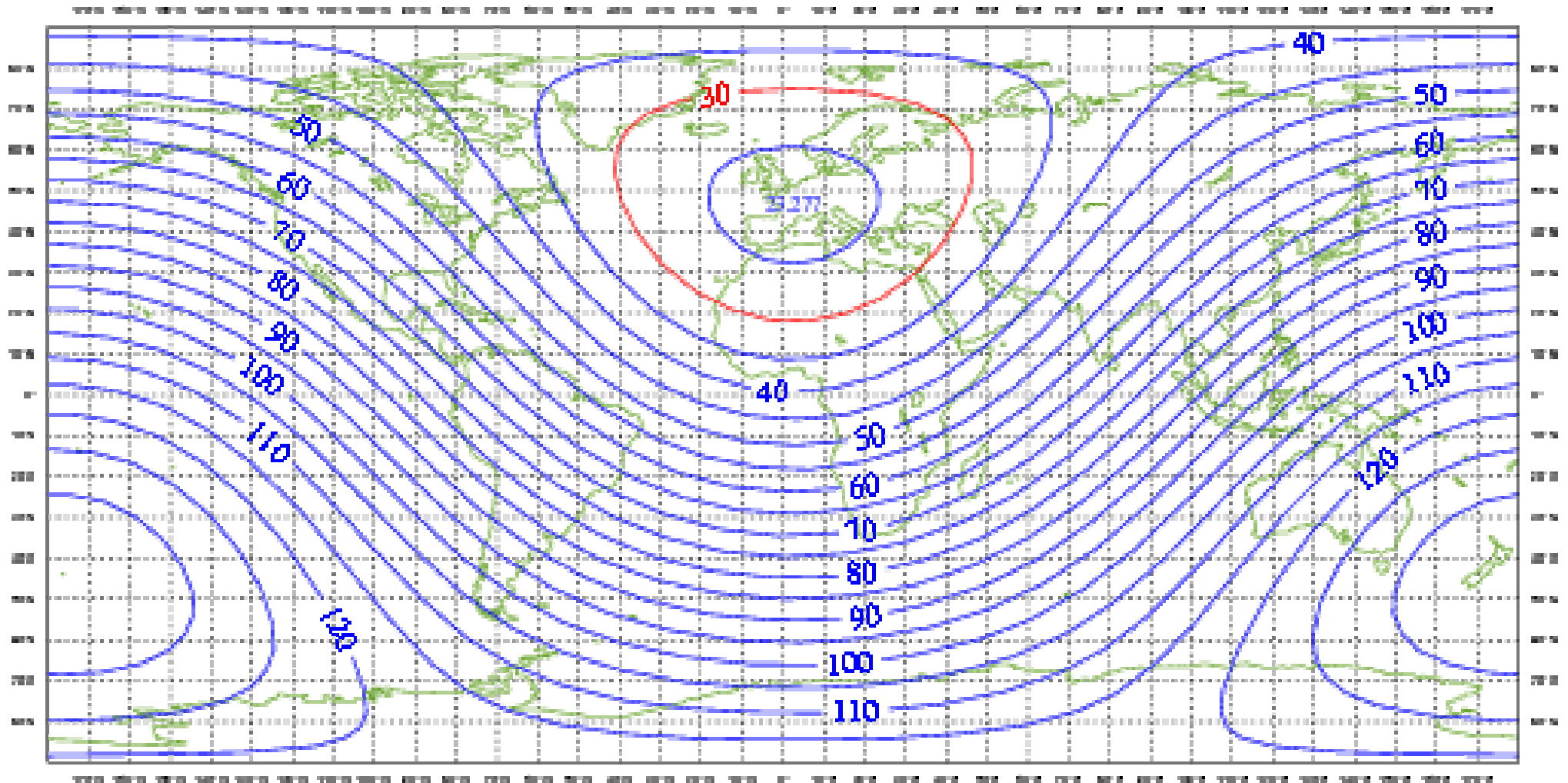


PEARP2 Target areas for singular vectors



PEARP2 – resolution

Resolution locale (en km) en T 358 C 2.4



PEARP3

(available next winter)

- ▶ Increased resolution
- ▶ Modified initial perturbations
- ▶ Modified model perturbations



PEARP3 – ongoing work

- PEARP3 will use ARPEGE
- Running at 06 UTC with a 72h range - 18UTC with a 108h range
- A control run and 34 operational members

- Initial perturbations :

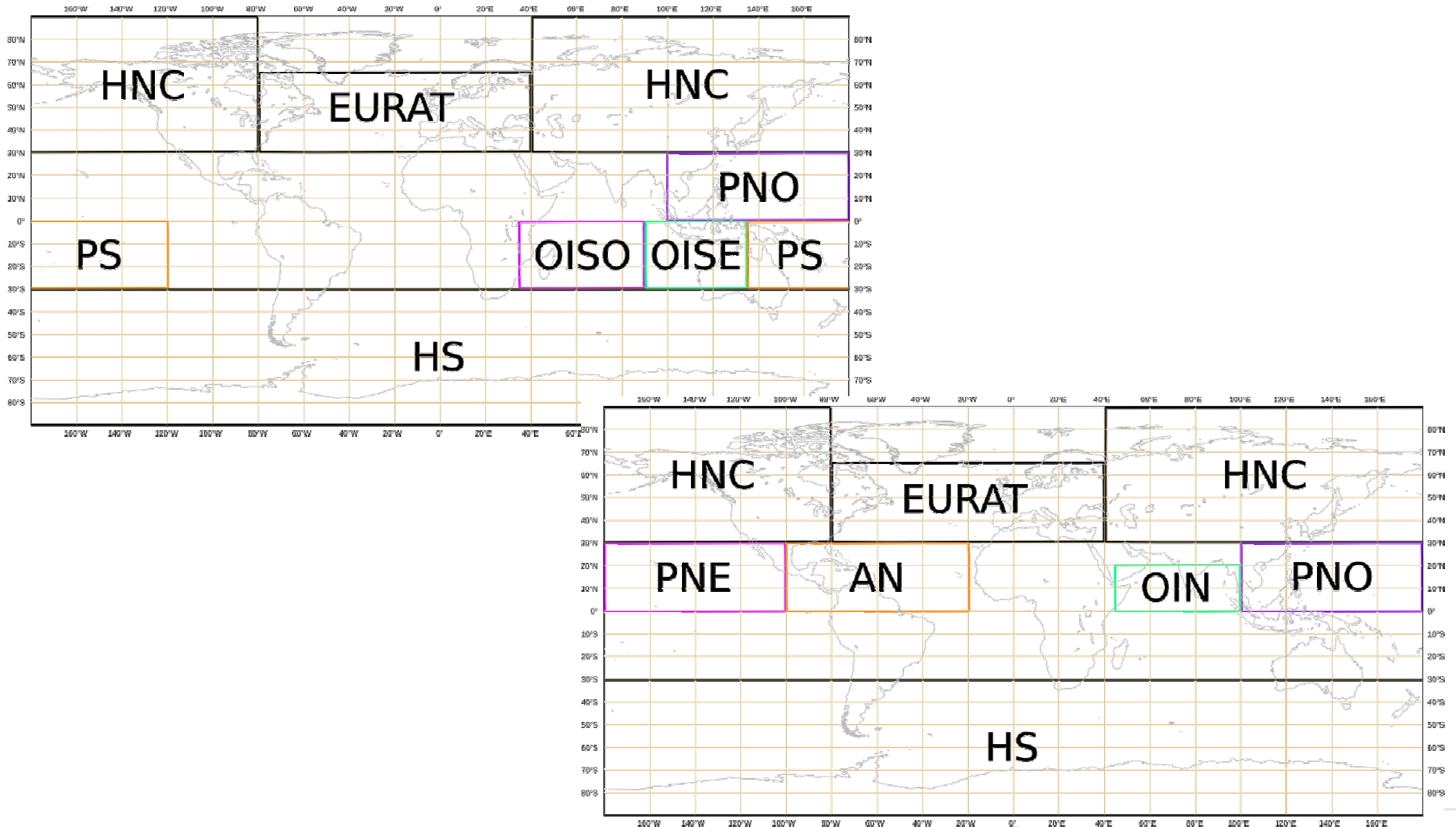
- dry singular vectors on 7 different areas >

	OTI	Res.	Norm
EURAT	18	TI95	TE
HNC and HS	24	TI95	TE
TROP	18	TI95	KE

- using the 6 analyses computed by AEARP (Assimilation Ensemble ARPege)
- scaled to an amplitude size using error variances background of the day consistent with 4D-Var assimilation cycle

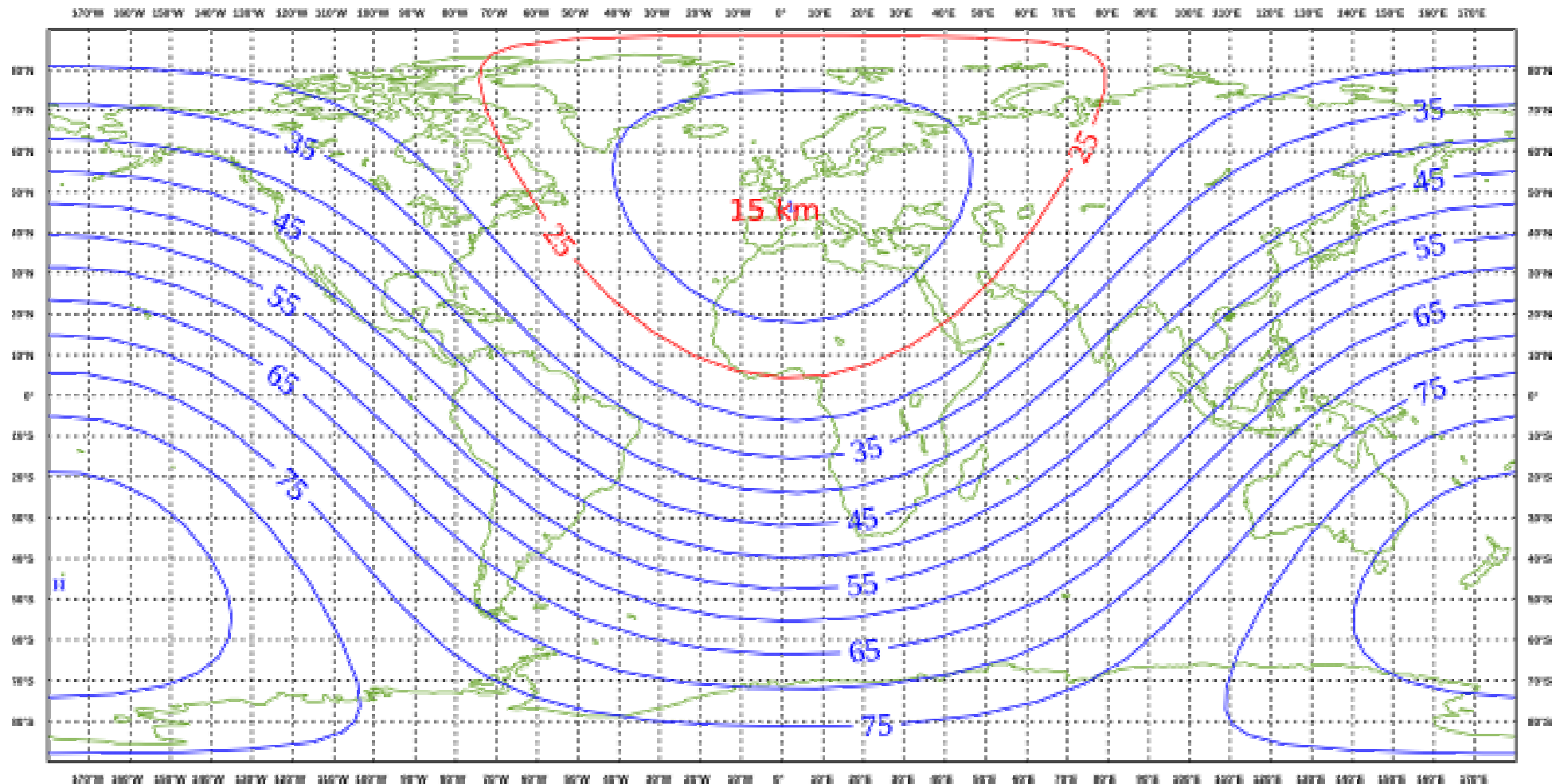
- Model perturbations : [multi-physics](#) (9 physics +ARPEGE operational physical package)
- Resolution PEARP3 T538L65C2.4 (~15km over France)

PEARP3 Target areas for singular vectors

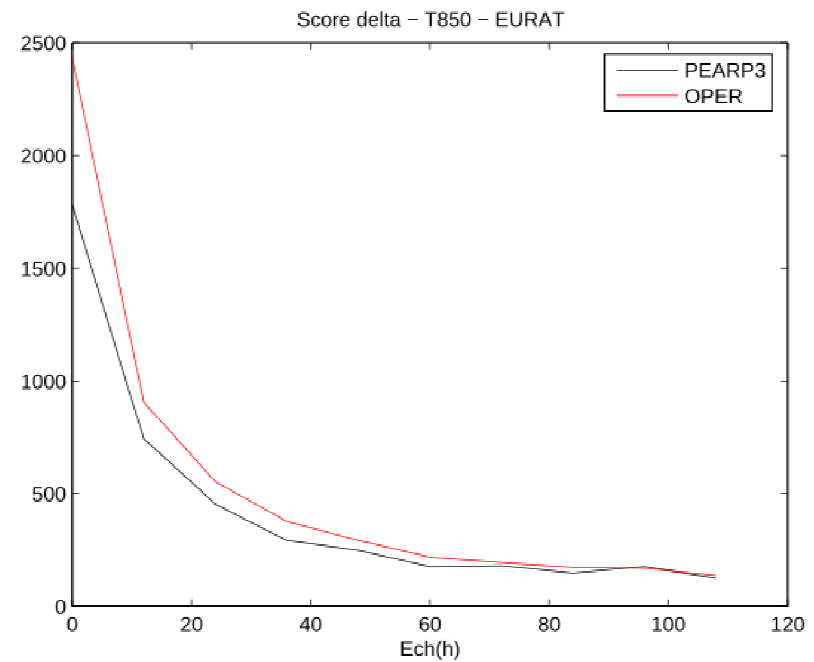
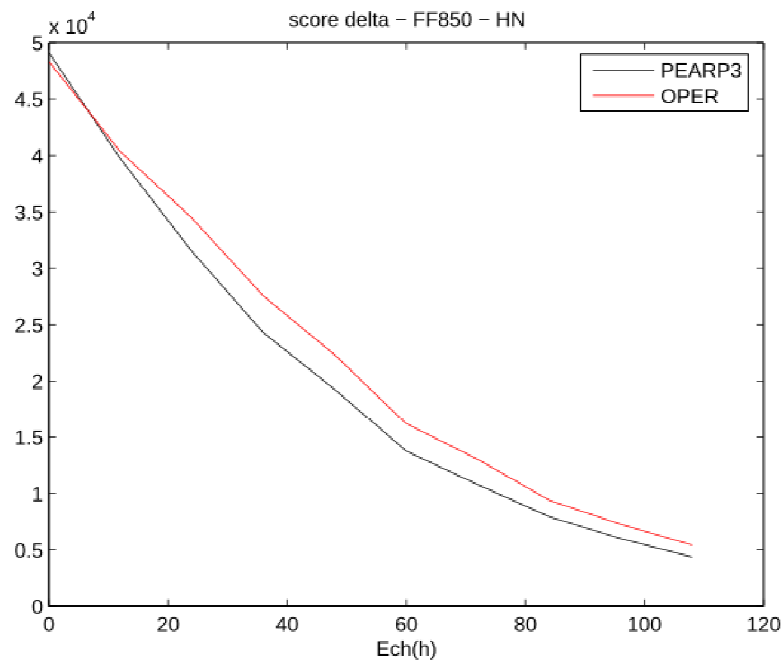
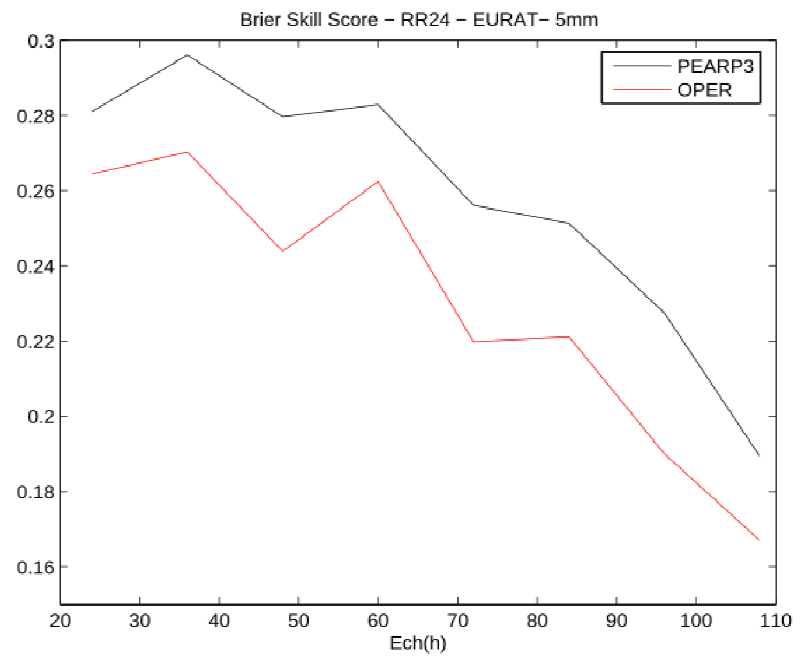
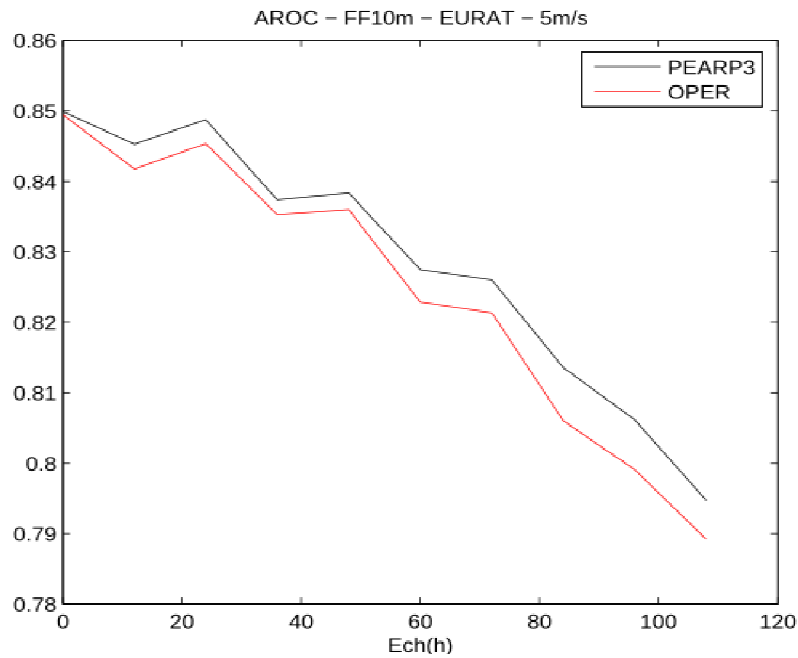


PEARP3 – resolution

Resolution locale (en km) en T 538 C 2.4



PEARP3 first results



Physics used in multi-model

- **TKE** : Turbulent Kinetic Energy
- **KFB** : schéma de convection peu profonde en flux de masse.
- **CAPE** : fermeture du schéma de convection en CAPE au lieu de la convergence d'humidité.
- **ECUME** : schéma qui permet de calculer les coefficients d'échanges de surface au dessus de la mer. Une option permet de forcer le coefficient pour $Q_v =$ à celui de T.
- **SM** : Smith micro-physic.



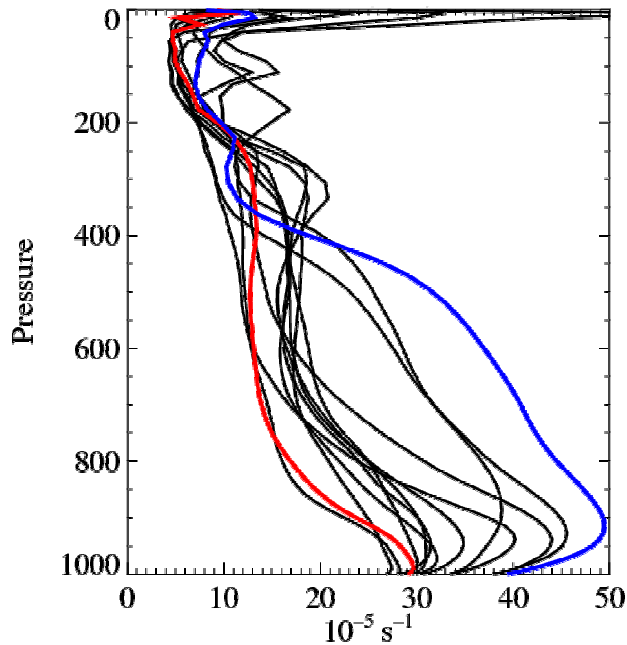
Use of ensemble information at mesoscale (LAM systems)

- ▶ *Arôme σ 's for 3D-VAR*
- ▶ *Perturbed IC & LBC for coupled LAM-EPS*

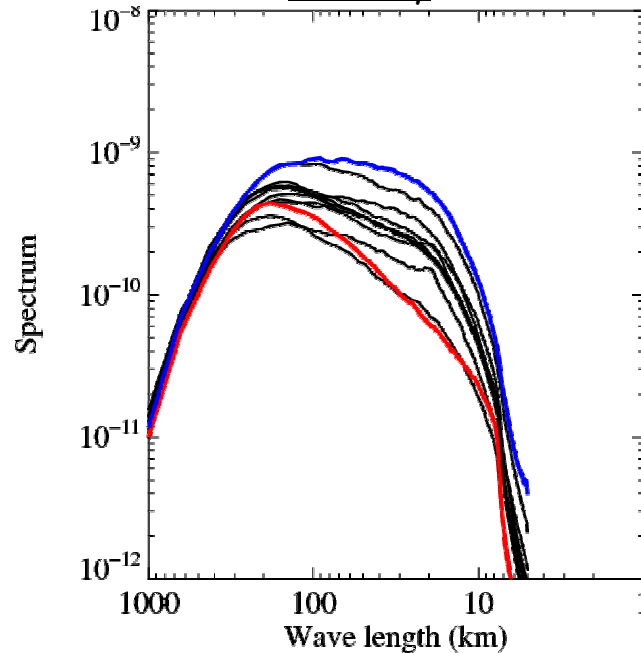


Evolution of profiles of σ_b 's

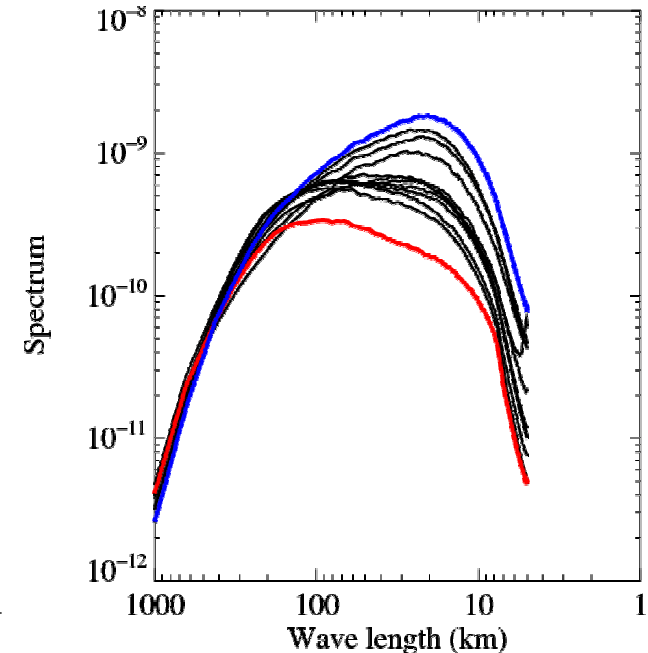
Evolution of statistics from 22 Feb. through 5 Mar. 2008 for
vorticity



Vertical profile of σ_b



Variance spectra at 500 hPa



Variance spectra at 850 hPa

— 2008/02/23 anticyclonic (fog , low cloud cover) — 2008/03/04 trough (showers, hail,...)

- Vertical profiles differ from one day to another : smallest values in the troposphere on 23 Feb., biggest on 4 March.
- Variance spectra :- generally, this increase concerns all scales.
 - in some cases, it could be more pronounced in the small scales (eg., convection on 04/03).

This method is able to evaluate the contribution of small scale phenomena to the evolution of statistics, even if the meteorological situation is driven by the large scales.

BROUSSEAU et al. 2010 : Background error covariances for a mesoscale data assimilation system : AROME-France 3D-Var submitted to QJRMS

BROUSSEAU et al. : Use of an ensemble assimilation to represent flow-dependent B in the AROME-France data assimilation system. In preparation.

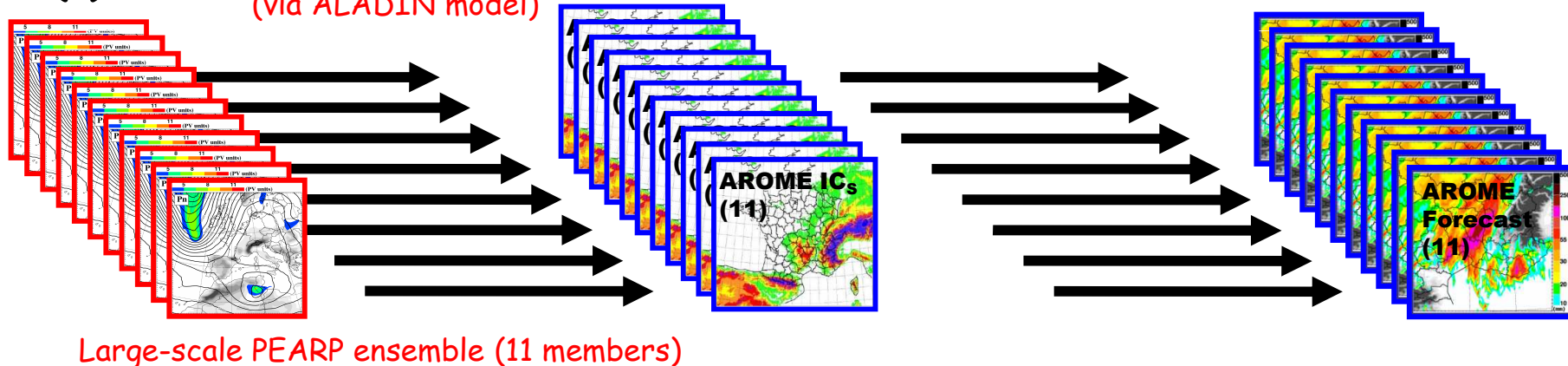
Convective-scale predictability of HPEs with AROME model

Uncertainty on synoptic-scale initial conditions and lateral boundary conditions

(i)

Downscaling of the PEARP members
(via ALADIN model)

Mesoscale data assimilation + AROME forecasts



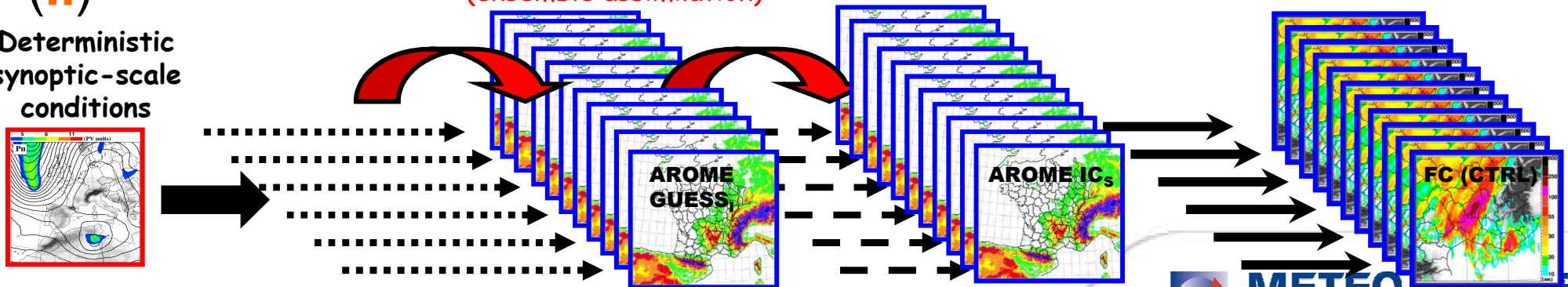
Uncertainty on mesoscale initial conditions

(ii)

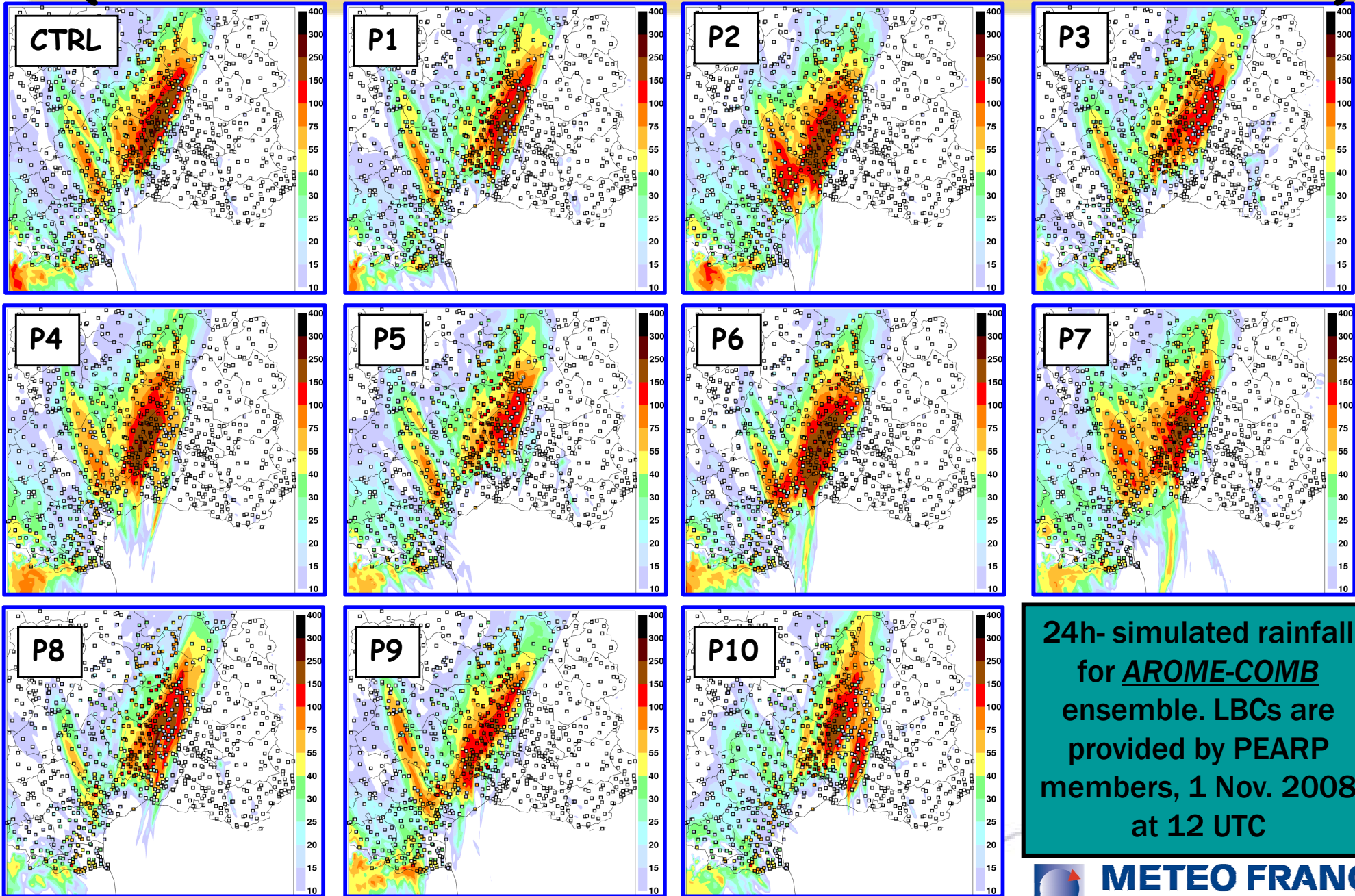
Deterministic
synoptic-scale
conditions

Rapid Update Cycle (RUC) with perturbed observations
(ensemble assimilation)

AROME forecasts



AROME EPS experiment (COMB = PEARP + Pert. Obs in AROME 3D-Var)



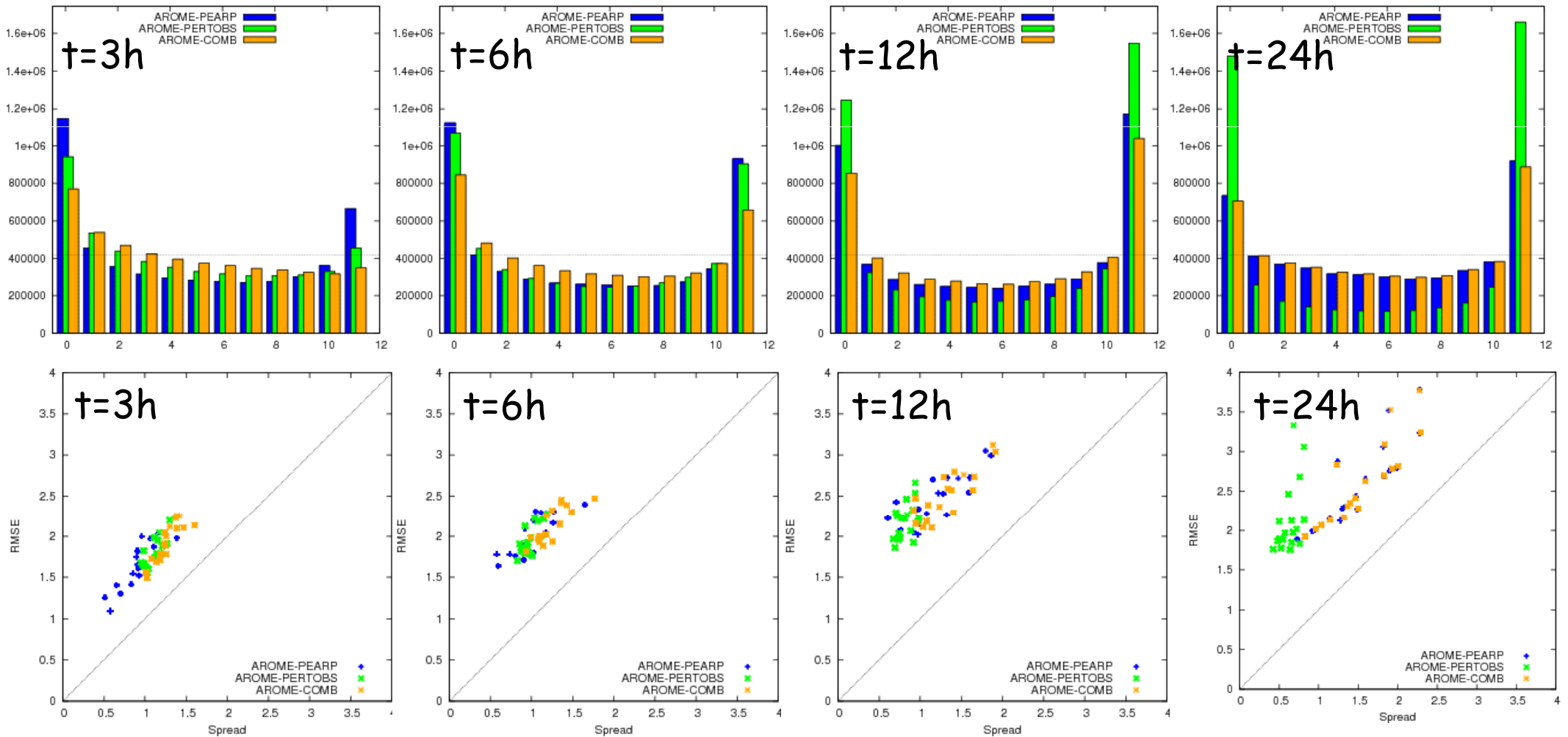
24h- simulated rainfall
for AROME-COMB
ensemble. LBCs are
provided by PEARP
members, 1 Nov. 2008
at 12 UTC



METEO FRANCE
Toujours un temps d'avance

Probabilistic evaluation

- Evaluation period: 05/10/2008 → 05/11/2008
- Rank histograms are shown for 925 hPa wind



RMSE vs. Ensemble spread

Results of this study are summarised in Vié *et al.*, 2010 (submitted to Mon. Wea. Rev.)