Sensitivity of regional ensemble data assimilation spread to perturbations of lateral boundary conditions

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Context of this study

- Assess specific properties of a LAM regional ensemble DA system
- Used here ALADIN/3D-VAR (B matrix), 6h cycling, 6 members
- Test period 23/04/10 – 10/05/10 (18 days)
- Goal:
  - assess impact of various techniques for specifying the LBC in the LAM EDA;
  - Constant LBCs: ULBC,
  - LBCs interpolated from a complete set of global Arpège EDA: GLBC,
  - LBCs defined from random draws of a pre-computed error covariance model sqrt(P).ξ, with sqrt(P)=0.3 sqrt(B);
- Companion work about the initial warm-up phase of a global EDA system (Arpège)
- PhD work by Rachida, defended on 16 April 2016 at Univ. Of Casablanca

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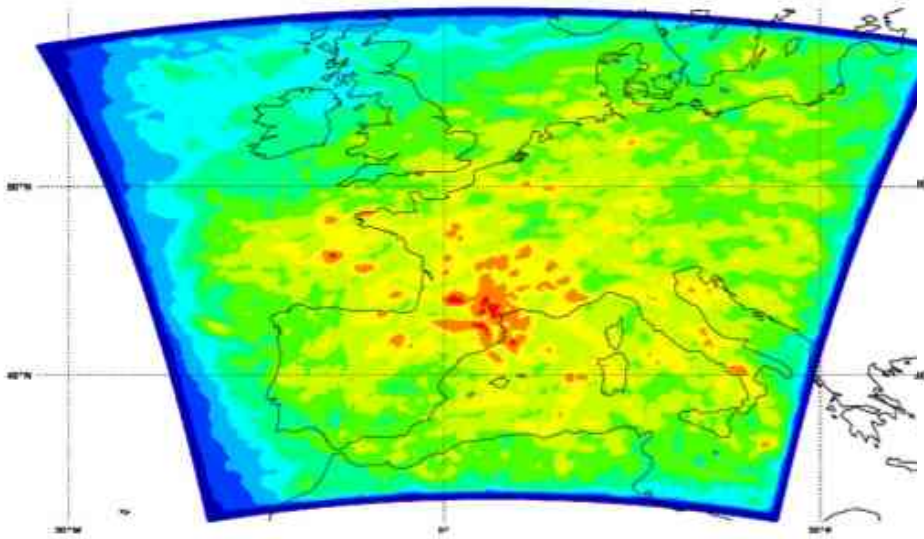
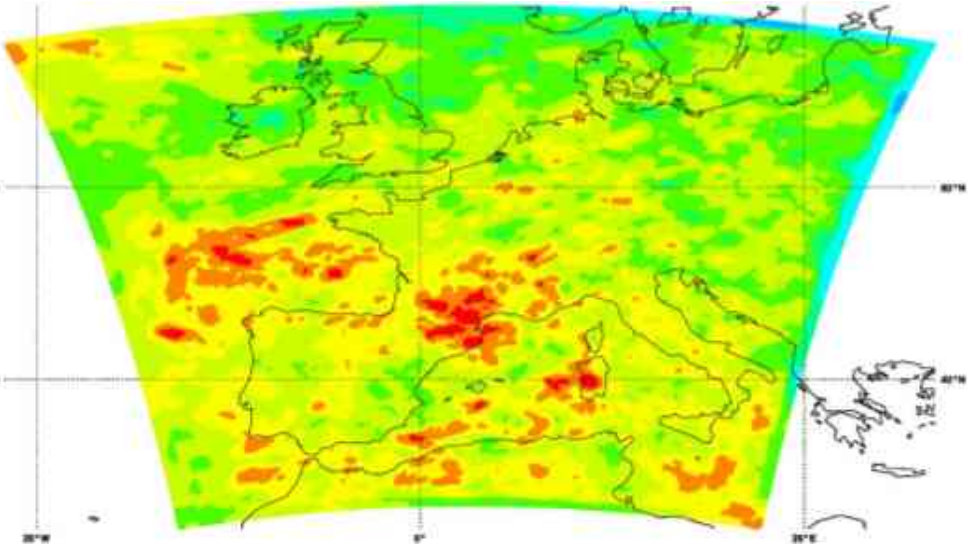
Maps of averaged standard deviation of 6h forecast U-wind at 500 hPa

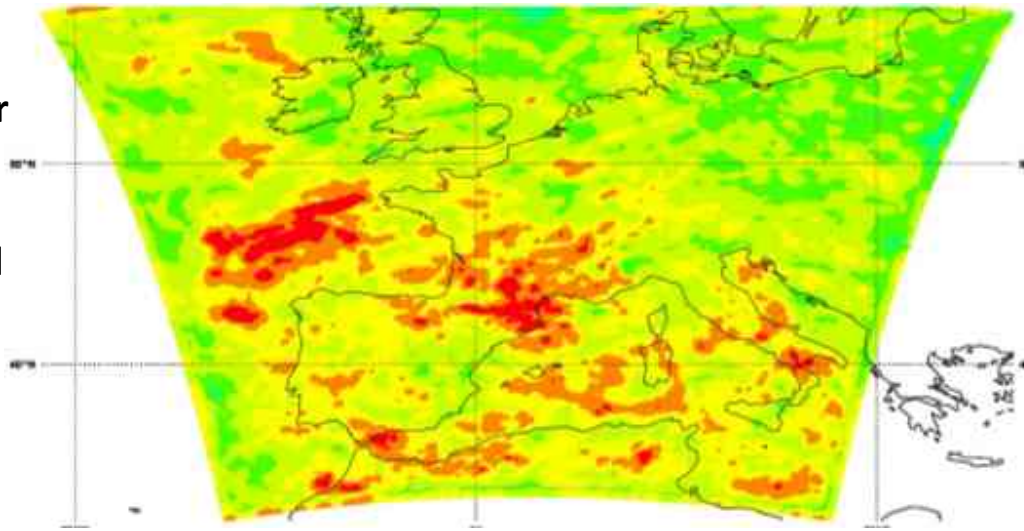
ULBC



GLBC



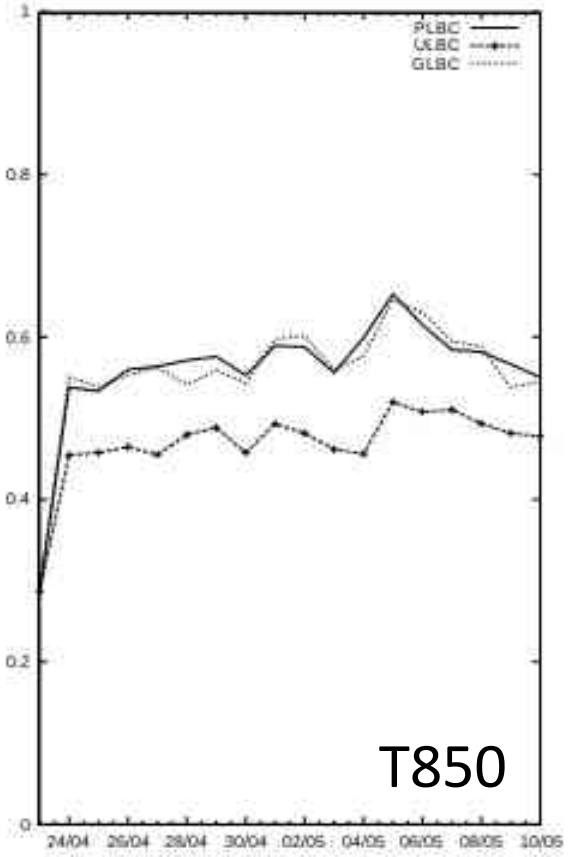
- **impact of constant LBC projects far into the LAM domain**
- **use of random draws produces rather similar stdev than use of global LBC**
- **this similarity is due to the identical OBS perturbations, the scaling in P and the similar DA system for breeding the perturbations**

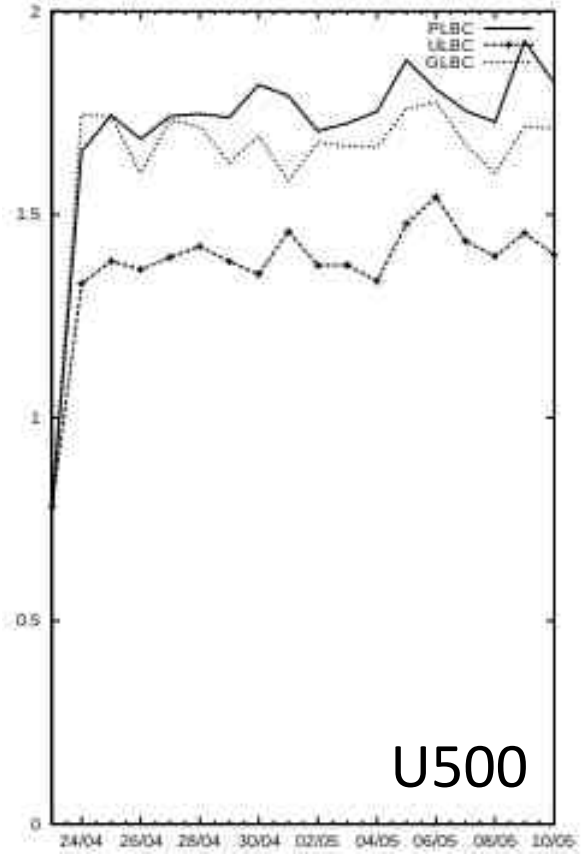


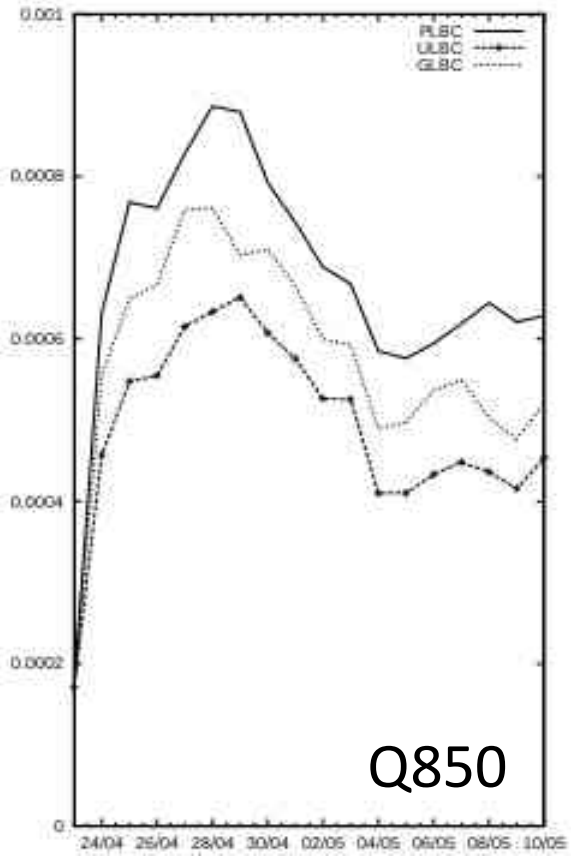
PLBC

Temporal evolution of horizontally averaged stdev (23/04/10 – 10/05/10)

- Similar spread for PLBC than GLBC, under-estimated for ULBC
- Over-estimated spread though for Q, suggesting that a parameter-dependent scaling of P could be beneficial
- Weather type dependence of spread is noticed mostly for Q (moist April, rather cold and dry May)
- Initial spin-up (warm-up) time of LAM EDA is about 1 day (note: 3d in global)





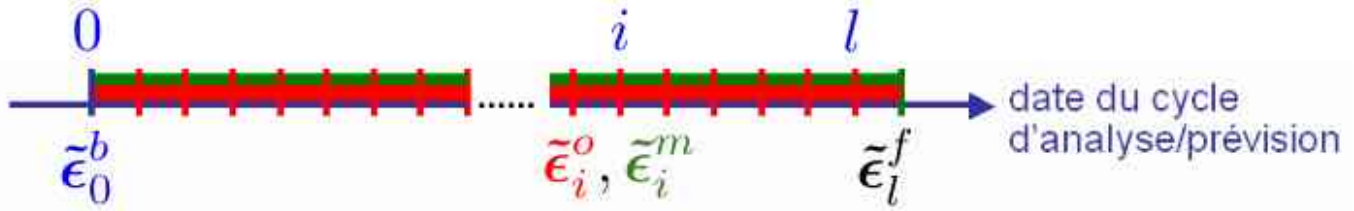


Global and LAM EDA properties: assessing the experimentally observed properties by a formal analysis (*not on poster actually* !)

Les perturbations évoluent au cours d'une étape l du cyclage :

- d'analyse : $\tilde{\boldsymbol{\epsilon}}_l^a = (\mathbf{I} - \mathbf{K}_l\mathbf{H}_l)\ \tilde{\boldsymbol{\epsilon}}_l^b + \mathbf{K}_l\ \tilde{\boldsymbol{\epsilon}}_l^o$
- de prévision : $\tilde{\boldsymbol{\epsilon}}_l^f = \mathbf{M}_l\ \tilde{\boldsymbol{\epsilon}}_l^a + \tilde{\boldsymbol{\epsilon}}_l^m$

$$\tilde{\boldsymbol{\epsilon}}_l^f = \mathbf{T}_{l+1}\ \tilde{\boldsymbol{\epsilon}}_0^b + \sum_{i=0}^{l} \mathbf{T}_{l-i}\ \mathbf{M}_i\ \mathbf{K}_i\ \tilde{\boldsymbol{\epsilon}}_i^o + \sum_{i=0}^{l} \mathbf{T}_{l-i}\ \tilde{\boldsymbol{\epsilon}}_i^m$$



$$\mathbf{T}_{l+1} = \prod_{j=0}^{l} \mathbf{M}_j\ (\mathbf{I} - \mathbf{K}_j\mathbf{H}_j)$$

$$\mathbf{T}_{l-i} = \prod_{j=i}^{l-1} \mathbf{M}_j\ (\mathbf{I} - \mathbf{K}_j\mathbf{H}_j)$$

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El Ouaraini & Berre, JGR, 2011: Sensitivity of ensemble-based variances to initial background perturbations
El Ouaraini, Berre, Fischer, Sayouty, Tellus, 2015: Sensitivity of regional ensemble data assimilation spread to perturbations of lateral boundary conditions

grazie e ci vediamo davanti al manifesto!

thanks and see you in front of the poster!