

## Estimations of N deposition impacts may be improved through deposition maps

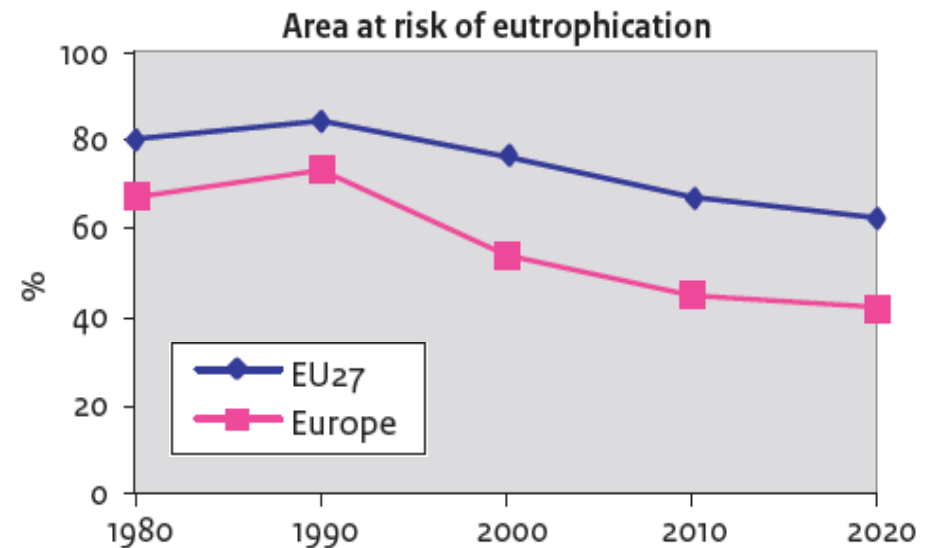
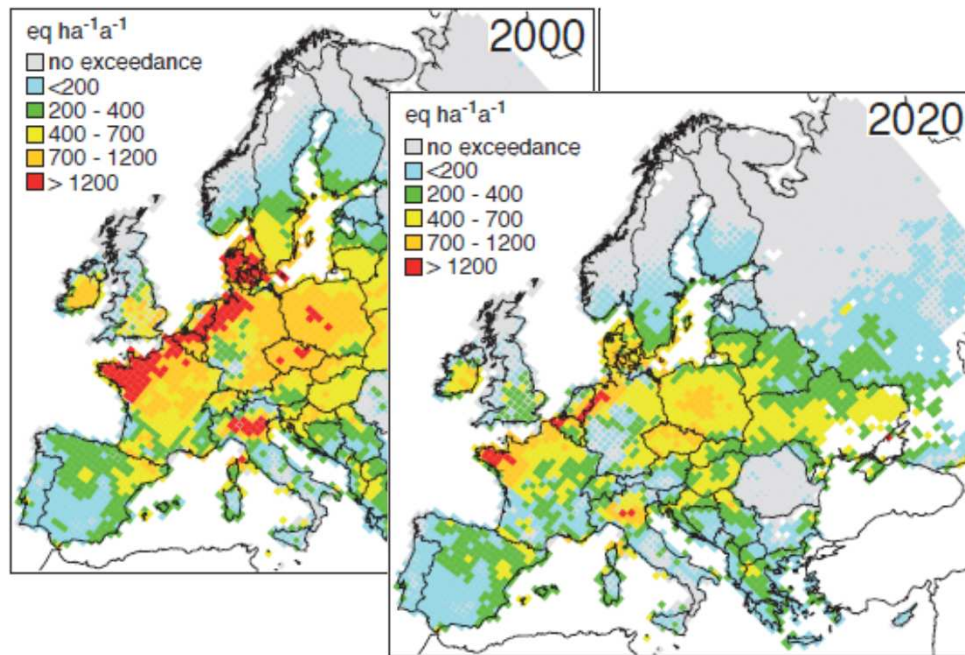
Comparing two independent approaches for mapping bulk deposition at French scale

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## Introduction

- Exceedance of critical loads is an important indicator for the definition of international targets on atmospheric pollution
- It is mostly sensitive to the spatial variations of atmospheric deposition estimates used as input (Posch et al. 2008)

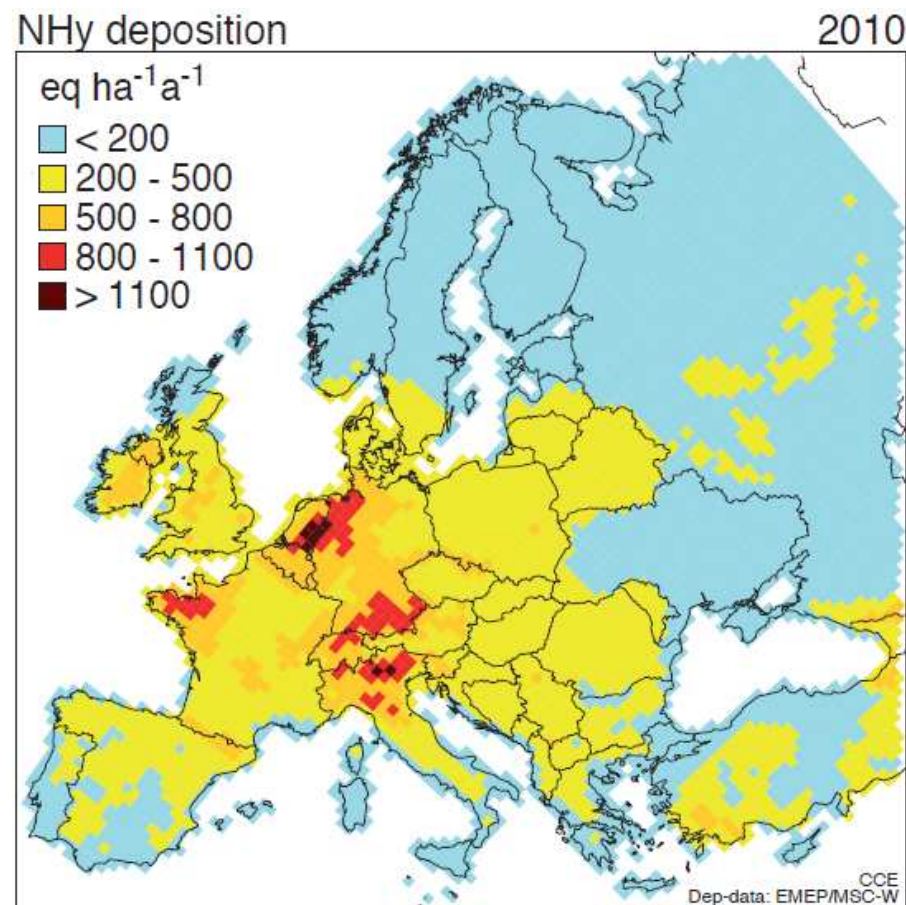


*Areas where critical loads for eutrophication are exceeded by nutrient nitrogen depositions (CCE Status Report, 2012)*

## 2 different approaches for mapping N deposition

### ■ EMEP process-based model

- Model based on chemistry and transport processes and applied to data from national atmospheric emission inventories
- Allows to predict deposition under future emission scenarios
- Deposition estimates used for calculating critical load exceedances at European scale

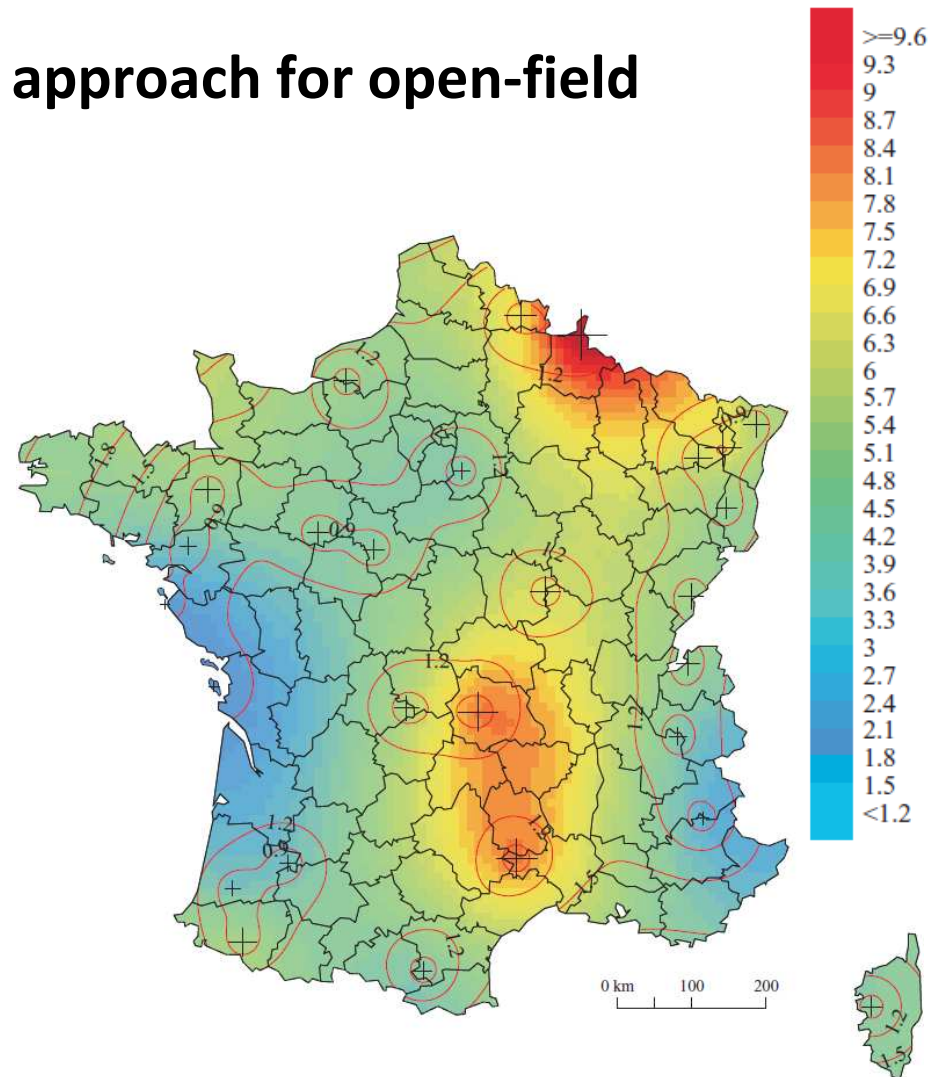


*Total (wet+dry) NHy deposition  
(CCE Report, 2012)*

## 2 different approaches for mapping N deposition

### ■ Geostatistics as an alternative approach for open-field deposition

- Empirical modeling based on measured bulk deposition data from ICP Forests plots and rainfall data from extensive meteo survey as a covariate
- 1st application in France on 1993-98 deposition data from 27 ICP Forests plots with rainfall data from 2 614 MeteoFrance stations (Croisé et al., 2005)



*1993-1998 mean  $N-NH_4$  bulk deposition (kg/ha/yr)*



## Maps based on independent monitoring networks

- 3 networks have monitored atmospheric deposition in France

**RENECOFOR** ⇒ ICP Forests program

[1993-...) Coord. : 

27 sites, bulk deposition, 4-week data

**MERA** ⇒ EMEP program

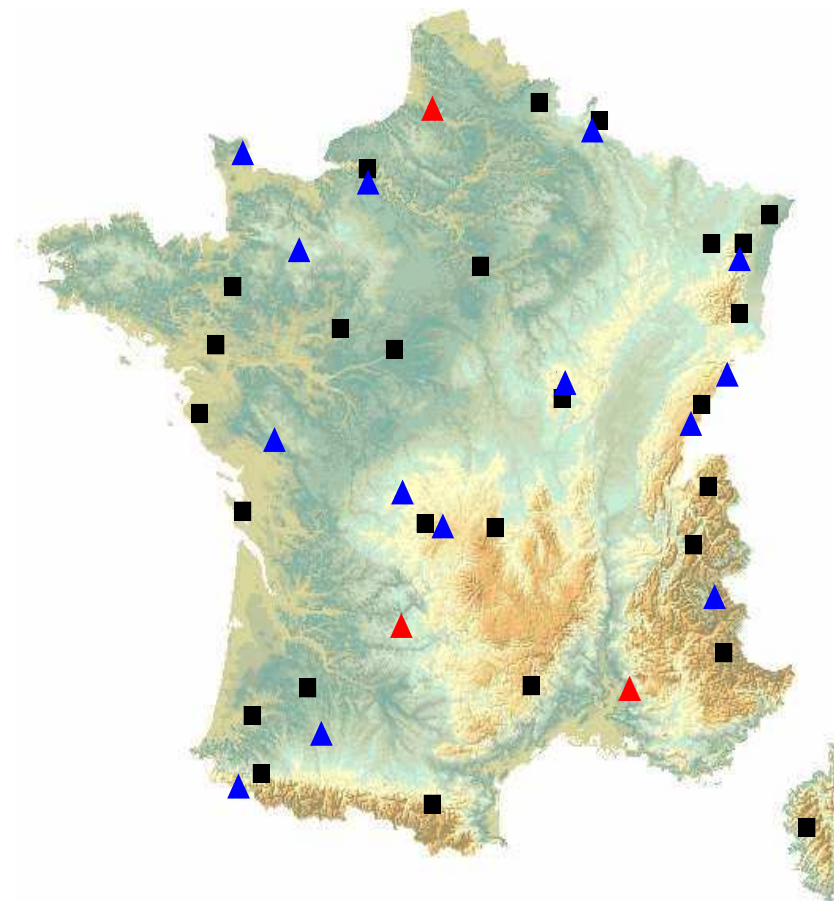
[1989-...) Coord. : 

14 sites, wet-only deposition, daily data

**BAPMON** ⇒ GAW program

[1978-2008] Coord. : 

3 sites, wet-only deposition, weekly data





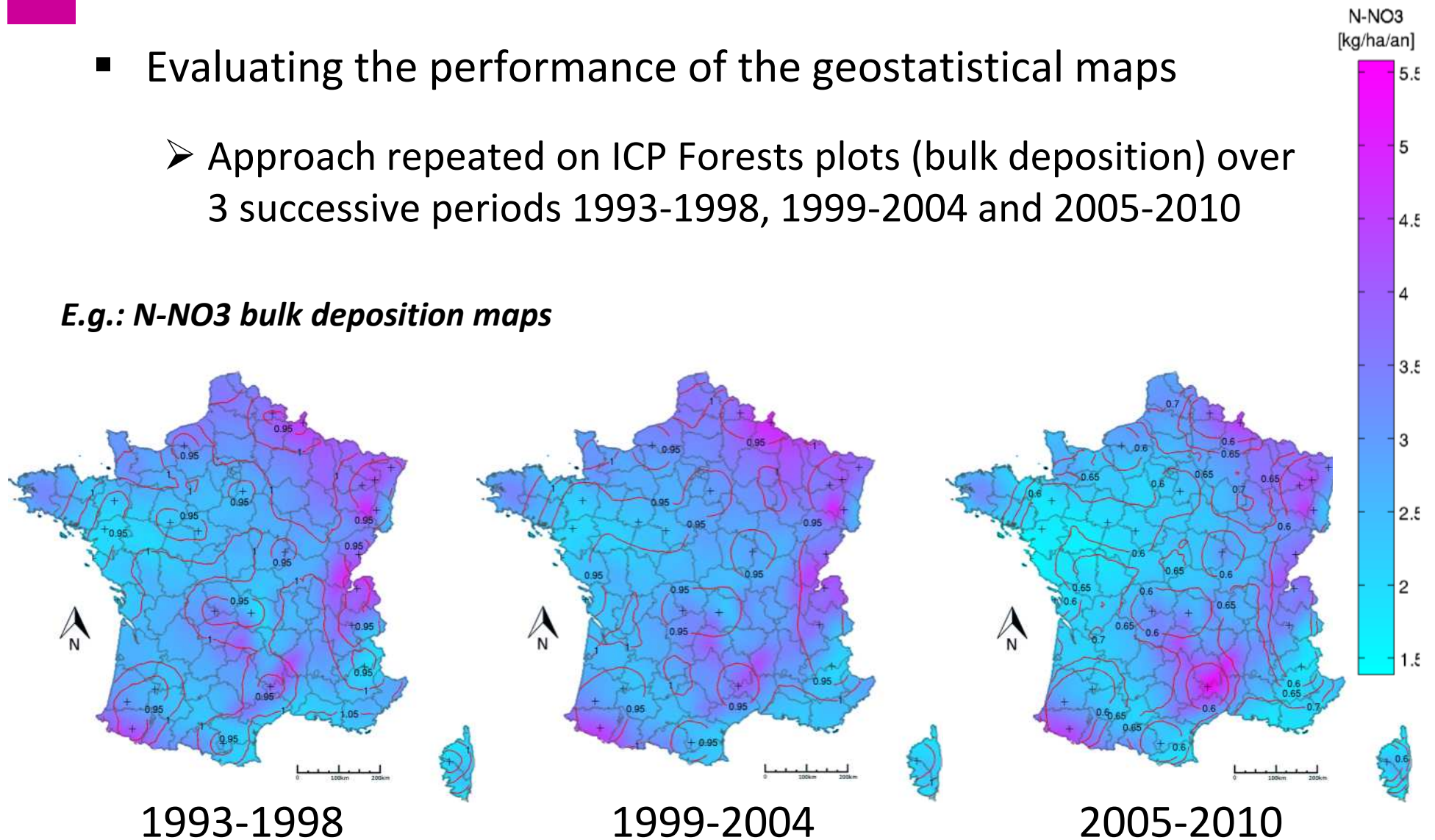
## Question

- What is the performance of each mapping approach in reproducing the variations of N-NO<sub>3</sub> and N-NH<sub>4</sub> deposition monitored at national scale on an independent set of plots?

## Materials and Methods

- Evaluating the performance of the geostatistical maps
  - Approach repeated on ICP Forests plots (bulk deposition) over 3 successive periods 1993-1998, 1999-2004 and 2005-2010

*E.g.: N-NO<sub>3</sub> bulk deposition maps*

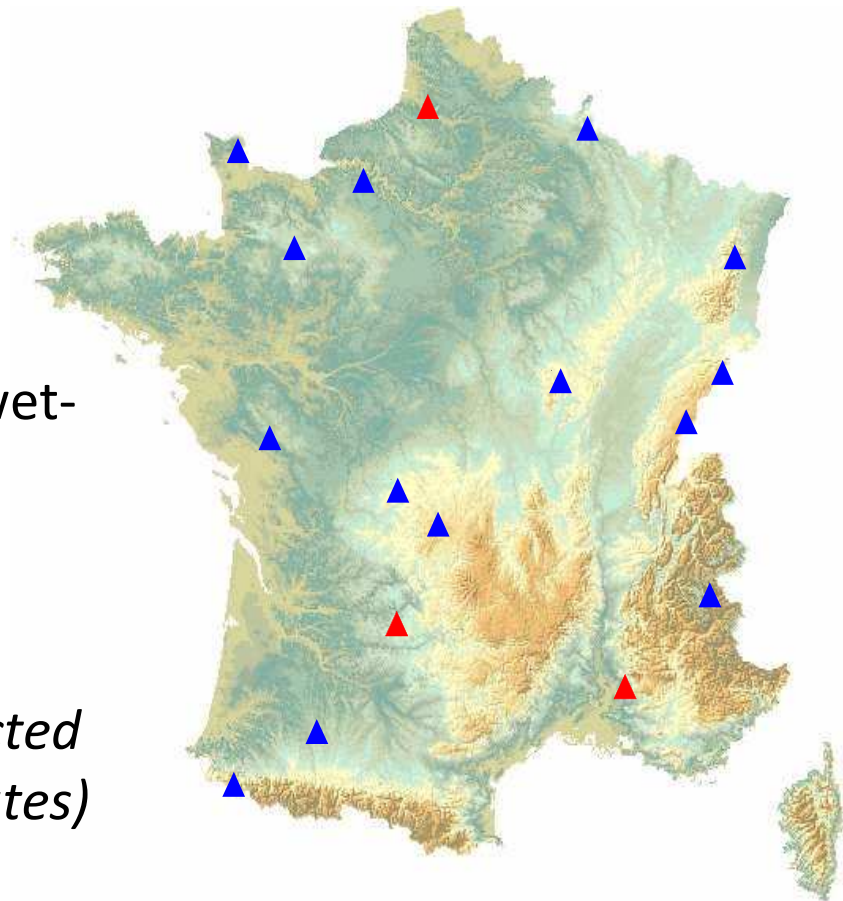


## Materials and Methods

- Evaluating the performance of the geostatistical maps
  - Approach repeated on ICP Forests plots (bulk deposition) over 3 successive periods 1993-1998, 1999-2004 and 2005-2010

- Estimates compared to the wet-only deposition independently measured on **MERA** and **BAPMON** monitoring plots

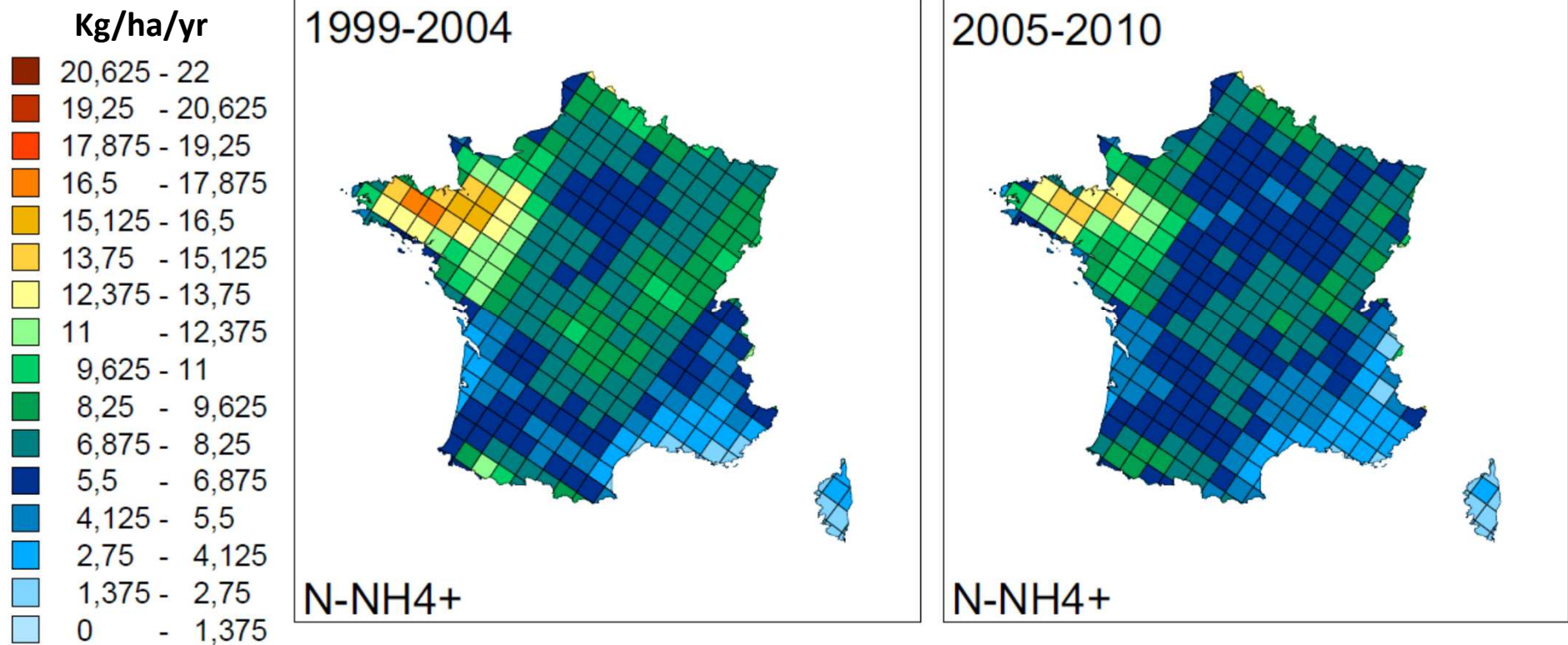
*(wet-only depositions expected to be lower than the estimates)*





## Materials and Methods

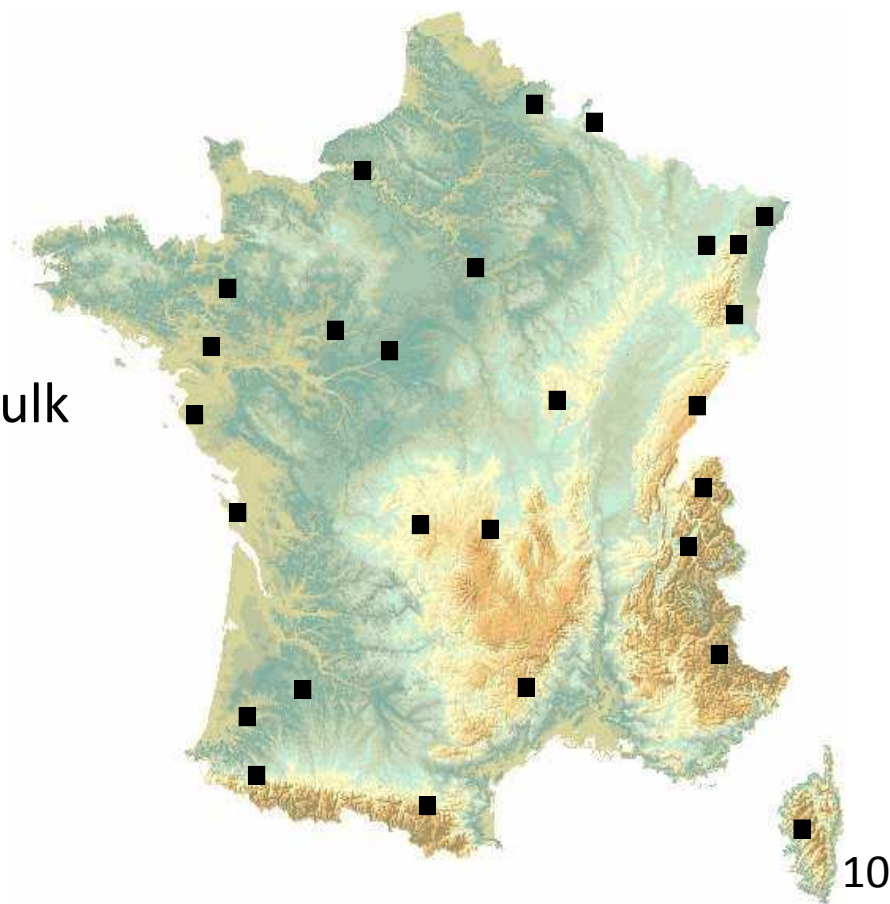
- Evaluating the performance of the EMEP maps
  - EMEP estimates for bulk deposition averaged over the same 6-year periods (data available only for 1999-2004 and 2005-2010)



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- Evaluating the performance of the EMEP maps
  - EMEP estimates for bulk deposition averaged over the same 6-year periods (data available only for 1999-2004 and 2005-2010)

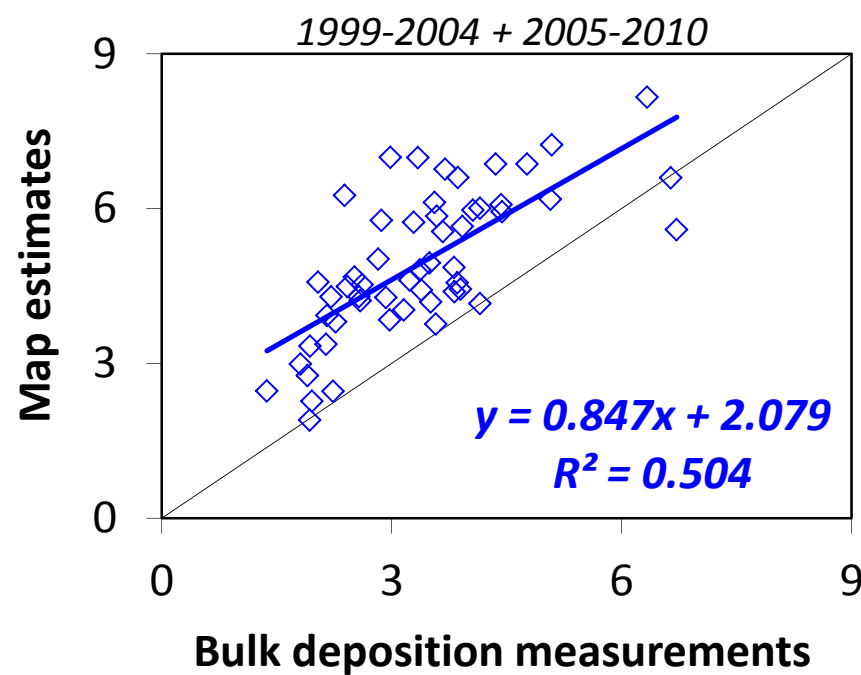
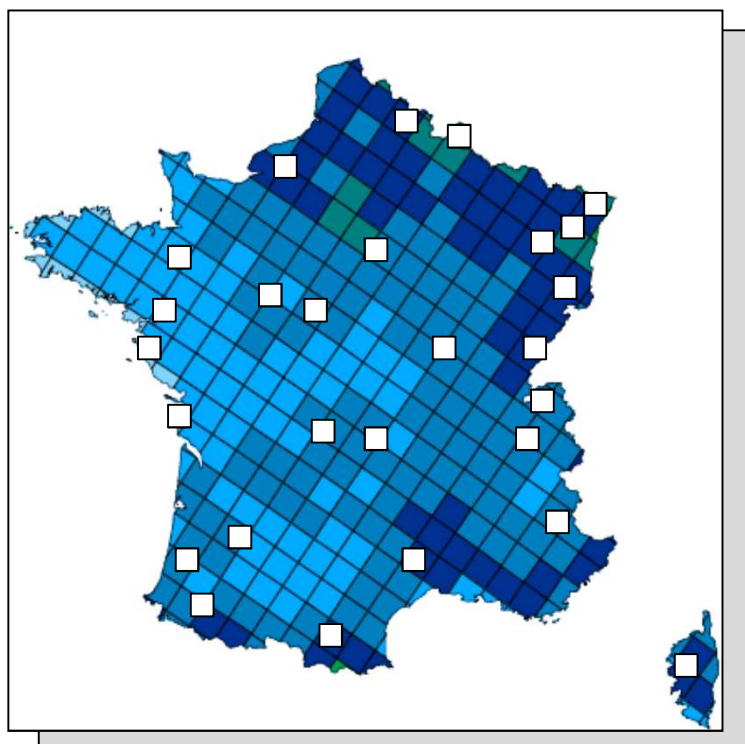
- Estimates compared to the bulk deposition measured on ICP Forests monitoring plots (RENECOFOR)



## Results: Bulk deposition estimates vs measurements

- N-NO3 (kg/ha/yr)

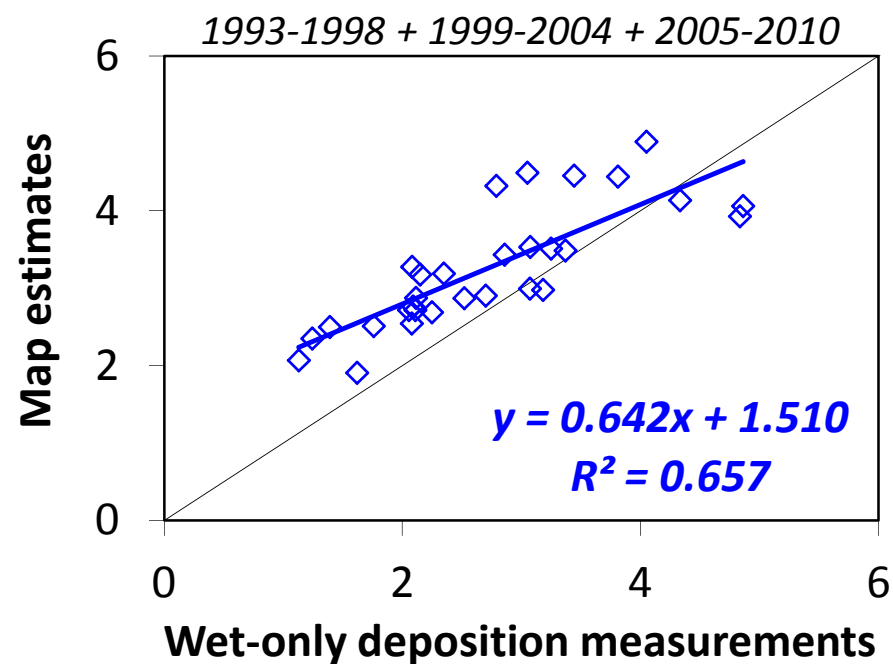
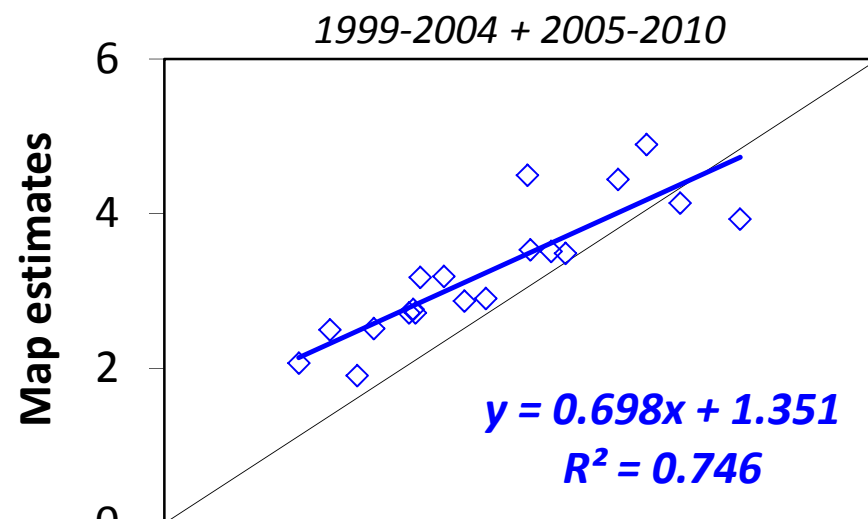
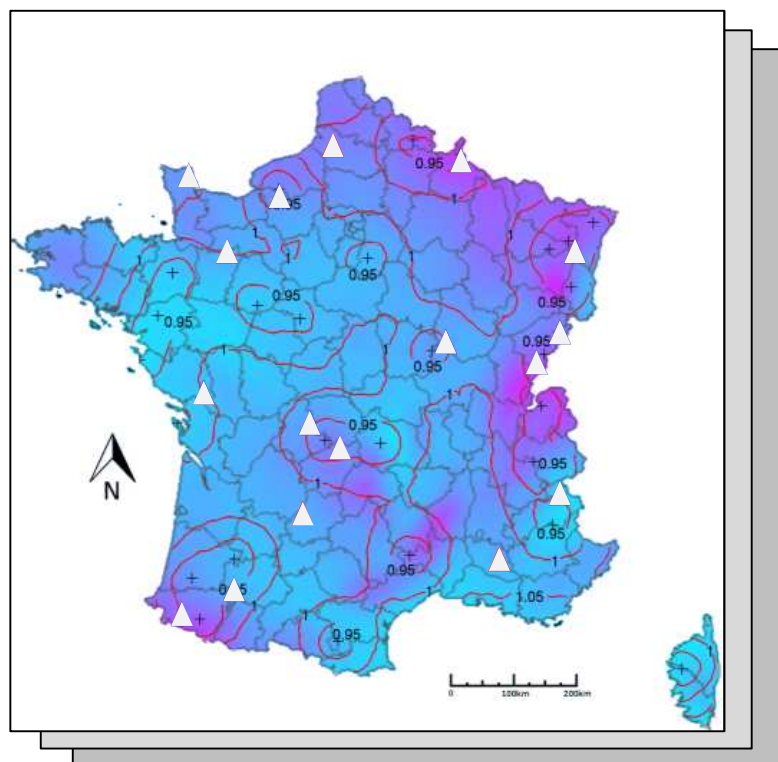
➤ EMEP mapping



## Results: Bulk deposition estimates vs measurements

### ■ N-NO3 (kg/ha/yr)

➤ Geostatistical mapping

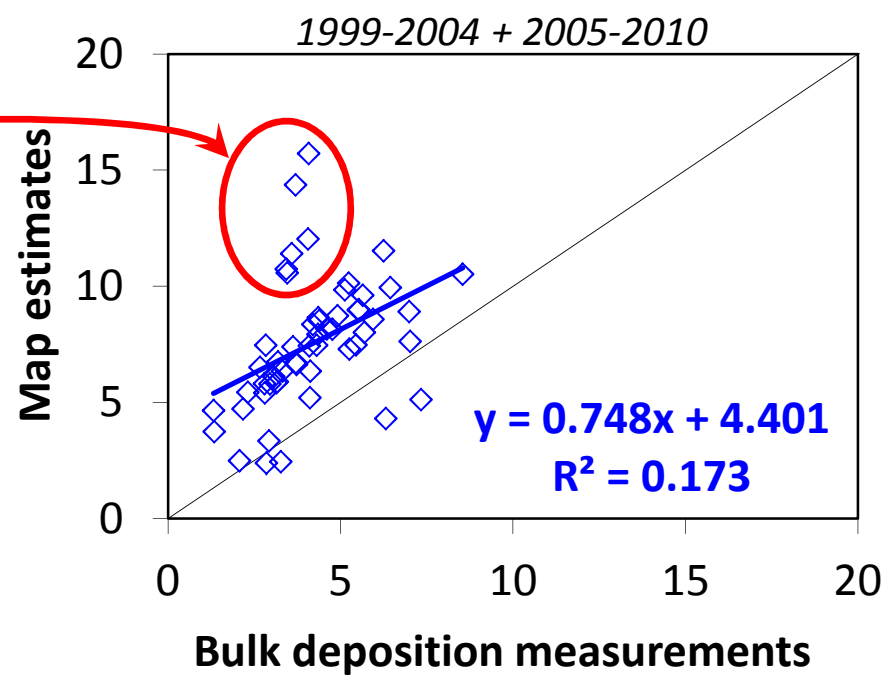
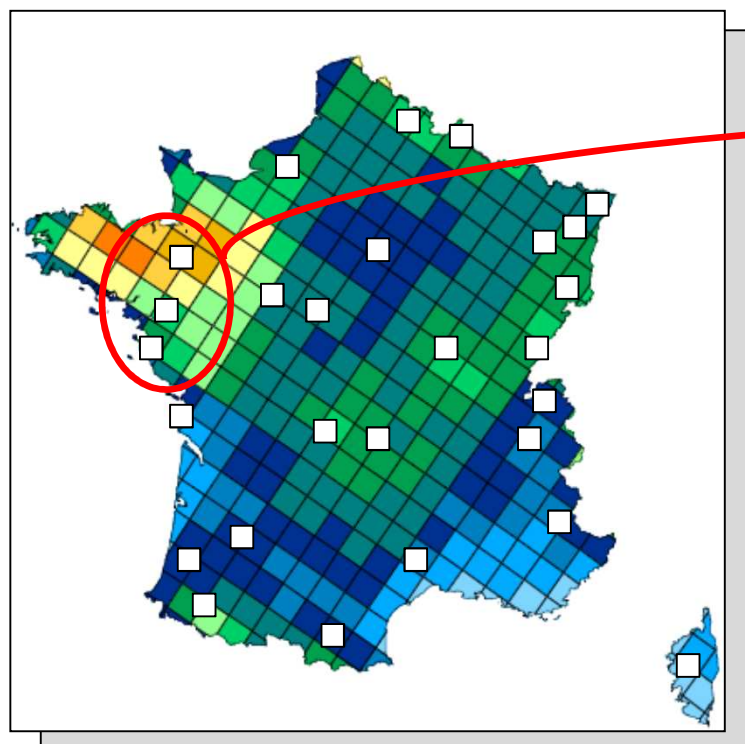




## Results: Bulk deposition estimates vs measurements

- N-NH<sub>4</sub> (kg/ha/yr)

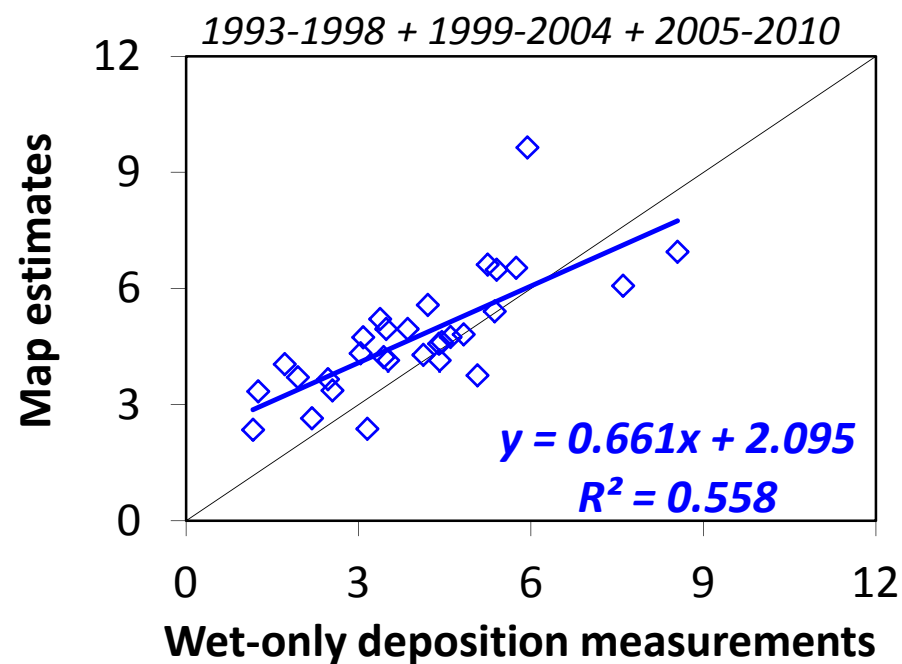
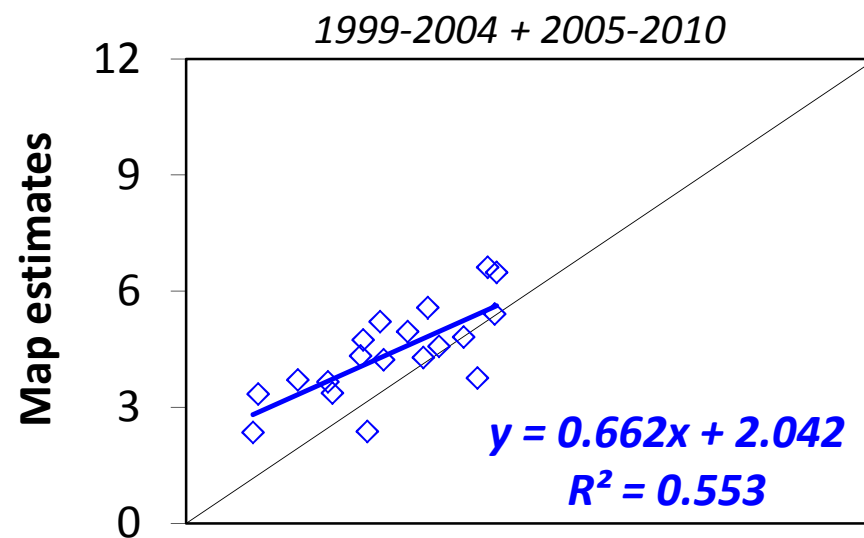
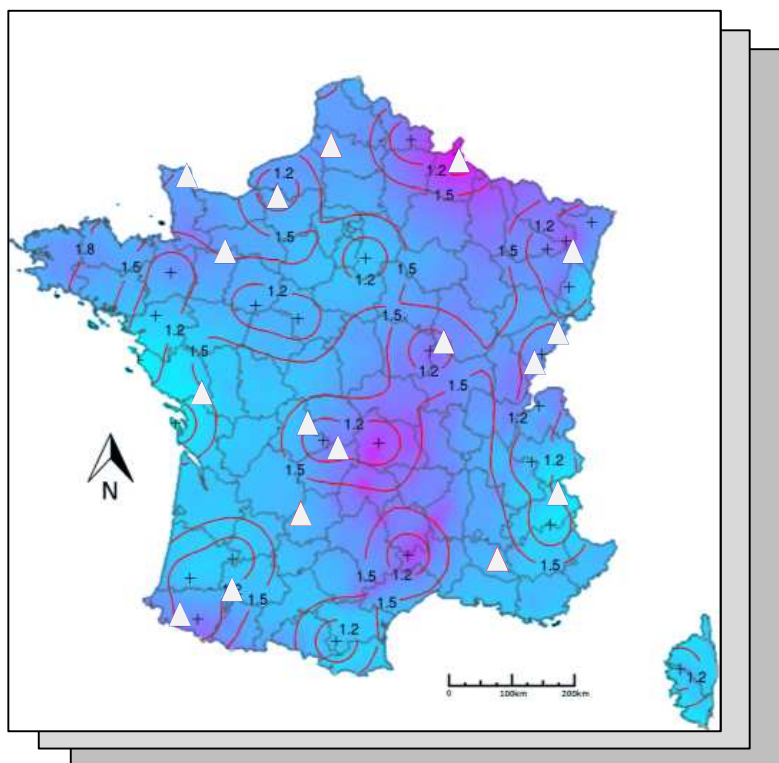
➤ EMEP mapping



## Results: Bulk deposition estimates vs measurements

### ■ N-NH<sub>4</sub> (kg/ha/yr)

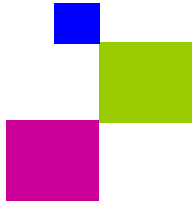
#### ➤ Geostatistical mapping





## Conclusions

- **N-NO<sub>3</sub> bulk deposition:** both mapping approaches correctly reproduce the variations observed on independent monitoring plots ( $R^2=0.5$  for EMEP map and  $R^2>0.65$  for geostatistical map).
- **N-NH<sub>4</sub> bulk deposition:**
  - Geostatistical map correctly fits with the variations observed independently ( $R^2=0.55$ );
  - EMEP map doesn't ( $R^2=0.17$ ): in particular the highest values estimated in western regions have not been observed on ICP Forests plots
- **Further research seems to be needed to better understand the processes ruling atmospheric N-NH<sub>4</sub> dispersion.**
- **ICP Forests brings a useful complement to EMEP program.**



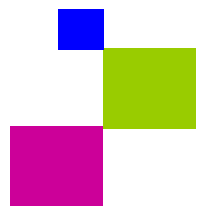
# Thank you for your attention

## **References:**

*Croisé L., Ulrich E., Duplat P., Jacquet O., 2005: Two independent methods of mapping bulk deposition in France. Atmospheric Environment, 39: 3923-3941.*

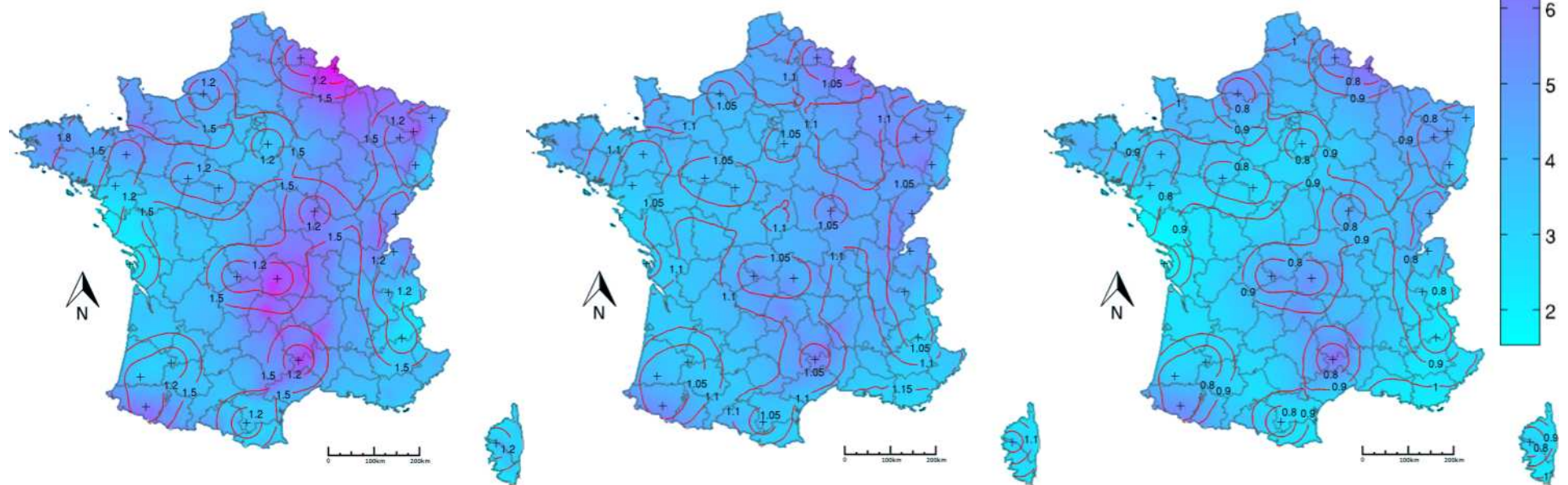
*Posch M., Seppala J., Hettelingh J.P., Johansson M., Margni M., Jolliet O., 2008: The role of atmospheric dispersion models and ecosystem sensitivity in the determination of characterisation factors for acidifying and eutrophying emissions in LCIA. International Journal of Life Cycle Assessment, 13, 6, 477-486. DOI: 10.1007/s11367-008-0025-9.*





# Résultats

## ■ Ammonium



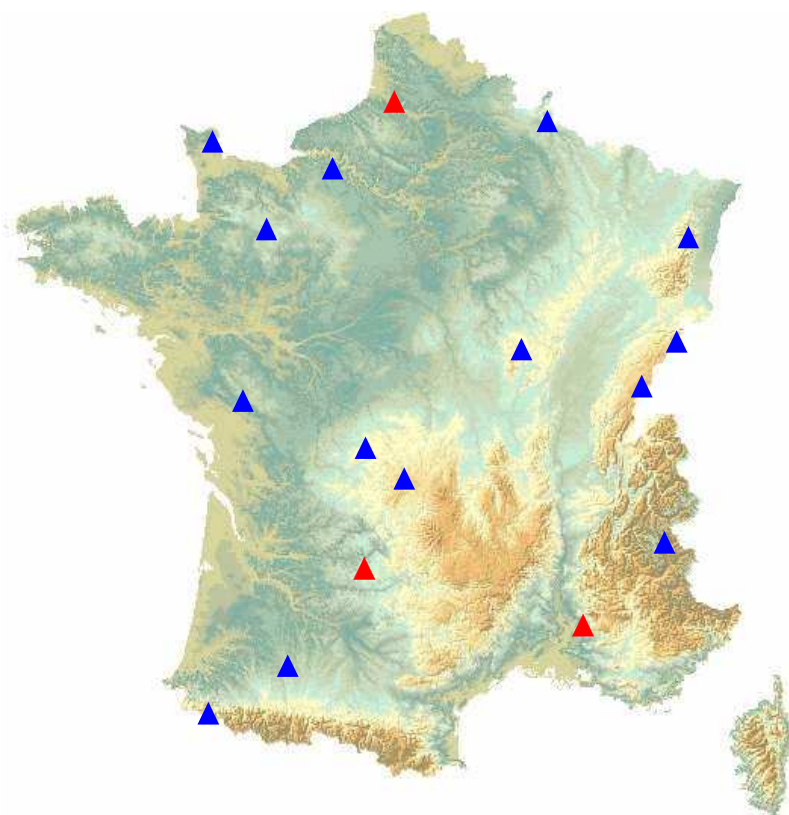
1993-1998

1999-2004

2005-2010

## Validation sur données indépendantes

- Available data from MERA and BAPMON monitoring plots.



	Plot	1993-1998	1999-2004	2005-2010
BAPMON	Abbeville	X	X	
	Carpentras	X	X	
	Gourdon	X	X	
MERA	Brotonne	X	X	
	Donon	X	X	X
	Iraty	X	X	
	La Coulonche			
	La Crouzille	X		
	La Hague	X		
	Le Casset	X	X	X
	Le Montfranc			X
	Montandon		X	X
	Morvan	X	X	X
	Peyrusse Vieille		X	X
	Revin	X	X	X
	Tardiere			X
N		11	11	8