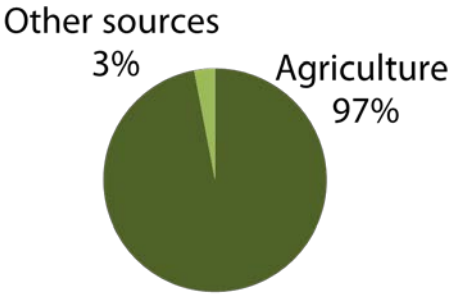
CADASTRE_NH_3

A new framwork to estimate spatio-temporal ammonia emissions after N fertilization in France

Génermont, S.[1], Dufossé, K. [1], Ramanantenasoa, M.M.J. [1], Maury, O. [1,2], Gilliot, J.-M. [1]

[1] UMR EcoSys INRA, AgroParisTech, Université Paris-Saclay
[2] US Agroclim, INRA
France

The need for a tool to help decision assessing ammoniac abatement techniques at regional and national scales



Ammoniac (NH_3), an "agricultural" gas

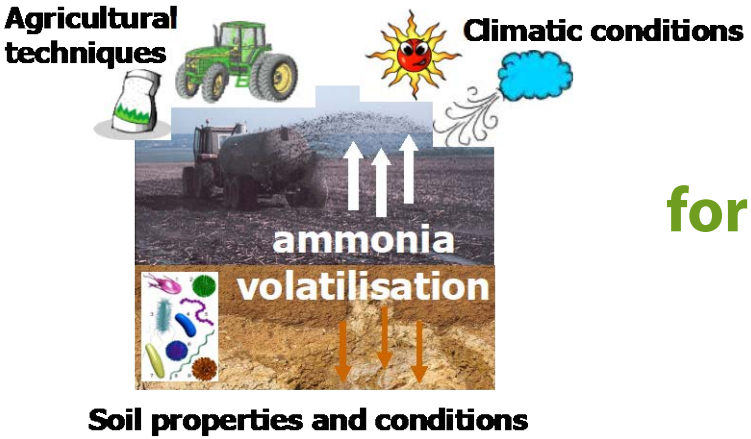
- 97% from agriculture, ~50% from field N fertilisation
- a major loss of nitrogen use efficiency of mineral and organic fertilisers

Negative impacts on human health and environment

➔ need for abatement

Field NH_3 volatilization

highly dependant on local pedoclimatic conditions



➔ High variability in emissions

➔ High variability in abatement technique efficiencies

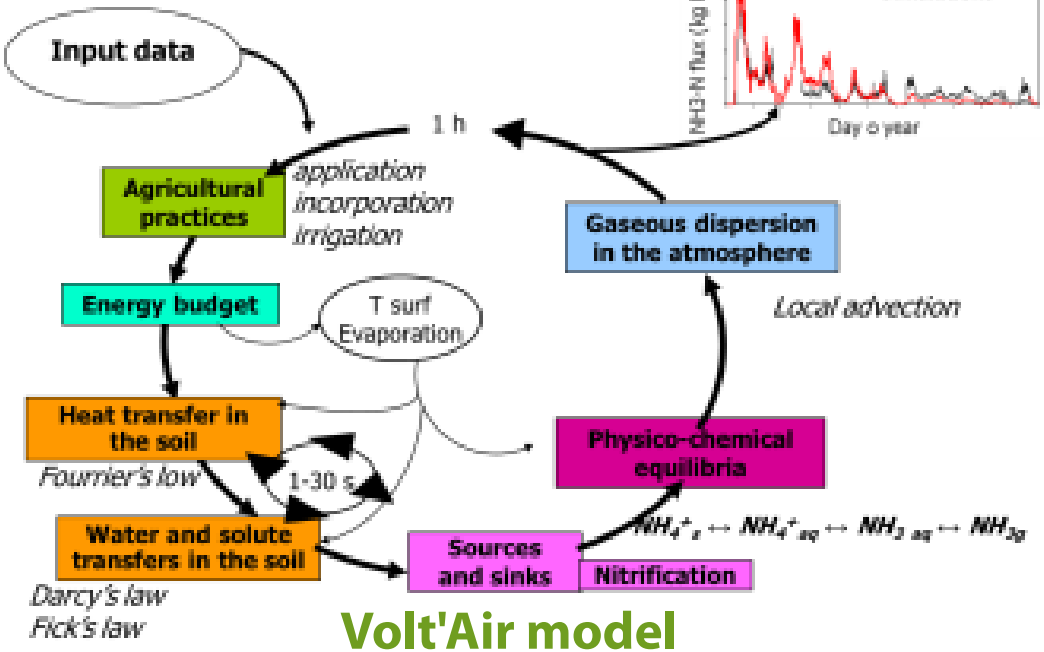
➔ Assessment needed for the whole range of agro-pedo-climatic conditions really encountered

The need for a tool to help decision assessing ammoniac abatement techniques at regional and national scales

1

Process-based model accounting for the main factors known to influence NH_3 volatilisation

Tool requires both:



Volt'Air model

(Génermont and Cellier, 1997; Le Cadre et al., 2008; Garcia et al., 2012)

2

Realistically described agro-pedo-climatic conditions encountered

Cadastre NH_3

(Ramanantenasoa et al., 2018, STOTEN)

Realistically described agro-pedo-climatic conditions encountered in France

At the Small Agricultural Region scale
Over one crop year

706 SAR

1,096 ha < SAR < 440,650 ha

N fertilization management: number/method of applications date, amount, fertilizer type	Fertilizer / manure properties	Weather conditions	Dominant soil type	Soil properties	Cultivated area
per crop per region for few crop years	per fertilizer type for France	per SAR per hour	per SAR	per soil type	per crop per SAR per crop year
Agricultural practice Survey	Expertises	SAFRAN	ESDB		LPIS

Agreste

CASD

+ fertilizer deliveries

unifa

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METEO FRANCE Toujours un temps d'avance

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O.D.R. Observatoire Du Développement Rural

CORINE Land Cover

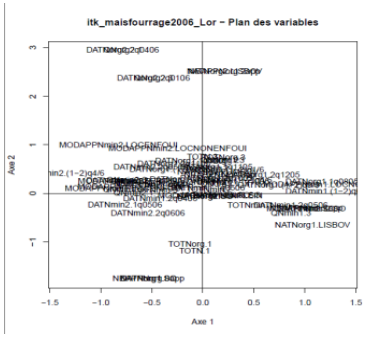
Data collection and processing at fine temporal and spatial scales

Data aggregation for one crop * soil * climate combination in each SAR

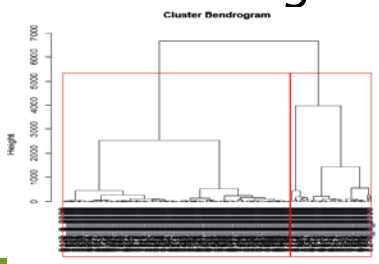
Zoom on the detailed N fertilization practices

Individual surveys Processed using Multivariate Analysis

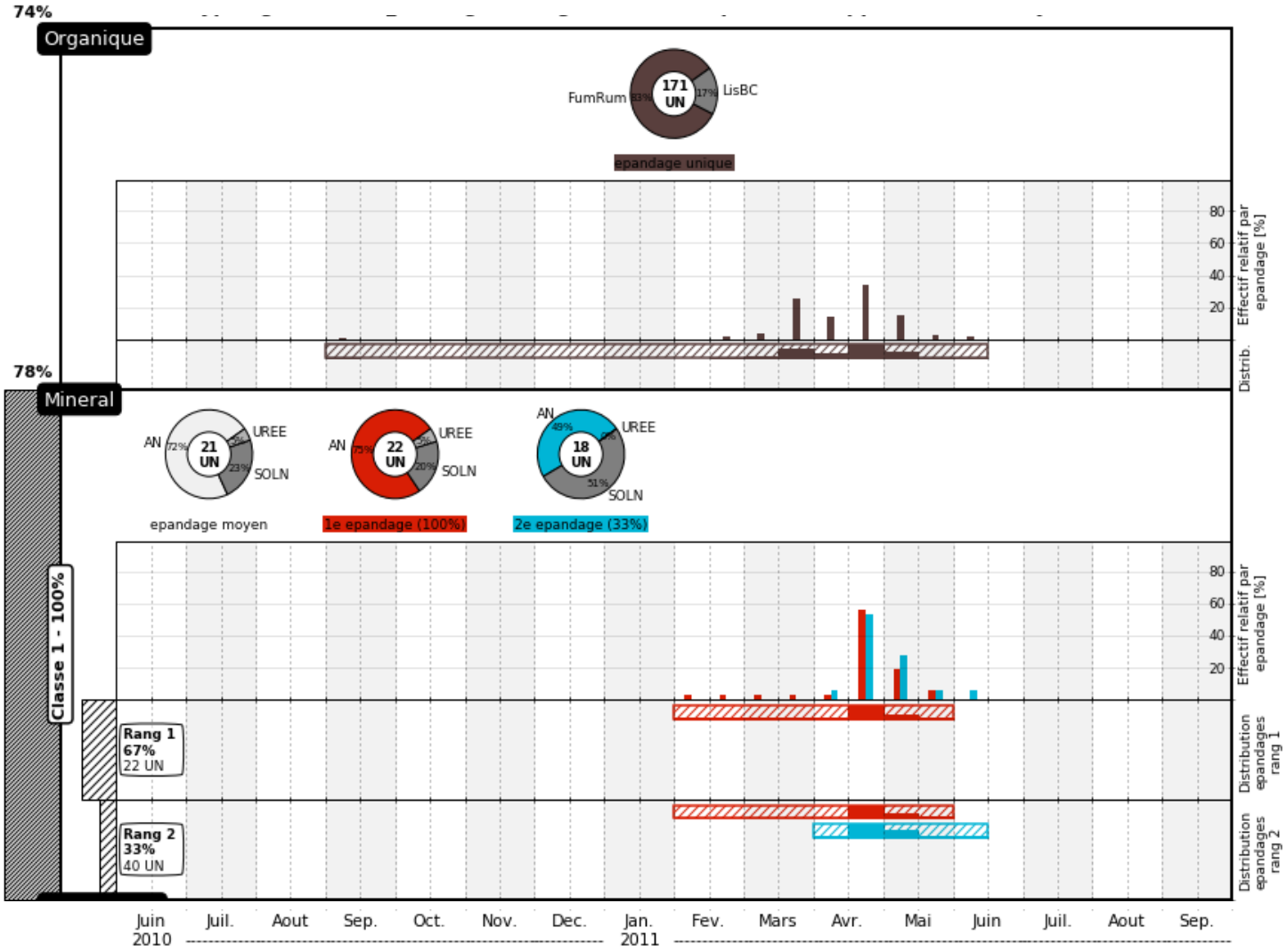
Factorial analysis of multiple correspondences



Hierarchical Clustering



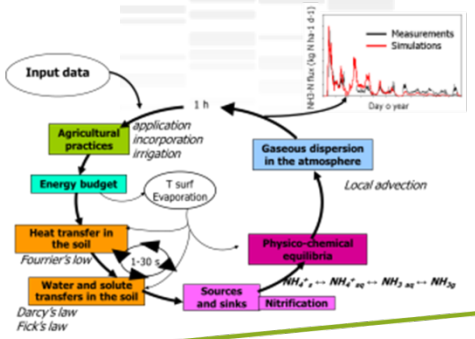
e.g. corn silage in Britany for crop year 2010-11



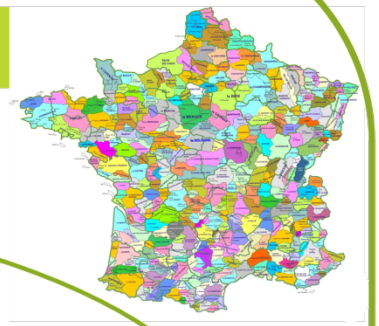
Schott, C., Mignolet C., et al. (2008)

The Cadastre_NH_3 framework

Spatial and/or temporal integration of emissions



Volt'Air multi-simulations
~ 80,000 per crop year



706 SAR

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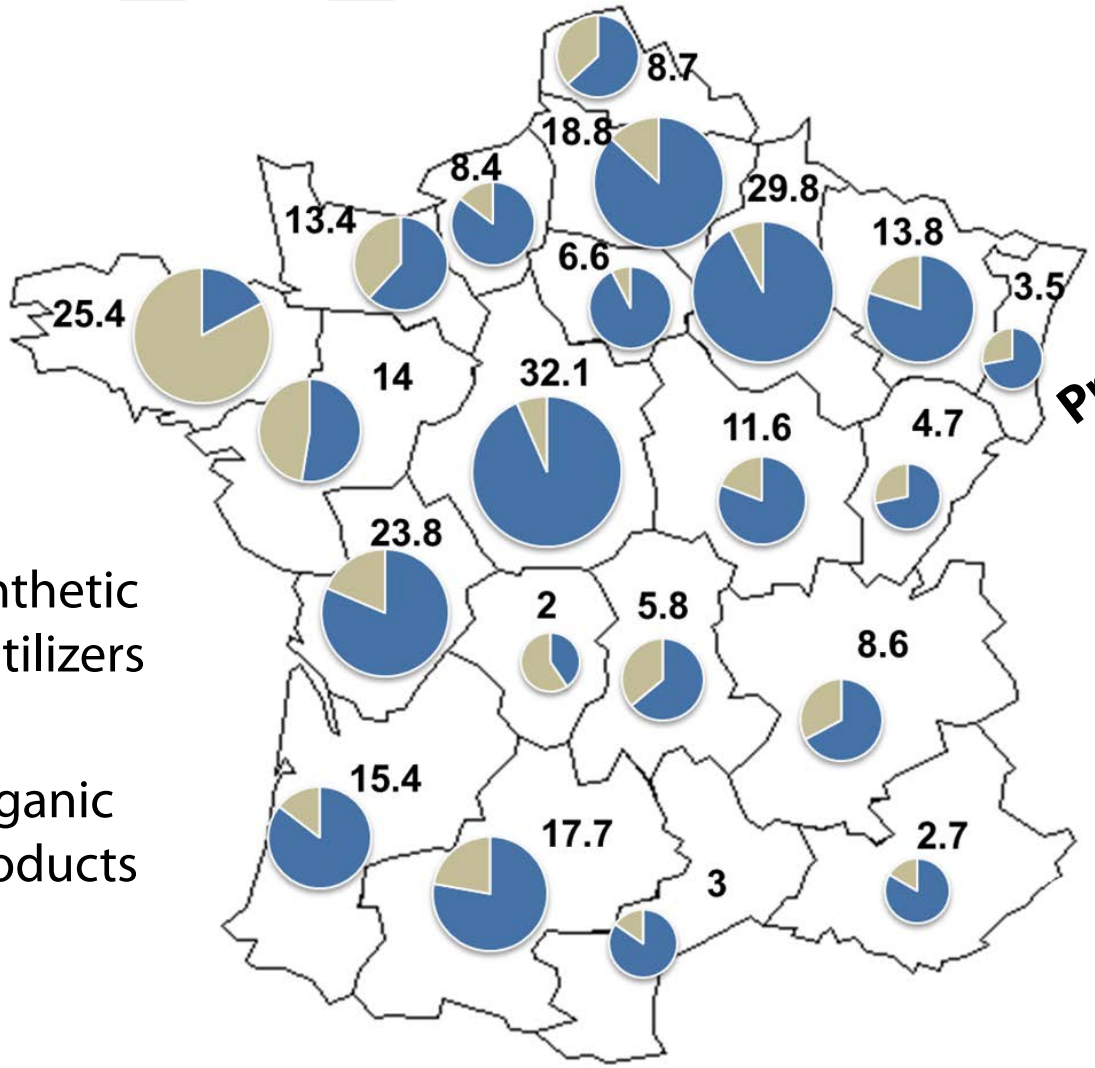
Data collection and processing at fine temporal and spatial scales
Data aggregation for one crop * soil * climate combination in each SAR

Can provide regional distribution of ammonia emissions

e.g. over the crop year 2005-06



Synthetic fertilizers

Organic products

(Ramanantenasoa et al., 2018, STOTEN)

Annual N applications for France

2005-06: 2,764 kt N

2010-11: 2,573 kt N

=> - 7%

Provisory results needing consolidation

Annual ammonia emissions for France

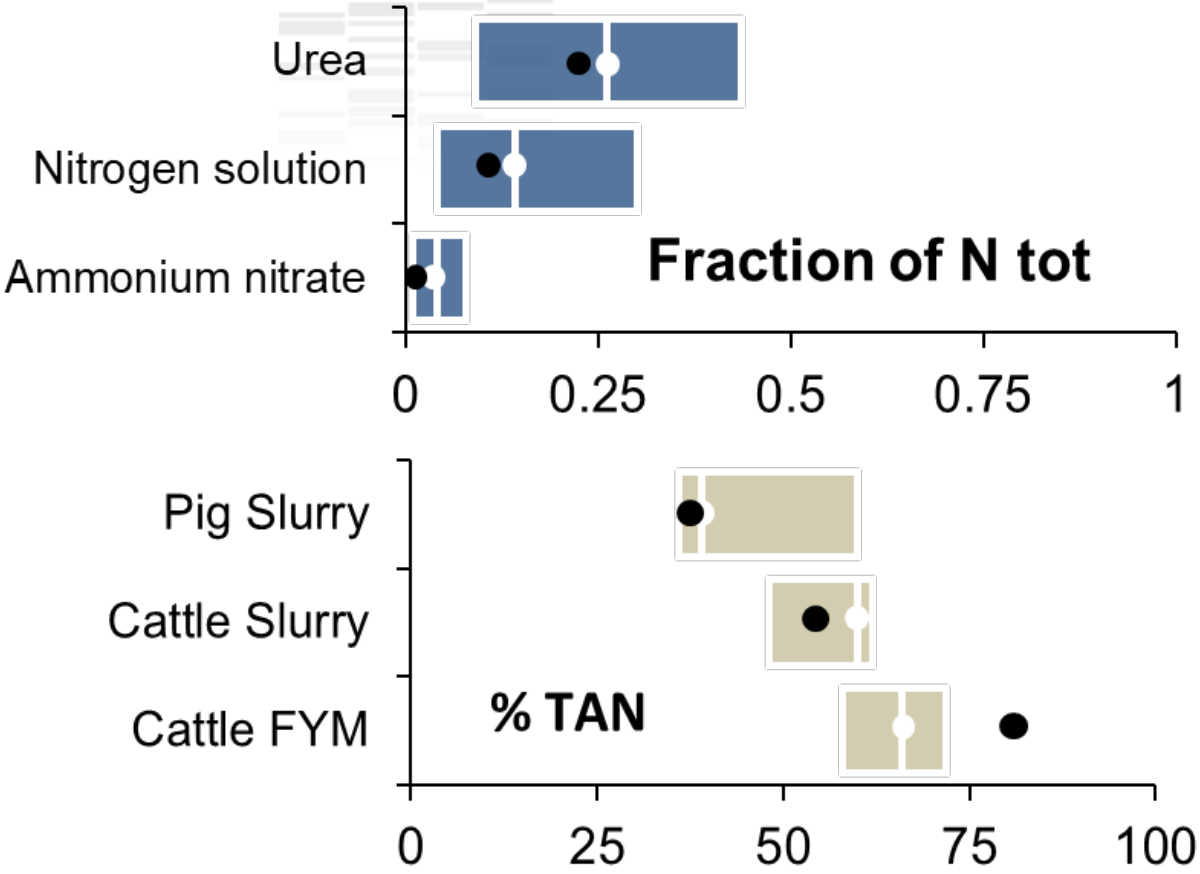
2005-06: 285 kt NH_3

2010-11: 366 kt NH_3

=> +22%

+ 30% : due to meteorological conditions *esp.* rain and temperature

Can provide Emission Factors for French conditions



(Ramanantenasoa et al., 2018, STOTEN)

Cadastre NH_3

CITEPA

uses EMEP/EEA air pollutant emission inventory guidebook values for France

~ same values

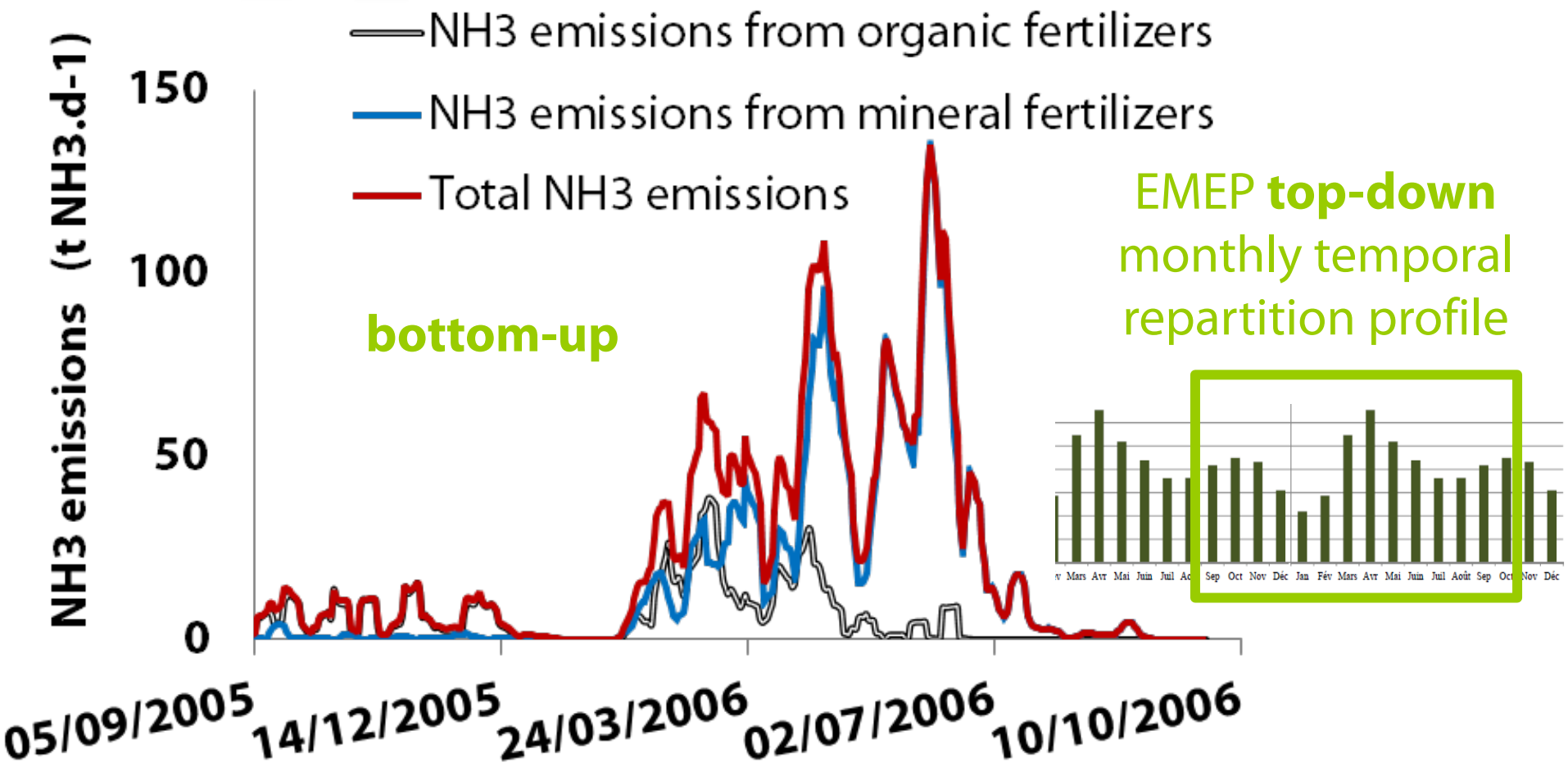
\+ variability (regional agro-pedo-climatic specificities)

➔ basis for the production of simple NH_3 volatilization functions for inventories Tier 3 methodology, sub-models for fertilization DSS…

Volt'Air meta-models (Ramanantenasoa et al., in preparation)

Can provide the dynamics of ammonia emissions

e.g. over the crop year 2005-06 in Rhône-Alpes

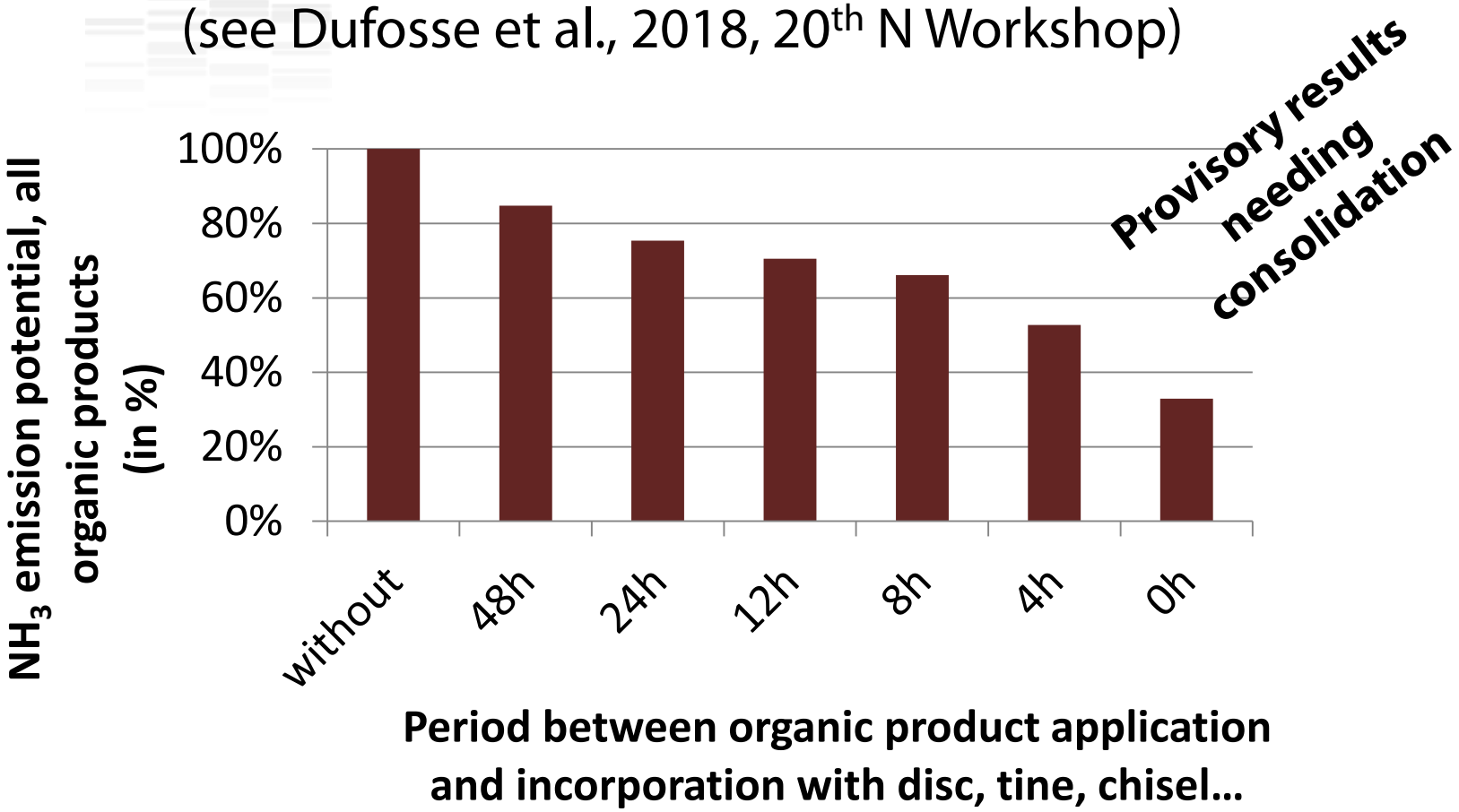


(Ramanantenasoa et al., 2018, STOTEN)

Will help assessing the efficiency of mitigation techniques

e.g. for organic products over the crop year 2010-11 for France

(see Dufosse et al., 2018, 20th N Workshop)



with differences between organic products
due to differences in volatilization rates and dynamics

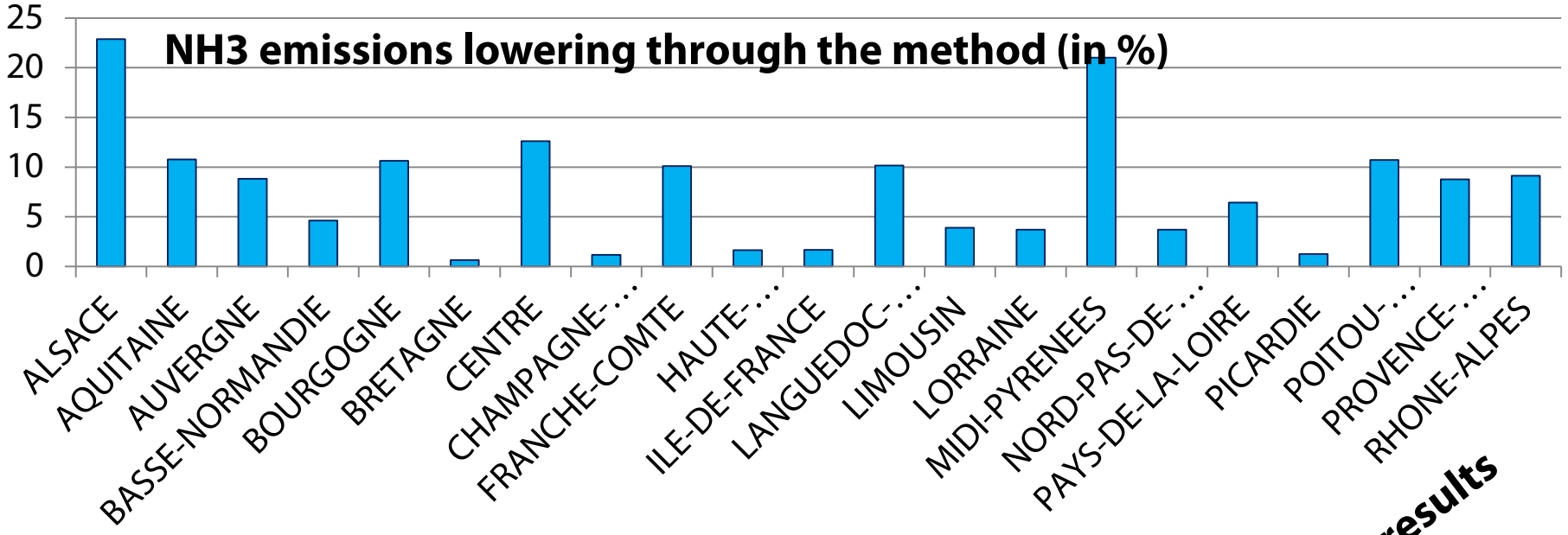
Will help assessing the efficiency of mitigation techniques

e.g. for mineral fertilizers over the crop year 2010-11 for France

(see Dufosse et al., 2018, 20th N Workshop)

Substituting 60% of urea by ammonium nitrate

Global mitigation :
- 7,2 % of NH_3 from N fertilisation



➔ differences between regions
- differences in quantities and time of urea use
- differences in pedo-climatic conditions

Provisory results needing consolidation

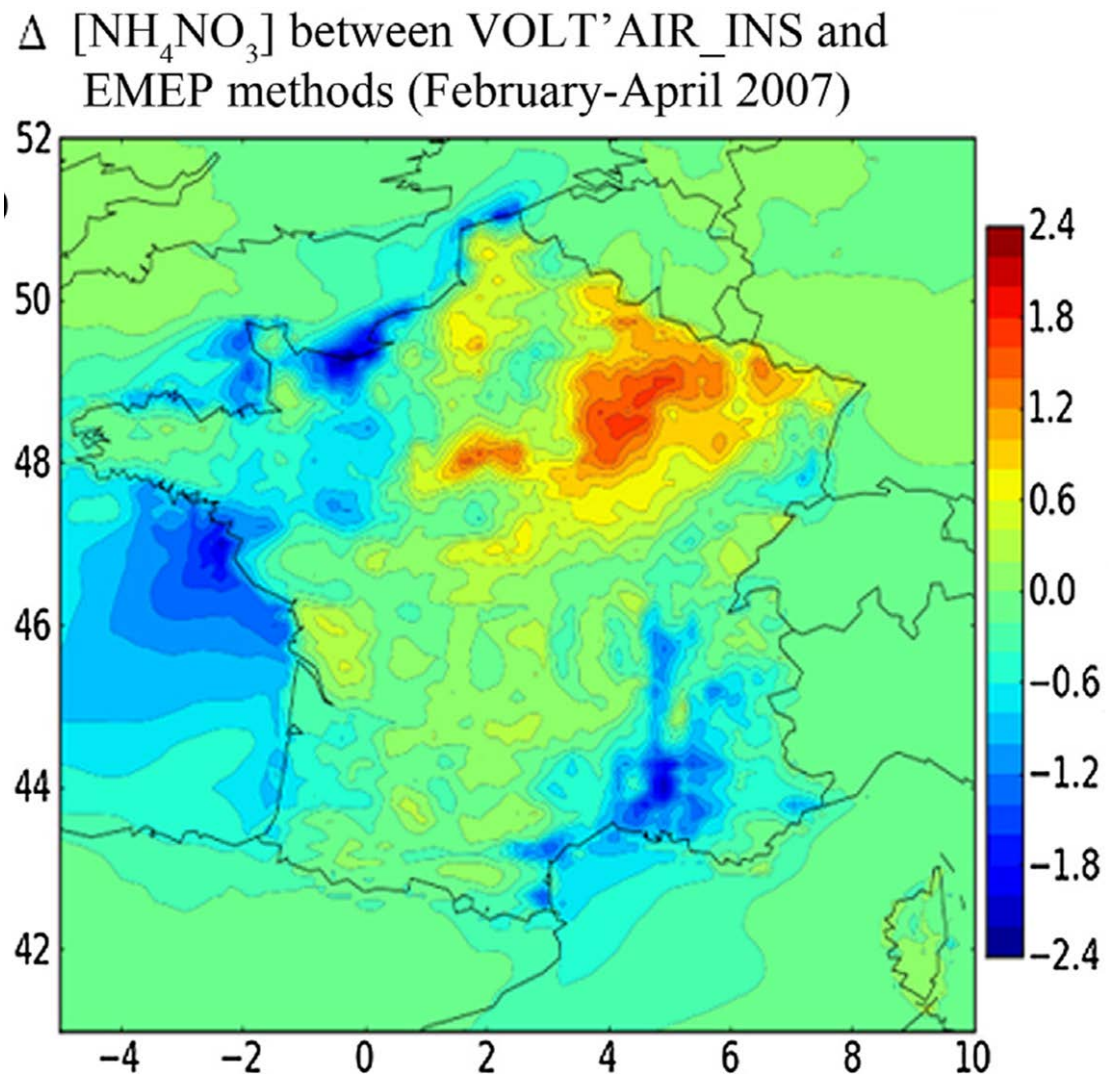
Integrating spatial and temporal ammonia emissions for air quality modeling and forecasting

Spatial and temporal variability: input for CTM models

Chimere

INERIS lisa

(see Hamaoui-Laguel et al., 2014)



Thank you !

Ramanantenasoa et al., 2018. STOTEN
Dufossé et al., 2018: 2 posters at the 20th N Workshop