

OMAR project : Surveillance of cattle mortality

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PhD work : [Anses - Lyon laboratory](#) & [INRA-Theix](#)

Webinar : Syndromic surveillance in animal health: public, animal and food safety
July 30th , 2013

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1. Datasources
 2. Retrospective analysis : Impact assessment
 3. Prospective approach : Anomaly detection
 4. Perspectives

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Cattle mortality : data sources

France : average cattle population = 20 millions (~ 220 000 holdings)
~1.2 millions deaths / y

National Cattle Register (NCR)

- **All farms**
- Since 2003
- Registration of **all cattle movements** to and from holdings
- Notifications are **mandatory** (European regulation)

Annual extractions

→ Retrospective analysis of cattle population and mortality

Fallen stock data interchange (FSDI)

- **All fallen stock companies**
- Since 2007
- Registration of **pick-up calls** and **cadaver disposals** (all species)
- Participation in FSDI is **mandatory** (national regulation)

Daily data transmission

→ Analysis of the data flow for daily monitoring of mortality

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Retrospective analysis

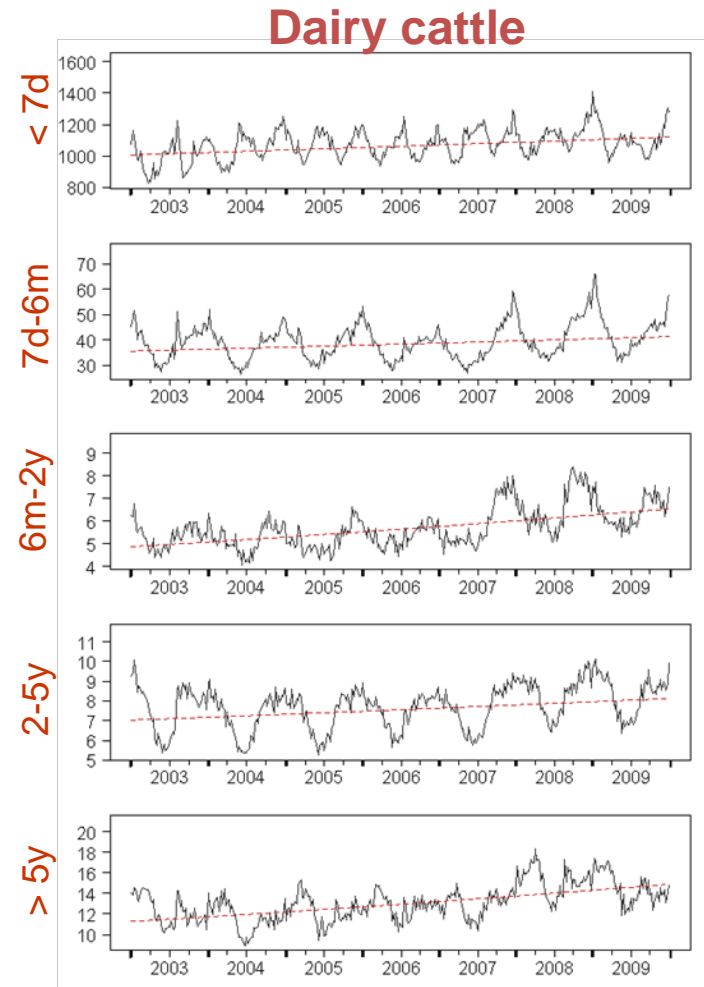
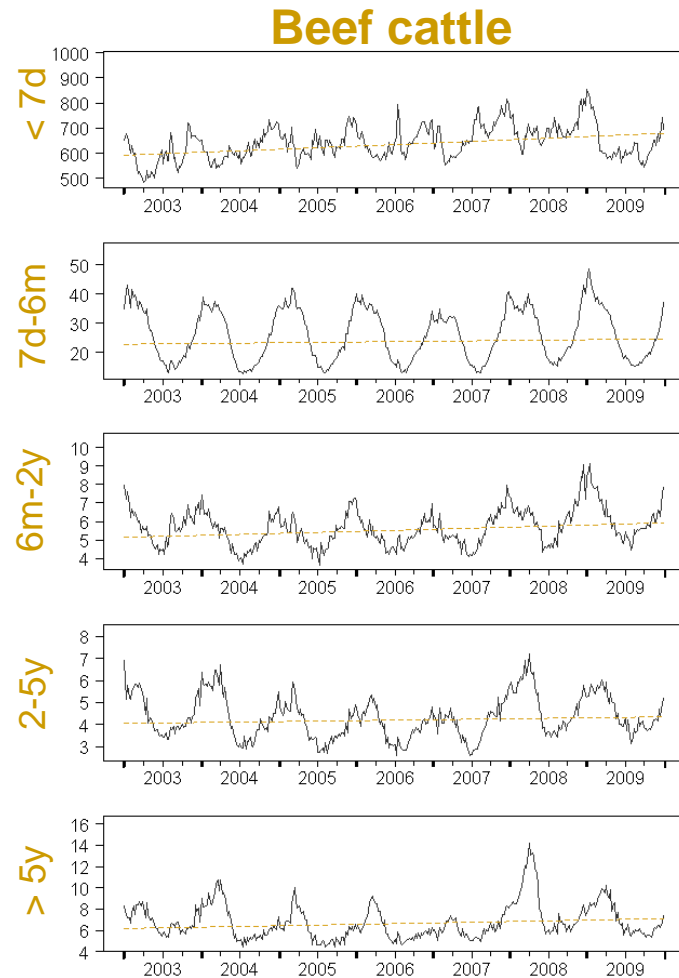
- 2003-2009 in France : ~ 65 millions cattle
 - 155 millions movements notified
 - 8,807,067 cattle deaths notified
- All movement notifications were used to compute
 - number of deaths
 - number of (living) cattle-days
 } by herd, week, age group and production type

J.-B. Perrin et al. / Epidemics xxx (2010) xxx-xxx

		mon	tue	wes	thu	fri	sat	sun	Days at risk (age group n)	Nb Deaths
Animals	A	Present in cat. n	Present in cat. n	Present in cat. n	Present in cat. n	Present in cat. n	sold	Absent	5	
	B	Present in other cat.	Present in other cat.	Present in other cat.	age grp n-1 → n	Present in other cat.	Present in other cat.	Present in other cat.	4	
	C	Present in cat. n	Present in cat. n	Present in cat. n	Present in cat. n	slaughter	Absent	Absent	4	
	D	Present in cat. n	Present in cat. n	death	Absent	Absent	Absent	Absent	2	1
	E	Absent	purchase	Present in cat. n	Present in cat. n	Present in cat. n	age grp n → n+1	Present in other cat.	4	
Total:								19	1	

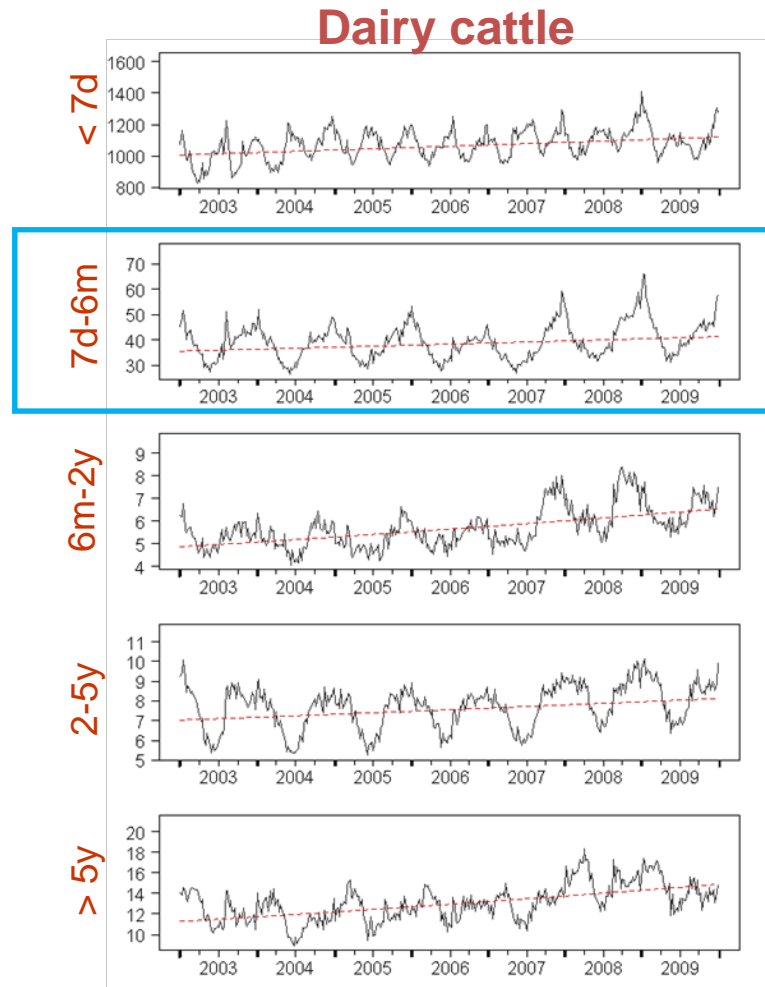
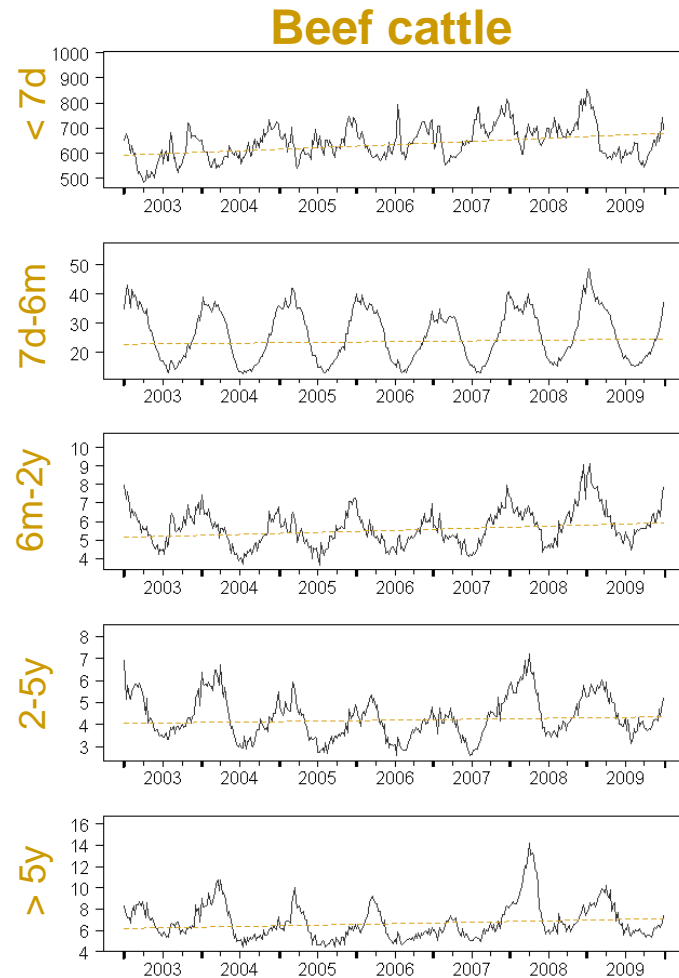
Weekly Mortality Incidence Rates

Weekly **MIR** (nb. of deaths / 100,000 cattle-days) in France by age group and production type, France 2003-2009



Weekly Mortality Incidence Rates

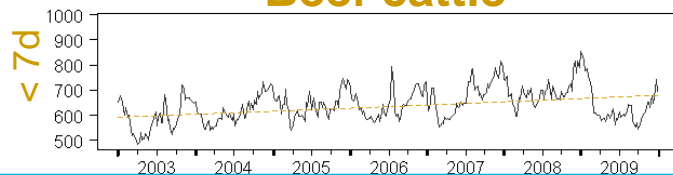
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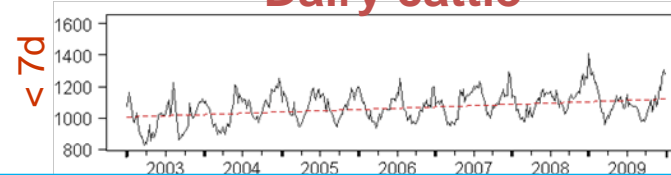
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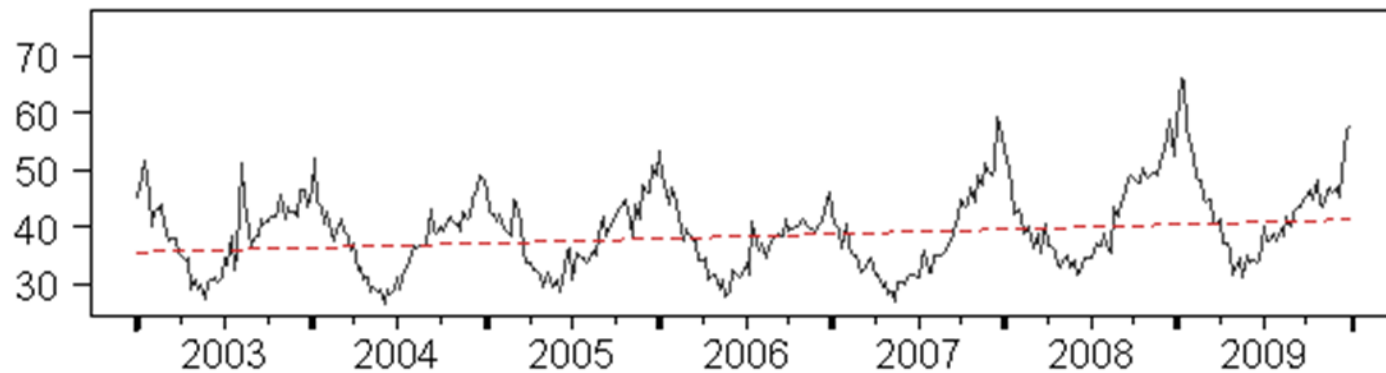
Beef cattle



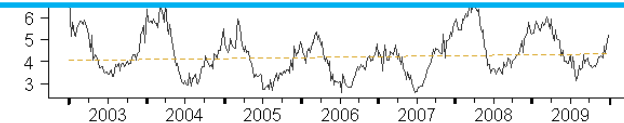
Dairy cattle



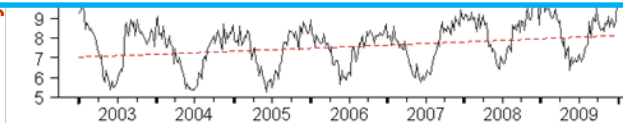
7d-6m



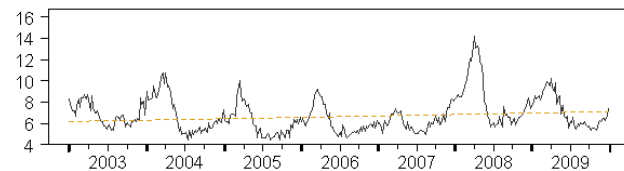
2-5y



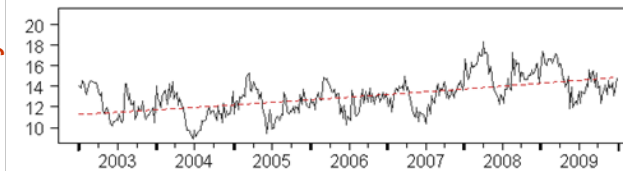
2-5y



> 5y

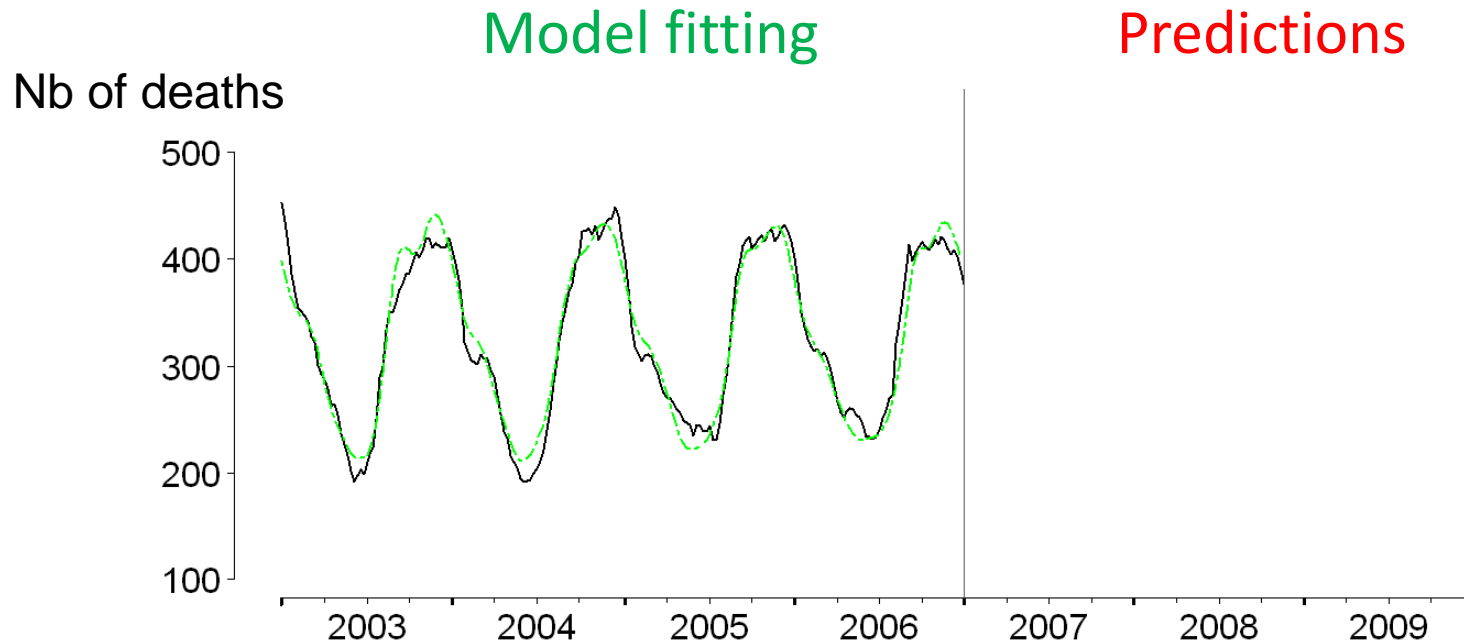


> 5y



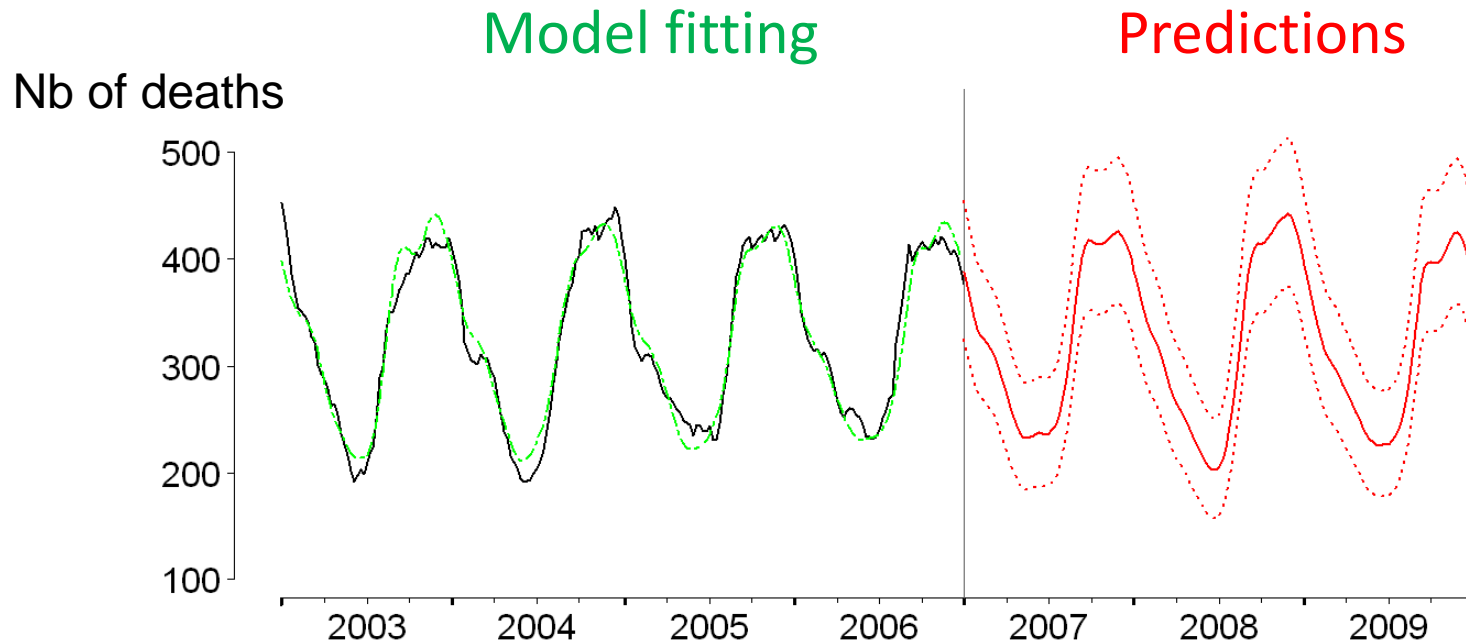
Excess mortality in Meuse department

Weekly BT8 outbreak notifications and cattle deaths number in Meuse department
(Perrin et al. 2010 *Epidemics* 2(4), 207-214)



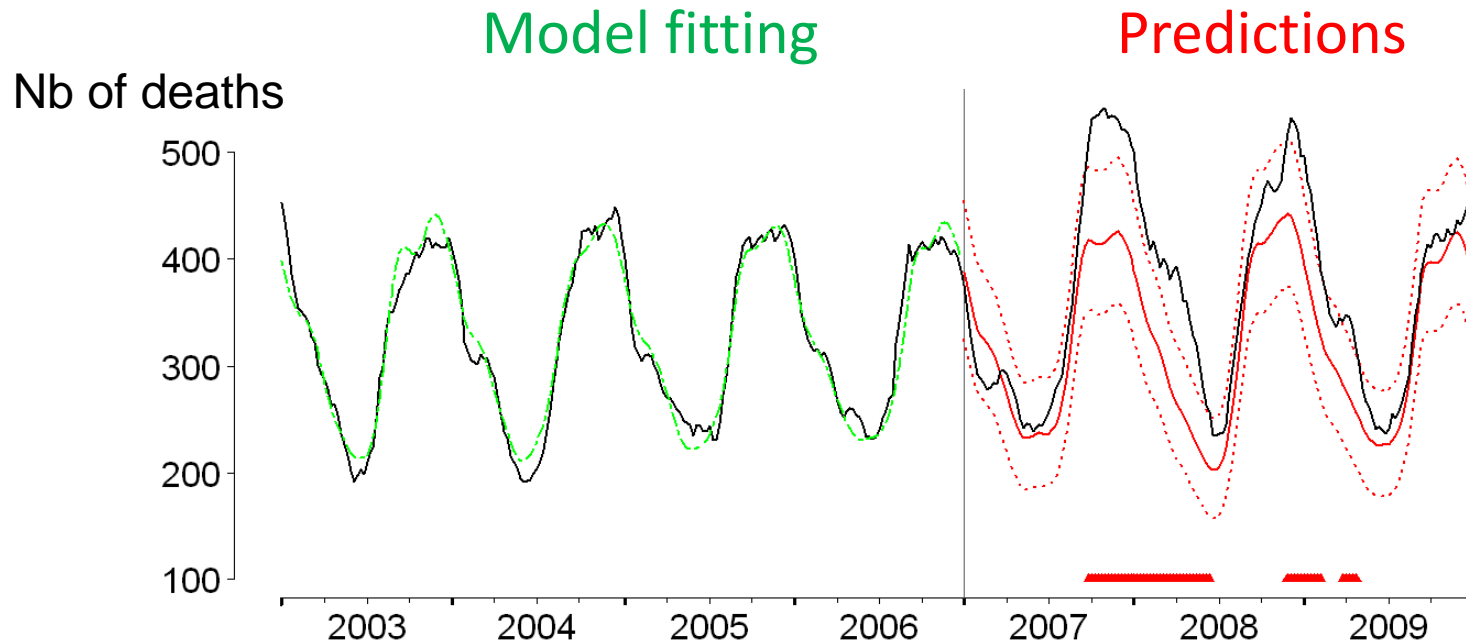
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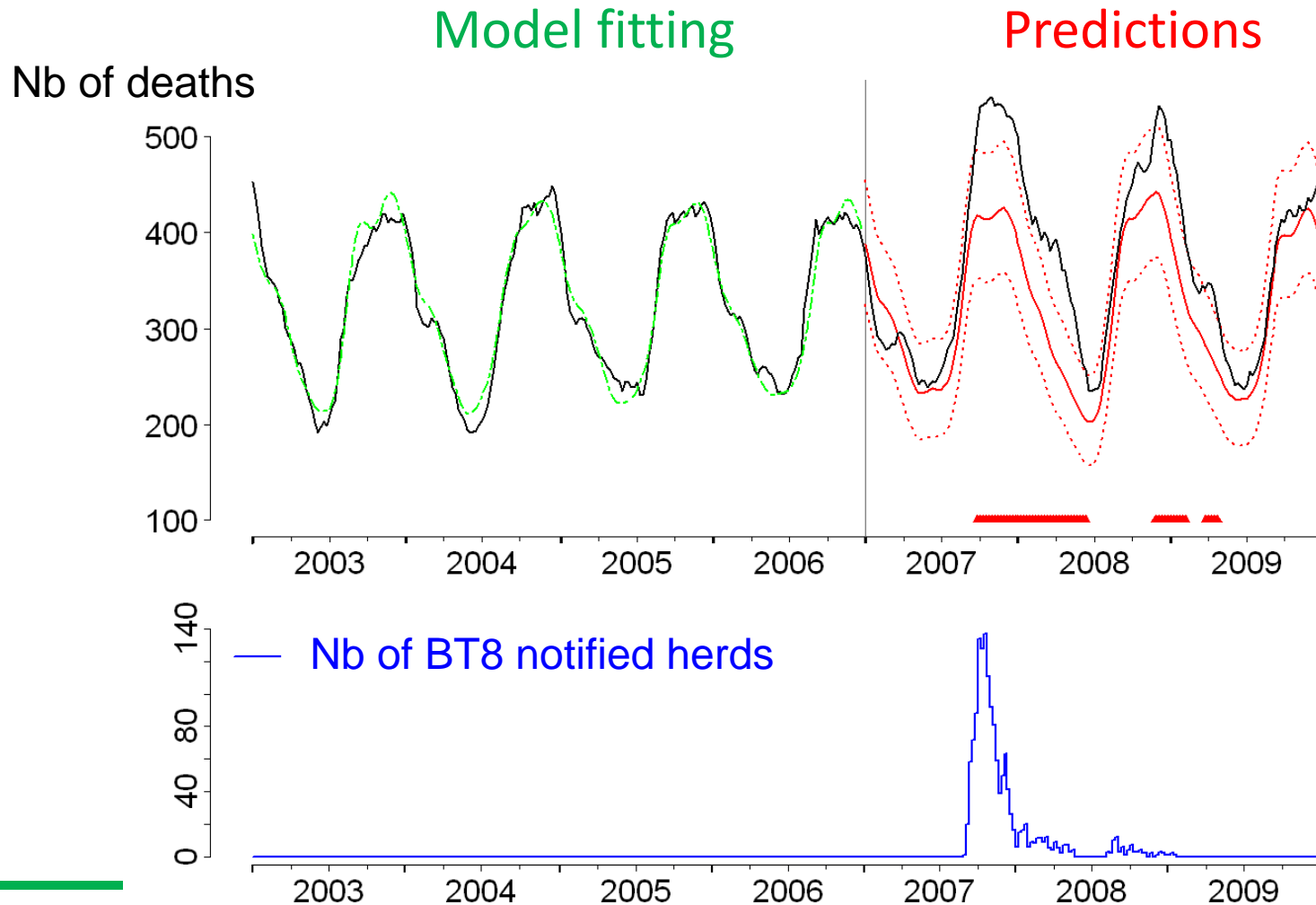
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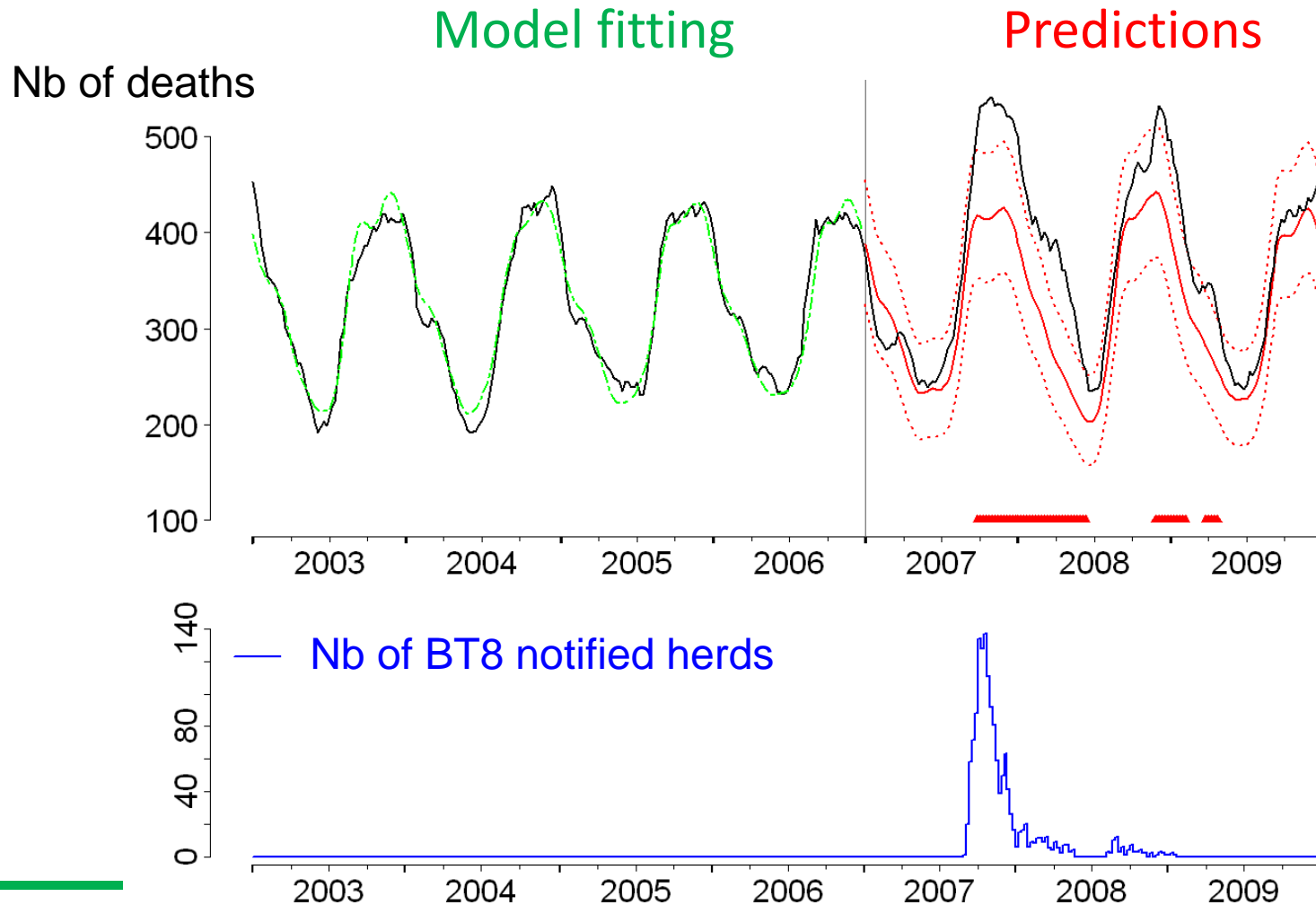
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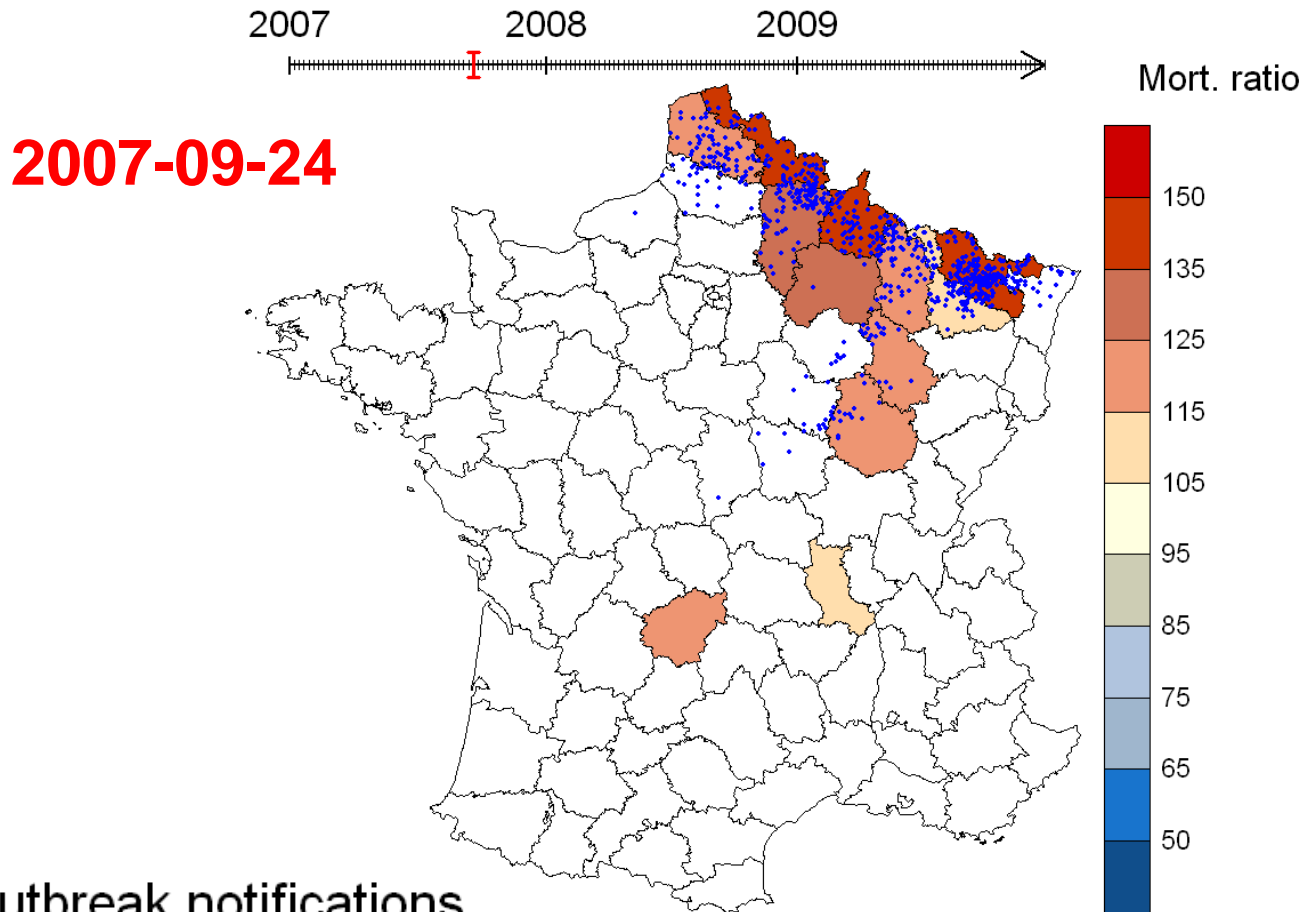
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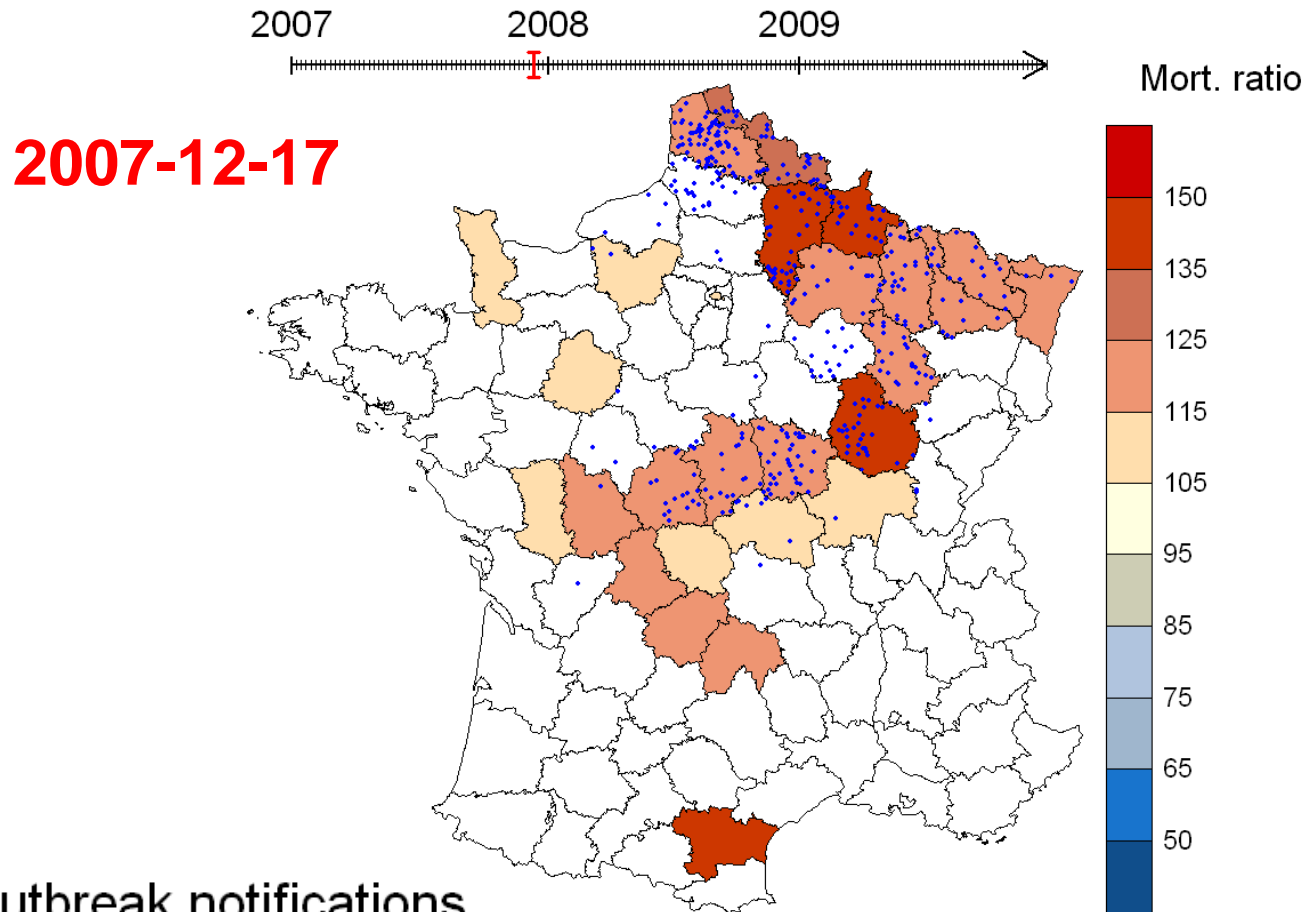
Excess mortality in France, 2007-2009

Excess mortality and number of BT8 outbreak notifications by department
(Perrin et al. 2010 *Epidemiol. et santé anim.* 57)



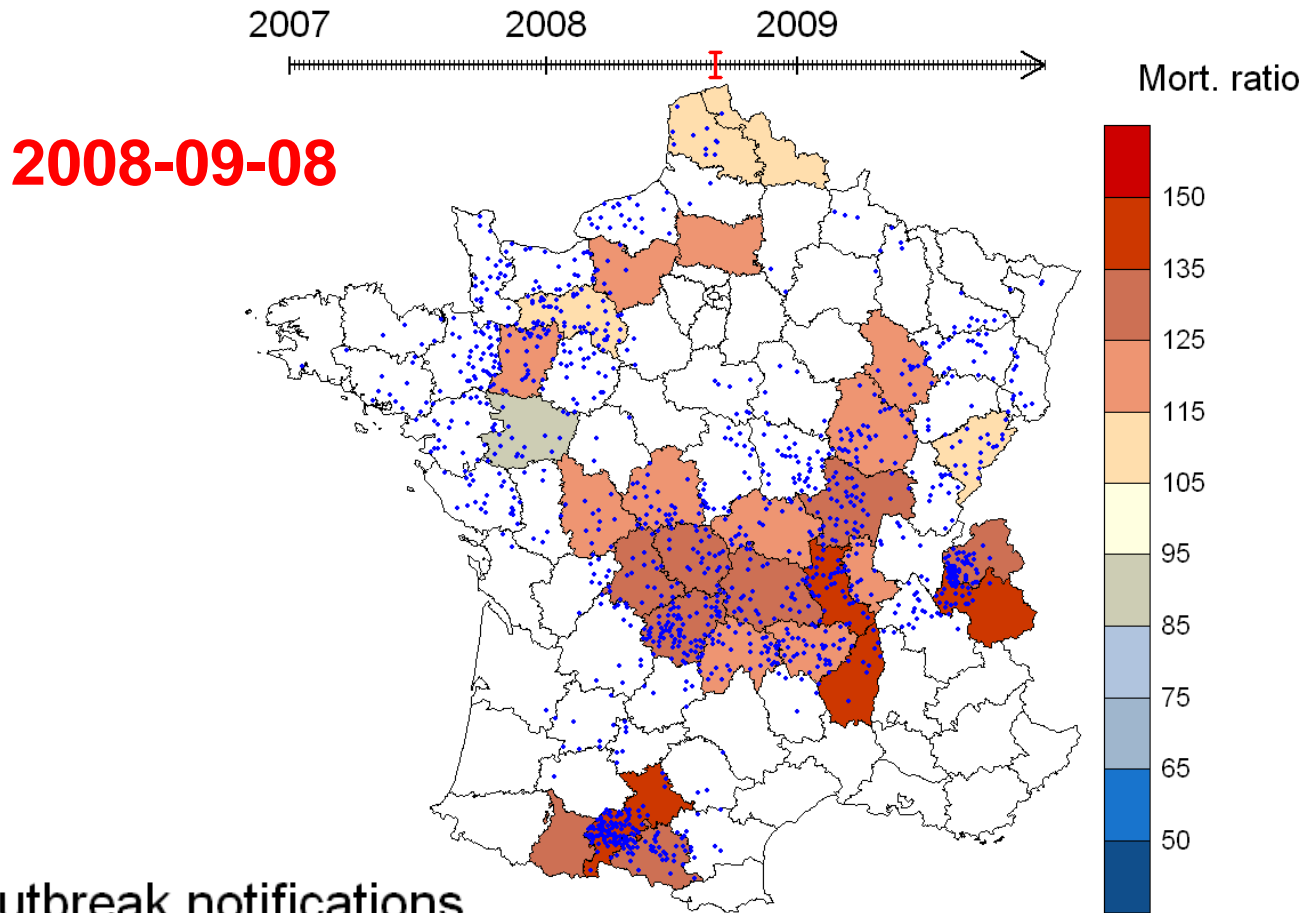
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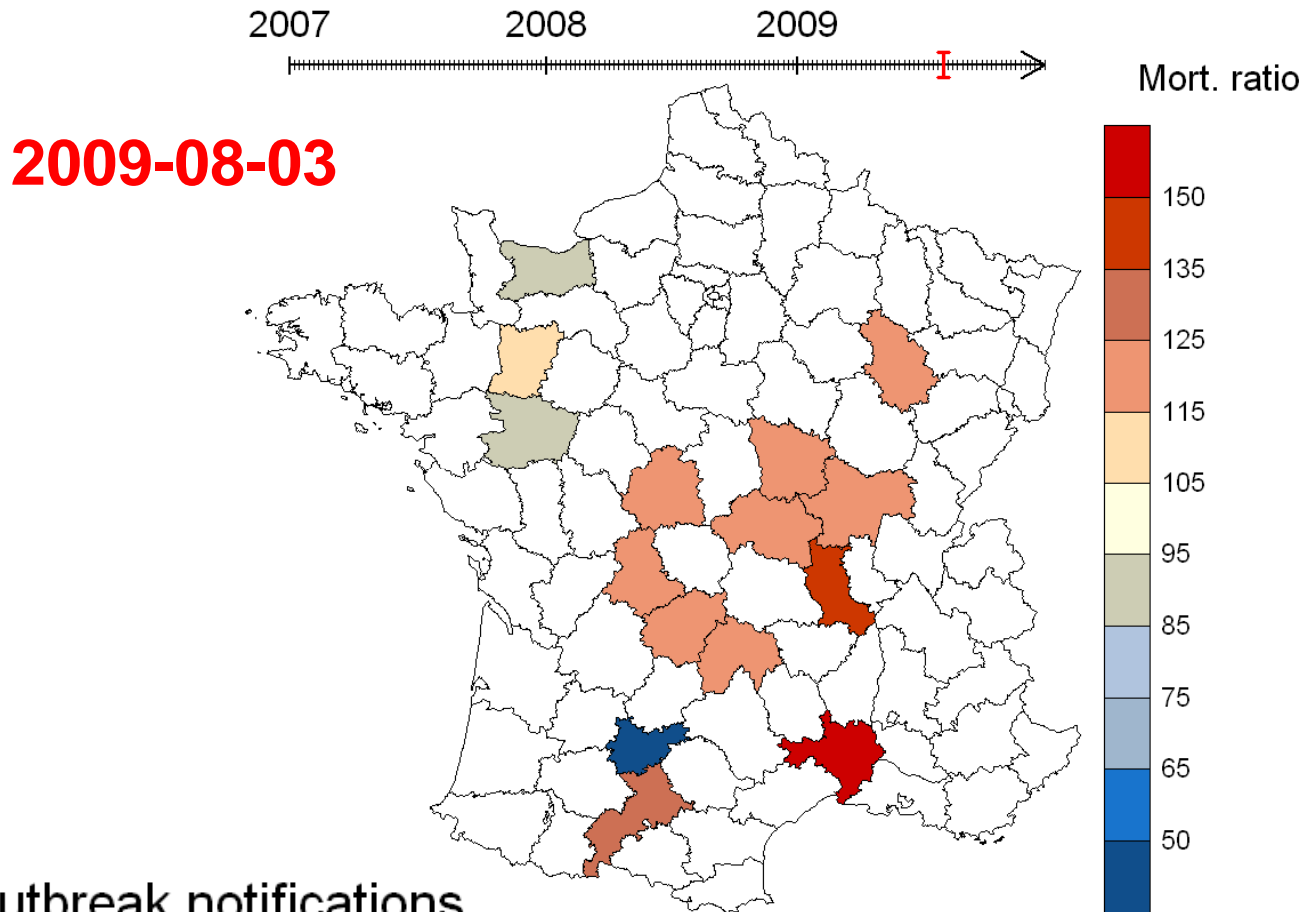
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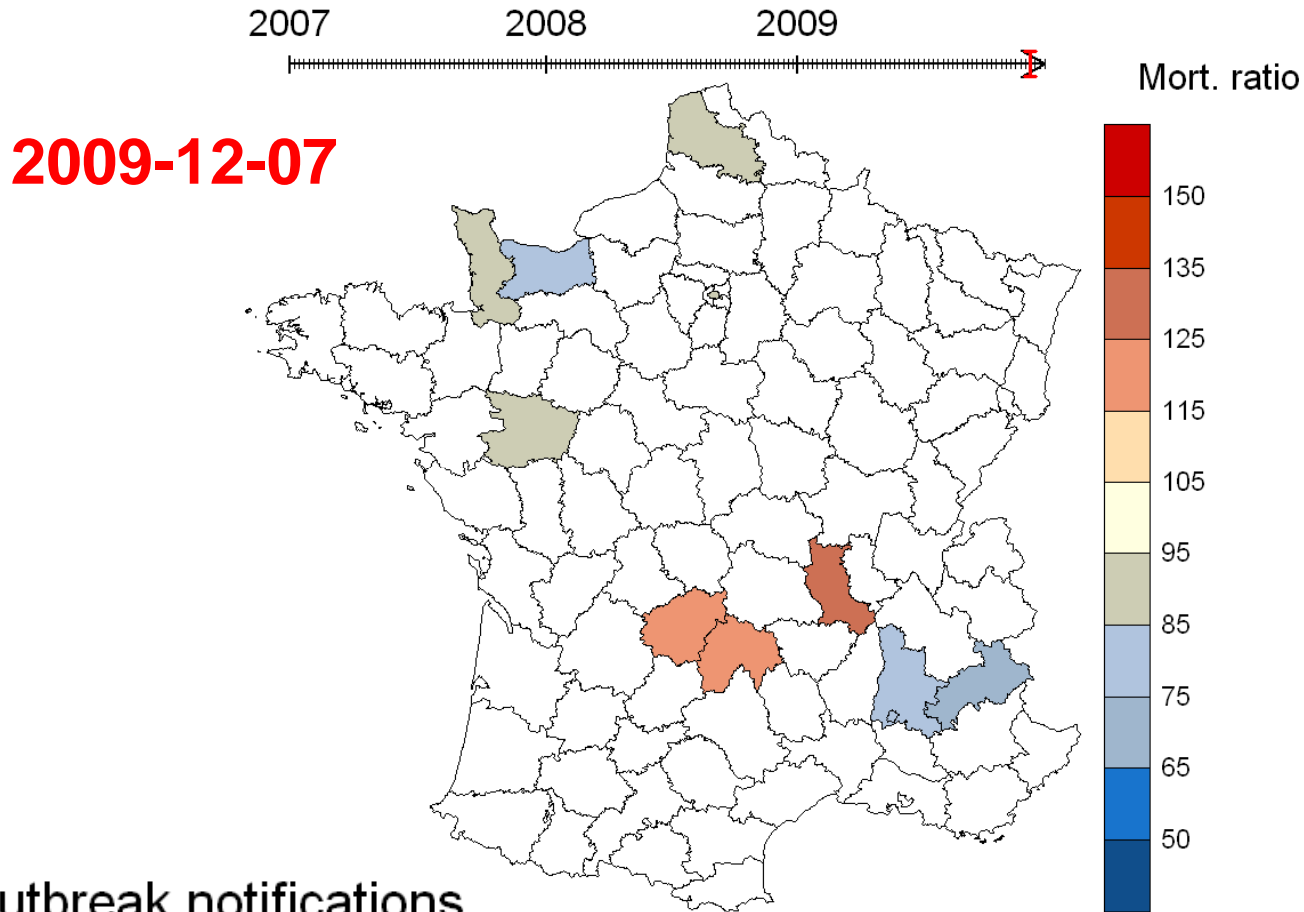
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Where to look for anomalies ?

- Time series approach
 - Stratification by areas and population categories : multiple time series

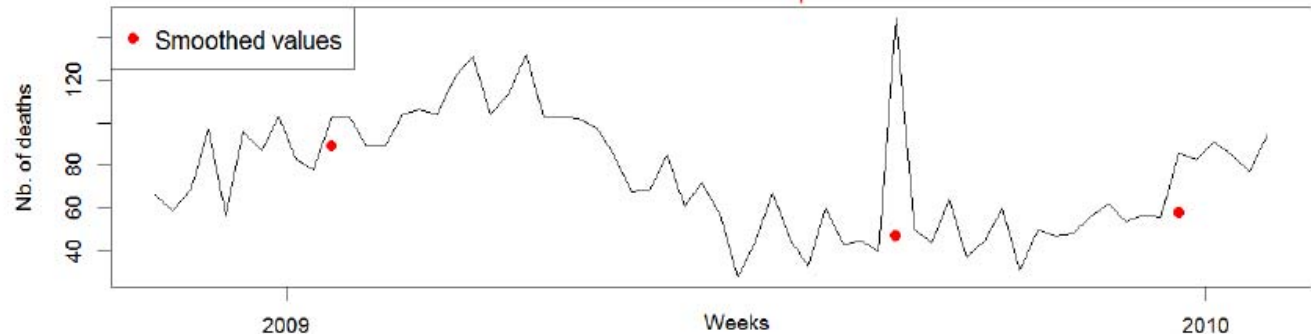
	No population stratification	4 population categories
National	1	5
Super regions	6	30
Regions	22	110
Departements	96	480
Cantons	4 000	20 000
Zipcodes	36 000	180 000
Herds	220 000	1 100 000
TOTAL	260 134	1 300 670

- Parallel analyses → multiple testing
- Hierarchical / Rule-based analysis ?

Proposal of an anomaly detection method

Principle

Tracking hexagons showing excess mortality in compare to their own historical fluctuations

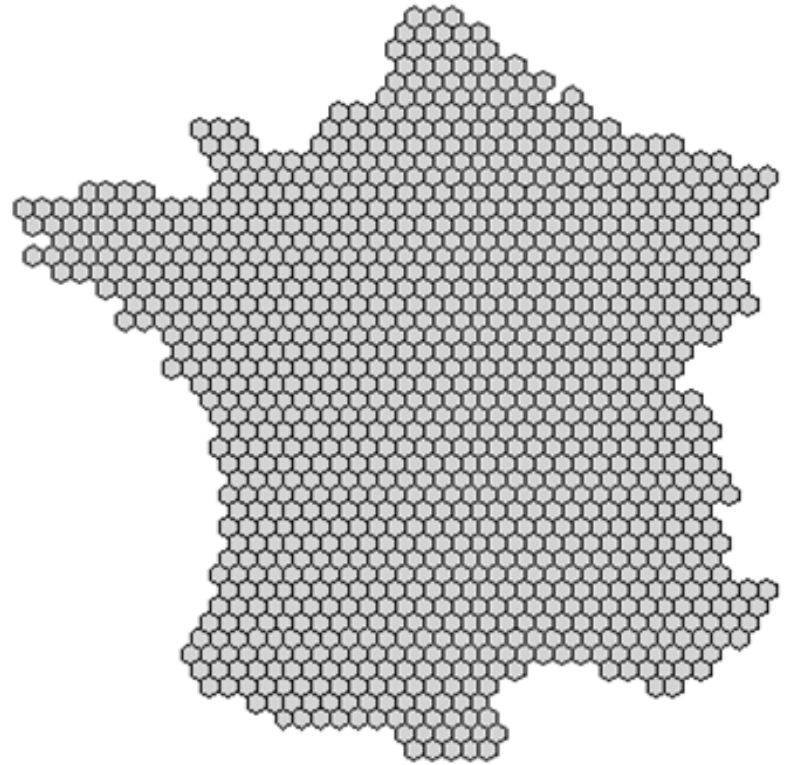


→ geometrical space unit, large enough to allow time series analyses, small enough to allow investigations

Evaluating performances of the method

1/ *Simulating excess mortality according to an epizootic scenario : intra-herd (SIR model) and between herds (local + animals trade) dispersion of the disease*

2/ *Injecting **excess deaths** in the real dataset on week n*

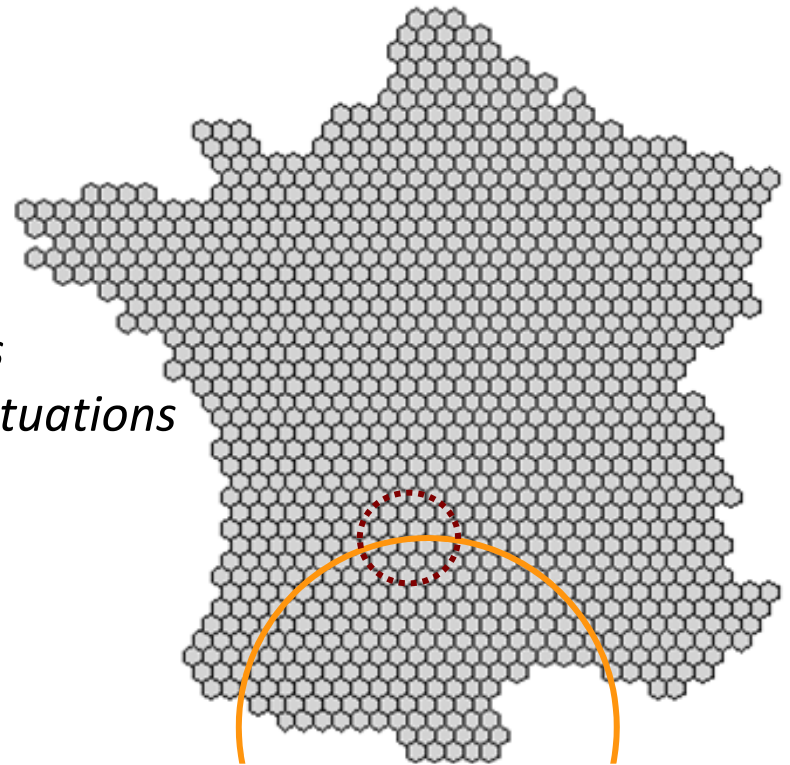




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3/ Tracking **clusters** of hexagons showing excess mortality in compare to their own historical fluctuations



 Clusters of hexagons showing excess mortality


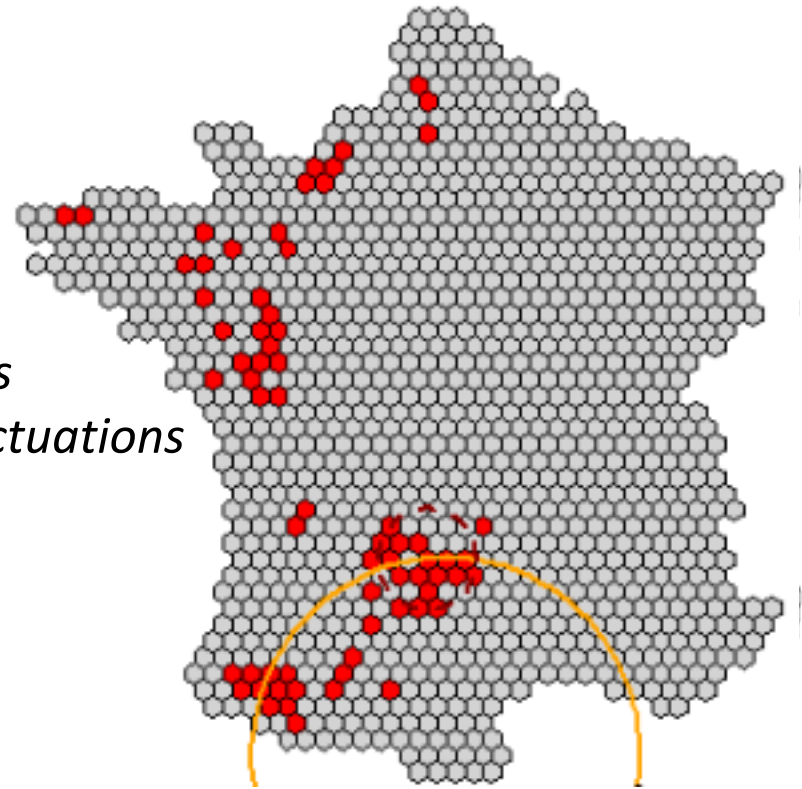
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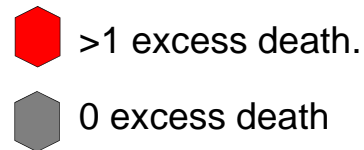
3/ Tracking **clusters** of hexagons showing excess mortality in compare to their own historical fluctuations

4/ Estimating proportion of hexagons clustered that indeed contain simulated **excess deaths**



Clusters of hexagons showing excess mortality

hex. containing



Discussing analysis strategy

- SatSCAN approach : same difficulty than with time series
Clusters detected can be different according to the area considered
→ to which area should be applied the method ?
 - the whole territory (as in the example) ?
 - in each region ?
 - both ?
- Defining the area & the frequency for analysis, according to practical possibilities : Who can do investigations, on which territory and how often ?
→ Produce outputs at department level, regional level and national level

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Perspectives

- Nov 2012 : PhD work ended
- Feb 2013 : Creation of a working group in the « French Plateform for epidemiological surveillance in animal health »

www.plateforme-esa.fr

- First group meetings : Defining expectations of each stakeholder
Central and local veterinary administration, breeders association, veterinarian association, fallen stock companies
 - Rapid anomaly detection at farm level / at regional level
 - Situational awareness / impact assessment
- 2014: Pilot study to evaluate how system fits the users expectations, the usefulness of outputs...

Question : who should investigate unspecific alarms ?

→ Regulated diseases / other health events

THANK YOU FOR YOUR ATTENTION

