



Improving knowledge of operational activities of emergency services using spatio-temporal analysis

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- ❑ In France, in suburban and rural areas, ambulances delays of intervention are sometimes too long.

- ❑ This can be explained by :
 - ▢ the decrease in medical demography ;
 - ▢ the lack of means ;
 - ▢ remoteness ;
 - ▢ accessibility conditions ;
 - ▢ etc.



- ❑ **Solutions exist, such as:**

- ☰ Use of instant take off medical helicopters



- ❑ **But, financial and human resources are limited**

- ❑ **First postulate: Solutions have to do with the available resources**

- ❑ **Second postulate: The location of ambulances is not always optimal**

So one of the solutions would be to optimize the localization of these ambulances in time and space

- ❑ **Ambulance activity varies in time and space.**
- ❑ **Localization methods must take into account the different « seasons ».**
- ❑ **Localization methods must propose one organisation per « season ». Such as a calendar of ambulances localization.**
- ❑ **The questions are :**
 - ☐ How many types of organization do we need?
 - ☐ What to do in order to identify the different seasons?

- ❑ The aim of this method is to divide up time into different homogeneous seasons.
- ❑ The general tendency must at least be the same in time and space for each season.
- ❑ The method suggests dividing up time by using cluster (family) analysis.
- ❑ Cluster analysis method consists in grouping statistics individuals depending on the variables which describe them.

- **This approach consists in :**
 - ▢ Carrying out an initial cluster analysis on a year scale.
 - ▢ Identifying the main seasons of operational activity.
 - ▢ Carrying out a cluster analysis for each identified season.

□ Study area

- ▢ Alpes-Maritimes (France)

□ Data

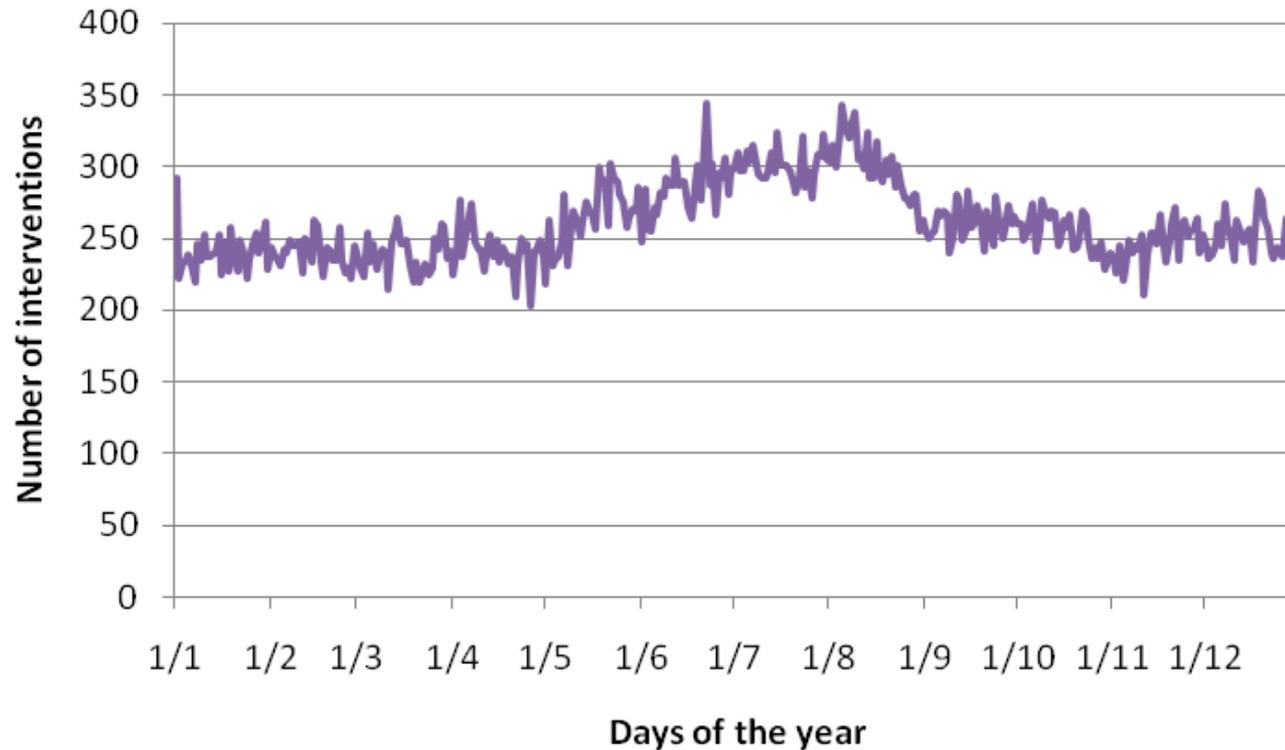
▢ Source :

- Fire and emergency service of Alpes-Maritimes (SDIS 06);
- Medical emergency and reanimation service of Alpes-Maritimes (SAMU 06)

▢ Interventions 2007, 2008 and 2009



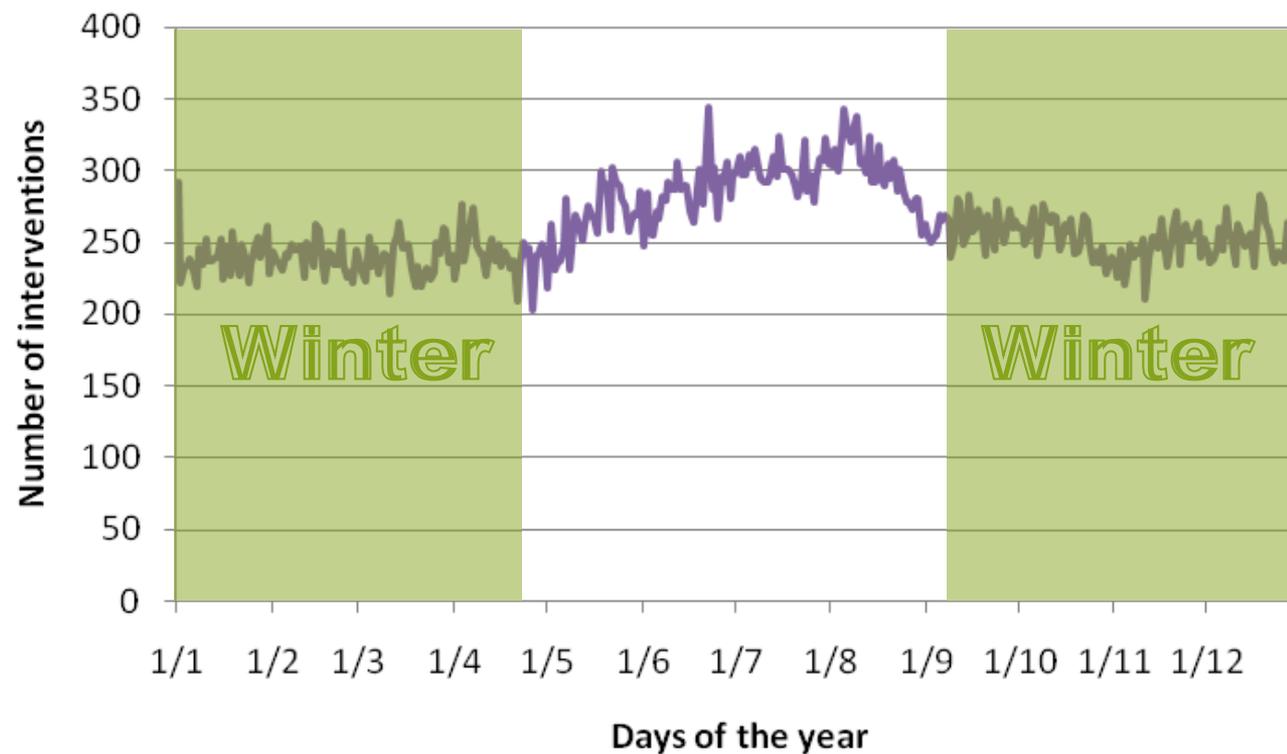
- Before the cluster analysis only two seasons can be identified :



Average number of interventions in 2007, 2008, 2009 for each day of the year.

Source : SDIS 06 / SAMU 06

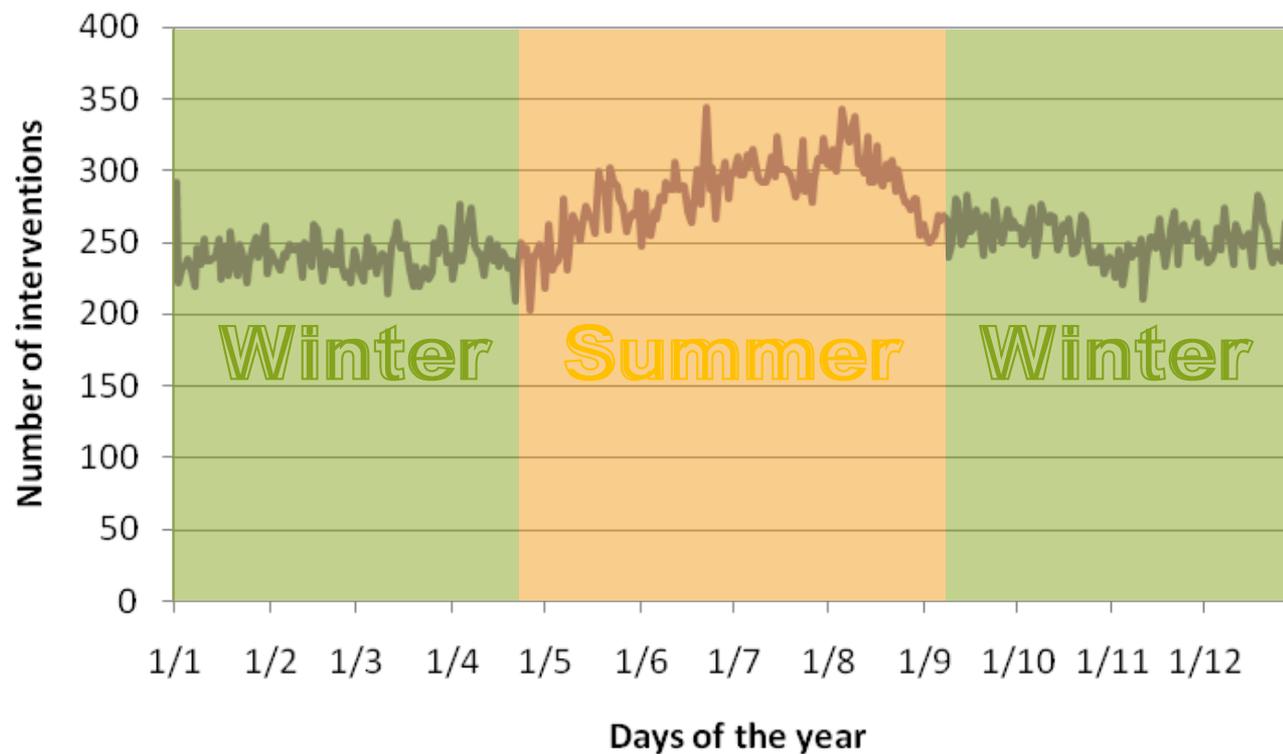
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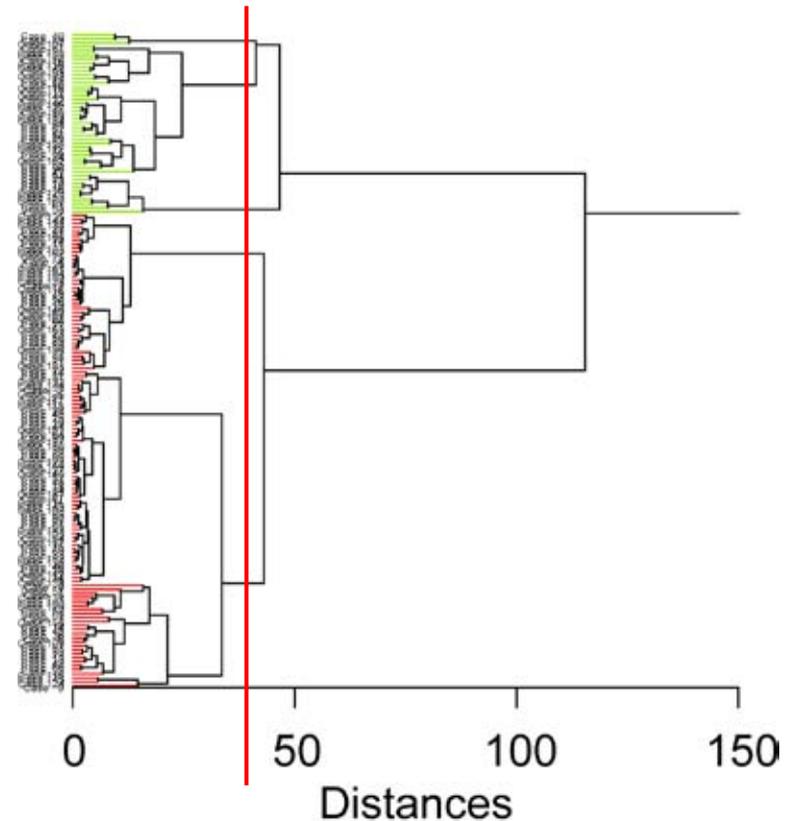


Average number of interventions in 2007, 2008, 2009 for each day of the year.

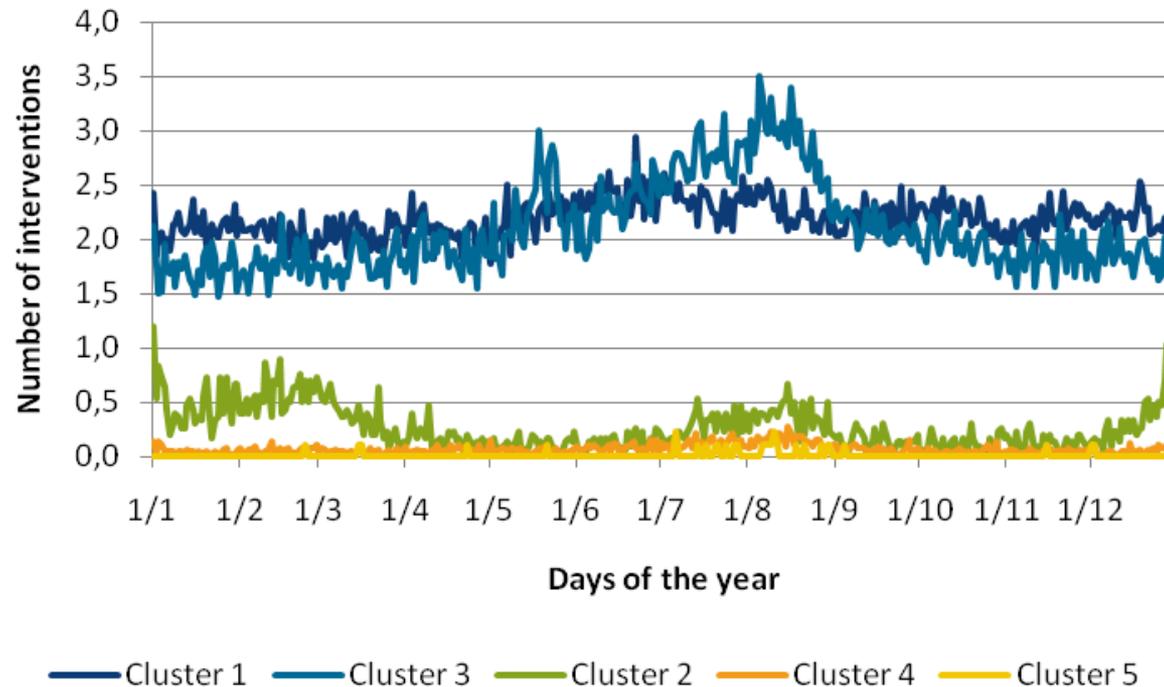
Source : SDIS 06 / SAMU 06

4. RESULTS

- ❑ For the first cluster analysis individuals are :
 - the 163 communities of Alpes-Maritimes.
- ❑ The variables which describe them are :
 - Number of interventions for each holidays period;
 - Number of interventions for each school time period.
- ❑ Data are given in relative form to avoid the effect of the size.
- ❑ 5 clusters have been identified



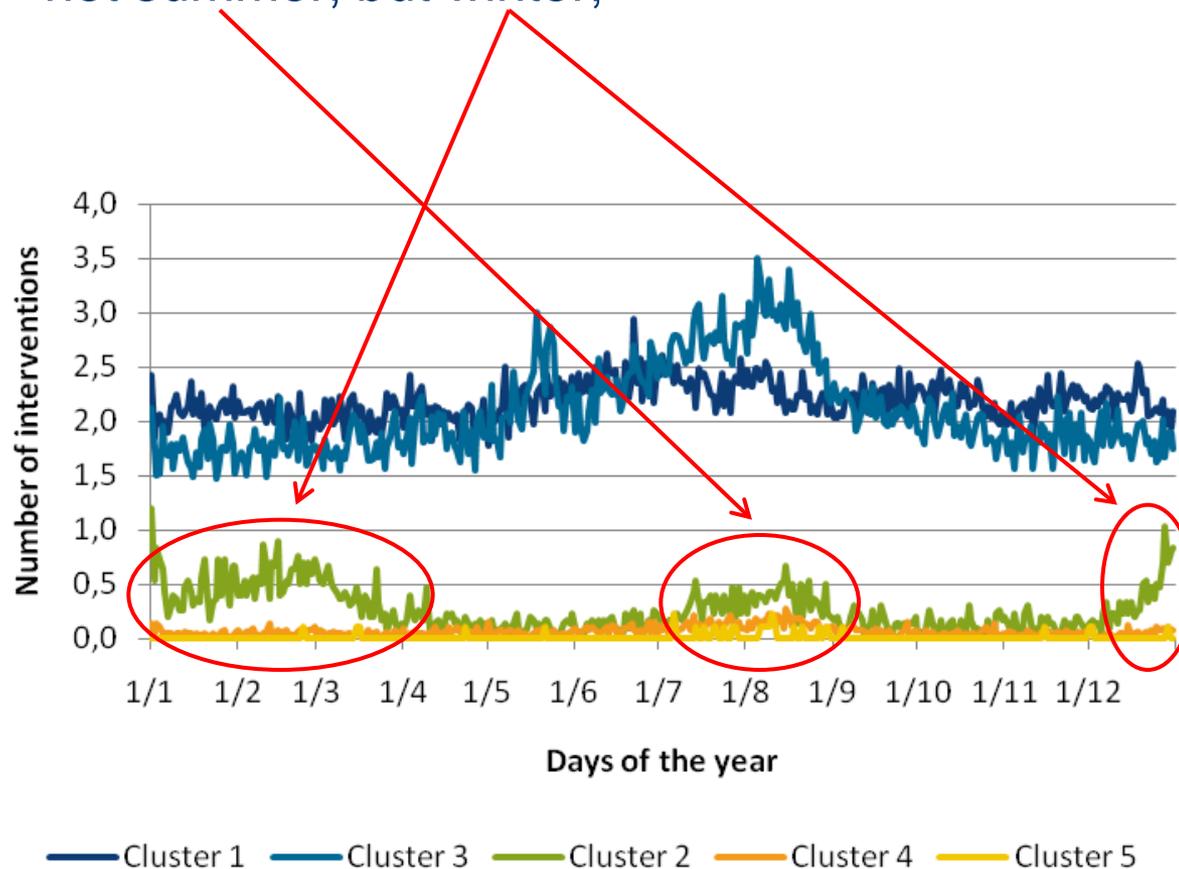
- The tendency is different for the group of towns in green:



Average number of interventions in 2007, 2008, 2009 by cluster and for each day of the year.

Source : SDIS 06 / SAMU 06

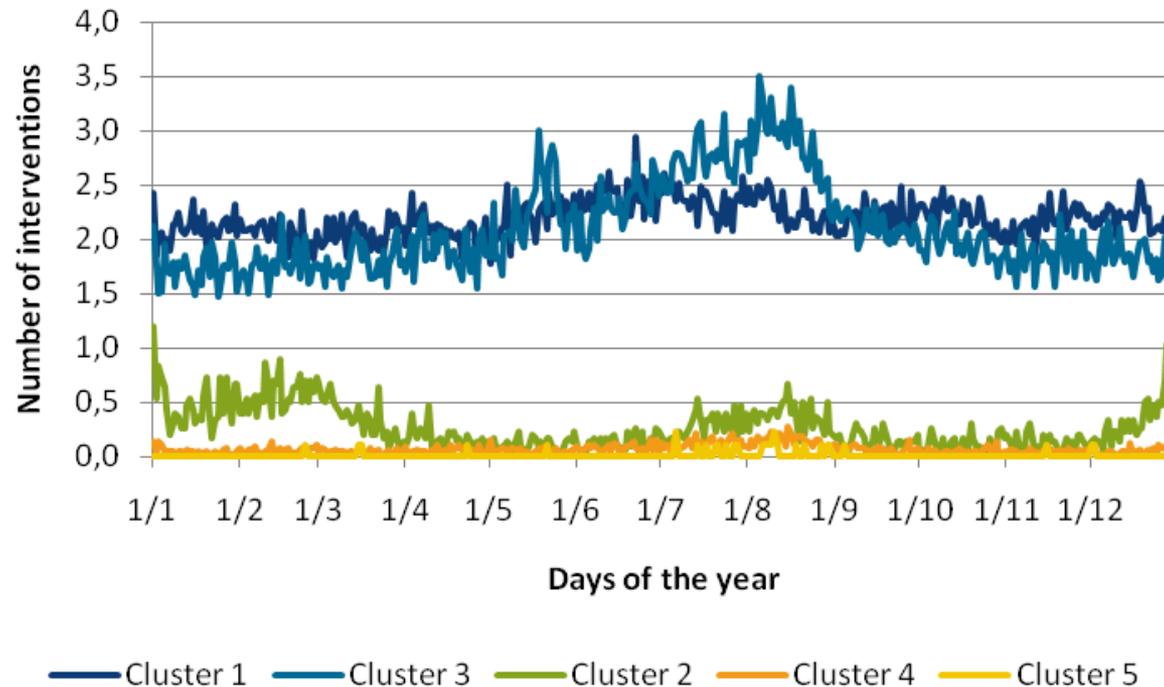
- The tendency is different for the group of towns in green:
 - ▢ First of all because the most important season for these towns is not summer, but winter;



Average number of interventions in 2007, 2008, 2009 by cluster and for each day of the year.

Source : SDIS 06 / SAMU 06

- **The tendency is different for the group of towns in green:**
 - ▢ First of all because the most important season for these towns is not summer, but winter;
 - ▢ Secondly because three seasons can clearly be distinguished : summer, winter and autumn/spring.

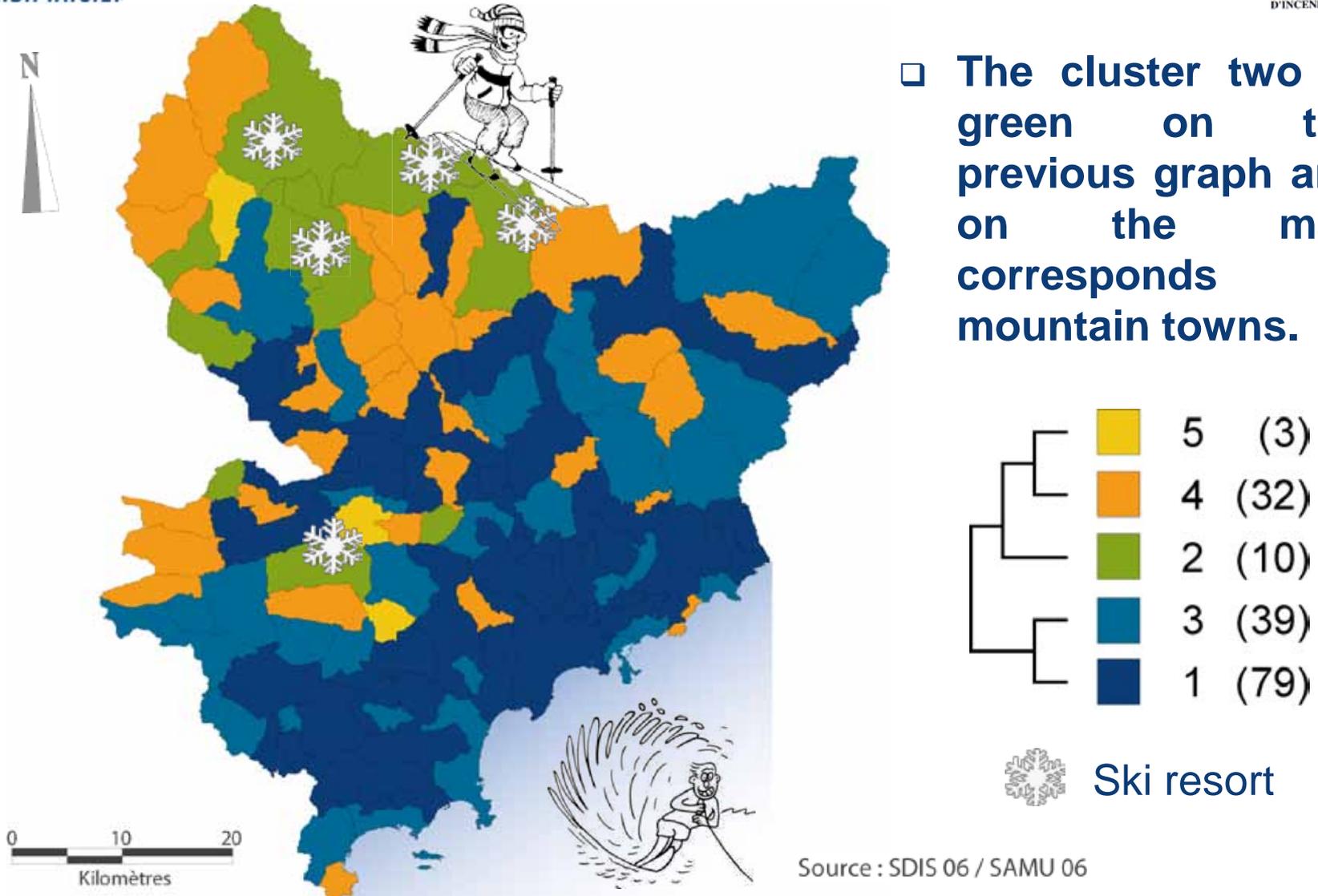


Average number of interventions in 2007, 2008, 2009 by cluster and for each day of the year.

Source : SDIS 06 / SAMU 06

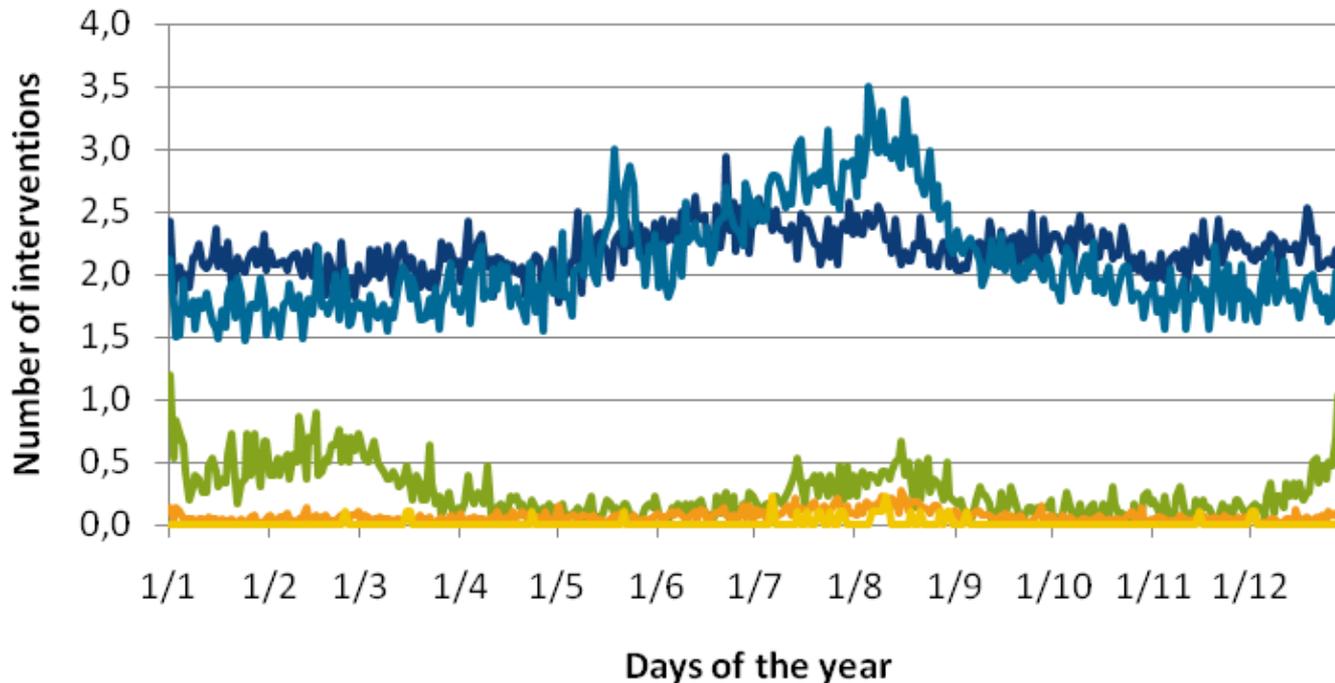
4. RESULTS

- The cluster two in green on the previous graph and on the map corresponds to mountain towns.



Source : SDIS 06 / SAMU 06

- Thanks to this first cluster analysis three seasons can be distinguished at the year scale:

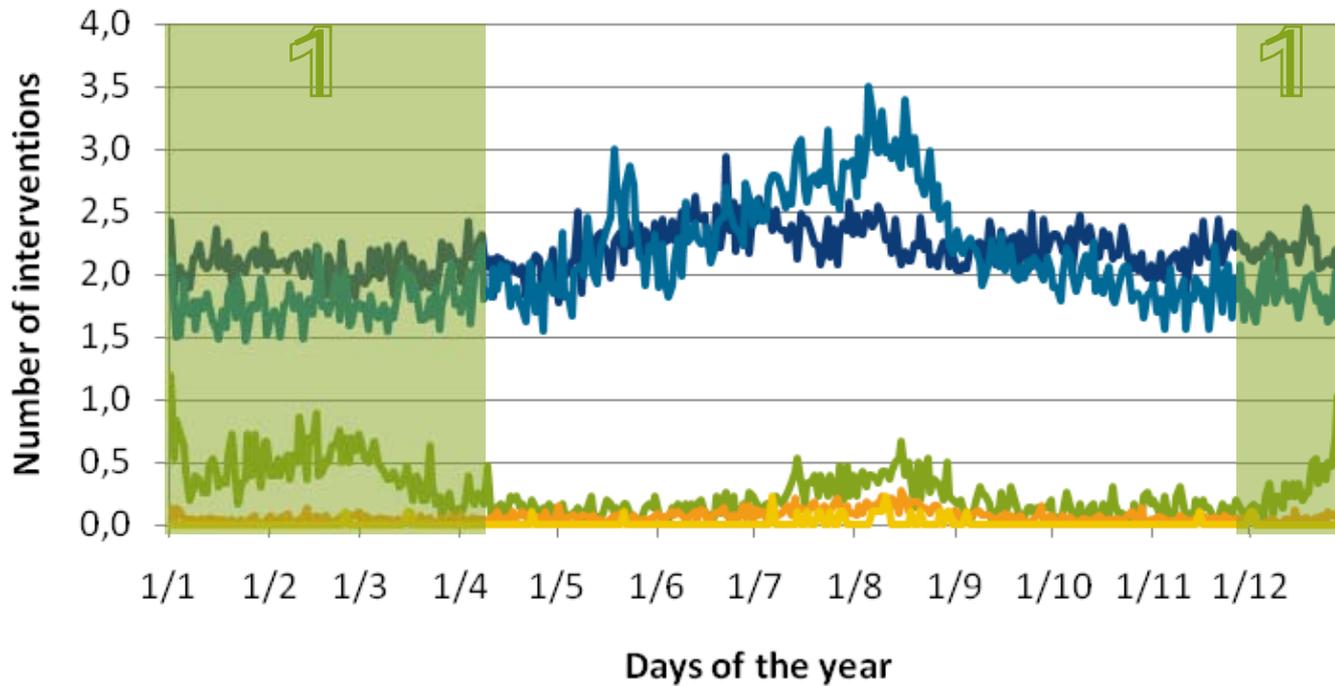


Average number of interventions in 2007, 2008, 2009 by cluster and for each day of the year.

Source : SDIS 06 / SAMU 06

Cluster 1 Cluster 3 Cluster 2 Cluster 4 Cluster 5

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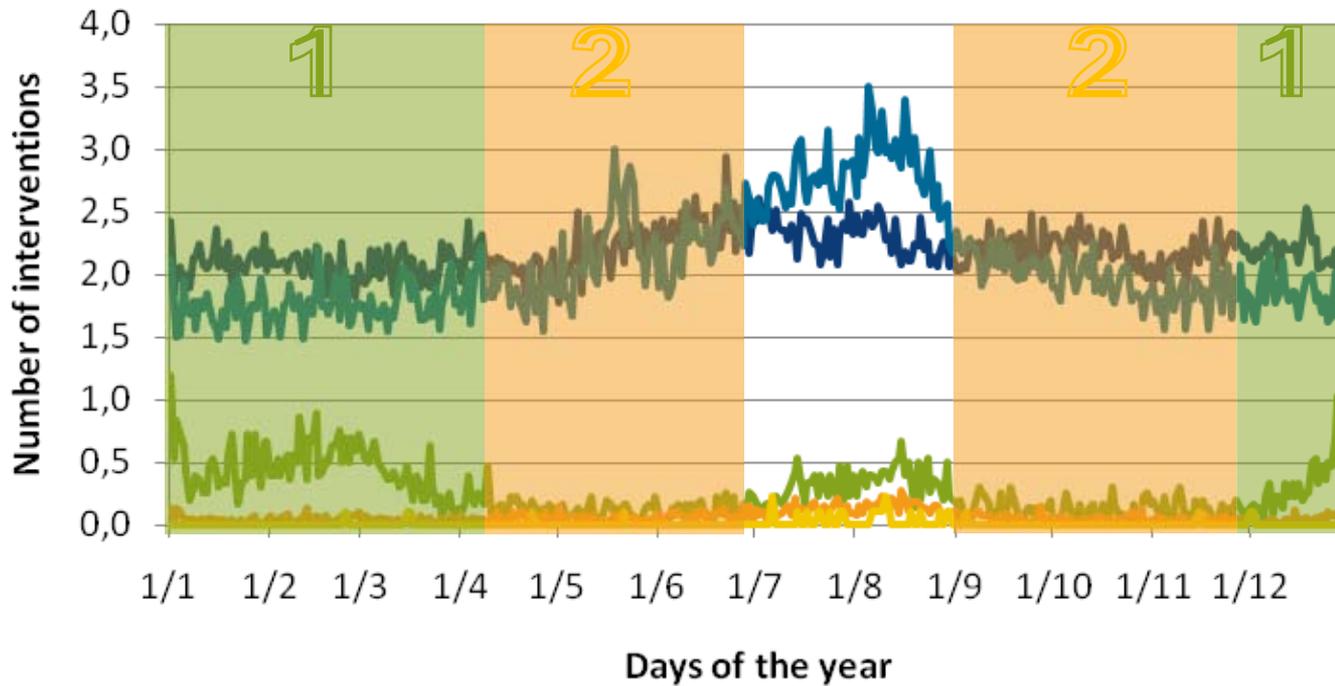


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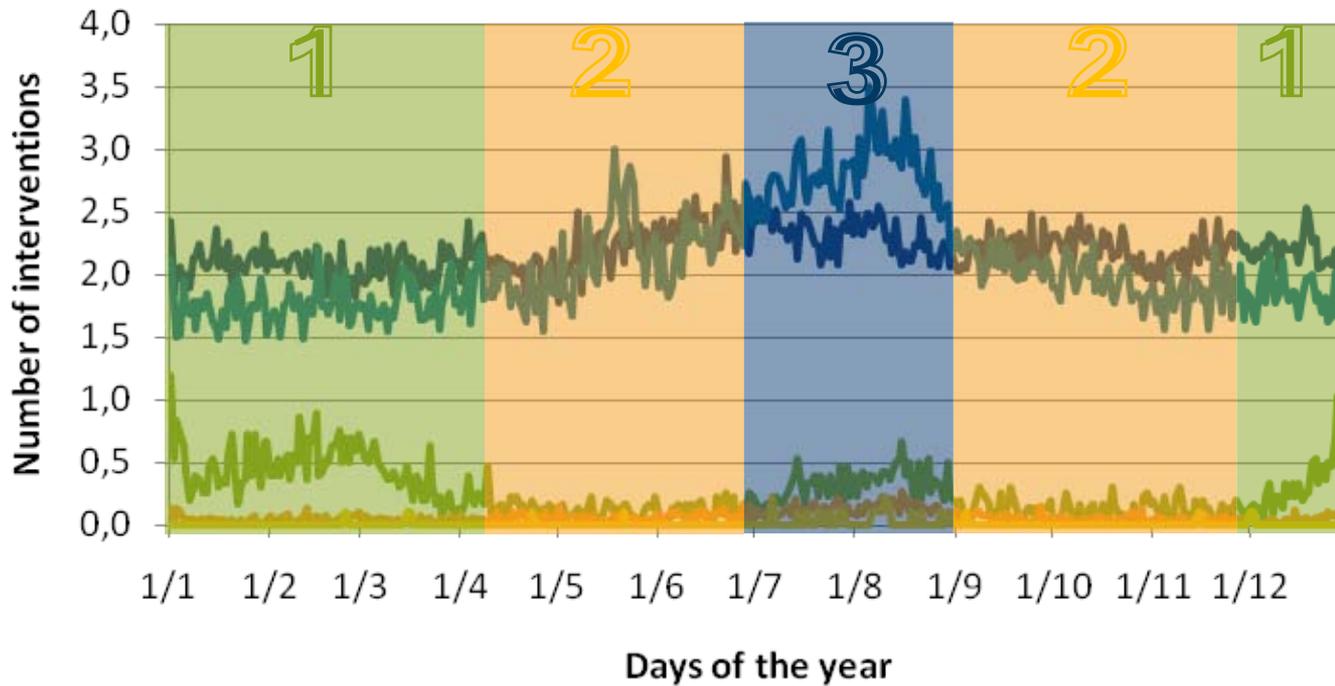
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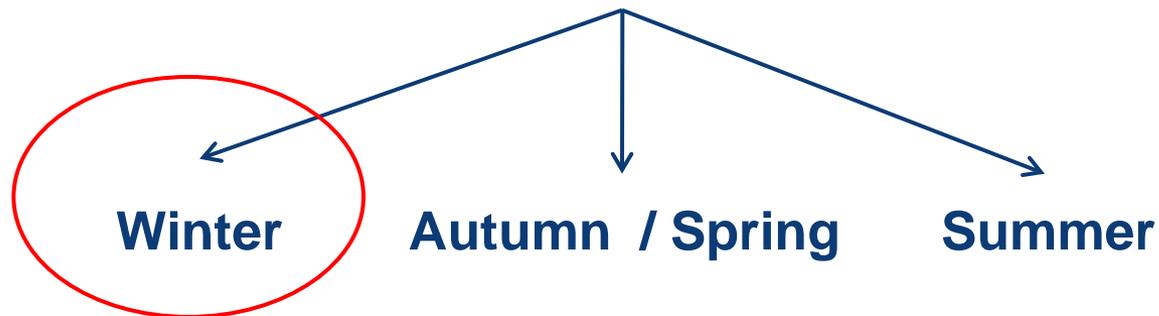


Average number of interventions in 2007, 2008, 2009 by cluster and for each day of the year.

Source : SDIS 06 / SAMU 06

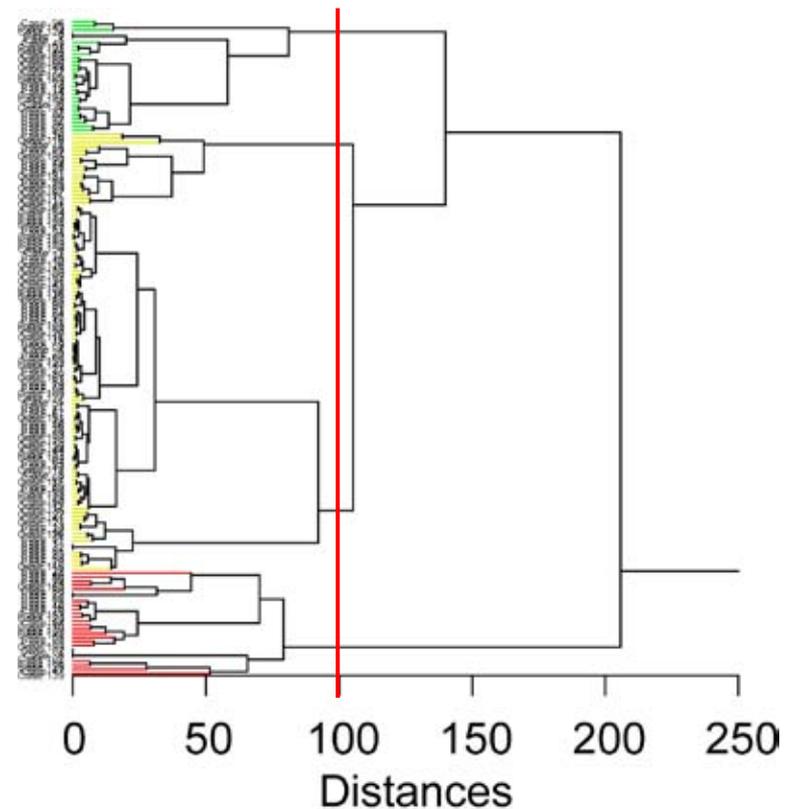
Cluster 1 Cluster 3 Cluster 2 Cluster 4 Cluster 5

- ❑ For each of these seasons a cluster analysis has been realized.
- ❑ Only the winter period is shown here.

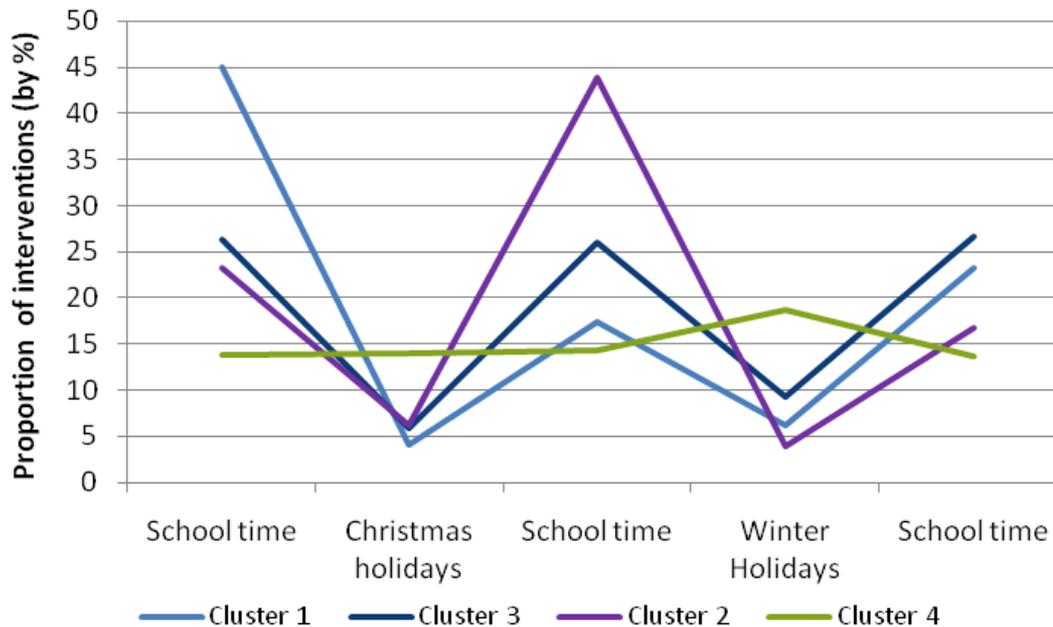


- For this second cluster analysis individuals are :
 - Always the 163 communities of Alpes-Maritimes.
- The variables which describe them are :
 - Number of interventions for each holidays **only in winter period**;
 - Number of interventions for each school time **only in winter period**.
- Data are given in relative form (relative to the winter period) to avoid the effect of the size.

□ 4 clusters have been identified



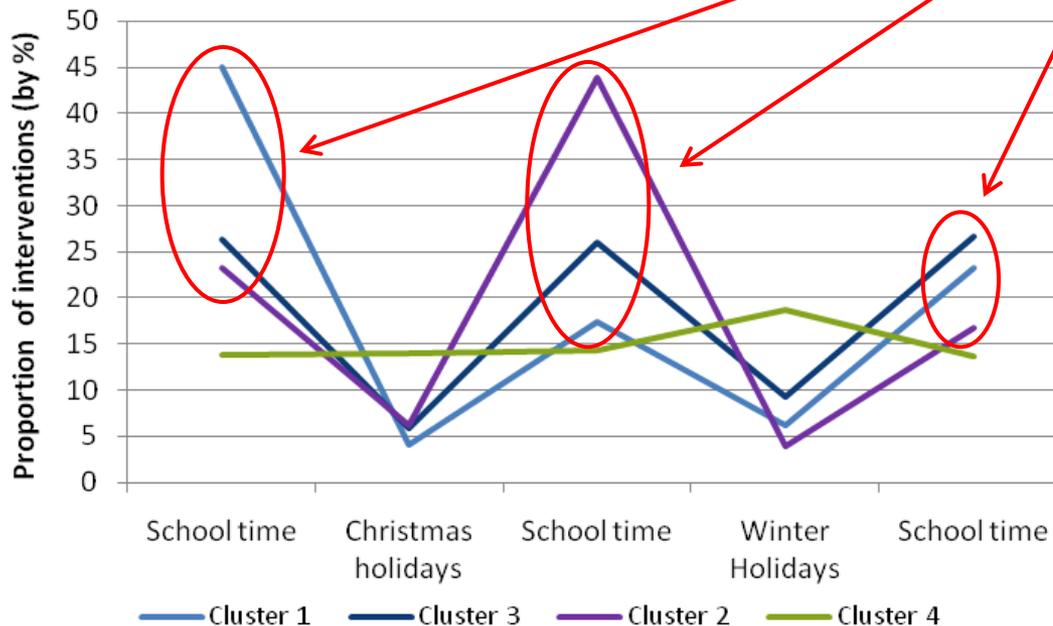
- The results show a difference between the holydays period and the school time period:



Average proportion of interventions in 2007, 2008, 2009 by cluster and for Holiday and school time period in winter.

Source : SDIS 06 / SAMU 06

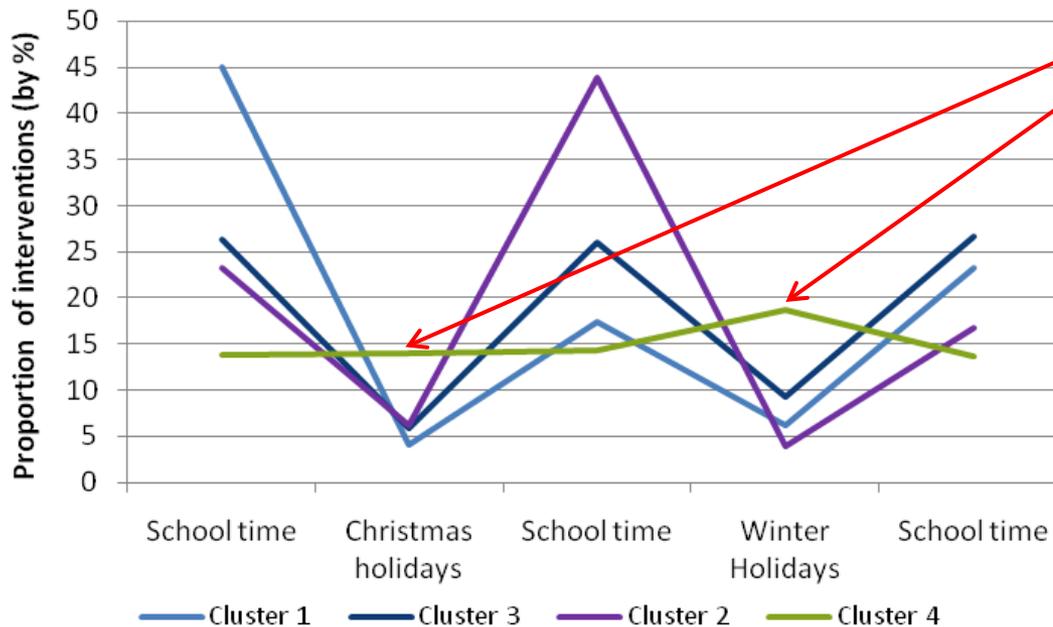
- The results show a difference between the holydays period and the school time period:
 - ▣ Either for the majority of towns where the proportion of interventions is more important during the school time;



Average proportion of interventions in 2007, 2008, 2009 by cluster and for Holiday and school time period in winter.

Source : SDIS 06 / SAMU 06

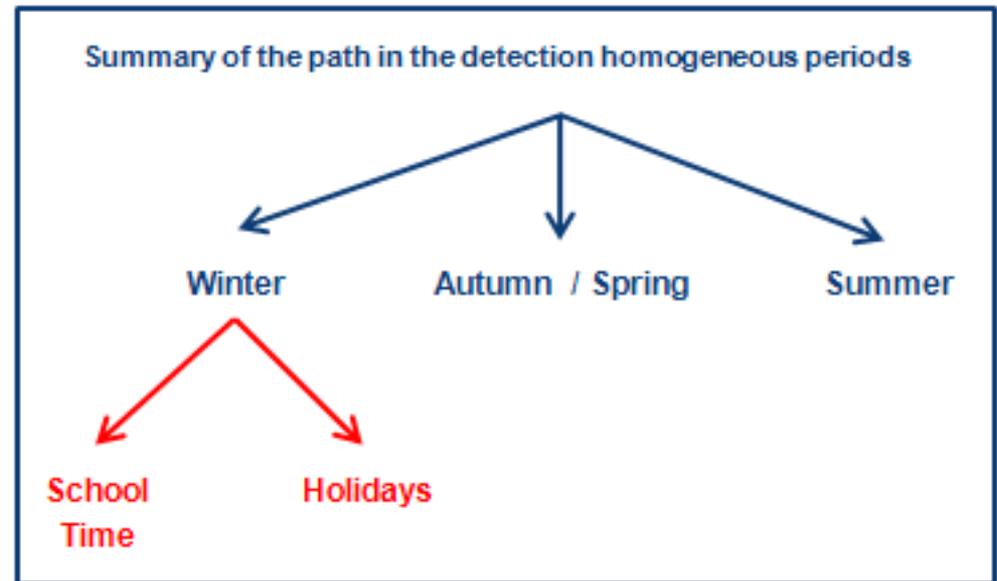
- The results show a difference between the holydays period and the school time period:
 - ▣ Either for the majority of towns where the proportion of interventions is more important during the school time;
 - ▣ Or the group of towns (cluster 4) in green where the proportion of interventions is more important during the holidays period.



Average proportion of interventions in 2007, 2008, 2009 by cluster and for Holiday and school time period in winter.

Source : SDIS 06 / SAMU 06

- After identifying three main seasons, we can identify two periods among winter:
 - ☐ Holiday;
 - ☐ And school time.



- q **what to do in order to identify the different seasons?**
 - 3 Cluster analysis method seems to give good results.

- q **how many types of organization do we need?**
 - 3 Depending on the context in which the analysis are realized and on the spatio-temporal variability.

- q **In all cases the spatial and temporal scale must be appropriate, neither too large nor too small.**

THANK YOU FOR YOUR ATTENTION