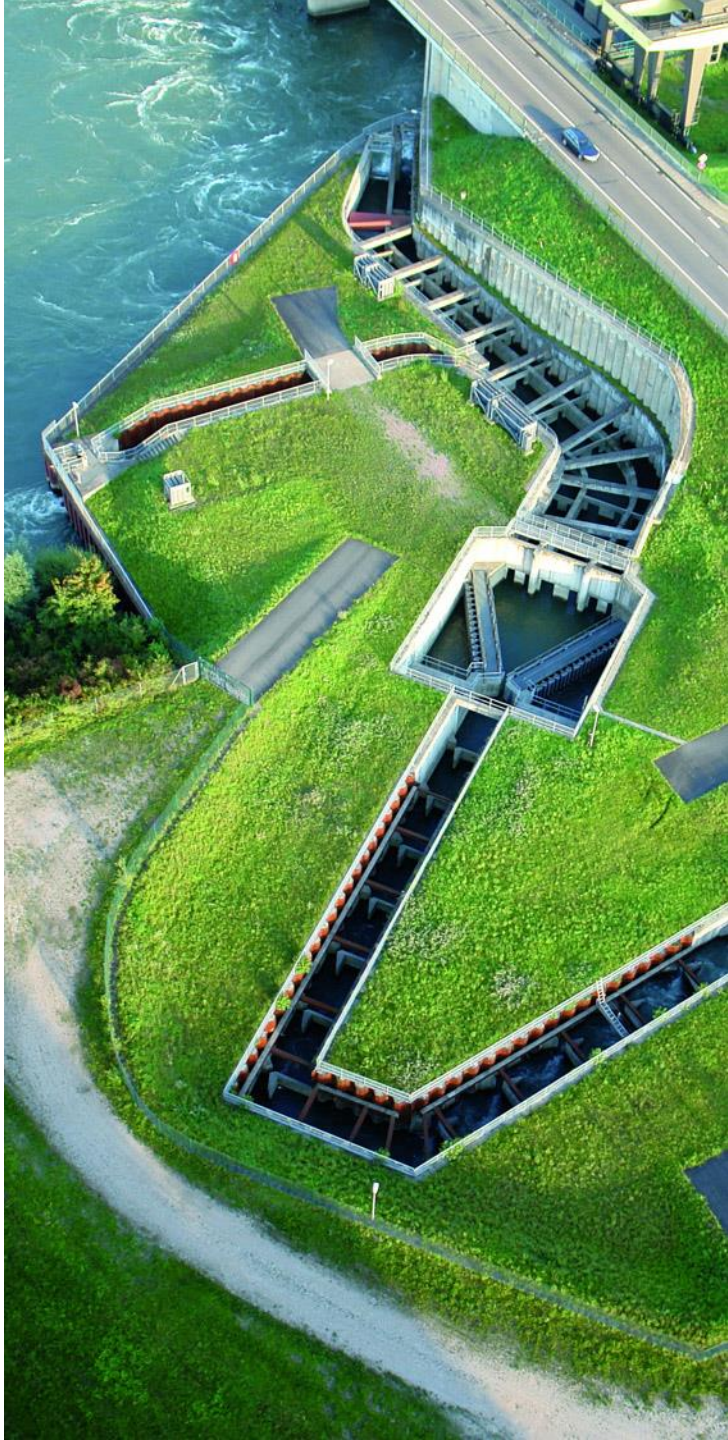
OBSERVED HEAT WAVE STATISTICS

EDF/R&D

January 2016



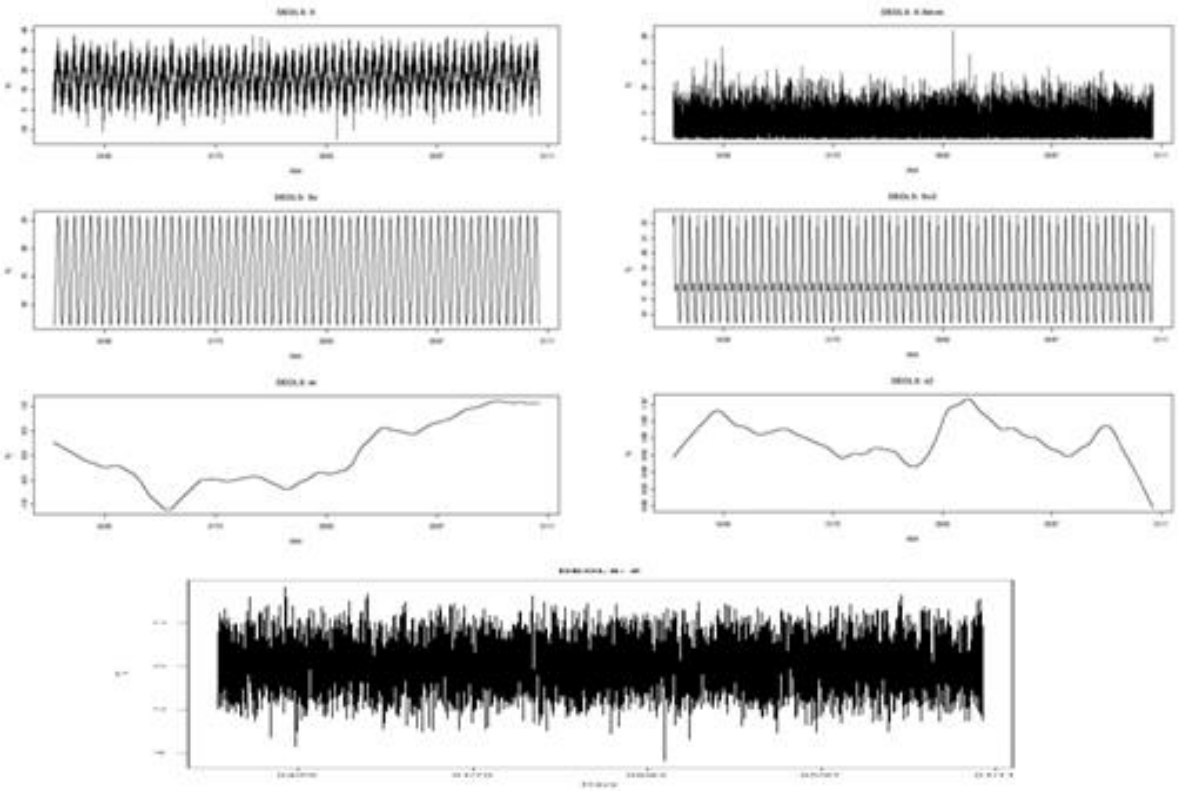
DATA

- 9 ECA&D daily maximum temperature (TX)
  - from1951 – 2015 (30/11)
  - Homogeneous
  - Publicly available

location	Period
Besançon	1951-2015
Cap de la Hève	1951-2015
Carcassonne	1951-2015
Ile de Groix	1951-2015
La Rochelle	1951-2015
Orléans	1951-2015
Pointe de la Hague	1962-2015
Strasbourg	1951-2015
Vichy	1951-2015

Stochastic model

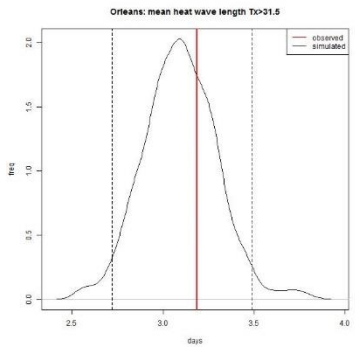
- Simulation de Z(t)

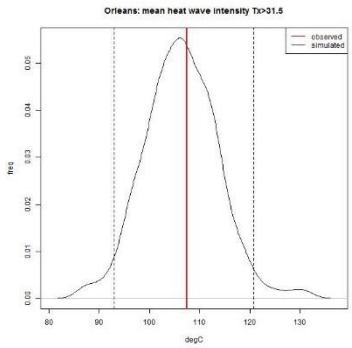


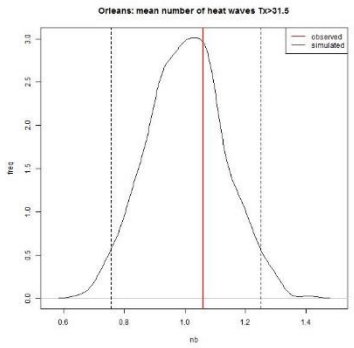
$$Z(t) = \frac{X(t) - S_m(t) - m(t)}{S_v(t)s(t)}$$

Heat wave analysis

- 500 simulations of Z(t) based on observations
- Heat wave:
  - At least 2 days with TX>threshold
  - Mean yearly duration (nb days), intensity (sum(TX)), number
  - ≠ thresholds: q95%, q80%, q75% summer TX
- Validation: ex Orleans q95%



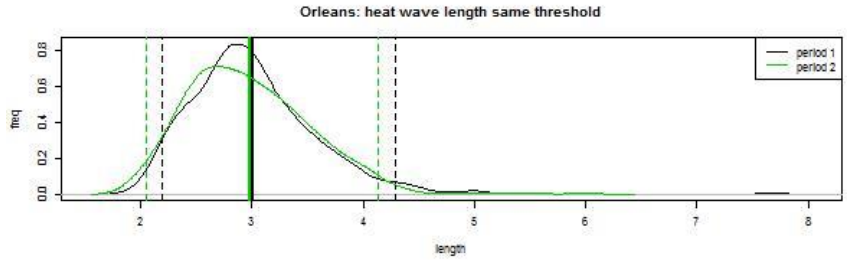


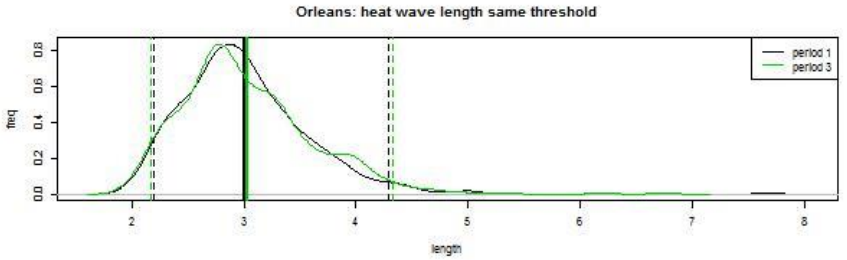


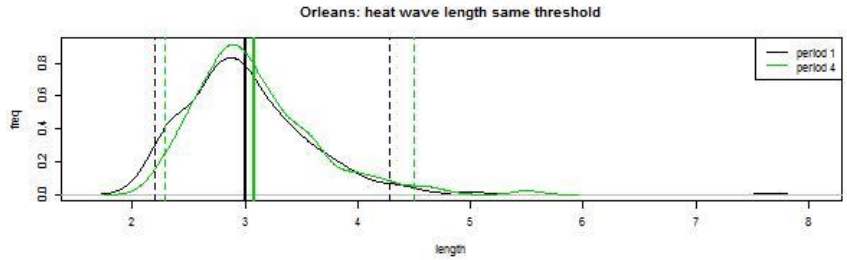
Evolution

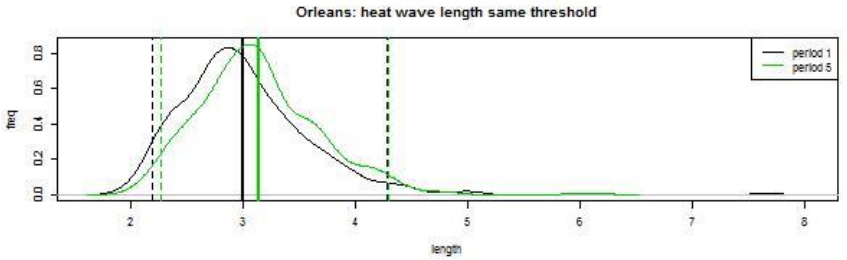
- Observation period divided into n successive 10-year sub-periods
- Changes for each sub-period / first one
- Significance / 90% confidence interval from the 500 simulations
- Duration, intensity, number
- Different thresholds

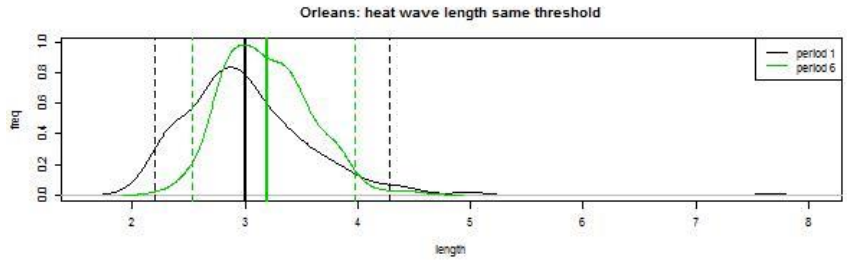
Results: duration q95



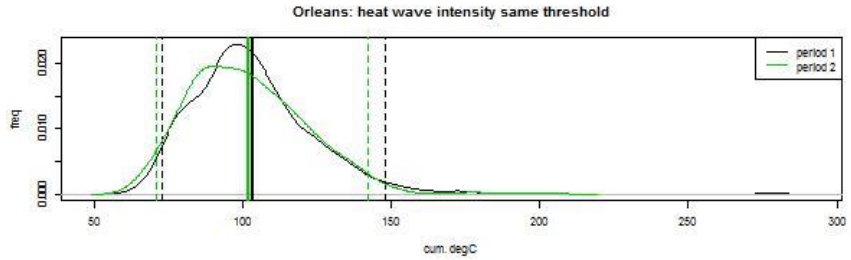


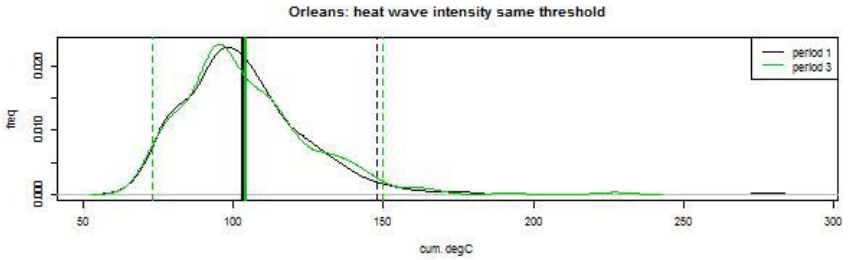


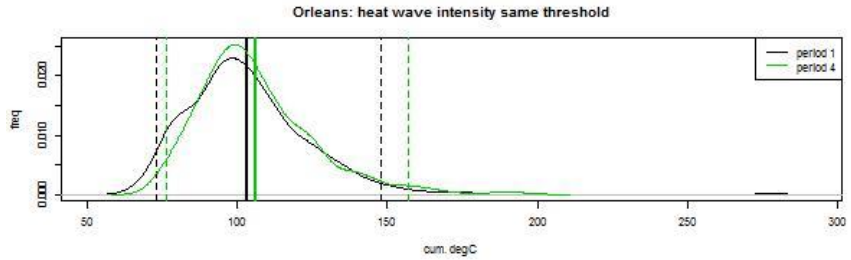


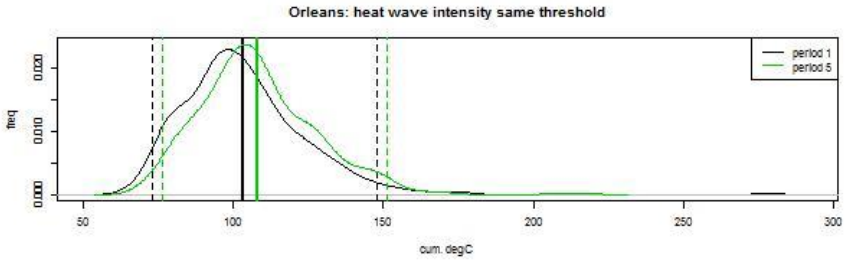


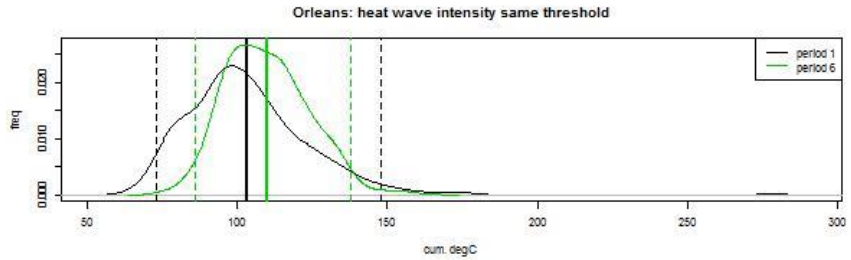
Results: intensity q95



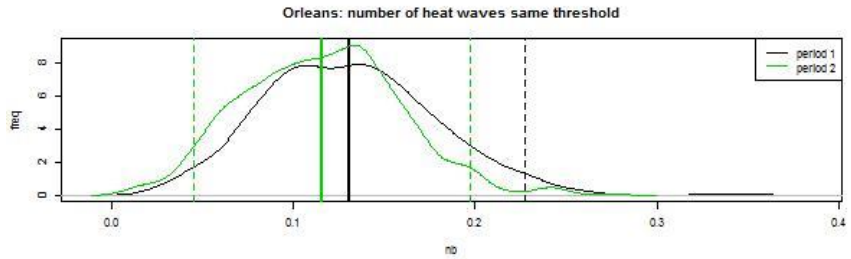


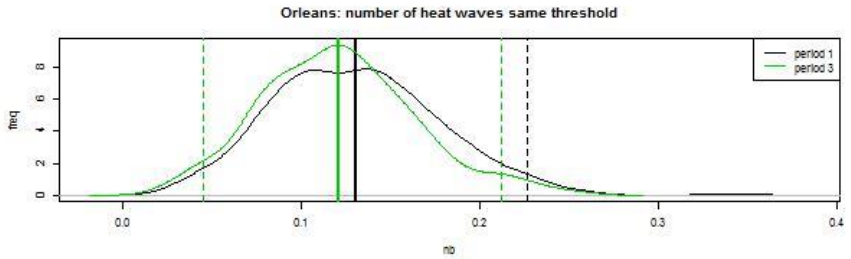


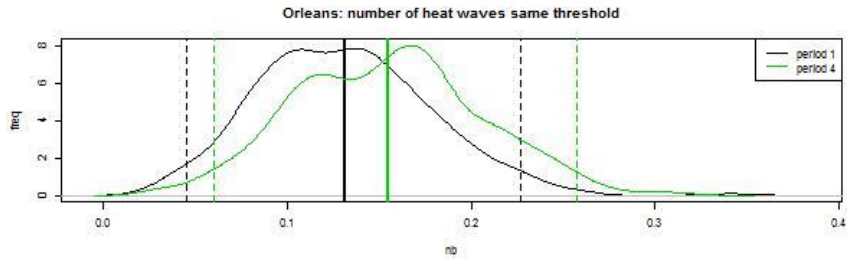


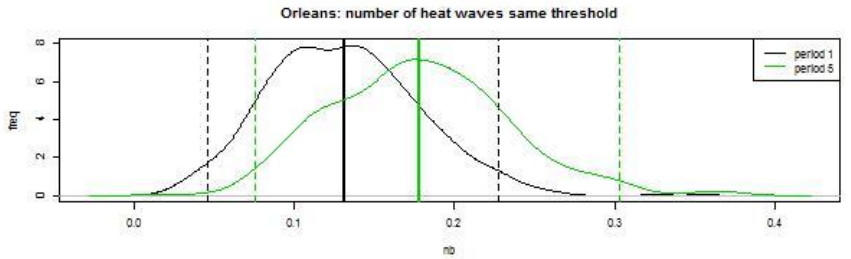


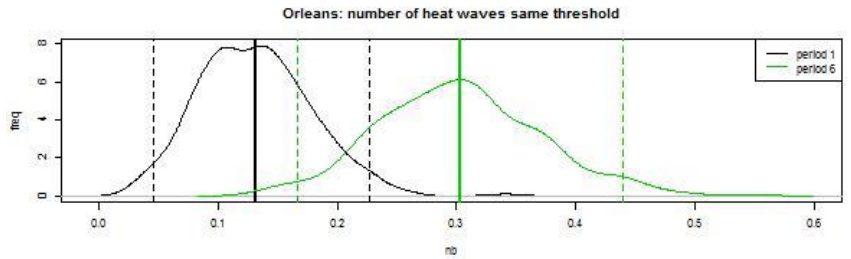
Results: number q95



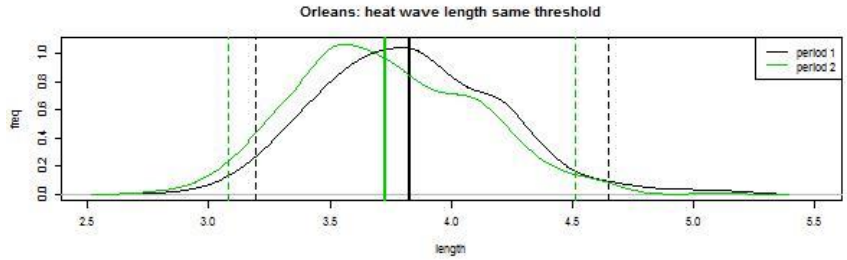


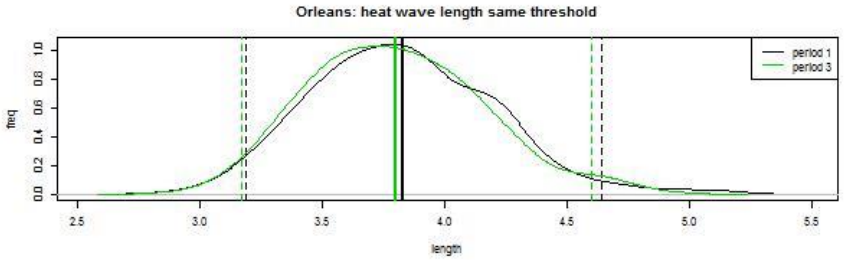


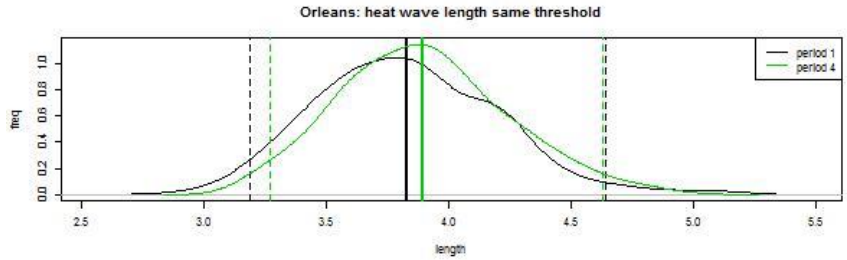


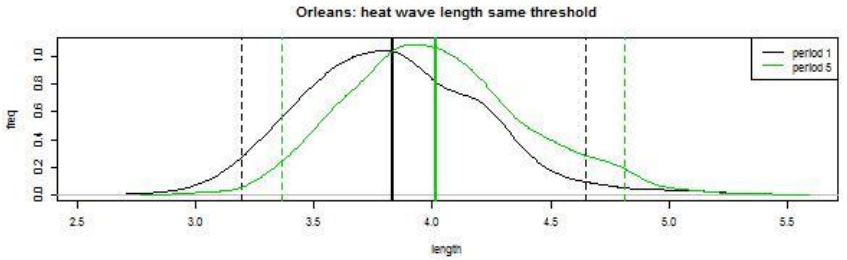


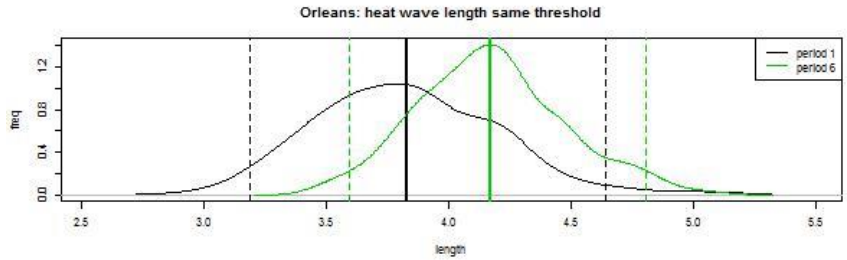
Results: duration q75



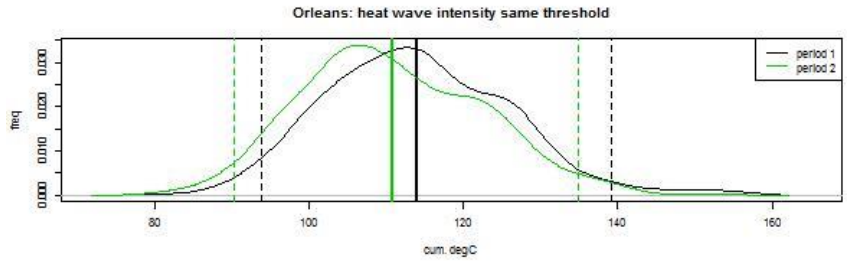


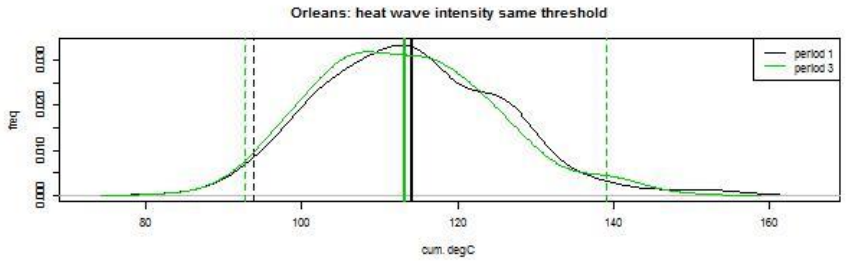


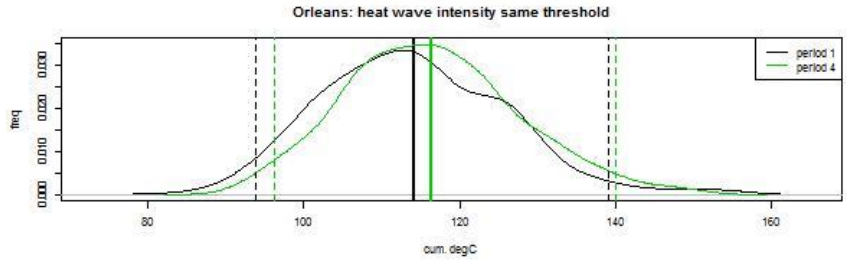


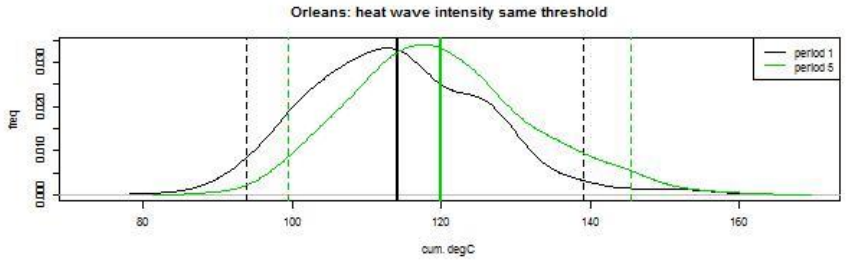


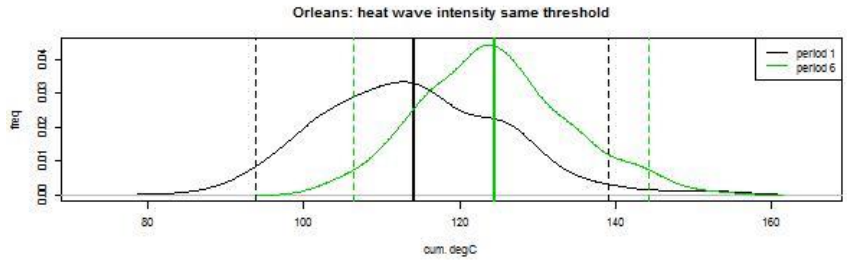
Results: intensity q75



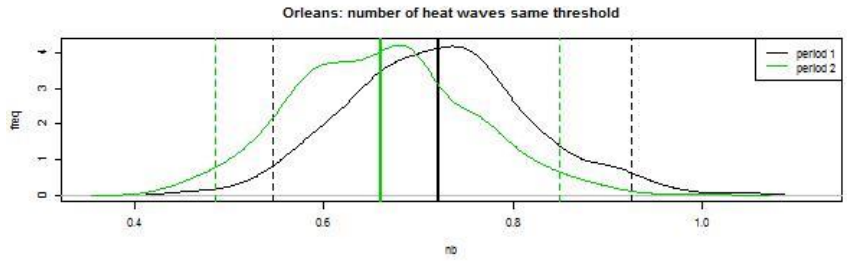


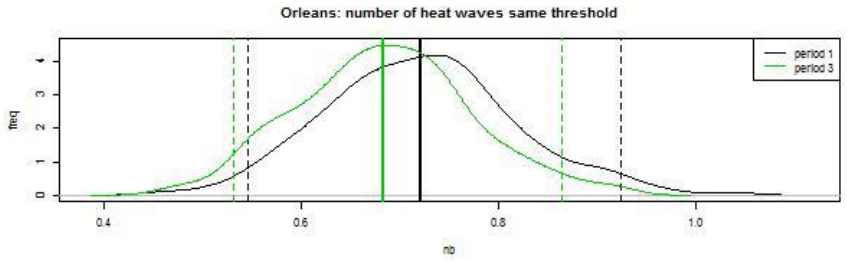


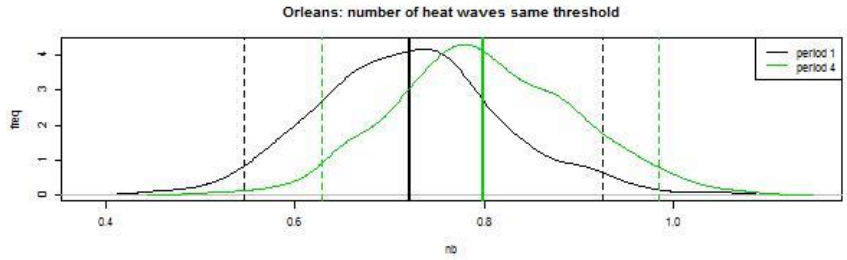


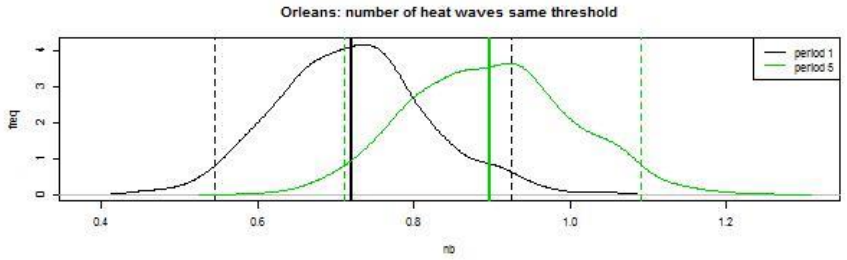


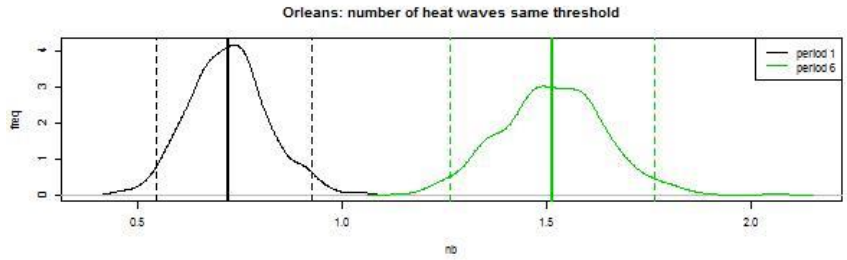
Results: number q75







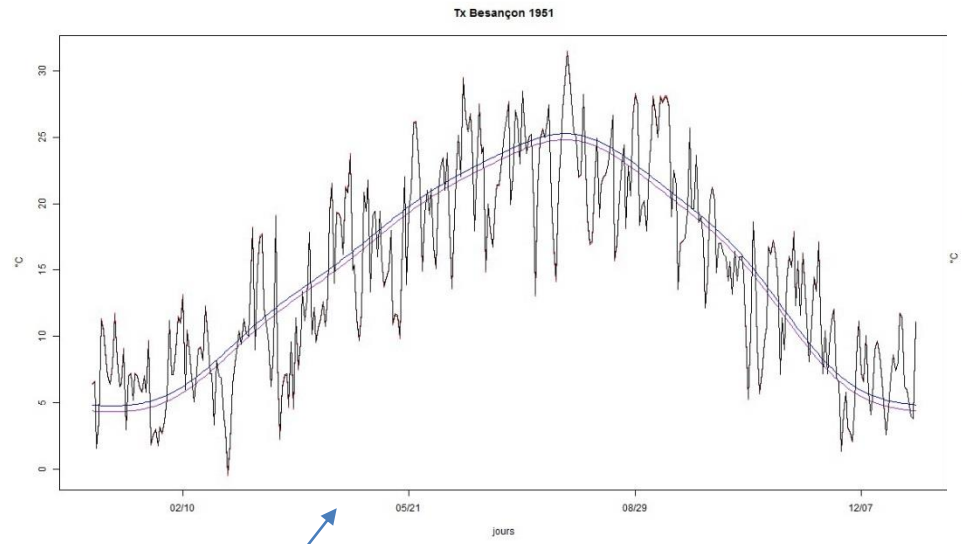


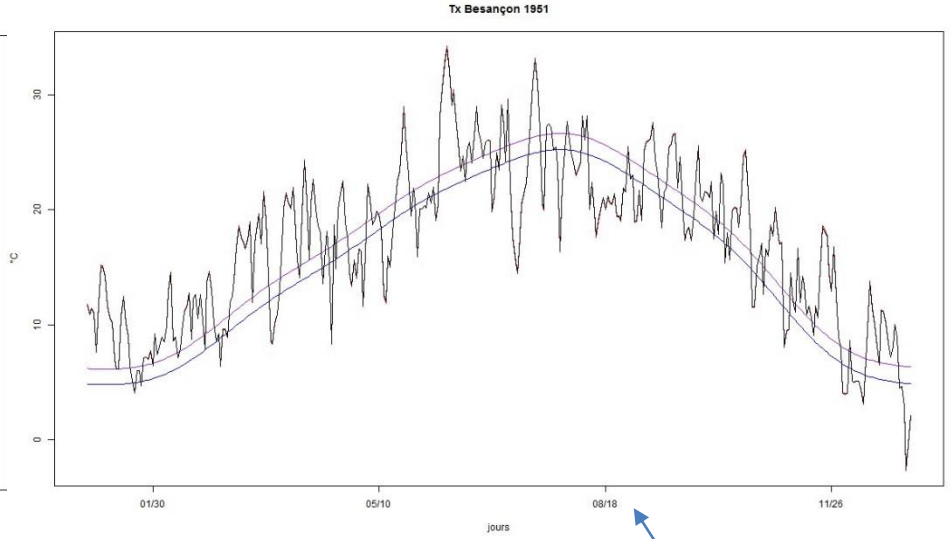


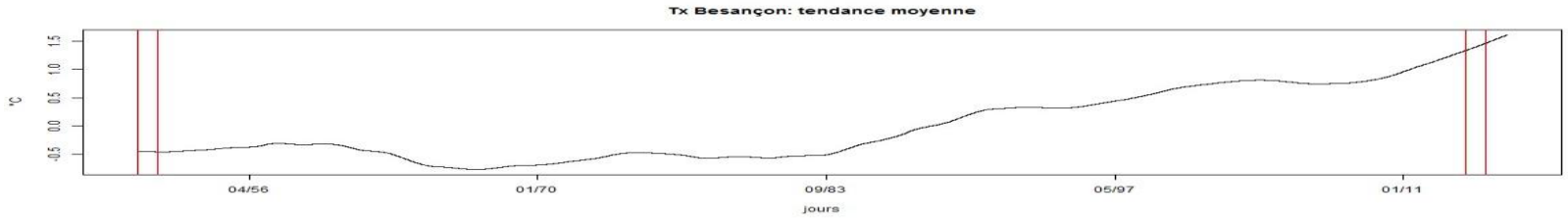
Peaks: highest values

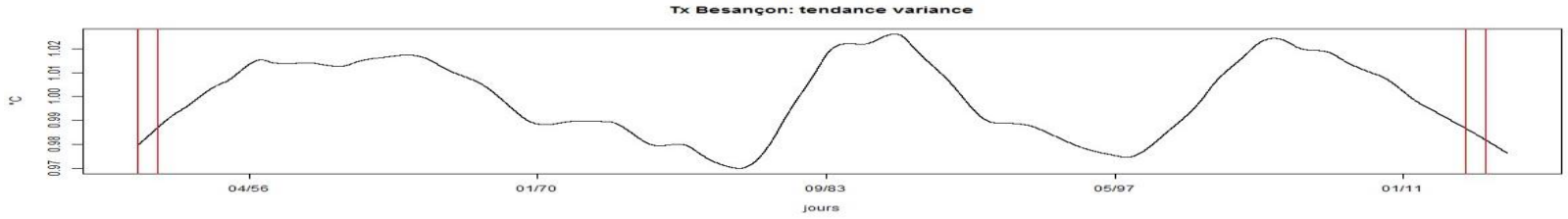
- Selection of warm events: consecutive days above q60% summer
- Selection of the highest TX during these events
- New selection of events: peaks > q95% previously selected peaks
- Respective values for X, m, s and Z

Decomposition: role for the peaks

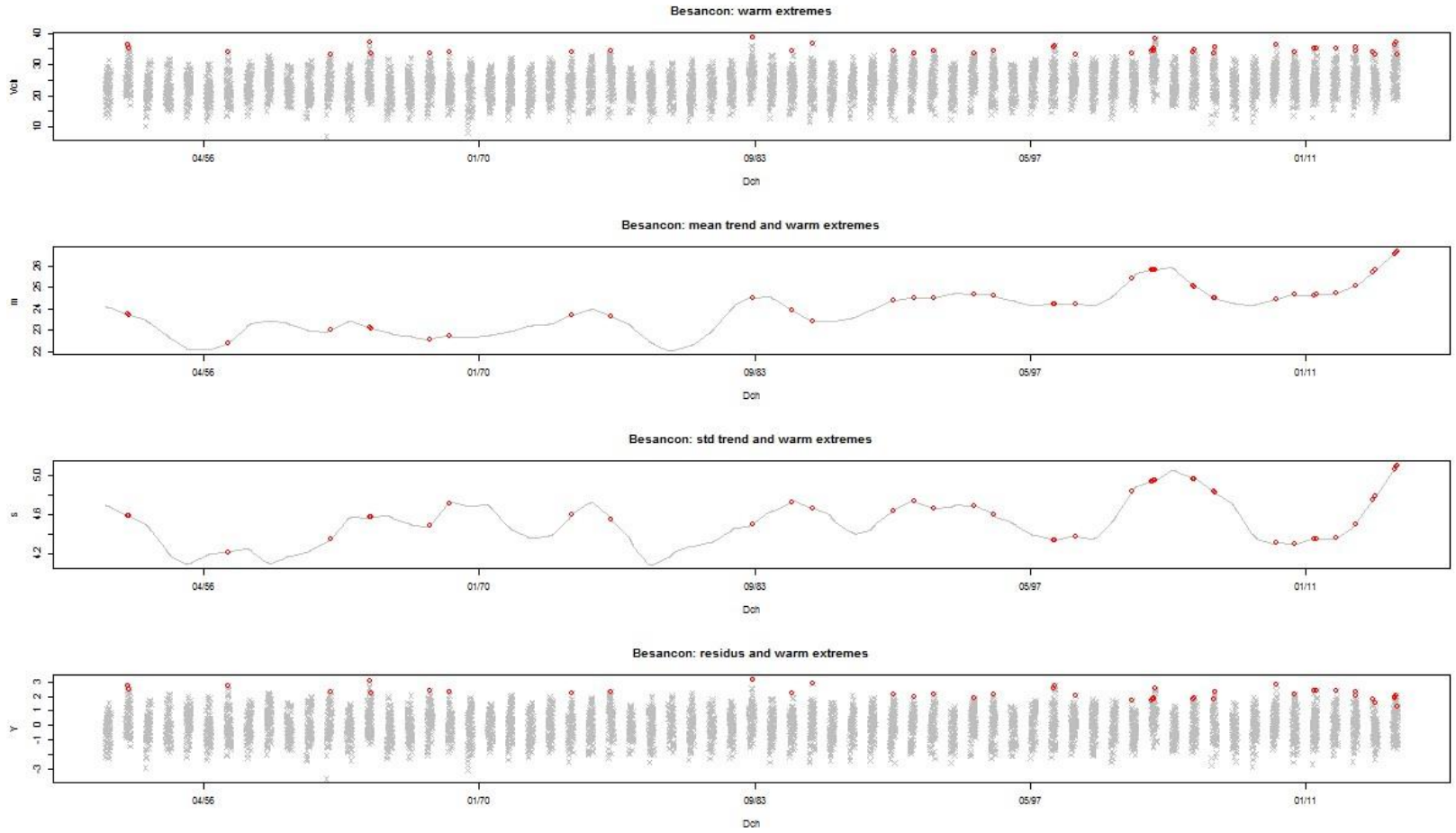








Example


Besancon: warm extremes
Vct
10
20
30
40
04/56
01/70
09/83
05/97
01/11
Dch
Besancon: mean trend and warm extremes
m
22
23
24
25
26
04/56
01/70
09/83
05/97
01/11
Dch
Besancon: std trend and warm extremes
s
4.2
4.6
5.0
04/56
01/70
09/83
05/97
01/11
Dch
Besancon: residus and warm extremes
Y
-3
-1
0
1
2
3
04/56
01/70
09/83
05/97
01/11
Dch

Discussion

- Observed heat waves evolution
  - Significant changes in mean annual number essentially
  - Stronger changes with lower thresholds, but still not significant
- Role of mean, variance and residuals for hot extremes
  - High levels = high values of Z
  - Highest ones: combination of high Z and high m and s

THANKS

Example for cold extremes