Seasonal Frequency Analysis of Floods in Canada

B. Simpara, F. Ashkar.

Department of Mathematics and Statistics, Université de Moncton

Abstract

We will analyze flood frequencies deduced from the daily streamflow records of about 220 hydrometric stations across Canada. We will examine the temporal distribution of floods during the year for each hydrometric record. The peaks over threshold (POT) method will be used to get a seasonal portioning of the year for each hydrometric station. We will then attempt to assemble stations that are similar in their seasonal flood distribution and try to group similar stations into geographical regions that display a certain degree of homogeneity. For each hydrometric record, a series of graphs will be constructed, similar to what is shown here, which will help identify the "seasons" for each record.

Figure 1:

This graph gives a visual idea of missing data; the graph (line) will not be continuous if dates are missing.

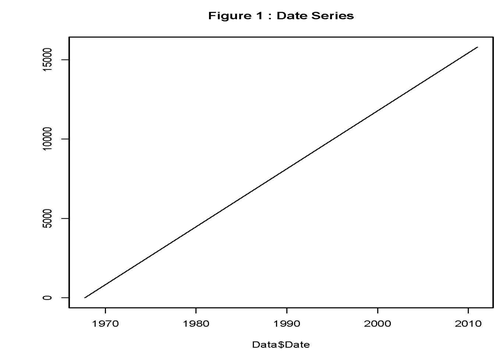


Figure 2

This graph provides a visual representation of the daily flows.

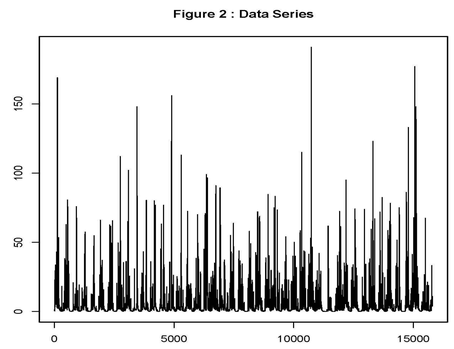


Figure 3

For each flow percentile, from the 50th up to the 99th, the number of floods exceeding the percentile is plotted. This helps in choosing the threshold level for POT data extraction

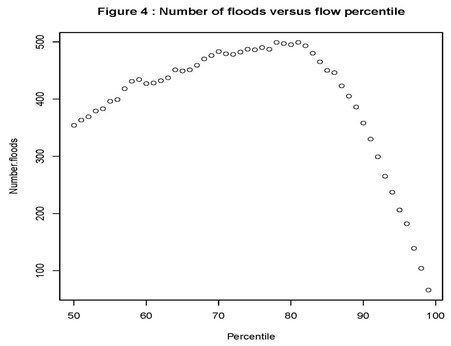


Figure 4

Once a threshold level is chosen, the following graph shows how the floods are distributed during the year. Each flood is represented by its intensity on the vertical axis and its date of occurrence (Julian day) on the horizontal axis.

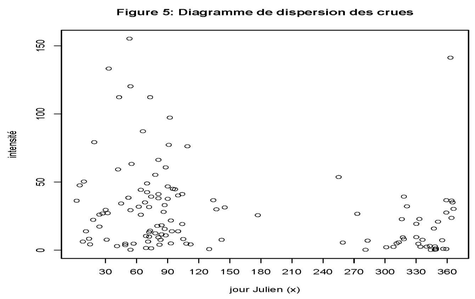


Figure 5

For five different threshold levels, the average number of flood exceedances of the threshold in the interval (0, x] is plotted against the Julian day, x. This helps visualize the seasons.

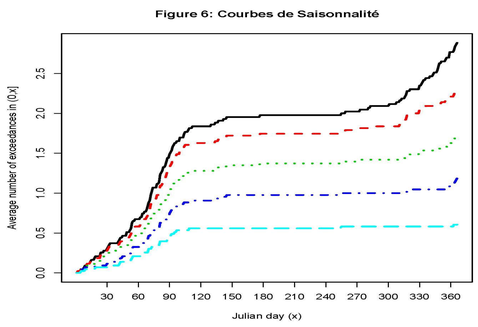


Figure 6

The previous two graphs are then presented together for easier interpretation

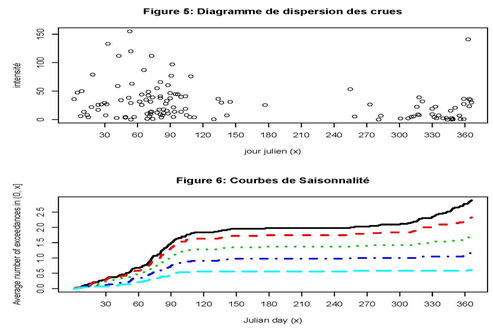


Figure 7

Two graphs are now presented: The upper graph is a reproduction of the uppermost curve in Figure 5 (i.e. the one obtained from the lowest threshold level). The lower graph is obtained by doing a slope analysis of the upper graph, with the help pf linear regression . Both graphs are used simultaneously to better identify the seasons

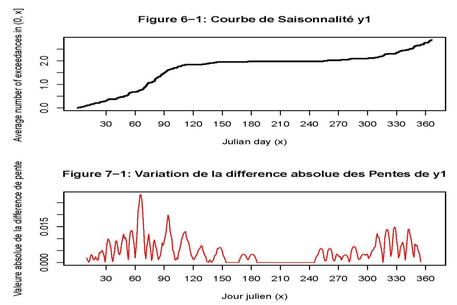


Figure 8

The threshold is then raised and graphs similar to those in Figure 7 are obtained and analyzed

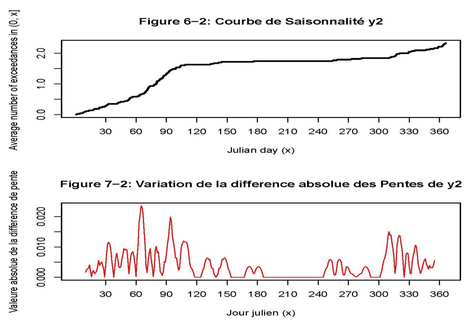


Figure 9

Another raise in the threshold yields the following:

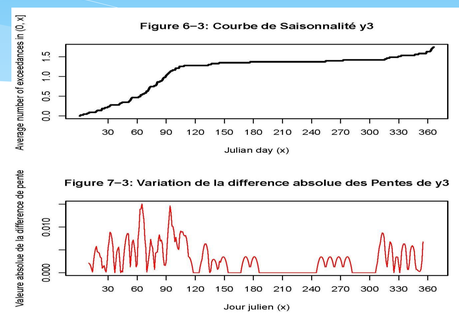


Figure 10

And yet another raise:

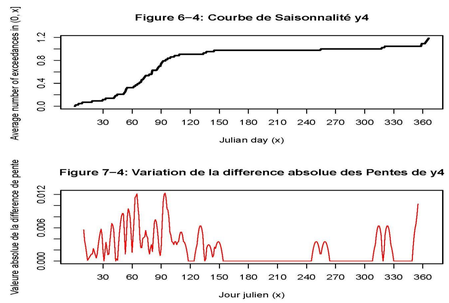
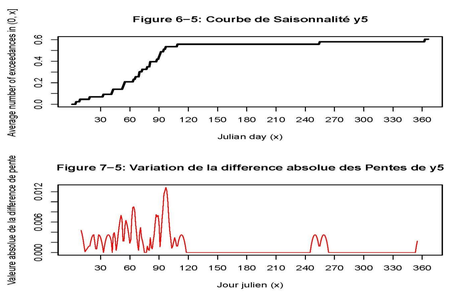


Figure 11

And a final raise:



References

Ashkar F., El-Jabi N., Ouarda B.M.J., (1993). "Study of seasonal trends in flood data with the partial duration series model". *Revue des sciences de l'eau 6*, 131-152.

Ouarda T.B.M.J, Cunderlik J.M., St-Hillaire A., Barbet M., Bruneau P., Bobée B. (2006). "Data-based comparison of seasonality-based regional flood frequency methods". *Journal of hydrology 330*, 329-339.

Rémillard L., Rouselle J., Ashkar F., Sparks D. (2004). "Analysis of the seasonal nature of extreme floods across Canada". *Journal of hydrologic engineering 9(5)*, 392-401.