Seasonal Frequency Analysis of Floods in Canada

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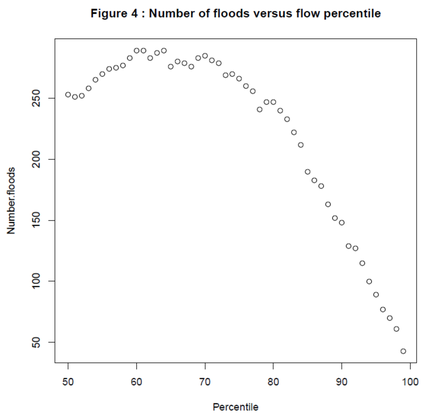
Abstract

We will analyze flood frequencies deduced from the daily streamflow records of about 188 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.

Method

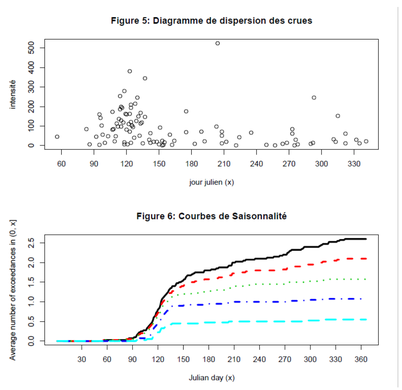
We first analyze the data set (check if there is missing data, get a visual representation of daily flow), then plot the number of floods exceeding the percentile, for each percentile form the 50th up to the 99th (figure 1). This helps in choosing the threshold level for POT data extraction.

Figure 1:



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 (Top graph).
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 (Bottom graph).

Figure 2:



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 of linear regression . Both graphs are used simultaneously to better identify the seasons.

Figure 3:

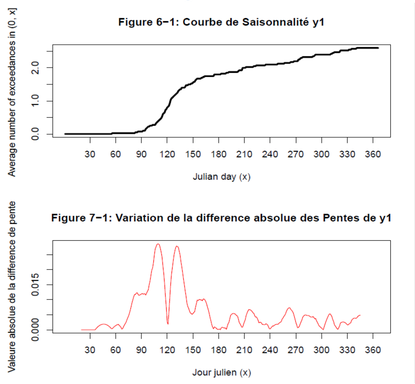
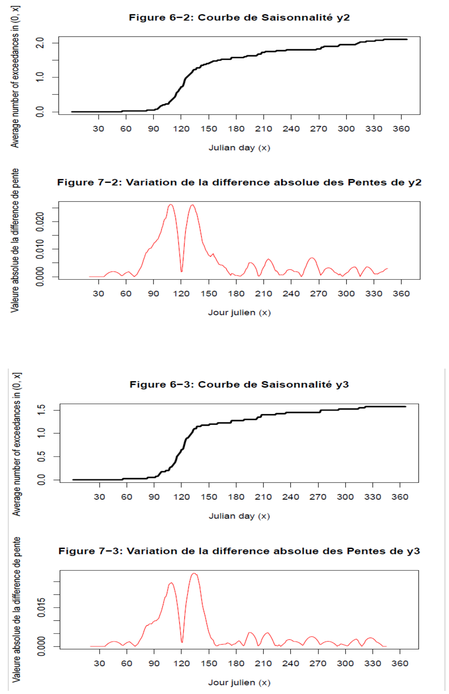
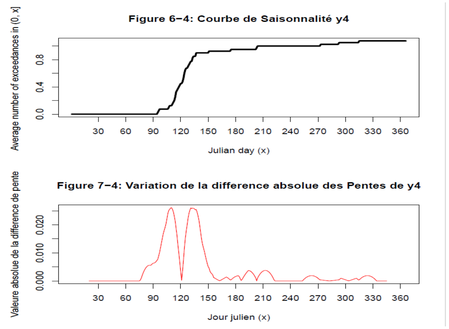
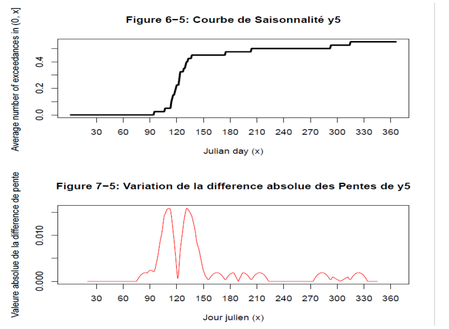


Figure 4:
The threshold is then raised multiple times and graphs similar to those in Figure 3 are obtained and analyzed







Results

After analyzing all the graphs and the results from the frequency analysis, we then partition the year in different flood seasons (humid, dry etc.…) at each of the 188 stations. The stations that are similar in their seasonal flood distribution, are all put together to form different groups. A part of the results obtained, from that process is display in table 1:

Table 1: Possible partitioning of the wet spring seasons

	Flood seasons			
Day	180 th-150th	150th –200th	200th -250th	250th – 80th
Stations	02AA001	03FA003	07RD001	08GA061
	02AB008	04GA002	08DA005	08HA003
	02BF002	05BA002		08HB008
	02CF008	05BB001		08HB028
	02EA005	05DA007		01EF001
	02EC002	05DA007		01FA001
	01AD002	05DA010		
	01AD003	06LC001		
	01AJ004			
	01AJ010			
	01BC001			
	01BJ003			
	01BL002			
	01BU002			
	01BE001			

For further work, an appropriate partitioning of the year into seasons will be established for different parts of Canada. Based on the seasons determined for each station, and the geographical distribution of these stations. A geographical regionalization of seasonality will be obtained.

Reference

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