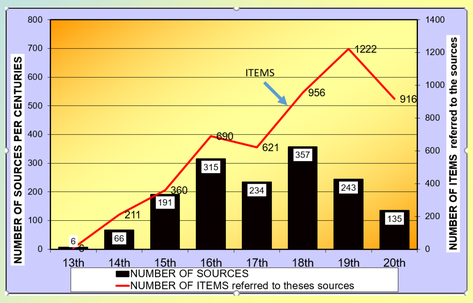
HISTRHONE a multi-secular database on the historical flood variability (AD1300-2000). Lower Rhône Valley https://histrhone.cerege.fr

Georges PICHARD[1] (*) and Emeline ROUCAUTE[2]. 1. Historian, Aix-Marseille University. 2. Historian Aix-Marseille University & Météo-France.
K. FAIDIX[3], Ph. DUSOUILLEZ[3], J. FLEURY[3] 3. GIS and image processing at SIGeo laboratory, CEREGE, Aix-en-Provence (France)
M. PROVANSAL[4], V. MORON[4] 4. Geographer , Aix-Marseille University, CEREGE, Aix-en-Provence (France)
(*) georgpichard@yahoo.fr

1. SOURCES OF HISTRHONE DATABASE

.**1541** usefull sources providing **4982** references (items)



Examples :

1548 flood : 17 pages of documents
1755 flood : 128 pages of documents
1856 flood : 261 pages of documents
etc.

A wide variety of sources

Municipal archives (deliberations, accounts). Family books, diairies,. State and administrative records, memories, letters, annals,. Technical and scientific records (« Pont et Chaussées »). Daily observations (from 1816 to 2000). Maps, Newpapers..

➡ An effort was made to balance the information through the centuries.

2- General Methodology

Classification of the events :

1. Floods and « crues »

445 C1 « big Rhone »
264 C2 floods (limited or local overflows)
144 C3 floods (severe overflow with damaging effects)
37 C4 floods (very severe and disastrous or extrem events)
62 Cd « crues » less well documented

About a thousand floods and « crues » along seven centuries

2. **Ice blockages and floating ices** :

101 ice blockage episodes
61 episodes of floating ices
Subsidiary database on the ices ; **341 pages** of documentary sources (Pdf).

3. **Subsidiary database on the droughts and severe low waters**

➡ **286 pages** of documentary sources (Pdf).

4. How to access data ?

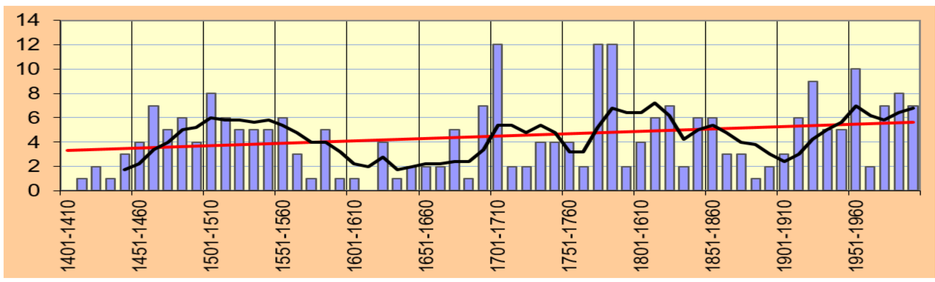
a) By event types, places (villages, towns), types of damages and by years or grouping of years
b) Using the **maps of main floods**
c) By accessing to the command « Transcription » : copy of the original writings or figurative documents
d) By accessing to the appended databases : **ices**, **droughts**, or by the « **General Chronology** »

3. ANALYSIS AND SYNTHESIS OF THE MAIN RESULTS

a) Method

1. **frequency analysis :** histograms and curves (on the basis of 11 yr and 31 yr moving averages)
2. **Frequency/severity index** caculated by the discharge (20th c) for each class flood (C2 between 5200 -7200 m3/s ; C3 between 7200-9000 m3/s; C4 > 9000 m3/s).

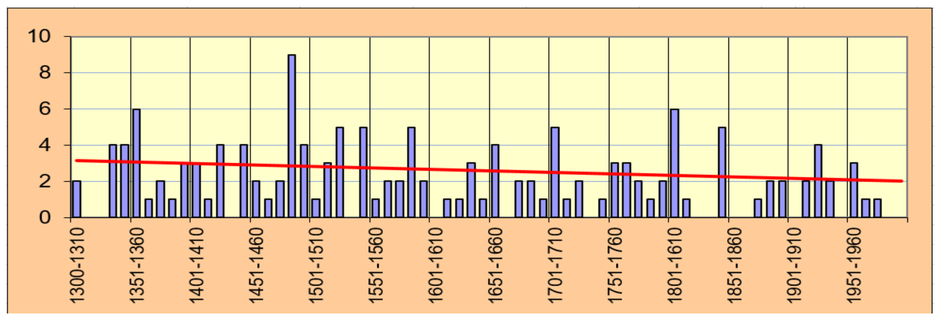
b) Frequency C2 flood (limited overflows) by decade



➡ *High variability and slight upward trend since the 15th century*

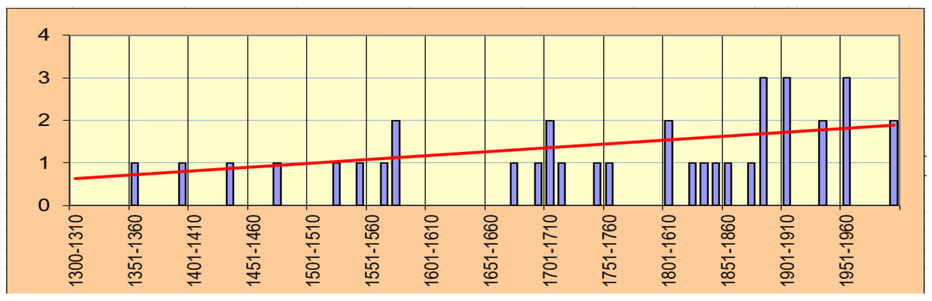
(linear trend (red line) and moving average (dark line) 5 decades.

C3 flood (severe overflow) by decade



➡ *Downward trend since the 14th century : better control of these floods of intermediate severity or change in the geometry of the bed ?*

C4 flood (extrem and catastrophic floods)

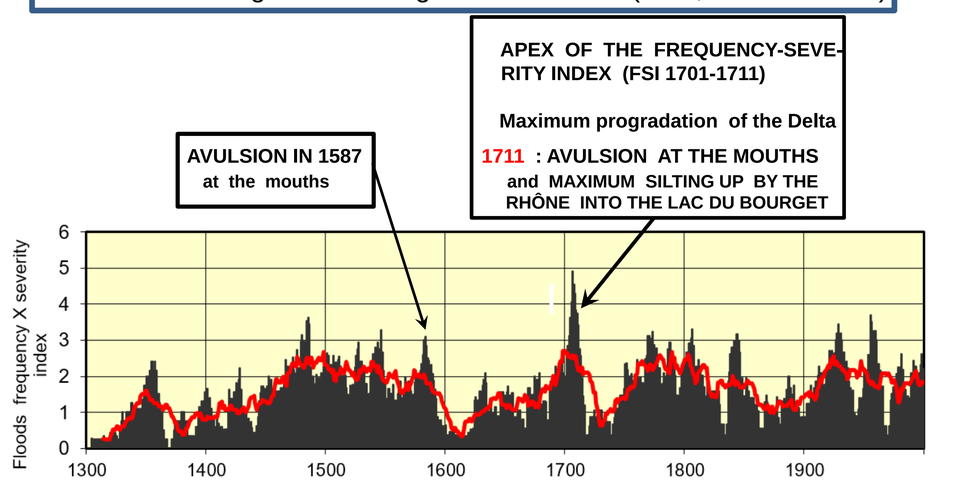


➡ *Obvious increase in frequency for these exceptionally severe flooding, since the 18th and more the 19th -20th centuries*

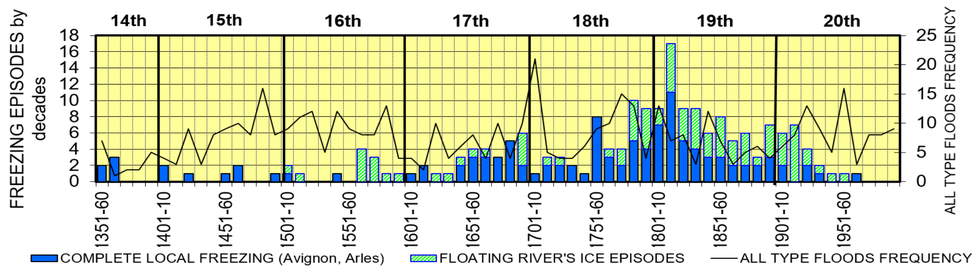
C) SYNTHESIS (FSI of the Floods and River ices) (See box 4)

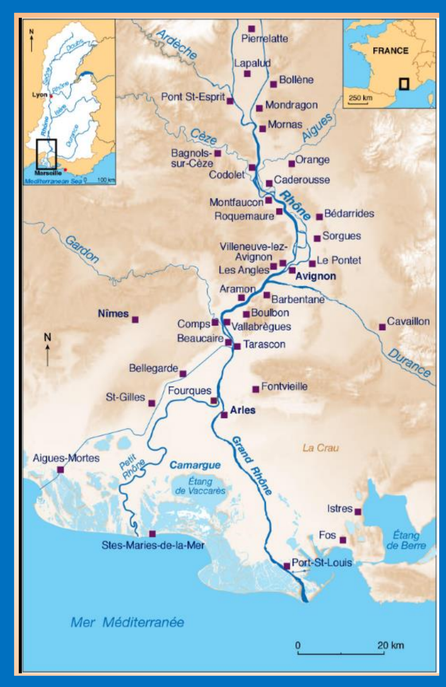
a) Annual Frequency Severity Index by moving average (11 and 31 yrs)
moving average ; 11 years (grey zone) 31 years (red line)

avulsion = change and shifting of the river bed (here, at the mouths)



b) Rhône River Ices during the LIA (distribution of 162 episodes)





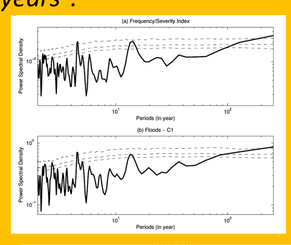
The Lower Rhône Valley

4. CONCEPTUAL DEFINITION

Frequency severity Index (FSI) is calculated by multiplying the frequency with a severity index in proportion with the average flow rate of each category of flood : C2 = 2, C3 = 2,70, C4 = 3,50. Then, for each period (annual or decadal) is performed the sum of the FSI indices .

5. DISCUSS and Conclusions

Series have been tested by Vincent MORON (Cerege and Univ. Aix-en-Provence France). Figure below "*shows the power spectral density -PSD- of (upper panel) FSI and (lower panel) all floods minus category C1. Both time series are highly similar (correlation = 0.94) and in consequence, their PSD matches almost perfectly. There are broad spectral peaks near 2-3, 4-5, 14-15 years. The spectrum is also significant for periods longer than ~ 100 years*".



This long enough homogeneous serie demonstrates the usefullness of a historical study of floods through a multi-secular period .

The database includes + 250 annual heights curves : Beaucaire, Arles, Avignon

Example : 1840 in Avignon

- References

Pichard G. (1995) Les crues sur le bas Rhône, de 1500 à nos jours, Méditerranée, n° 3-4, 1995, p.105-116.

Pichard G. et Roucaute E. (2014), Sept siècles d'histoire hydroclimatique du Rhône d'Orange à la mer (1300-2000), Méditerrané », Hors série, 191 p.

Submit :

Pichard G., Arnaud-Fassetta G., Moron V., Roucaute E (2016), Hydrology-climatology of the Lower Rhône Valley. Historical flood reconstruction (AD 1300-2000) based on documentary and instrumental sources.

Acknowledgements

Thanks to DREAL Rhône-Alpes for the financial support at the realisation of HISTRHONE database. [European funds ; participation of PACA and Languedoc-Roussillon regions; Compagnie Nationale du Rhône CNR).]