SIGNATURES OF KRAKATOA TSUNAMI RECORDED BY TIDE GAUGES ALONG THE EUROPEAN ATLANTIC COAST

M. Karpytchev[1], C. Daubord[2], H. Hébert[3], G.Woppelmann[1]

[1] Université de La Rochelle, UMR 6250 CNRS LIENSS France

[2] SHOM, Brest, France , [3]CEA DAM/DIF/DASE/LDG, Arpajon, France

mikhail.karpytchev@univ-lr.fr

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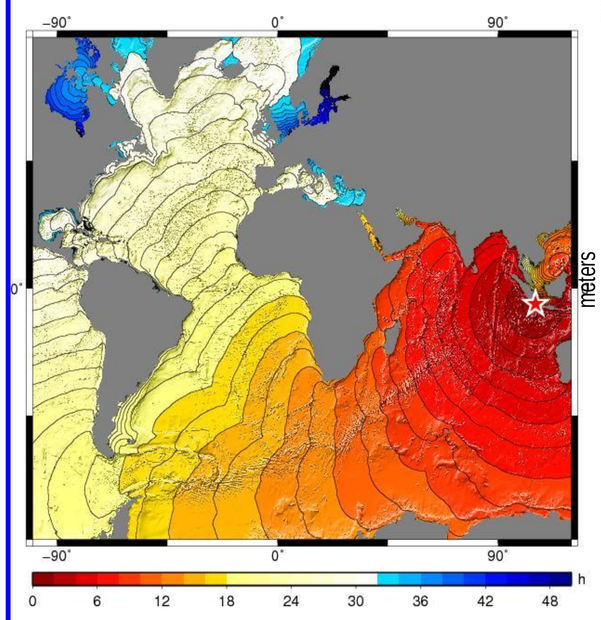
Introduction

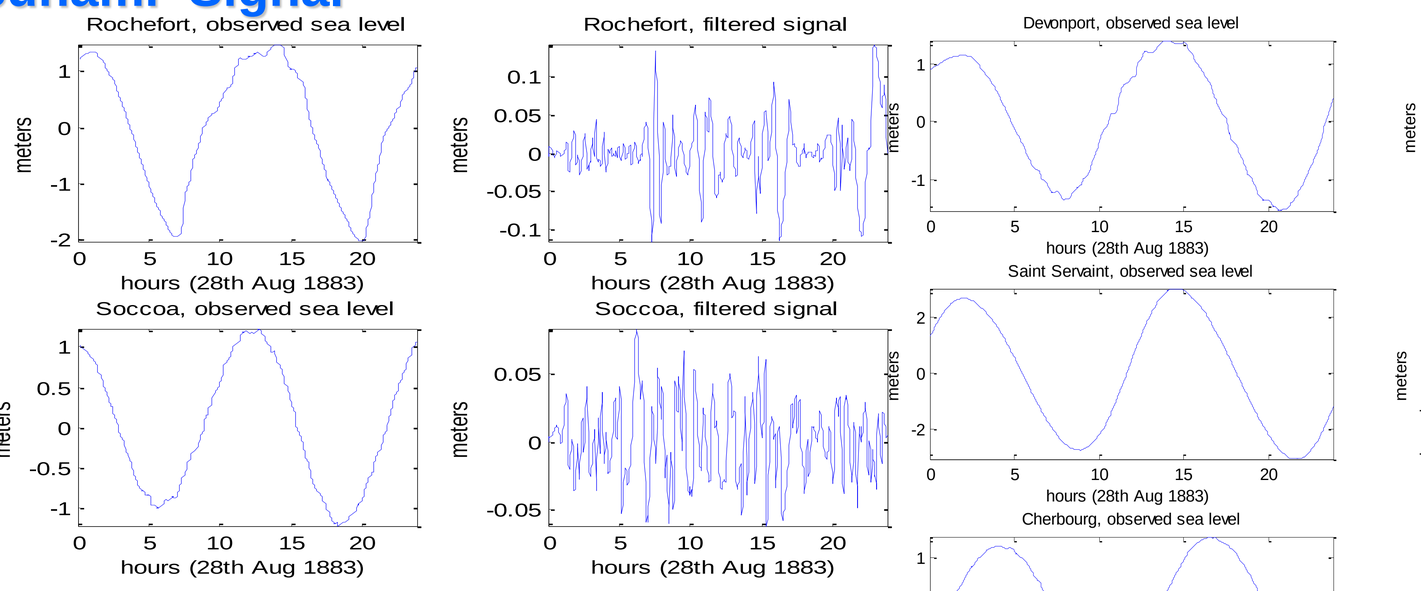
The explosion of Krakatoa on the 28th August, 1883, generated one of the highest tsunami ever recorded by tide-gauges. The tsunami has significantly weakened when approached the tidal stations at the European North Atlantic coasts. The tidal records have been studied and published by the Krakatoa Committee (Symons, 1888), but the original records seem to be lost. Pelinovsky et al (2005) have recently digitized the Krakatoa Committee reproductions and pointed to the difficulties of using the Symons' (1888) figures for a quantitative analysis. In this study, we compared the tsunami signal as it is presented in data from the Symons's (1888) report with the sea level variations measured at the tidal station Saint Servant (see fig). This record is the only one *directly observed series* in the North Atlantic available for us. The Saint Servant record has been discovered and digitized in the framework of the French ANR project *MAREMOTI (www.maremoti.fr)*

Tidal stations in operation during the Krakatoa tsunami →

Filtering the Tsunami Signal

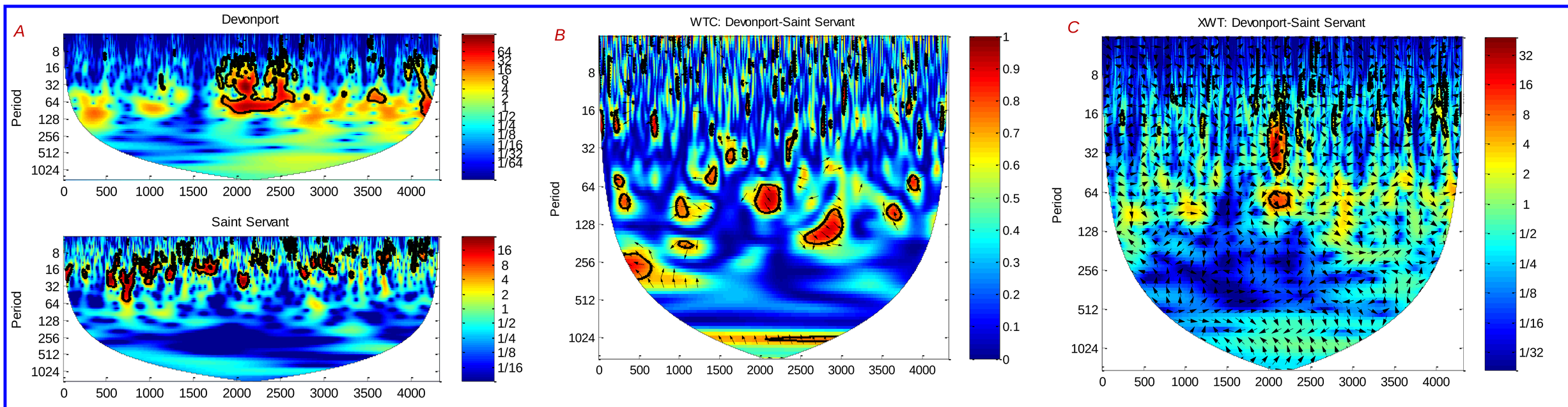
Tsunami travel time map computed from a ray-tracing model.





Sea level at 6 tide gauges and their high frequency components obtained by decomposing the tidal records in the Empirical Modes (Huang, 1998).

Peaks in the filtered records concord with the predictions of the ray-tracing model, but it is difficult to distinguish the tsunami signature from the high-frequency noise peaks. The wavelet (Morlet) decompostion has been performed in order to detect the coherent signals in the Devonport and in Saint Servant records (Grinsted et al, 2004).



(A) The wavelet spectra (Grinsted, 2004) of the Devonport and Saint Servant records (horizontal axis : time in min from 0h00, 28th Aug 1883), vertical axis: freq in min) (B) wavelet coherence (C), cross-wavelet transform. Color bars yield normalized variances and wavelet squared coherencies. The vectors indicate the phase difference (an arrow pointing from left to right signifies *in-phase*, and an arrow pointing upward means that Devonport lags Saint Servant by 90. Bold contours are 95% confidence levels

Conclusions

❑ The wavelet coherence displays the coherent "spots" between the Devonport and the Saint Servant records. As the phase arrows in these spots are in phase and the time of these spots correspond to the tsunami arrival time predicted by the ray-tracing model , we can conclude that both series have recorded the Krakatoa tsunami passage.

❑ The comparison of the Saint Servant record to other tidal series digitized from Symons' report show, however, no much coherence (the results are not presented here). It means that other techniques should be applied to analyze the Krakatoa records including the direct numerical modeling that can now be fitted to Saint Servant data.

❑ The Krakatoa signal is pretty small in the North Atlantic and the signal-to-noise ratio is low. It thus looks evident that additional efforts should be aimed at searching the original data used by the Krakatoa Committee until a firm evidence will be discovered that these observations are definitely lost.

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