Long Term Trend Components in Sea Level from Tide Gauge and Satellite Altimetry Records

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Introduction

The comparison between sea level derived from satellite altimetry and sea level derived from tide gauges has proved to be of major technical and scientific interest. From the beginning of the altimetric mission tide gauges have been used to estimate the reliability and accuracy of the satellite altimeter. On the other hand the accuracy of the altimetric mission is now able to identify some of the particular biases of tide gauges such as sensor drift or appreciable land movement. We aim to perform a combined analysis of the long term trend of the sea level derived from a selected set of tide gauges and altimetric time series. The approach is essentially local and based on a careful editing of the data and on a dedicated coastal altimetric treatment.

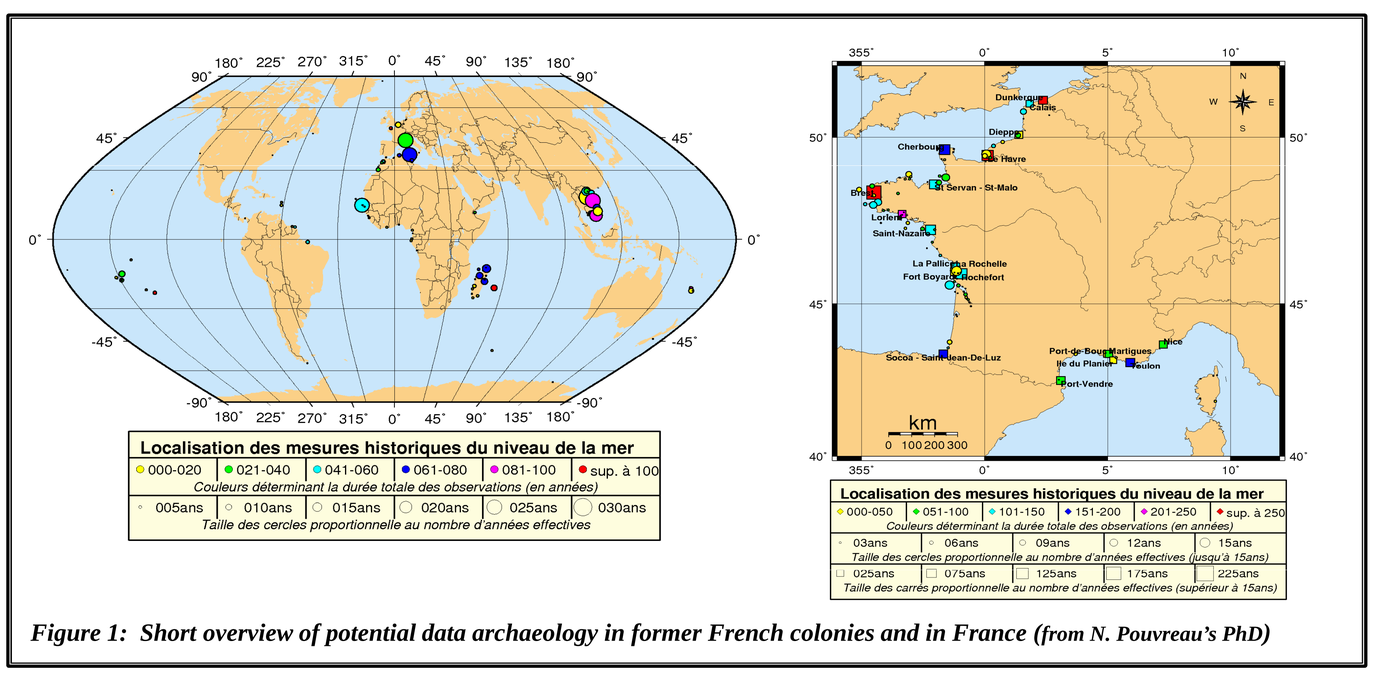

Figure 1: Short overview of potential data archaeology in former French colonies and in France (from N. Pouvreau's PhD)

Data archaeology

We know from experience that a large amount of sea level records or historical sea level bench mark information sleeps in the archive of many national institutes. This is the case for example in France, because of its early implication in sea level monitoring for science or navigation purposes. Moreover due to its old colonies and early presence in polar region historical sea level records or related sea level information from Antarctica, Artic, Africa, Asia are archived at a large number of archives (*see Figure1*). This information could, in some case, be of great interest in terms of low variability of the sea level or trends. Even without long continuous historical data records, it is possible to estimate valuable information on long term sea level rise. This exercise is particularly interesting when it allows to estimate trend on region of the ocean where long records are inexistent (Hunter et al., 2003, Woodworth at al. 2005, Testut at al. 2006).

The first step of this proposal will be to carefully select the set of sites (combination of tide gauge and altimetry) and to derive the best possible sea level series. These sea level time series will be then analysed with sophisticated statistical tools in order to produce relevant information on long term variability. We finally aim to make a dedicated data and metadata base (technical, historical, statistics, altimetric products) which will feed the PSLML databank.

First test case : Brest / Roscoff / Newlyn

In order to develop and tune the methodology we have decided to study the comparison in term of long term sea level signal in the Channel. Long term sea level series are available for Newlyn in UK (1915-2008) and for Brest (1846-2008) and Roscoff (1973-2008) for France. The (T/P and JASON1) track N°70 join the Newlyn and Roscoff tide gauge (*see. Figure 3*). A first look at the data quickly show that even if the monthly mean sea level for Brest and Newlyn are well correlated (r=0.93) their trend (for the 1990-2007 period) are quite different with respectively 2.6 mm/yr and 4.6 mm/yr for Brest and Newlyn. Moreover the comparison between altimetry and tide gauge shows different behavior between altimetry and the tide gauge. One of the aim of this proposal is to explain these different trend behavior.

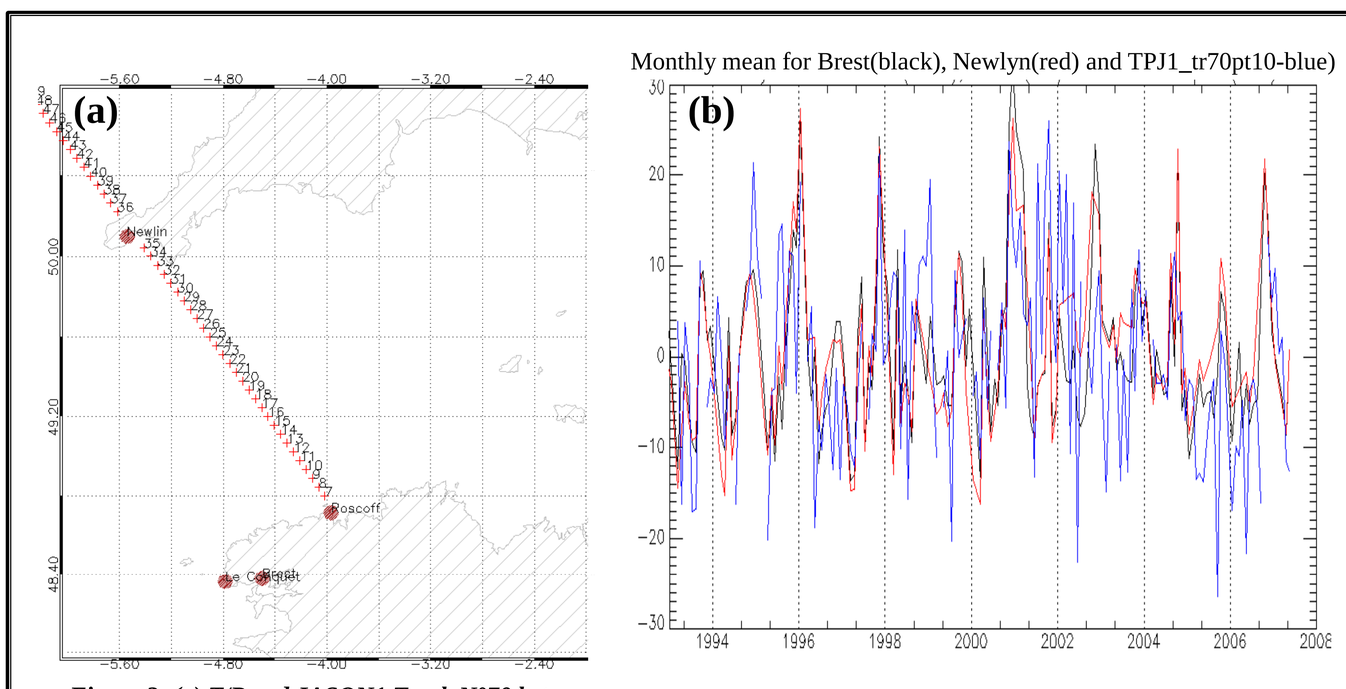

Figure 3: (a) T/P and JASON1 Track N°70 between Newlyn and Roscoff tide gauge. (b) Monthly Mean sea level observed at Newlyn (red), Brest (black) and pt n°10 of T/P Track.

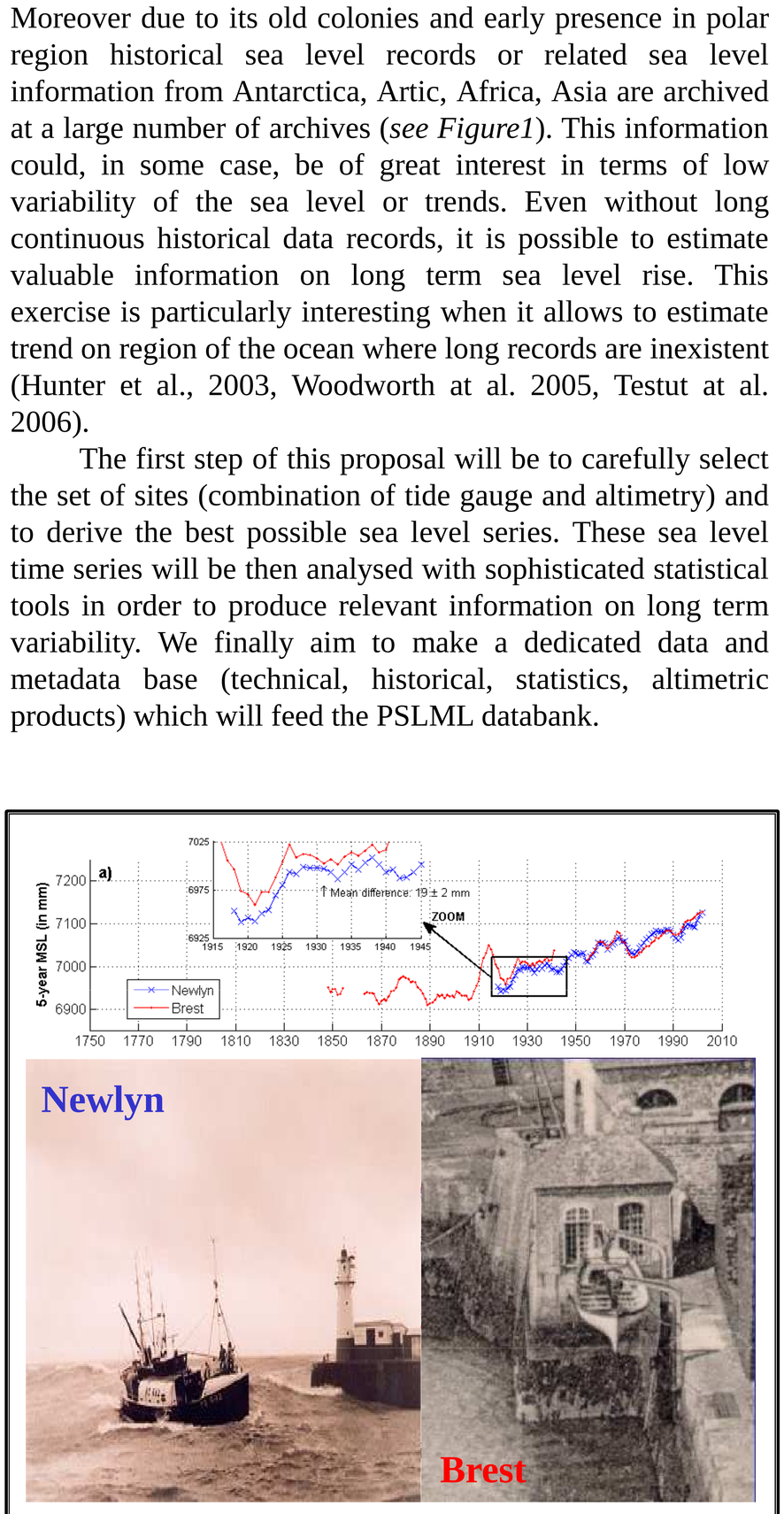

Figure 2: (a) Annual Mean Sea Level at Brest and Newlyn (5yr running mean, cf. Wöppelmann et al. 2008). The photos shows the location of the Newlyn and Brest tide gauge.

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