A multi-peak model for peaky altimetric waveforms

A simple parametric model was recently introduced to model peaky altimetric waveforms [1] [2]. This model assumes that the received altimetric waveform is the sum of a Brown echo and Gaussian peaks. A maximum likelihood estimator for the parameters of this Brown + peak model was studied in [2] in the simple case where altimetric signals are corrupted by a single peak. However, an analysis conducted on real altimetric waveforms from the PISTACH project [3] shows it is also interesting to consider multi-peak models. This paper studies a generalization of the algorithm presented in [2] to estimate the parameters of multi-peak altimetric signals. The main contribution of this paper is a method allowing one to estimate the number of peaks which are present the Brown + peak model. The effects of model order mismatch will also be studied. Simulation results conducted on synthetic and real altimetric waveforms allow one to appreciate the performance of the proposed multi-peak model and its interest related to the single-peak version. When dealing with peaky waveforms, the classical algorithm (denoted "MLE") can fail to fit the altimetric signal, as shown in Fig. 1 (black curve). The single-peak model provides interesting results (left figure - red curve) but cannot model accurately the presence of multiple peaks in the observed signal. The multi-peak algorithm proposed in this paper clearly shows significant improved performance as illustrated in Fig. 1 (right – red curve).
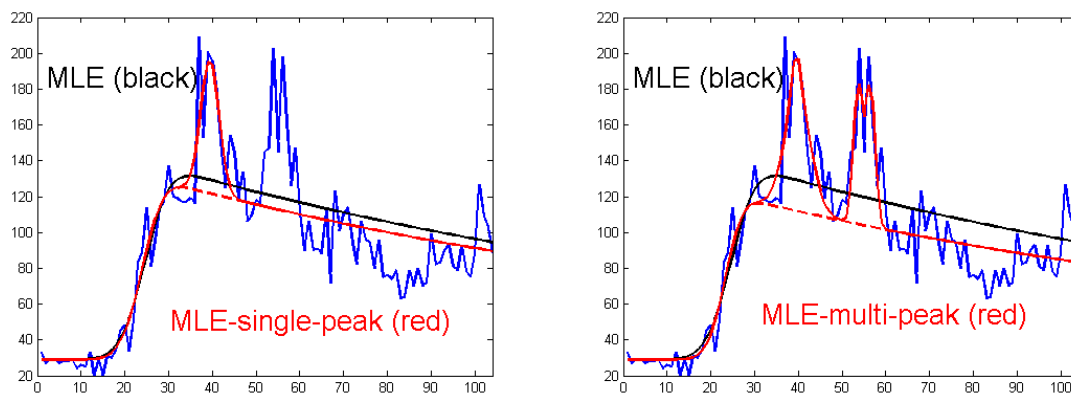

Fig.1: Comparison of single-peak (left) and multi-peak (right) Brown models for a real altimetric waveform from the PISTACH project.

[1] Gómez-Enri, J., S. Vignudelli, G.D. Quartly, C.P. Gommenginger, P. Cipollini, P.G. Challenor and J. Benveniste (2009). Modeling ENVISAT RA-2 waveforms in the coastal zone: case-study of calm water contamination. *3rd Coastal Altimetry Workshop*, Frascati (I).

[2] Tourneret, J.-Y., C. Mailhes, J. Severini, P. Thibaut (2010). Parameter estimation for peaky altimetric waveforms. *Ocean from Space*, 16-30 April 2010, Venice (I).

[3] P. Thibaut, P. and J.C. Poisson (2008). Waveform Processing in PISTACH project. *2nd Coastal Altimetry Workshop*, Pisa (I).