

Waveforms Processing in Pistach Project

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Pisa, Italy
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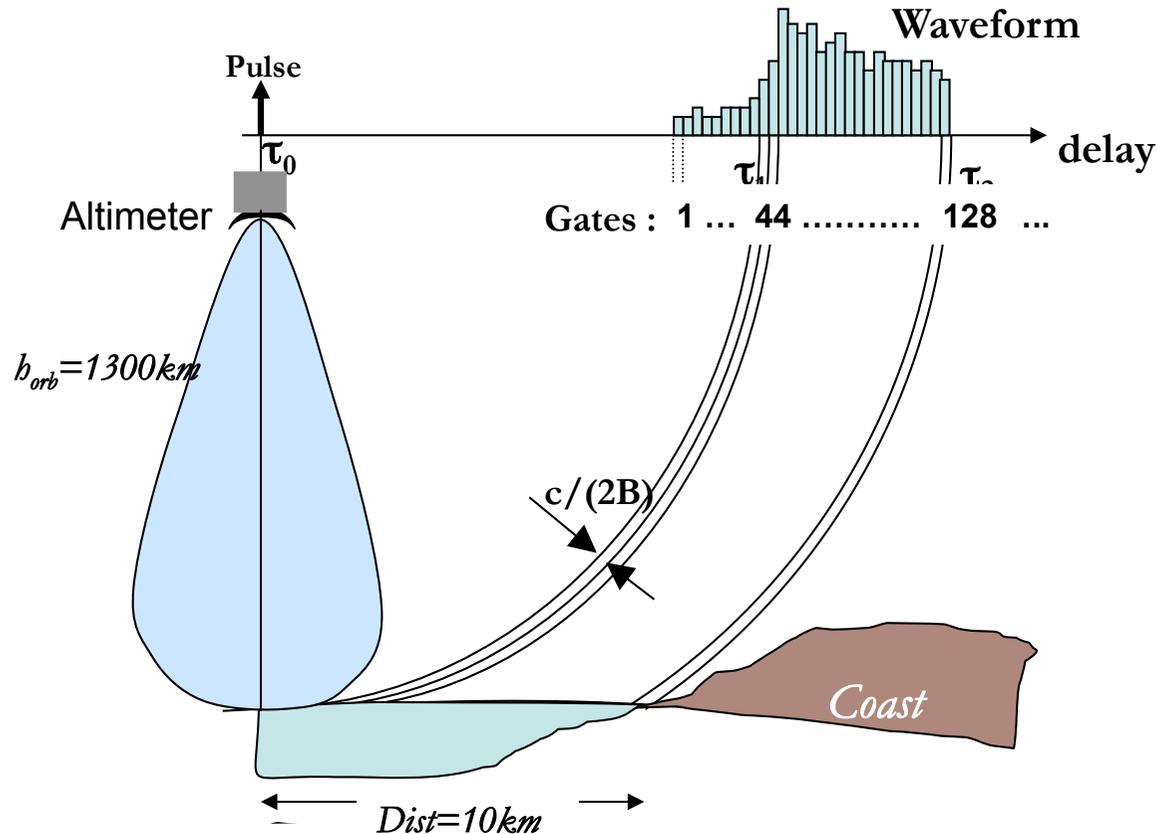
Limitations of actual products in coastal regions

- Pb of robustness of the on-board tracker → No J1 data on a coastal band up to 2 to 15 km (especially for land to sea transitions)
- When present in the coastal band, waveforms often do not conform to Brown's model (non homogeneous scattering surfaces in the antenna patterns)
- The usual « deep ocean » retracking algorithm doesn't converge or is not optimal for such waveforms
- The nature (class, shape) of each waveform is not provided to users (no quality criteria in the products)
- 1 Hz data sampling rate is not optimal for the user in the coastal band and some corrections are only provided at 1Hz (SSB for example)

➔ The aims of **PISTACH waveforms processing** are :

- to increase the number of data in coastal regions (and also on the hydrological basins)
- to optimize the waveforms processing (to add new retracking output)
- to provide the user with high rate products including quality criteria.

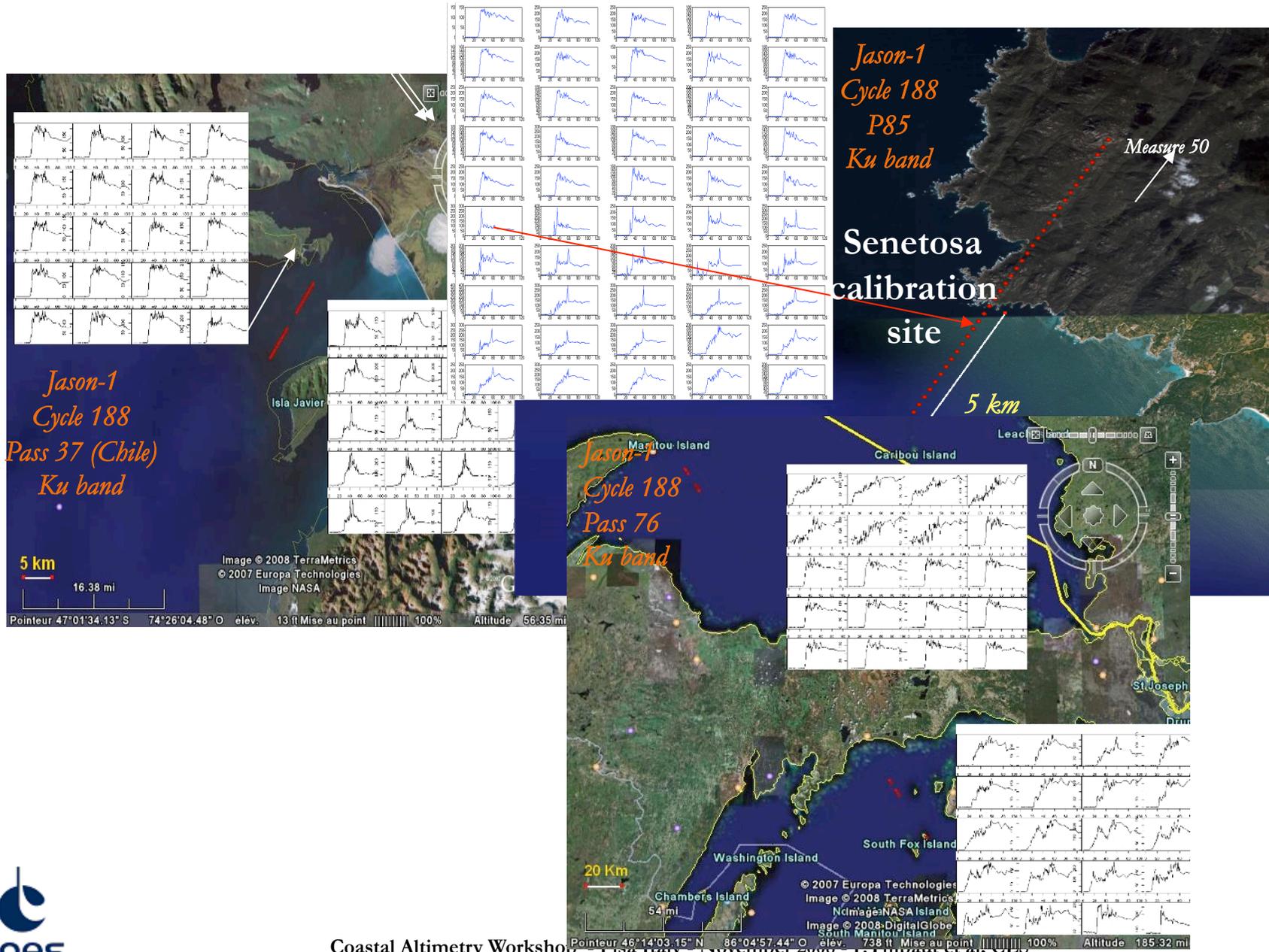
Land effect on waveforms (already shown in Silver Spring)



Where in the waveform the land contamination appears, depends on the height and areal extent of the land, as well as its proximity to the nadir point.

How the waveform is affected depends on $\text{Area}_{\text{Land}} \times \sigma_{0,\text{Land}}$ relative to $\text{Area}_{\text{Ocean}} \times \sigma_{0,\text{Ocean}}$. If $\sigma_{0,\text{Land}} < \sigma_{0,\text{Ocean}}$ (often true), the effect can be small. In some environments, however (coral atolls) $\sigma_{0,\text{Land}} > \sigma_{0,\text{Ocean}}$ & the effect is large.

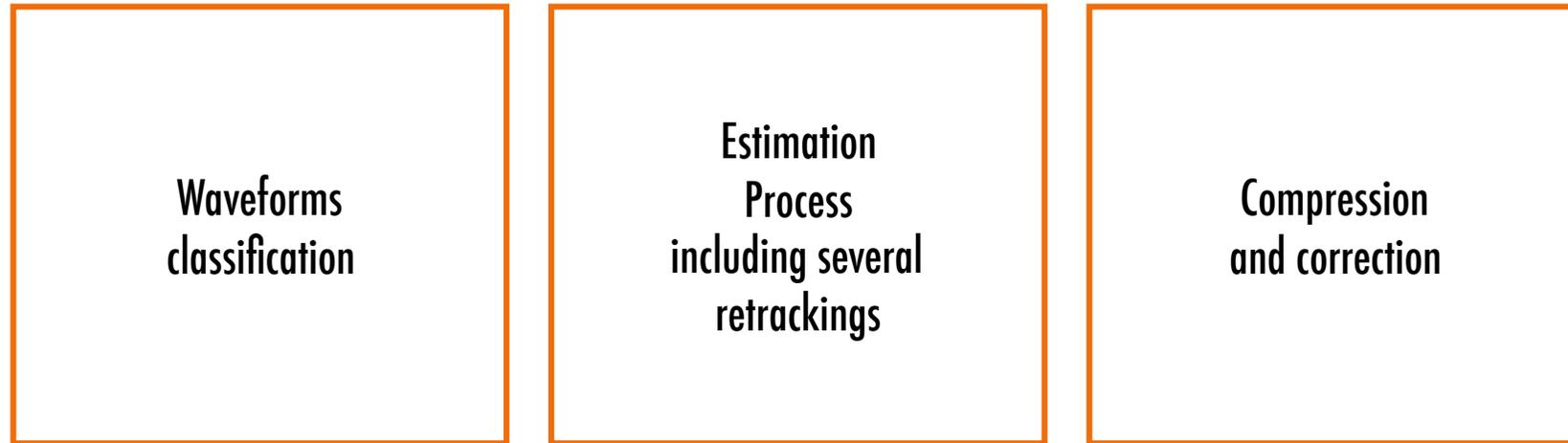
In Silver Spring coastal meeting (Feb 2008), we already showed the great diversity of waveform shapes near coasts.



Coastal Altimetry Workshop - Pisa Italy - November 2009 - Leffler et al., 2010

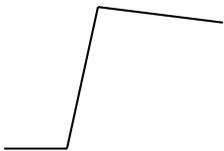
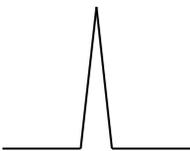
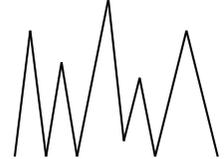
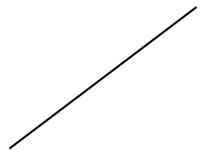
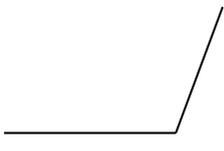
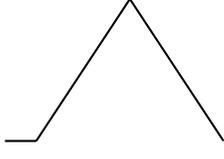
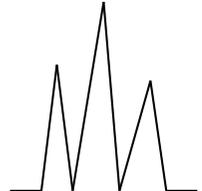
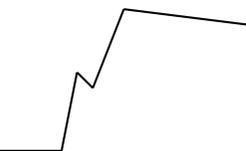
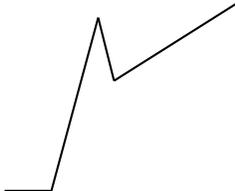
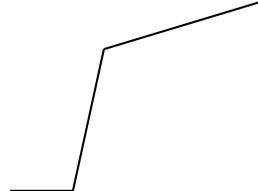
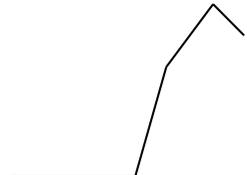
Waveforms processing in PISTACH

3 main modules have been developed :



The main output of these modules are in PISTACH coastal products

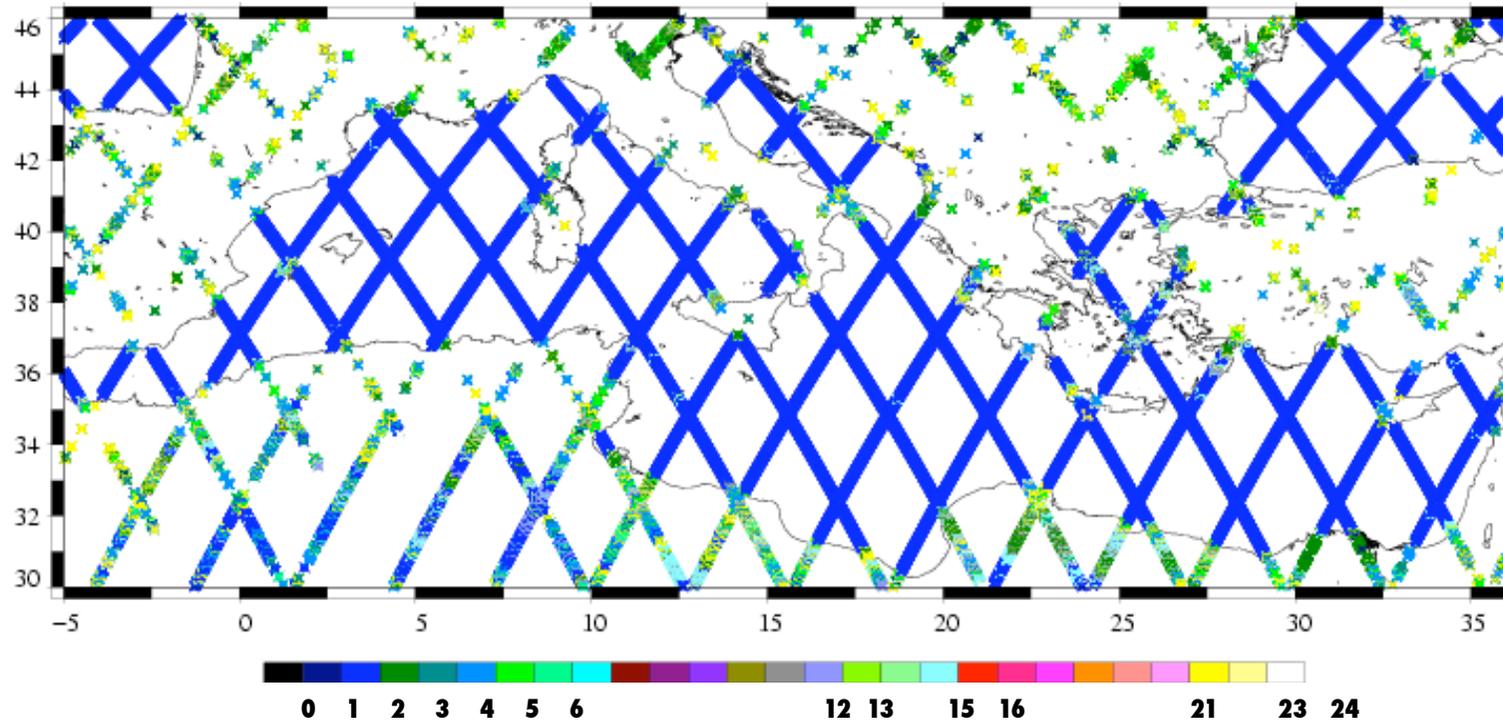
Waveforms classification

<p>Class 1</p>  <p>Brown echos</p>	<p>Class 2</p>  <p>Peak echos</p>	<p>Class 3</p>  <p>Very noisy echos</p>	<p>Class 4</p>  <p>Linear echos</p>	<p>Class 5</p>  <p>Peak at the end of the echos</p>	<p>Class 6</p>  <p>Very large peak echos</p>
<p>Class 12</p>  <p>Brown + Peaky echos</p>	<p>Class 23</p>  <p>Peaky + Noise</p>	<p>Class 13</p>  <p>Brown + leading edge perturbation</p>	<p>Class 24</p>  <p>Brown + Peaky + linear variation</p>	<p>Class 15</p>  <p>Brown + increasing leading edge</p>	<p>Class 0</p>  <p>CS 32</p>
<p>Class 21</p>  <p>Brown + Peak echos</p>	<p>Class 35</p>  <p>Leading at the end + noise</p>	<p>Class 16</p>  <p>Brown + strong decreasing plateau</p>	<p>Class 99</p> <p>??</p> <p>Doubt</p>		

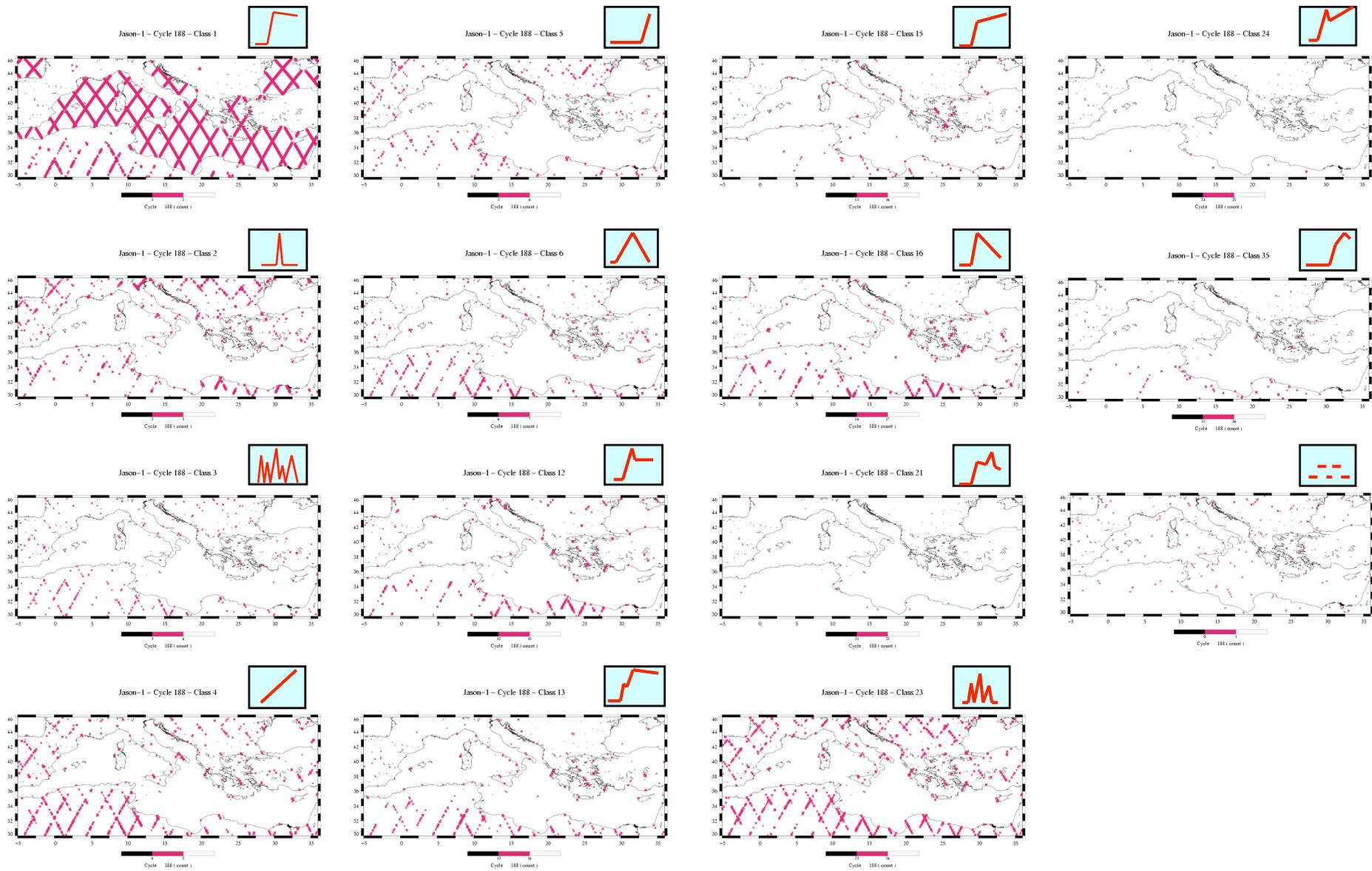
The most likely class is determined for each waveform and **provided in the PISTACH coastal products**. This class can be used as a retracking choice criteria.

Ku band WFs classification on Mediterranean Sea

Jason-1 – Cycle 188 – Class Repartition

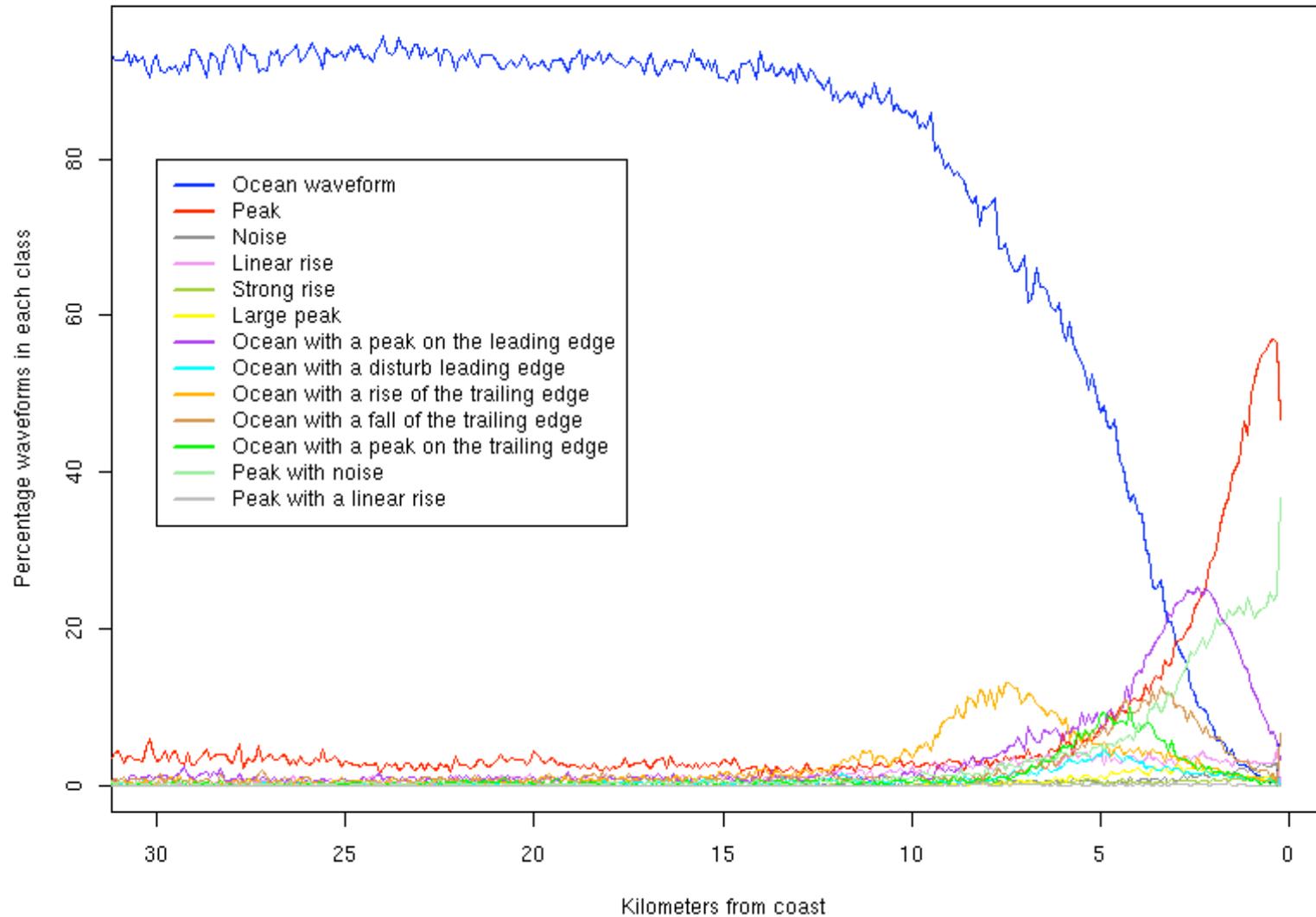


Ku-band WFs class. on Mediterranean Sea (J1, Cycle 188)

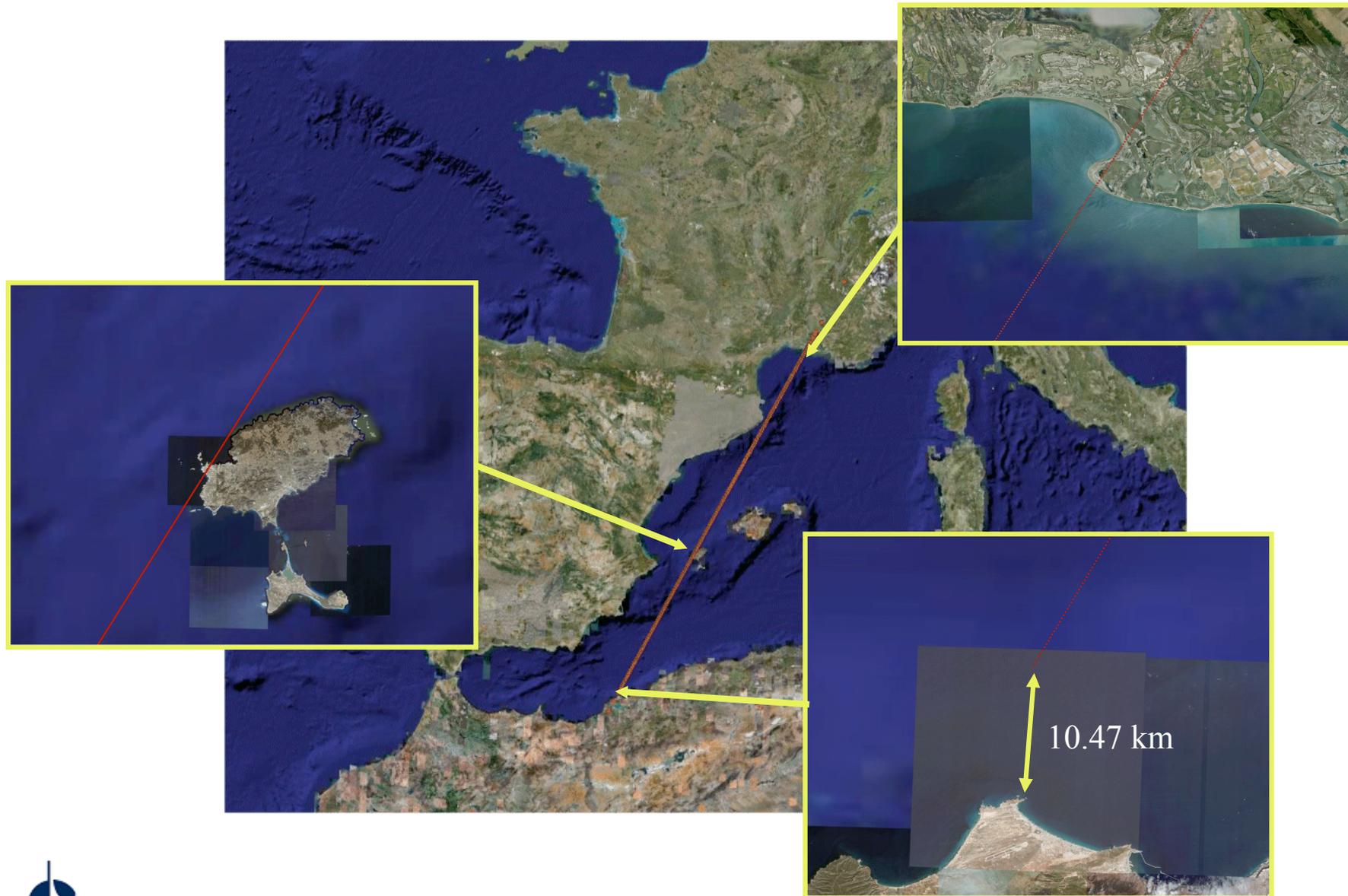


Ku band WFs classes versus Distance to coast (J2, cycle 8)

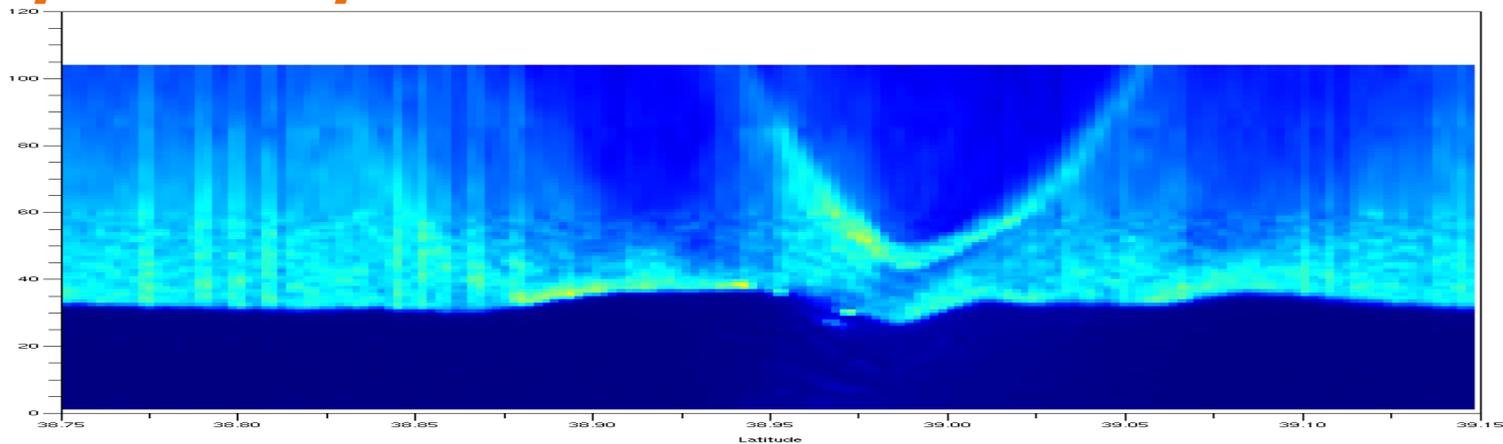
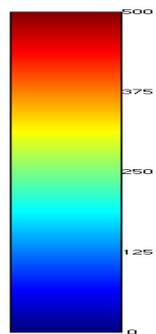
Waveform shape characteristics in coastal regions



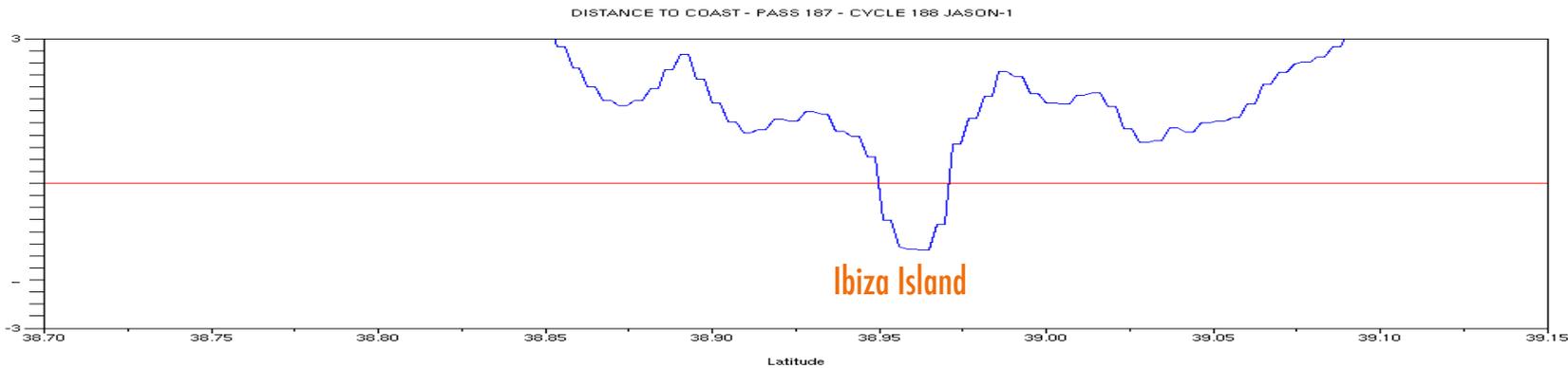
Examples of Pistach Products on J1, Cycle 188, Pass 187



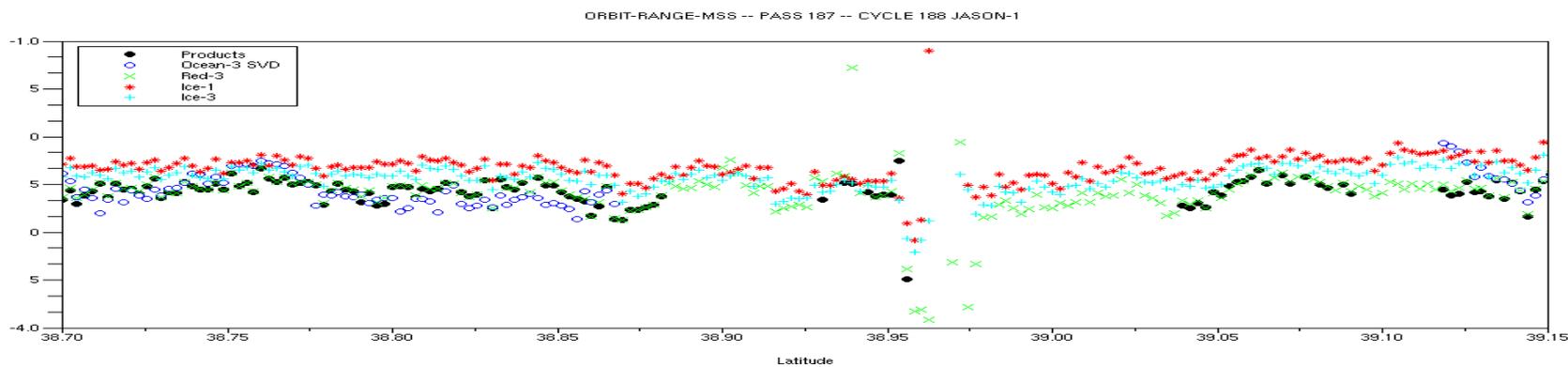
J1, Cycle 188, Pass 187, Ibiza island



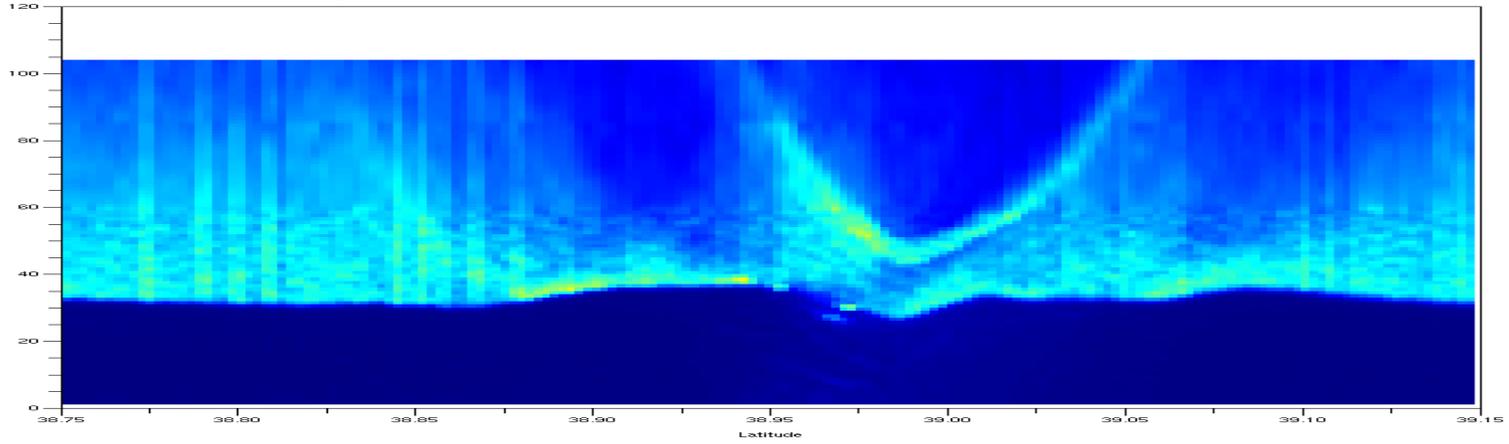
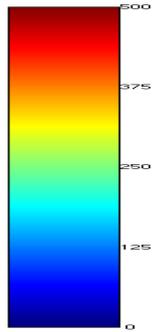
Distance
to
coast



Orbit
- range
- mss



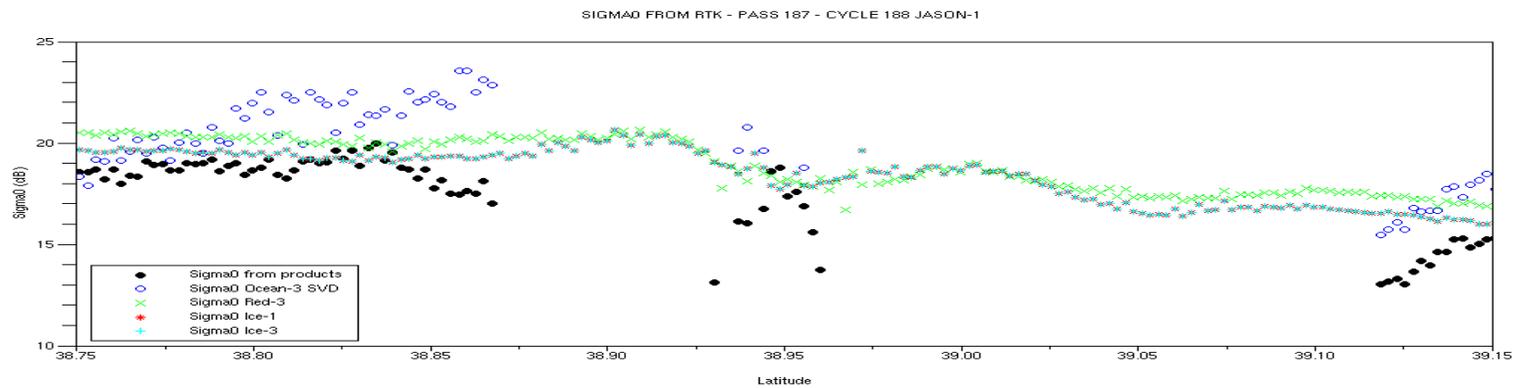
J1, Cycle 188, Pass 187, Ibiza island



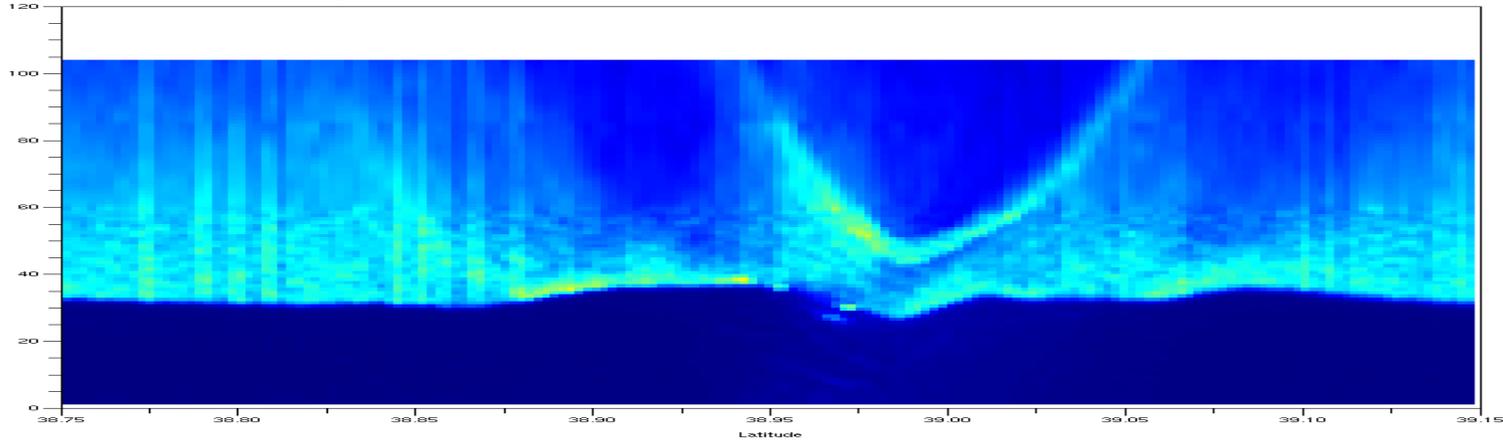
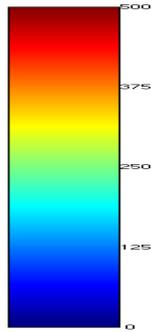
Distance to coast



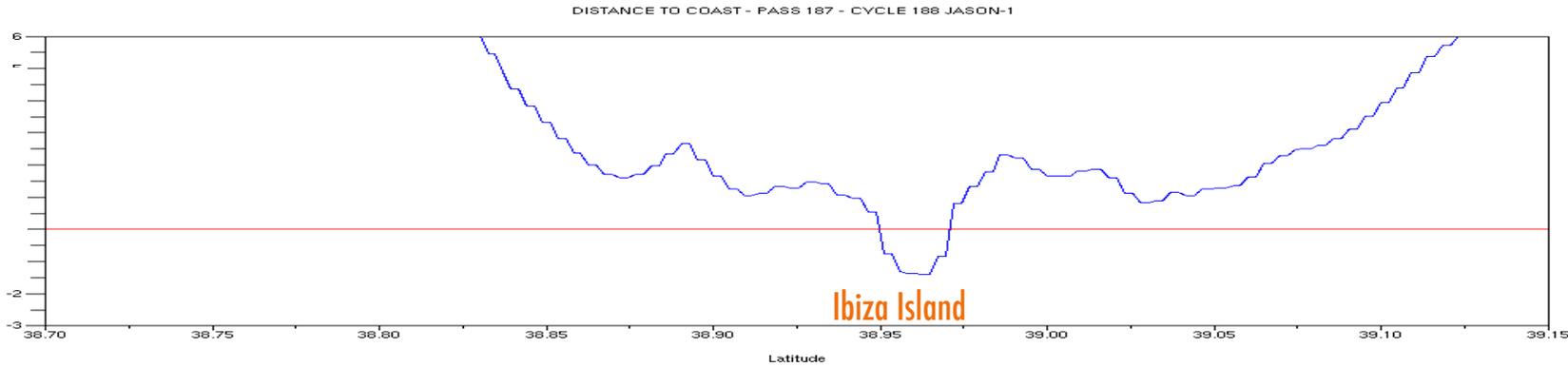
Sigma0



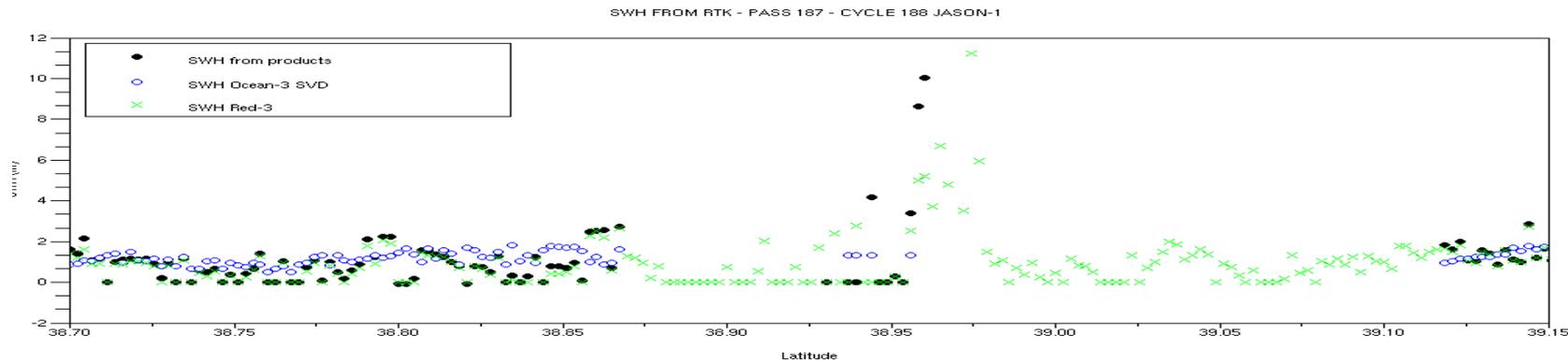
J1, Cycle 188, Pass 187, Ibiza island



Distance to coast



SWH



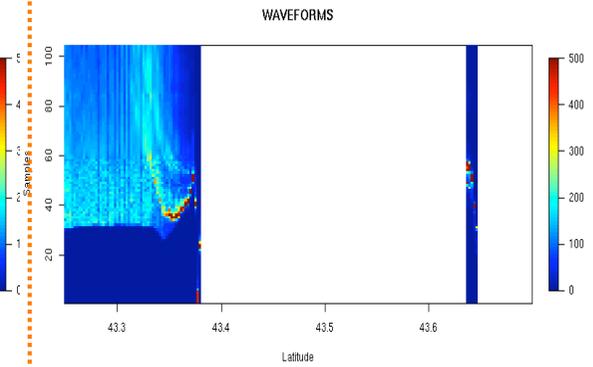
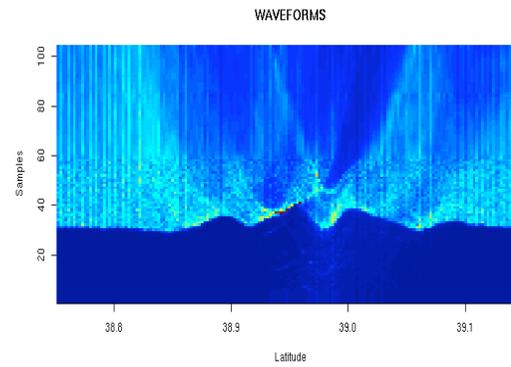
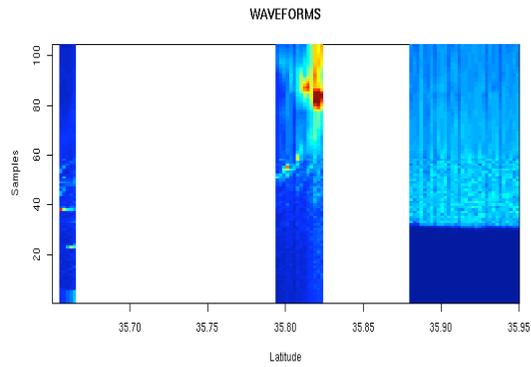
Jason-1 / Jason-2 comparison on coastal zones : P187 on med. sea

*From land
to ocean*

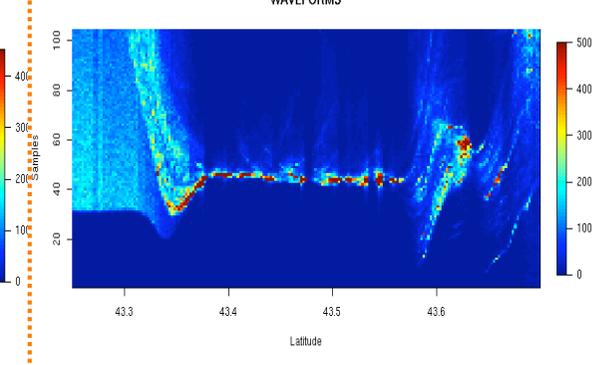
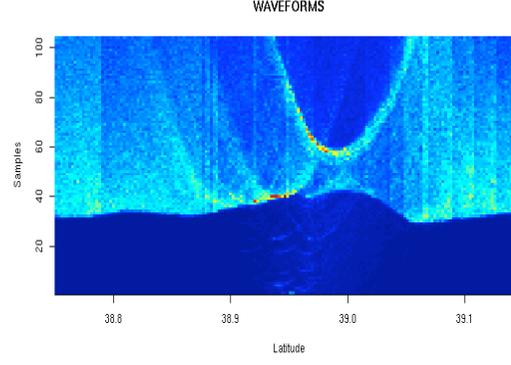
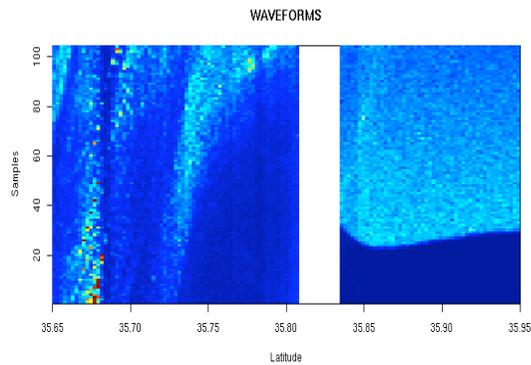
On islands

*From ocean
to land*

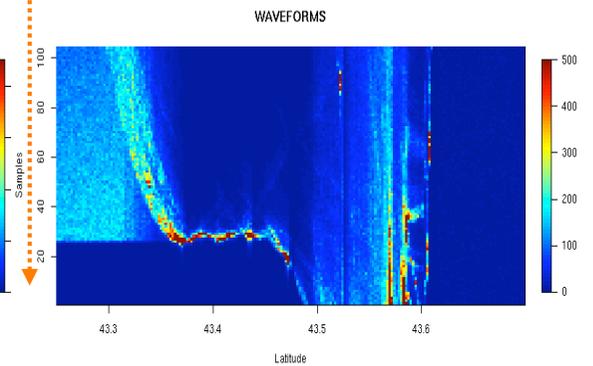
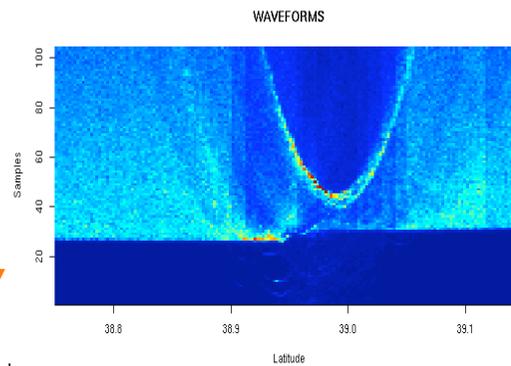
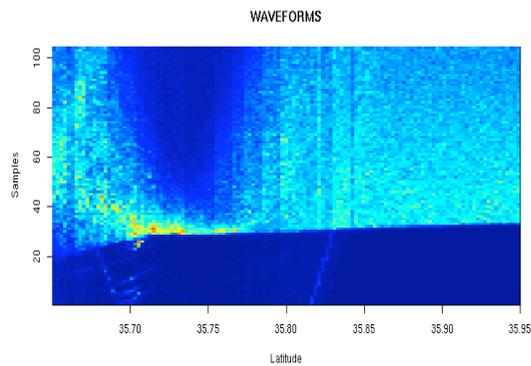
*J1
(cycle 240)*



*J2 Median
(cycle 8)*



*J2 DIODE
DEM
(cycle 7)*



Conclusions on PISTACH coastal products

➤ Pb of robustness of on-board tracker (J1)

➤ When present in the coastal band, WFs often do not conform to Brown's model (non homogeneous scattering surfaces in the antenna patterns)

➤ The usual « deep ocean » retracking algorithm is not optimal for such WFs

➤ The nature (class, shape) of each WF is not provided to users (no quality criteria in the SGDR products)

➤ SGDR 1 Hz data sampling rate is not optimal for the user in the coastal band and some corrections are only provided at 1Hz

➔ **J2 tracker provides much more data in coastal and hydro zones than J1 tracker (because of new tracker modes : median and Diode/MNT)**

➔ **Still true**

➔ **4 other retracking output (20Hz) are provided in the PISTACH products allowing a much better coastal coverage.**

Retracking output still have to be intercalibrated to reduce jumps and SWH dependancies differences

➔ **Now, provided in the PISTACH coastal products**

➔ **Pistach products are provided at 20Hz with corrections computed at 20Hz. SSB will be computed at 20Hz on interpolated SWH and wind.**

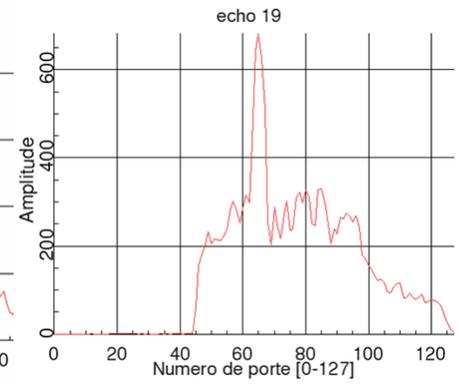
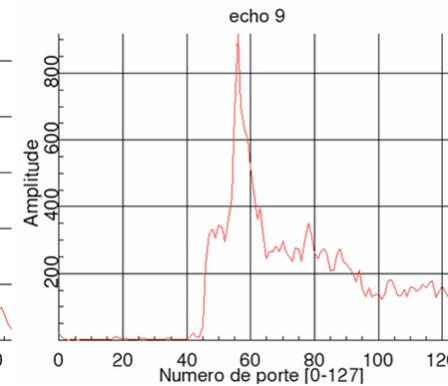
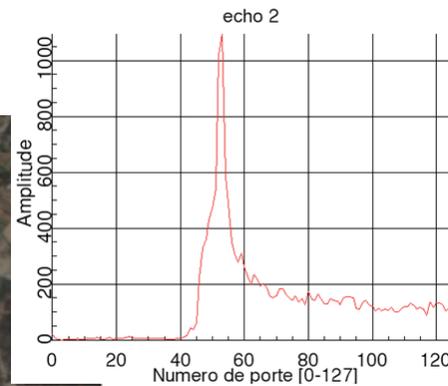
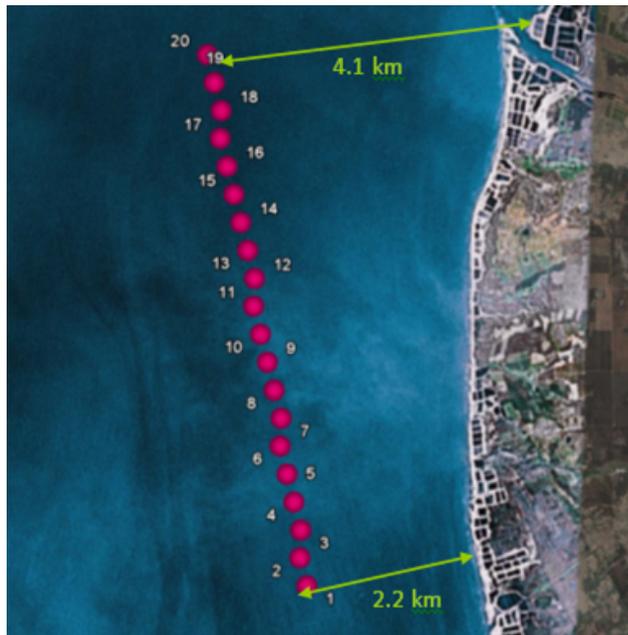
Simulation of coastal waveforms – O.Z.Zanife and A.Vernier (1/2)

The aim is to simulate echos from exogenous data over surfaces mixing water and land areas

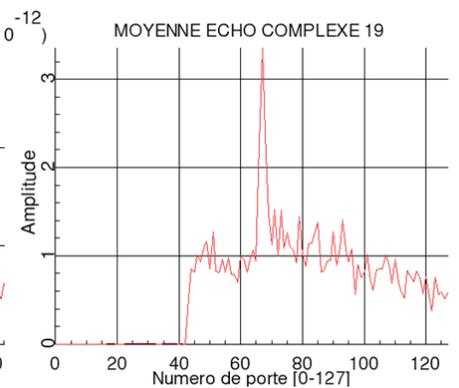
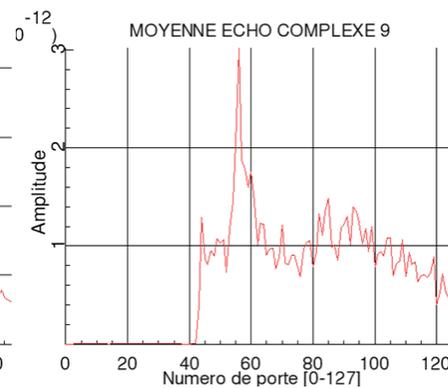
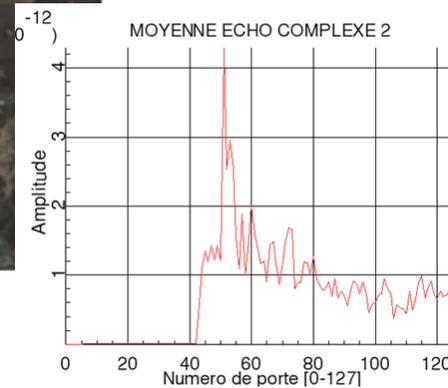
- determination of the backscattering from the water area
- determination of the backscattering from soil and vegetation area

Envisat Echos

Chinese coasts

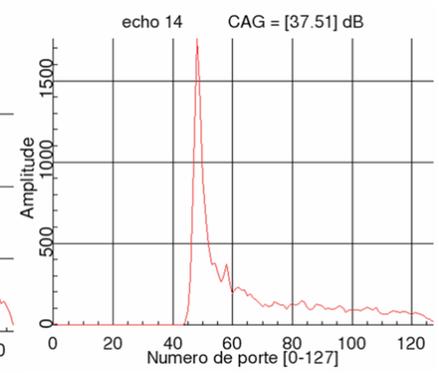
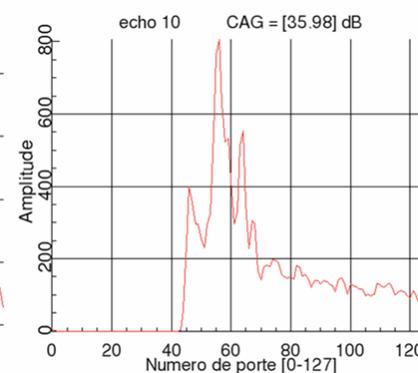
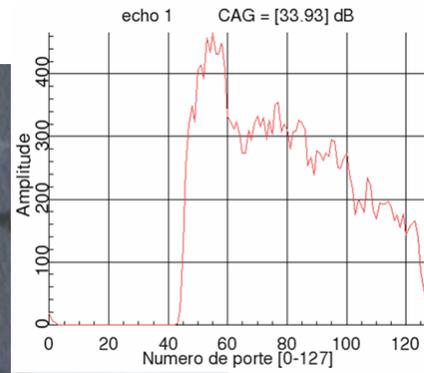
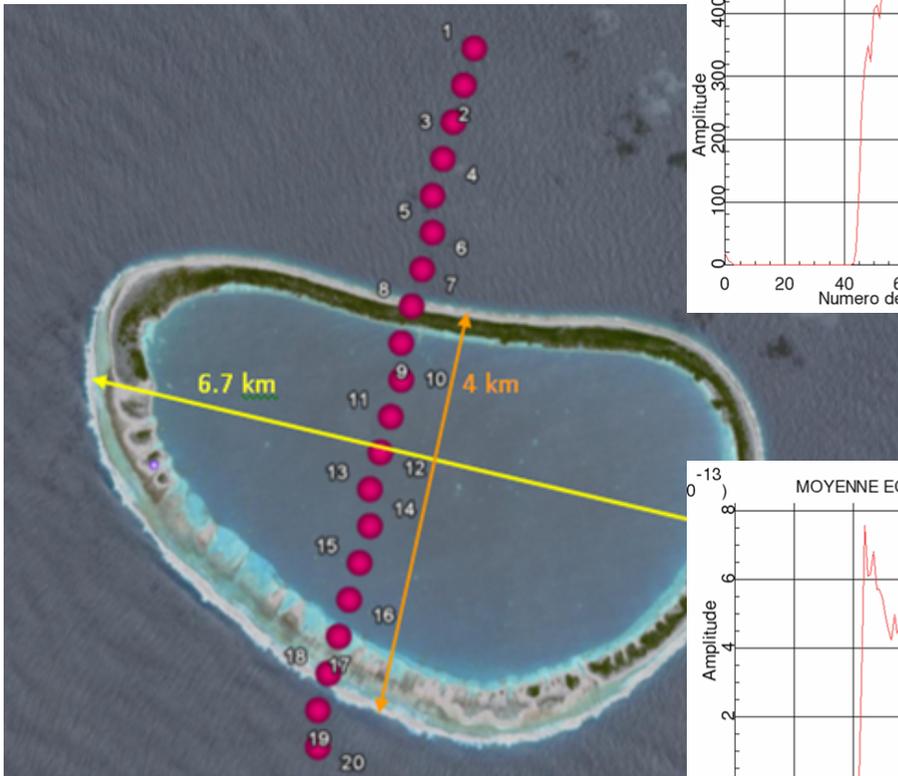


Simulated Echos

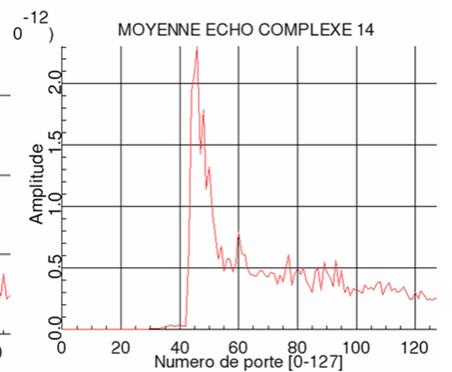
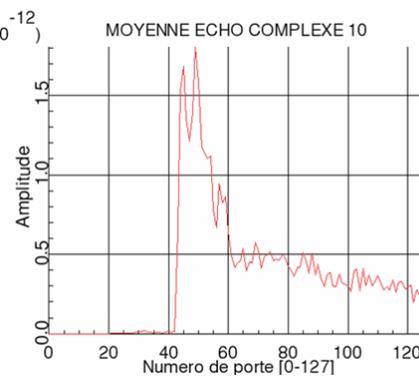
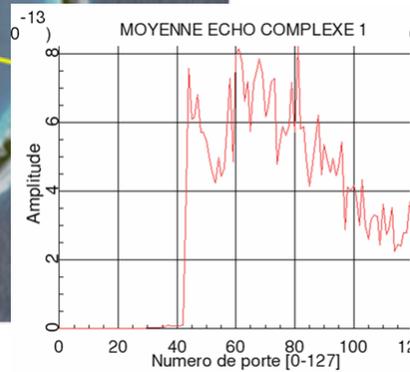


Simulation on a Pacific Atoll (2/2)

Envisat Echos



Simulated Echos



Thank you