Making coastal altimetry happen: a prototype Envisat processor from the COASTALT Project

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The COASTALT Project, funded by the European Space Agency (ESA), aims at defining, developing and testing a prototype software processor to generate new Envisat radar altimeter products in the coastal zone. Ultimately, the plans are for ESA to routinely generate and distribute these new Envisat coastal altimetry products, also in preparation for exploitation of data from the future altimetry missions, CryoSat and Sentinel-3. These missions will have inherently improved coastal zone capabilities by virtue of the adoption of a Delay-Doppler instrument. Whilst paving the way to this overall objective, the COASTALT partners also aim to:

a) carry out an extensive study of the possible improvements in geophysical corrections in the coastal zone, and identify the best correction strategies
b) revisit the whole approach to waveform retracking, by assessing the capabilities of geophysically-based retrackers in the coastal ocean, testing novel retracking schemes and strategies, identifying the best candidate strategy for immediate operational application and producing a fully usable prototype of that retracker, while at the same time seeding the research into the next generation or retrackers for Sentinel-3
c) assess the performance of the new retracked products over three coastal regions with different characteristics, where a host of in situ measurements are available for validation
d) provide full documentation on the new product in a way that is consistent with – and can be integrated with – the Envisat User Handbook
e) contribute to capacity building, outreach and dissemination of coastal altimeter data to a wider user base.

In this paper we will illustrate the research and development that has gone into points a) and b), leading to the design of the coastal altimetry processor. First we discuss the different possible approaches to deal with the problem of geophysical corrections in the coastal zone, including the assessment of models of the wet tropospheric correction, the use of GPS-meteo observations and Global Ionosphere maps from GPS tomography, and the use of regional models for the inverted barometer correction and for high frequency and tidal de-aliasing. Then we illustrate and discuss the various options for coastal waveform retracking, and describe the current plans for the design of the coastal altimetry processor to be implemented within COASTALT. Results of an in-depth analysis of Envisat waveforms in two coastal regions are guiding the definition of the retracking algorithms, and the work on corrections has driven the design of the architecture of the processor.