How kilometric sandy shoreline undulations correlate with wave characteristics: preliminary analysis

Déborah Idier, Albert Falqués

How kilometric sandy shoreline undulations correlate with wave characteristics: preliminary analysis

D. Idier[1] and A. Falqués[2]

[1] BRGM, Orléans, France. d.idier@brgm.fr
[2] Applied Physics Department, UPC, Barcelona, Spain. albert.falques@upc.edu

1. Introduction

Sandy coasts are characterized by many rhythmic patterns like, for instance, cusps (metric scale), megacusps (hundreds meters) or shoreline sandwaves (kilometric scale). The processes involved in the formation of such shoreline patterns have already been analysed, by field observation and/or modeling. Cusps and megacusps would be mainly related to surf zone processes, whereas shoreline sandwaves would be strongly controlled by shoaling area processes (Falques and Calvete, 2005).

These kilometric scale patterns has been widely studied, mainly based on modeling approaches. It seems that many of these patterns are due to coastline instability under high angle wave incidence (Ashton et al, 2001), which has been called HAWI (High Angle Wave Instability). HAWI may provide an explanation for the self-organized formation of some shoreline sand waves which are reported in the literature (e.g. Davidson-Arnott and van Heyningen, 2003). However, it is still not clear if the observed shoreline sandwaves result from the HAWI processes. Recent model experiments allow proposing a scaling such that the shoreline wavelength of high angle wave instabilities can be expressed as a function of surface wave wavelength and beach slope (van den Berg, 2012). Besides, only few data analyses of such kilometric patterns have been done. If done, most of them considered one single site.

2. Research under way

The present study aims at investigating kilometric sandy coastline undulations in a wider geographical perspective and at seeing how these undulations correlate with wave and bathymetric parameters.

First, a preliminary database is presented, made of about 40 sites characterized by kilometric undulations of sandy coasts. Second, the method and data are described. Then, as an example, the correlations between shoreline undulations, wave and bathymetric parameters are analysed. These results are discussed regarding the scaling issued from modeling investigations (van den Berg, 2012), as well as the theories of shoreline sandwave formation. ndeed, from numerical investigations on HAWI s, van den Berg (2012) proposed the following relationship between the shoreline wavelength and the wave and beach characteristics.

$$\lambda_y = L_0 / \beta \qquad (1)$$

with λ_y the shoreline wavelength, L_0 the deep water wavelength of waves and β the mean beach slope from shore to the wave base.

Furthermore, a HAWI linear stability model will be applied on some of the selected sites in order to confirm / infirm that the observed shoreline sandwaves could result from HAWI mechanism.

Figure 1: Map of a part of potential HAWI locations.

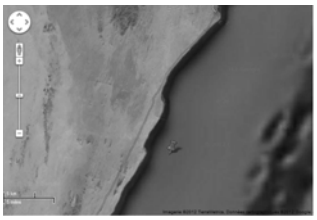

Figure 2: Example of a potential HAWI location, Oman.

Acknowledgments

Funding from BRGM, the Carnot institution and the Spanish government (CTM2009-11892/IMNOBE project and TM2006-08875/MAR project), are acknowledged. The authors like also to thank D. Calvete and N. Van den Berg for fruitful discussions.

References

Ashton, A., A. B. Murray, and O. Arnault (2001), Formation of coastline features by large-scale instabilities induced by high-angle waves, *Nature*, 414, 296 300.

Davidson-Arnott, R. G. D., and A. van Heyningen (2003), Migration and sedimentology of longshore sand waves, Long Point, Lake Erie, Canada, *Sedimentology*, 50, 1123 1137.

Falqués, A., and D. Calvete (2005), Large scale dynamics of sandy coastlines: Diffusivity and instability, *Journal of Geophysical Research*, 110, C03007, doi:10.1029/2004JC002587.

van den Berg, N. (2005), Modelling the dynamics of large scale shoreline sand waves. PhD Thesis, Applied physics department, Universitat Politecnica de Catalunya (2012).