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Vulnerability of sandy coasts to climate change and anthropic pressures: methodology and preliminary results

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1-INTRODUCTION

Climate change is considered in the latest reports of the Intergovernmental Panel on Climate Change IPCC (2007) as unequivocal. Induced vulnerability of the system is defined as "the combination of sensitivity to climatic variations, probability of adverse effects, and adaptive capacity". Substantial methodological challenges remain, in particular estimating the risk of adverse climate change impacts and interpreting relative vulnerability across diverse situations. As stated by the IPCC, the "coastal systems should be considered vulnerable to changes in climate". In these areas, amongst the most serious impacts of sea-level rise (Nicholls, 1996) are erosion and marine inundation. Thus, the coast of metropolitan France, being composed of 31% sandy coasts, is potentially vulnerable, as it has been qualitatively assessed on the pilot coasts of Aquitaine and Languedoc-Roussillon in the RESPONSE project (Vinchon et al., 2008).

Within the ANR VULSACO project (VULnerability of SAndy COast to climate change and anthropic pressure), the present day erosion tendencies as well as the potentially future erosion trends are investigated. The main objectives are to: (1) assess indicators of vulnerability to climate change for low-lying linear sandy coastal systems, from the shore to the hinterland, facing undergoing climate change and anthropic pressure until the 2030s; and (2) identify the aggravating or improving effect of human pressure on this vulnerability. This second issue is sometimes considered as a main driver of coastal risks. The methodology proposed in the project considers anthropic adaptation (or not) by putting decision makers in front of potential modifications of the physical system, to study the decision process and the choice of adaptation (or not).

The coastal system is defined by its morphology, its physical characteristics and its land use. The time scales will range from short-term (days to weeks, e.g. time scale of extreme events) to medium-term (decades), whereas the space scales range from several tens of meters to several tens of kilometers. The project is based on the study of representative coastal units: 4 sites characterised by low-lying linear sandy beaches but different, representative, hydrodynamic and socio-economic environments. These sites are located in: Mediterranean Sea (Lido of Sète), Atlantic coast (Truc Vert beach and Noirmoutier island) and English channel coast (Est of Dunkerque). Each of these sites is studied following the same methodology, on both the physical and socio-economic dimensions, the aim being to identify vulnerability indicators regarding climate change and anthropic pressure.

2 - METHODOLOGY

The work is based on the following methodology, for every site:

1) The compartments of the unit are defined: shoreface, coastline, backshore, hinterland, from a physical and socio-economical point of view.

2) The available data are analysed in order to provide some information on the present trend of the coastal unit, regarding climate change and anthropic pressure, but also to support the model validation.

3) The vulnerability is studied. On one hand, the socio-economic dimension is assessed and, in a risk governance perspective, stake holders are identified and involved. This part of the project combines the study of social perceptions of dangers along with a deliberative workshop. On the other hand, numerical models of the physical behaviour of shoreface and coastline are applied. The selected models cover a time scale from short-term (storm time scale) to long-term (decades). Then, vulnerability can be studied: the vulnerability of coast/beach is defined and studied based on in-situ observations and model results. Most of these models needs some forcing conditions (waves at the boundary of the computational domains for instance). The present day conditions can be potentially

modified by climate change. However, the model and literature review on climate change show that the few prediction of wave conditions available for the future deal mainly with the significant wave height, and not so much with the wave direction or period. To compensate this lack of knowledge, a sensitivity study is done to get information on the possible changes within the next decades (2030). It consists in studying the influence of a modification in the characteristics of the present day forcing conditions(like waves) within a reasonable magnitude order.
4) The anthropic pressure is taken into account as a modulator of the physical vulnerability. In each context, participative techniques are used to involve representatives of the main stakeholder groups into decision-making simulations. The scenario of a storm in 2030 is adopted to provide structured interactions during the workshop. Along with socio-economic projections, this simulation relies upon a fictive journal article written on the basis of the model outputs. These methodological choices aim at better understanding how decisions are made by stake holders dealing with risks and scientific uncertainty.

Some applied results on the study sites will be presented at the EGU.

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