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Coastal vulnerability: climate change and natural hazards perspectives

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Introduction
Studying coastal zones as a territorial concept (Integrated coastal zone management) is an essential issue for managers, as they have to consider many different topics (natural hazards, resources management, tourism, climate change…). The recent approach in terms of "coastal vulnerability" studies (since the 90's) is the main tool used nowadays to help them in evaluating impacts of natural hazards on coastal zones, specially considering climate change. This present communication aims to highlight the difficulties in integrating this concept in risk analysis as it is usually practiced in natural hazards sciences.

1) Coastal vulnerability as a recent issue
The concept of coastal vulnerability mainly appears in the International panel on climate change works of 1992 (IPCC. 2001), where it is presented as essential for climate change adaptation. The concept has been defined by a common methodology which proposes the assessment of seven indicators, in regards to a sea level rise of 1m in 2100: people affected, people at risk, capital value at loss, land at loss, wetland at loss, potential adaptation costs, people at risk assuming this adaptation. Many national assessments have been implemented (Nicholls, et al. 1995) and a global assessment was proposed for three indicators (Nicholls, et al. 1999). The DINAS-Coast project reuses this methodology to produce the DIVA-tool for coastal managers (Vafeidis, et al. 2004). Besides, many other methodologies for national or regional coastal vulnerability assessments have been developed (review by (UNFCCC. 2008).
The use of aggregated vulnerability indicators (including geomorphology, hydrodynamics, climate change…) is widespread: the USGS coastal vulnerability index is used worldwide and was completed by a social vulnerability index (Boruff, et al. 2005). Those index-based methods propose a vulnerability mapping which visualise indicators of erosion, submersion and/or socio economic sensibility in coastal zones.
This concept is a great tool for policy makers to help managing their action and taking into account climate change (McFadden, et al. 2006). However, in those approaches, vulnerability is the output itself (cost of effective impacts, geomorphologic impacts…), but is not integrated it in a risk analysis. Furthermore, those studies emerged from a climatic perspective, which leads to consider climate change as a hazard or pressure whereas risk studies commonly consider hazards such as erosion and flooding, where climate change modifies the drivers of the hazard.

2) The natural hazards and socio economic perspectives
In order to reduce impacts of natural hazards, decision makers need a complete risk assessment (probability of losses). Past studies on natural risks (landslide, earthquake...) highlighted the pertinence of defining risk as a combination of : (1)hazard occurrence and intensity, (2) exposition and (3)vulnerability of assets and population to this hazard (e.g. Douglas. 2007, Sarewitz, et al. 2003).
Following the Renn and Klinke risk assessment frame, high uncertainties associated with coastal risks considering climatic and anthropic change highlights the importance of working on that concept of "vulnerability" (Klinke and Renn. 2002).

Past studies on vulnerability assessment showed a frequently mentioned gap between "impact based" and "human based" points of view. It is nowadays a great issue for natural risk sciences. Many research efforts in FP7 projects such as MOVE and ENSURE focus on integrating the different dimensions of vulnerability (Turner, et al. 2003, Birkmann. 2006).
Coastal risk studies highlight another issue of concern. We previously detailed the different use of the term

"vulnerability" in the coastal context, quite different of the "natural risk's" use. Interaction of social, economic and physical sciences is considered within two french research projects (Vulsaco, Miseeva), in order to identify the vulnerability of a system to flooding or erosion (i.e. its characteristics that create potential harm), and integrate them in a risk assessment. Global change is considered by modifications of hazard, anthropogenic pressure and exposition, in order to point out possible modification of vulnerabilities.

3) Learning from both perspectives

Coastal vulnerability in its "end in itself" and climate change dimension is a widespread tool for decision makers but it can be inadequate when vulnerability is a component of risk.

This is mainly due to the consideration of climate change as a "hazard", so that coastal vulnerability is seen as the possible adverse impacts of climate change. As a matter of fact, this concept is clearly well considered by managers, who feel deeply concerned by climate change.

However, coastal risk managers would gain in considering climate change more like a driver able to modify existing hazards than like the pressure in itself. Using this concept could lead to new perspectives of coastal risk mitigation for decision makers (social vulnerability, risk perception…), learning from other disciplines and sciences thanks to research projects such as MOVE (FP7).

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