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Use of the Source – Pathway – Receptor – Consequence Model in Coastal Flood Risk Assessment

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ABSTRACT
Coastal flood management has become a topic of great relevance in the recent past due to a combination of accelerated sea-level rise and storminess associated with climate change and a continuing increase in the value of natural and anthropogenic coastal assets. The conflict of interest between the value of our coastal assets and the costs of protecting them is, at present, largely resolved with the help of risk-based analyses.

In the past decade or so, systems-based approaches to risk assessments have been developed that attempt to understand relationships within the coastal system at a broad scale rather than at the level of individual components (Sayers, Hall & Meadowcroft, 2002; Townend, 2003). One common framework for this type of analysis is the Driver-Pressure-State-Impact-Response (DPSIR) model (e.g. Wheater et al., 2007; EEA Integrated Assessment Portal, 2007). For coastal flooding however, the Source – Pathway – Receptor – Consequence (SPRC) model is believed to provide a better instantaneous representation of the physical flooding process with regard to the propagation and consequences of a particular flood event and has been used in several recent coastal flood risk assessment studies (Bakewell & Luff, 2008; Thorne et al., 2007; FLOODsite Consortium, 2009). The main strengths of this model lie in its simplicity, inherent flexibility and ability to capture system linkages during a flood event. Though widely cited, there is however hardly any literature that describes the manner in which this conceptual model is used to shape flood propagation and risk evaluation studies. It is felt that the SPRC model in its current form is weak and not being implemented to its full potential. The ongoing EU project 'THESEUS: Innovative Coastal Technologies for Safer European Coasts in a Changing Climate' aims to address both the human and ecological consequences of a flood event and proposes use of the SPRC model as the basis for integrating these aspects in terms of coastal flood management while providing a systems overview of the flood propagation process (Hanson, 2010). In order to achieve this, it is essential that the SPRC framework be modified and strengthened as a conceptual model in order to enable representation of the various coastal systems within the scope of the study.

This paper describes the SPRC model delineating its strengths and weaknesses in its current form. The relationship of SPRC to other systems-based risk models such as the DPSIR model is discussed and suggestions are made with regard to building on SPRC with inputs from the DPSIR model in order to obtain a more comprehensive systems model. A systems diagram based on the SPRC concept is proposed as an initial step in representing the state of the coastal flood system. The systems diagram is built starting with the sources, through the various physical elements of interest to the outermost entities of the defined system. The main advantage of the proposed diagram is that any element, natural or artificial, may be picked out as a receptor, thereby automatically designating the role of 'pathway' to all elements linking it to the sources of the event. Such a system diagram affords a very good overview of the various elements and linkages that have been recognised in the study and as such, constitutes an effective and intuitive conceptual model. Once built, such a model may be used to characterise any flood event that falls within the defined boundaries of the study at any resolution. Using the SPRC framework as described above system diagrams are built for two sites being studied in the EU THESEUS project. Based on these, suggestions are made to help improve the conceptual model and provide a strengthened basis for comprehensive integrated coastal flood risk assessments for different coastal systems.

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