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Introduction to RISC-KIT: Resilience-increasing strategies for coasts

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A B S T R A C T

Recent and historic low-frequency, high-impact events have demonstrated the flood risks faced by exposed coastal areas in Europe and beyond. These coastal zone risks are likely to increase in the future which requires a re-evaluation of coastal disaster risk reduction (DRR) strategies and a new mix of PMP (prevention, e.g., dike protection; mitigation, e.g., limiting construction in flood-prone areas and eco-system based solutions; and preparedness, e.g., Early Warning Systems, EWS) measures.

In response to these challenges, the RISC-KIT project has delivered a set of open-source and open-access methods, tools and management approaches to reduce risk and increase resilience to low-frequency, high-impact hydro-meteorological events in the coastal zone (the "RISC-toolKIT"). These products enhance forecasting, prediction and early warning capabilities, improve the assessment of long-term coastal risk and optimise the mix of PMP-measures.

In this paper an introduction is provided to the objectives, products, applications and lessons-learned of the RISC-KIT project, which are the subjects of this Special Issue. Subsequent papers provide details on the tools and their application on 10 case study sites in Europe.

1. Introduction

Recent and historic storm events have demonstrated large impacts on coastal zones in Europe. Among these events are the 2010 Xynthia storm in France (Kolen et al., 2010; Garnier and Surville, 2010; Lumbroso and Vinet, 2011; Bertin et al., 2012), the 2013 Xavier/St. Nicholas storm in North-West Europe and the 2015 St. Agatha storm in the Adriatic (Perini et al., 2015), as well as historic events such as the 1953 Flood in Northwest Europe (Baxter, 1953; Gerritsen, 2005), the 1962 Floods in Hamburg and the 1872 flood in Kiel Fjord (WSB, 2015), and older events such as the 1775 storm studied by Baart et al. (2011).

Coastal risk as a result of hydro-meteorological events is likely to increase due to two effects: 1) because of predicted climate change the *hazards* of sea level rise and coastal flooding (due to marine storms and fluvial run-off) may increase; and 2) on-going coastal development will increase the *impact* (or consequences) of these events. Without adaptation, flood damage on European coasts will increase up to 17 billion Euros per year (IPCC, AR 2015). These issues are not limited to Europe, as 10% of the world's population (600 million) lives in coastal areas with an elevation lower than 10 m above sea level (McGranahan et al., 2007). Worldwide, without adaptation, 0.2–4.6% of the global population is expected to be flooded annually in 2 100 under 25–123 cm of global mean sea-level rise, with expected annual losses of 0.3–9.3% of the global gross domestic product (Hinkel et al., 2014).

With this view of the future, coastal authorities need to assess the level of impact and the risk in their coastal zones, and implement Disaster Risk Reduction (DRR) measures to prevent or mitigate coastal disasters. To facilitate risk reduction, the UNISDR (2015) formulated the Sendai Framework for Action, and the EU has issued the Floods Directive in 2007. However, both these frameworks are not specific for coastal hazard and impact issues and do not provide appropriate tools to analyse risks. Therefore, methods to identify hotspots of risk and to assess the effectiveness of DRR measures in coastal zones have to be developed to guide effective disaster risk prevention and management. However, in order to

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reach that goal, a number of questions need to be addressed:

- Where on the coast are areas (or "hotspots") of higher risk located? What are the areas that are to be prioritized?
- What was the impact of past storms and what may be the impact of future coastal hazard scenarios?
- What are effective and (socially) acceptable DRR measures at a hotspot?
- How can DRR measures best be implemented, given the available resources?
- What are the socio-cultural and historic aspects of DRR measures? How do they influence risk assessment and management at regional scales?
- Can a generic approach be applied across Europe, in both data-rich and data-poor environments?

The RISC-KIT project has developed methods, tools and approaches to help answer these questions. RISC-KIT was an EU-funded project with 18 partners across Europe and coordinated by Deltares, The Netherlands (Van Dongeren et al., 2014; www.risckit.eu).

The RISC-KIT toolkit, publically available as free-ware or open-source, comprises five tools. In this Special Issue, all tools and examples of their application on 10 case study sites in Europe are presented and discussed. In this way, we hope that potential users will gain insight into the theory behind and the potential applicability of these products on their coasts. In this paper, the components of the toolkit and their application on 10 case study sites in Europe will be introduced and reference will be made to subsequent papers in this special issue. In addition, we discuss the lessons learned from the project with recommendations for further research.

2. The RISC-KIT toolkit

2.1. RISC-KIT tools in the disaster management cycle

The RISC-KIT toolkit is comprised of five elements, which are the

1) Storm Impact Database
2) Coastal Risk Assessment Framework (CRAF)
3) Web-based Management Guide
4) Hotspot Tool for DRR assessment, Early Warning and Decision Support (EWS/DSS)
5) Multi-criteria Assessment (MCA)

These tools can be plotted on the Disaster Management Cycle (Fig. 1). This cycle describes the stages of action that take place after a disaster has occurred. First, there is the immediate Response such as emergency relief, then follows a phase of Recovery in which the affected area is

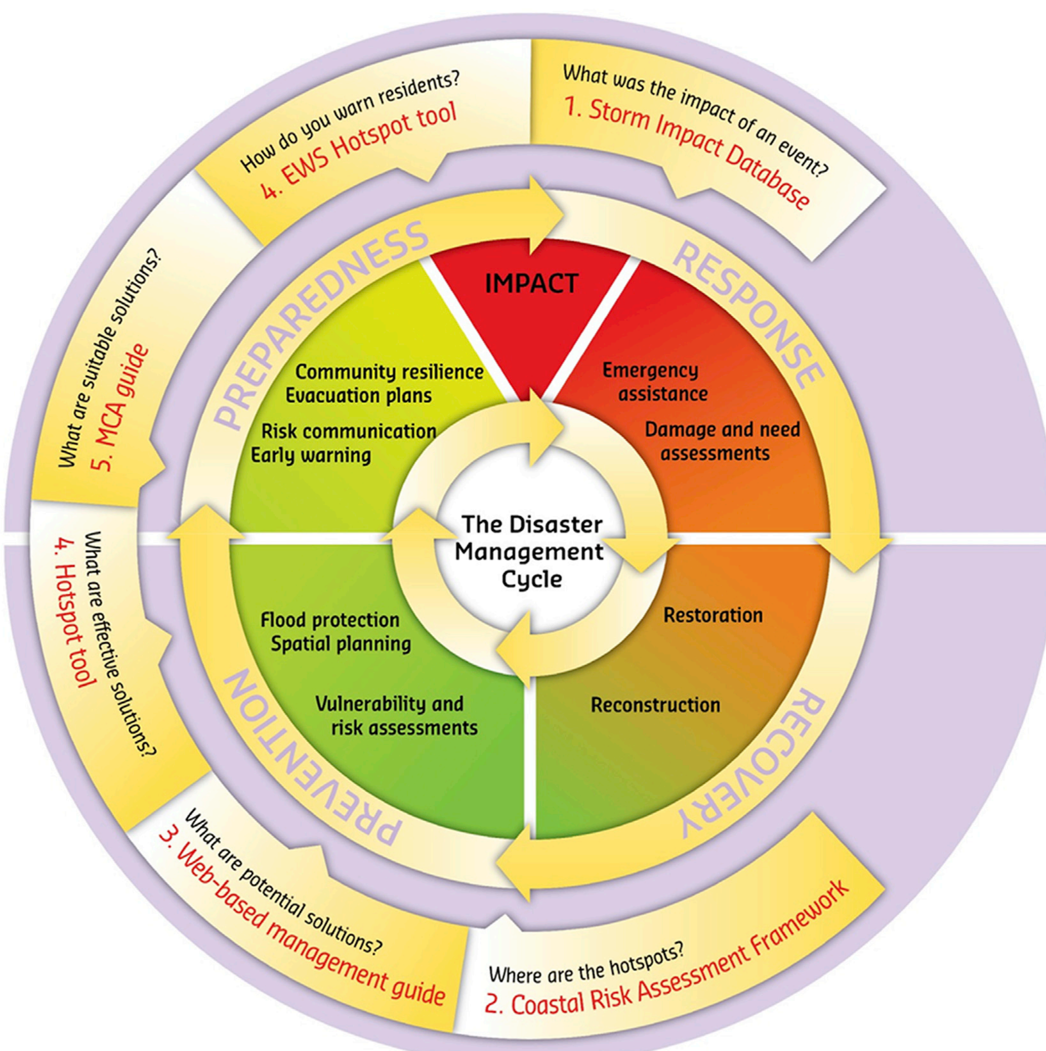

Fig. 1. The Disaster Management Cycle, describing the Response, Recovery, Prevention and Preparedness stages, and the place of the RISC-KIT tools in this cycle (figure adapted from an original by and courtesy of C. van de Guchte, Deltares).