Snowball

Lower the impact of aggravating factors in crisis situations thanks to adaptive foresight and decision-support tools

D6.2 : Decision Algorithm (version 2)

For the attention of the Research Executive Agency

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Snowball aims at lowering the impact of aggravating factors in crisis situations thanks to adaptive foresight and decision-support tools.

The project runs from March 2014 to February 2017, it involves 11 partners and is coordinated by Gedicom.

More information on the project can be found at http://www.snowball-project.eu.

Abstract

The present deliverable documents the progress achieved by task 6.2 in correspondence of M30 milestone, describing the Decision Algorithm (D6.2) as a software module of the comprehensive Snowball Decision Support System. To this end, the document – after a short summary of the methodological choices and design principles illustrated in D6.1 – describes the final version of the algorithm, focusing on its relation with the evaluation of cascading effects performed by the cascading effects model of WP3 and the coupled grid simulation tool of WP5 and its capacity of dealing with uncertainty, obtained through an ensemble approach. The software design of the core algorithm is provided, together with the description of the data exchange process *among the modules of the Snowball DSS and the implementation of a simple Graphical User Interface to show the results to the end user. In the last section, we provide a concrete description of the use of the Decision Algorithm as a tool to compare preparedness and mitigation strategies in the context of a volcanic eruption with cascading effects in the pilot site of the Santorini Island. In the conclusions, we also illustrate the application of the Decision Algorithm to other pilot sites as a tool to compare mitigation strategies on grids.*

Executive summary

The Snowball project is an ambitious research project aimed at increasing the preparedness of civil protection bodies and local authorities in the context of crises characterized by cascading effects, by means of the development of a Decision Support System (DSS) for crisis managers. Through the Cascading Effects Model developed in WP3 and the Coupled Grid Simulation Tool defined in WP5, the user of the DSS is able to simulate the impacts of preparedness and mitigation strategies in a crisis with cascading effects and to visualize them in the Cascading Effects Dashboard. The choice of the most appropriate preparedness and mitigation strategies is rendered particularly challenging by the evaluation of cascading effects, which introduce an additional level of uncertainty as well as a stronger dependence of the impacts on the timing of the intervention. Therefore, the Decision Algorithm, as a core component of the Snowball DSS, is aimed at supporting the decision maker in the comparison and choice among mitigation and preparedness strategies, relying on a simulation of a crisis with cascading effects. In accordance with the methodological choices of D6.1 'Decision Algorithm (version 1)', the Decision Algorithm is based on a Multi-Criteria Decision Making (MCDM) approach. More specifically, it combines the ranking approach of ELECTRE III and the class assignment of ELECTRE TRI. The Decision Algorithm applies these algorithms on top of the event tree modelling of WP3, starting from a hazard chain, and considering a single preparedness measure evaluated at different timings as different alternatives of the Multi-Criteria analysis. In this way, it supports the decision maker in the choice of the best timing of the intervention, a crucial factor when cascading effects are evaluated. Then, an ensemble approach allows to take into account different impact scenarios for the decision process, rather than an average impact scenario, computing a ranking and a class assignment distributions, which convey a proxy of uncertainty of the outputs to the decision maker. It is important to remark that the Decision Algorithm works in the pre-crisis phase and it is supposed to be used for better planning and training, rather than for operational decisions in real-time.

In Section 1, we introduce the Snowball DSS and we specify the functions of the Decision Algorithm, as well as the context of its utilization.

In Section 2, we report the most relevant related work in terms of Decision Support Systems for disaster management, with a specific focus on related European research projects.

In Section 3, we first summarize the Cascading Effects Model of WP3 and the Coupled Grid Simulation Tool of WP5 and then we describe in detail the Decision Algorithm.

In Section 4, we provide the details of the technical implementations of the Decision Algorithm, describing how it exchanges data with other components of the Snowball project, what are its requirements and the cloud infrastructure on which it runs and how it is integrated in the dashboard.

In Section 5, we show a concrete example of the use of the Decision Algorithm as a tool to compare preparedness and mitigation strategies for the pilot study of the volcanic eruption with cascading effects in the island of Santorini.

In Section 6, we report the next steps still to be achieved for the actual testing of the Decision Algorithm in the pilot studies.

In Section 7, we briefly summarize the document and report the conclusions.

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