

Evaluation of emergency protocols using agent-based approach

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ABSTRACT

Integrated flood risk management involves a large portfolio of options for mitigating risks that includes hard and soft structural, non-structural, and recovery responses. Non-structural responses include flood warnings, emergency services supported by individuals, collective actions and the use of resistance and resilience measures. Sufficient flood warning time, appropriate actions at desired locations and time are essential for effective and beneficial responses. From this perspective beside the management of the crisis itself, the level of preparedness including the evaluation of plans involving such responses (e.g. emergency protocols) also needs to be sufficient and, thus in the context of various event scenarios.

The emergency protocol can be easily represented by the functional modelling of its different operations whereas the emergency services or volunteers and their coordination can be represented using agent-based systems. This poster presents the development of such a model using the NetLogo software platform. Each action of the emergency protocol is represented by a located agent and ruled by the following overall location-action procedure driving the actions of professionals: "Triggered by an event A, a location is requiring X persons to accomplish an ACTION in T minutes before an event B and to report the action". A specific valuation of the success or the failure of each action allows analysing the outcomes of the model under different scenarios.

The model has been developed on the basis of an existing protocol and discussions with the authorities of an Italian municipality and tested for different flood return periods using synthetic scenarios to simulate the river level. The volunteer movements and the progress of each action can be visualized on a map interface and followed in the command centre interface situated at the bottom of the screen to facilitate the interpretation, the validation and the discussion of the outcomes of the protocol in a given situation. The model can also be run multiple times to analyse a protocol under resource constraints. As such each flood synthetic scenario were tested by incremental increases of one-unit of volunteer. Such analysis allows assessing the minimum number of volunteers required to perform the protocol.

Keywords

Disaster operations management, response resource allocation planning, emergency protocol, agent-based modelling.