

# Disaster scenarios under the purview of discrete mathematical modelling

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## Disaster exercise scenarios

Exercise scenarios are the descriptions of the conditions under which the crisis management system or crisis management policy to be designed, tested or evaluated as well as emergency personnel to be trained is assumed to perform.

To this end, an exercise scenarios specifies a possible, but not necessarily probable, **context** (description of the environment the crisis takes place in) and series of events (**crisis**), leading to a particular set of outcomes.

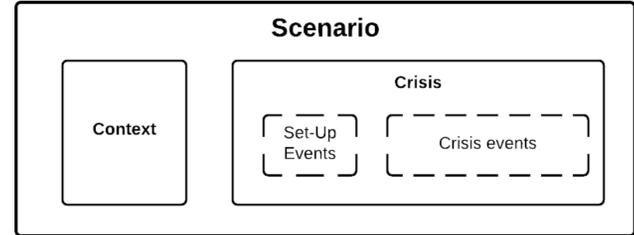


Figure 1: Structure of a crisis scenario

## Scenario properties

Changing the properties of a scenario allows scenario designers to introduce new goals as well as to reproduce different crisis characteristics.

Examples:

- ▶ Scenario scope
- ▶ Scenario length
- ▶ Scenario duration
- ▶ Order of events
- ▶ Temporal spacing of events
- ▶ Geographic spread of events
- ▶ Visibility of events

## Components of modelling framework

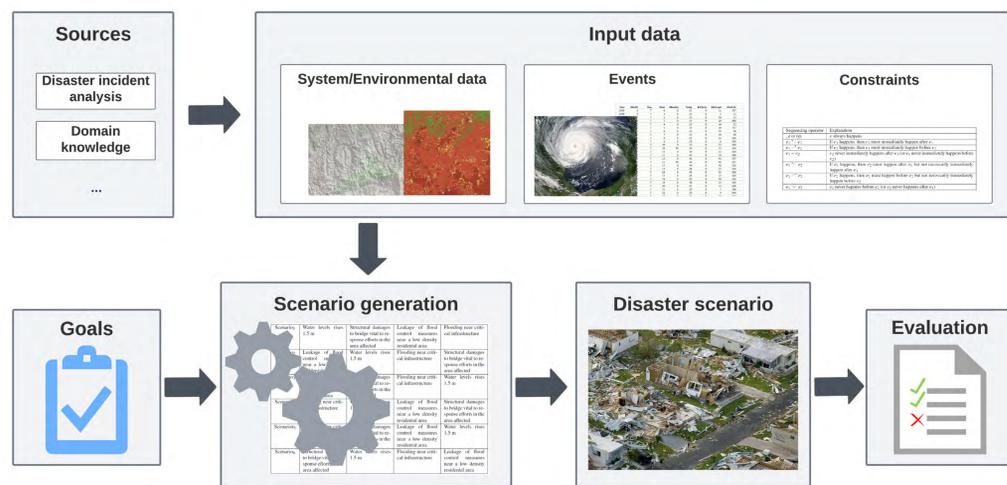


Figure 2: Components of a crisis scenario

## Scenario requirements

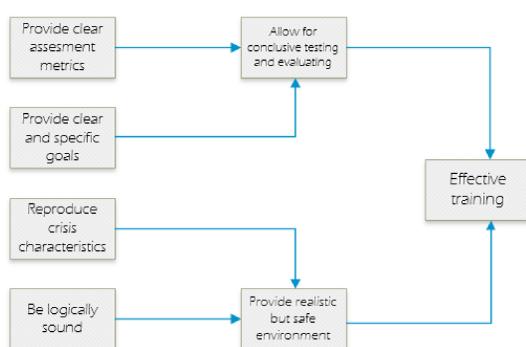


Figure 3: Scenario requirements

## Disaster Incident Analysis via Algebra Stories

The information extracted from post-disaster reports by Natural Language Processing (NLP) can be significantly enhanced by considering the text also as an algebra story which enables the identification of additional knowledge obtained with the help of computer algebra systems that will subsequently be stored in a knowledge base (e.g., Structured Scientific Knowledge Representation object).

This knowledge base is the starting point for further analysis of all the extracted information. For example, it can be used in the generation of disaster scenarios for evaluating different disaster response management strategies.



Figure 4: Incident analysis workflow

## Future Work

- ▶ Modelling and analysis of historical disasters.
- ▶ Improve and strengthen knowledge gathering via NLP, math extraction and subsequent data computation.
- ▶ Evaluation of different mathematical structures and methods for the generation of disaster scenarios.
- ▶ Integration of our scenario models in crisis management.