

# Tracing how disaster impacts escalate will improve emergency responses

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Eyjafjallajökull volcano in Iceland. Credit: rachelcifelli

Mapping common pathways along which the effects of natural and man-made disasters travel allows more flexible and resilient responses in the future, according to UCL researchers.

Naturally occurring extreme [space weather events](#) or man-made cyber security attacks affect [critical infrastructure](#) through shared points of vulnerability, causing disasters to cascade into scenarios that threaten life and the global economy.

"We're quite good at responding to high-frequency threats, such as

floods, but aren't well equipped to deal with risks that indirectly cause loss of life," explained lead author Ph.D. candidate, Gianluca Pescaroli (UCL Institute of Risk & Disaster Reduction).

"It's often the knock-on effects rather than the initial event that threaten life as access to technology that provides electricity, food and clean water is compromised. We've developed a strategy to test disaster preparedness and increase our response to unknown, complex, high-impact, low-probability events."

In a new study, published today in a special issue of *Safety Science* and funded by the European Commission and UCL, a team of researchers from UCL Cascading Disasters Group and University of Bologna propose a scenario mapping approach called M.OR.D.OR – 'Massive, Overwhelming Disruption of Operations' – to map vulnerabilities and test emergency responses to unknown events.

"Natural hazards that lead to disasters such as volcano eruptions, tsunamis and earthquakes is very well characterised, but surprisingly little research has been done into the socioeconomic impacts and cascade pathways of disasters and how to mitigate them," said co-author Professor David Alexander (UCL Institute of Risk & Disaster Reduction).

The 2010 eruption of Eyjafjallajökull in Iceland is a good example of a cascading disaster. Some 8.5 million people were stranded by the air transportation ground-stop and many economic activities were postponed or abandoned, with huge losses. It could easily have been much worse.

The team studied two scenarios with different hazards – extreme space weather events where the Sun's activity may compromise satellite functions, including GPS, and cyber security attacks.

They found that despite the different nature of the triggers, there are common vulnerabilities are triggered similar cascading effects occur. All threats, known and unknown, that impact the same technological vulnerability pathway can result in a M.OR.D.OR scenario, meaning that highly-developed countries are susceptible.

"We called it M.OR.D.OR after Lord of the Rings as we think these events are analogous to the end of Tolkien's story when a hobbit destroys a powerful ring while a battle rages over it, thus ending the war. Often, we are distracted by the big battle, be that the flood, earthquake or ash cloud but fail to notice the very real danger of unseen, unknown events such as food supply issues or the availability of money from ATM's due to technical issues, which are the hobbit with the ring," added Gianluca.

The team now plan on deepening their knowledge of the consequences of cascading [disasters](#).

"When critical infrastructure such as electricity and water supply is cut off there are many 'consequences of consequences', and in our investigation we need to go much further down the chain of causes and effects," concluded Professor Alexander.

**More information:** G. Pescaroli et al. Increasing resilience to cascading events: The M.OR.D.OR. scenario, *Safety Science* (2018). [DOI: 10.1016/j.ssci.2017.12.012](https://doi.org/10.1016/j.ssci.2017.12.012)

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