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Resilience: the viewpoint of modern thermodynamics and information theory

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Understanding, qualifying and quantifying resilience as the system's effective performance and reserve capacity is an essential need for implementing effective and efficient risk mitigation strategies; in particular if possible synergies between different mitigation alternatives, such as active and passive measures, should be achieved.
Relevant progress has recently been made in explaining the phenomenon of adaptation from the standpoint of physics, thereby delineating the difference is in terms of physical properties between something that is well-adapted to its surrounding environment, and something that is not (England, 2013). In this context the specific role of the second law of thermodynamics could be clarified (Schneider and Kay, 1994) and the added value of information theory could be illustrated (Ulanowicz, 2009). According to these findings Ecosystems resilience in response to a disturbance is a balancing act between system's effective performance and its reserve capacity. By extending this string of argumentation, the universe of discourse encompassing the concept of resilience of socio-ecologic systems impacted by natural hazard processes, is enriched by relevant implications derived from fundamental notions of modern thermodynamics and information theory. Metrics, meant to gauge ecosystems robustness in terms of the tradeoff allotment between systems effective performance and its beneficial reserve capacities developed by Ulanowicz (2009), are reviewed and their transferability to the natural hazard risk research domain is thoroughly discussed. The derived knowledge can be explored to identify priorities for action towards an increased institutional resilience.
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