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The concept of vulnerability within the disaster management cycle - A geospatial perspective

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This paper illustrates the concept of vulnerability within the disaster management cycle from a geospatial perspective. Disaster management is widely regarded as a cyclic multi-stage concept starting with (1) a response phase after a disaster strikes, followed by (2) risk analysis and (3) mitigation efforts to minimize the impacts of future disasters. Different types of hazards such as hurricanes, tsunamis, floods, earthquakes and fires feature individual characteristics and require adapted actions in all three stages mentioned above. From a general point of view the phase of response includes first-pass impact assessment and accordingly coordinated search and rescue efforts as well as follow-on recovery and rehabilitation. Mitigating impacts of disasters starts with risk reduction and prevention measurements whereas land use management plays an important role as well as general preparedness both in terms of social and economic activities and infrastructural measures. Prediction and early warning preceding the next hazard event form the final part of this phase and at the same time start the next run of the disaster management cycle.

Risk assessment as an integral part of disaster management is composed of hazard and vulnerability analysis. Most aspects of hazard investigations have a spatial component whereas both Earth Observation data and terrestrial surveys provide essential information for delineation of potentially affected areas and monitoring influencing environmental conditions. The mere incidence of a natural event does not necessarily cause negative effects, e.g. wildfires are actually an important factor for ecosystem stability and recurring flooding often benefits riparian forests and agricultural areas. The term disaster is thus not used until impacts on social systems including human beings and associated assets (i.e. economic, infrastructural) are caused. This is where the concept of vulnerability comes into play which is defined by a set of interrelating input factors including exposure and sensitivity, initial coping capacity and social response of a system.

Public awareness and accepted residual risks are essential factors in this context of social response, system susceptibility and resilience. Analysis of documented damage records from the severe flooding event in the western part of Austria in the year 2005 confirmed that the actual impact of natural disasters is not directly related to preinstalled risk-reducing measures. Protection measures providing safe conditions until a certain threshold often lead to distorted human risk perception. Technical flood protection (e.g. levees, dams) eliminates flooding hazard up to a certain flood dimension. The residual risk of rare but very large floods is thus not perceived as such by local populations. Built-up areas are often extended to these 'risk-freed' regions without considering the residual risk. This increases the probability of high damage costs and direct impact on humans (e.g. casualties) as a consequence of flood events exceeding the protection capacities of technical measures. Active public communication can play an important role in disaster mitigation and prevention. A well informed society being aware of environmental risks and hazards and understanding that it is impossible to achieve zero risk is less vulnerable to certain natural events. This awareness may eventually reduce disaster impacts and damage costs.