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Why risk managers need information about spatio-temporal variability of natural hazards. Examples from practice

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Integrated risk management consists of risk prevention, early warning, intervention during an event and restoration/re-construction after an event. The prevention phase consists of land use planning measures with a long-term time horizon and of structural measures that sometimes have a lifespan of more than 30-50 years. In this case, it is important to analyse the long-term evolvement of natural risks due to climate changes or land use changes. Besides of this, the spatial and temporal variability of a natural hazard process during the course of an event is also important. The shift from "static" hazard and risk assessment towards a "dynamic" assessment offers benefits for improving the intervention phase in risk management. This contribution describes some examples and points out the benefits of this shift for risk management. One example is the variable disposition of small alpine catchments for runoff and its relevance for early warning. The disposition for runoff depends on the actual status of environmental variables such as soil moisture and the snowpack characteristics. A feasibility study showed how the monitoring of soil moisture and the status of the snowpack can be incorporated into a rule base for describing the temporal variability of the disposition for high runoff in alpine catchments. The study showed that this information about the system state of alpine catchments can be used to improve the assessment of the consequences of a weather forecast for risk management. Another example is the use of snowpack and weather monitoring and traffic intensity measurements for avalanche risk management on alpine roads. Here, the information about the spatio-temporal variability of the snow avalanches and the presence of vehicles can be used for improving the procedures for road closure and re-opening. Another example is the preparation of intervention plans for fire brigades and other relief units during urban floods. The simulation of the temporal evolvement of a single flood event (time horizon of 0-24 hours) provides information for the elaboration of the intervention tactic. The following questions can be answered only by knowing the temporal and spatial evolvement during an event itself: Which intervention priorities have to be set if the resources of the relief units are limited? Which early interventions could be turn out to be unhelpful because in a later step the object to be protected will be flooded anyway? What is the time available for setting up object protection measures and other flood protection measures? The most important factor to implement the theory in practice is the focus on the interlinkages between the simulation of all possible scenarios in advance (scenario techniques, analysing the time-steps in flood simulation), the monitoring system (now-casting, real-time-data), the scenarios of intervention measures and their interdependency with the hazard scenarios. The interlinkages can be set up and described with the expert system approach.