

TOWARDS OPTIMISED EARLY WARNING

DEVELOPMENTS IN SWITZERLAND

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ABSTRACT

The analysis of the flood events of 2005 and 2007 in Switzerland showed that the damage caused by natural disasters can be reduced significantly with the help of improved measures in the areas of preparedness, early warning and response. Hence, a project for the “Optimisation of Early Warning and Alerting of Natural Hazards” (OWARNA) was established, which encompasses a set of measures for improving the monitoring and forecasting of hazard events, alerting procedures, the provision of information to the authorities and public, and the training of intervention units. Considerable progress has been made on these measures over the past three years: business continuity has been adopted at the relevant federal agencies, additional monitoring and measuring units are being created, forecast models are being developed, information platforms for the authorities and public are being developed and coordination between the stakeholders is being improved. However, many of the measures (e.g. forecast systems and information platforms) are still under development and the new system has yet to be tested in an actual disaster event.

Keywords: early warning and alerting, preparedness, response, national coordination

INTRODUCTION

In the past, major natural disasters frequently prompted the reviewing and reformulation of Switzerland’s natural hazard protection strategy (e.g. 1987, 2000). Event analyses offer the opportunity to learn lessons and identify possible improvements to be made in the management of natural hazards. This was the case, for example, with event analysis of the floods of 2005: the analysis revealed that improved intervention could have reduced the losses incurred by 20% (Bezzola & Hegg, 2008). Shortly after the floods, the Federal Council initiated the project “Optimisation of Early Warning and Alerting of Natural Hazards” (OWARNA) and mandated the responsible federal authorities to implement associated measures at organisational, structural and technical levels. The context, conceptual framework, measures and results of the OWARNA project are described in this paper.

THE FLOOD OF 2005 AND ITS EVENT ANALYSIS

In August 2005, flooding, erosion, overbank sedimentation, landslides and depositions from debris flows affected large parts of Switzerland; they claimed six lives and gave rise to damage to property amounting to CHF 3 billion. In terms of the damage caused, the event was unparalleled for many decades. The event analysis, which was carried out by Swiss Federal Office for the Environment (FOEN), not only focused on the natural processes that caused the damage but also on the quality of the available hazard mapping and its implementation in land use, the effectiveness of structural protection measures and of the warning, alerting and response actions (Bezzola & Hegg, 2007).

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The analysis identified several weak points in the intervention: the lack of coordination between the responsible federal authorities resulted in the transmission of inconsistent and delayed warnings and information. Furthermore, intervention staff working at local level had difficulties in interpreting the official warnings and transforming them into the necessary rescue and relief actions. A further weak point was the limited exchange of information between crisis staff and experts specialised in meteorology, hydrology, geology and engineering at all state levels. The event analysis also identified deficits in flood warning: whereas warning systems and operation centres were well established for weather and avalanche forecasting, the flood forecasting services were not well developed.

ORGANISATIONAL FRAME

Swiss policy on dealing with natural hazards is based on the concept of integral risk management, which involves prevention, response and recovery (see Fig. 1).

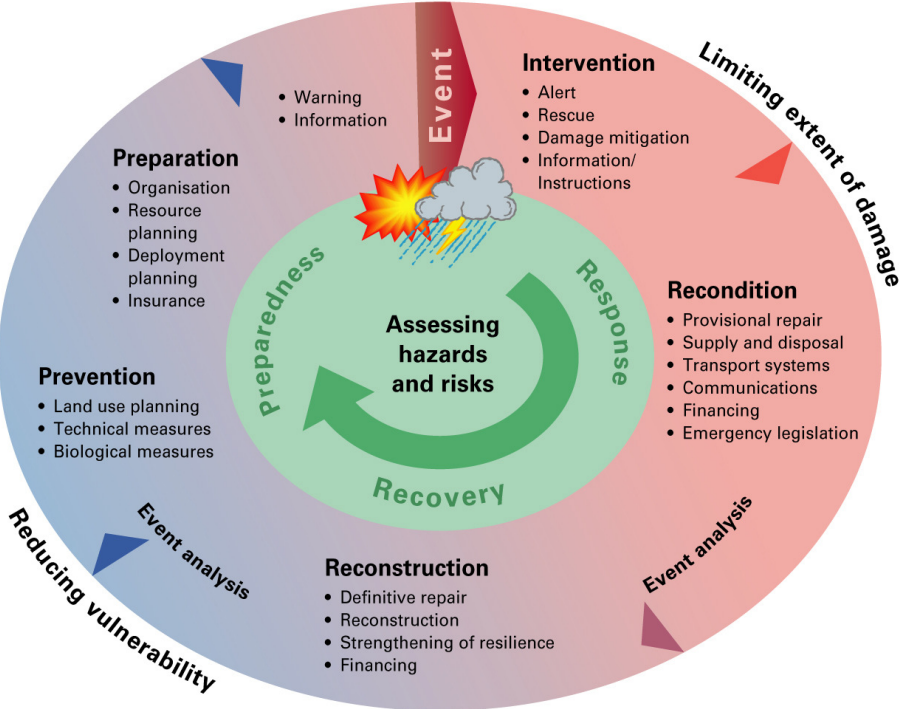


Fig. 1 Cycle of measures involved in integral risk management as defined by the Swiss Federal Office for Civil Protection FOCP.

Dealing with natural hazards in Switzerland involves the complex cooperation of various public actors organised on the three state levels along with that of private actors. Whereas leadership in the area of hazard prevention lies with the agencies specialised in natural hazards and land-use planning, the civil protection system is responsible for the preparedness and response phase of the cycle. The civil protection system consists of five partner organisations, i.e. the police, fire brigade, healthcare system, technical services and the protection and support service. However, in the case of emergency management, the rescue and relief units rely on information and early warning provided by the specialist authorities.

Tasks are also shared between the different levels of the state. Responsibility for legislation and the formulation of natural hazard management policy lies with the Confederation and federal authorities, which also provide financial support to the 26 cantons and are responsible for warning and alerting the population and authorities in the case of a natural hazard event. The cantons are responsible for the enforcement of the federal laws, for contingency planning and for cantonal emergency management. The communes are responsible for the planning and implementation of preventive measures and also have to deal with natural hazard events on-site.

Private actors are also involved in all phases of integrative risk management. Recovery measures, in particular, are assigned to the private sector. Land-owners are also involved in the implementation of preventive measures and are bound to take precautionary measures to reduce damage in the case of an emergency.

THE CONCEPT OF RESPONSE

Response is considered an essential means of reducing the risks posed by natural hazards. However, response actions need to be carefully prepared in order to be successful. This approach includes the planning and preparation of temporary measures (for example the construction of sandbag barriers or protective dams), regular training drills and rehearsals, the training of rescue staff, and the provision of the necessary financial resources. The preparedness and response phases are connected in a “warning and alerting chain” (see Fig. 2): each element is indispensable and contributes to the functioning of the entire system. In accordance with the sharing of tasks between the Confederation and the cantons, the responsibility for response operations lies with the emergency management units and the cantonal civil protection authorities. The specialist agencies at national level provide hydrological and meteorological forecasting and warnings and inform the authorities and the population. High quality and timely warnings and alerts enable both intervention staff and private individuals to safeguard human life and material assets against the effects of natural disasters.

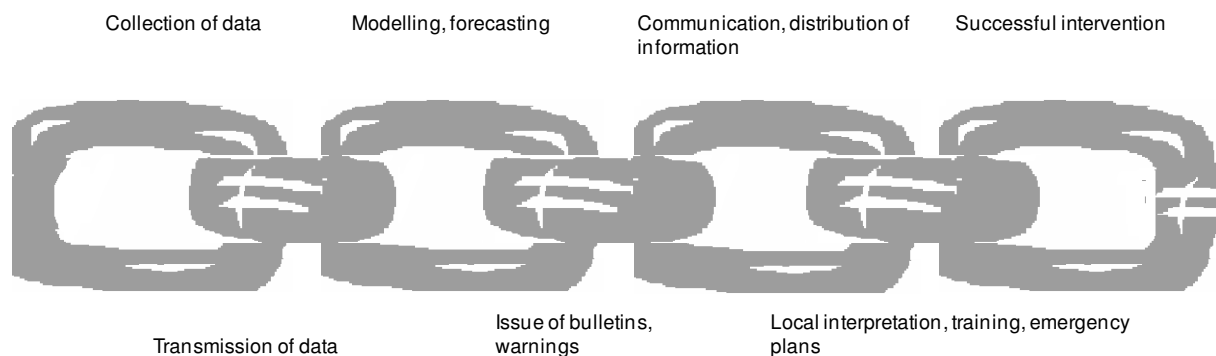


Fig. 2 A functioning warning and alerting chain contributes to a successful response.

OPTIMISATION OF EARLY WARNING AND ALERTING OF NATURAL HAZARDS

Shortly after the floods of 2005, the Federal Council initiated the project “Optimisation of Early Warning and Alerting of Natural Hazards” (OWARNA) at national level and mandated the responsible federal authorities to take following measures:

- Provision of 24-hour flood forecasting and specialist advisory services in the case of a flood event by the Federal Office for the Environment, which is responsible runoff prediction and flood control at national level.
- Guaranteeing of emergency power supply for warning and alerting systems (Federal Office for Civil Protection).
- Improvement of weather and flood forecasting models to ensure the availability of very reliable data with high spatial and temporal resolution. These developments have to be carried out by the Federal Office for the Environment and the Federal Office of Meteorology and Climatology (MeteoSwiss). Establishment of an electronic information platform to link the various specialist units.
- Establishment of a reporting and situation centre also for natural hazard events at the National Emergency Operations Centre. This centre would work around the clock and provide a nationwide overview of the emergency, thereby enabling the crisis staff to mobilise and assign relevant resources where necessary. The centre would provide the first point of contact for the cantons on all civil protection issues.
- Improvement of the provision of information to the public (Federal Chancellery).

- Establishment of a “single official voice” for warnings from the federal authorities.
- Creation of a training drill scheme (Federal Office for Civil Protection).

A Common Information Platform for Natural Hazards (GIN) has been established within the framework of this project (see Petzold et al.). The platform contains data, models and early warning products relating to avalanches, floods, heavy precipitation and storms. Information from MeteoSwiss, the Federal Office for the Environment and the WSL Institute for Snow and Avalanche Research SLF is available on the platform in a combined and practical form. Data from other sources, for example the Swiss Seismological Service SED, cantons and private companies, are also integrated into the platform or will be integrated in the near future. The platform is aimed at federal, cantonal and communal crisis staff to facilitate their response to natural hazard events. GIN has been operational since March 2010 and had over 1100 users in December 2011.

In May 2010, the Federal Council approved the follow-up report on the OWARNA project and allocated financial and human resources, mainly for the improvement of flood forecasting.

The Federal Council also approved additional measures. Further elements are required to ensure the consistent functioning of the entire safety chain: a “natural hazards crisis staff” needed to be established to enable coordination between the federal offices in case of a major hazard event.

Another project involved a training programme for local natural hazard advisors (see Buser et al.). In case of a hazard event, the intervention staff have to rely on local expert knowledge to comprehensively assess the situation and make the correct decisions. This expertise is also needed for the correct interpretation of the meteorological and hydrological forecasts in the local context, i.e. taking into account local observations and the knowledge of local conditions.

SINGLE OFFICAL VOICE

The warning activities carried out by the federal authorities were identified as one the shortcomings in the management of the floods of 2005. The emergency services and the population were not provided with either adequate or timely information. Furthermore, there was no system for the general dissemination of the warnings, for example using radio and television stations.

To tackle these deficits, a project has been carried out to establish a “single official voice” for warnings related to natural events. The responsible authorities at national level coordinate the issuing of warnings. Clear responsibilities have been assigned: MeteoSwiss provides information about dangerous weather conditions, the Federal Office for the Environment about floods and related landslides as well as forest fires, WSL Institute for Snow and Avalanche Research about avalanches, and the Swiss Seismological Service about earthquakes. In a situation, in which several natural processes may lead to a major disaster (e.g. heavy precipitation and floods), it is planned to issue joint warnings and information, which will be prepared by the aforementioned natural hazards crisis staff.

The responsible authorities have adapted their warnings to a five level hazard scale (see Fig. 3). The definition and delimitation of the levels are based on different criteria, depending on the type of hazard involved. For meteorological hazards, the steps are often delineated by the magnitude of physical values, such as rainfall intensity, storm velocity etc. For floods, the levels are defined by the recurrence period of runoff (HQ_x): for example, HQ_{20} is a flow rate that is reached or exceeded statistically once every 20 years on average. The warning thresholds for rivers are defined as follows: HQ_2 , HQ_{10} , HQ_{30} , HQ_{100} . Flood statistics are not compiled for lakes. Hence the warning thresholds for lakes are defined differently: the variance between summer high and flood limit is divided into three equal ranges corresponding to hazard levels 1, 2 and 3. The flood limit forms the transition between hazard levels 3 and 4. Hazard level 5 is reached if the lake level rises above the “flood limit + 25 cm” warning threshold.

Scale	Meaning
5 (dark red)	Extreme risk
4 (red)	High risk
3 (orange)	Considerable risk
2 (yellow)	Moderate risk
1 (green)	Little or no risk

Fig. 3 Five-level scale for natural hazard warnings.

Today, the warnings of high or extreme risks are issued not only to the cantonal authorities but also to the population. Warnings to the public are restricted to level 4 and 5 and must be indicated as “warnings from the Confederation”. The dissemination process also has been harmonised across the authorities: the National Emergency Operations Centre provides an information hub for all. Private and public radio and television stations are obliged to broadcast hazard warnings by law (“Alerting Ordinance”, SR 520.12). The warnings must contain a description of the expected hazard and advice on the safety measures to be undertaken. They are transmitted in German, French and Italian. Additional information is provided for the population on the recently established platform naturgefahren.ch.

COORDINATION AT NATIONAL LEVEL

Safeguarding the population during natural events is the joint endeavour of specialist units and crisis staff (see Fig. 4). The floods of 2005 showed that close interaction between these bodies is essential to minimise losses.

Permanent structures across the various federal departments and offices were required to coordinate the measures implemented as part of the “Optimisation of Early Warning and Alerting of Natural Hazards” (OWARNA) project. Hence, in October 2008, the Directors of the Federal Office for the Environment, the Federal Office of Meteorology and Climatology, the Federal Office for Civil Protection, Swiss Federal Institute for Forest, Snow and Landscape Research, and the Federal Chancellery established the “Steering Committee Intervention Against Natural Hazards” (LAINAT). The Swiss Seismological Service has also been member of the committee since 2010. The Committee is guided by its directorial conference. A management board, consisting of professional experts from the participating bodies, is responsible for the preparation and implementation of decisions of the directorial conference. The LAINAT secretariat is affiliated to the Federal Office for the Environment and has been operational since April 2009. The Committee’s mandate is specified in a legislative act that regulates responsibilities and procedures in the event of nuclear, biological, chemical and natural disasters (ABCN-Einsatzverordnung, SR 520.17)

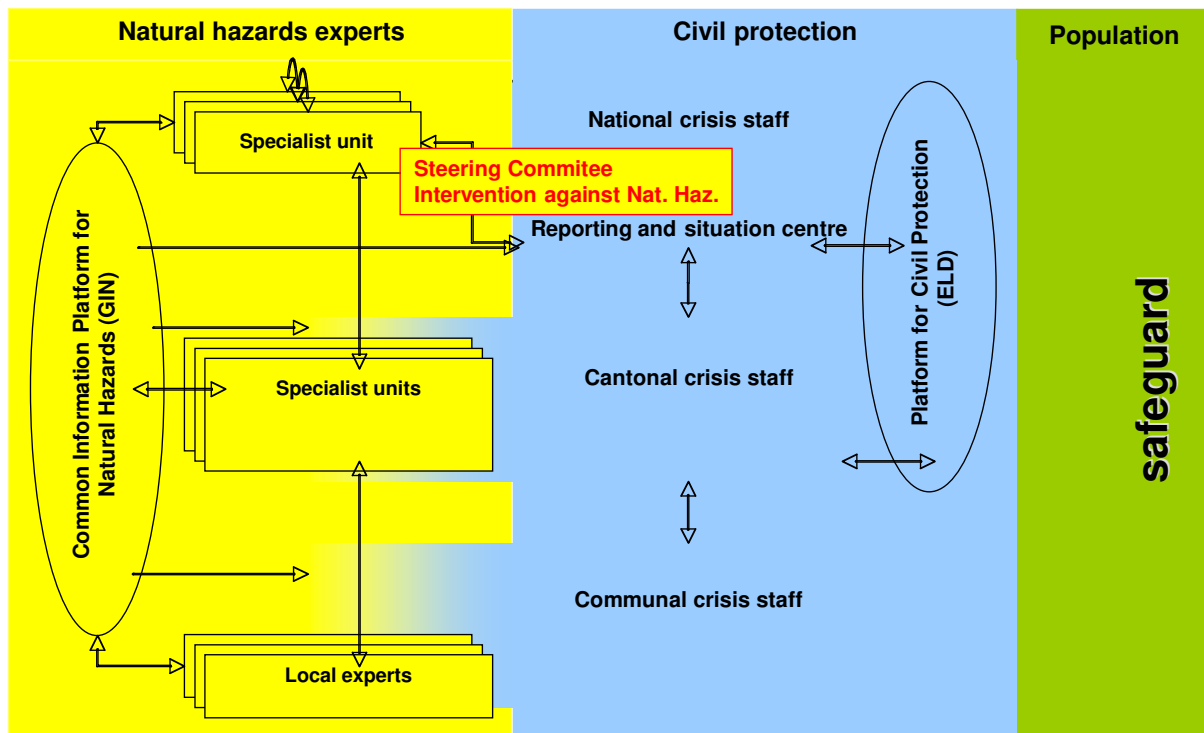


Fig. 4 Cooperation of specialists units (left side, yellow) and crisis staff (right side, blue) at all state levels. The actors have access to virtual platforms to facilitate “vertical cooperation”.

PROGRESS ACHIEVED IN THE IMPLEMENTATION OF OWARNA ACTIVITIES

It has been possible to implement several measures successfully in recent years. The 24-hour availability (Business Continuity Management, BCM) of personnel in case of an emergency is now also guaranteed at the Federal Office for the Environment. A crisis staff has been established to ensure BCM. It is formed by specialists from different divisions who can be mobilised at short notice. Apart from participating in several training drills, the crisis staff was active during the period of drought and risk of forest fires in spring and early summer 2011. They coordinated the exchange of information with and between the cantons, assessed the situation and regularly informed the public about the situation by means of press releases.

For emergency situations, a natural hazards staff unit has been established across several federal offices as a complement to the “Steering Committee Intervention Against Natural Hazards”. In the case of natural events with impacts on a national scale (i.e. several cantons are affected), the FOEN acts as an information hub and makes its core natural hazards staff available to the other federal authorities and integrates specialists from MeteoSwiss, SLF or SED. This body enables the overall expert assessment of a hazard situation or event (see Fig. 5). If required, it also transmits warnings to the authorities and the population.

Improvements have also been made in the area of flood forecasting. The responsible persons at the FOEN have defined so-called “surface waters of Swiss national interest”, e.g. rivers and lakes along which high potential for flood damage exists or main rivers which flow through several cantons or international rivers and lakes bordered by several cantons or forming a frontier with neighbouring countries. Predictions are made and warnings are issued, if necessary, for these rivers and for major lakes. The national hydrological forecast system is complemented by regional forecast models and systems, which are run by the cantons. The Confederation supports and advises the cantons on the establishment of regional systems.



Fig. 5 Sound forecasting of hazard situations is necessary to ensure correct and timely action by the emergency management units (here: closure of a road due to floods.).

A “hazards portal” on ch.ch shows which natural hazards can occur in Switzerland, provides information on how to prevent damage and respond to a natural hazard event. Furthermore, it lists all of the relevant contacts and links. The portal is accessible to the general public. Since January 2011, the naturgefahren.ch platform provides further information in case of the issuing of a level 4 or 5 natural hazard warning. It is planned to merge the two platforms and integrate information from GIN that is of public interest so as to have one point of access and information source for the population.

OUTLOOK

This paper shows that major efforts have been made to improve preparedness and intervention in relation to natural disaster events at national level in Switzerland. As the cantons are responsible for emergency management, they must implement similar or corresponding measures. The sharing of tasks between the Confederation and cantons has been defined at several workshops involving representatives of both the federal authorities and the cantons. The financial resources required for these measures have been estimated as follows: between CHF 40 and 50 million must be invested annually by the cantons while the Confederation’s contribution amounts to CHF 15 million per year. The activities to be undertaken next will include the completion of the OWARNA project. This will mainly involve the improvement of hydrological forecasting, GIN and the reporting and situation centre for natural events at the National Emergency Operations Centre, and the establishment of the “hazard portal” for the optimisation of the provision of information to the public in the case of an emergency.

Crisis staff units and warning procedures, which have already been established, will need to be consolidated through training and involvement in real crisis operations. The cooperation between the numerous stakeholders on all three state levels will also have to be strengthened.

All of the measures that have already been implemented and these future actions will be necessary to ensure that the OWARNA measures prove effective in the context of a future natural disaster.

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