Abteilung Naturgefahren
Amt für Wald des Kantons Bern

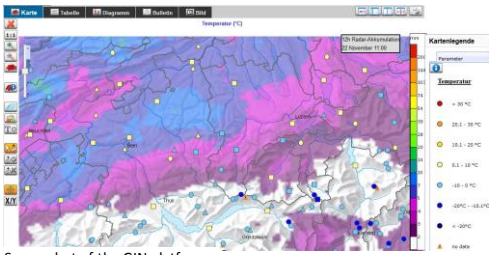
NATURAL HAZARDS DIVISION of the CANTON BERN

Natural hazards division is …

- Responsible office for gravitative natural hazards such as avalanches, landslides, rockfall, debris flows
- Guide and support of security responsibles by
  - hazard assessment in case of critical situations
  - evaluation and coordination of protection measures
  - instruction of fire services, civil protection organizations and crisis teams in managing natural hazards
  - developing emergency plans
- First responder and chairman of different emergency coordination groups (debris flow, glacier hazards)
- Tester and assistant of the national natural hazard platform GIN and the avalanche tool ProNXD.

GIN as established tool

- GIN is the common information platform for natural hazards of the Swiss Federal Government for all cantons
- It contains information on all weather, discharge, snow, including natural hazard bulletins and current warnings
- Well established at the national and cantonal levels (experts), poorly established at the local level (laymen)
- Main focus on measurements, models are subordinated, linkage between weather forecast and influence on local hazard disposition almost lacks



Screenshot of the GIN platform

Gaps

- Variable disposition is poorly monitored and almost not implemented in forecast and warning models
- The existing warnings are too general to cause a benefit on local level and the nowcasting component in warnings is (almost) inexistent
- More probabilistic than deterministic data for forecast would be useful
- Forecast trends for 4 to 7 days ahead are precious to handle floods in large catchment areas, avalanche hazards and forest fires

Challenges

Obviousness of local trigger limits

If the trigger limit can clearly be determined and there's enough time until the damage level is reached, a intervention will be successful.

Spatial probability of occurrence

The higher the spatial probability of occurrence, the smaller the uncertainty where hazardous processes will occur and where intervention has to be done.

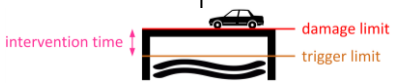
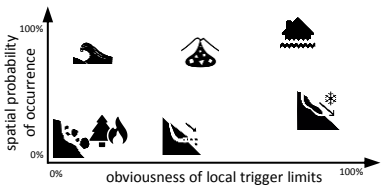


Illustration of the intervention time for the example of floods

Successful intervention

The combination of spatial probability of occurrence and the obviousness of local trigger limits define whether a preventive intervention is possible or not.



Process types with high spatial probability and reliable local trigger limits have a great potential for a successful managing based on improved weather forecast.

Crying wolf phenomenon

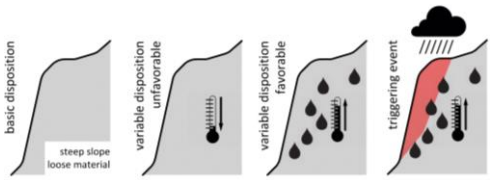
Process types with low spatial probability of occurrence and bad obviousness of local trigger limits cause warning fatigue in case of alarming.

Needs for improvement

- Based on the existing platform, the following improvements are helpful, beneath the filling the gaps listed on the left
- Forecast
  - Linkage of forecasted weather data to events in the past by nearest neighbour models (e.g. as ProNXD of SLF)
  - Derivate of existing data to e.g. local soil moisture, development of ground humidity
- Nowcast
  - Analyse of nowcast, fore-cast and local trigger limits (cf. figure on the right)
  - Information on the occurrence and the size of hail as well as the movement of thunderstorms

Disposition concept

- **Basic disposition** determines the general and long-term potential for a hazard process of a certain area
- **Variable disposition** is characterized by time-dependent parameters such as e.g. soil moisture
- **Trigger events** activate the hazardous process by a given disposition. This may be e.g. precipitation
- For an event to occur both trigger and the variable disposition must be critical and coincide.

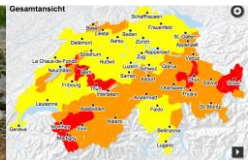


Warning systems

Process warning systems

- Observe the development of an ongoing hazardous process or its direct triggering event on a specific source of danger (clearly located in geographic terms, usually small-scaled)
- Output: alarm or warning
- Examples: gauging stations, measurement of landslide velocities, trigger lines

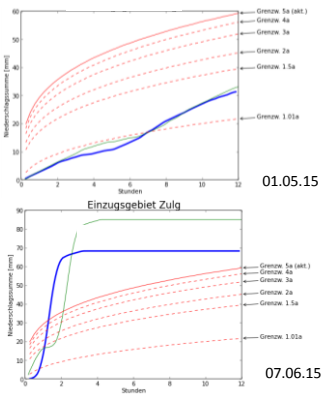
Example of a process warning system: geophone



Example of a disposition warning system: flood risk map

Disposition warning systems

- Observe the variable disposition or triggering event of a process type in geographically larger areas, not specifically towards a source of danger
- Output: warning
- Examples: forecast of heavy snowfall, forecast for thunderstorms, output of discharge modelling



Example of a permanent comparison of measured rain by radar and rain gauges and local trigger limits for flash floods in the Zulg basin

Avalanche **Landslide** **Rockfall** **Forest fire** **Debris flow** **Inundation** **Flash flood**