

From Documentation to Response – the operational Swiss Rapid Mapping Service for Natural Hazard and Crisis Management

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Abstract:

Various Swiss Federal institutes responsible for issuing natural hazard warnings joined forces in 2008 in the Steering Committee Intervention in Natural Hazards (LAINAT)¹ to better achieve necessary coordination and collaboration. LAINAT is operational since 2009. It strengthens institutional processes and also facilitates new joint developments of forecasting and warning activities among the mentioned Federal partners (Wernli-Schärer et al., 2016).

The present conference contribution focuses on the Rapid Mapping service as an instrument to document, and increasingly, to respond to natural hazard events. After such events, during the recovery phase, the Federal government and Cantons are obliged to carry out damage and event documentation as defined by the Water Hydraulic Act. Image data, which is used here as an umbrella term for aerial and satellite imagery, often makes up an important part of these documentations. Meanwhile, the Cantons increasingly wish to use Rapid Mapping outputs and methods during natural hazard event response. Therefore, Rapid Mapping activities are gaining importance within LAINAT. Set up with clearly defined responsibilities and procedures, Rapid Mapping is a 24/7 Swiss Federal government on-call service for the timely acquisition and provision of image-based, i.e., aerial or satellite, geodata in case of natural disasters (floods, droughts, debris flows, landslides, rock falls, snow avalanches, glacier breakoffs, storms, forest fires and earth-quakes). Three LAINAT-partners, the FOEN, the FOCP and affiliated NEOC, and swisstopo are involved in providing a Rapid Mapping service: FOEN and FOCP coordinate the needs of Federal offices and Cantonal natural hazard offices in case of large-scale and significant events. After a positive evaluation, FOEN places an order to swisstopo for data acquisition (FOEN, 2022). Swisstopo is Switzerland's geoinformation center and is responsible for the provision of analysis-ready geodata before and after natural hazard events and supports various stakeholders (Federal government, Cantons, communes) in documenting natural hazard events. Swisstopo provides data freely within the Open Government data framework which is particularly beneficial to technical experts and downstream crisis committees.

The Swiss Rapid Mapping service encompasses a range of basic products, mainly depending on the question to be answered, but also on weather conditions, day-light, availability and flight authorization. Options to choose from include digital image data deriving from various acquisition platforms (satellites, aeroplanes, helicopters, and drones in exceptional cases) and sensors of varying spatial, temporal and spectral resolutions. Due to the diversity of events, however, there are no sharp criteria for the deployment of the Rapid Mapping service. At least four criteria have to be met: 1) one of the above-mentioned hazards is concerned; 2) imagery is indispensable for documentation and/or response; 3) allocation of resources is justified (cost/benefit aspects, spatial extent, significance of event); and 4) data acquisition is urgent. Additional criteria may be: a national interest for image data (research, media response) or wide-ranging testing purposes of material and methods. So far, swisstopo has successfully acquired image data for rapid mapping of forest fires, droughts, landslides and floods and avalanches. Specifically, optical satellite imagery is used in cloud-free situations, while radar-based satellite imagery is suitable for all-weather and has been effectively used for flood area detection (Fig. 1).

¹ Federal Office of Meteorology and Climatology ([MeteoSchweiz](https://www.meteo.ch)), the Federal Office for the Environment ([FOEN](https://www.bafu.admin.ch)), the Federal Office for Civil Protection ([FOCP](https://www.babs.admin.ch)) in conjunction with the National Emergency Operations Centre ([NEOC](https://www.nec.ch)), the Swiss Federal Institute for Forest, Snow and Landscape Research ([WSL](https://www.wsl.ch)) in conjunction with the Institute for Snow and Avalanche Research ([SLF](https://www.slf.ch)), ETH Zurich in conjunction with the Swiss Seismological Service ([SED](https://www.sed.ethz.ch)) and, since 2018, the Federal office of Topography ([swisstopo](https://www.swisstopo.ch)).

Of particular importance is the fact that the Rapid Mapping air service, within the national airspace usage priority framework, has been upgraded to the highest priority level, thus acknowledging the benefit of this service and facilitating of its deployment in crisis management. While, in collaboration with the Swiss Air Force, swisstopo operates its own flight service to produce aerial image data, satellite data is acquired and managed via the swisstopo-led National Point of Contact for Satellite images (NPOC, 2022). Through this contact, various additional satellite data – both free and commercial – may be obtained, such as products from the Copernicus Sentinel portfolio or very high-resolution imagery.

For natural hazard specialists, access to analysis-ready rapid mapping products is granted through the Swiss Federal geodata infrastructure. Products are freely available in read-only formats on map.geo.admin.ch. Both pre- and post-event data is presented via this geodata infrastructure, along with a functionality facilitating image comparisons (Fig. 2). At the moment, data web-links are accessible for a limited period of time, but will be made available permanently on web-map layers in the near future. This way, they may be integrated in other relevant natural hazard platforms, such as the Swiss Natural Hazard Platform (e.g., Lienert et al., 2021). This will allow to share mapping products and related natural hazard information widely and instantly – not only for natural hazard documentation, but also as a promising additional instrument for the response to natural hazards and support of crisis management.

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Figure 1: Satellite radar data showing the flood and inundation area (in red) at lake Biel on 16.07.2021 (RADARSAT Constellation Mission), left; and 18.7.2021, right (TANDEM-X). Source: swisstopo (2022)



Figure 2: Quick orthophoto derived from the Swiss rapid mapping service. After a large debris flow in Bondo on 25. 08.2017, left; and SWISSIMAGE pre-disaster year 2015, right. Source: swisstopo (2022).