Application Programming Interfaces (APIs) for real-time warnings on mobile maps – the case of forest fires

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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.

This conference contribution focuses on centralized, standardized APIs providing real-time warnings that are temporally and spatially coherent, and used in a mobile mapping application through linked, dynamic points of interest (POI) symbols. Rather than letting users search for warning information and selecting layers on a warning platform, user intentions are anticipated by conveying information implicitly and ad-hoc, when users are interested in a POI. In this particular case, POIs are outdoor fire pits which are used to warn people planning an outdoor activity from forest fire hazards.

Warnings from various natural hazard processes ("multi-hazard"), along with their different attributes such as thresholds, time validity, location, severity, urgency, certainty, behavioural recommendations, and impact information are all integrated and provided within a (geo-)data infrastructure. The warnings are sent to a (geo-)data infrastructure where they are merged, formatted, updated regularly and automatically by official warning authorities. Thereby the warnings serve as a standardized warning product for any user group. The mentioned infrastructure is equipped with an API, providing warnings originating from a "single-source of truth", thereby ensuring that all warning recipients, warning distribution channels, and warning terminals (i.e., clients of this single warning source, such as third-party platforms, traveling and hotel booking apps, advertising surfaces in public spaces, railway destinations boards, etc.) may make use of these warnings in their specific context and for their specific needs. The main idea is – from a viewpoint of an official warning authority – to no longer provide platforms/websites, but coherent, real-time warning *services*. This ensures that users see official warnings on the apps and websites they regularly use (without searching for it) and no longer need to install specific apps or actively sign up for a warning service.

In the domain of forest fire hazards, two LAINAT-partners took the lead on Swiss national level and operationally provide API-based warning services. FOEN is responsible for issuing forest fire warnings and behavioral recommendations for Cantons, communities and the public (FOEN, 2024; Lienert et al. 2021). In the specific case of forest fires, more strict response measures imposed by the Cantons (e.g., fire bans) are issued as well. Swisstopo is Switzerland's geoinformation center and is responsible for operating the multi-lingual mobile app (swisstopo, 2024) and operating the Federal geodata infrastructure. Within this infrastructure, swisstopo provides data freely within the Open Government data framework and has installed an API for the FOEN that provides real-time information on forest fire hazards and existing response measures (for each warning region, as data sets). These data sets are linked in the backend of the swisstopo's mobile app with a data set on outdoor fire pits, which is obtained daily from Open Street Map. Real-time information on forest fire hazards and response measures, provided by the API, are linked via IDs of warning regions. Within the mobile app, further information can be retrieved when clicking on these symbols (Fig. 1a).

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The rendering of fire pit POI symbols takes place according to a predefined representation matrix that considers hazard levels and response measures (Fig. 1b). Depending on these two aspects of a warning (i.e., hazard level and response measure), different symbols are visualized in the mobile app. For better map legibility, to keep memory consumption low and performance high, the fire pit symbols appear only at a high map zoom level. Some conceptual and technical challenges during development involved the location of the fire pits and the existing warning regions, i.e., the accuracy of polygons depicting their borders. By applying a level-of-detail approach (i.e., show higher-resolution of borders with higher zoom levels), it is now possible to unambiguously determine and assign warning regions to a specific fire pit location and avoid misinformation.

The swisstopo app has been downloaded about 3 Mio times. One of the integrated map types is the base map, a fully vector-based topographical map that is entirely rendered on the client/smartphone-side. It is complemented with various POIs, such as the fire pits. Since the launch of the forest fire API, increasing interest in fire pit POIs is noticeable. User surveys highlight the growing relevance for outdoor-related POIs (e.g., fire pits, picnic and scenic spots, public bathrooms, fountains, etc.). The swisstopo mobile app is the first implementor of the forest fire API and it acts as both a "demonstrator" and a "door opener" for other app operators, thus further leveraging forest fire warnings and raising awareness thereof. The forest fire API – with its "proxy" fire pits – greatly enhances communication of forest fire hazards. The app thereby acts as a distribution channel that makes use of the API warning service. The open data and API approach facilitates information flow and allows individuals, as well as specialized services (fire fighters, police), to work with coherent, standardized, and official real-time warnings. Inconsistencies are avoided while at the same time, users/clients of the forest fire API have certain freedom to re-use and integrate official warnings into their own online products.

For the LAINAT, the forest fire API is an important step forward. It shows the feasibility to apply a "single-source of truth" for natural hazard warnings and to move "from websites to services" by issuing warnings tailored to warning recipients needs – using POIs on mobile maps. Summarizing, the API approach for forest fires is a promising way forward to increase reach and effectiveness of warnings. It has great potential to be applied to other natural hazards.

References

FOEN, 2024. Federal Office for the Environment, Forest Fire Danger. Current danger situation; retrieved November 2024.

Lienert C., Angly F., Neveršil B., Meier D., 2021. The public Swiss natural hazard portal for warnings and recommended behaviour, *Abstr. Int. Cartogr. Assoc., 3, 180*, https://doi.org/10.5194/ica-abs-3-180-2021

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Figure 1a (left):

16:38   63%

Feuerstelle
1.1 km

Waldbrandgefahr
Mässige Gefahr
Aktiv seit 25.09.2023

Massnahmen
Keine Massnahmen in Kraft
Feuer möglich, jeweils mit der angebrachten Vorsicht
Aktiv seit 28.08.2023

Die Kantone sind zuständig für das Ergreifen von Massnahmen. Die kantonalen Vorschriften sind massgebend.

Position

Tour

Figure 1b (right):

Forest fire hazard	level	Measures				
		No measures	Warning that care should be taken when lighting fires in the forest and in the proximity of the forest/in the open	Conditional ban on fires in the forest and in the proximity of the forest / in the open	Absolute ban on fires in the forest and in the proximity of the forest	Absolute ban on fires in the open
		1	2	3	4	5
No or low danger	1	firepit_11	firepit_12	firepit_13	firepit_14	firepit_15
Moderate danger	2	firepit_21	firepit_22	firepit_23	firepit_24	firepit_25
Consider-able danger	3	firepit_31	firepit_32	firepit_33	firepit_34	firepit_35
High danger	4	firepit_41	firepit_42	firepit_43	firepit_44	firepit_45
Very high danger	5	firepit_51	firepit_52	firepit_53	firepit_54	firepit_55

Figure 1a (left): Screenshot of mobile map with fire pit POIs indicating forest fire hazard; Figure 1b (right) POI symbol matrix combining forest fire hazard levels and response measure for users/warning recipients. Source: swisstopo (2024) and FOEN (2024).