LAND-deFeND: a tool for managing structured documentation on historical and recent geo-hydrological hazards

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Structured documentation on natural hazards is a key for (i) planning mitigation strategies and understanding their effectiveness, (ii) developing vulnerability curves for the quantitative estimation of the risk, (iii) analyzing the threat posed by the climate induce disasters to the built environment and the individuals.

Among the other natural hazards, landslides and floods, hereinafter referred to as "geo-hydrological hazards", are frequently triggered by intense and prolonged rainfall event, causing impacts and damage on the same area in a short time.

The spatial and temporal frequency of geo-hydrological events and their impacts can be studied through the analysis of dedicated catalogues compiled at national or regional scales, where the medium/long-term actions for risk mitigation strategies and land management are planned at administrative levels.

A number of databases and digital catalogues on natural hazards exist and were used for different scopes, including research, insurance and economic purposes. The analysis of the existing databases dealing with geo-hydrological hazards, at national scale, reveals some limitations: (i) missed separation between the geographical location of events and the location of their consequences or of the mitigation measures, (ii) non-compliance with the recent European Commission EC directives on digital archives of natural hazards, (iii) inadequacy of the database structure for the compilation at different scale, (iv) partial focus on a single type of phenomenon (landslide or flood), (v) restrictions on the type of geometry (point, line, polygon) to be used for the geospatial representation (e.g. landslide shape, road, inundated area, house).

Here we present LAND-deFeND, an acronym for LANDslides and Floods National Database, a database structure designed for overcome these limitations and capable of recording non-homogeneous historical and recent informations on landslides and floods, their consequences, mitigations and related costs.

The conceptual design of LAND-deFeND is aimed at concentrate and manage in a single database structure all the relevant information on historical and recent geo-hydrological hazard, even if derived from different sources, dating back to different periods and provided with different levels of accuracies.

The main innovation of the LAND-deFeND database structure is in its conceptual model, and regards the identification of four groups of entities used to describe the geo-hydrological events and their socio-economic and environmental impacts. The core of the database structure is represented by the three Nature-related entities that we differentiated in hierarchical levels: "phenomenon", "event" and "trigger". Common denominator of this distinction is an increasing level of complexity: from the single localized phenomenon, to the more extended event, to the widest meteo-climatic or seismic trigger. Each entity is freestanding from the others, but inherently connected by an association table. The structure allows storing the physical, geographical and socio-economic data at different degrees of detail, and makes it possible to store at the same time extremely detailed data or aggregated information.

To test LAND-deFeND more than one thousand records of events occurred in Italy in the period between 2000-2015 were added. The database structure is released under the "Open Database License" (ODbL) and a simple QGIS interface was used for data entry.