

Responsive urban warning system for extreme weather threats built on feedback and interaction

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The Slovenian pilot action, implemented within the Interreg Central Europe LOCALIENCE project, focused on strengthening local preparedness and response capacities to extreme meteorological and hydrological events in the urban environment of Municipality of Ljubljana. Led by the Slovenian Environment Agency in cooperation with the Ljubljana Fire Brigade and civil protection authorities, the pilot developed and tested an integrated, user-oriented warning and communication framework tailored to the operational needs of emergency responders. The pilot was structured around four interlinked sub-actions designed to enhance situational awareness, decision-making, and timely response under rapidly evolving extreme weather conditions.

The first sub-action resulted in the development of a dedicated web-based platform that consolidates key meteorological and hydrological measurements, forecasts, and warnings into a single access point for local emergency response units. The platform complements existing national information systems and protocols by providing selected products according to local operational relevance and time horizons before anticipated extreme events. While the platform builds on established data streams and forecasting capabilities, its primary added value lies in improving accessibility, clarity, and speed of information use during critical phases of preparedness and response.

The second sub-action formalised direct consultation procedures between operational emergency services and duty forecasters. A structured agreement enables shift leaders and commanders of the Ljubljana Fire Brigade to consult meteorological and hydrological forecasters by telephone during periods of increased risk. This measure strengthens real-time interpretation of forecasts and warnings, reduces uncertainty in operational decision-making, and improved alignment between forecast information and field-level response planning.

The third and fourth sub-actions addressed feedback and alerting mechanisms. A real-time media monitoring tool was introduced to support rapid situational feedback from the field and public media, enhancing awareness of emerging impacts. In parallel, an automated alerting system was developed to disseminate SMS and email notifications when predefined hydrological and meteorological thresholds are exceeded. The system, implemented using selected monitoring stations in Ljubljana and its

surroundings, supports early detection of potentially hazardous conditions while ongoing threshold optimisation aims to minimise false alarms.

Overall, the Slovenian pilot demonstrated that targeted procedural improvements, combined with technical tools and structured communication channels, can significantly enhance urban resilience to extreme weather events by improving the functional integration of forecasting and monitoring services with local emergency response units. For the Municipality of Ljubljana, the pilot provides a practical framework for integrating environmental data, expert interpretation, and operational response into daily preparedness and emergency management practices. Moving forward, the pilot outcomes offer a solid basis for further refinement, wider stakeholder inclusion, and long-term institutional embedding, while also representing a transferable model for other municipalities facing similar climate-related challenges.

Keywords: early warning system, disaster management, extreme weather, emergency response, forecasting service, resilience, project.