Knowledge co-production outcomes 2024

Periodic report #2 on outcomes of the RWL knowledge co-production process

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Janne Parviainen[18], Sukaina Bharwani[18], Lydia Cumiskey[6], Valeria Pancioli[8], Jana Löhrlein[11], Paolo Mazzoli[4], Max Steinhausen[1], Jacob Pedersen[7], Arnau Macià Pou[7], Stefano Bagli[4], Pia-Johanna Schweizer[5], Christopher Genillard[9], Dominik Hedderich[9], Stefan Hochrainer-Stigler[10], Julian Struck[11], Levente Huszti[12], Tracy Irvine[17]

1. TECHNISCHE UNIVERSITAET BRAUNSCHWEIG
2. POTSDAM-INSTITUT FUR KLIMAFOLGENFORSCHUNG EV
3. DANMARKS TEKNISKE UNIVERSITET
4. GECOSISTEMA SRL
5. RESEARCH INSTITUTE FOR SUSTAINABILITY
6. UNIVERSITY COLLEGE CORK – NATIONAL UNIVERSITY OF IRELAND, CORK
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15. 52 NORTH SPATIAL INFORMATION RESEARCH GMBH
16. EIDGENOESSISCHE TECHNISCHE HOCHSCHULE ZÜRICH
17. OASIS HUB LIMITED
18. SEI OXFORD OFFICE LIMITED

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Report overview

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Executive summary

This second periodic report (M4) discusses knowledge co-production outcomes based on the progress of Real World Labs during 2024, (Phase 2 of the Risk-Tandem process emphasizing co-exploration of contextual risk issues). It supports Monitoring, Evaluation and Learning (MEL) for knowledge co-production, as discussed in detail under D1.2. (The Capacity Development Strategy for DIRECTED), and continues the process of reporting of RWL outcomes that begun under D1.1 (RWL Description and Set-Up). The following annual reports (M5-M6) will continue reporting progress and achievements gained through interactive and transdisciplinary RWL collaboration, structured following WP 4s guidance on designing MEL. This Milestone consists of self-reported reflections from RWL hosts-as-Trainers, complemented updates made available to date (debrief consultations, workshop reports and interviews).

This information will be used to further guide and inform the development of capacity development modules to match training activities with contextual needs under Phase III of Risk-Tandem (alongside capacity needs assessments and individual consultations).

Contents

1. Introduction

This Milestone Report is the second of 4 periodic reports (M3-M6) seeking to demonstrate progress in implementing T1.2 regarding the implementation of knowledge co-production in the Real World Labs (RWLs):

> **Task 1.2** RWL Co-production process (M1-M45) (lead: SEI, co-lead: UCC, contributors: 52N, RWL resp. partners) Training of trainers will be conducted on how to implement the TANDEM trans-disciplinary knowledge co-production cycle in the RWL to allow for deeper knowledge co-production processes between developers of data and models, governance actors, and stakeholders. This will take place in conjunction with Tasks 4.1-4.4. The cycle for co-production will be defined and periodically reviewed during the project implementation (Task 4.4) with context-specific refinements made where needed to address the needs of the RWL and that of those developing transformative tools (WP 2), governance mechanisms (WP 3), and for design of the Data Fabric (WP 5)

Based on the methodology in the Capacity Development Strategy (D1.2), this report discusses knowledge co-production outcomes during 2023-2023, and the implementation of the Tandem framework within the overall Risk-Tandem approach (D3.1). It captures developments within the RWLs toward co-produced risk governance during Phase 2 of Risk-Tandem (figure 1). Later reports will further capture evolution of the Labs through phases 3-4 (as discussed under D3.1), as well as demonstrate progress made through co-productive collaboration between Labs and project partners. As such, it does not intend to compete with the measuring of outcomes and impacts (which will be monitored under T1.3), but rather elaborates how transdisciplinary and intensely collaborative working approaches have contributed toward innovation. This includes trust-building, developing new relationships, identifying transformative solutions for holistic risk governance that consider the systemic nature of risks in a complex multi-hazard environment and integrate Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA). These reports contain key information to support MEL on co-production (D1.2), needs assessment (T4.2) and the revision of the Tandem framework (T4.4) based on lessons learned throughout DIRECTED. It will also support the design of capacity development modules to further advance the implementation of knowledge co-production and the Risk-Tandem framework.

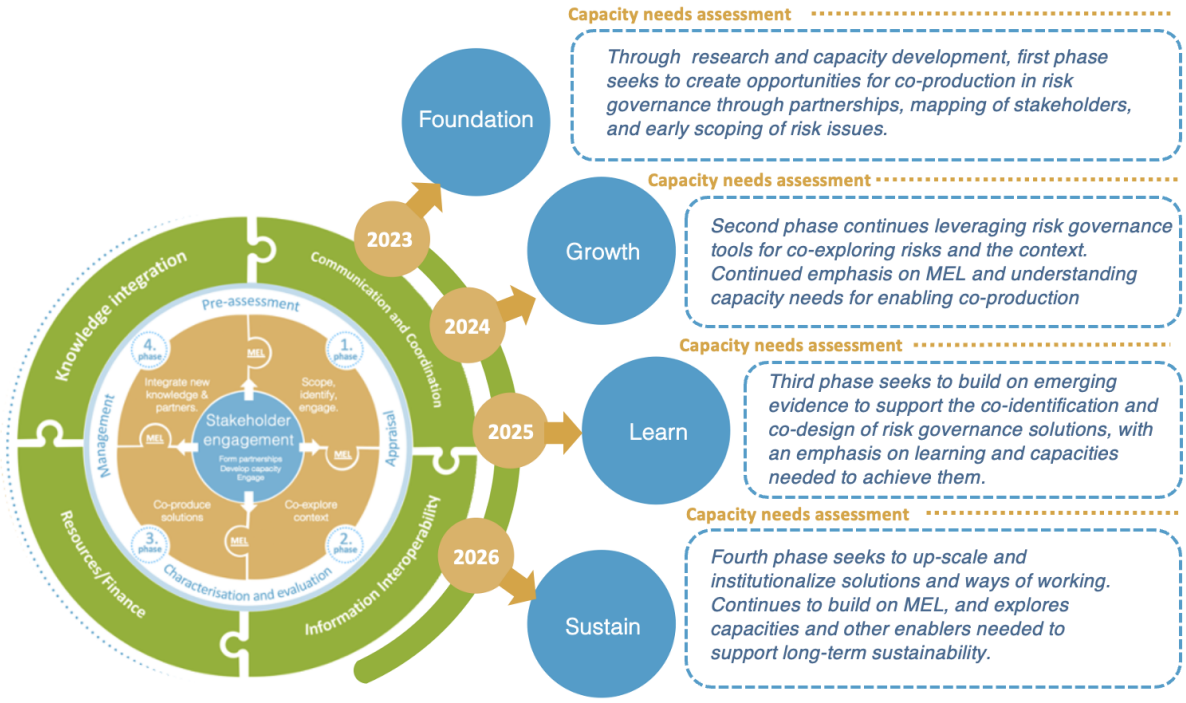

Figure 1: Phases of Risk-Tandem.

1.1 Methodology

In efforts to structure reporting related to knowledge co-production, these periodic reports are founded upon the MEL strategy as detailed in the Capacity Development Strategy (D1.2). It combines Norström et al's., (2020) "good principles" with Tandem guiding questions (Daniels, et al., 2020; Bharwani, et al., 2024)– distilled from practical application to guide and structure co-production processes. The good principles will form the themes under which successes and challenges of co-production will be measured, and the coded Tandem questions will form part of the indicators that seek to further contextualize and elaborate these categories for the DIRECTED context (see Annex I).

Importantly, this MEL strategy is evolving, and refined with RWL hosts to align it in their working contexts. Therefore, new indicators are likely to emerge over the course of the project, and these reports (and the MEL approach) will be revised accordingly. To further support the locally led implementation and monitoring of this process, the majority of knowledge co-production outcomes rely on self-reporting from RWL hosts (to capture and understand their experiences and perspectives, particularly in terms of effectiveness and capacity development outcomes). This is complemented via data coding and analysis as further described under D1.2 (Annex VII). These produce a robust "baseline" for co-production that supports the co-production of DIRECTED solutions during Risk-Tandem phase III, and measuring progress using a Theory of Change.

Aligning with this method, data is reported and analyzed according to the good principles of co-production to elaborate whether the co-production process as implemented in RWLs is considered beneficial, impactful, and contributing toward expected outcomes. Under each

thematic category, Tandem questions have been included to guide RWL hosts in the writing process (Figure 1). However, since the application of knowledge co-production and the Risk-Tandem framework is a phased process, each annual report will cover one of the four steps – this report focusing on stakeholder identification, engagement, and early risk scoping (as identified through engagements and workshops between partners, hosts and their RWLs during 2023).

Building on the foundation laid in Deliverable D1.1, this document highlights the significant progress made in Real World Labs (RWLs) since the initial setup. This document showcases advancements such as expanded stakeholder engagement refined risk assessments, and the integration of sophisticated data management solutions. These developments reflect our deeper understanding and adaptive approach to Disaster Risk Reduction and Climate Change Adaptation, ensuring that our strategies continue to evolve in response to new challenges.

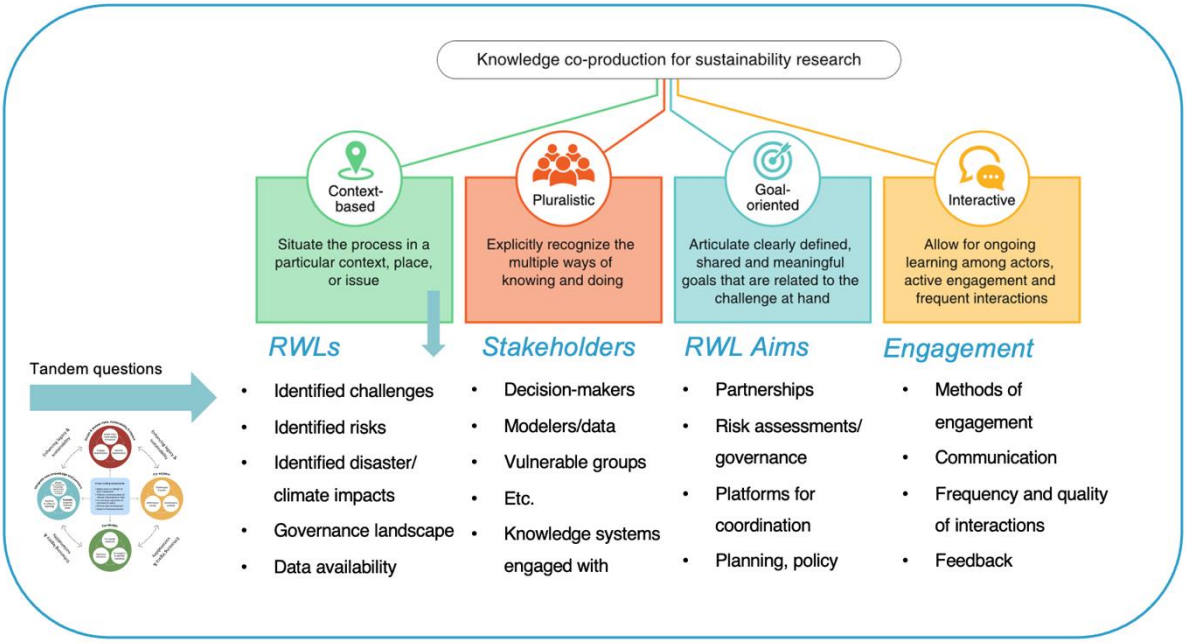

Figure 2: Good principles for knowledge co-production, elaborated and measured through the Tandem guiding questions for the purposes of Monitoring, Evaluation and Learning.

The discussion below is primarily sourced from RWL hosts reflecting on the outcomes of the co-production process. In addition, they will be complemented by discussion that has emerged in workshops and discussed in debriefs, bilateral support consultations, and during the process and co-exploration of user needs for the Data Fabric. Relevant reports and complementary evidence used as a source material for this document have been annexed at the end.

2. RWL Co-production Outcomes

This section summarizes the knowledge co-production outcomes as achieved during the implementation of Risk-Tandem Phase II emphasizing co-exploration of the risk and governance contexts across all RWLs. It will highlight outcomes of workshops and collaboration between RWL hosts, stakeholders (and project partners) toward establishing a more collaborative, transdisciplinary, and inclusive risk governance approaches and mechanisms for integrated DRR, CCA and improved resilience. It should be noted that Phase II emphasises co-exploration and deep examination of contextual governance challenges and risk issues, due to which a majority of the reported outcomes emphasize findings of the knowledge co-production process, and how they can be used to support the co-production of solutions to contextual challenges (Phase III of Risk-Tandem). Theories of Change (ToC) are currently being discussed and revised for the purposes of MEL and the co-design of indicators based on identified challenges and priorities discussed under this report.

2.1 Capital Region of Denmark (RWL 1)

By September 2024, the Capital Region of Denmark (RWL 1) continued the building of relationships and engagement of their RWL, arranged two workshops, continuous bilateral engagements, and stakeholder interviews with the support of WPs 1, 3 and 4 to scope opportunities for the design of co-exploration workshops in August, 2024. The responses were categorized based on modelling needs, organizational needs, communication needs and others covering all four phases of the disaster management cycle. A summary of findings was then presented in the August workshop (Annex I) to structure and drive co-exploration of potential opportunities for developing shared solutions between DRM and CCA actors operating in the Roskilde Fjord, the Capital Region RWL. WPs 3 and 4 provided their support in designing the workshop with RWL 1 hosts via planning meetings and tailored facilitation guidance in alignment with the Risk-Tandem Phase II and aims of co-exploration. WP 5 provided their support in running a simulation event, utilizing the DTU cost damage model alongside CLIMADA, to demonstrate projected flooding impacts in the Capital Region and introduce stakeholders to the modeling capacities of DIRECTED. This section outlines outcomes of these engagements in more detail, in efforts to report progress made through application of the Risk-Tandem and knowledge co-production approach.

Context

Currently, Disaster Risk Management and Climate Change Adaptation around Roskilde Fjord is handled by three individual emergency services, covering five municipalities. One of said emergency services has a larger capacity to support the municipalities, and thus has three under its jurisdiction (in a real-life context, they support five municipalities, however only three of them are relevant for the work in RWL, and two emergency services, supporting one municipality each. As such, there are three systems for collaboration between Disaster Risk Management and Climate Change Adaptation in the region. When combined, the five municipalities and three emergency services constitute the main stakeholders in the RWL, alongside the police force, who maintain primary responsibility over coordinating emergency response, and are therefore also considered an important stakeholder. Opportunities for further involving the police force in RWL 1 are currently being explored. Roskilde Fjord is divided by two police districts, thus adding to the complexity of the organisational setup in the area. Responsibility for each individual actor is regulated by law. However, there is still enough flexibility for different approaches and decisions to influence the way they work and thus the challenges they encounter.

Risk governance challenges identified through workshops and other knowledge co-production activities (can also build on interviews and discussions with stakeholders).

Overall, the main stakeholders (whether emergency services or municipalities) are all relatively small or have limited influence, relying on key individuals who act as gatekeepers of knowledge and contacts as identified by RWL hosts. This means that while most things appear to run smoothly during planning and events, the set-up is also relatively fragile. Although these “gatekeepers” are competent, reliable, and have a flexible approach to problem solving, and though the broader processes seem codified, they are almost indispensable for operational efficiency, as the knowledge loss upon their departure would be major. While the setup in all three Disaster Risk Management areas for now seem to be generally strong and well run, it remains to be seen if the organisations are strong enough to go through changes in personnel without losing too much know-how and cohesion. It should be noted that this challenge is based on observation during interviews and is not something which the stakeholders themselves have reflected upon. It has thus so far not been part of a discussion among stakeholders. It can therefore not be said with certainty that they would recognise it as a shared challenge. The issue should however be addressed, especially since communication and organisation communication and organisation relies on the different stakeholder’s knowledge of how to access key people.

The general hands-on approach at a local level also means that, while there might be an acknowledgment of more structural challenges in and in between DRM and CCA, it has not gotten a lot of attention by the stakeholders. The ‘whatever it is, we´ll fix it somehow’ attitude among the stakeholders implies that structural challenges are more seen as a fact of life to deal with than something to actively engage with through planning. Case in point could be the attitude toward financing where stakeholders very direct say, that they at local level know how to improve collaboration, better their planning and handle both events and adaptation. But the political will to find the necessary finances is not there according to stakeholders.

That is treated – probably rightly so – as a fact of life and things are therefore done from the assumption, that any change or addition will have to be done within budget.

Potential capacity gaps have also not been explored in detail by the stakeholders around Roskilde Fjord, neither in DRM nor CCA, in regard to hazards beyond flooding in particular. It is however a national subject with the emergency services´ national organisation clearly stating, that they don´t feel that the Disaster Risk Management system is sufficiently prepared for the consequences of future events caused by climate change. Systematic examination of the preparedness capacities is yet to be conducted but could become beneficial. This especially applies for events related to droughts and heatwaves, which are perceived as a concern affecting Denmark, but are likely to become pressing concerns. Potential stronger storm surges are also seen as a challenge. There´s no reason to assume that the Disaster Risk Managers around Roskilde Fjord are in any way better prepared for these events than the average DRM actors in Denmark.

Disaster and climate risks (and expected impacts) identified through workshops and other knowledge co-production activities (can also build on interviews and discussions with stakeholders).

Currently, the main hazard addressed by RWL 1 are coastal flooding due to storm surges, as well as heavy rain, cloudbursts and consecutive rainfall events. Throughout the interviews carried out during April and May 2024, some of the emergency services authorities and municipalities have shared their concern over a coupled event consisting of high-water levels in the Fjord combined with persistent rainfall. Some of the physical coastal protection measures in the Roskilde Fjord, aimed at preventing sea water intrusion, can cause river flooding in a situation of increased river discharge. It is thus important to consider the impacts that persistent or intense precipitation can pose, especially when coupled with storm surge events, and to identify windows of opportunity for supporting emergency response and risk management in consideration of expected impacts of climate change.

Projected relative changes in sea level from 1981-2010 to 2071-2100 in Denmark range between 0.3 m, under a moderate climate change scenario, to 0.5 m, under an extreme climate scenario (Ottersen et al., 2023). The uncertainty in sea level rise projections can post difficulties to climate adaptation efforts, however present uncertainty associated with weather and storm forecasts issued by the Danish meteorological institute (DMI) is, according to emergency agency respondents and municipalities, a much more pressing issue. There isan overall wish for more precise and accurate weather models and forecasts.

In December 2013, storm Bodil swept across Denmark, with hurricane-force wind gusts. As a result of the storm and the strong winds associated with it, the water levels in Roskilde Fjord rose more than two meters, leading to severe flooding in several municipalities. The residential area of Jyllinge Nordmark was especially impacted with 286 houses flooded (Baron et al., 2020). When conducting the interviews with the municipalities and emergency services working around Roskilde Fjord, Storm Bodil has been often described as a turning point for disaster risk managers and public authorities.

> "We learned a lot after Bodil. And we can say that the emergency plan we made [afterwards] has been tested in many incidents since then, none of which have reached Bodil's intensity."
>
> -Stakeholder from the Roskilde Fire Department

RWL 1 hosted its second workshop with the RWL 1 stakeholders in August 20th, 2024. This workshop demonstrated how a storm surge like the one experienced under storm Bodil in 2013 could look like in 2050 under different sea level rise projections. It also allowed for an examination of organizational priorities and perceptions regarding the management of such events. Past events and collective memory are essential regarding the amount of attention towards Climate Change Adaptation (CCA) and Disaster Risk Management (DRM). It has been over ten years since the storm Bodil (2013), and hence people are starting to forget its impacts**.** Overall, there should be more political awareness and attention on Climate Change Adaptation and Disaster Risk Management.

Issues related to data availability (including uncertainty) and accessibility identified through workshops and other knowledge co-production activities (can also build on user stories)

In alignment with the Risk-Tandem process and its role in supporting the Data Fabric and information interoperability, it is also necessary to examine current informational needs. These are done in more detail in the context of user needs discussion. Here, matters relevant for knowledge co-production are highlighted.

Hazard forecasts and warnings are provided by the Danish Meteorological Institute (DMI), a public agency under the Ministry of Climate and Energy of Denmark. Uncertainty and forecast precision are a challenge that has been repeatedly mentioned in the interviews with municipalities and emergency services. Overall, there is a demand for more accurate forecasts given the high-cost of mobilizing and deploying emergency resources. During the course of an emergency, real-time data is also of a high importance. There is a desire among municipalities for additional local measuring points and stations, which can supply forecasts information. However, considering the relative uncertainty embedded in all efforts to model and understand climate change impacts in specific country contexts, expectation management may become necessary (alongside capacity development on adaptive governance).

Additionally, municipalities use free models and tools ((Klimaatlas, Geus Nationale Hydrologiske Model) for their climate adaptation planning. Budget constraints, tend to favour the use of free tools, limiting the access to more detailed and accurate models used by consulting firms or utility companies. Collaboration with utility companies can be an option for municipalities to access more detailed models and data.

The Danish Meteorological Institute (DMI) issues warnings for Danish Land and Coastal areas about dangerous weather, following guidelines agreed upon with the Danish Emergency Management Agency and the National police, up to 36 hours before the

dangerous weather is expected. General warnings are issued on dmi.dk and are adjusted continuously up until the weather event occurs. Additionally, DMI warns local emergency services and other actors involved in emergency management – these warnings are not visible to the public on DMI.dk.

Local warnings are primarily relevant in connection with elevated water levels along the coasts and are issued up to 36 hours before the dangerous weather is expected. The warning criteria are determined by local authorities who are familiar with the area's vulnerabilities. Seven hours before the weather event occurs, DMI advises and shares data with the involved actors every hour. Additionally, DMI offers the climate atlas tool, which is a shared database that municipalities can use to plan climate adaptation. Climate Atlas contains data on, among other things, temperature, precipitation, water levels, and storm surges in the expected future Danish climate under different RCP scenarios.

Governance context/policy landscape (in relation to workshops and other engagement with stakeholders)

The regulatory landscape and risk governance context require further research by WP 3. However, Throughout the interviews carried out in April and May 2024, some municipalities expressed their hope for new legislation addressing the distribution of protection responsibilities in vulnerable coastal areas highly exposed to storm surges. Overall. There is still not a national focus on retreat as a climate adaptation strategy. The focus is mostly set on protective hard and mobile measures. An increase in the frequency and intensity of storms might however require alternative climate adaptation approaches.

Similar views were expressed during a meeting with the Danish Emergency Management Agency (DEMA) and the RWL 1 hosts on July 2024. It is hard to imagine emergency services being able to keep up with the already ongoing and projected climate change impacts. There’s a need for more ambitious policies around land-use planning and climate adaptation such as for example banning further development in vulnerable coastal areas and waterfronts or considering relocation of existing housing and infrastructure in vulnerable coastal areas. In general, organizations and municipal employees responsible for climate adaptation should be more involved in emergency planning and response. Generally, municipal employees work mostly with disaster mitigation and prevention through Climate Change Adaptation (CCA), while the police and emergency services are mostly involved with the disaster response phase (DRM). It could be beneficial to work more transversely and ensure knowledge-sharing among actors and institutions involved with CCA and DRM takes place throughout all the phases of the disaster management cycle.

Political priorities and economical restraints on both Disaster Risk Management and Climate Change Adaptation are seen as factors restraining both municipalities and emergency services from addressing some of the data & modeling, organizational and communication needs identified through the stakeholders interviews and workshops.

Cities, and residential coastal areas like the area of Jyllinge Nordmark, which was severely impacted under the storm Bodil in 2013, are in many instances vulnerable to high storm

surges. There are several ongoing projects to build new dikes as protective coastal measures. Only in the municipality of Frederikssund, for example, five new dike projects are currently being planned. Although the risk posed by coastal flooding in Denmark is assessed to be limited in terms of loss of human life, older and disabled persons might need extra assistance during an emergency, especially if evacuation is required.

Reflection

A thorough planning for future workshops would require participation from utility services, local dike boards and the planning and environmental departments of the municipalities. Given the coordination role of the police districts during the response phase of an emergency the RWL hosts are also in the process of engaging them in the RWL 1 activities, and have established contact with the Danish Meteorological Institute (DMI) and the Danish Emergency Management Agency (DEMA). RWL hosts would like to sustain their engagement in the RWL, and in both cases, have extended an invitation to the second RWL 1 workshop on 20th of August, 2024.

Another important governance update relates to the recent establishment of the new Ministry for Social Security and Emergency Preparedness, which is planned to absorb and oversee risk governance processes, especially in terms of coordinating flood management and coastal protection. It will also take a role in emergency management, but its exact authority over CCA remains currently unclear. In addition, Roskilde Fjord will be covered by the EU Flooding Directive, for which the Danish Coastal Authority has conducted national risk and hazard screening to identify where new risk management plans are needed to align with the Directive. The number of municipalities where plans are required is expected to increase from 27 to 51, including Roskilde Fjord. Depending on the timeline, these may represent an opportunity for DIRECTED, RWL 1 and its partners to support the work of municipalities in developing holistic risk reduction plans for flood events. The Coastal Authority has already developed as social vulnerability index to be used in the risk mapping areas.

Pluralism and transdisciplinarity

In RWL 1, efforts to design and implement transdisciplinary knowledge co-production are recognized to depend largely on the stakeholders involved. To date, stakeholders of the RWL are primarily actors of the government, including municipalities, coastal authorities and regional organisations working either in emergency response, Disaster Risk Management or Climate Change Adaptation planning. In addition, DTU provides its technical support regarding data/information needs and risk modelling. Progress has also been made in terms of involving the Police in the activities of RWL 1, with options for further engaging them being currently negotiated. Efforts have been made to explicitly recognise the range of perspectives, knowledges and expertise involved, and to enable open discussion between stakeholders.

Stakeholders, disciplines and knowledges now involved in the RWLs

In the workshop organized on 20th of August, 2024, attending stakeholders included representatives from the Danish Technical University (DTU), the municipalities of Egedal, Roskilde, Frederikssund, Lejre, Halsnæs, the Danish Emergency Management Agency (DEMA), the Region of Zealand, as well as emergency responders from, Lejre Fire Brigade, and Fredriksborg Fire and Rescue. With their expertise in planning, Climate Change Adaptation and Disaster Risk Management, stakeholders were invited to identify shared challenges and priorities for RWL 1 under DIRECTED, further discussed below.

Reflection

As discussed during consultations and workshop debriefing between RWL 1 hosts and partners from WP 3 and WP 4, stakeholders involved represent adequate diversity for promoting DIRECTEDs objectives in the Capital Region, and to address risk governance challenges as identified to date. However, some challenges remain, particularly in terms of citizen engagement. Since involving citizens must happen via municipalities, there is a need to solidify shared goals and priorities to agree how and when citizens can be included in decision making.

Identified goals and priorities

Knowledge co-production should articulate (and result in) clearly defined goals that are shared and valued by stakeholders involved (Nordström, et al., 2020). To support Phase III of Risk-Tandem (the co-production of tailored solutions), the August workshop sought to co-explore and prioritize shared goals and priorities among RWL 1 stakeholders, in efforts to inform the design of next steps.

Shared goals and priorities that have been identified through RWL engagements and workshops:

Based on interviews and the collaborative activity arranged in the workshop to prioritize challenges and needs, the following issues were ranked as the highest priority issues across all involved stakeholders:

- Improved modelling for coupled/compound events (such as the combination of heavy precipitation and storm surges in urban/coastal areas).
- Models incorporating wave height in storm surge warnings, similarly to Emilia-Romagna, and more accurate data regarding sea level rise during storm surges
- More localized measuring points and weather stations to supplement information gathered from models and flood monitoring equipment
- Dedicated staff and resources to improve locally-led GIS and risk mapping.

- Expectations between municipalities, emergency services and citizens could be better managed and aligned.

Issues that received 'low priority' ranking include improved coordination across municipalities in terms of cooperation and communication with citizens, need for municipal platform to gather information during an active incident, differing emergency plans across municipalities, differing EWS across municipalities covered by the same emergency service, or differing methods used for post-incident evaluation. Although seemingly preferring technological solutions over identifying and addressing issues of risk governance, the potential for strengthening coordination, communication and/or policy and integrated CCA/DRM planning are still discussed in the RWL 1 context (see section Reflection below).

Building on issues identified as high priority, a visualization exercise was leveraged to discuss short- and long-term needs and opportunities for co-producing solutions, using a - the prompt "desired future state of integrated risk management by 2050". Potential short-term plans included open and free data, uniform responsibilities and standardization of measuring, accurate forecasts (and data) and improved early warnings. User-friendly software for visualizing data and modelling outputs was highly desirable, alongside holistic emergency plan/system that can link cascading/coupled events. Municipal risk maps led by municipalities themselves was discussed, alongside maps that could illustrate worst-case scenarios, and infrastructural improvements (such as updating of dykes). Vulnerability maps were highlighted (although phrased as "citizens who cannot evacuate themselves"), and some training was proposed (on the deployment of sandbags for volunteers, or in terms of improving technical capacities of municipalities to lead GIS-based risk assessments).

Longer term aspirations include nationwide solutions to support planning and integrated decision making, connecting government bodies, businesses and citizens to inform risk management, Climate Change Adaptation, water resources management, and land use. This could also include a unified database for Climate Change Adaptation that all stakeholders can agree on, and improved implementation of adaptation action through an adaptive and flexible approach that can cope with uncertainty. Knowledge sharing across municipalities was also highlighted, although this could also be improved now.

Interactive methods

Knowledge co-production process should enable on-going and transformative learning among stakeholders (Nordström, et al., 2020). To advance these ambitions, the August workshop was designed keeping in mind the importance of enabling open discussion through engagement beyond top-down or expert-led presentations. Stakeholders have also agreed to attend physical workshops twice per year, and remain open to the possibility to attending online meetings and webinars in the meantime. The Capital Region and DTU will arrange bilateral meetings when needed.

Methods of stakeholder engagement utilized in RWL workshops

To support planning the Danish Emergency Management Agency (DEMA) also introduced the idea of organizing a planning exercise involving RWL 1 stakeholders. The underlying goal would be to promote a move from emergency response toward adaptive governance and risk reduction, through dialogue and participatory examination of complex risk issues in a real-world setting. This could also involve testing new technologies for modelling and communication, and to improve the cooperation between authorities, central infrastructure managers, service providers, and citizens through a simulation designed alongside and with the support of DIRECTED partners.

Reflection

During debrief consultations with WP 3/WP 4, Hosts of RWL 1 reflected the challenges relating to facilitating open discussion with stakeholders. Currently, technological solutions are seen as a priority by many stakeholders. There is no perceived need to change ways of working or collaboration. It is expected that governance issues become more approachable as stakeholders get to know each other better.

Reflection and feedback on capacity development

In alignment with the Capacity Development Strategy outlining the approach to Training of Trainers toward facilitating knowledge co-production, the project also needs to monitor the effectiveness of capacity development activities in supporting RWL hosts. For this purpose, it is useful to reflect the degree to which DIRECTED partners have succeeded in this task, and what else may be needed in terms of enabling co-production in the future.

Reflections from hosts and facilitators

Several workshop participants have expressed their gratitude for the dialogue opportunities facilitated by the RWL, which has brought together CCA and DRM stakeholders. Through the first two workshops and a series of interviews, DIRECTED has provided stakeholders with a valuable platform to exchange knowledge, share information, and identify priority areas that could enhance current CCA and DRM efforts around Roskilde Fjord. The inclusion of Roskilde Fjord in the recent national screening by the Danish Coastal Authority—highlighting it as an area where flood risks demand a coordinated and comprehensive risk management plan—underscores the relevance of DIRECTED and the importance of fostering strong dialogue and collaboration among all stakeholders.

2.2. RWL 2. Emilia-Romagna (RWL 2)

Between September 2023 and September 2024, RWL 2 has progressed rapidly toward identifying contextual risk and governance challenges through workshops, co-exploration, and engagement with partners in a co-productive mode. Following the workshop focusing on wildfire and coastal flooding in Ferrara on 28th of September 2023), RWL 2 organized a webinar to demonstrate and promote DIRECTED's tools and modelling capacities (Annex II) to their stakeholders for the purposes of peer-learning (and to continue potential synergies between stakeholder needs and the project's technical expertise). From these, Hosts of RWL then focused their efforts on planning the General Assembly of 2024 in June (Annex III), large proportion of which emphasized practical flood management via a civil protection exercise in Rimini (Annex IV), organized jointly with RWL stakeholders (including volunteer associations). Considering the scale of the simulation, significant investment of time was required across partners and involved organizations between January and June of 2024. Delivered as a core element of the GA, the flood exercise was used as a tool to discuss, diagnose, and unpack potential challenges and windows of opportunity in flood risk governance (and the integration of climate change considerations into risk management operations), to be addressed via co-produced governance solutions (Phase III of Risk-Tandem) and technological innovation under the Data Fabric (WP 5). Progress will be further discussed below.

Context

RWL 2 has continued to expand its engagement in Comacchio, Mesola (Ferrara province) and Rimini coast, in efforts to address DIRECTED's commitment to multi-hazard risk governance. In the former, focus of activities targets continues to explore coastal and riverine flooding, storms, and heavy rain (and their compound effects to flood risks). In Ferrara test area, wildfire hazards remain as the primary interest of stakeholders. The current progress in co-exploring flood-related risks in Emilia-Romagna will be discussed below, in relation to the June 2024 simulation and related reporting. Specifically, the objectives of this exercise were to test the regional warning system for hydrogeological, hydraulic and coastal weather risks; to define coastal/pluvial risk management procedures and governance; verify and test strategic resources in relation to critical situations and emergency response; identify most practical ways to provide timely information and early warnings to peoples and the trade associations, and; observe and collect information during the exercise to improve the delivery of warnings to the last mile. The model scenario for the exercise was based on the known geographical characteristics and past historical events, incorporating the impacts of estimated sea level rise by 2050 to marine ingression (according to Copernicus projections measured on a 10-year return period).

Since the initial stakeholder mapping detailed in D1.1, the engagement process in the Emilia-Romagna Region has expanded to include additional stakeholders. These new stakeholders, identified during subsequent phases of the project, reflect an enhanced collaborative effort to address the evolving challenges in Disaster Risk Reduction and Climate Change Adaptation.

Risk governance challenges identified through workshops and other knowledge co-production activities (can also build on interviews and discussions with stakeholders).

The coastal areas are important for the Emilia-Romagna Region due to their socio-economic and environmental importance. However, they are also highly exposed and sensitive to natural hazards and on-going development and growth of the tourism industry. The shallow sandy beaches continue for about 130 kilometers with an average depth of 70 meters. River valleys of the Marecchia basin draining into the sea are also exposed to flooding, often triggered by heavy rains. In the City of Rimini, the water flows are managed via an artificial riverbed (Deviatore del Marecchia), designed to prevent flooding of the city.

Disaster and climate risks (and expected impacts) identified through workshops and other knowledge co-production activities (can also build on interviews and discussions with stakeholders).

The efforts of RWL 2 have substantially increased DIRECTED partners' and stakeholders' understanding of the contextual risk issues affecting Emilia-Romagna. Although the risks identified remain the same since 2023 (with a focus on riverine floods, coastal flooding, storms, heavy rain, and wildfires) engagement and the simulation exercise have revealed new dynamics that could be accounted for. These include the deepened understanding of the interaction between river flows, rainfall and compound flooding events, and the coastal wave/storm surge conditions during storms. Under the simulation, flood exposure and infrastructural vulnerabilities (due to the combined effects of sea level rise and rainfall and storm surges reaching 1.85 meters above mean sea level) were identified in Rimini, Forli-Cesena, Ravenna, and the city of Ferrara, especially in terms of coastal infrastructure and bathing establishments. These and future exploration of risk dynamics in Emilia-Romagna contribute toward developing the hazard baseline for strengthening compound flood risk management in RWL 2. Wildfire risks of Ferrara will be further explored in a workshop in November, 2024.

Issues related to data availability (including uncertainty) and accessibility identified through workshops and other knowledge co-production activities (can also build on user stories)

Discussions regarding user needs have identified three priorities for improving data availability and use for risk management in Emilia-Romagna. These include an integrated flood model for understanding coastal and riverine flood risk dynamics. Currently, equipment and data exist in isolation from one another, and some tide gauges used for flood monitoring and forecasting are operated by private companies. Similarly external companies (up to 30 individual operators) manage flood-related equipment from monitoring gauges to flood gates and pumps. For integrated decision making and understanding compound flood events, it would be beneficial to develop an integrated data and operations systems to support preparedness, planning, and improving the understanding of flood impacts. This would include data from multiple sources related to flood impacts, such as wind, temperature, rain gauging data, hydrometers, wave meters, and tide gauges. For instance, high-resolution information would be needed for assessing water outflows during flood events to inform the

placement of sandbags along the riverbanks. During the floods of 2023, many sensors were also damaged or could not rely data, due to which it would be beneficial to identify opportunities for strengthening the monitoring network to support real-time evolution of flood events.

For wildfire risk management, it was suggested that visualizations could be improved for the warning bulletin issued by Civil Protection Agency in Bologna. Susceptibility index for Emilia-Romagna (risk maps integrating considerations for humidity, temperature, weather forecast and other indicators), are published for citizens in Italian, and shared on social media. Issues related to public risk communication are further discussed below. In addition – and although currently beyond DIRECTED's technical capacities – a system for monitoring the live progression and evolution of wildfires would be considered beneficial (in consideration of factors such as wind direction and speed). The current system relies primarily on volunteers monitoring wildfire hazards on a fixed observation route, and communicating the situation to a control room comprising emergency managers, fire fighters, and other civil protection staff.

In relation to data accessibility, the simulation and discussions with volunteers of Emilia-Romagna revealed gaps in terms of shared systems. Volunteer groups do not have direct access to software used by the Civil Protection Agency, and for instance, utilize an Excel sheet for categorizing and prioritizing incoming requests during live emergencies. Although a working system, it was acknowledged that an integrated and accessible data system or management tool for emergency management operations would benefit all stakeholders involved in emergency management.

Governance context/policy landscape (in relation to workshops and other engagement with stakeholders)

Building upon the governance framework initially outlined in D1.1, the RWLs have further identified challenges as the project has progressed. These challenges, particularly in the Emilia-Romagna region, represent a deepened understanding of the local policy landscape and the dynamic nature of disaster risk governance as the project evolves.

Overall, the current regulatory landscape is considered adequate in terms of emergency response in particular, given the high autonomy regions and municipalities have under the Italian emergency management system. In Emilia-Romagna, the Civil Protection agency covers emergency planning for municipalities, volunteer training, coordination of operational structures, as well as emergency management. In practice, operation of the Civil Protection system involves fire fighters, police, armed forces, ARPAE, voluntary coordination centers, and others. Their work is complimented by 36 voluntary associations, including 1320 volunteers who are trained depending on their specialization. During active emergencies territorial operations room is established depending on the scale of the event, followed by the activation of volunteer groups. For flood risk management, hydraulic authorities cover aspects of structural prevention and non-structural flood risk mitigation. Flood services represent their combination, involving active control and emergency preparedness and response.

Discussion between actors and partners in RWL 2, however, has revealed that practical operations are often complex, based on a subsidiary principle that can be top-heavy – especially in a critical situation. In some cases, coordination and collaboration between actors remains informal (and although efficient) lacks formalized procedures. The benefits of informal collaboration are, of course, witnessed in increased flexibility, but may sometimes cause delays (for instance, in terms of notifying stakeholders during alerts). Coordination and communication between actors can always be improved, especially between volunteer associations and the Civil Protection Agency (since they are not formally part of their information management systems). In terms of flood risk management, coordinated risk reduction with beach owners was identified as a challenge. Given their unwillingness to close bathing establishments due to lost profits, they have sometimes neglected early warnings, and appear disinterested in attempts to engage them. Yet, given that the coastline is composed of privately owned sections of beaches, it is still deemed necessary to develop a coordinated approach for improving emergency preparedness through public/private cooperation agreements.

Public risk communication has also been identified as a priority, extreme importance of declining the alert at local level (scaling possible scenarios), essentiality of targeted and specific communication for local communities (for example, a delay in communication to mayors during the alert is evident), the importance of information clear and direct to the population. The aim is to ensure that people are adequately informed about potential threats and how to react in case of the event. It was highlighted that it is crucial to choose the right channels and adapt the language to the diversity of the interlocutors to ensure effective communication. For wildfire, the risk bulletin is published weekly during the wildfire season (from July to September), its reach is considered limited. It is published only in Italian (thus potentially failing to inform tourists visiting Emilia-Romagna), and only available through official channels. Options for improving risk communication to the last mile will be discussed further in the October 2024 workshop in Ferrara. Risk perceptions and high-risk behaviors among citizens are currently poorly understood, and options for involving citizens in wildfire risk reduction could be further explored.

Overall, the approach to risk management in Italy tends to favor emergency preparedness and response at the expense of holistic Disaster Risk Reduction and Climate Change Adaptation through development and planning. For instance, considerations for wildfire risk are limited in urban development planning, which may thus contribute to urban sprawl in high-risk areas. Same applies for coastal developments, as risk management in coastal areas is often fragmented due to the high numbers of public and private actors operating in these areas. The protection and management of coastal areas is also governed by maritime domain laws, landscape/urban planning regulations, national strategies, regional strategies, and concession laws, which further complicate coordinated action toward coastal risk reduction.

Pluralism and transdisciplinarity

To identify windows of opportunity for enabling transformations, or to generate novel solutions to complex risk challenges in Emilia-Romagna, it is evident that transdisciplinary

knowledge co-production between stakeholders will benefit coordinated flood and wildfire risk reduction. Since September 2023, beach owners have already been highlighted as potential stakeholders for improving early warnings in coastal areas. Similarly, the importance of citizen engagement has been highlighted for wildfire risk reduction (to support the delivery of warnings, and in terms of high-risk behaviours that contribute to wildfire risks).

Stakeholders, disciplines and knowledges now involved in the RWLs

Composition of RWL 2 has remained largely the same since the signing of DIRECTED agreements in 2023. By 2024, it includes stakeholders from the municipalities of Comacchio, Bellaria Igea-Marina, Mesola, Rimini, Riccione, Cattolica, Misano Adriatico, as well as the Region of Emilia-Romagna. Additionally, signed engagement letters have been collected from the service provider Hera, Romagna Reclamation Consortium, Volunteer Coordinators of Rimini and Ferrara, Civil Protection Associations, and Po Delta Park (one of the most important wetland areas in Europe, and largest in Italy). In addition, other potential stakeholders have been identified through RWL engagement, including beach owners, citizens, municipal police authorities, port master's office of Rimini, Hotelier's association, and Legambiente (Italian Environmentalist Association). Their involvement will be further discussed in relation to proposed solutions and identified needs with regards to promoting integrated risk reduction and adaptation in the context of RWL 2.

Reflection

As briefly discussed above, the involvement of private beach owners has been identified a challenge due to limited past collaboration. Similarly, engaging fisherpeople, lifeguards, hoteliers, and citizens for risk management purposes is not straightforward, requiring the involvement (and approval) of municipalities – responsible for outreach to local communities. They are likely to require support from RWL 2 hosts and partners in efforts dedicated to improving EWS and raising risk awareness. Engagement approaches will be further negotiated with DIRECTED partners to promote holistic risk governance and co-productive modes of working to address these challenges.

Identified goals and priorities

Knowledge co-production should articulate (and result in) clearly defined goals that are shared and valued by stakeholders involved (Nordström, et al., 2020). In RWL 2, clear and feasible goals have been identified through the knowledge co-production process. However, they require further prioritization and discussion between RWL 2 stakeholders before the co-design of risk governance solutions can begin.

Shared goals and priorities that have been identified through RWL engagements and workshops:

In relation to the Data Fabric, clear priorities have been identified through examination of user needs. These include an integrated model for river and coastal flooding to support decision-making by the Civil Protection Agency. In terms of wildfires (and although live prediction models may be too ambitious), solutions for supporting wildfire risk mapping are currently being identified with partners. In addition, a software accessible for all stakeholders (including volunteer associations) has been identified as a potential option that would support and streamline the coordination of emergency response.

In terms of risk management priorities that support Climate Change Adaptation, potential windows of opportunity have been outlined as well. These include improved coordination and communication on flood risk management and early warnings between public and private stakeholders (such as the beach owners or service providers, and Civil Protection operators), or improving risk communication between municipalities and citizens. Potential solutions include a risk management forum or platform connecting multiple stakeholders. Improved integration of the volunteer associations into the Civil Protection system is also deemed a beneficial and a highly impactful solution, although this requires participation and approval from involved municipalities.

Reflection

As previously mentioned, RWL 2 achieved a comprehensive engagement of the main actors in risk management and related emergencies, however some important stakeholders did not participate due to the impossibility of accepting further commitments (Fire Brigades, Prefectures).

One of the aspects that emerged during the discussion with the Stakeholders is the importance of reaching out to some civil society trade associations that can play a very important role both in the prevention and management phases of the event. This will be one of the aspects to be evaluated in the next scheduled activities to ensure that all points of view can contribute to further understanding the needs and objectives. Another important reflection is the observation of the results, so-called intangible, that these activities in the RWL are bringing: the creation of a continuous dialogue between the officials of ARSTPC-ER, ARPAE, the Municipalities and the Volunteers, which increases direct knowledge between people and consequently strengthens effective coordination between them.

Interactive methods

Knowledge co-production process should enable on-going and transformative learning among stakeholders, achieved via active, creative, and frequent engagement in safe settings that support open discussion even when facing difficult topics (Nordström, et al., 2020).

Methods of stakeholder engagement utilized in RWL workshops

Since the workshop of 2023, majority of the stakeholder engagement has either taken place online (through webinars and bilateral discussions), and in the General Assembly. During the Rimini GA, stakeholders were engaged in a practical flood response exercise connecting Civil Protection operators, municipalities, service providers, and the reclamation consortium (seeking to define preventative actions based on the forecasts provided). Although a planned exercise, it provided a platform for identifying challenges discussed throughout this section, including elaborating issues affecting the coordination between civil protection agency and volunteer associations. Barriers to collaboration may arise due to limited past engagement with private sector stakeholders, primarily beach owners who have appeared disinterested in cooperation with the Civil Protection Agency. The subsidiary principle has also been discussed as a potentially limiting factor, as organizations must operate within their mandates and official responsibilities that therefore set boundaries for developing 'transformative solutions'. Considerations for the realities of current regulatory landscape and funding must be accommodated into the design of risk governance solutions.

Reflection

In recent years, the Agency and the Emilia-Romagna Region in general have been implementing methods of participation and involvement of Stakeholders, pursuing the objective of knowing and using the most effective techniques related to different contexts. Directed therefore represents an opportunity, in line with regional objectives, to avail of the consultancy of specialists in the sector and test the most effective techniques in the practice of RWL both in person and remotely.

Reflection and feedback on capacity development

In alignment with the Capacity Development Strategy outlining the approach to Training of Trainers toward facilitating knowledge co-production, the project also needs to monitor the effectiveness of capacity development activities in supporting RWL hosts. For this purpose, it is useful to reflect the degree to which DIRECTED partners have succeeded in this task, and what else may be needed in terms of enabling co-production in the future.

Reflections from RWL hosts and facilitators

In our opinion, an important aspect of the project lies in the methodological and facilitation support of the Risk-tandem group, the workshops held so far have benefited from the suggestions and tools proposed. For us it will be important to understand, from an expert analysis, what worked well and what could be improved in order to better set up the next activities. We are currently planning a workshop scheduled for November, 2024, in Mesola. This workshop will focus this time on key areas including a wildfire risk exercise, communication strategies for public bulletins, and methods of informing visitors to establishments and forest areas through tools like posters, QR codes, and informational videos.

2.3 RWL 3. The Danube Region (RWL 3)

RWL 3 continues to solidify its RWL in Vienna and partner lab in Zala, Hungary, with workshops taking place in 2024. Interviews have already been conducted to identify the potential scope of interest and priorities of stakeholders to support the design approach and co-exploration activities, alongside DIRECTED's modeling teams (WP 5) to identify windows of opportunity for the Data Fabric. A central point of interest with regards to both data exchange and production, as well as governance for the Vienna RWL is the interaction and communication between public officials, flood and disaster experts and practitioners, scholars and researchers, as well as the numerous insurance and reinsurance agencies involved in this highly concentrated and urbanized area. These are further in a workshop in September, 2024 (report under review at the time of writing of this document). The Zala region, in turn, is a vast rural landscape with hundreds of small villages and towns, and numerous municipalities, while also operating in the highly centralized Hungarian governance system. The context is currently under investigation by DIRECTED partners and local stakeholders.

Context

Situating the knowledge co-production process in a particular place, entails focusing on understanding how the challenges in question have emerged (Nordström, et al., 2020). This includes reflecting on the wider socio-economic, political, and ecological contexts, and the different beliefs and needs of those affected by the RWL processes and planning. In the case of the Vienna RWL, this means that there are a variety of different stakeholders who all might not share the same goals, all the while being embedded in a long, geographical, and political history of flood management. This is owed to Austria's imperial history that affects both existing governance hierarchies as well as the local landmarks and histories of dealing with the Danube.

Risk governance challenges identified **through workshops and other knowledge co-production activities (can also build on interviews and discussions with stakeholders).**

The primary challenges identified by stakeholders in Vienna relate to communication, particularly the absence of tools to communicate emergency responders during an active disaster or crisis. In addition, RWL 3 has expressed interest in understanding the gaps in the implementation of the EU flood protection directives in the Danube contexts, and strengthening the skills of first responders, flood modellers capacities and risk governance to further flood resilience in the city. Beyond this, a number of the workshop participants have pointed out that there is a lack of coherence when it comes to the relationship between Disaster Risk Management and Climate Change Adaption policy. Here, potential knowledge gaps and institutional silos are reinforced through the unavailability of a shared platform for

communication and knowledge sharing. There is little to no interaction between the insurance industry, the public sector/practitioners, and academia with regards to sharing information and data.

In Zala, issues relate to the highly centralized risk governance processes and structures, which may limit the agency of local actors to lead planning and emergency response. Gaps also have been identified between national level plans and local level capacities to implement them.

Disaster and climate risks (and expected impacts) identified through workshops and other knowledge co-production activities (can also build on interviews and discussions with stakeholders).

Hazards now discussed in RWL 3 currently cover pluvial and fluvial flooding affecting the city. Shifting frequency and severity of heavy rain events are a concern. In addition, the potential compound effects of heavy precipitation and snowmelt run-off has been identified as a priority challenge that current modelling capacities are not able to accurately assess, in relation to changes in the regional climate. Furthermore, the economic question of how and to what degree insurances and reinsurances can cover the costs of ever-increasing flood damages is a central concern to stakeholders involved.

Issues related to data availability (including uncertainty) and accessibility identified through workshops and other knowledge co-production activities (can also build on user stories)

Precise data availability issues, uncertainties and needs require further scoping with stakeholders, to be identified via workshops and collaboration in Vienna. Various stakeholders showed interest in some of the modelling tools developed in DIRECTED, considering whether they could be available as a modules. With regards to the usability of the tools, it was also mentioned that an interface should be as accessible as possible for all stakeholders, including the public.

In Zala County, primary issues relate to lack of usable and accessible data to inform decision-making at the local level. Although risk maps are available at the national level, they rarely comprise enough detail to support risk reduction or Climate Change Adaptation within towns, villages, and rural areas. In addition, mudslides are an emerging and currently poorly understood hazard in the region. Multi-hazard risk mapping and climate information are urgently needed.

Governance context/policy landscape (in relation to workshops and other engagement with stakeholders)

The governance context Of RWL 3 requires further examination with the support of WP 3, partners and RWL stakeholders. For the Vienna RWL, a critical insight made through the latest workshop, however, highlights the need for a continuous and institutionalized platform to provide, share, and store information from various Disaster Risk Management and Climate Change Adaptation experts.

Reflection

The socio-historical context of the Vienna region positions its governance structures in an interesting light. On the one hand, clear organizational structures allow for a high sense of safety and feeling of control. On the other hand, these structures tend to be relatively slow and rigid, especially given the dynamic and uncertain nature of a warming climate. For local governance then, a central question is how to account for the uncertain nature of climate change and communicate that uncertainty publicly.

Pluralism and transdisciplinarity

In Vienna RWL 3 is primarily connecting public and private stakeholders to identify potential for cross-sectoral solutions to flood risk management in the capital area, as discussed in the previous report. In Zala, Hungary, engagement connects Municipalities, volunteer associations, town/city authorities, the Zala County Disaster Management Directorate, and authorities from the road department, sewage management, forest management, hazardous material transport company and the MouldTech engineering company (which have signed their letters of engagement).

Stakeholders, disciplines and knowledges now involved in the RWLs

To date, RWL 3 in Vienna maintains diverse engagement with public and private sector stakeholders, including insurers. Civil protection, first responders, climate scientists, hydrologists, and modellers. Progress toward transdisciplinary engagement is currently being discussed, with citizen involvement as a potential opportunity. However, how to practically support citizen inclusion in risk governance remains unclear. In Zala – and although primarily involving government agencies – the composition of the sub-lab represents an opportunity to develop bottom-up risk governance solutions in a highly centralized system, in a manner that can be scaled across the county

Reflection

The Vienna RWL has a wide array of expert stakeholders that all carry immense amounts of valuable information. For this reason, their experience needs to be leveraged in the context of sharing information and making it available to each other. This could also serve as an insightful input for other RWLs.

Identified goals and priorities

Knowledge co-production should articulate (and result in) clearly defined goals that are shared and valued by stakeholders involved (Nordström, et al., 2020). These will then inform the future development of co-production activities and engagement to co-explore the challenges in detail, identify potential solutions, and to generate shared pathways to achieving them.

The latest Vienna RWL workshop highlighted the need for a shared communication platform. Importantly, such a platform needs to come with a clear institutional set-up that allows for the continuous exchange of data and information. A first step towards such a platform was achieved by building interpersonal and inter-institutional bridges and networks among the participants of the workshops. Many participants were grateful to be put together in such a context, something that rarely or never happens. A next step is to build on these networks and find a practical solution for how such a platform could be set up and run.

Shared goals and priorities that have been identified through RWL engagements and workshops:

To date, interviews, and bilateral engagement in Vienna have identified potential opportunities for deepening collaboration between RWL actors. These include further improving the interoperability of existing data on flood modelling (including in transboundary risk governance). However, it has been acknowledged that all stakeholder groups have competing interests and priorities, with overlaps identified in improving forecasting, communication and first response. In addition, stakeholders would benefit from improving the transparency regarding use of resources for planning and response.

Reflection

When it comes to the identification of shared goals and priorities in the RWL Vienna, it is important to keep in mind that not all stakeholder interests necessarily always align. The insurers for instance might have different measurements of success than the public sector, which again differs from the goals of academics. However, a clear interest was shown by all stakeholders to cooperate and understand Disaster Risk Management as a shared undertaking.

Interactive methods

Knowledge co-production process should enable on-going and transformative learning among stakeholders, achieved via active, creative, and frequent engagement in safe settings that support open discussion even when facing difficult topics (Nordström, et al., 2020). In RWL 3, these methods are currently being introduced and tested, beginning from the workshop of September 2024.

Methods of stakeholder engagement utilized in RWL workshops

The current methods for engagement are still being formalized in the context of Vienna, in efforts to avoid overwhelming stakeholders – as a response to needs and demand. The September workshop will be the first opportunity to engage stakeholders in a collaborative mode. In the first segment of the workshop, the stakeholders as well as representatives of the DIRECTED presented insights, tools, and state-of-the-art aspects of local Disaster Risk Management strategies. This segment was then used as a segue to break into heterogenous breakout groups, with representatives from different sectors present in each of the three groups. Through the use of a Risk-Tandem Storyline exercise, the groups

(alongside two Directed facilitators), were asked to define their main challenges when dealing with a flood scenario, how they would envision solutions, and to what degree the tools presented throughout the workshop could be useful for this endeavor.

Reflection

The interactive process was somewhat slow in the beginning, as some of the stakeholders were not immediately engaged in the conversation surrounding governance. However, after some light introductions, it slowly became clear that all parties did share one or another struggle with regards to their decision-making process in the context of Disaster Risk Management.

Reflection and feedback on capacity development

In alignment with the Capacity Development Strategy outlining the approach to Training of Trainers toward facilitating knowledge co-production, the project also needs to monitor the effectiveness of capacity development activities in supporting RWL hosts. For this purpose, it is useful to reflect the degree to which DIRECTED partners have succeeded in this task, and what else may be needed in terms of enabling co-production in the future.

2.4. RWL 4. Rhine-Erft (RWL 4)

Continuing progress of 2023, RWL 4 aims toward increasing resilience to extreme climatic events through integrated adaptation and risk management solutions. Although currently emphasizing flood risks, considerations for drought and climate change are being explored, and further opportunities for dealing with hydrometeorological hazards are discussed between stakeholders. Creating and sustaining working partnerships is among the highest priorities to support continued engagement beyond DIRECTED. Agendas of meetings four and five for 2024 can be found under Annex IV. Results and discussions emerging from these engagements are further discussed in sections below.

Date (DD/MM/YY)	title of meeting	type of meeting	kind of engagement	purpose
19/04/23	First stakeholder meeting RWL 4	online	presentations, discussions, exchange	- introduce DIRECTED Project to stakeholders - talk about expectations and feasibility of engagement - get to know each other
29/06/23	Second stakeholder meeting RWL 4	In person	presentations, discussions, exchange	- more details to DIRECTED - discussion on DRM challenges and topics in the region
20/11/23	Third stakeholder meeting RWL 4	In person	presentations, discussions, exchange	- understand DRM situation from the perspective of administrative district level and municipal fire department - discussion on concrete measures in the RWL
18/03/24	Fourth stakeholder meeting RWL 4	In person	presentations, discussions, workshop, exchange	- presentation project KRITIS-Dialog (Protecting critical infrastructures through resilience governance) - workshop on procedures/structures in case of an imminent or actual flood - agreed on first concrete measure that will be tested and implemented
19/08/24	Fifth stakeholder meeting RWL 4	In person	presentations, discussions, exchange	- Update DIRECTED (Project meeting Rimini) - feedback on first concrete measures that have already been tested and on the course of the project to date - discussion on further steps

				(involvement of municipalities)

Table 1: Stakeholder engagement meetings of RWL 4.

Context

Situating the knowledge co-production process in a particular place, focusing on understanding how the challenges in question have emerged (Nordström, et al., 2020). Includes reflecting the wider socio-economic, political, and ecological contexts, and the different beliefs and needs of those affected by the RWL processes and planning.

Risk governance challenges identified through workshops and other knowledge co-production activities (can also build on interviews and discussions with stakeholders).

In Disaster Management in Germany, a distinction is made between Civil Defense (Zivilschutz) and Civil Protection (FMIC, 2024a). The former comprises the defense and protection of the general public against war related hazards and is the duty of the federal government. In civil protection, the federal government has no direct responsibilities. As part of the general emergency response, civil protection falls within the remit of the federal states (FMIC, 2024b). Each of the 16 federal states in Germany has enacted its own laws in crisis management related areas. Within the federal states, the administrative districts constitute the lower civil protection authorities and thus, are contact to the general public in matters of civil protection. As specialty, in the federal state of North Rhine-Westphalia (NRW), some water management state tasks are handed to water boards. Each of the water boards has its own law. In order to ensure the water management tasks to be carried out uniformly, all water boards are supervised by the ministry of environment (ONEP, 2024). They have information about the water bodies in their area of activity and take also responsibility in phases of water excess and shortage. In disaster control, water boards have no authority to warn. Many of them operate flood retention basins, for example, which protect local areas in the event of flooding.

The Rhine-Erft RWL is hosted by the Erftverband, a water board. The Erftverband is not only host of the Rhine-Erft RWL, but also an important stakeholder. Besides, the two administrative districts Rhine-Erft and Euskirchen, whose area are the spatial focus of the RWL, are involved. Of both districts, representatives of different departments, such as emergency response and water and soil conservation, take part in the meetings and further exchange in directed. Other stakeholders are a university working group in the field of hydraulic engineering and water management (interface between science and practice), an institution for corporate security (expert in flood protection, either on local or private level) and a fire department. There is also contact and exchange with the North Rhine-Westphalia state agency for nature, environment and consumer protection (LANUV) and other districts in the catchment area of the Erft river. The focus on administrative districts in the RWL is based on their key role in Disaster Risk Management (DRM) in Germany. In order to obtain information and also involve the next lower level to the administrative districts, the RWL connects with the intermunicipal flood protection corporation (FPC), with Erftverband

maintaining the project lead. With the intermunicipal FPC the municipalities and districts within the catchment area of the Erft as well as the Erftverband aim to coordinate flood protection measures and tasks with riparian municipalities in order to improve flood protection in the region.

Most of the gathered information in the RWL regarding the processes and structures before, during and after a flood event in the region are from a questionnaire, discussions and a workshop carried out with the stakeholders. Also, presentations of an employee in rescue and Civil Protection (Bevölkerungsschutz) of one of the administrative districts involved and a representative of a municipal fire department expanded the knowledge on the actual processes carried out during a flood event.

Disaster and climate risks (and expected impacts) identified through workshops and other knowledge co-production activities (can also build on interviews and discussions with stakeholders).

Until the end of august 2024, five meetings with the stakeholders of the Rhine-Erft RWL have been carried out. In one of the first discussions, it emerged that the devastating flood of July 2021 and the dealing with it is still very much on the minds of people. Furthermore, floods are the most visible natural hazard in the region up to now. Thus, it was decided to focus on the climate extreme event of flooding in the Rhine-Erft RWL for the first half of the directed project duration. The severity of the flood in July 2021 took the region by surprise and showed what kind of extreme events can also occur in the future. As the focus of the Rhine-Erft RWL currently is on floods, the topics of droughts and climate change impacts have not yet been addressed.

The inclusion of droughts and Climate Change Adaptation is planned for the turn of the year 2024/2025. With giving the present topic of severe floods in the region attention and time, the goal of getting to know each other and building trust within in the RWL is pursued. This hopefully helps with future topics and difficulties.

Issues related to data availability (including uncertainty) and accessibility identified through workshops and other knowledge co-production activities (can also build on user stories)

As soon as a hazardous rain event has been identified through flood and weather forecasts, different sources of information are used by employees in DRM. The information is provided by e.g. the German Weather Service (DWD), the Ministry of the Environment, Nature Conservation and Transport of the State of North Rhine-Westphalia, the State Agency for Nature, Environment and Consumer Protection of North Rhine-Westphalia, as well as water boards. During the exchange with the stakeholders, it has become apparent that they do not use models or a lot of software, but rather inform themselves via websites and apps. They were asked for gaps-of and issues-in accessing data or information during several discussions, however, were satisfied with what is currently provided. Even so, the provision of all information on various websites and apps makes it difficult to get a quick overview, and is a definite area for improvement. Another issue is that the information is difficult to interpret. Given the amount of information and existing uncertainties in the data, expertise

and experience are required to classify data outputs correctly and make decisions. Thus, an easily accessible and integrated software to analyze and visualize data is considered beneficial for supporting flood risk management.

Governance context/policy landscape (in relation to workshops and other engagement with stakeholders)

In general, policy and legal frameworks seem to give structure and support. Often, they leave room for interpretation, which on the one hand gives more freedom of decision making but on the other hand makes it hard to compare approaches. The stakeholders prefer being flexible with how to reach predefined goals. The discussion with the stakeholders of the Rhine-Erft RWL showed, that the data and information provided by authorities on federal state level often is supra regional and thus difficult to use for decision making on local level. Hence, the information provided by water boards is gladly and well used. As water boards are no part of the official warning and information chain, however, it is difficult to support without stating a warning. In the case of a disaster, decision makers fear both, legal or financial consequences when thinking about possible decisions. If e.g. an evacuation of people is carried out and it turns out to be not necessary, who pays for it? In addition, measures to improve flood protection and measures to counter the effects of heavy rainfall are funded separately in NRW. This means that a strict separation must be made in the planning of measures in order to receive state financial support. In reality, however, this distinction is often not useful.

Reflection

Considering the findings in Rhine-Erft RWL, a few tasks emerged. An important one that is already worked on is the strengthening of the interface of the Erftverband as water board with the disaster management in the region. This includes in particular sharing knowledge and expertise on the data the Erftverband already provides in an understandable way. One concrete element has already been decided on, tested and implemented in the general procedure for potential imminent flooding. The online meeting, in which experts in duty of the Erftverband and representatives of civil protection of the administrative districts participate and estimations on the current weather and hydrological situation are exchanged. This offers a good opportunity to have a two-way communication between hydrologists and decision makers. But to further improve the resilience in such crucial situations, the procedures and ways of communication have to be understood even better. Hence, the second task in Rhine-Erft RWL is to examine the structures in civil protection even better. More concrete next steps will be the conduction of a table-top exercise on flooding in the region. The aim of this is to go more into detail in current structures, procedures and communication in case of a flood event. Also, the hazard drought and Climate Change Adaptation will be moved into focus of Rhine-Erft RWL in the second half of the project duration.

Pluralism and transdisciplinarity

To identify windows of opportunity for enabling transformations, or to generate novel solutions to complex risk challenges, transdisciplinary collaboration is essential. Therefore,

Knowledge co-production processes should explicitly recognise a range of perspectives, knowledge, and expertise of stakeholders, and generate information through their integration (Nordström, et al., 2020). In addition, it would be necessary to consider factors such as gender, ethnicity, and age, and how the ability to influence decision-making affects the use and creation of knowledge.

In Rhine-Erft RWL no new stakeholders have been included since Deliverable 1.1. The focus is still on the administrative districts who function as disaster management authorities and therefore are responsible for civil protection. The spatial focus in Rhine-Erft RWL is on the two administrative districts of Rhine-Erft and Euskirchen.

Besides the official stakeholders, there are also other parties that are included in the Rhine-Erft RWL. Those are other administrative districts in the catchment area of the Erft and the State Agency for Nature, Environment and Consumer Protection (LANUV). The representatives of those organizations e.g. participate in meetings or can be addressed for any questions or topics, but have not signed the letter of engagement. Reasons for that are inter alia personnel capacities. Further, currently there is an indirect inclusion of the municipal level and citizens via the intermunicipal flood protection corporation (FPC). The intermunicipal FPC, in which the Erftverband is involved in, aims to create a flood protection concept coordinated between municipalities in the Erft catchment area. It serves as an interface between DIRECTED and the municipalities as well as citizens. Currently, the exchange between the RWL and the members of the intermunicipal FPC is not active, but the connection is used as source of information.

The Rhine-Erft RWL includes the most important actors in civil protection, but there are more parties that play a role which are not (yet) involved. The district government of Cologne and the municipalities are part of the intermunicipal FPC. Thus, the Rhine-Erft RWL has a connection with those parties. A further exchange with the municipal level in the region is intended. An idea for the municipal engagement is to find one representative on the municipal level of both of the focus districts (Rhine-Erft and Euskirchen) to involve in the Rhine-Erft RWL. Citizens are important because they are the ones directly affected by the effects of extreme events and are therefore also affected by changes in procedures and overall Disaster Risk Management. An exchange with citizens takes place in the workshops of the intermunicipal flood protection cooperation in which they can make suggestions and share ideas for flood protection measures in their place of residence.

These workshops are also a platform to exchange with citizens and listen to their voices. This format has also shown us how complex and challenging it is to involve citizens, especially because the experiences of the flood in 2021 are still so fresh and the mood is often emotionally charged. An example for that is that the expectations regarding the duration of the implementation of measures differ greatly from reality. We experienced that after suggestions are made first reproachful requests were already made after a few months. This is despite of the fact that we are already explaining the implementation periods of different measures. We definitely want to communicate the project, our approach and progress to citizens and are open to any suggestions and ideas they may have. Platforms we use for that are also other events in which the Erftverband participates. For example, there is an event at the end of September in a municipality in the Erft catchment area for

citizens to inform themselves about floods and heavy rain. The Erftverband will have an information stand there where the DIRECTED-project is presented (supported by a poster) and we'll offer the opportunity to ask questions. This kind of integration will also take place in the further course of DIRECTED, but we do not consider it feasible to go beyond this with the many challenges at district and municipal level in the region. The previous exchange with decision makers in DRM showed that there is still a lot of support needed in the organizations responsible for decision making and the topics of droughts and Climate Change Adaptation have not even been addressed yet. When the focus of the RWL will be extended to Climate Change Adaptation, probably an expert in urban planning will be required.

Reflection

In disaster management in Germany, several actors play an important role. Besides the administrative levels there are also several key organizations such as the Federal Agency for Technical Relief (THW). These organizations are very important pillars in the German civil protection system and thus, should be considered critical stakeholders in Rhine-Erft RWL. In the beginning of the project, the involvement of stakeholders in the RWL was just started and not meant to be finished soon. But the exchange with the stakeholders and Erftverband internal conversations led to the conclusion, that an involvement of more people does not necessarily serve the success of the project. People involved have positively empathized that the group of stakeholders is relatively small. Alone with RWL hosts and representatives of different departments of the two focus administrative districts, the number of participants is already in double figures. During the engagement of the stakeholders we also figured out, that they need trust in the people involved in the project and the project itself in order to share critical information. This also supports the approach of keeping the group of stakeholders small. The stakeholder landscape in Rhine-Erft RWL includes also key actors when it comes to dealing with droughts and CCA. Possibly then other stakeholders will be involved.

Identified goals and priorities

Knowledge co-production should articulate (and result in) clearly defined goals that are shared and valued by stakeholders involved (Nordström, et al., 2020). These will then inform the future development of co-production activities and engagement to co-explore the challenges in detail, identify potential solutions, and to generate shared pathways to achieving them.

Shared goals and priorities that have been identified through RWL engagements and workshops:

In a questionnaire in the beginning of the project, the two focus administrative districts have stated the same goal of achieving an improved resilience against climate extreme events. They also agree, that solutions have to be practical and implementable with the resources available. The stakeholders which are no decision makers in civil protection, aim on support and help as good as they can to reach an improved resilience against climatic extreme

events (e.g. via support to first responders, and the exploration of contextual risk issues by enabling conversations between practitioners and researchers).

During the following meetings with the stakeholders, in general, the need for the improvement of communication and support in case of a possible imminent flood has become visible. Hence, a first measures was developed, tested and implemented. This is an online meeting when the hydrologists and the "Water Operations" department of the Erftverband are put on standby due to the possibility of a flood event occurring. Participants are employees of the Erftverband as well as representatives of the administrative districts in the catchment area of the Erft river. This meeting serves not only the provision of information and knowledge of the Erftverband, but also helps to bridge linguistic ambiguities (technical terms), helps to deal with or get an impression of uncertainties and enables the reverse transfer of information from the regions affected. However, this online meeting is an opportunity to strengthen the connection between the administrative districts and the Erftverband. As the severe flood in July 2021 is not completely worked through yet, the priority of the stakeholders is on finding optimizing options in flood protection.

There is also potential for arranging a serious game or a simulation exercise in RWL 4. Based on the floods of 2021, the Hosts (and some stakeholders) have expressed interest in using such methods to unpack and discuss problems in emergency management processes (particularly in terms of communication and coordination between stakeholders).

Reflection

The goals and needs in the RWL have been identified using a questionnaire, a workshop and multiple discussions. All contributions were taken seriously and into account at any time. The approach of meeting each other on eye level and inform the stakeholders about their importance in the RWL led to them being active in the meetings. However, issues in trust have also become visible. Stakeholders seem to hold back critical information that is needed to improve the situation further. Thus, even more trust building is necessary.

Interactive methods

Knowledge co-production process should enable on-going and transformative learning among stakeholders, achieved via active, creative, and frequent engagement in safe settings that support open discussion even when facing difficult topics (Nordström, et al., 2020).

Methods of stakeholder engagement utilized in RWL workshops

In Rhine-Erft RWL the stakeholder meetings take place on a regular basis. In order to avoid issues in finding dates, there were appointments agreed on every two months for 2024. Meetings are used if needed and canceled if not. Overall, the stakeholder meetings in Rhine-Erft RWL take place about every four months. Besides varying content-related topics, in every meeting there is plenty of time dedicated to open discussions. In order to vary the engagement and move people from their chairs, a workshop was conducted. Another form of

interaction with the stakeholders is the biannual newsletter with e.g. more general project updates and current topics that is sent to them.

Reflection

The engagement of the stakeholders in Rhine-Erft RWL showed that it leads to successful discussions and a good working basis. The workshop also improved the understanding of issues and several processes in flood management. An issue identified is that some of the in-official stakeholders stated their interest in the project in the beginning, but are now hard to reach. They do not participate the stakeholder meetings and cancel only shortly before.

Furthermore, during the exchange and work with the stakeholders, also shortcomings in communication between the participants and RWL hosts became visible. When the participants of the Rhine-Erft RWL meetings had undisturbed small group discussions and were afterwards asked to repeat the topics of their exchange in the big round, they stayed quiet. This situation shows that the stakeholders potentially withhold some critical information. The assumed reasons for that are their fear of condemnation when issues are made public and that they are representatives of an organization and speak for it rather than themselves. Thus, they probably need reassurance of their boss when they talk about critical topics. The same effect was visible when the stakeholders were asked to contribute to a prepared timeline of the procedures during a flood event (workshop). The contribution fell short of the expectations and only a few details were given. The hesitation to share critical information can hopefully be overcome by building trust. Unfortunately, the most important factor for this is probably time. Simulation exercise or a serious game could further contribute toward addressing these topics.

Reflection and feedback on capacity development

In alignment with the Capacity Development Strategy outlining the approach to Training of Trainers toward facilitating knowledge co-production, the project also needs to monitor the effectiveness of capacity development activities in supporting RWL hosts. For this purpose, it is useful to reflect the degree to which DIRECTED partners have succeeded in this task, and what else may be needed in terms of enabling co-production in the future.

Reflections from RWL hosts and facilitators

An important support by DIRECTED partners were the preparation and debriefing of the stakeholder meetings in the RWL. Especially when things have gone differently than expected or hoped, the exchange and discussions with partners from Work Packages three and four were extremely helpful. The expertise and experience of the DIRECTED partners are also crucial to the success of RWL activities, as they make it possible to classify and understand results and people's behavior. Furthermore, the training of trainer activities, discussions and meetings on various topics have led to many matters receiving attention in the RWL that they would certainly not have received without them.

3. Discussion and next steps

Overall, majority of the labs have progressed in implementing knowledge co-production approaches and methods within their RWLs, in efforts to promote co-exploration of contextual risk issues with their stakeholders. In alignment with Risk-Tandem Phase II, their primary objective during 2024 has been to explore and identify relevant governance, communication and interoperability challenges, as well as windows of opportunity for co-producing fit-for-purpose solutions. However, it is important to note that many of the issues require further exploration, research and discussion between stakeholders and partners to negotiate trade-offs, available resources and underlying issues that may limit the effectiveness of proposed interventions (such as gaps in policy or financing).

For RWL 1, the current priorities for co-production emphasize support for the interoperability, increased accessibility, and usability of data to support climate adaptive planning and flood risk management. For emergency management, improved coordination and cooperation across municipalities has been highlighted. Solutions will be developed during Risk-Tandem Phase III, over the course of 2025 (in association with WP 5 and the Data Fabric regarding information needs). The potential for arranging a planning exercise for all involved emergency management stakeholders has been identified as an option to build capacities and identify issues in response coordination. In addition, co-produced risk maps for each municipality could improve the contextual risk understanding for the RWL and improve integrated risk management in the longer term. Organizing a planning exercise/simulation event is also being explored with DIRECTED partners. Data regarding social vulnerabilities (hosted by the Danish Coastal Authority) is also likely to provide benefits for risk reduction planning. However, gaps still remain in terms of cultivating a multi-hazard risk management approach for RWL 1, and in terms of citizen engagement (primarily responsibility of the municipalities).

For RWL 2, the next steps involve arranging a knowledge co-production workshop in October 2024, to further assess wildfire risk reduction priorities. These include co-exploring data needs and the potential for new knowledge products, and exploring opportunities to increase risk awareness through two-way public risk communication. The plans for developing an accessible and integrated flood risk model for the region is progressing as planned, in consideration of the needs of DRM and CCA planners. Potential approaches to improving coordination and collaboration between scales and actors on DRM and CCA will be developed during Phase III of Risk-Tandem, for instance by identifying opportunities to involve beach owners and hoteliers in adaptive and forward-looking coastal risk governance.

Following their workshop in Vienna in September, 2024, RWL 3 is well-positioned to continue developing an integrated flood model for the city with their stakeholders and WP 5 partners. In Zala, work resumes to develop accessible and usable information products to support decision-making in the country (with the support of user needs discussions). However, options for strengthening risk governance processes and mechanisms are still being debated. In Vienna, the opportunity to strengthen public/private partnerships is an

unparalleled opportunity to strengthen collaboration and information sharing. The role of the insurance sector in disseminating early warnings could also be further explored, and there is interest in further mapping the gaps and needs in terms of national capacities vis-à-vis commitments to the European Floods Directive, and other regional policies. However, some gaps remain. There is a need to further explore the multi-hazard potential of the Vienna lab, and how transboundary collaboration or knowledge-sharing could be instigated between partners within RWL 3.

For RWL 4, regular workshops have significantly contributed toward the implementation of knowledge co-production for the purposes of co-exploration and planning. Workshops have outlined opportunities to improve collaboration and coordination between DRM/CCA actors toward improved flood risk management, in consideration of climate change. Opportunities for developing a simulation exercise or a simulation exercise are currently being explored with DIRECTED partners, in efforts to diagnose issues in terms of communication and collaboration during active emergencies, and to identify opportunities for addressing them (based on flooding of 2021). This can also provide an entry into examining the potential for further developing the capacities of RWL 4 stakeholders by the Hosts, leveraging the Training of Training components of DIRECTED. This can also be leveraged to support improved citizen engagement between involved municipalities and the public, in recognition of the challenging contexts characterized by low public preparedness, and high expectations among the citizens regarding emergency management. In terms of data interoperability and increased usability, WP 5 partners continue their work in building an accessible, integrated flood information system for DRM/CCA purposes based on available modelling capacities, to support decision making for stakeholders who currently do not use such products.

3.1. Capacity development

Between September 2023 and 2024, majority of the capacity development activities, tailored consultations and peer learning has emphasized the need to cultivate a deeper understanding of the RWL risk governance context and associated challenges. As such, support for co-exploration workshops, interviews, research and methods for exploring hazards, risks and user needs from a holistic perspective have driven engagements between RWLs and partners of WPs 3, 4 and 5. However, as the implementation of Risk-Tandem approaches phase III (co-production of solutions), the needs for capacity development and Training of Trainers are rapidly increasing. To further support the implementation of T4.1, capacity development and ToT, a structured capacity needs assessment will be conducted with each RWL, now that their goals and priorities for integrated risk governance, communication and data interoperability have been more clearly outlined and researched. To support the co-design, co-production and implementation of solutions with RWLs and their stakeholders, it is expected that organizations and individuals beyond RWL hosts require support throughout this process.

For each RWL, this involves cultivating a tailored capacity development “pathway” toward achieving their goals, informed by RWL priorities as outlined here, supporting research and comparative assessments by WPs 3 and 4 (within the wider Risk-Tandem approach). These

will further inform the development of additional capacity development modules for the implementation of knowledge co-production in risk governance contexts.

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Annex I.

RWL 1 DIRECTED Workshop II: What does it take to be ready for the consequences of climate change?

This document contains a summary of the second DIRECTED workshop held on the 20th of August 2024 at Regionsgården (Hillerød).

Workshop participants

Jeppe Dahl-Nielsen – Egedal Kommune

Malene Jakobsen – Egedal Kommune

Hanne Karup Nielsen – Egedal Kommune

Kathrine Utzon-Frank – Egedal Kommune

Thomas Oest – Egedal Kommune

Christian Steenstrup Petersen – Frederikssund Kommune

Stine Holm – Halsnæs Kommune

Ole Hermansen – Frederiksborg Brand og Redning

Sigurd Falck – Frederikssund Kommune

Stine Stetson – Lejre Kommune

Frank Præfke – Lejre Brandvesen

Jens A. Andersen – Roskilde Kommune

Henrik G. Petersen – Beredeskabsstyrelsen / Kommune og Borger

Alexander Hauer – Region Sjælland

Arnau Macià Pou – Region Hovedstaden

Jacob Pedersen – Region Hovedstaden

Philip Tofting Junker – Region Hovedstaden

Martin Drews – Danmarks Tekniske Institut

1. **Are we ready for a Bodil 2.0? Simulation of an extreme event around Roskilde Fjord in 2050**

A link to the presented maps and visualisations will be made available to the participants.

2. **Where are the challenges and which ones should be addressed by DIRECTED?**

The aim of this part of the workshop was to clarify which of the challenges should DIRECTED help address and set focus on going forward.

During this part of the workshop, participants, divided into three groups, were asked to use green (high priority) and orange (low priority) post-its to prioritise the data and models, organisational and communication needs and challenges identified through the interviews in spring 2024 and the first DIRECTED workshop. The total number of post-its - across the three groups - can be seen in the table below. The six highest prioritised challenges are highlighted in green.

Challenges and needs	No. of green post-its: high priority	No. of orange post-its: low priority
1. Demand for more accurate data on the sea level rise during storm surge events.	**6**	**3**
2. Desire for models that can simulate coupled events (i.e. heavy rain in combination with a storm surge).	**10**	**0**
3. Desire for wave height to be incorporated into storm surge warnings.	**10**	**0**
4. More localised measuring points and weather stations to supplement information from models and warnings.	**7**	**2**
5. Some organisations are pressed for staff resources to handle GIS and mapping.	**7**	**2**
6. Different warning systems across municipalities covered by the same emergency service.	**1**	**5**
7. Emergency plans are formulated differently across municipalities with no distinction to neighbours.	**1**	**5**
8. Lack of knowledge of how inter-municipal coordination is organised.	**3**	**5**
9. Some municipalities may experience manpower chal-	**3**	**6**

lenges in connection with incidents that occur on weekends.		
10. Uneven levels of post-incident evaluation.	**3**	**3**
11. Alignment of expectations between municipalities and emergency services on the one hand and citizens on the other can be strengthened.	**5**	**4**
12. Need for coordination across municipalities in terms of co-operation and communication to citizens.	**3**	**6**
13. Need for a common municipal communication platform to gather information during an incident that affects the entire fjord.	**2**	**7**

3. **Way forward**

The six challenges and needs that received the most green (high priority) post-its became the point of departure for the next part of the workshop. In this part, participants were asked to:

- define the desired future state of the challenge/need in 2050
- establish a plan to close existing gaps by identifying short-term and long-term needs and opportunities.

The results from the group discussions and brainstorming can be seen below.

1 & 4: Demand for more accurate data on the sea level rise during storm surge events. Desire for more localised measuring points and weather stations to supplement information from models and forecasts.
Desired future state in 2050 Open and free data. Uniform responsibility and standards for measuring points. Forecasts are accurate and more detailed. Measuring points set up in areas with high flood risk. Good warning systems from measuring systems, which are easy and intuitive.

Emergency services arrive on time *to the 'right' places.*

Considerations

In the discussion that followed, it was mentioned that a mapping of established measuring point and weather stations should be complemented by an attempt to map the need and location of additional stations in order to have a complete picture of an event. The point was to ensure that on the one hand there are enough measuring points, but on the other hand that an unnecessary number is not established due to economic reasons.

(Note: Does it matter for the quality of mapping if the measuring points that are set up are of the same type?)

Short-term needs and opportunities

Key players in dialogue about future responsibility, standards and expansion of the network of measuring point and stations.

Municipalities set up their own measuring points and stations.

Mapping analyses e.g. optimization of measuring stations.

Does the Danish Meteorological Institute have access to data? Wind data?

Precipitation data and quality assurance. How dense a network of measuring points is needed?

Long-term needs and opportunities

A unified database for climate adaptation.

Nationwide solution, for example through the environment portal*.

Better forecasting.

*Denmark's Environmental Portal is a public partnership between the state, municipalities, and regions, aimed at supporting digital environmental management. The portal provides shared access to data on the environment, water, nature, land use, and climate adaptation for government bodies, businesses, and citizens. This data is used in various areas, such as soil contamination certificates, pesticide-free zones, and water management plans.

2: Desire for models that can simulate coupled events.

Desired future state in 2050

More complex data models but user-friendly tools.

Emergency plans can be made based on a complete picture.

A system that can link all possible incidents.

Good enough data basis for good forecasting.

Coupled events for emergency response take into consideration fjords, lakes and rivers.

Short-term needs and opportunities

Linking real-time groundwater levels and precipitation data.

Identifying opportunities to mitigate challenges.

Long-term needs and opportunities

A unified database for climate adaptation.

Which RCP (2.6-4.0-6.0-8.5) should be used for climate adaptation? It's not always clear which climate change scenario and time horizon to consider for climate adaptation

Better forecasting.

Better implemented climate adaptation in time and as groundwater and sea levels rise.

Considerations

It is probably a misunderstanding of the climate scenarios to ask which ones to use for climate adaptation (even though the recommendation is 4.5 in the short/medium term and 8.5 in the long term). Climate adaptation should aim for flexible solutions that can be adapted to different pathways and scenarios.

3: Desire for wave height to be incorporated into warning systems.

Desired future state in 2050

More complex data modelling but user-friendly tools.

Wave heights are included in storm surge warnings with a high level of detail. Access to historical wave height data for dike construction and planning.

Good forecasting.

Short-term needs and opportunities

Better for forecasting. Setting up gauges. Identification of local challenges such as breakthrough risk and erosion risk of dykes and bridges.
Long-term needs and opportunities A unified database for climate adaptation. Better use of data for planning. Better protection and better warning.

5: Some organisations are pressed for staff resources to handle GIS and mapping.
Desired future state in 2050 Joint training of GIS people in the municipalities so that calculations and mapping can be carried out by the municipalities themselves. Several common systems for damage calculation. DMI maps with open and closed locks. Competent digelaug Maps with placement of watertubes in the right critical locations where permanent climate adaptation solutions have not yet been established.
Short-term needs and opportunities Preprepared maps Continuous updating of new infrastructure e.g. dykes. Maps with worst-case challenges and scenarios e.g. if watertubes burst.
Long-term needs and opportunities A unified database for climate adaptation Organisation of knowledge sharing across municipalities.

11: Alignment of expectations between municipalities and emergency services on the one hand and citizens on the other can be strengthened.
Desired future state in 2050 Communication to citizens and national standard for calculation of financial contribution. To be solved locally. Where should messages/alerts be displayed? How much should be displayed? (worst case scenarios can induce panic). Who makes the announcement? Who holds the responsibility? An early warning system ensuring that citizens know what they can expect when it comes to help and what measures they would need to take themselves.
Short-term needs and opportunities Prioritisation of efforts and national standard. A mapping of citizens who cannot and will not evacuate themselves. Explain why not all buildings are protected by e.g. watertubes. Video with instructions on how to properly deploy sandbags.
Long-term needs and opportunities Future planning

4. **How do we move forward?**

During the first DIRECTED workshop in March 2023, participants expressed their interest in attending:

- Physical workshops (in person) twice a year.
- Possible online meetings/webinars in the meantime.
- Bilateral meetings with the Capital Region and DTU when needed.

Participants confirmed their interest in continuing with this agreement.

Other opportunities for collaboration:

Henrik G. Petersen Head of Office at the Danish Emergency Management Agency presented the idea of a planning exercise. The idea of planning exercises is to shift the focus from crisis management to crisis planning and to stimulate dialogue at a pace everyone can participate in. And thus, allow further time to deal with complex issues. The planning exercise will illustrate that a very severe disaster situation can only be handled properly if all actors in society; authorities, central infrastructure managers, supply-critical companies, as well as a number of companies and citizens work together to solve the task. In particular, the planning exercise should be used to test new technologies, including communication technologies, to help create both an overview of the situation and an overview of resources.

Workshop reflections

The following are reflections from DIRECTED partners in RWL 1 triggered by statements and discussions during the workshop. They therefore mainly express judgements, ideas and to some extent a goal to challenge some of the workshop conclusions.

Data and modelling needs and comments

There is interest in a Data Fabric solution that can combine different data sources in one place. There is a consensus that the different models and data sources need to talk to each other and that the resulting tool should be user-friendly and intuitive.

There is a desire for more local measuring points and stations. Municipalities and emergency response organisations know the area and, in some cases, can identify critical locations where local measurements can provide useful insights. Financial constraints pose the question: how do we optimise the location and number of stations?

Modelling and preparing for coupled incidents are a challenge that both municipalities and emergency services recognise. What types of linked incidents do municipalities account for in their emergency response plans and what data do we require?

Should DIRECTED offer data and modelling training to interested municipalities and emergency services? There is room within the project framework to offer capacity building if there is an interest.

DIRECTED will try to start a dialogue with the Danish Meteorological Institute and the Danish Environment Portal to explore collaboration opportunities.

Organisational needs and remarks:

Differences in service levels across municipalities affect citizens' expectations. Dialogue between neighbouring municipalities and emergency services allows for standardisation and increased awareness of these differences.

Frederiksborg Fire and Rescue Service covers five municipalities (Egedal, Frederikssund, Furesø, Halsnæs and Hillerød), which poses different organisational challenges compared to emergency services covering a single municipality. It is worth taking these differences into account within DIRECTED.

Communication needs and remarks:

DIRECTED offers a framework for building a network and promoting dialogue across the actors working with climate adaptation and emergency response around Roskilde Fjord. In this sense, the second DIRECTED workshop was another opportunity to promote knowledge exchange among climate adaptation and preparedness actors.

Other comments and observations:

How can DIRECTED best promote political dialogue and engagement?

Annex II. RWL 2 Webinar

Annex III. RWL 2 Civil protection exercise (GA2024)

Acronyms

ACRONYM	DEFINITION
ARPAE-SIMC-CF	REGIONAL AGENCY FOR PREVENTION, ENVIRONMENT AND ENERGY OF THE EMILIA-ROMAGNA REGION - HYDRO-METEO-CLIMATE SERVICE - FUNCTIONAL CENTRE
ARSTPC	REGIONAL AGENCY FOR TERRITORIAL SAFETY AND CIVIL PROTECTION OF THE EMILIA-ROMAGNA REGION
COC	MUNICIPAL OPERATIONS CENTRE
CS	SUPRA-COMMUNAL CENTRE
SOT	UT TERRITORIAL OPERATIONS ROOM
CCS-SOPI	RELIEF COORDINATION CENTRE - INTEGRATED PROVINCIAL OPERATIONS ROOM
COR	REGIONAL OPERATIONS CENTRE
CPV	PROVINCIAL COORDINATION OF CIVIL PROTECTION VOLUNTEERS
VO RE.G.EM	VOLUNTARY ORGANISATION EMERGENCY MANAGEMENT REGISTER
RIRER	INTEGRATED HYDRO-METEO-PLUVIOMETRIC NETWORK EMILIA-ROMAGNA REGION
UTRN	RIMINI TERRITORIAL OFFICE (ARSTPC)
UTFE	FERRARA TERRITORIAL OFFICE (ARSTPC)

Foreword

Non-structural civil protection prevention activities include the promotion and organisation of exercises in order to promote the integrated and participatory exercise of the civil protection function (Legislative Decree No. 1/2018 'Civil Protection Code').

The "DIRECTED_Flood 2024" exercise is part of the European project DIRECTED "DISASTER RESILIENCE FOR EXTREME CLIMATE EVENTS PROVIDING INTEROPERABLE DATA, MODELS, COMMUNICATION AND GOVERNANCE "https://directedproject.eu/ (Disaster resilience to extreme climate events through interoperable data, models, communication and governance), which has as lead partner the Technische Universität Braunschweig, DE and in which the Agency for Territorial Safety and Civil Protection participates as beneficiary partner, in addition to the following

- POTSDAM-INSTITUT FUER KLIMAFOLGENFORSCHUNG, DE;
- DANMARKS TEKNISKE UNIVERSITET, DK;
- GECOSISTEMA SRL, IT;
- INSTITUTE FOR ADVANCED SUSTAINABILITY STUDIES EV, DE;
- UNIVERSITY COLLEGE CORK - NATIONAL UNIVERSITY OF IRELAND, IE;
- GENILLARD & CO GMBH, DE;
- INTERNATIONALES INSTITUT FUER ANGEWANDTE SYSTEMANALYSE, AT;
- ERFTVERBAND, DE;
- ZALA KULONLEGES MENTOK ES ONKENTES TUZOLTO EGYSULET, HU;
- REGIONAL AGENCY FOR ENVIRONMENTAL PREVENTION ENERGY EMILIA-ROMAGNA, IT;
- HELMHOLTZ ZENTRUM POTSDAM DEUTSCHESGEOFORSCHUNGSZENTRUM, DE;
- NORTH SPATIAL INFORMATION RESEARCH GMBH - 52°North GmbH, DE,

and associated partners:

- SEI OXFORD OFFICE LIMITED, UK
- OASIS HUB LIMITED, UK;
- EIDGENOESSISCHE TECHNISCHE HOCHSCHULE ZUERICH Switzerland.

The project, financed by the Horizon Europe Programme - Horizon-CL3-2021-DRS-01 - Disaster-Resilient Society 2021, aims to promote transnational cooperation and the growth of knowledge and skills with respect to the new topics of Disaster Risk Reduction - DRR (Disaster Risk Reduction) and Climate Change Adaptation - CCA (Climate Change Adaptation) in a multi-risk perspective.

1. Purpose of the exercise

The coastal and river risk exercise, which will take place on 13th-14th June 2024, has the main purpose of improving the response capacity of the regional and transnational civil protection system to storm events concomitant with river flooding.

Specifically, the objectives are:

- test the regional warning system for hydrogeological, hydraulic and coastal weather risk, as per DGR no. 1761/2020, with particular reference to the actions to be put in place (intervention model) following the issuing of an alert for hydraulic, coastal and sea state criticality (in the forecast phase) and notifications of exceeding of hydrometric thresholds, during the event;
- Define and test coastal/pluvial risk management procedures and governance useful for updating civil protection planning;
- verify the critical situations on the coast, taking into account the civil protection interventions, through a joint inspection of the technicians of the local authorities and the regional technical structures;
- verify the local strategic resources needed to cope with the emergency (monitoring tools, prevention tools based on territorial modelling data also in function of climate change highlighted by increasingly extreme events with medium-term return times, emergency areas and facilities, etc.);
- Identify the most practical ways of providing correct and timely information to the population and trade associations;
- observe and collect information during the exercise phases in order to improve the last-mile warning system by the municipalities concerned.

In addition, tools made available both within the DIRECTED project and by the project stakeholders will be tested as part of the exercise and the interoperability of data and tools for risk management and impact prediction and assessment will be verified.

2. Entities and operational structures involved in the exercise

Emilia-Romagna Region - Agency for Territorial Security and Civil Protection:

- Technical coordination sector territorial security and civil protection
- Ferrara Territorial Office
- Rimini Territorial Office

ARPAE SIMC Functional Centre

Municipalities of Bellaria-Igea Marina, Rimini, Riccione, Misano Adriatico, Cattolica.

CS Riviera del Conca (Centro Operativo Sovracomunale dei Comuni di Riccione, Cattolica, Misano Adriatico)

HERA SPA

Consorzio di Bonifica della Romagna

Provincial Civil Protection Volunteer Coordinations (FE, RN)

Stakeholders and partners of the European DIRECTED project will also be involved as observers.

3. Reference event and scenario

The reference event chosen for this exercise is a fictitious scenario, which involves the issuing of an orange colour-coded alert for hydro-geological, hydraulic, thunderstorm, wind and offshore sea criticality, and a red alert for coastal criticality.

The scenario foresees intense and persistent precipitation of thunderstorms in the eastern part of the region, associated with gusts of wind, which may be added to the strong bora currents associated with the presence of an intense low-pressure area positioned over the lower Adriatic.

Sea levels are expected to rise in the Upper Adriatic due to the persistent sirocco winds preceding the bora event, resulting in rough sea conditions off the regional coast, with the direction of the wave coming from the north-eastern sectors. These conditions will generate the propagation of the sea as far as residential areas, extensive flooding of the coastline, extensive beach erosion and serious damage to bathing establishments and settlements near the coast.

The predicted rainfall will generate rapid rises in water levels in minor watercourses and widespread flooding in the secondary urban network, as well as moderate flooding in major watercourses, with occupation of floodplain areas and involvement of embankments. The difficulty in the outflow of rivers and canals into the sea, due to the simultaneous storm event, will generate the persistence of high hydrometric levels at the mouths of watercourses, with possible overflows and further flooding in built-up areas near the coast.

3.1 Characteristics of the Emilia-Romagna coastline

The coast is an important territory for the Emilia-Romagna Region, both from a socio-economic and historical-naturalistic point of view, with a high environmental sensitivity due to the difficult coexistence between natural phenomena and numerous human activities.

It is characterised by a shallow, sandy beach that is almost continuous for about 130 km and ranges in width from a few metres to over 200 m, with an average depth of about 70 m. The submerged beach is characterised by a closing depth of around -6/-7 m and generally gentle slopes with increases at the delta cusps and decreases at a 'gulf' at its northern edge.

The coastal dune is only present along about 30 % of the coastline and develops discontinuously and at an average height of 2-3 m only in the central and northern sectors of the coastline, while it is practically absent in the southern sector, where it was widely levelled and destroyed in the first decades of the 20th century.

3.2 Characteristics of the Marecchia river basin

The river valleys of the watercourses running from south-west to north-east of the Romagna territory are, on average, between 6-7 and 15-16 km wide. Generally speaking, these are torrential watercourses with strong summer low flows and overflowing floods in the autumn and winter periods. This situation of extreme flow rates is mainly due to the rainfall regime (outflows linked to meteoric inflows) and the presence of poorly permeable soils (clays, marls, marly-sandstone alternations).

The Marecchia is the ancient Ariminus that gave Rimini its name. Today, its short stretch of plain and mouth are conventionally used to delimit the end of the Po Valley and the whole of northern Italy. The basin covers the territories of Tuscany (province of Arezzo), Emilia-Romagna (province of Rimini), and part of the Republic of San Marino.

The river originates in the municipality of Badia Tedalda in Tuscany from the Alpe della Luna (Monte Zucca 1,263 m a.s.l.), near Pratieghi in the Tuscan-Romagna Apennines. Its 70 km course runs through Tuscany and Romagna along the Marecchia Valley (which takes its name from the river), receiving the contribution of several tributaries including the Presale stream, the Senatello stream, the Mavone stream, the Mazzocco stream, the San Marino stream and the Ausa stream. With a wide and pebbly bed, the river then reaches the city of Rimini where it flows into the Adriatic Sea. In the past, the final stretch (about two kilometres) of its course passed under the Tiberius Bridge and then flowed into the sea through the canal port. Between 1924 and 1930, however, an artificial riverbed ('Deviatore del

Marecchia') was built to prevent flooding. Following this operation, the current mouth is located north of the city, near San Giuliano Mare and Rivabella.

3.3 Meteorological Reference Event

On the day of 14th of June, a deep low centred over Sardinia is present over the Mediterranean basin, on the eastern branch of which a fast flow of south-easterly currents from the Adriatic is active within the warm sector of the frontal system. The convergence on the ground of the warm and humid currents on the east coast of Emilia-Romagna rising along the orographic barrier of the Apennines causes precipitation over the entire eastern sector of the region, and the development of an intense thunderstorm line over the Rimini area. The south-easterly shift of the minimum on the following day causes an increase in pressure over the sector upwind of the Alps, with an intensification of the pressure gradient on the ground that causes strong bora currents to develop over the northern Adriatic.

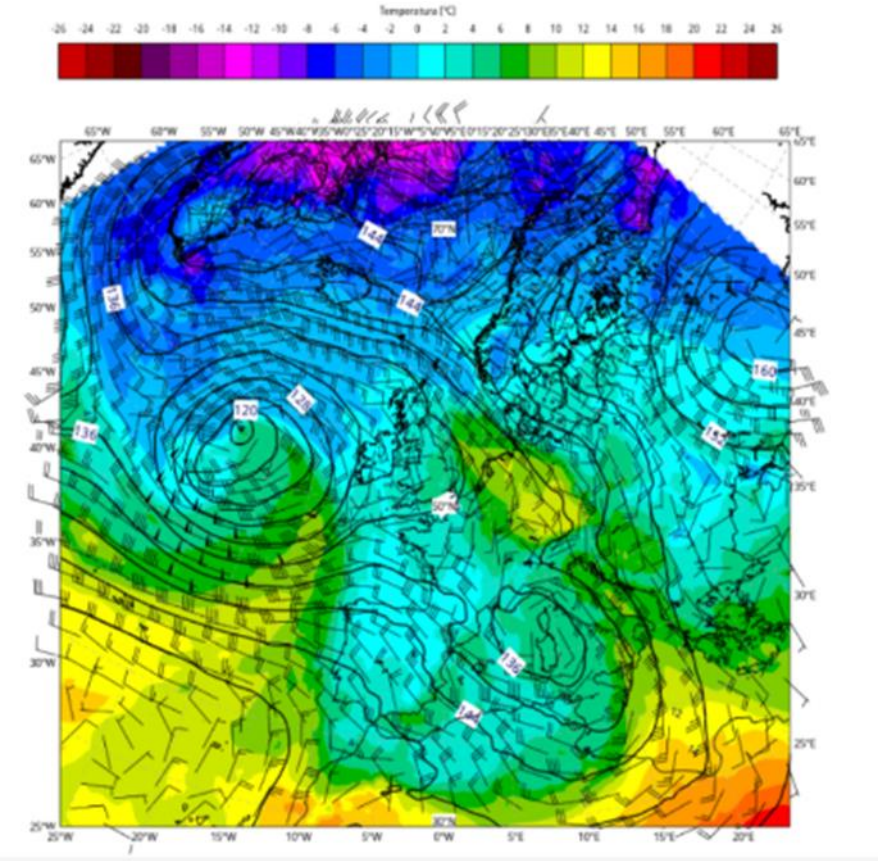


Figure 1: Analysis map (from IFS-ECMWF model) of the geopotential field, temperature and wind at 850 hPa on 14th of June at 00:00 UTC.

3.4 Analysis of phenomena

3.4.1 Rainfall analysis

On 13th-14th of June, the regional monitoring network recorded intense and persistent thunderstorm rainfall in the eastern sector of the region, with rainfall totals exceeding 70 mm in 24 hours in the central-eastern hilly area, from Bologna to Rimini, and peaks of over 100 mm in the lowland area.

The maximum accumulated rainfall in the Rimini area was recorded at the Vergiano station, with 100.4 mm/24 h, Ponte Verucchio, with 111.80 mm/24 h, and Rimini Ausa, with 100 mm/24 hours.

The highest hourly intensities were recorded at the Rimini Ausa station with 90 mm/h.

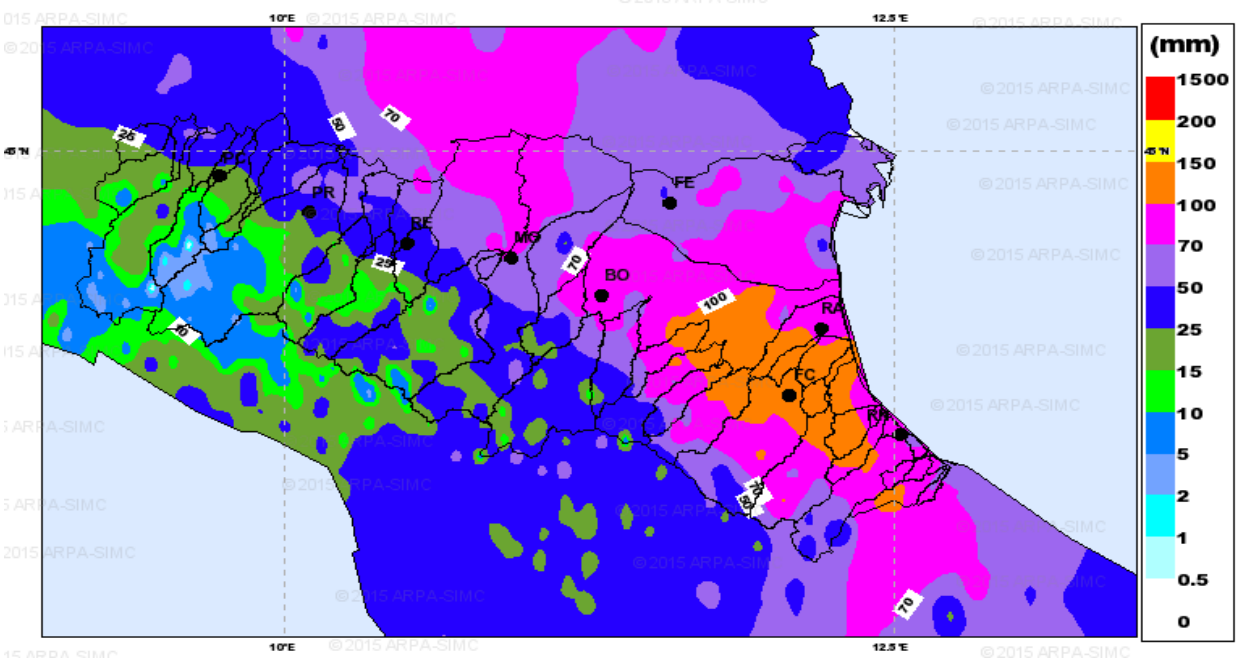


Figure 2: Cumulative rainfall in 48 h of the event on 13th-14th of June over the territory of the Emilia-Romagna Region.

3.4.2 The flooding of the Marecchia River

The rainfall of the event on the mountainous part of the central-eastern area of the Region generated flood waves of considerable volume, characterised by several successive floods in many watercourses starting from the right tributaries of the Reno River to the Marecchia

river and other minor streams in the province of Rimini, with hydrometric levels generally exceeding thresholds 2 and close to thresholds 3 at the mouth for several consecutive hours, corresponding to the orange colour code.

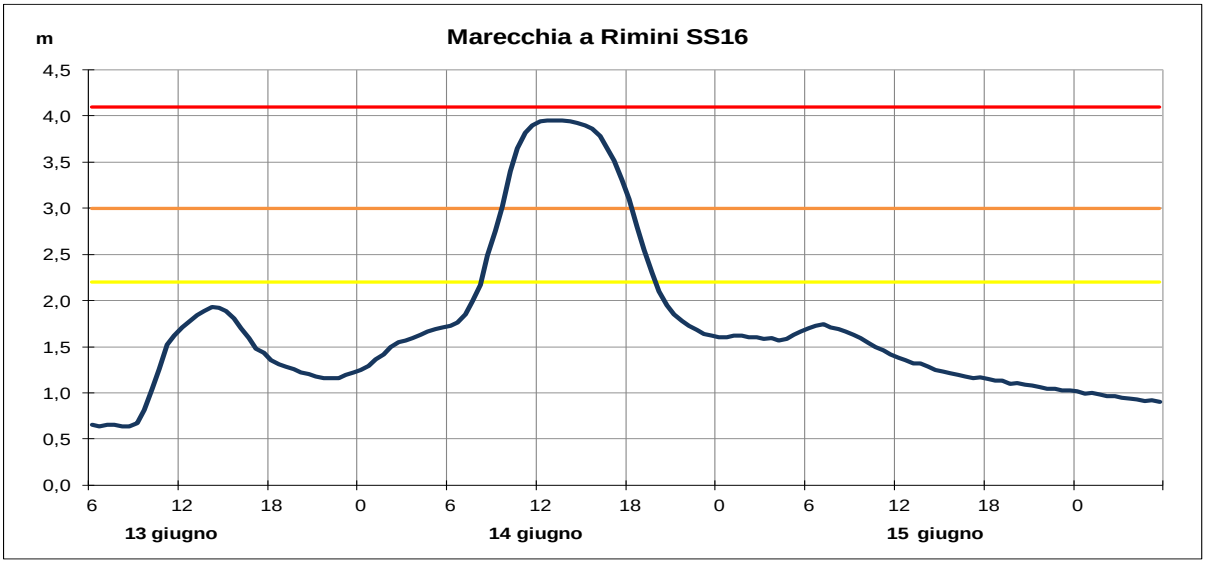


Figure 3: Flood hydrogram for the Marecchia River at Rimini SS16 section.

3.4.3 Storm surge and marine ingress analysis

On 14th of June, persistent Sirocco winds from the south-eastern sectors generated a sharp rise in sea level in the upper Adriatic. This phenomenon is generally caused by the persistence of the Sirocco winds that blow for many hours over the entire length of the Adriatic basin and tend to stack masses of water towards the north, generating the so-called 'Acqua Alta' phenomenon. Already in the early hours of 14 June, the sea level recorded by the tide gauges at Porto Garibaldi, Cervia and Cattolica Porto exceeded 1 m for a few hours. On the day of 14th of June, the sea level measured by the 3 tide gauges detected high-frequency sea level fluctuations generally associated with intense storm surges caused by meteorological disturbances. On the day of 14th of June 2024, the Cervia and Cattolica tide gauges showed similar trends, with two peaks in the level. For the Cervia tide gauge, the values recorded are 1.10 m and 1.33 m; slightly lower for the Cattolica tide gauge.

Due to the shift of the minimum pressure, which led to a rotation of the winds in the upper Adriatic into Bora winds (coming from the north-east), a progressive increase in wave motion was recorded on the Emilia-Romagna coast, coming from the north-eastern sector. The Nausicaa wave buoy positioned off the Municipality of Cesenatico recorded a peak wave height of 3.20 m associated with Bora winds. The wave conditions with a height greater than 1.35 m, the threshold used to identify the beginning and end of a storm event in Emilia-Romagna (corresponding to the 95th percentile of the wave dataset available from 2007 to date), lasted for many hours. The storm event showed an average direction of origin of 60° N and a duration of about 12 h.

The meteo-marine event caused considerable criticalities along a large part of the regional coastline, in terms of flooding of beaches and the urbanised territory behind and strong

erosion in specific areas of the coastline. On the basis of the event report drawn up by the Emilia-Romagna Region's Geology, Seismic and Soils Area, the areas affected by the event are the following

- Rimini: beach and winter dune erosion along the entire coastline (Cattolica, Misano Adriatico, Riccione-Rimini, Bellaria Igea Marina) and consequent damage to bathing establishments and the urbanised area due to sea intrusion.
- Forli-Cesena: beach and winter dune erosion along the entire coast (Savignano sul Rubicone, Gatteo, Cesenatico - Valverde) with flooding of the backshore up to the urbanised areas of Savignano sul Rubicone, with consequent damage to establishments, and Valverde. The Vinciane Gates were hit and the covers of the pumps were damaged.
- Ravenna: flooding of the urbanised area in Lido Adriano, Punta Marina, Marina di Ravenna, Lido di Savio and Porto di Cervia. In the areas of Cervia, Lido di Savio, Lido Adriano, Marina Romea and Casal Borsetti, on the other hand, erosion of the beach and winter dune was observed. In the Milano Marittima, Lido Adriano, Marina Romea, and Casal Borsetti areas, damage to the establishments was observed.
- Ferrara: flooding of the entire urban area (Ferrarese, Porto Garibaldi and Goro) associated with erosion of the beach and winter dune, damage to establishments and defence works mainly in the Ferrarese area.

The concomitance of sea level rise and wave signals resulted in a particularly critical condition for the Emilia-Romagna coastline, causing extensive and widespread damage along the entire regional coastline.

3.5 Model Scenarios and Forecasts under the DIRECTED_Flood2024 exercise

The marine weather scenario that is the subject of the DIRECTED_Flood2024 exercise is hypothesised on the basis of the characteristics described in the previous paragraphs, elaborated on the basis of the knowledge of historical events that actually occurred, however, in order to test the civil protection system looking to the future, it is assumed that the scenario of marine ingression with coastal flooding also considers the rise of the mid-sea in 2050 as a result of the climate change phenomena underway.

To summarise, the DIRECTED_Flood2024 exercise involves simulating the following concurrent events:

- Intense storm precipitation characterised by 100 mm in 1 h localised over part of the territory of the municipality of Rimini
- Marine intrusion reaching a level of 1.85 m above mean sea level corresponding to the 2050 scenario with a 10-year return time according to Copernicus estimates (https://cds.climate.copernicus.eu/cdsapp#!/dataset/sis-water-level-change-

timeseries-cmip6?tab=overview)

In terms of the impact and mapping of the hazard on the affected territory, modelling simulations are carried out using the Saferplaces platform (www.saferplaces.co) and the RIM2D model, which are tools provided by the DIRECTED project.

High-resolution maps will then be available that can analyse in detail the extent of the impacted areas and the critical points that will be subject to mitigation measures to reduce the impact.

Figure 4: Coastal Flooding with Mean Sea Level at 1.85 m without protection (sandbags) at critical points on the canal port.

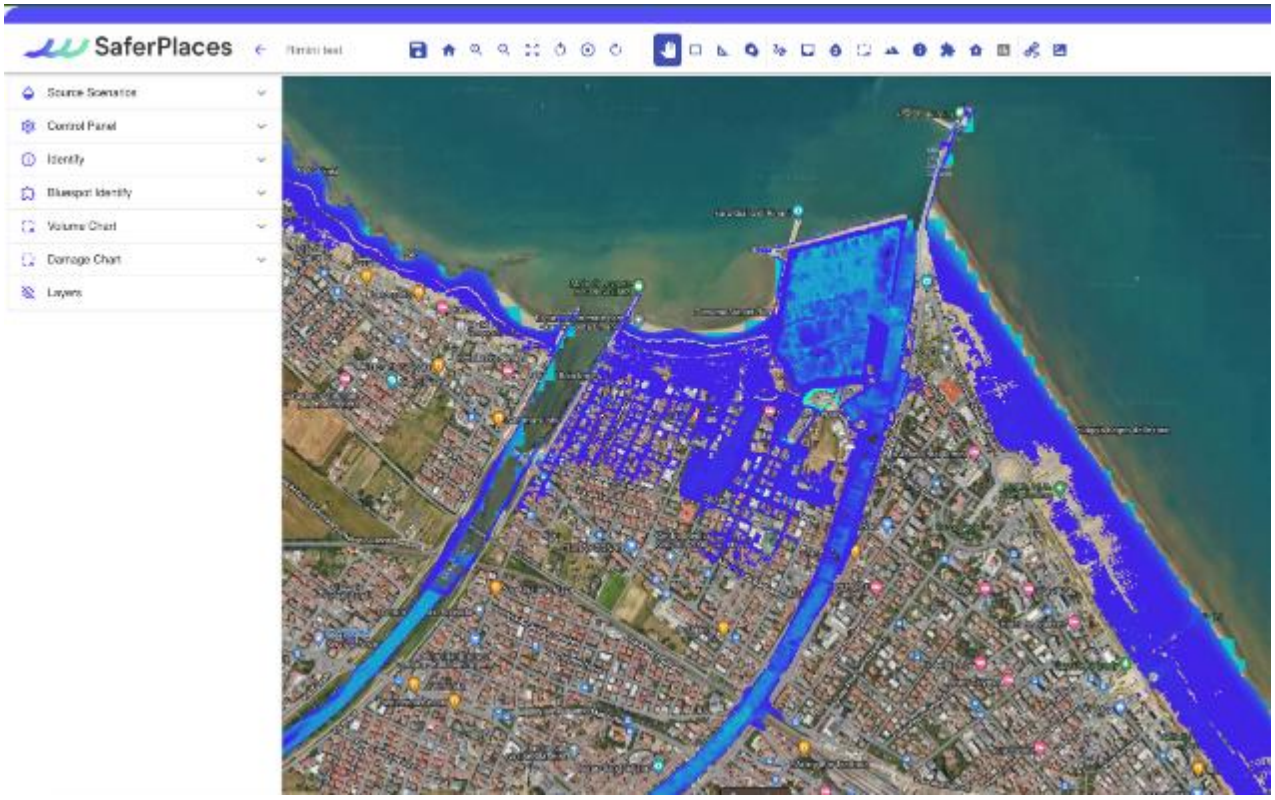


Figure 5: Coastal Flooding with Mean Sea Level at 1.85 m with protection (sandbags) at critical points on the canal port.

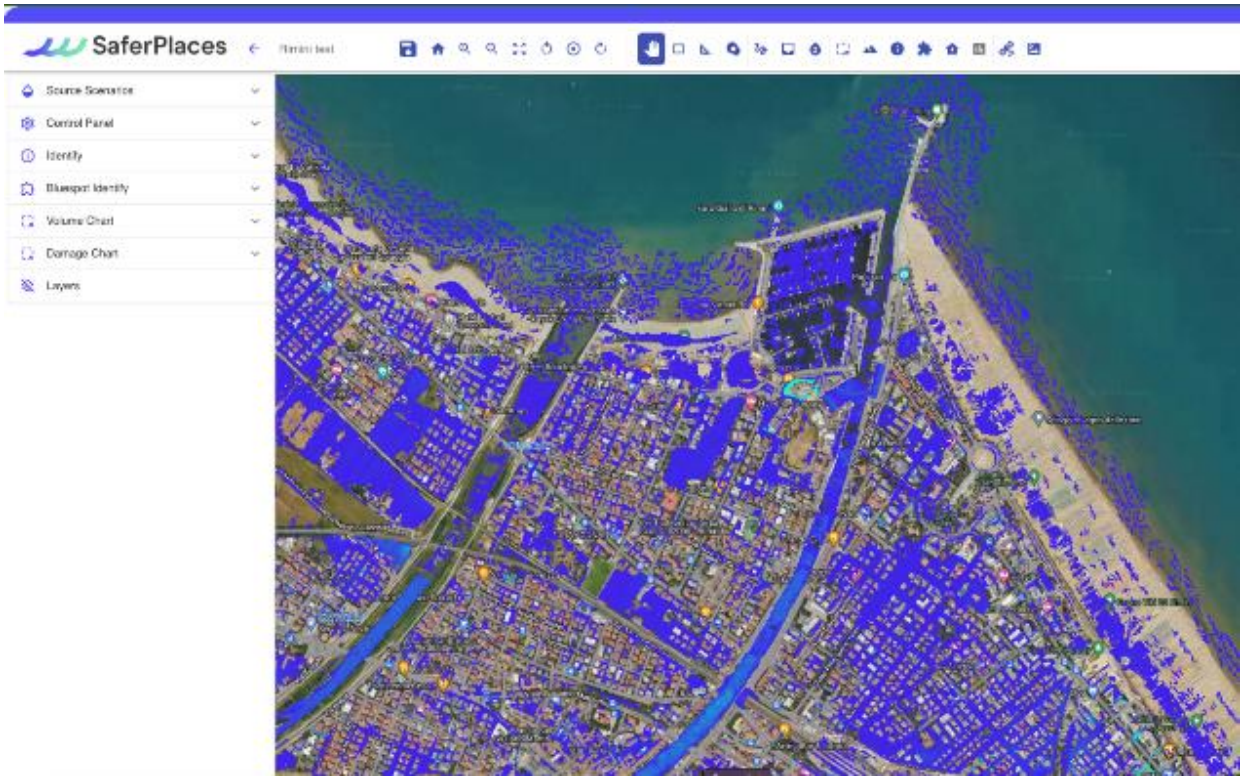


Figure 6: Rainfall Flooding 100 mm in 1 h.

4. Regional intervention model

The intervention model that is tested in the exercise is the one defined in the "Document for the organisational and functional management of the regional warning system for hydrogeological, hydraulic, coastal weather risk and avalanche risk for civil protection purposes" approved by DGR no. 1761/2020, and eventually detailed in the provincial and local emergency planning.

The risk prevention and emergency management actions implemented by the operational structures of the regional civil protection system are tested in relation to the Alert level (colour code) and in relation to the following distinct time phases

- **forecasting phase:** before the event occurs, to which corresponds the activation of prevention actions aimed at reducing/mitigating the possible damage on the territory and preparing for the management of possible emergency situations, with reference to the civil protection planning and to what is contained in the hydrogeological-hydraulic weather alert;
- **event phase**: the occurrence of the event, to which corresponds the activation of actions for monitoring, countering and managing the emergency in progress in relation to the punctual evolution that must be followed at the local level.

The communication of the expected alert level and the sending of notifications during the event have the main purpose of enabling the bodies and operational structures of the territorial civil protection system to prepare specific activities aimed at preparing for the management of the expected phenomena and the planning of the actions that will gradually be implemented, from the "forecast phase" to the management "of the event in progress", aimed at dealing with the critical situations that may occur in a territory.

The coordinating bodies to be activated in the conduct of the exercise at the various levels of government are:

REGIONAL LEVEL

- Regional Agency for Territorial Security and Civil Protection - Regional Operations Centre
- Functional Centre - ARPAE SIMC

PROVINCIAL LEVEL

- Regional Agency for Territorial Safety and Civil Protection - UT Rimini (SOT-SOPI)
- Consorzio della Bonifica della Romagna
- HERA SPA
- Provincial Civil Protection Volunteer Coordinations

SUPRA-MUNICIPAL LEVEL

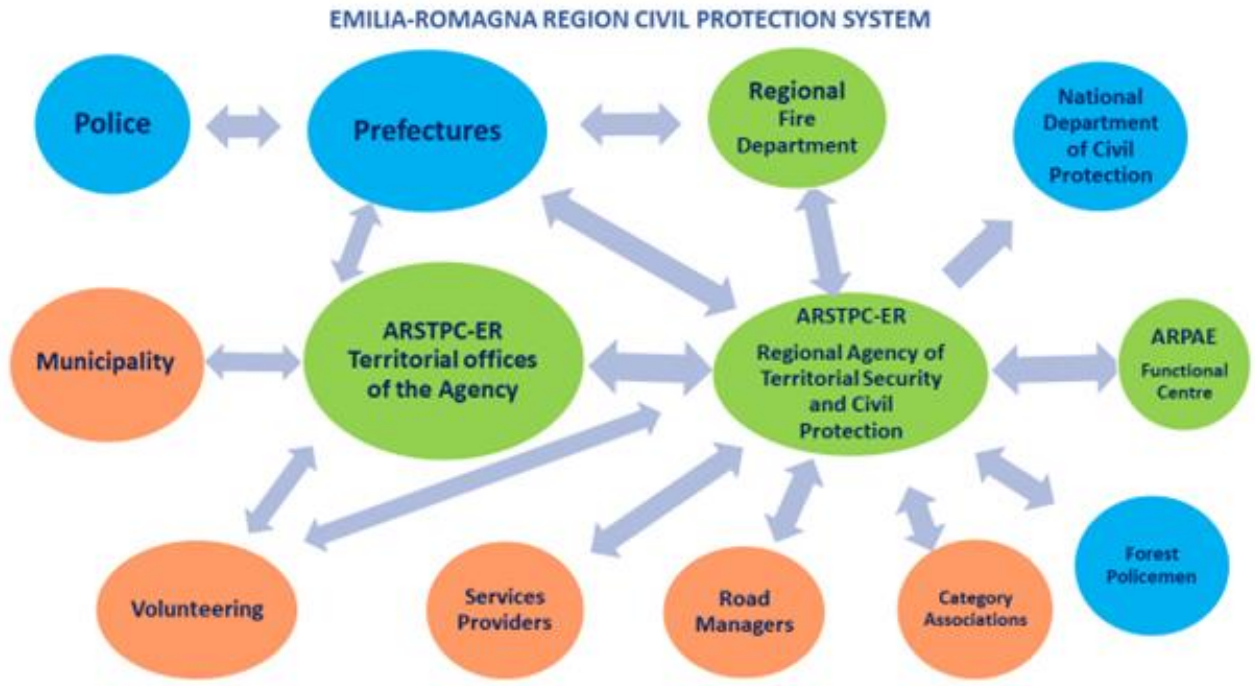
- CS (Centro Sovracomunale) RIVIERA DEL CONCA

MUNICIPAL LEVEL

Municipal Operations Centre (COC) coordinated by the Mayor, (functions: technical and assessment; voluntary work; logistics, materials and means) of the municipalities

participating in the exercise: COC Rimini, COC Bellaria-Igea Marina, COC Riccione, COC Misano Adriatico and COC Cattolica.

The diagram in the following figure represents the regional civil protection system within which the actions defined in the intervention model are developed and partly carried out during the exercise, as described in the Attachment to this document.



4.1 Activation Procedures and Actions

For the purposes of activating the operational phases of civil protection foreseen by the procedures of the regional warning system referred to in the 'Document for the organisational and functional management of the regional warning system for hydrogeological, hydraulic, coastal weather and avalanche risk, for civil protection purposes', the reference event was reconstructed as follows.

In the forecast phase

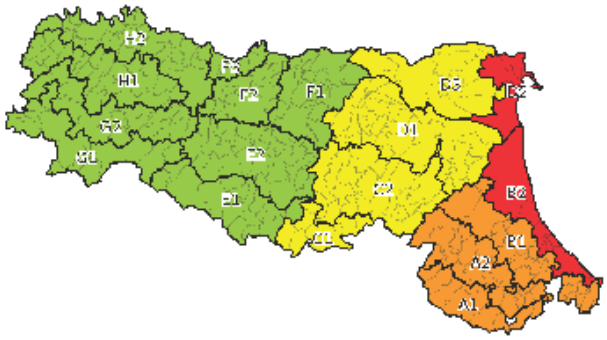
The following Hydrogeological and Hydraulic Weather Alert was simulated:

RegioneEmiliaRomagna

ALLERTA METEO-IDROGEOLOGICA-IDRAULICA

arpae

DOCUMENTO N.	DATA EMISSIONE	INIZIO VALIDITA'	FINE VALIDITA'
000/2024		14/05/2024 00:00	15/05/2024 00:00



ZONE DI ALLERTA:

A1: Montagna romagnola (FC, RN)
A2: Alta collina romagnola (RA, FC, RN)
B1: Bassa collina e pianura romagnola (RA, FC, RN)
B2: Costa romagnola (RA, FC, RN)
C1: Montagna bolognese (BO)
C2: Collina bolognese (BO, RA)
D1: Pianura bolognese (BO, FE, RA)
D2: Costa ferrarese (FE)
D3: Pianura ferrarese (FE)
E1: Montagna emiliana centrale (PR, RE, MO)
E2: Collina emiliana centrale (PR, RE, MO)
F1: Pianura modenese (RE, MO)
F2: Pianura reggiana (RE)
F3: Pianura reggiana di Po (PR, RE)
G1: Montagna piacentino-parmense (PC, PR)
G2: Alta collina piacentino-parmense (PC, PR)
H1: Bassa collina piacentino-parmense (PC, PR)
H2: Pianura piacentino-parmense (PC, PR)

	CRITICITA' IDRAULICA	CRITICITA' IDROGEOLOGICA	CRITICITA' PER TEMPORALI	VENTO	TEMPERATURE ESTREME	NEVE	PIOGGIA CHE GELA	STATO DEL MARE	CRITICITA' COSTIERA
A1	ARANCIONE	ARANCIONE	ARANCIONE	GIALLO	VERDE				
A2	ARANCIONE	ARANCIONE	ARANCIONE	GIALLO	VERDE				
B1	ARANCIONE	ARANCIONE	ARANCIONE	GIALLO	VERDE				
B2	ARANCIONE	ARANCIONE	ARANCIONE	ARANCIONE	VERDE			ARANCIONE	ROSSO
C1	GIALLO	GIALLO	GIALLO	GIALLO	VERDE				
C2	GIALLO	GIALLO	GIALLO	GIALLO	VERDE				
D1	GIALLO	VERDE	GIALLO	GIALLO	VERDE				
D2	GIALLO	VERDE	GIALLO	ARANCIONE	VERDE			ARANCIONE	ROSSO
D3	GIALLO	VERDE	GIALLO	GIALLO	VERDE				
E1	VERDE	VERDE	VERDE	VERDE	VERDE				
E2	VERDE	VERDE	VERDE	VERDE	VERDE				
F1	VERDE	VERDE	VERDE	VERDE	VERDE				
F2	VERDE	VERDE	VERDE	VERDE	VERDE				
F3	VERDE	VERDE	VERDE	VERDE	VERDE				
G1	VERDE	VERDE	VERDE	VERDE	VERDE				
G2	VERDE	VERDE	VERDE	VERDE	VERDE				
H1	VERDE	VERDE	VERDE	VERDE	VERDE				
H2	VERDE	VERDE	VERDE	VERDE	VERDE				

RegioneEmiliaRomagna

ALLERTA METEO-IDROGEOLOGICA-IDRAULICA

Arpae

DESCRIZIONE DEI FENOMENI

Per la giornata di domani 14 giugno si prevedono precipitazioni intense e persistenti a carattere temporalesco sul settore orientale della regione, che possono generare fenomeni franosi, ruscellamenti, rapidi innalzamenti dei livelli idrometrici nei corsi d'acqua minori, diffusi allagamenti nel reticolo secondario urbano, nonché piene nei corsi d'acqua maggiori, con occupazione delle aree golenali ed interessamento degli argini.
Si prevedono venti di burrasca moderata da nord-est sulla costa, mare agitato al largo, con direzione dell'onda dai settori nord-orientali, e concomitante innalzamento del mare, con possibili fenomeni di ingressione marina fin nelle zone residenziali, estesi allagamenti del litorale, ingenti fenomeni di erosioni dell'arenile e gravi danni agli stabilimenti balneari e agli insediamenti in prossimità della costa.
La persistenza di livelli idrometrici elevati alla foce di fiumi e canali, a causa del difficile deflusso in mare, potrà generare esondazioni ed ulteriori allagamenti nei centri abitati in prossimità del litorale.

Tendenza nelle successive 48 ore: ☐ intensificazione ☐ stazionarietà ■ attenuazione ☐ in esaurimento

NOTE

RIFERIMENTI E CONTATTI

Per approfondimenti sul contenuto del presente documento e la consultazione dei dati in tempo reale:
https://allertameteo.regione.emilia-romagna.it

Per ulteriori informazioni di carattere meteorologico:
Centro Funzionale Regione Emilia Romagna – Arpae Servizio Idro-Meteo-Clima
https://www.arpae.it/sim/
tel: 051 649 7600 (segreteria telefonica previsioni)
email: centrofunzionalerer@arpae.it
pec: centrofunzionale.emilia-romagna@cert.arpa.emr.it

Per ulteriori informazioni di protezione civile:
Agenzia per la sicurezza territoriale e la protezione civile – Emilia Romagna
http://protezionecivile.regione.emilia-romagna.it/
Centro Operativo Regionale lun. - sab. 08:00-20:00 - 051 527 4440/4200
Centralino Agenzia regionale attivo H24 - 051 527 4404
email: procivcor@regione.emilia-romagna.it

IL DIRIGENTE REFERENTE CENTRO FUNZIONALE

Amministratore Amm

Firma autografa omessa ai sensi dell'art.3, c.2, D.Lgs. 12/02/1993, n.39

PER IL DIRETTORE
AGENZIA REGIONALE PER LA SICUREZZA TERRITORIALE E LA PROTEZIONE CIVILE

Amministratore Amm

Firma autografa omessa ai sensi dell'art.3, c.2, D.Lgs. 12/02/1993, n.39

Ongoing event

In order to signal the current critical hydraulic conditions, it is planned to send notifications of hydrometric threshold exceedances in the Rimini SS16 section on the Marecchia river, as well as the sending of two hydrological-hydraulic weather monitoring documents, the first one with the forecast of the flood summit exceeding threshold 2 at Rimini SS16, the second one with observed flood summit and forecast of hydrometric level exhaustion. For the time criticality, it is foreseen that the notifications of exceeding the rainfall thresholds of 30 mm/1 hour and 70 mm/3 hours on the Rimini AUSA rain gauge will be sent at the same time.

For the coastal criticality, since no notifications are to be sent during the event, the activation of the operational phases on the territory will have to be foreseen according to the procedures of the civil protection planning subject of the exercise.

5. Deployment of civil protection volunteers and the mobile column

Approximately 50 volunteers belonging to the Provincial Coordination Units of Rimini and Ferrara were estimated to be involved in the exercise, as detailed below:

VOLUNTARY ORGANISATION	NUMBER
PROVINCIAL COORDINATION FERRARA	15
RIMINI PROVINCIAL COORDINATION	30
TOTAL VOLUNTEERS	**45**

Given the scenarios planned in the timetable, volunteers will be involved mainly for activities of

- Bagged reinforcement for embankment and coastal overbanking;
- Support activities to the Flood Service with VIV intervention;
- Embankment tarpaulins;
- Positioning of Secretariat and Advanced Territorial Operations Room;
- meal production via mobile kitchen.

The Voluntary Organisations will provide means and equipment for the hydraulic risk:

- vehicles equipped with hydraulic kit (tarpaulins complete with fixing accessories, specific tools including hammers, stakes, ropes and ballasts);
- vehicles minibuses transferring volunteers and partners, mobile secretariat;
- heavy vehicles for transporting bulky material and sandbags.

The operational secretariat of the CAVPCs will be open to ensure the continuous flow of communication between the CAVs and the ARSTPC, regarding the prompt operability of teams and vehicles.

A refreshment point will be set up on the beach at bathing establishment no. 8 in Rimini for the preparation of lunch on Friday 14, in which the mobile kitchens of the Rimini and Ferrara CAVPCs will be activated.

Attachment: timeline of actions

Forecast phase Thursday 13 June 2024

TIMELINE (EXERCISE)	INSTITUTIONS/STRUCTURES	ACTIONS
H.9.30-10:00	WELCOMING PARTICIPANTS	ARRIVAL OF PARTICIPANTS AT HOTEL AMBASCIATORI.
H. 10:00		START OF GENERAL ASSEMBLY.
H.10:45-11:45	ARPAE	PRESENTATION OF THE WARNING SYSTEM AND THE INSTRUMENTS AND FORECAST MODELING FOR THE PURPOSES OF ISSUING WEATHER WARNINGS. BRIEF VIEW ON THE WEATHER BRIEFING, ILLUSTRATION OF THE EVENT SCENARIO.
H.11:45-12:30		COMPARISON AND DISCUSSION.
H.12:30-13:30		FREE LUNCH.
H.13:30-14:30		TRANSFER TO THE UTRN HEADQUARTERS WITH VOLUNTEER AND ARSTPC VEHICLES.
H. 12:15	ARPAE - ARSTPC	A WEATHER ALERT IS ISSUED WITH AN ORANGE CODE FOR HYDRAULIC, HYDROGEOLOGICAL AND STORM CRITICALITY IN THE ALERT ZONES A1, A2, B1 AND AN ORANGE CODE FOR WIND, SEA STATE IN THE B2 ZONE AND A RED CODE FOR COASTAL CRITICALITY B2.
H. 12:30	ARSTPC- UT RIMINI	RECEIVE THE ALERT.
		OBTAIN INFORMATION ON THE PHENOMENA FORESEEN BY THE ALERT BY CONSULTING THE WEBSITE HTTPS://ALLERTAMETEO.REGIONE.EMILIA-ROMAGNA.IT AND CONSTANTLY CHECKS THE SENSORS.
		CHECK TIDE FORECAST LEVELS

		CHECK THE AVAILABILITY OF CPV RN TEAMS READY TO DEPART WITH EQUIPMENT, VEHICLES AND MATERIALS.
		CHECK WITH COLLEAGUES THE POSSIBLE PRESENCE OF CONSTRUCTION SITES ON THE COAST AND ON THE RELEVANT HYDRAULIC SECTION.
		CONTACT THE COASTAL MUNICIPALITIES ALSO VIA THE WA USTPC-RN CHAT TO VERIFY RECEIPT OF THE ALERT AND TO REPORT ANY POTENTIAL CRITICAL ISSUES IN THE AREA AND ON THE COAST.
		REPORT ANY POTENTIAL CRITICAL ISSUES TO THE COR ALSO VIA THE ORMA WEBSITE.
		AGREES ON THE ACTIVATION OF THE TERRITORIAL OPERATIONS ROOM AND THE FLOOD SERVICE AND ARRANGES THE ROTATION OF STAFF IN THE TERRITORIAL OPERATIONS ROOM 24 HOURS A DAY, COMMUNICATING THIS TO THE COR.
		IT CONSULTS WITH THE PREFECTURE TO EVALUATE THE OPENING OF THE CCS-SOPI AND AGREES ON A CCS MEETING WITH THE PRESENCE OF THE LOCAL MUNICIPALITIES AT 14.30 VIA LIFESIZE VIDEOCONFERENCE ROOM 769128 #5555.
		MAINTAINS CONTACT WITH THE PREFECTURE AND THE LOCAL CIVIL PROTECTION SYSTEM (WITH THE COMMUNICATION METHODS DEFINED IN THE PROCEDURES) IN ORDER TO COLLECT ANY FURTHER REPORTS.
H. 12:40	CVPCP	THE ODV RECEIVE REGIONAL ACTIVATION FROM THE VOLUNTEERING FUNCTION OF THE TERRITORIAL SECURITY AND CIVIL PROTECTION TECHNICAL COORDINATION SECTOR.
		THE PROVINCIAL VOLUNTEERS COORDINATIONS AFFECTED BY THE ALERT VERIFY THE READY OPERATION OF THE TEAMS AVAILABLE, VEHICLES AND EQUIPMENT AND SUPPORT TEAMS.

		PARTICIPATE IN THE CCS BRIEFING CONVENED BY THE PREFECTURE AT 2.30 PM VIA LIFESIZE VIDEO CONFERENCE ROOM 769128 #5555H.
H. 13:30	CCS-SOPI	THE CCS MEETING IS CONVENED BY THE PREFECT IN AGREEMENT WITH ARSTPC-UTRN, IN VIDEOCONFERENCE AND PRESENCE, WITH THE PARTICIPATION OF THE INTERESTED MUNICIPALITIES, ARPAE-SIMC, THE OPERATIONAL STRUCTURES, HERA SPA, THE RECLAMATION CONSORTIUM, THE VOLUNTEERING.
H. 14:30	ARSTPC, ARPAE-SIMC, MUNICIPALITIES, HERA, RECLAMATION CONSORTIUM, VOLUNTEERING	PARTICIPATE IN THE CCS AND, TO THE EXTENT OF THEIR COMPETENCE, INDICATE AND DEFINE THE PREVENTIVE ACTIONS TO BE ADOPTED BASED ON THE FORECASTS OF THE EVENT AND ANY RISK OF DAMAGE. USING EFFECTS SIMULATION TOOLS.
H.14:30 - 17:00	ARSTPC- UT RIMINI	ORGANIZATION OF THE UTRN CIVIL PROTECTION SYSTEM. TERRITORIAL OPERATIONS ROOM AND FLOOD SERVICE.
		ROLE OF THE ROMAGNA RECLAMATION CONSORTIUM - HYDRAULIC AUTHORITY.
		ROLE HERA SPA MANAGER OF WATER DISPOSAL PLANTS.
		ROLE OF THE MUNICIPALITIES AND ATO (RIVIERA DEL CONCA) AND UUSA.
		RAPID FLOOD MAPPING (SFERPLACES/RIM2D) – GECOSISTEMA.
		ROLE OF VOLUNTEERING.
H.17:00 - 18:00	PARTNERS	QUESTIONS AND DISCUSSION.

1.2 Event phase Friday 14 June 2024

TIMELINE (EXERCISE)	INSTITUTIONS/STRUCTURES	ACTIONS
H. 8:30 - 9:00	VOLUNTEERING	SET-UP OF MOBILE SECRETARIAT ON THE RIGHT SIDE OF THE PARK AT THE PORT

		AUTHORITY.
H. 9:15	ARPAE-SIMC- ARSTPC	ISSUE OF NOTIFICATION OF SIMULTANEOUS EXCEEDING OF RAINFALL THRESHOLD 2 ON THE RIMINI AUSA RAIN GAUGE.
H. 9:00 - 9:30	PARTNERS	PARTNERS ARRIVE ON FOOT.
H. 9:30 -10:30	ARSTPC – UT RIMINI	CHECK WITH THE COR THE EVOLUTION OF THE ONGOING EVENT BASED ON THE UPDATED FORECAST MODELS ANALYZED BY ARPAE-SIMC.
		RECEIVES FROM THE MUNICIPALITIES THE OPENING OF THE MUNICIPAL OPERATIONS CENTERS AND THE FIRST REPORTS OF WIDESPREAD DAMAGE FROM THE STORM.
		SEND TECHNICAL COLLABORATORS TO THE AREA FOR COASTAL MONITORING AND FLOOD SERVICE.
		CONTACT THE MUNICIPALITIES INVOLVED FOR LAST MILE CHECKS AND COMMUNICATIONS.
		REPORT CRITICAL ISSUES TO THE COR ALSO VIA THE ORMA WEBSITE.
		MOVES THE COORDINATION OF THE CIVIL PROTECTION VOLUNTEERS FOR THE CONSTRUCTION OF EMBANKMENT DEFENSES ON THE EASTERN QUAY INSIDE THE PORT OF RIMINI.
H. 9:35	ARPAE-SIMC	ISSUE OF MONITORING DOCUMENT NO. 1 WITH PEAK FORECAST ABOVE THRESHOLD 2 ON THE MARECCHIA IN THE RIMINI SECTION SS16.
H. 9:40	COC E CS RIMINESI	COMMUNICATE THE OPENING OF THE COC-CS TO THE ARSTPC-UTRN.
		THEY IMPLEMENT THE OPERATIONAL PROCEDURES OF THE MUNICIPAL EMERGENCY PLANS IN A STATE OF PRE-ALARM.
		ACTIVATE THE SUPPORT FUNCTIONS OF THE OPERATIONS CENTRE IN PRE-ALARM STATUS (RED COLOR CODE).

		IMPLEMENT PREVENTIVE AND CONTRAST ACTIONS AGAINST THE ONGOING EVENT ALSO MAINTAINING CONTACTS AND INFORMATION WITH THE RIMINI SOT VIA EMAIL AND REQUESTS ON THE REGEM.
H. 10:00	PROVINCIAL VOLUNTEER COORDINATION RIMINI	THE RIMINI COORDINATION, GIVEN THE NUMEROUS REQUESTS FOR INTERVENTION FROM THE FIRE BRIGADE AND THE COC, REQUESTS THE SOT FOR THE SUPPORT OF OTHER VOLUNTEER TEAMS FROM THE COORDINATIONS OF THE OTHER PROVINCES.
H. 10:05	ARSTPC – UT RIMINI	ASK THE COR FOR THE SUPPORT OF AN ADDITIONAL 2 VOLUNTEER TEAMS FOR EMBANKMENT AND BAGGING ACTIVITIES.
H. 10:10	ARPAE-SIMC- ARSTPC	ISSUE OF NOTIFICATION OF EXCEEDING LEVEL 2 HYDROMETRIC THRESHOLD RIMINI HYDROMETER SS16 (MARECCHIA RIVER).
H. 10:10	COC RIMINI	NOTIFY ARSTPC - UTRN OF THE OVERFLOWING OF THE MARECCHIA RIVER INTO THE HISTORICAL RIVERBED.
H. 10:15	ARSTPC - UTRN	THE FLOOD SERVICE REQUIRES THE INTERVENTION OF VOLUNTEERS TO CREATE A TARPAULIN TO PROTECT THE RIGHT BANK OF THE DIVERTER OF THE MARECCHIA RIVER AT THE ENTRANCE TO THE SEA UPSTREAM FROM THE SHEDS.
H. 10:20	ARSTPC – COR	COMMUNICATE THE MOVEMENT OF THE FERRARA COORDINATION TEAMS IN SUPPORT OF RIMINI.
H. 10:45	PROVINCIAL VOLUNTEER COORDINATIONS FERRARA, RIMINI	THE CPV-FE TEAMS ARRIVE AT THE MOBILE SECRETARIAT FOR REGISTRATION AND DELIVERIES.
H. 11:00 - 12:00	PROVINCIAL VOLUNTEER COORDINATIONS FERRARA, RIMINI	2 CVP-FE TEAMS AND 1 CVP-RN TEAM REACH THE PLACE INDICATED FOR THE TARPAULIN TO PROTECT THE CRACKED EMBANKMENT LOCATED ON THE RIGHT BANK OF THE MARECCHIA RIVER DIVERTER, PARKING THE VEHICLES ON THE BEACH SIDE PART OF P.ZA DELLA BALENA IN SAN GIULIANO MARE.

H. 12:00	ARPAE CF	ISSUE OF MONITORING DOCUMENT N. 2 (RIMINI), WITH COMMUNICATION OF THE PASSAGE OF THE FLOOD PEAK ON THE MARECCHIA IN THE RIMINI SECTION SS16, AND PROGRESSIVE DEPLETION OF THE LEVELS.
H. 12:30	ARSTPC - UTRN	UPDATE ARSTPC - COR ON THE EVOLUTION OF THE ONGOING EMERGENCY.
		SEND TO ARSTPC - COR THE INFORMATION RELATING TO THE DAMAGE REPORTS RECEIVED AND THE ACTIVITIES OF THE SECTOR AND VOLUNTEERING, ALSO VIA THE ORMA WEBSITE.
H. 12:30 - 14:00	PARTNERS	LUNCH AT BAGNO 8 RIMINI

Annex IV. RWL 4 2024 Agendas

Meeting minutes

4th Stakeholder-meeting RWL Rhine-Erft Region

Location / Date:
Roomm Veybach, Am Erftverband 6 in 50126 Bergheim/ 18.03.2024, 1:00 PM

Created by: David Schmidt and Jana Löhrlein

Participants:

Christian Aumann (lower water & soil protection authority; district of Rhein Neuss)
Christine Bernt (head of department of technical environmental protection; district of Rhine-Erft)
Dr. Daniel Bittner (head of department of river basin management; Erftverband)
Frederik Held (department of civil protection; district of Rhein Neuss)
Peter Jonas (employee in the department of civil protection; district of Euskirchen)
Dr. Tilo Keller (team leader hydrology measurements and data management; Erftverband)
Hartwig Kaven (employee water & soil conservation; district of Euskirchen)
Jana Löhrlein (DIRECTED project; Erftverband)
Martina Noethen (employee in the department of emergency response, rescue services and fire protection; district of Rhein-Sieg)
Sarah zur Linden (reconstruction unit, leader of the project KRITIS-Dialog; district of Euskirchen)
David Schmidt (intern; Erftverband)
Marcel Schneider (team leader - water & soil conservation; district of Euskirchen)
Dr. Julian Struck (project manager of the intermunicipal flood protection corporation and DIRECTED project; Erftverband)
Thomas Weiler (head of department of rescue, fire and civil protection; district of Rhine-Erft)

	Agenda	by
1	**Welcome and introduction of participants** (see list of participants)	Löhrlein
2	**Update DIRECTED** - Periodic report (due end of March) - Work package (WP) 2 (Data and Model Interoperability) and WP 5 (Data fabric) have developed surveys on the topics *data and tools* as well as *taxonomy and collaboration*; those are answered by a few stakeholders in each real world lab (RWL) - DIRECTED consortium will make a case study document for the comparison of the flood in Germany in 2021 and the flood in Italy in 2023 Update RWL - Contribution to the periodic report - Literature research and initial project internal exchange on serious game - Webex meeting on the assessment of potentially hazardous weather situations; procedure as in the attached scheme (annex 1); for practicing the meeting, the hydrological situation report of the North Rhine-	Löhrlein

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Version: 1.0

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	Agenda	by
	Westphalia state agency of Nature, Environment and Consumer Protection is used as trigger for the exercise; the procedure is practiced beginning with the next hydrological situation report that contains information about the Erft	
3	**Introduction of the project KRITIS-Dialog (KRITIS-dialogue)** - Project on critical infrastructure the district of Euskirchen is part of - Strengthening of resilience by improving a risk dialogue - No sufficient communication so far - Lack of protection concepts - No sufficient exchange on the prioritization of measures - Idea: Exchange platform - Observation: in case of a crisis situation it is important to people to know their contact persons - Current state of the project: Risk analysis finished - Question: Are the infrastructure providers responsible for a safe design? difficult, KRITIS-Dialog project is not responsible for teaching responsible companies, but it suggests certain aims and points out issues - Question: Will data of KRITIS-Dialog be maintained and updated after the end of the project? project partners are interested in that, not yet sure if the maintenance and update of such data is needed and useful - Question: Have municipalities been involved yet? No, but the involvement of crucial stakeholders is scheduled (social structures such as schools)	zur Linden
4	**Workshop** - Detailed clarification of the procedure in the event of (possible) imminent or actual flooding - Basis for simulation game	
5	**Discussion** - Situation assessment is central topic → water management and districts could provide a situation assessment for municipalities - Warning o Too frequent warning leads to dulling of citizens o Notifications of warning-App NINA can be set up at different levels o For information of the hydroogical situation the Testa net can be used: Hydrologische Lage NRW (testa-de.net)	
6	**Outlook** - Digitalization of the flowchart - Serious game - Case study (floods Germany 2021 and Italy 2023) - Project meeting in Rimini in June - Topic early warning trough sensors on municipal level came up at meetings of the flood protection corporation (FPC) Erft o only uniform solution in the municipalities makes sense o issue will be brought up in the next sub-project meetings of the FPC Erft - EV ist interested in introducing DIRECTED or the FPC Erft if there are any suitable events planned	Löhrlein

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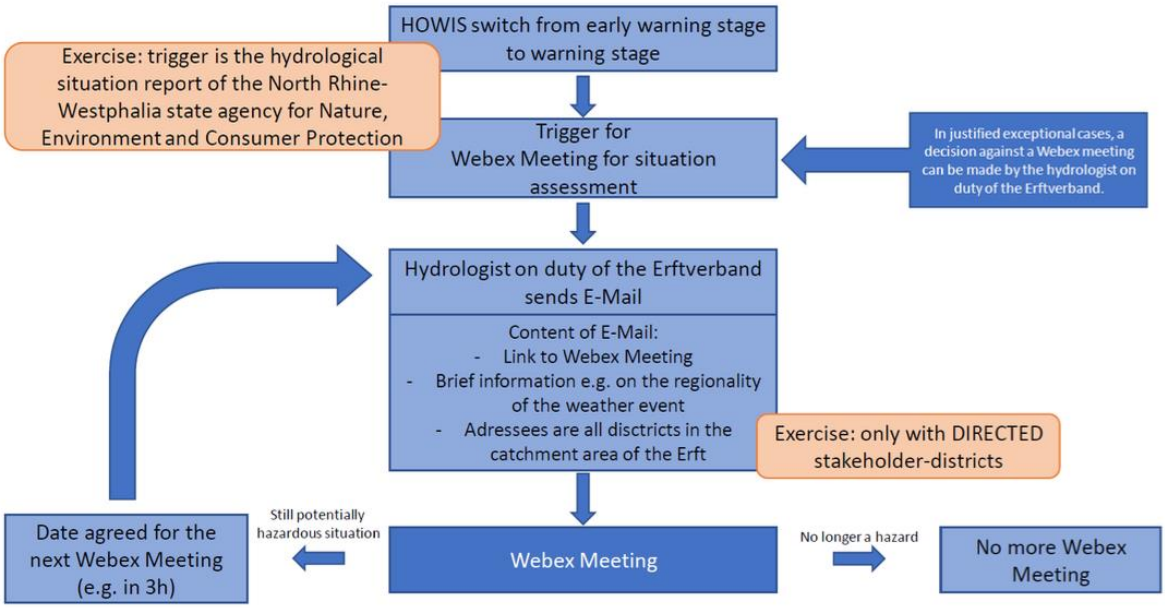
HOWIS switch from early warning stage to warning stage
Exercise: trigger is the hydrological situation report of the North Rhine-Westphalia state agency for Nature, Environment and Consumer Protection
Trigger for Webex Meeting for situation assessment
In justified exceptional cases, a decision against a Webex meeting can be made by the hydrologist on duty of the Erftverband.
Hydrologist on duty of the Erftverband sends E-Mail
Content of E-Mail:
- Link to Webex Meeting
- Brief information e.g. on the regionality of the weather event
- Adressees are all disctricts in the catchment area of the Erft
Exercise: only with DIRECTED stakeholder-districts
Date agreed for the next Webex Meeting (e.g. in 3h)
Still potentially hazardous situation
Webex Meeting
No longer a hazard
No more Webex Meeting

Meeting minutes

5th Stakeholder-meeting RWL Rhine-Erft Region

Location / Date:
Room Veybach, Am Erftverband 6 in 50126 Bergheim/ 19.08.2024, 1:00 PM

Created by: Jana Löhrlein

Participants:

Christine Bernt (head of department of technical environmental protection; district of Rhine-Erft)
Frederik Held (department of civil protection; district of Rhein Neuss)
Dennis Hünseler (deputy head of the fire department Erftstadt)
Peter Jonas (employee in the department of civil protection; district of Euskirchen)
Kai Uwe Groß (employee water & soil conservation; district of Euskirchen)
Jana Löhrlein (DIRECTED project; Erftverband)
Sarah zur Linden (reconstruction unit, leader of the project KRITIS-Dialog; district of Euskirchen)
Marcel Schneider (team leader - water & soil conservation; district of Euskirchen)
Dr. Julian Struck (project manager of the intermunicipal flood protection corporation and DIRECTED project; Erftverband)
Thomas Weiler (head of department of rescue, fire and civil protection; district of Rhine-Erft)

	Agenda	by

1	**Welcome and Project update; start at 1:00 PM**
	- Reference to newsletter with project updates (02/2024 from July)
	- Simulation exercise project meeting June 2024 Rimini, Italy
	  ○ Brief presentation of the civil protection actors involved in the simulation in the Emilia-Romagna region and the province of Rimini (ARPAE, ARPAE-SIMC, Rimini Territorial Security and Civil Protection Agency)
	  ○ Warning system (warning report)
	  ○ Saferplaces
	  ▪ Cloud-based web application
	  ▪ Digital twin of the respective catchment area
	  ▪ Use of AI models
	  ▪ Fast computing time; testing of the protective effect of measures possible in an emergency
	  ○ Starlink for communication in the event of a crisis
	  ○ Exercise for volunteer emergency services (stacking sandbags, protecting an embankment with tarpaulin, mobile kitchen)
	- Volunteers play an important role in civil protection in Italy
	- Findings from the project meeting for RWL Rhine-Erft
	  ○ Cooperation between water management and civil protection is important
	  ○ Consideration of the creation of a digital twin for the Erft catchment area
		Löhrlein

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	Agenda	by
	○ Coordination of operations in Italy, e.g. via online table, how is the organization in Germany? ▪ Operational forces report changes to the operations center ▪ Administrative organization -> crisis team (Krisenstab) ▪ Not all operations are communicated up to a higher administrative level ▪ Data protection problematic ▪ Desire for a standardized system for all levels (federal, state, district, municipal); system for NRW in test phase ("VIDaL" - networking of information to present the state situation) ▪ Offer to visit the Rhine-Erft district operations center - Interface to municipal level in the RWL via teams for extraordinary events (Stäbe für außergewöhnliche Ereignisse - SAE)? ○ SAE not legally binding in NRW ○ Some municipalities therefore lack structures ○ When regular operation and from when SAE? This depends on the municipal structure ○ SAE includes specialized personnel -> these could be contact persons ○ As soon as several municipalities are affected -> crisis team at district level ○ Contact with operational managers (public order offices and hazard prevention) at municipal level sought ○ Erftverband contacts district of Rhein-Erft and the district of Euskirchen with the duration and content of a project presentation, who then find time slots at suitable events	
2	**Feedback online meeting for situation assessment** - Test May 2024 ○ Generally positive feedback ○ Could have been more specific (discharge situation) ○ Information on the use of the basins would also have been helpful after the exchange (information on backwater, reserve and expected emptying of basins); this also applies to other measures taken by the EV - future contact via functional e-mail addresses; districts must adapt internal processes and send EV corresponding e-mail addresses - Structure of online-meeting ○ Participants: all districts of the Erft catchment area ○ Mail subject always the same ○ Meeting always has the same structure (procedural instructions) -> also helps the hydrologist on duty (HvD) to lead the meeting ○ Time of the meeting? Goal of earlier and better exchange -> if possible not only in the event of an incident; transition from observation to standby level HOWIS Erft (all levels: no flood risk - observation level - standby level - operational level) ○ Municipalities should join as required at most - Formulate mail after the meeting from EV to participants in such a way that information can be passed on directly to municipalities - Request that the EV mail to announce the HOWIS observation level also goes to Webex meeting participants and that the first information is not	Löhrlein

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	Agenda	by
	the standby level with an invitation to the meeting -> this is discussed internally by the EV - Idea: Create reporting agreement for Webex meeting o Where/how is information provided? o When is information provided (notification thresholds) o Compare with flood warning NRW (and RLP) o Signed by district administrator for binding force	
3	**Result Workshop and preparation tabletop exercise** - Results of workshop are used for tabletop exercise - Concept for tabletop exercise is currently being developed	Löhrlein
4	**Feedback on the progress of DIRECTED to date** - We are on the right track - Valuable exchange of information that does not compete with the official reporting channel, as communication takes place in both directions here - Could also be helpful for other water boards later on	Löhrlein
5	**Outlook** - Time slot for presenting DRECTED to local authorities at events organized by regulatory authorities and emergency services - Next meeting on 18.11.2024 (tabletop exercise) - Scheduling 2025 like 2024 -> Monday afternoon, EV sends dates - Poster DIRECTED at the municipal flood forum 26.08. Gymnicher Mühle - Poster DIRECTED at the Heavy Rain and Flood Protection Action Day 28.09. Rheinbach	Löhrlein

Partners


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AGENZIA PER LA SICUREZZA TERRITORIALE E LA PROTEZIONE CIVILE
REGIONE EMILIA-ROMAGNA


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