EUROPEAN UNION

EU MISSIONS

ADAPTATION TO CLIMATE CHANGE

December 2024

EU Mission Adaptation Community

Event Summary: Flood Resilience: Strategies and Solutions for a Safer Future

Wednesday 26th September 2024

1. Introduction: The event at a glance

Registrations & participants:
275 registrations and 110 participants, including:

- 34 Charter Signatories
- 20 Mission Projects
- 9 Other Projects working on adaptation
- 7 Region or Local Authorities that are not Charter Signatories
- 3 Friends of the Mission
- 15 Private Sector
- 19 Research & Academia
- 1 European Commission
- 2 Others

The event introduced the challenges, opportunities, and tools associated with flood management in the context of climate change. It also shared principles, experiences, practices, and case studies on adaptation options related to flood management from a region and/or local authority.

Watch the recording here.

The presentations are available in the Library.

Key findings:

- Flood risk management plans should include clear objectives, prioritisation of measures based on cost-benefit analysis, long-term funding perspectives, and tracking of progress in implementing measures, as well as public consultation.
- The overall impact of flooding can be mitigated by identifying and protecting critical infrastructure nodes, such as power distribution nodes and pumps.
- The Climate IMPETUS project's decision-support system uses flood models and 3D digital twins to display flood information in an easy-to-understand way, bridging the gap between experts and non-experts.
- The stakeholder's perception in the TransformAr project Lappeenranta case study is that the transition from pilots to normal operation is difficult.
- Balancing buildings, green spaces, and pavements in urban planning is crucial, as well as the potential use of brownfield sites for green and blue infrastructure deployment.

For further details see Section "Findings and outputs".

The event highlighted different tools and experiences with recommendations for flood resilience. Attendees were able to deepen their understanding of flood management and prevention models. Presentations gave an insight into the latest research on further efforts in drought and climate change resilience.

Ioannis Kavvadas from the European Commission DG Environment presented tools, available data, and local best practices for the EU's flood risk management. Key highlights include:

- The EU Floods Directive, established in 2007, aims to reduce adverse consequences of flooding on human health, the environment, economic activity, and cultural heritage.
- Member states must identify areas of significant flood risk, prepare flood hazard and risk maps, set flood reduction objectives, and develop flood risk management plans.
- Good practices for flood risk management include a clear framework, assigned responsibilities, continuous prioritisation by decision-makers, a river basin-wide approach with local input, coordination among regions, and attention to awareness, protection, prevention, preparedness, and response.
- Public consultation is essential for flood risk management plans, preliminary assessments, and flood hazard and risk maps to increase relevance, improve public acceptance, and educate the public.
- Flood risk management requires coordination and collaboration between various stakeholders, including civil protection, town planners, municipalities, insurance companies, and agriculture.
- The Flood Risk Areas Viewer, accessible on the European Environment Agency (EEA) website, provides public access to flood risk information in multiple European languages.

Mehdi Khoury from the University of Exeter presented the cascading failure of critical infrastructure services modelling. Key highlights include:

- In a flood scenario, school and public transportation closures can significantly impact workforce availability, especially for critical services like hospitals.
- The flood model for the city of Torbay shows that indirect impacts of flooding, such as disruptions to transportation, power, and emergency services, extend far beyond the directly flooded areas. When you combine all the different services, the general indirect impact of cascading failure is much greater than the direct individual flooded destruction because of the disruptions.
- This flood model also considers the demographics of affected populations, providing insights into the potential consequences for vulnerable groups like the elderly, disabled, and low-income residents. Moreover, it quantifies the amount in percentages for different postcodes and the disturbance for different services: supermarkets, retirement homes, schools, power emergency services..
- The model can be applied for different case studies and it is downloadable for free here. A model with similar features was developed for the whole area of Tenerife, the only difference being that the crop dimension was added.

Jasper van Lieshout from Nelen & Schuurmans presented a Decision Support System (DSS) for Adaptive Flood Risk Management in the Netherlands. Key highlights include:

- The Netherlands traditionally focused on flood prevention, but with climate change and limited space, there is a need to shift towards other layers of flood risk management, such as spatial adaptation and resilient recovery.
- A decision support system was developed to quantify flood risk and translate complex flood data into understandable information for decision-makers and citizens using hydrodynamic software models and 3D digital twins.
- The hydrodynamic Software Models simulate how floods expand and transition over time for a certain area, both for current situations and future projections, with a highly detailed spatial resolution (up to 0.5 x 0.5 meter).
- The project engaged with stakeholders in co-designing the tool through workshops and case studies. The decision support system was created with input from stakeholders, including municipalities, universities, and citizens, to ensure it meets the needs of end-users.
- The tool can support local flood risk management by identifying at-risk regions and promoting sustainable urban planning. More information on the case study is available here.

Sanna Varis from Lappeenranta City presented a sustainable urban drainage system that was implemented in the city. Key highlights include:

- Lappeenranta is participating as one of the six demonstrators in the TransformAr project, and they are implementing structural changes to the urban stormwater management system. These include rehabilitation of the network and new means of stormwater management and treatment, coupled with a set of new sensors to monitor the contamination, water quality & flow within the drainage system.
- The runoff system is completed with Nature-based solutions, including construction of eight urban wetlands and a bio-infiltration area in the city centre used to absorb and purify water, to reduce stormwater drain filling and to provide green spaces.
- The project included stakeholder engagement through workshops and a survey distributed to private plot owners in Finland and Norway.
- The city has experienced extreme weather events, including heavy rainfall in July 2019 and August 2024, leading to flooding in underpasses and other areas.
- A citizen app, developed in collaboration with technical partners, allows residents to monitor the urban environment, including stormwater, water quality, weather, air quality, and street works.
- A cost-benefit analysis of an infiltration area showed it was still a desirable investment even if maintenance was two to three times more intensive.

Ariane Blum from ARN presented Water4All ongoing projects and next calls. Key highlights include:

- Water4All, a co-funded program under the Horizon Europe framework program, will run from June 2022 to June 2031 with 90 partners in 30 countries to support research activities in water.

- Water4All funds research projects. The first call focused on managing water resources under extreme hydroclimatic events, and the 2023 call focused on aquatic ecosystem services, potentially including nature-based solutions for floods.

- 27 funded projects in JTC1 (2022) were selected, with some dealing with floods and developing nature-based solutions. Some of these projects started in April this year and will end in 2027. Examples of some of these projects are the ECCO project and the GROUNDEDEXTREMES project.

- The already open 2nd Joint Transnational Call, "Aquatic Ecosystem Services", is about water for a circular economy. The deadline to submit the proposal is November 13, 2024. Ariane recommended the inclusion of policymakers and local authorities in the consortiums. More information was provided in the webinar on 2nd October 2024.

- The 4th Joint Transnational Call (September 2025) will be on water and health.

- Other Water4All activities include the Water Oriented Living Labs (WOLLs): a network of 25 Wreal-life, water oriented environments with a cross-sector nexus approach, which involve and commit multiple stakeholders (including water authorities) and provide a 'field lab' to develop, test, and validate a combination of solutions, which include technologies, their integration as well as combination with new business models and innovative policies based on the value of water innovation ecosystems.

The Q&A covered diverse topics surrounding flood management, risk assessment methodologies, and the impact of climate change on flood forecasting and preparedness. It emphasised the need for flexible frameworks and tools adapted to various regions, including non-European areas. It highlighted the role of stakeholder engagement and local data in enhancing model accuracy and decision-making.

For a full compilation of the questions asked and answers, please refer to the Annex.

3. Findings and outputs

Based on the insights gathered from the different surveys launched during the event, along with the presentations, several key lessons and findings have emerged:

- 11% of hospitals in Europe and an eighth of Europeans are in areas potentially prone to river floods. Source: EEA.

- Indirect damage caused by cascading failure, such as disruptions to infrastructure and services, can be much greater than the initial damage footprint directly caused by a flood hazard.

- The flood model for the city of Torbay can also assess the impact on workforce availability. For instance, if all primary and secondary schools in the town were to close due to flooding, many single-parent families with children under 12 would need to stay home to care for them, significantly affecting workforce participation in critical infrastructure sectors. For example, hospital staffing could decrease by 16%.

- The decision support system developed in the provinces of Zeeland and Rijnmond translates technical simulation data into accessible information. It can serve various purposes including citizen engagement to bridge the knowledge gap on the topic and support the dialogue between policymakers and the population. It also improves local flood risk management by

allowing to identify regions at risk, quantify the impact of climate change on local flood risk, evaluate potential measures and take informed decisions for urban planning.

- The bio-infiltration area tested in Lappeenranta serves multiple purposes, including enhancing water absorption and purification, recharging groundwater, and introducing new green spaces and urban nature in a city center dominated by impermeable surfaces. Additionally, real-time monitoring enables the measurement of water temperature and turbidity while tracking potential flooding within the system during rain events.

- Transitioning from a traditional drainage system to a sustainable one is often a gradual process, as adapting to new methods requires time. In some cases, traditional methods are preferred due to the higher costs associated with implementing sustainable alternatives. However, a cost-benefit analysis of the infiltration area in Lappeenranta demonstrated that, despite maintenance costs being three times higher than the original solution, investing in the sustainable option was still deemed advantageous.

- Lappeenranta faced significant challenges related to collaboration and mindset. Decision-makers, planners, builders might have doubts on implementing Nature-based solutions. Additionally, fostering cooperation within city organisations, ensuring effective communication, and achieving a shared vision can be particularly challenging when adopting new methods.

- Effective sustainable water management, requires action on both private and public sites. However, engaging private landowners has been challenging. To address this, a survey was distributed to private plot owners in Finland and Norway to assess their attitudes towards the measure proposed.

- Results from a second survey from the TransformAr project show that although demonstration sites can be effective to test new solutions the transition from pilot to normal operation is complex and requires time.

- The satisfaction survey conducted at the end of the event received 18 responses, with attendees rating their satisfaction with the media event at 4.4 out of 5. This score indicates that the event successfully met attendees' expectations.

- Among the most interesting topics highlighted in the feedback were the development of new flood prevention models, the role of the hydropower energy sector in flood prevention, comparisons of maintenance costs between traditional methods and nature-based solutions, and tools for flood risk assessment and cost-benefit analysis of mitigation and adaptation actions.

- Other topics of interest included water management challenges (balancing floods and droughts), collaboration opportunities between industry and research, and updates on future calls from the Water4All program.

4. Next Steps

The recording and presentations have been uploaded after the event to the online EU Mission Adaptation Community site.

Find more information about upcoming events on the EU Mission Adaptation Community site.

Upcoming announced events and other key dates include:

- Creative citizens' engagement, 4 December.
- Citizen science, 10 December.

The second cycle of the Peer Learning Programme for Charter Signatories is open for registration until 6 October.

For any queries from members of the Community of Practice on associated activities and events, specific concerns about your climate adaptation planning process, communications and press releases, and IT technical issues with the website, contact us via the Helpdesk form.

Annex

Q&A Compilation

Questions for Ioannis Kavvadas from the European Commission DG Environment

Is there any standard methodology for determining a "big flood"? Maybe the big difference in the number of floods between countries is the perception of a "big flood."

There isn't a standard methodology. The definition of a "big flood" varies across European countries, with each member state setting its thresholds based on its specific flood history and perception.

Are there models of floods in Europe that consider climate change impacts based on IPCC scenarios? This would help anticipate future floods.

Yes, we observed in the second flood risk management plan that most member states are considering these scenarios. Some still rely primarily on historical climate change data, but most look forward to the future.

The second preliminary flood risk assessment has already been published. The EC will publish an assessment of the member states, a second flood hazard and risk map assessment, and a second flood risk management plan.

To what extent could this risk assessment/tool be extended to other regions, such as Japan?

The flood viewer is not a risk assessment tool; it serves as an entry point. The flood directive is a flexible framework that can be extended to areas outside the European Union. For instance, we have heard that there is interest in parts of Latin America.

What is the spatial resolution of the flood viewer?

I do not have the information on the resolution at hand, but you can zoom in close to the surface of the Earth. There is a scale bar that shows it.

Questions for Mehdi Khoury from the University of Exeter

The tool is great; congratulations. How much time was required to gather all the data to build the tool, and at what intervals are you updating it?

Initially, developing the whole thing from scratch took a year and a half, but now we have made the open-source structure, so it takes approximately two months and hours to adapt it to a new town, get new data. Of course, you could make it more precise if you got more data, and you can go on for six months to have a bigger model.

I update it often because I've received more detailed information from stakeholders. As soon as you have new data, you can add more detailed information to the model (e.g., more pumps for sewage, location of broadband cabinets, etc.).

This looks like a great tool, and you can get a lot of data and information from it. How have you verified this tool, the results and error margins?

The tool is verified using historical data and by consulting stakeholders.

Is the tool in use by any municipality or other user? If yes, for what purpose? If not, is there any interest in using it?

The tool is going to be used by stakeholders from the Torbay municipality. It has attracted the attention of the town council, fire emergency services, and operators connected to the Torbay helpline that deals with vulnerable communities. A serious game based on the demonstrated simulation engine is being designed to help with preparedness for Torbay ward helpline operators who deal with vulnerable communities.

The cascading failure engine has also been applied to the island of Tenerife, where it is being considered for evaluating how Nature-Based Solutions can decrease damages to critical infrastructure services induced by floods.

Questions for Jasper van Lieshout from Nelen & Schuurmans

Is this model also useful for rain-caused flooding?
The model can simulate all kinds of flooding, including coastal events, rain events, and discharge events. So, it's applicable to all.

Questions for Ariane Blum from ARN

Are the 3rd and 4th calls also open for researchers from the industry?
All the calls are open to companies and private companies, but it depends on the national rules. Each funding agency has its approach, funding agencies to support private companies' participation, so I encourage you to look at the rules set by your national funding agency.

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