



Issue 3

RESCUER Newsletter

October 2025

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The Doctoral Network **RESCUER**

(Resilient Solutions for Coastal, Urban, Estuarine and Riverine Environments)

aims to train 10 young researchers to tackle medium and long term water challenges that face coastal communities, focusing on forecasting and modeling of coastal, riverine, and urban flooding and associated water quality issues.

EDITORIAL

Welcome to the third issue of the RESCUER project newsletter!

The past months have been filled with exciting developments and collaborative progress across the consortium! During this period, all fellows were successfully recruited, and the consortium organized the second training workshop (held online), the first RESCUER Mid-Term Meeting, and the third training workshop, hosted in Senigallia, Italy, in May 2025.

This edition showcases our collective progress -key moments from recent events, research highlights from our fellows, and a look ahead to the exciting activities planned for 2026.

The next issue of our newsletter will be published in January 2026 and will be available for download on the RESCUER website: <https://www.rescuer-msca.net/>.

Stay tuned and happy reading!



Funded by the
European Union

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RESCUER's 2nd Workshop

Workshop 2: **Numerical Models for Hydraulic Simulation, Urban Flows, and GPU Programming** took place online from March 6-19, 2025 hosted by the University of Zaragoza (UNIZAR) via Google Meet. The sessions were held daily from 09:00 to 12:00 and 14:00 to 17:00. This virtual training event offered 60 hours of instruction covering topics such as Numerical Models for Hydraulic Simulation, Urban Flows, and GPU Programming. The workshop was co-organized by UNIZAR and INRIA, as part of the RESCUER training activities. On average, each session was attended by 15 participants, including 10 RESCUER PhD fellows, 6 supervisors, 2 PhD candidates from UiB, 2 from UNIZAR, and 2 from University di Pavia, project coordinator and project manager.

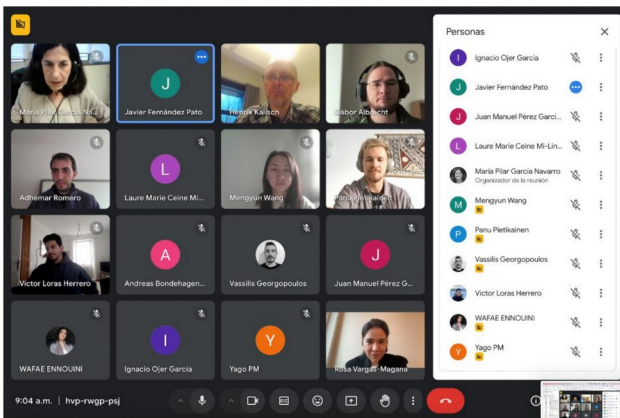


Figure 1: First day of the 2nd workshop. Lecturer P.-G. Navarro (UNIZAR).

The program combined lectures and hands-on sessions, creating a dynamic environment that encouraged both scientific learning and practical skill development. Participants explored key topics such as urban flooding, sediment transport, and high-performance computing using GPUs. In addition to the introductory and advanced technical sessions, the workshop also featured a transferable skills day, organized by UiB, which focused on academic integrity,

publishing strategies, and enhancing researcher visibility.

All teaching materials and numerical codes were made openly available through a dedicated GitHub repository, ensuring that participants could easily access and revisit the content after the workshop. All required tools for code compilation and graphical visualization were based on free and open-source software, promoting accessibility and reproducibility.

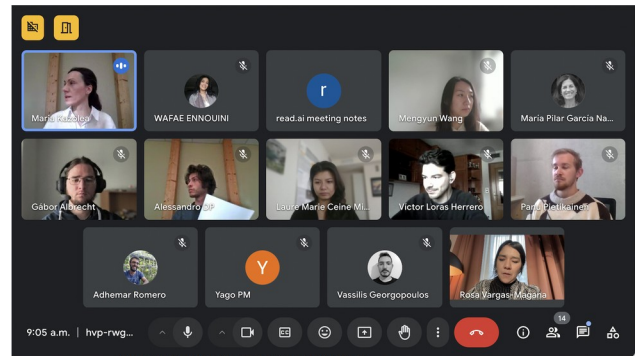


Figure 2: During the workshop. Lecturer M. Kazolea (INRIA).

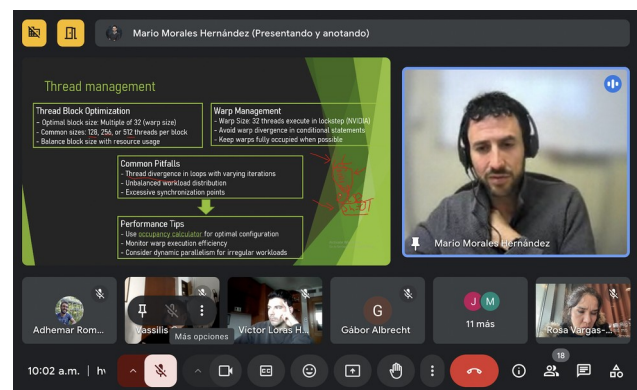


Figure 3: During the workshop. Lecturer M. Morales (UNIZAR)

The workshop promoted knowledge exchange and strengthened the collaborative spirit of the RESCUER network. It provided fellows with an opportunity to expand their expertise, build valuable connections, and explore computational tools relevant to their research.

1st RESCUER Midterm meeting and 3rd Workshop

The RESCUER Doctoral Network held its midterm meeting, on May 12th, at Hotel Raffaello in Senigallia, hosted by **Università Politecnica della Marche (UNIVPM)**. Senigallia is a comune and port town on Italy's Adriatic coast. It is situated in the province of Ancona in the Italia region of Marche and lies approximately 30km north-west of the provincial capital city Ancona. The agenda of the meeting included

- **Welcome & Tour de Table:** Each beneficiary summarized their role in the network.
- **Program Officer Presentation:** Key insights and expectations were shared.
- **Doctoral Candidate Talks:** Fellows presented their research progress, chaired by Michele Mossa.
- **Project Status Update:** Henrik Kalisch reported on recruitment, data management, IP, and outreach.
- **Fellow Feedback Summary:** Rosa Maria Vargas-Magana shared insights from the fellows.
- **Restricted Sessions:** Separate discussions with the Program Officer and fellows/coordinator.
- **Open Discussion & Wrap-Up**
- **Social Events:** A beach volleyball challenge and gala dinner rounded off the day.

The meeting opened with a welcome session and a tour de table, during which each beneficiary briefly summarized their role in the network. The Program Officer then presented key insights and outlined the expectations for the upcoming period.



Figure 4: Organisers of the meeting: H. Kalisch (UiB) and M. Postacchini (UNIVPM)

The doctoral candidates, chaired by Michele Mossa, shared updates on their research progress, followed by a comprehensive project status report from Henrik Kalisch covering recruitment, data management, intellectual property, and outreach activities.



Figure 5: Vassilis Georgopoulos, UB, PhD candidate RESCUER fellow.



Figure 6: During fellows' presentations.

The program officer emphasized the importance of internal collaboration among the fellows and of maintaining regular contact with one another. Following this advice, **we established monthly informal meetings where the fellows will present the status of their work** to the rest of the group.

1. Environmental Statistics, taught by associate partner Professor Francesco Lagona; Urban Flood Drifters (UFD):
2. Identification, Classification, and Characterization, taught by associate partner Professor Mario Franca, which included an on-site exploration of UFD risk hotspots in Senigallia's city center; and
3. Field Measurement Techniques, taught by Matteo Postacchini, Lorenzo Melito, and Maurizio Brocchini, which involved a field visit to the monitoring devices installed in Senigallia, both in the river and in the area of Senigallia harbor.

The lectures, tutorials, and hands-on activities held in Senigallia were attended by all 10 RESCUER fellows, along with several PhD students from the Università Politecnica delle Marche.



Figure 7: During the dinner night!

Next two days were fully dedicated to RESCUER's workshop #3. Sessions were held daily from 09:00–12:00 and 14:00–17:00. The workshop followed the RESCUER midterm meeting on May 12th at the same location. This event featured three main units:

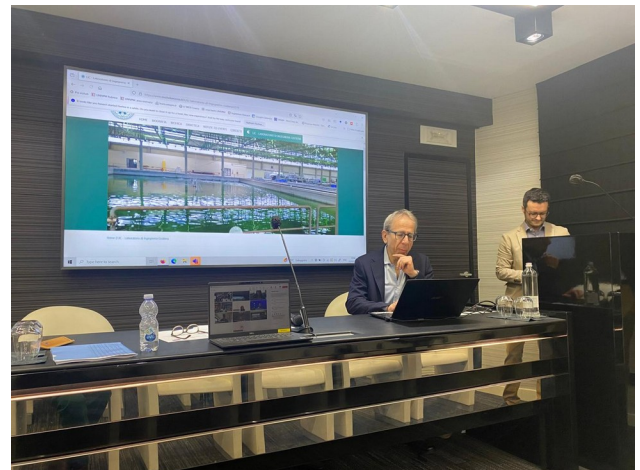


Figure 8: Prof. Michele Mossa, Politecnico Di Bari

The program combined lectures with hands-on sessions, focusing both on scientific learning and practical skill development. Beyond the scientific session, the workshop also included social events including joint lunches and dinners.

One of the meeting's highlight was the field visit of the Senigallia site. We visited the mouth of the river Misa. This area will be the pilot region of the Rescuer project and it will be used by the fellows to simulate and test their codes. More precisely, the outcome of this project will be a suite of universal, highly efficient, and accurate numerical models covering the whole spectrum of hazards induced by sea and river forcing actions, such as wave run-up and overtopping, coastal and urban flooding, water-quality issues, bed and riverbank erosion. These multi-physics models validated using data from dedicated laboratory campaigns and collected at this site (Senigallia) and put into service by our commercial partners, will be able to provide a complete picture of potentially hazardous conditions on the coast.



Figure 11: Social activity: Wine tasting.



Figure 9: Visit to the Misa River



Figure 10: Visit to the Misa River

Focus on University of Coimbra

by prof. Rita Carvalho and Adhemar Romero,

A Year of RESCUER in Coimbra: Exploring how pollutants travel through water, from lab experiments to AI and numerical models.

Sea level rise must be considered in future predictions of pollutant circulation and distribution, and ocean currents and sediment transport also influence the redistribution of pollutants locally and globally. However, there is a lack of knowledge in fundamental research, namely advection, diffusion and dispersion of water particles having different pollutant concentration, the influence of turbulence, and the kinetic description of the chemical reactions. The objectives in the framework of the RESCUER project are to understand the potential threats on eco-hydraulics in fluvial and coastal environments due to heavy metals, pesticides, detergents etc., and to be able to describe and predict the transport and fate of pollutants, sediments and microplastics in hydraulic environmental models and their connections.

In the first year of the RESCUER project at the University of Coimbra, we combined laboratory experiments, artificial intelligence, and computer simulations to study how pollutants spread in flowing water. In our lab flumes, we recreated a stretch of the Mondego River (the largest river entirely within Portugal) using real topographic data. A dye tracer was then released to simulate real-world pollutant discharges, allowing us to observe how contaminants move with the flow.

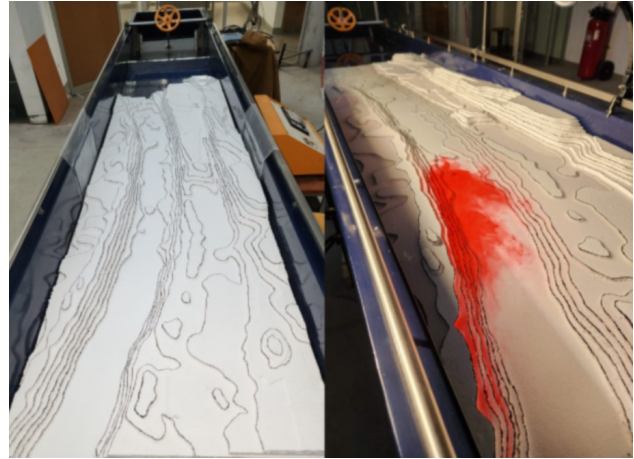


Figure 12: Laboratory experiments

After completing the laboratory experiments, we developed an AI tool based on colorimetry techniques to quantify the transport of the dye in the flow. By analyzing the red intensity captured by cameras, the AI tool determines the dye's volumetric concentration within a defined region of the physical model, allowing us to obtain the data without needing any extra equipment or setup that might interfere in the local hydrodynamics.

Furthermore, we conducted computational numerical simulations using the OpenFOAM® to reproduce the experiments performed in the laboratory. A scalar transport equation (advection-diffusion) was implemented alongside a VoF (Volume of Fluid) solver, capable of determining the water free surface elevation by solving the Navier-Stokes equations. The turbulent Schmidt number was also used to determine the diffusivity coefficient.

This integrated approach, mixing experiments, CFD modeling, and AI, offers good perspectives to improve pollution patterns in rivers and estuaries, supporting environmental protection

and sustainable water management. The work developed in the first year not only outlined the research plan for the coming years but also laid foundation for developing stronger tools to protect rivers and coastal environments.

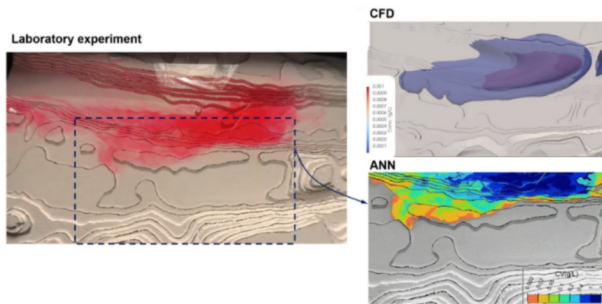


Figure 13: Laboratory experiments and the volumetric concentration determined through AI (ANN) and CFD

During the first three months of the second year, we are hosting Mengyun Wang, a PhD fellow at University of Zaragoza for one of her secondments. She is working on assessment of surface water interaction and pollutant dispersion between urban watershed, canals and coastal flows. As part of her work in Coimbra, she is analyzing how emerging pollutants are adsorbed in rivers and estuarine sediments.

Focus on Università Politecnica Delle Marche

by RESCUER Fellow (8), Beka Chelkeba Tumsa,



My PhD research primarily focuses on modeling flow dynamics in estuarine urban environments. The study will investigate wave-driven urban flooding dynamics, which occurs when waves climb the beach or overtop the seawalls, and propagate into the urban environment. This process leads to hydrodynamic impacts on various urban structures and goods such as buildings, parked cars, movable objects, and obstacles. The main goal of the research is to replicate and analyze both complex flow conditions and impacts on the urban fabrics to understand how structures affect flood dynamics during flooding events and how flows impact upon structures. To achieve this, the hydrodynamics around both fixed and moving objects will be studied numerically (see **Figure 14**) and validated through physical modeling conducted in the wave flume at the Hydraulics Laboratory of UNIVPM.

This validation aims to provide deeper insights into how urban features influence flood dynamics, ultimately helping to understand and reduce flood-related risks to evacuees and infrastructure. At the same time, impacts on urban structures will be assessed by means of suitable numerical modeling.

Beyond the urban flooding scenario, the research also explores compound flooding that considers sea-river interactions within estuarine systems. In this context, waves generated offshore push water inland through estuaries, raising water levels and causing overflow or flooding farther upstream. The compound flooding phenomenon will be investigated via field observation at the pilot site of Senigallia (Central Italy), focusing on the interaction between the Adriatic Sea and the Misa River (see **Figure 15**).

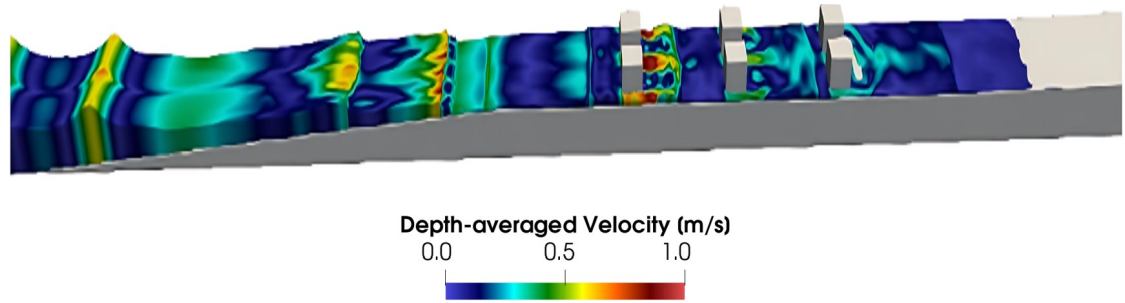


Figure 14: The propagation of wave-driven flooding through urban features and streets

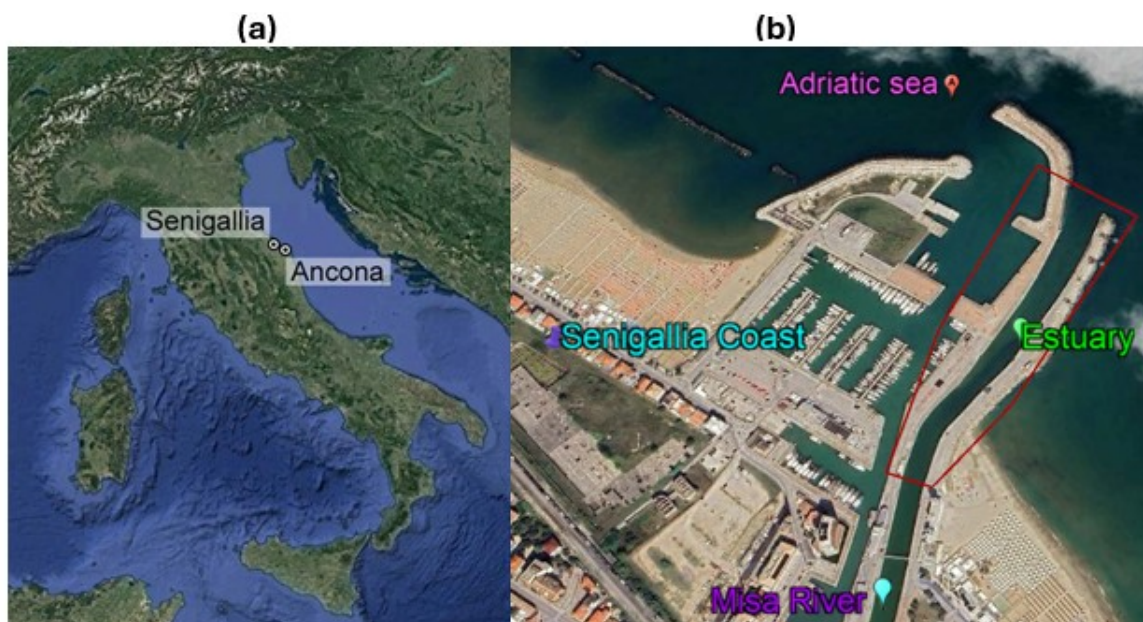


Figure 15: (a) Italy, (b) Pilot site of Senigallia

Project News

We are happy to announce one publication concerning the project.

- [Exploring a conservative staggered scheme for Boussinesq-type equations: Insights into numerical diffusion, dispersion, and wave-breaking. Fatima-Zahra Mihami, Volker Roeber, Coastal Engineering, 204, 2026.](#)

Looking ahead, the consortium is planning **Workshop 4**, a two-day online event to be held in the **second half of November 2025**. To complement this and maintain the balance of in-person activities, an additional **Workshop 5a** is also being planned as an on-site event. The location for this workshop will be discussed and confirmed in the coming months.



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