Rheinblick2027 Opening Seminar Report:

a transdisciplinary exchange to align the project design with stakeholder needs

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Abstract
Transdisciplinary exchange across the Rhine catchment is essential to align the project design with stakeholder needs and to support simulation-based climate change mitigation and adaptation planning. To foster this exchange, the Rheinblick2027 project, initiated by the International Commission for the Hydrology of the Rhine Basin (CHR), hosted an Opening Seminar with 50 participants from diverse scientific and stakeholder backgrounds. The seminar featured two parallel sessions: one focused on stakeholder interests and the other on the modelling framework. Key emerging topics included water resources management, groundwater, and flash floods. Groundwater was identified as a priority for further investigation due to its strong link to water quantity. Active engagement, such as fostered during the Opening Seminar, is essential and will remain a core element of Rheinblick2027.

Keywords
Rhine, Climate Change, Hydrology, Streamflow Scenarios, Impact Assessment, Rheinblick2027

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1 Background

Rheinblick2027 is the successor project to Rheinblick2010 (formerly known as (Rheinblick2050), initiated by the International Commission for the Hydrology of the Rhine Basin (CHR). Advances in hydro-climate research and hydrological modelling have underscored the importance of regularly updating streamflow scenarios. These updates are essential for effective climate change adaptation planning. Additionally, the outcomes of Rheinblick2027 are intended to support future assessments on the Rhine, including those conducted by other commissions such as the International Commission for the Protection of the Rhine (ICPR) or the Central Commission for the Navigation of the Rhine (CCNR).

2 Opening Seminar

Rheinblick2027 was officially launched in April 2024 and became operational in September 2024. The Opening Seminar, held on 14 April 2025 in Deventer, NL and online, served as a platform for stakeholders and scientists to discuss preliminary results and help shape the project's direction. Around 50 participants from diverse professional backgrounds attended (Fig. 1).

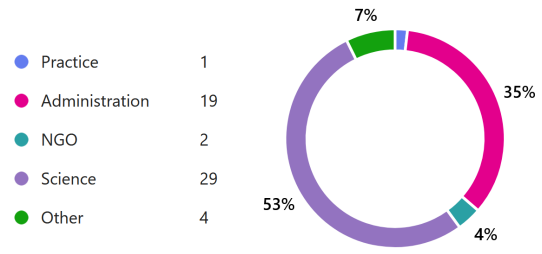

Figure 1: Composition of the around 50 participants (hybrid) at the Opening Seminar, divided by professional background.

In the initial project phase, hydrological streamflow scenarios are being developed using the KNMI'23 climate scenarios. These are based on a suite of models (CMIP6 = Coupled Model Intercomparison Project) and include three emission scenarios (SSP = Shared Socioeconomic Pathways), three future 30-year time slices, and both wet and dry climate variants. The streamflow scenarios are being simulated using three hydrological models: NL-WFLOW, CH-PREVAH, and D-LARSIM-ME. Preliminary results are consistent with previous projections, e.g., reduced summer streamflow from Basel to Lobith and increased high-flow events in the downstream section of the Rhine.

In the next project phase, we will analyse hydrological model differences using KNMI'23 climate scenarios. Subsequently, we will compute transient streamflow scenarios using the ensemble of EURO-CORDEX climate model simulations as input for the three hydrological models.

The Opening Seminar was structured into two sessions: one focused on stakeholder interests to enhance the relevance and usability of the project's outcomes, and the other dedicated to gathering scientific expertise to guide the development of streamflow scenarios and assess climate change impacts on hydrological special items, such as groundwater, stress test scenarios, flash floods, extreme events, sea level rise, and projections for the Meuse (Maas) River.

Figure 2: Session on Stakeholder Interests at the Rheinblick2027 Opening Seminar.

3 Outcomes of the Stakeholder Interest Session

Around 20 representative stakeholders from the Rhine region (Fig. 2) participated in this session, discussing three key questions:

a) Which factors controlling hydrological change should be further investigated?

b) If given the choice, what additional aspects should be examined in Rheinblick2027?

c) What hydrological indicators should be considered for Rheinblick2027?

The most critical factor controlling hydrological change identified for further investigation was water management strategies, followed by hydrological processes (Fig. 3a). Glaciers received no votes—not due to a lack of relevance, but because the two finalised ASG projects (ASG I and (ASG II) already provide stakeholders with valuable information on this topic. Additional aspects considered relevant included water temperature and groundwater, which were among the most frequently mentioned (Fig. 3b).

From a regional perspective, the GlW (Gleichwertiger Wasserstand, a key indicator for navigation) was specifically proposed for locations such as Duisburg, Kaub, and Maxau. GlW is relevant considering both the observed and projected low flow conditions during summer. Other proposals, partly associated with low flows, include flow velocities, water temperature, sediment transport, and ecological indicators (Fig. 3c). The Core-Working Group of Rheinblick2027 is currently assessing the feasibility of including some of these topics as special items in the project.

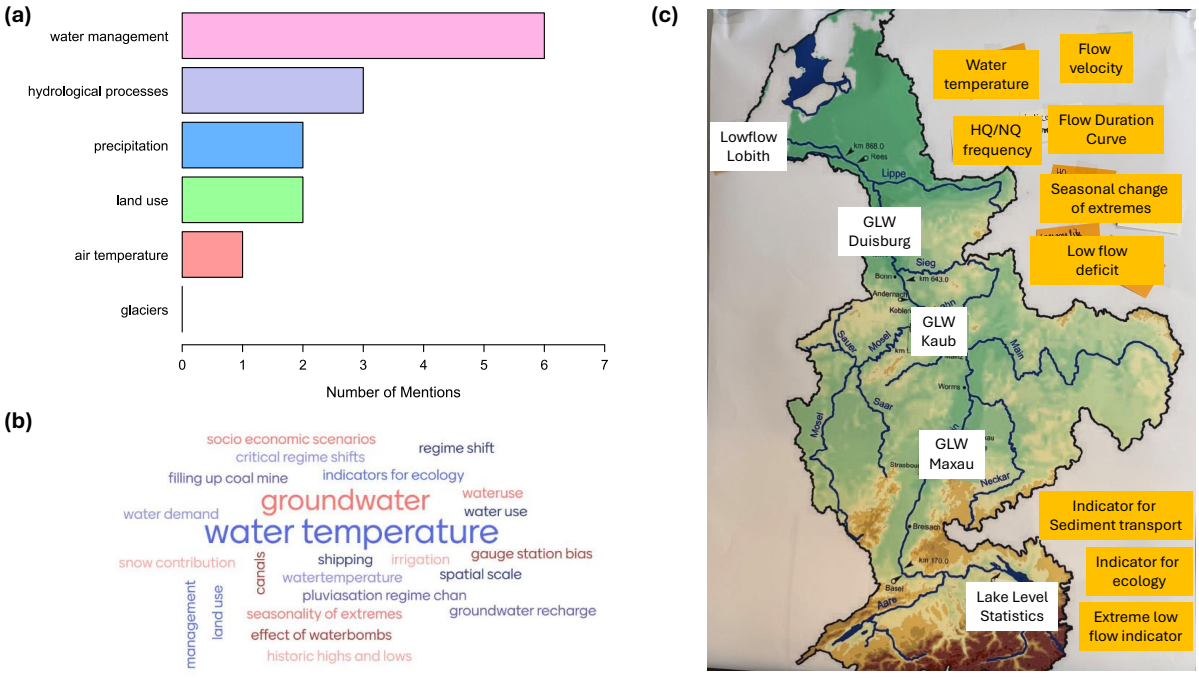

Figure 3: Outcomes of the stakeholder interest session included: (a) determining key factors driving hydrological changes that warrant further investigation; (b) other aspects that are considered relevant to examine; and (c) highlighting relevant indicators within the Rhine catchment.

4 Outcomes of the Modelling Framework Session

Around 30 scientists participated in this session in a hybrid format, engaging in discussions around two key questions:

a) How can the workflow for hydrological projections be improved?

b) What is the assumed relationship between public interest and the effort to assess climate change impacts on special items?

Enhancing the workflow for hydrological projections requires standardising calibration and bias-correction practices (Fig. 4a). Model calibration across different models should be based on a common dataset, and bias-correction techniques should be simplified to ensure consistency and better reflect responses to climate scenarios. Rheinblick2027 aims to strengthen the modelling framework by welcoming more modelling teams, enabling a robust multi-model ensemble. This will support a more comprehensive evaluation of each model's ability to capture present climate variability.

Assuming a positive relationship between public interest and the effort required to assess climate change impacts on special items: the higher the interest in a special item, the more effort is expected (Fig. 4b). Since not all special items require the same level of detail, this overview can support strategic resource planning within Rheinblick2027. For instance, the Meuse (Maas) River may be better suited for stakeholder engagement through a dedicated workshop, whereas groundwater is expected to require more intensive modelling efforts for large-scale simulations.

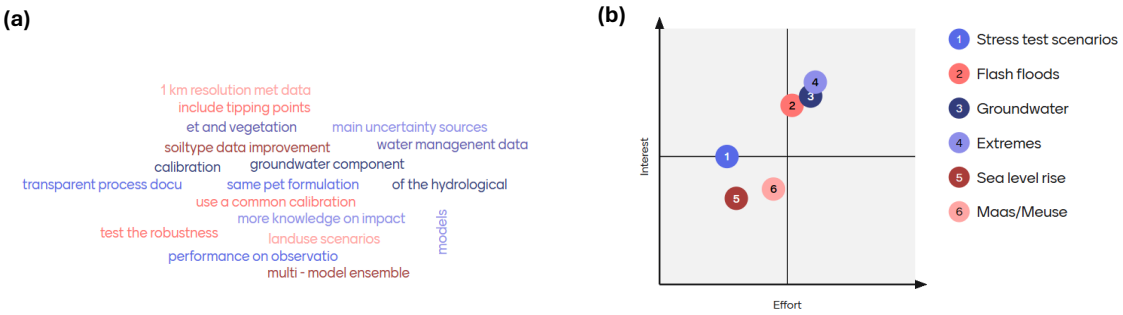

Figure 4: Outcomes of the modelling framework session included: (a) potential to improve the hydrological projections; and (b) the assumed relation between public interest and effort in assessing climate change impacts.

5 Conclusion

The Opening Seminar provided a platform for stakeholders and scientists across the Rhine catchment (Fig. 5) to gather expertise. Participants had the opportunity to learn from one another's perspectives and gain inspiration that extended beyond the catchment. This active engagement is essential and will remain a core element of Rheinblick2027. Further collaborations are highly appreciated, such as contributing additional models, testing the new scenarios, participating in workshops, supporting young scientists by offering thesis opportunities within the project, and more.

Figure 5: Transdisciplinary exchange at the Opening Seminar of the Rheinblick2027 project.

The stakeholder session highlighted several key topics, such as water resources management, groundwater, and changes in sub-daily extremes (e.g., flash floods), which also emerged during the Modelling Framework session.

The CHR's primary focus on quantitative contributions to streamflow provides a clear orientation for the project's goals. However, this focus also highlights certain limitations, as related aspects cannot always be clearly separated. For example, both stakeholders and scientists have identified groundwater as a topic of interest. Although it has not been a central focus of the CHR to date, groundwater is closely linked to streamflow. In the Rheinblick2027 project, groundwater is designated as a special topic. We will therefore provide an overview of existing initiatives and explore feasible options for a follow-up project, such as assessing the impacts of climate change on groundwater–surface water interactions or groundwater recharge.

Similarly, water temperature and the effects of water resources management are intrinsically connected to water quantity and were recognised as relevant during the Opening Seminar. These insights are crucial for refining the focus of Rheinblick2027 and addressing relevant interconnections, such as those on the water demand side, which are being explored in the Socio-economic Scenarios (SES) project, another ongoing CHR project.

6 Outlook

Rheinblick2027 runs from September 2024 through December 2027. The project aims to generate hydrological scenarios, explain the differences in hydrological models, strengthen stakeholder and scientist engagement, collect observational data, and publish a data paper and a summary for stakeholders on the project's outcomes. The input data (precipitation, temperature, etc.) from the KNMI'23 scenario will be publicly available by autumn 2025, particularly for stakeholders and researchers interested in assessing climate change impacts until 2150. Updates on the project will be published regularly on the CHR website.

For questions, suggestions, or collaboration ideas, get in touch with Michael Schirmer (`michael.schirmer@geo.uzh.ch`), Tobias Wechsler (`tobias.wechsler@wsl.ch`), or any member of the Rheinblick2027 Core-Working Group.

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