

Transdisciplinary integration via the CliWaC Explorer – a platform for science co-production, decision support, and education

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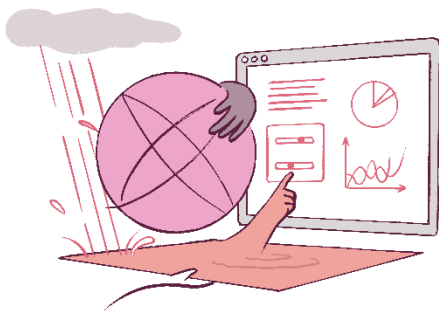
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What was the initial situation?

Inter- and transdisciplinary projects are increasingly demanded for tackling complex societal issues, such as climate adaptation [1]. These projects present numerous challenges regarding the integration and visualization of data and information (e.g., different vocabulary, assumptions and knowledge creation processes among involved disciplines) [2]. We use experiences from a large inter- and transdisciplinary Einstein Research Unit in the

climate and water sector (CliWaC) to derive conceptual aspects and guide the development of a software platform that facilitates the integration of such endeavors. This platform is made accessible to researchers, practitioners and decision-makers in the Berlin-Brandenburg area.

Aims & Approach

Overarching research question:

How should a research integration platform be designed to make interdisciplinary spatial science accessible?

... our aim is to develop a user-friendly tool that serves the following internal and external purposes:

- 1 Aid the identification of joint research questions, topical linkages, and data integration
- 2 Display project results in coherent way and allow users to interactively explore the topics
- 3 Develop a re-usable technical framework for future projects & external contributions

CliWaC investigated water-related issues in the Berlin-Brandenburg region from diverse perspectives across a wide range of disciplines, involving 28 research groups from natural to social sciences, as well as numerous regional stakeholders. The project produced qualitative and quantitative material, e.g. raster & vector data, time series, text-based stories, images, video, and audio.

The development of our software tool began during the CliWaC project (2022-2024) as a postdoctoral-led initiative to enhance the project's internal data and results communication, and to create a

communication tool that would persist beyond the project. Although not part of the original goals or expected results of CliWaC, the steering committee supported the activity, and an initial prototype was developed. By the end of CliWaC, however, only its participants had contributed to the CliWaC-Explorer (CWX). We missed the input of users *after* CliWaC (stakeholders, practitioners, policymakers).

What has happened in the project?

Within the TD-Lab-funded project, we conducted two workshops (the first in person and the second online) with a live demo and a standardized questionnaire to evaluate our software prototype and gather feedback from potential users regarding user-friendly improvements to the tool, as well as to discuss and refine the concept and content. With the feedback from the first workshop, we approached a software developer to implement the most promising suggestions. In the second workshop, we were able to present some of these improvements and also collect further ideas.

Workshop 1 was held on 11 April, 2025 to engage stakeholders with diverse expertise. The first workshop convened researchers from CliWaC and beyond, practitioners, water authorities, NGOs, and private-sector actors, focusing on CWX's potential as a decision-support tool. Discussions centered on usability, data integration, and practical applications for managing climate-related water risks. This workshop used structured co-production methods, including facilitated group discussions, hands-on platform testing, and participatory design exercises, ensuring that stakeholder voices directly shaped the development roadmap.



Following this workshop, an intermediate development phase began. A contracted software developer (already engaged as a consultant) translated stakeholder feedback into concrete improvements. This included enhancing the user interface for accessibility, integrating new external datasets, and implementing additional visualization features to make data more intuitive for non-specialists.

A second workshop (held on 11 July 2025) brought together participants from the earlier sessions to test the enhanced platform. This session functioned as both a usability evaluation and a future-

planning forum, identifying long-term opportunities for CWX's evolution and fostering cross-sectoral partnerships for future projects.

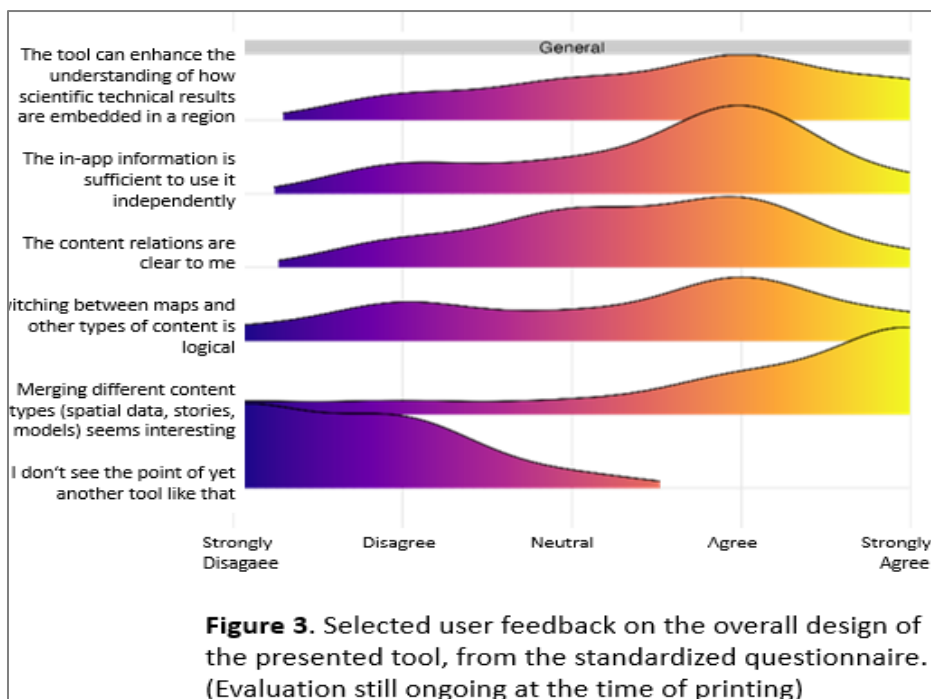
The project proceeded largely as planned, with no major disruptions. However, the breadth of interest from education-sector participants exceeded expectations, leading to expanded discussions on how CWX could be embedded in school curricula. This serendipitous input broadened the project's scope, positioning CWX as a dual-purpose tool for decision-makers and educators. In terms of unexpected changes in the project plan, we had to omit a third workshop that was supposed to target teachers and students from basic and higher education institutions, exploring CWX as an educational resource to foster understanding of water-climate interdependencies. We had to omit this workshop due to time constraints.

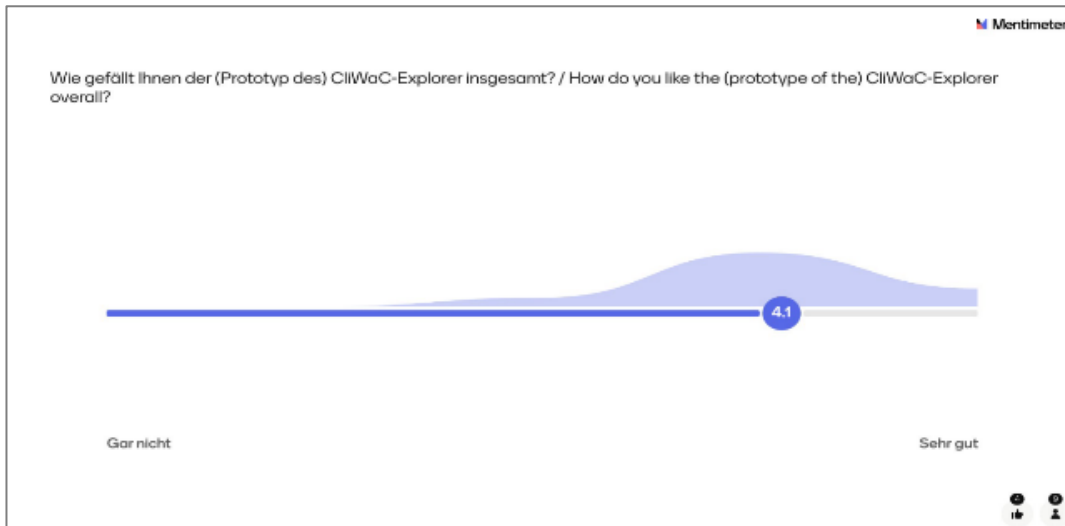
The audiences of both workshops differed slightly, although some participants attended both. Our decision to conduct the second workshop online was a response to the difficulties of some potential user groups to attend an in-person meeting and finding a date within a relatively short time.

What has been achieved?

Our overall concept was well-received. In particular, participants found the combination of qualitative and quantitative material from a wide range of scientific disciplines novel and engaging. Participants also found the “story-mode” feature very interesting. The general debate with the diverse audience at both workshops significantly enhanced our understanding of the tool's relevance and positioning, as well as the necessity for specific design choices.

Many participants expressed that they enjoyed learning about novel interactive visualization methods during our events. Furthermore, discussions on water & climate topics in the Berlin-Brandenburg region emerged from the hands-on experience of exploring the specific scientific content presented in the software.





During the workshops, we received numerous constructive suggestions for improvement, and participants identified several priority enhancements for the CliWaC Explorer to improve usability and accessibility (see the table below). Some highlights that have been implemented are:

- **Improved navigation and overview:** Users can now explore contents via a text-based interface in addition to the navigation graph.
- **Better user interaction:** Zoom can be locked manually, markers respond to hovering, and categories (e.g., stories, data, models) can be filtered more easily.
- **Clearer interface design:** The sidebar distinguishes between project types, legends remain visible, and buttons include clear labels or tooltips.

Below we list the received comments and related topics.

Werkskomponente	Beschreibung
Seite für textbasierte Übersicht und Navigation	Die Inhalte des CliWaC Explorer sind alternativ zum Navigationsgraphen auch über Text erkundbar. Nutzer*innen können auch so zur Kartenansicht gelangen
Statische Verlinkungen mit persistenter UI Konfiguration	Nutzer*innen können einen Kartenausschnitt mit Position, Zoom, und aktivierten Layern direkt teilen
Zoom-lock Funktion und manuelle zoom trigger	Nutzer*innen der Software können zwischen automatischem und manuelle Zoom umschalten.
Überarbeitung der seitlichen Leiste (sidebar)	Unterscheidbarkeit der Projekttypen (z.B. „story“, „data layer“) muss gegeben sein. Die Legende muss jederzeit sichtbar/zugänglich sein. Datenvisualisierungen erscheinen in einem separaten Fenster (nicht unter dem Text nach Scrollen)
Datenauswahl: Tooltip für Eingabeelemente; Slider mit Anzeige der Initialwerte	Eingabeelemente enthalten entsprechende Beschreibungen in der Konfiguration

Sichtbarkeit aktiver Layer	Aktive Layer müssen einfacher sichtbar und farblich markiert in der rechten Seitenleiste erkennbar sein
Marker Interaktion & Sichtbarkeit	Marker reagieren auf Hovering (Cursor) und Cluster von Markern sind visuell unterscheidbar
Projektfilter	Die Liste aller Datenbeiträge („all projects“) muss nach Kategorien (z.B. „story“, „data“, „model“) filterbar sein, um die Datensuche zu erleichtern
Schaltfläche für Labels / Tooltips	Schaltflächen sollten verständliche Labels tragen, oder alternativ Tooltips enthalten
Gekoppelte Parameter	Inhaltlich gekoppelte Daten müssen mit einem einzelnen Eingabeelement (z.B. Slider) bedienbar sein
Verbesserungen am Navigationsgraph und ggf. Animationen	Bedienelemente in der Graphenansicht müssen jederzeit gut zugänglich sein.
UI zur Konfiguration / content-backend	Ein spezielles UI erleichtert Content Managern den Zugriff auf Konfigurationen der Software, um diese zu editieren und weitere Daten einfach in das System zu integrieren

From a scientific perspective, the workshops revealed critical gaps in existing regional data platforms, prompting new research questions about how cross-sectoral data can be better integrated for climate adaptation. The co-production process also generated transformation-oriented knowledge, linking scientific models with practical concerns expressed by authorities, NGOs, and educators. This highlighted the value of participatory design in making digital research tools socially relevant.

Socially, the project built new networks connecting universities, water authorities, NGOs, and educators. These networks now provide a foundation for future collaborative projects and foster mutual understanding of water-climate challenges across sectors. Importantly, CWX has become more than a data repository: it is now a space for dialogue, learning, and collaborative planning in the Berlin-Brandenburg Region.

One unexpected but positive outcome was the strong engagement from the policy sector, which revealed CWX's untapped potential as a tool for decision support. This insight expanded the platform's perceived role beyond research into the domain of policymaking, opening opportunities for broader societal impact.

Finally, it became clearer to us how much the degree of curation needed differs by user group. UI refinements based on user feedback will be implemented. A bottleneck for reusability is the entry barrier to onboarding additional data. While this is not unexpected per se, we learned during the project to put more emphasis on this aspect. We discussed separating the role of "content manager" (less technical) and "data manager" for the tool in the future. We also gained more detailed insights into the ongoing tool development processes at other institutions, such as the LfU (Landesamt für Umwelt) in Brandenburg, the SenMVKU (Senate Department for Mobility, Traffic, Climate Protection, and Environment) in Berlin, and within the private sector.

What could happen next?

Looking ahead, the next step is to institutionalize and expand CWX as a permanent, actively maintained platform for water-climate knowledge in the BBR. Ideally, this would involve integrating CWX with other regional and national data platforms, creating a comprehensive, interconnected network for climate adaptation information.

Follow-up measures could include:

- Developing curricular materials to embed CWX in school and university education.
- Extending platform functionalities for real-time data integration and interactive scenario modeling for decision-makers.
- Establishing a formal multi-stakeholder advisory board to guide CWX's long-term evolution.

These measures could be implemented by universities in the Berlin University Alliance, in collaboration with state agencies, NGOs, and schools.

The effects would be substantial: CWX could become a go-to regional knowledge hub, supporting informed decision-making, fostering public engagement, and strengthening resilience to climate-related water risks. By bridging science, practice, and education, CWX would continue promoting transdisciplinary collaboration on pressing water and climate challenges.

Further information

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