



# Meeting of Waters

## Reconciling Humanity to Water

By Charlotte Qin  
*Founding director of Meeting of Waters*

Meeting of Waters (MoW) is an art-driven non-governmental organisation (NGO) based in Geneva, Switzerland active since 2022. MoW was born from the vision of artist and activist Charlotte Qin. What began as a personal journey has since become a transdisciplinary platform that reconnects humanity to water's essence through art, science, and policy.

Water has always been a mirror through which humanity perceives itself — calm or turbulent, transparent or opaque, its movements echo our collective emotions. Over the past months, *Noéa* has entered a new phase: from reading water's emotional pulse to embodying it. With the creation of our first XR prototype, *Noéa* moves beyond data visualization and into the realm of experience. Extended Reality (XR)—an umbrella for immersive technologies including augmented, virtual, and mixed reality—becomes a language through which climate data can be felt rather than merely observed.

At the heart of climate science lies an elemental truth: climate change is water change. Every shift in temperature, pressure, and circulation manifests through water's states—evaporation, condensation, melting, flow. Yet while science measures these transformations with precision, the public imagination remains distant. Hydrology, the discipline that traces the world's circulatory system, often speaks in numbers too abstract to touch.

### Extended Reality for Climate Empathy

In 2025, *Noéa* introduces a new bridge between hydrological data and human experience: an Extended Reality (XR) model that translates climate datasets into emotional landscapes. Developed through the collaboration between Meeting of Waters, HKUST, and WMO scientists, the model transforms a century and a half of rainfall and glacier data into an affective simulation of the Earth's heartbeat.

Within this immersive environment, every beat represents a year in the planet's water history. Patterns of precipitation and evaporation modulate colour, rhythm, and spatial expansion—encoding arousal and valence from the Russell Circumplex Model of Affect. When the climate system grows unstable, the virtual water body turns red and restless; when it stabilizes, it breathes slowly in blue. The result is not simply visualization, but embodied understanding—a sensory encounter with climate variability.

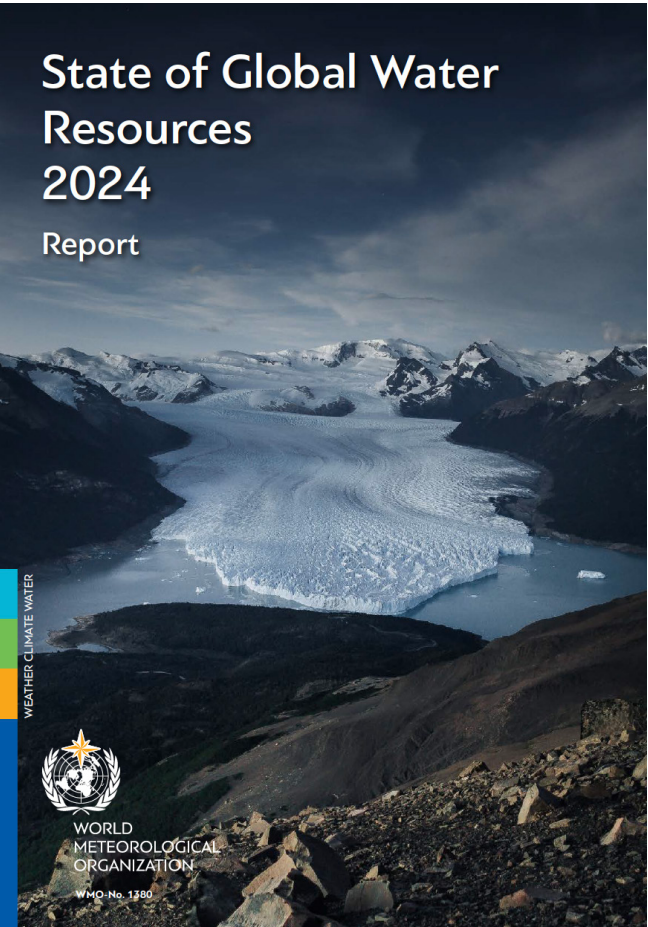
The integration of XR into hydrological communication redefines what it means to “feel” climate data. It allows scientists, policymakers, and citizens to experience the dynamics of the water cycle in intuitive terms: not as an external system to be managed, but as a living organism we are part of. This, we believe, is a vital step toward restoring empathy as a scientific instrument.

### Global Water Resources Report 2024

- The World Meteorological Organization's Global Water Resources Report 2024 delivers a stark diagnosis:
- Three consecutive years of global glacier mass loss (negative net balance since 2022).
  - Amplified precipitation extremes, with record floods in parts of Asia and drought intensification across the Mediterranean and South America.
  - Persistent groundwater depletion in key agricultural regions, threatening long-term food and energy security.

These findings confirm what we intuitively sense—climate change manifests through water. Yet despite the precision of hydrological data, public response often remains abstract, detached from lived experience.

This cross-disciplinary collaboration between art and science strengthens the mission of the WMO and its partners: to communicate water stress and resilience in ways that drive behavioural and policy transformation. *Noéa's* emotional translation is not a replacement for science—it is an amplifier of meaning, capable of awakening care where data alone cannot.



Here, *Noéa's* contribution is methodological as much as aesthetic. By translating WMO's datasets into experiential and emotional signals, *Noéa* complements hydrological models with perceptual ones. It invites a broader public to engage not only intellectually but viscerally. When audiences watch the colour of the XR environment pulse with rainfall records, they begin to understand that hydrological balance is not static but alive.

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Listening to the Planet's Pulse

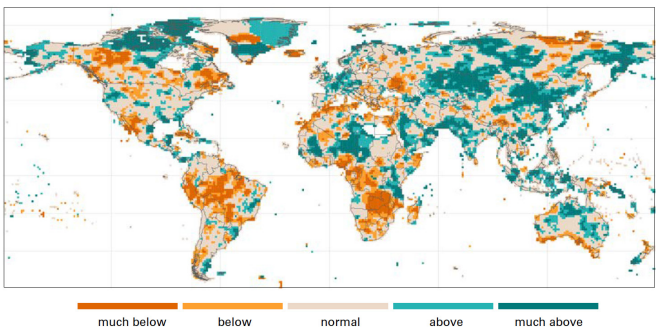
The hydrological cycle represents the most fundamental coupling between the atmosphere, the land surface, and the ocean. In scientific terms, precipitation constitutes the atmospheric input of water, while river discharge reflects the integrated terrestrial response — linking meteorological processes with hydrological storage, runoff generation, and human influence. This section traces the methodological expansion of *Noéa* from a localized precipitation dataset to a global hydrological framework in collaboration with the World Meteorological Organization (WMO). The transition from precipitation to discharge marks a scientific and conceptual progression: from the instantaneous input of water to its cumulative redistribution across the Earth's surface — from the vertical motion of rainfall to the horizontal circulation of rivers.

From Hong Kong to the World

The Climate Heartbeat prototype originated from a single long-term meteorological dataset: 141 years of daily precipitation records (1884–2024) from the Hong Kong Observatory. The model represented each hydrological year as one heartbeat, mapping annual rainfall anomalies onto affective parameters—valence (emotional tone) and arousal (intensity)—to visualize the variability of the subtropical climate system. This localized time series demonstrated how atmospheric input could be interpreted both quantitatively and sensorially.

The collaboration with WMO extends this methodology to a global precipitation dataset as presented in the GSWR 2024 report. The analysis integrates satellite-based and reanalysis products (e.g. ERA5, GPM) to assess precipitation anomalies and trends in total annual accumulation across all major latitudinal bands. The global patterns reveal an intensification of the hydrological cycle—higher precipitation extremes in equatorial and high-latitude regions, contrasted with persistent deficits in the subtropics and mid-latitude dry zones.

In scientific terms, this shift represents a transition from regional meteorology to global hydroclimatology. For *Noéa*, it signifies a transformation from the micro-scale intimacy of a single atmospheric record to the macro-scale visualization of the Earth's planetary water budget—the net balance between atmospheric input (precipitation) and terrestrial and oceanic storage.



Total annual precipitation in 2024 expressed as anomalies compared with the 1991–2020 reference period

In Hong Kong, *Noéa* first learned to listen to the heartbeat of rainfall: one pulse for every year, one emotion for every storm. Now, as its field expands to the scale of the Earth, *Noéa* listens to the whole hydrological symphony — to the rivers that remember, to the floods and silences that reveal our shared imbalance. From sky to river, from emotion to memory, the cycle speaks: the planet's pulse is uneven, and it is calling to be felt.

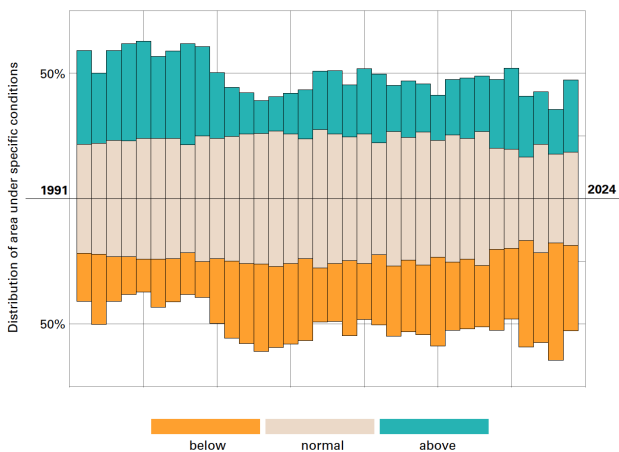
From Precipitation to River Discharge

While precipitation reflects the atmospheric supply of water, river discharge quantifies the terrestrial response—how that supply is partitioned into runoff, infiltration, storage, and eventual outflow. Scientifically, discharge integrates the cumulative effects of climate forcing, catchment hydrodynamics, cryospheric melt, groundwater interaction, and human regulation. It is the most direct indicator of freshwater availability and surface hydrological stress.

The GSWR 2025 (pp. 8–12) compiles river discharge anomalies derived from hydrological reanalyses (ERA5-Land) and in-situ observations (GRDC, HydroSOS). Results reveal pronounced spatial heterogeneity:

- Positive anomalies in the Amazon, Northern Europe, and parts of Southeast Asia, associated with above-average precipitation and snowmelt.
- Negative anomalies in the Mediterranean Basin, North Africa, Western Asia, and the southwestern United States, reflecting persistent drought and groundwater depletion.
- Extreme temporal variability, with multi-year trends in both surplus and deficit conditions indicating destabilized runoff regimes.

For climate science, these findings highlight the nonlinear coupling between atmospheric input and hydrological response. The same precipitation event can produce contrasting outcomes depending on antecedent soil moisture, land cover, and anthropogenic modification.



The distribution of the global basin area under different river discharge conditions for the years 1991–2024.

For *Noéa*, this transition—from precipitation to discharge—extends the affective model from the moment of input to the continuum of flow. The work's new datasets translate the temporal immediacy of rainfall into the spatial integration of river systems. Each river basin thus becomes an emotional unit within a global hydrological network—its discharge curves rendered as rhythms of accumulation, release, and exhaustion.

# From Prototype to Experience

When data begins to breathe, the world listens back.

This section brings together the development of *Noéa*’s Climate Heartbeat Prototype, its first field performance at the Zurich AI Festival 2025, and the subsequent evolution toward multisensory and inclusive design. It outlines how the project has grown from a coded model into a lived experience, translating hydrological data into an embodied form of understanding. The trajectory from simulation to accessibility demonstrates that the communication of climate data can move beyond representation, allowing people to sense the patterns and stresses of the planet through rhythm, space, and touch.

## The Unity 3D Development Framework

The Climate Heartbeat Prototype was conceived as a Unity 3D simulation that animates 141 years of precipitation data (1884–2025) as a continuous sequence of heartbeats. Each annual datapoint corresponds to one pulse in a 2–3 minute temporal arc, creating an emotional chronicle of the hydrological record. The model uses valence and arousal, two parameters derived from *Russell’s Circumplex Model of Affect*, to translate data into affective form. Valence defines the quality of emotion, determining whether the motion feels soft or volatile, while arousal regulates the intensity of color and rhythm.

Visually and sonically, the sphere at the centre of the simulation expands and contracts in response to rainfall volume. When precipitation increases, the heartbeat accelerates and the form grows more luminous; during dry years, the rhythm slows and the palette cools to deep blue. Sound pulses accompany each expansion, creating a link between the viewer’s perception of movement and their awareness of time. Across the sequence, the rhythm evolves from calm to agitation, mirroring the acceleration of hydrological extremes in the late twentieth century.

In its structure, the Unity prototype captures both the cyclical and the cumulative nature of climate time. The repetition of beats mirrors the periodicity of annual rainfall, while subtle variations express the system’s growing instability. What began as a digital experiment in data visualization thus became a study in affective hydrology — a model for how quantitative records can be translated into perceptual rhythm.

## Field Performance at Zurich AI Festival

The Climate Heartbeat was first presented publicly at the Zurich AI Festival 2025, marking *Noéa*’s debut as a performative and immersive work. Installed within a darkened, acoustically tuned space, the piece invited audiences to step into the emotional field of water — to witness data not as abstraction, but as pulse. Visitors were surrounded by fluctuating light, sound, and motion, each responding to a century of recorded precipitation. The environment shifted between serenity and turbulence, mirroring the global intensification of the hydrological cycle.

The experience revealed how effectively emotional translation can complement scientific interpretation. For

This section traces how *Noéa*’s journey moves from the lab to the world: from coded simulation to lived experience. Through field work—whether in digital space or physical encounters—*Noéa* transforms hydrological data into shared emotion. The project evolves into an instrument of connection, where art and science converge to restore the relationships that sustain life: between data and feeling, human and planet, knowledge and care.

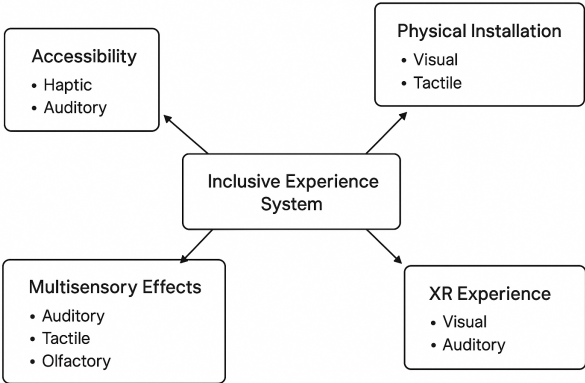
climate scientists and data specialists attending the festival, the work demonstrated the potential of affective visualisation as a new mode of science communication — one capable of conveying complexity through bodily experience.

Yet Zurich also exposed the limits of visual immersion. While the XR experience produced profound emotional engagement, it remained inaccessible to participants unable to use headsets or navigate visual environments. The team recognized that if *Noéa*’s purpose is to restore empathy and connection with water, then its design must itself embody inclusivity. This realization became the foundation for the project’s next stage: a multisensory, universally accessible installation.

## Designing for All Senses

Following the Zurich presentation, *Noéa* evolved beyond the headset into a physical, multisensory environment that could be experienced through the full range of human perception. The XR system was reimaged as an embodied installation, where the same hydrological data animates sound, vibration, airflow, and touch.

In this expanded form, sound becomes the primary language of emotion. Low-frequency pulses reproduce the deep, resonant heartbeat of the Earth, while higher tones convey the agitation of climatic extremes. Vibration modules embedded in the floor and seating transmit these rhythms directly to the body, allowing visitors to feel hydrological stress through subtle tremors. Gentle airflow and temperature shifts recreate the sensation of wind, evaporation, and glacier melt, linking atmospheric data to physical presence. At the centre of the space, a sculptural installation materializes the presence of water. Made from wax, clay, or other locally sourced organic materials, the form changes over time, absorbing and reflecting light while emitting a faint mineral scent. Its tactile surface invites touch, connecting visual and haptic experience. Each iteration of the installation is developed in collaboration with local artisans, ensuring that the materials and sensory cues reflect the environmental context of the site.



By integrating these elements, *Noéa* transforms the scientific abstraction of data into a shared, inclusive experience. The installation allows audiences who cannot see, hear, or use XR technology to perceive the same climatic rhythms through different senses. It redefines accessibility not as a technical requirement but as a principle of empathy — an acknowledgment that every body, like every river, carries its own way of knowing.



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| <h1>Ethics of Empathic Intelligence</h1>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <div>6</div> <p>Technology mirrors the hands that shape it. If machines learn from us, then the world they create will remember the way we imagine. <i>Noéa</i> was born not from the pursuit of precision, but from a desire for relation. If science measures, and art feels, then empathy is the bridge that holds them together. In the end, intelligence is not what predicts the future, but what learns to care for it.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <p><i>Toward a Technology of Care</i></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <p>In contemporary discourse, artificial intelligence is often defined by its predictive and computational capacities: systems that model uncertainty, optimize processes, and anticipate outcomes. Yet this framework neglects the question of purpose — why such intelligence is built, and to what end it is used. The development of <i>Noéa</i> introduces a distinct approach to artificial intelligence: one that emphasizes ethical, relational, and empathic design over optimization or prediction. The project positions AI as a bridge between scientific precision and human perception, employing emotional translation not to manipulate feeling, but to restore connection between people and planetary systems.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <p>mation into relation: it helps people recognize that data is not abstract, but the echo of a living system. Care, in this sense, is not sentimentality but methodology — an intentional design that privileges connection over prediction.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <p>Philosophical Foundation</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <p>Transparency as a Practice of Trust</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <p>In an age when artificial intelligence is primarily defined by its power to predict, optimize, and control, <i>Noéa</i> proposes a different paradigm — one in which technology serves not efficiency but empathy. It is an experiment in what philosopher Yuk Hui calls the “cosmotechanical” reorientation of technology: the idea that our tools should not merely extend our capabilities but reflect our values, imaginations, and relationships with the world. “Our imagination,” Hui writes, “is not merely triggered by technology; our imagination should also determine what kind of technology shall be invented and what shall not be used.”</p> <p>Yuk Hui’s philosophy situates technology within culture, claiming that every invention carries a cosmology — a way of relating to the world. When imagination becomes reactive, innovation risks losing its ethical compass. But when imagination becomes formative, technology can embody values such as humility, respect, and reciprocity. <i>Noéa</i> embodies this principle by reimagining artificial intelligence as an aesthetic and ethical practice. Its purpose is not to automate perception, but to refine it; not to replicate emotion, but to translate it. Through this approach, data becomes dialogue. The algorithms behind <i>Noéa</i> do not seek control over nature — they learn to listen to it. The result is an intelligence shaped by moral imagination: one that measures the Earth not only by what it knows, but by what it <i>feels</i>. Through this act of translation, AI becomes not a detached observer but a mediator of care — a technology that restores connection rather than abstraction.</p> | <p>Transparency stands at the core of <i>Noéa</i>’s ethical framework. It functions as both a scientific standard and a moral gesture — the commitment to make processes visible, interpretable, and accountable. In the context of artificial intelligence, transparency means more than disclosing data sources; it means revealing how emotion, interpretation, and computation intertwine.</p> <p>Every dataset used in <i>Noéa</i>, from precipitation to river discharge, is traceable to verifiable open repositories such as the WMO’s Global State of Water Resources reports, the Global Runoff Data Centre (GRDC), and ERA5-Land reanalysis. The emotional mappings derived from these data are documented, reproducible, and open for peer review. This ensures that empathy in <i>Noéa</i> is not fabricated sentiment but the result of transparent correlation between environmental variability and affective interpretation.</p> <p>At a deeper level, transparency also governs <i>Noéa</i>’s relationship with its audiences. Visitors are invited to understand not only what they feel, but why the system behaves as it does. This ethical openness transforms AI into a collaborative rather than authoritarian presence. By exposing its mechanisms, <i>Noéa</i> converts technological opacity into trust — allowing care to begin with comprehension.</p>                                                                                         |
| <p>Technology of Care</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <p>Centralized and Decentralized Intelligence</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <p>The majority of AI systems function on the logic of prediction. They quantify, anticipate, and optimize. Yet in the context of the climate crisis, prediction alone does not foster responsibility. It tells us what may happen, but not how to feel or act in response. <i>Noéa</i> reframes this relationship between intelligence and empathy.</p> <p>Through the translation of hydrological data into affective experience, <i>Noéa</i> operates as a Technology of Care — a system that listens before it calculates. It transforms rainfall, discharge, and water stress indicators into sensory language, inviting users to perceive climate systems through movement vibration, and sound. This gesture of translation turns inform-</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <p><i>Noéa</i>’s design integrates two complementary ethical structures: centralized accountability and decentralized participation. Its analytical components ensure scientific rigor and transparent data provenance. This centralized foundation guarantees accuracy, traceability, and alignment with international climate standards.</p> <p>At the same time, <i>Noéa</i>’s artistic and experiential outputs — from the XR prototype to the river installations — operate through decentralized authorship. Each iteration adapts to local contexts, drawing from regional datasets, materials, and artisanship. This open framework transforms <i>Noéa</i> into a distributed intelligence system: not a single entity, but a network of practices rooted in empathy and co-creation.</p> <p>This dual architecture represents a new ethical paradigm for AI. It balances responsibility with openness, precision with intuition, structure with improvisation. By doing so, <i>Noéa</i> demonstrates that technology can be both rigorous and relational — scientifically valid yet emotionally resonant, globally relevant yet locally grounded. ethics is not an afterthought but the system’s foundation — a continuous practice of listening, translating, and attending. <i>Noéa</i> embodies a form of empathic intelligence, where prediction and feeling converge, and where the purpose of technology is not to master the world but to belong to it.</p> |

## References

The *Noéa* project is made possible through the collaboration of artists, scientists, technologists, and institutions committed to rethinking how climate science can be felt, not just known. Special gratitude is extended to our partners and collaborators whose trust and partnership have enabled the convergence of art, science, and ethics into a shared language of care.

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### Institutional Collaborations and Scientific Partnerships

World Meteorological Organization (WMO) — Hydrological data partnership and scientific advisory (Stefan Uhlenbrook).

Eawag, Swiss Federal Institute of Aquatic Science and Technology — Hydrology and WASH research support (Abishek Narayan).

GainForest — Open-source AI and decentralized environmental data ethics collaboration (David Dao).

Youth Negotiator Academy (YNA) — Policy and negotiation partnership for climate governance.

Imagine 360 — XR production and systems integration partner (Daniel Grozdanov).

Zurich AI Festival (AI + Environment Summit and AI + X Summit) — Host of the first public presentation of *Noéa*: Climate Heartbeat.

### Creative and Technical Credits

#### *Artistic Direction and Concept*

Charlotte Qin — Founder & Director, Meeting of Waters.

#### *Scientific and Technical Development*

Jeffrey Xu — Data-driven affective mapping.

#### *XR and Systems Engineering*

Daniel Grozdanov (Imagine 360) — XR architecture, spatial sound, and visualization systems.

#### *Scientific Advisors*

Stefan Uhlenbrook (WMO) — Hydrology and cryosphere.

Abishek Narayan (Eawag) — Water science and sustainability.

David Dao (GainForest) — Decentralized AI and environmental data ethics.

Marie-Claire Graf (YNA) — Climate diplomacy and youth policy networks.

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