

Meeting of Waters

Reconciling Humanity to Water

By Charlotte Qin

co-Founder of Meeting of Waters

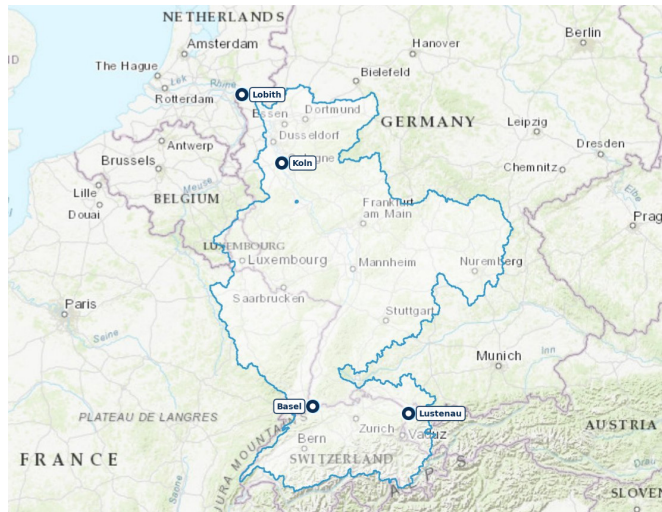
Meeting of Waters (MoW) is an art-driven non-governmental organisation (NGO) based in Geneva, Switzerland active since 2022. Overtime, MoW has since become a transdisciplinary platform that reconnects humanity to water's essence through art, science, and policy.

After mapping the climate heartbeat (precipitation) and developing the human-water interface (proximate sensing of lakes and wetlands), *Noéa* now listens to the autonomous physiology of rivers — their pulse, breath, personality, and memory. Issue 6 explores datasets scientists use to understand the river systems at different scales, and how these perspectives each feeds into the development of the two modules of *Noéa*: Climate Pulse and Human-Water Interface (HWI). Through our dialogues with hydrologists at the World Meteorological Organization (WMO), MétéoSuisse, and the Office cantonal de l'eau (OCEau) in Geneva, this issue connects two complementary modules of the system: global hydrological sensing through river discharge data, and local physical modelling of the river systems.

The streams of knowledge from Climate Pulse and HWI modules flow into *Noéa*'s training: one planetary, one intimate, providing a hollistic understanding of river system from both long-term and intimate levels. At current state, we chose two river systems as case studies for each module of *Noéa*, as proof of concept: the Rhine for Climate Pulse and Aire for HWI. These choices are based on availability of data as well as its value for storytelling.

Climate Pulse: Rhine

At the planetary scale, *Noéa* reads rivers as arteries of the climate body. To quantify this circulation, we draw on the Global Runoff Data Centre (GRDC), the world's primary repository of in-situ river discharge observations, operating under the auspices of the World Meteorological Organization. Each GRDC station measures the volume of water passing a fixed cross-section of a river over time, producing discharge records that integrate precipitation, snowmelt, and ground-water response across entire catchments — a continuous physiological reading of the basin above.



For the Rhine, we selected four stations from the 23 available in the GRDC network, following a strict longitudinal logic: each marks a genuine transition in the river's character, not merely a different position along the same story. Lustenau, immediately downstream of Lake Constance, captures the alpine signal at its first natural threshold — snowmelt-dominated, summer-peaking, reactive to the high mountain seasons. Basel records the Rhine as it leaves Swiss territory, having already absorbed the Aare, the Reuss, and the Thur; the purely alpine regime ends here. Köln receives the river after its passage through the Rhenish Massif and the addition of the Moselle and Main — fully lowland now, rainfall-driven and winter-peaking, carrying the memory of a 144,000 km² catchment. Lobith, at the German-Dutch border, is the trans-

boundary sentinel: the last fixed measurement before the Rhine dissolves into the delta, and the legal reference point for international water agreements. Together, the four stations span 870 kilometres and nearly 1,200 metres of altitude loss — from the last alpine threshold to the edge of the sea.

Station	Catchment Area (km ²)	Altitude (m)	Position
Lustenau	6,301	393	Alpine, Lake Constance exit
Basel	35,901	294	High Rhine
Köln	144,232	35	Middle Rhine
Lobith	160,800	8.5	Lower Rhine, transboundary

The Climate Pulse module uses this dataset to compare rivers as distributed sensors of global emotion: how they respond to stress — read through the hydrograph and flow duration curve — how they breathe through the seasons, and how they retain memory in the slow recession of baseflow after flood. GRDC's multi-decadal continuity allows *Noéa* to trace this emotional resonance across continents — a syntax of flow encoded in numbers, and decoded through four diagnostic lenses: pulse, breath, personality, memory.

Human-Water Interface: Three Rivers

The Human-Water Interface module translates basin intelligence into physical and sensory presence — a river experienced as structure, pulse, and consequence rather than data locked inside a technical report. Three river partnerships are currently active. L'Aire in Geneva is *Noéa*'s most intimate case: a 5km urban river renaturalised by the interdisciplinary team Superpositions across four phases from 2002 to the present, now managed by OCEau (Office cantonal de l'eau), where the HWI data pipeline is in development. The Vardar basin — a transboundary river crossing North Macedonia, Kosovo, and Greece — is the most operationally advanced partnership, and culminating in Vardar Days in November 2026, where SWAT-based basin modelling, governance dialogue, and a physical river sculpture will converge in a single public demonstration. Green Qinba, based in Ankang, Shaanxi, is an independent environmental non-profit protecting rural watersheds in the Qinba mountains — a partnership active since 2024.

The Climate Pulse methodology developed in this issue is fully transferable to any river system with sufficient data coverage. At the time of publication, institutional adoption remains open. Dialogue with scientists and institutions is ongoing; no formal partnership has yet been confirmed. This issue documents the work as it stands — rigorous, available, and waiting for the rivers that need it.

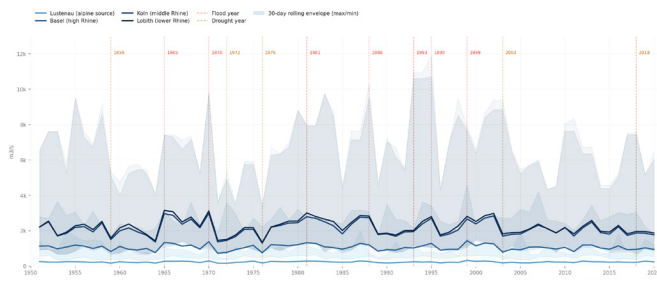
Four “Organs” of a River

Listening to the Physiology of a River

The hydrograph reveals the river’s pulse, the seasonal cycle its breath, the flow duration curve its personality, and the recession curve its memory. Together they form a physiology of rivers — a language through which landscapes reveal their hidden water dynamics. In the Rhine, these four organs speak about an alpine river shaped by snowmelt, glacial retreat, and the accumulated pressure of one of Europe’s most densely inhabited and industrialised catchments.

Hydrograph — The Pulse

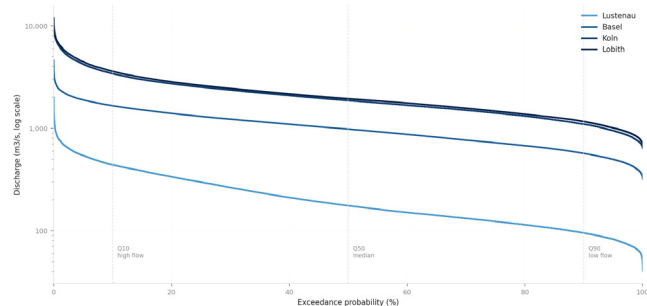
A hydrograph plots discharge (Q [m³/s]) over time, the fundamental rhythm of the river, connecting also precipitation and melt into flow. For the Rhine, we read four stations simultaneously on a single axis, from Lustenau to Lobith, each showing three layers: the annual mean as the river’s resting pulse, the 30-day sustained maximum as its flood ceiling, and the 30-day sustained minimum as its drought floor. The shaded envelope between them is the river’s dynamic range.



Lustenau and Basel carry far less volume than Köln and Lobith, therefore, the four stations naturally separate into two registers, making the alpine and lowland characters visually distinct: a pronounced spring peak driven by alpine snowmelt in the upper catchment, followed by secondary pulses shaped by frontal rainfall systems across the lowland basin. Extreme years surface clearly — 1995 and 1976 among them — not as isolated spikes but as systemic events, the entire body contracting or surging across all four stations at once.

Flow Duration Curve (FDC) — Personality

The FDC ranks all discharge values from highest to lowest and plots them against exceedance probability — the proportion of time any given flow is equalled or exceeded. It is an extraordinarily expressive diagnostic: a portrait of the river’s character distilled from its entire recorded history. Where the hydrograph shows the river in time, the FDC reveals its temperament.

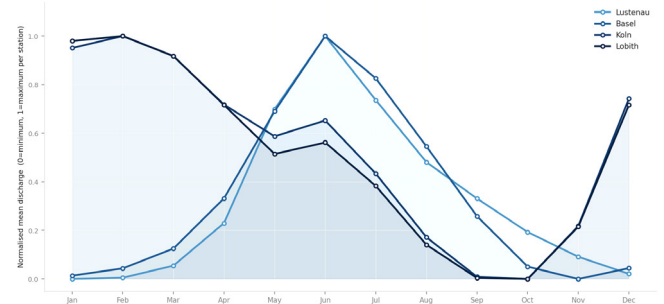


Lustenau’s curve is the steepest: a sharp alpine gradient, highly reactive and seasonally extreme. Lobith’s is the flattest

buffered by lakes, groundwater, and the inertia of a vast catchment, while Basel and Köln trace the progressive transformation between them. The reference lines (Q10, Q50, and Q90) mark high flow, median, and low flow thresholds. The FDC shows that Rhine is a river of seasonal drama and long-term persistence, and each station along its length tells a slightly different version of that story.

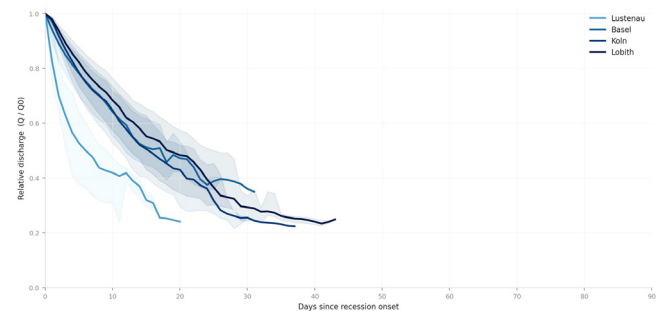
Seasonal Flow Cycle — Breath

The mean monthly flow averaged across decades reveals the waxing and waning of discharge with the seasons. Breath marks the river’s dialogue with climate. For the Rhine, this breath is not one rhythm but four — plotted together on a single axis, each station normalised so that shape rather than magnitude becomes the subject. The counterpoint is immediate: Lustenau inhales in June and July, driven by alpine snowmelt swelling the upper reaches, while Köln and Lobith peak in winter and early spring, shaped by lowland



Master Recession Curve — Memory

After a rainfall or snowmelt event, river discharge does not drop instantly — it decays slowly, sustained by the gradual release of water stored in soils, aquifers, and the landscape itself. The recession curve is the measure of this release: the hydrological memory of the basin. Here, we plot the master recession curve for each of the four stations — the median decay shape derived from all recession events of ten days or longer across the full record, with the interquartile range showing how consistently the river returns to baseflow.



The contrast between stations is immediate. Lustenau’s curve drops sharply, the alpine catchment releasing its water quickly with little groundwater buffering. Lobith’s decay is slower and more sustained, the accumulated storage of a vast, geologically diverse basin keeping the river alive long after the pulse has passed. Basel and Köln fall between them, each carrying a different depth of memory. The Rhine remembers — but not everywhere equally, and not forever.

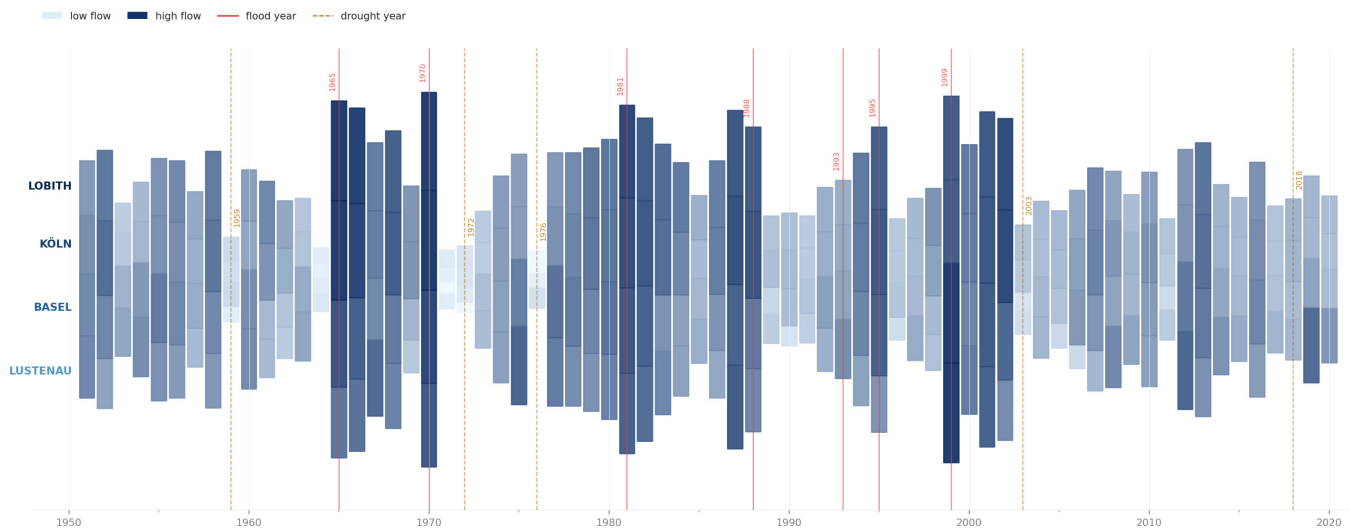
Anatomy in Time

The River as Continuous Body

The four diagnostic figures on the preceding page constitute a clinical portrait: a river fully measured, fully understood in its parts. But a river is not its parts. It is the continuity between them — the way a flood pulse at Lustenau becomes a memory at Lobith three weeks later, the way a drought summer in the Alps arrives at Köln as a winter of low flows, the way seventy years of climate pressure accumulates not in any single measurement but in the slow change of the body's shape over time.

River's Biography

The ribbon synthesises what the four diagnostic figures analyse separately into one continuous life, read from left to right. Lustenau, Basel, Köln, and Lobith become four layers of one organism, stacked flush against a shared spine, flowing left to right from 1951 to 2020. Colour and width encode discharge simultaneously: deep navy means high flow, pale blue means drought, and the total height of the form at any moment represents the Rhine's aggregate vitality from source to sea.

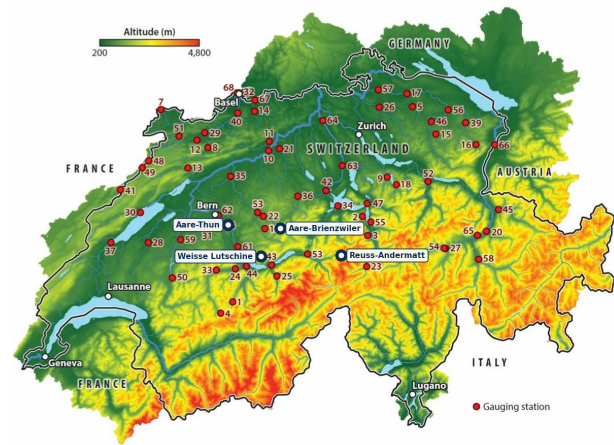


The 1976 drought collapses the entire body at once — all four stations pinching toward the spine simultaneously, the organism contracting as a whole rather than failing at a single point. The sustained fullness of 1999 to 2002 bilges outward across every layer. The gradual thinning after 2010 — visible as a slow loss of body weight in the right-hand third of the figure — is the long-term drying signal.

Where the body begins — the alpine sources

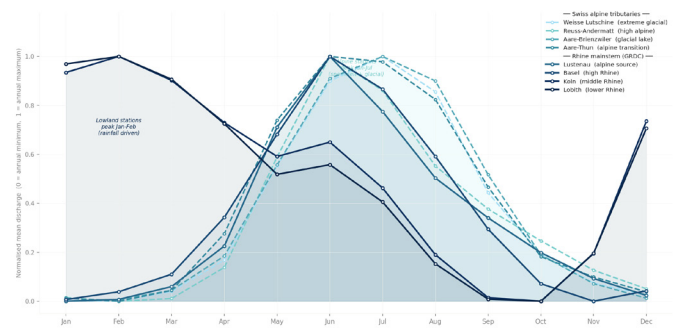
The seasonal flow cycle extends the lens upstream where the Rhine begins. Eight stations plotted on a single normalised axis reveal a fundamental physiological counterpoint. The four Swiss alpine headwater stations, monitored by the Swiss Federal Office for the Environment (FOEN), were selected to represent distinct hydrological regimes across the Swiss catchment: Weisse Lütischine at Zweilütschinen (856 m) drains the glaciated Bernese Oberland and carries the most extreme melt signal in the network — almost a spike; Reuss at Andermatt (1,447 m), the highest station in the selection, sits immediately below the Gotthard massif and captures a pure high-alpine snowmelt regime with minimal buffering; Aare at Brienzwiler (567 m) integrates the outflow of the Brienz glacier

If the pulse, breath, personality, and memory are the river's organs. Here we ask a different question: what does the Rhine look like as a single continuous body, alive across time and space simultaneously? And if that body extended upstream into the glacial headwaters of Switzerland, where does it begin?



system through its eponymous lake, which smooths the melt peak before it enters the lowland; and Aare at Thun (558 m) receives the further-buffered signal after passage through Lake Thun, already transitioning toward the lowland character of the mainstem Rhine. The four Rhine mainstem stations

peak in January or February, shaped by lowland rainfall and the slow accumulation of a vast basin. The crossing of the two curve families around March–April marks the Rhine's fundamental hydrological transition: the point where alpine-dominated seasonality gives way to a rainfall-driven lowland regime. Lustenau sits at this hinge — downstream of Lake Constance, which buffers the alpine signal, but still carrying a measurable summer peak absent at Basel and Köln. It is where the two worlds overlap, and the crossing of the curve families around April marks the Rhine's fundamental physiological transformation: the moment where alpine memory gives way to lowland rhythm.



Human-Water Interface

Three rivers, three scales, three conversations

A river does not become real to a community through a discharge graph or a flood risk report. It becomes real when it can be stood beside, listened to, felt as something alive and consequential. The Human–Water Interface is *Noéa*'s translation layer — the work of converting basin intelligence into presence. Three river partnerships are currently active, each at a different stage, each asking the same question from a different shore.

L'Aire, Geneva — Switzerland

L'Aire rises in France at the foot of Mont Salève and reaches the Arve at the edge of Geneva: five kilometres of river that spent most of the 20th century inside a concrete channel, reduced to infrastructure. In 2001 the State of Geneva launched a competition to restore it. The winning team, Superpositions, led by Georges Descombes, proposed something more precise than restoration: keep the canal as a cultural scar, and open a new space beside it where the river could find its own form again. Implemented across four phases from 2002 to the present across 50 hectares of the Aire plain, the project received the Council of Europe Landscape Award in 2019. L'Aire is now managed by OCEau (Office cantonal de l'eau), with whom *Noéa* is in early dialogue.



Vardar Basin, Skopje — North Macedonia

The Vardar crosses three countries before reaching the Aegean, carrying the accumulated memory of a politically complex and climatically stressed basin. It is *Noéa*'s most operationally advanced HWI site, implemented within SDC-funded Groundwater Management Programme, a programme of the Government of Switzerland under the auspices of the Ministry of Environment and Physical Planning and the Ministry of Agriculture, Forestry and Water Economy, which is implemented by the consortium Skat Consulting Ltd. (Switzerland) and PointPro Consulting (North Macedonia). The modelling framework applies SWAT (Soil and Water Assessment Tool) which integrates elevation, land use, soil properties, climate inputs, and streamflow records to simulate the full hydrological cycle of the basin and test it against future climate and management scenarios. In November 2026, this scientific work reaches its first public realisation at Vardar Days, a basin event for authorities and stakeholders from all three countries, where data, governance dialogue, and a physical river sculpture converge in an integrated demonstra-

The Climate Pulse module reads rivers as planetary sensors. The Human–Water Interface asks the inverse question: how does a river speak to the people who live beside it? Not through dashboards or technical reports, but through presence — something that can be gathered around, felt, and understood without prior scientific training.

tion. The XR experience, presented in the next section, first shown publicly in Skopje on World Water Day in March 2026, has been the geometric foundation of this work.



Green Qinba, Ankang — China

In the Qinba mountains of Shaanxi province, where rivers feed the Han basin and sustain millions of people downstream, the Ankang Green Qinba Environmental Public Welfare Service Centre has been working since 2014 to rebuild the relationship between rural communities and their waterways — through public participation, environmental research, and policy advocacy. Their programme, Streams Flow On, protects rural rivers across multiple watersheds in the region. *Noéa*'s partnership with Green Qinba, active since 2024, is at an open stage. Outcomes are still being shaped. What the partnership already holds is alignment — a shared conviction that rivers are not managed from above but restored from within, one community and one watershed at a time.



Three rivers, three different answers to the same question. What connects them is not a data standard or a governance framework but a posture — the decision to approach a river as something that has a character, a memory, and a right to be understood on its own terms. The Human–Water Interface is not a product. It is a practice, built incrementally, in partnership, at the pace the river sets. Each of these collaborations is incomplete. Each is, in that sense, honest — a record of where the work actually is, not where it is hoped to arrive. *Noéa* will return to all three in future issues as the conversations deepen and the rivers speak more clearly.

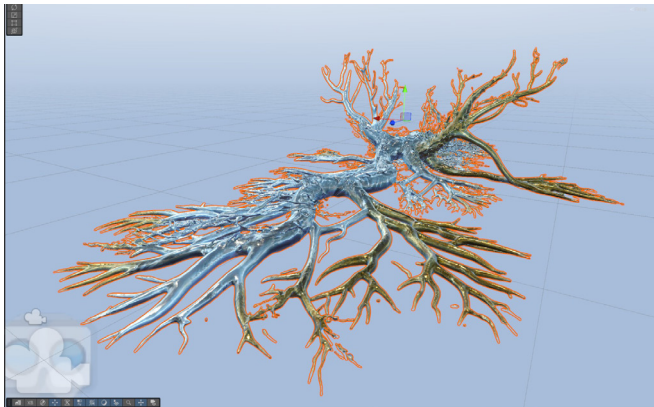
Birth of a River

Towards a four-dimensional hydrological body

A discharge graph tells you how much water passed a fixed point on a given day. A map tells you where the river goes. Neither tells you what a river feels like as a body moving through space and time simultaneously — swelling in February, contracting in August, branching at every confluence, carrying seventy years of climate memory encoded in its form. This page documents *Noéa*'s first attempt to answer that question geometrically, and the pipeline that will make the answer quantitatively real.

Where the body begins — the alpine sources

Using Higgsfield with image generation model Nano Banana 2, a reference image of the river body was generated and fed into Meshy AI to produce a three-dimensional mesh. The resulting geometry was textured with water and gold materials and rendered in Unity using the Meta XR SDK and Mixed Reality ToolBlocks — producing the first version of the river as a navigable spatial object. The model was first presented publicly in Skopje on World Water Day in March 2026, as part of the groundwork for upcoming Vardar Days in November.



What the viewer encounters in the headset is not a representation of any specific river at a specific moment. It is a proposal — a first answer to the question of what a river body might feel like when freed from the flat plane of cartography. The geometry is organic, branching, asymmetric. In drought the form narrows; in flood it swells. At confluences it accumulates mass the way a tree trunk thickens toward the root. The shape is the argument. The ribbon figure on page 4 already implies this geometry — time along one axis, discharge infla-



The four diagnostic figures and the longitudinal ribbon establish what the Rhine is as data. The next question *Noéa* poses is geometric: what does a river look like as a continuous body in space and time simultaneously — not as a line on a map, not as a curve on a graph, but as an organic three-dimensional form that breathes, contracts, and expands according to its own hydrological logic?

ting and deflating the body's cross-section as it moves from source to sea. The fuller model we are working toward is a river body in four dimensions at once: three spatial dimensions plus time.

Vardar — towards a data-driven river body

The Vardar basin is where this geometry becomes real data. The SWAT modelling framework will produce a continuous historical time series of basin behaviour across 40 years in the Vardar catchment — surface runoff, baseflow, soil moisture, sediment transport, and streamflow at every sub-basin outlet, at daily resolution, calibrated against observed discharge records and extended into future climate and management scenarios. This output is precisely what the four-dimensional river body requires as its input. Where the current XR model is driven by intuition and artistic inference, the Vardar integration will drive the geometry with measured and modelled hydrology: the body's diameter at any point along the river determined by actual discharge, its surface texture by sediment load, its luminosity by temperature anomaly, its pulsing by the seasonal rhythm visible in the flow duration curves. The ribbon becomes a body. The body becomes the basin.



The target for this integration is “Vardar Days” in November 2026 organised by the Macedonian team in Skopje, a public basin event where the physical river sculpture, augmented by digital and sensory layers, will translate the SWAT model outputs into something authorities, stakeholders, and communities from North Macedonia, Kosovo, and Greece can stand beside and understand without a technical briefing. At present, our GRDC data gives us four anchor points along the Rhine — Lustenau, Basel, Köln, Lobith — and the ribbon is their two-dimensional shadow. The Vardar model will give us the full continuous body: every tributary, every confluence, every sub-basin, animated by decades of hydrological memory and the scenarios that follow from it.

Once the geometry is established, additional attributes follow. Colour deepening with sediment load. Luminescence tracking temperature anomaly. Surface turbulence encoding flood stress. But the shape comes first — the claim that a river has a body, that this body has a history, and that history is legible in form. The hydrological analysis in this issue is its proof of concept. Vardar is where the proof becomes practice.

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L'Aire, Geneva

OCEau (Office cantonal de l'eau)
République et Canton de Genève

Vardar Basin, North Macedonia

The Groundwater Management, Use and Protection Programme, a programme of the Government of Switzerland under the auspices of the Ministry of Environment and Physical Planning and the Ministry of Agriculture, Forestry and Water Economy, implemented by the consortium Skat Consulting Ltd. (Switzerland) and PointPro Consulting (North Macedonia)

Green Qinba, Ankang, Shaanxi, China

Ankang Green Qinba Environmental Public Welfare Service Centre — member of Regeneration Youth Hub, World Economic Forum

Data analysis and visualisation
Python (pandas, matplotlib, numpy)

3D asset generation

Higgsfield
Nano Banana 2
Meshy AI

XR development

Unity
Meta XR SDK
Mixed Reality ToolBlocks

AI research and writing assistant

Claude (Anthropic)

www.meetingofwaters.org

