Supporting STakeholders for Adaptive, Resilient and Sustainable Water Management by co-creation in data science, information and knowledge

STARS 4 Water

The Rhine River Basin

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Deltares & The International Commission for Hydrology of the Rhine basin

EU Grant Agreement 101059372

Introduction to the Rhine River basin and transboundary water cooperation

– a continuous journey to address the challenges now and ahead

Rhine riparian states (Schulte-Wülwer-Leidig et al, 2018)

[International Commission for the Hydrology of the Rhine basin]

[International Commission for the Protection of the Rhine]

[Central Commission for the Navigation of the Rhine]

[Supported by EU horizon research project]

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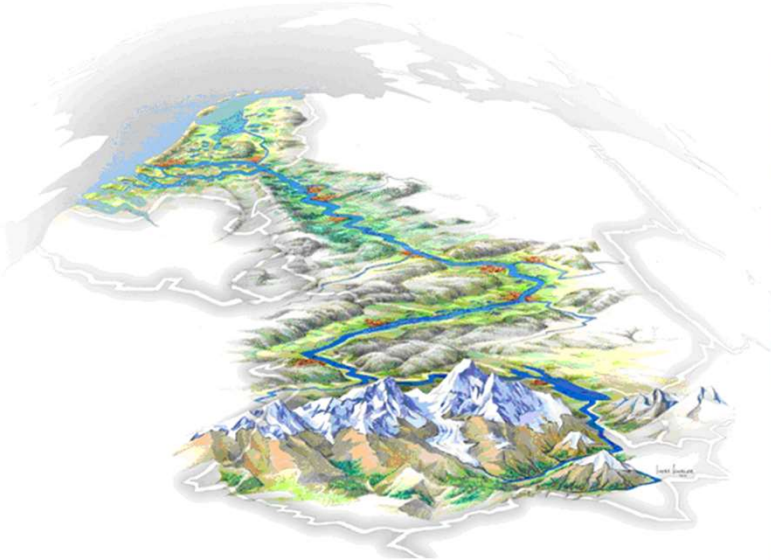
More low water and high-water extreme events in the Rhine river basin

- urgently call for intensified transboundary cooperation and co-created action for raising water resilience



Geography of the Rhine basin
(Source: Province Gelderland)

Low water issues for inland water transport at Nijmegen, The Netherlands, in 2018

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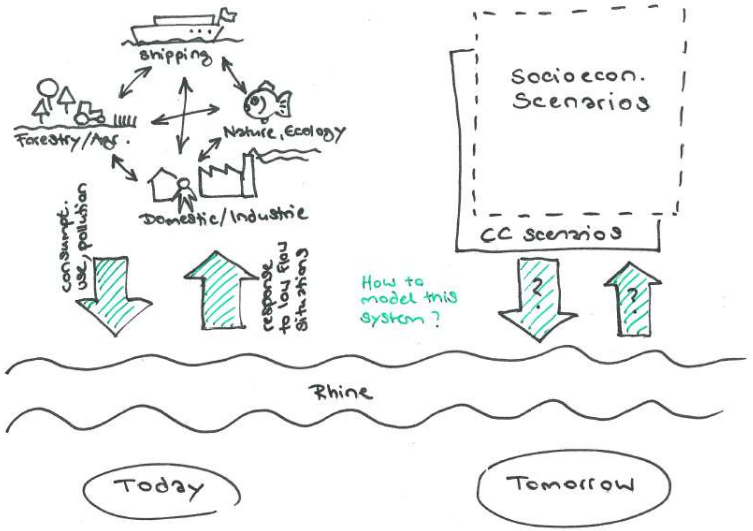
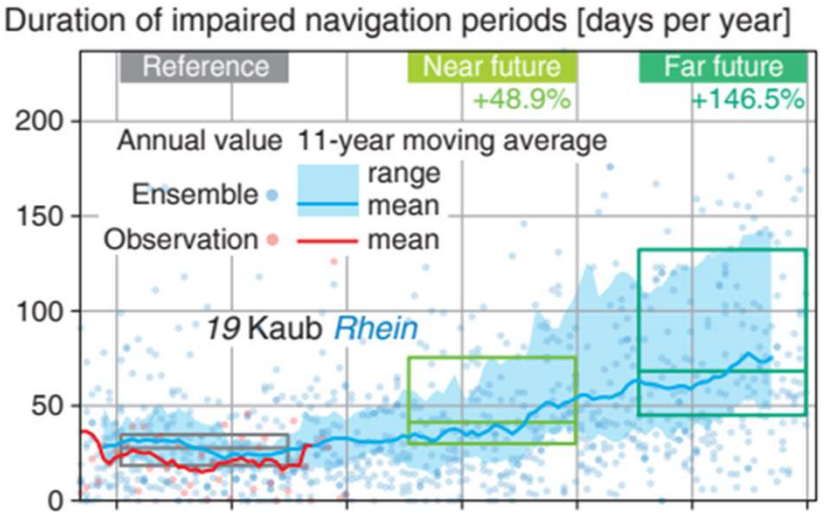
What-if….? Co-design of transboundary future scenarios

– Understand the impact of socio-economic developments on the river discharge under climate change



[CHR Socio-Economic Scenarios project]: Implications of the impact of socio-economic developments on the river discharge



[CHR ASG] and [Rheinblick2027] projects: Implications of the impact of climate change on the river discharge

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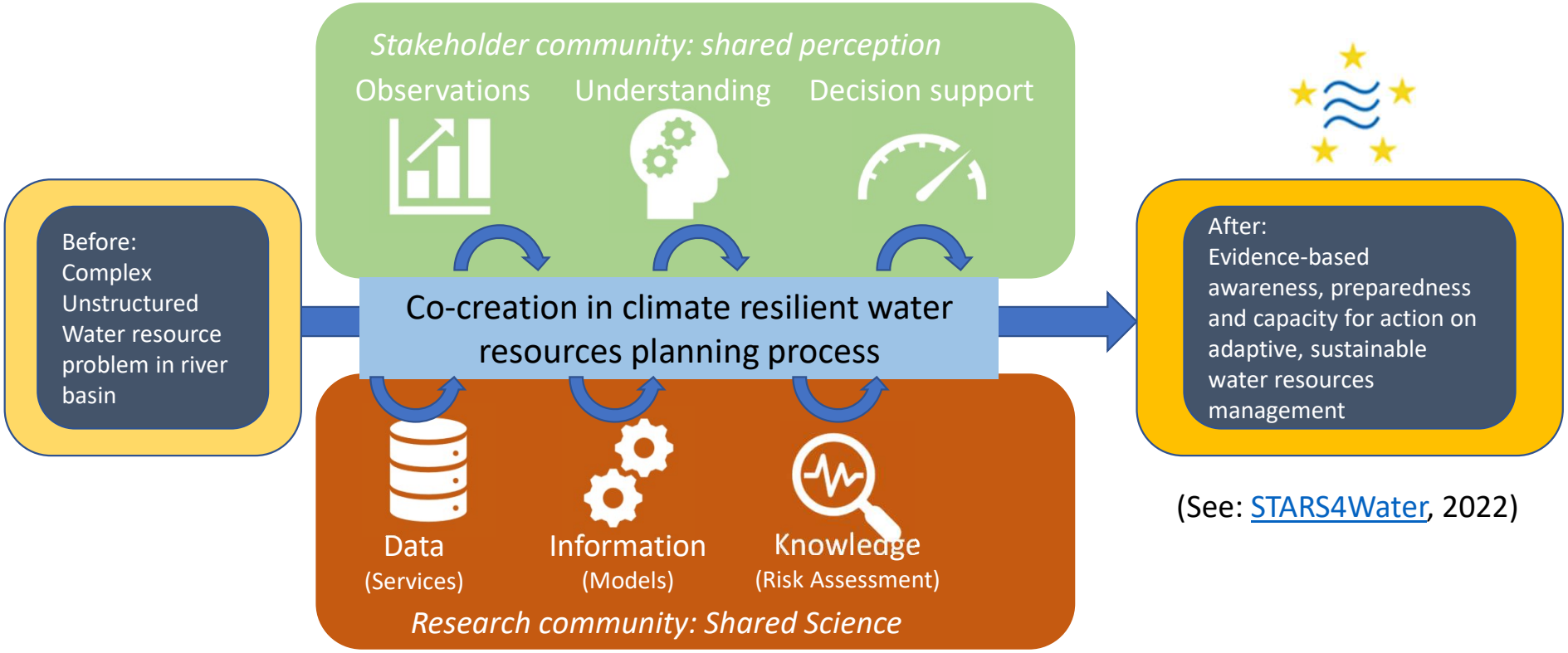
STARS4Water: Role of Data Science, Information and Knowledge in River Basin Management



(See: STARS4Water, 2022)

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Stakeholders' needs driven innovation

Priority areas for supporting Stakeholders for Adaptive, Resilient and Sustainable water resources management	Danube (Trans-boundary)	Drammen (NO)	Duero (SP/PO)	East Anglia (UK)	Messara (GR)	Rhine (Trans-boundary)	Seine (FA)	Europe
Climate, hydrology and natural water availability	**X**							**X**
Land use and (Agricultural) water demand assessment	x	**X**			x	**X**	x	
Balancing water availability, supply and demand	**X**					**X**		
Groundwater management and conjunctive SW-GW water use	x		**X**	**X**	**X**	x	**X**	**X**
Low flows, water allocation and prioritization, incl. reservoir management	x	**X**			**X**	**X**	x	
Ecological flow and good ecological status	x	x		X	**X**	x		
Flood risk management - early warning and/or planning								
Drought risk management - early warning and/or planning	**X**	x	x			**X**	x	
Water quality management			x	x			x	
Future scenarios for strategic planning	**X**	**X**	**X**		**X**	**X**	**X**	

*Table: Stakeholder needs: key topics for improving the understanding on water resources under changing climate, risk assessment, operational management and water resources planning. Legend: **X** = high priority within STARS4Water project, x = priority, blank = no priority* (Richards et al, 2023)

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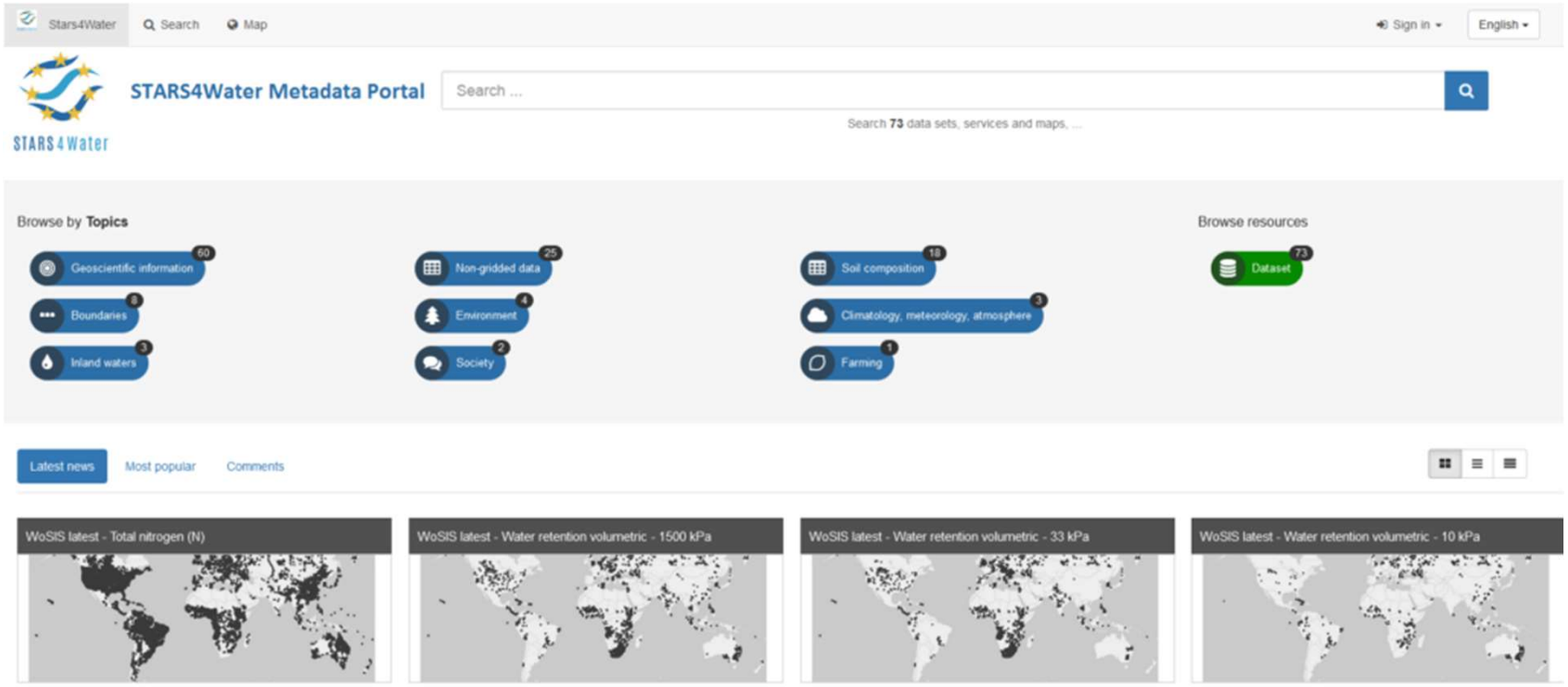
Start with global open datasets and information

- STARS4Water Metadata Portal entry point to more than 300 global datasets supporting river basin planners around the world



See: [STARS4Water metadata portal]

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Mobilizing local datasets, information and knowledge

- Accessibility, protocols for exchange, creating library, identifying gaps

- But it is also about mobilizing people and co-create!
- National/local information combined with global/EU information for the transboundary level
- Harmonizing datasets and approaches; every country has its own.

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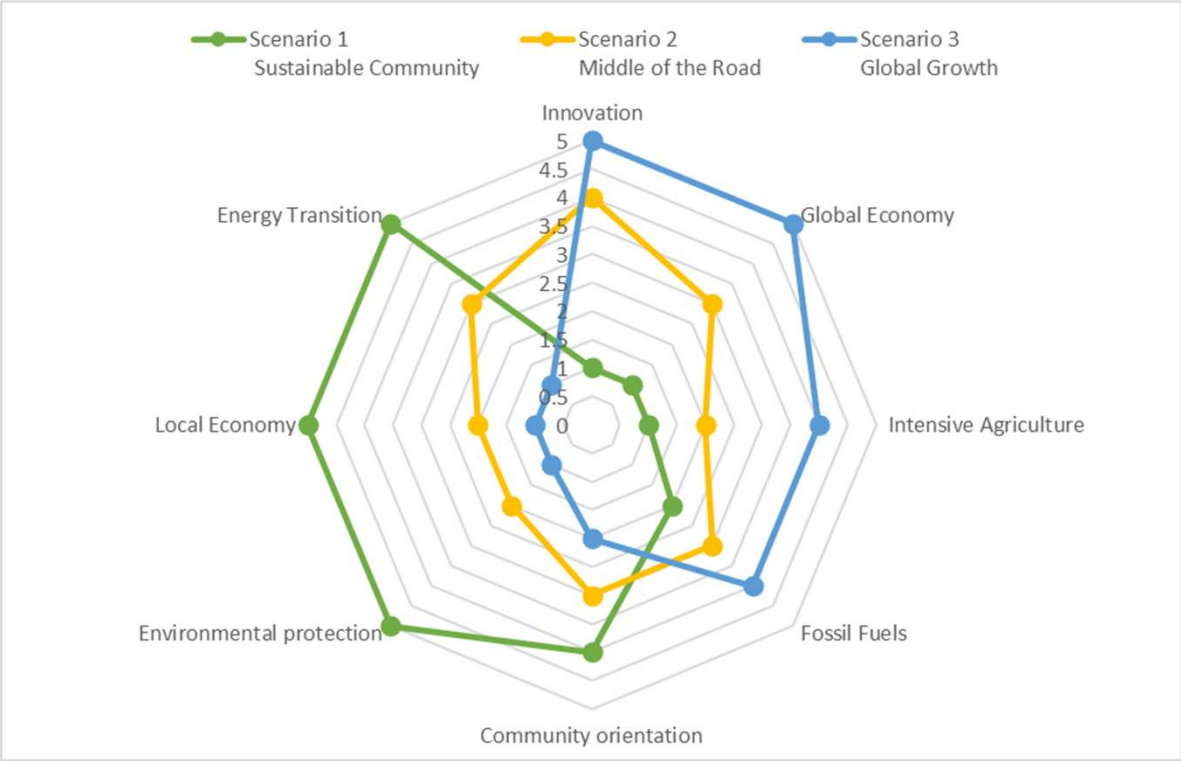
Co-design of 3 scenario narratives for the future of the transboundary Rhine river basin

- inspired by IPCC and national scenarios



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Support from scenario modelling tool

- for system understanding and quantitative and qualitative analyses

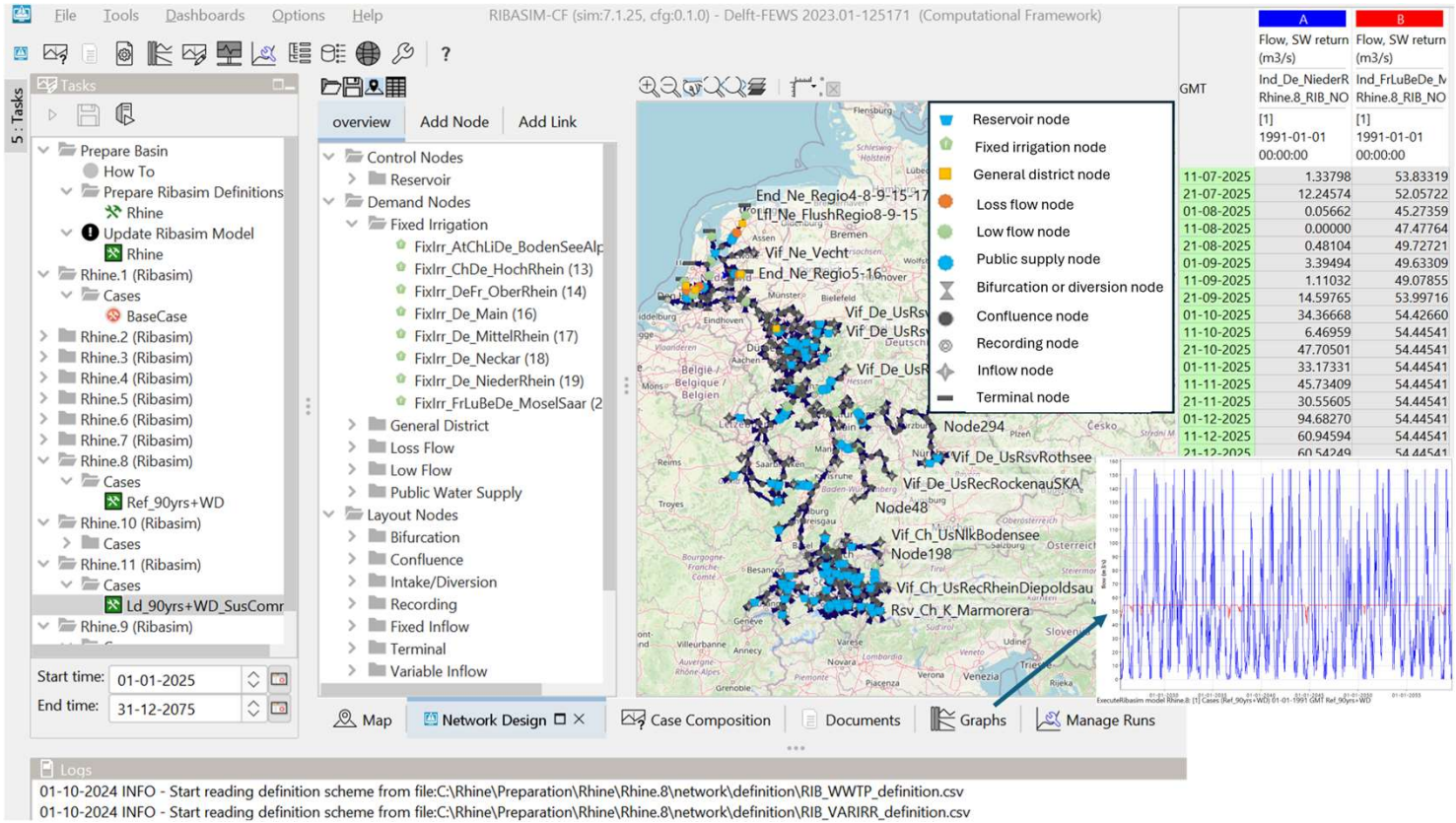
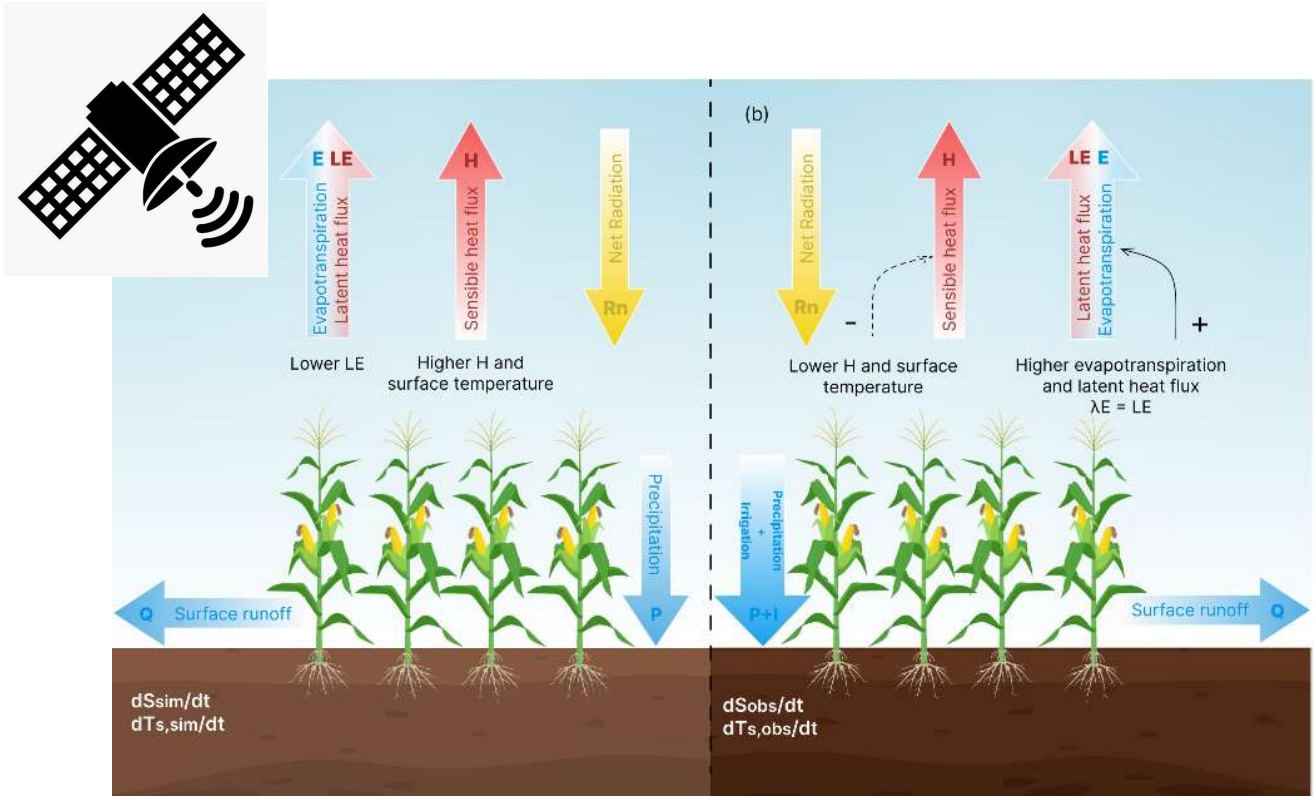
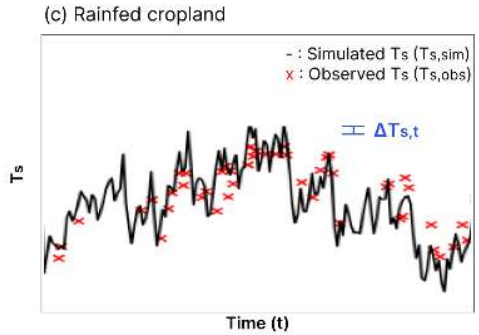


Figure: user interface for modelling Rhine scenarios
(See: https://oss.deltares.nl/web/Ribasim)

Novel data services and hybrid modelling

– combining earth observation datasets, process-based modelling and Machine Learning





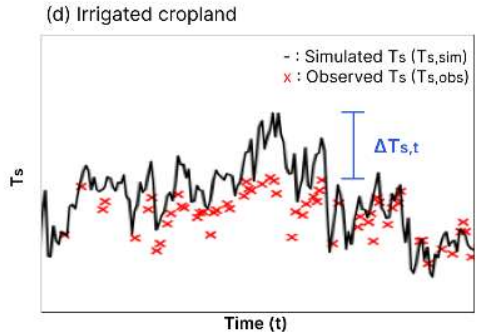


Figure: Illustration of energy and water balance in the wflow_sbm hydrological model and observations (Purnamasari, in preparation)

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Tailored information for decision making

- showing output of risk assessment according to meaningful local indicators

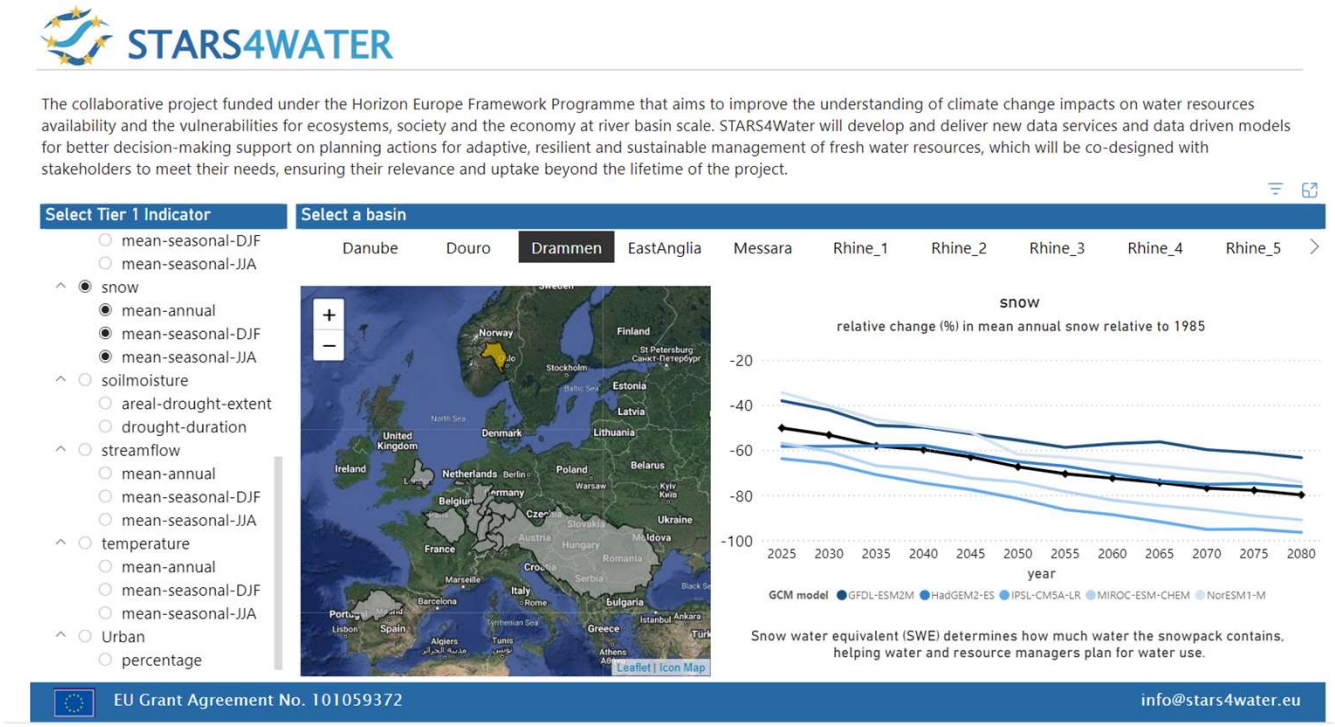

Figure: Generic dashboard presenting indicators based on global, open datasets for defining safe operating space for 7 river basin hubs (Mes et al, 2024)

More information?

- home | International Commission for the Hydrology of the Rhine basin (CHR) (chr-khr.org)
- Stars4Water (stars4water.eu)

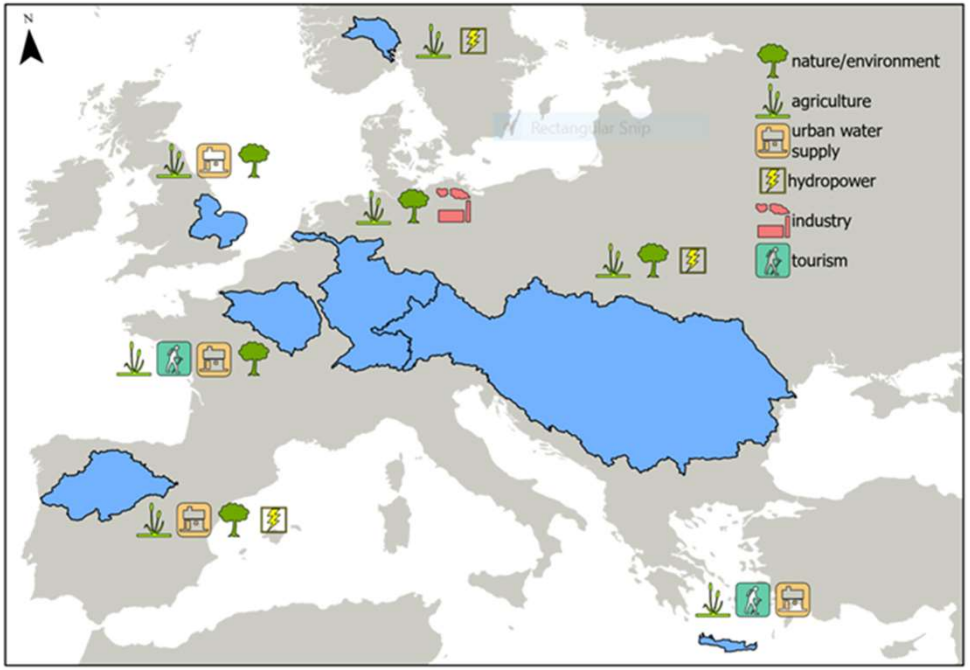

Figure: The 7 river basins that co-create with STARS4Water research partners to improve the understanding of climate change impacts on water resources availability and the vulnerabilities for ecosystems, society and economic sectors at river basin scale (Hegdahl et al, 2023)

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