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International Center for Interdisciplinary Research Water Systems Dynamics

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Modeling for change,
A science & public policy challenge
Modéliser pour changer,
Un défi entre science et politiques publiques

http://m4c.watagame.info

Montpellier, Hydropolis Lavalette, France, nov, 13-15, 2024

International workshop for scientists and public stakeholders	*Atelier international pour scientifiques et acteurs publics*
Which design, use and impact of modeling to trigger hydro-social transitions ?	**Quels designs, usages et impacts de la modélisation pour favoriser les transitions dans les socio-hydrosystèmes ?**
An international workshop where scientists and public stakeholders can mutually learn and co-design new modeling procedures to foster adaptation in hydro-social systems.	Un atelier international où scientifiques et acteurs publics peuvent apprendre et concevoir ensemble de nouvelles procédures de modélisation pour l'adaptation des socio-hydrosystèmes

Contacts : m4c@watagame.info URGENT MATTERS : +33673993693

ZOOM ACCESS : for registered participants : http://visio.watagame.info

Chair persons : Nils FERRAND, INRAE ; Mathilde Boissier, INRIA ; Olivier Barreteau, INRAE & UNESCO ICIREWARD

Organization & logistics : Sandra Bardin, Sandie Mennechet, UNESCO ICIREWARD

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Final Program

nov. 13			
09:00:00	09:30:00	Registration	
09:30:00	09:40:00	Official Welcome	Olivier Barreteau, G-EAU INRAE & UNESCO ICIREWARD
09:40:00	09:55:00	Workshop introduction	Nils Ferrand, G-EAU INRAE, workshop coordinator
09:55:00	10:25:00	Participatory Modeling Yesterday, Today and Tomorrow: the Evolution of Modeling and Participation	Pr. Dr. Alexey Voinov Department of Water Management, Faculty of Engineering Technology (FET), Uni. Twente, NL
10:25:00	10:35:00	Discussion	
10:35:00	10:45:00	Case study process introduction	Nils Ferrand, G-EAU INRAE, workshop coordinator
10:45:00	11:20:00	Case study workshop - Group 1	
11:20:00	11:35:00	Break	
11:35:00	12:10:00	Case study workshop - Group 2	
12:10:00	12:25:00	Debriefing	
12:25:00	13:30:00	Lunch	
13:30:00	14:00:00	~~Apprehending cybernetic water system dynamics and futures: A review of games and immersive environments for education and foresighting~~ **FLIGHT DELAY → moved to nov 14**	Amy Wardrop, ANU, AU
14:00:00	14:30:00	AI for forecasting variables useful for crisis management	Anne Johannet, Ecole des Mines Alès, FR
14:30:00	15:00:00	Feedback on the use of participatory modelling tools from the CoOPLAGE suite for groundwater use in the Badriane oasis (Timimoun, Algeria)	Bruno Bonté & Amine Saidani, G-EAU, INRAE, FR
15:00:00	15:30:00	Integrated assessment and modelling of agricultural systems and landscapes: toward a generic agent-based simulation platform MAELIA	Manon DARDONVILLE (visio) Research Scientist, PhD, Laboratoire Agronomie et Environnement- UMR 1132 – Université de Lorraine – INRAE
15:30:00	15:50:00	Break	
15:50:00	16:35:00	ALL scientists	Short talks --> 9x5'
16:35:00	17:00:00	Reflexivity (structured) by small groups + feedback	
17:00:00	18:00:00	Posters and open dialogue session	
18:00:00	18:00:00	END D1	

nov. 14			
08:30:00	09:00:00	Welcome coffee	
09:00:00	09:05:00	Welcome UNESCO	Olivier Barreteau, UNESCO ICIREWARD Montpellier
09:05:00	09:15:00	Welcome INRAE	Eric Martin, Direction de l'Appui aux Politiques Publiques, INRAE, FR
09:15:00	09:30:00	Welcome JRC	Jolita Butkevičienė Director for Innovation in Science & Policymaking at the Joint Research Centre, European Commission
09:30:00	09:35:00	Welcome FutureEarth	Coline Grimée, FutureEarth France
09:35:00	09:40:00	Welcome INRIA	Peter Sturm, dir STEEP, INRIA, FR
09:40:00	09:45:00	Summary of issues and day 1 work	Nils Ferrand, UMR G-EAU, INRAE, FR
09:45:00	10:05:00	Public stakeholders' expression	
10:05:00	10:35:00	Innovations and Limitations in Modeling for Public Policies in Water Governance and Resilience (Ceara, Brazil)	Eduardo Martins - FUNCEME, Brazil
10:35:00	10:55:00	Break	
10:55:00	11:25:00	LIFE Eau & Climat : model design and use experience between science and public policy	Sonia Siauve, Office International de l'Eau & Emilie Darne, EPAGE LoireLignon, FR
11:25:00	12:05:00	C3PO, a digital model for collective decision making on the future of water sharing in the Durance catchment	Pascal Dumoulin, Durance River Syndicate, FR
12:05:00	12:35:00	Water quality in a contested catchment – modeling for change	Nelson Odume, Rhodes University, ZA
12:35:00	13:05:00	Modeling for participatory planning toward a national water policy in New Caledonia	Pearl Winchester, New Caledonia
13:05:00	14:15:00	Lunch	
14:15:00	14:45:00	Digital Twins: for which use cases ?	Laurence Gauthier, SAFEGE Ingénierie, FR
14:45:00	15:25:00	Modeling in support of territorial planning in Tunisia: politician-researcher perspectives	E. Hassenforder, G-EAU CIRAD, France & Taher Adjemi, DG ACTA, Tunisia
15:25:00	15:55:00	Contested Knowledge for Participatory Modelling. When and where to infuse knowledge in the process	Maria Manez, GERICS, HEREON, DE
15:55:00	16:15:00	Break	
16:15	16:45	Apprehending cybernetic water system dynamics and futures: A review of games and immersive environments for education and foresighting	Amy Wardrop, ANU, AU
16:45:00	17:15:00	Reflexivity → needs' assessment	
17:15:00	18:45:00	Cocktail	
nov. 15			
09:00:00	09:00:00	**JRC special session : From EU high-level hydro-social transition targets to accountable results on the ground – the case for a comprehensive and effective science-policy interface to build climate and water resilient food systems** https://fr.unesco-montpellier.org/document/lien/672e25d0cf587_JRC%20@%20UNESCO%20ICI	

		REWARD.pdf	
09:00:00	09:05:00	Welcome and introduction (JRC CC-MOD)	Christine MÜLLER Science for Modelling, Monitoring and Evaluation Unit, European Commission's Joint Research Centre (Head of Competence Centre on Modelling team, and moderator of the event)
09:05:00	09:10:00	Better Regulation: the role of JRC CC-MOD/Model Inventory and Data Access System (MIDAS) in the new Commission	Fabienne CORVERS Senior Expert, Evaluation and Impact Assessment Unit A.2, Secretariat General, European Commission
09:10:00	09:15:00	The EU Multi-Annual Financial Framework (MFF) 2028-2034: towards a policy (target) driven and performance-based EU budget	Kai WYNANDS Head of MFF & Annual Management Cycle Unit A.3, Secretariat General, European Commission
09:15:00	09:30:00	Hydro-social transition in the EU towards 2030: Direction and instruments in the areas of natural resource management/water and food/better nutrition – policy statements	High level policy targets on climate adaptation, emission reduction and carbon sequestration, biodiversity and water, key policy instruments Christian HOLZLEITNER Head of Low Carbon Solutions: Land Economy and Carbon Removals Unit C.3, Directorate General for Climate Action of the European Commission Claudia OLAZABAL Head of Sustainable Freshwater Management Unit C.1, Directorate General for the Environment, European Commission
			High level policy targets on organic farming, fertilizers, pesticides, key policy instruments Gijs SCHILTHUIS Head of Policy Perspectives Unit A.1, Directorate General for Agriculture and Rural Development, European Commission
			High level policy targets on poverty reduction/EU Child Guarantee – healthy food component, key policy instruments Czaba ANDOR Vice-Chair of the Indicator Sub-Group of the Social Protection Committee, advisory policy committee to the Ministers in the Employment and Social Affairs Council (EPSCO)
09:30:00	11:00:00	**Science for transition planning, performance monitoring and reward programs**	
09:30:00	09:50:00	Evidence from the Organiko LIFE+ project, a multi-faceted action plan in place in Cyprus to demonstrate the generation of high quality field data on greenhouse gas emissions related to organic farming and children's health indicators, while interacting	Konstantinos C. MAKRIS Assistant Professor of Environmental Health, Cyprus University of Technology, Cyprus Int. Institute for Environmental and Public Health

		with policy makers and communicating the science to the public and private sector	
09:50:00	10:00:00	Outlook on changing weather patterns/agricultural growing conditions across Europe (and beyond) from Destination Earth, Climate Change Adaptation Digital Twin	Grazyna PIESIEWICZ Head of High Performance Computing and Applications Unit C.1, Communications Networks, Content & Technology Directorate General, European Commission
10:00:00	10:30:00	Challenges to better represent water in micro-economic models: the case of IFMCAP (Individual Farm Model for Common Agricultural Policy Analysis) – Opportunities to assess the impact of climate and farming practice change with IFM-CAP and CAPRI	Lola REY Economics of the Food System Unit D.4, European Commission's Joint Research Centre
10:30:00	10:50:00	Opportunities to follow the impact of adapted regional agriculture, its improved nutrient balances, pesticide application on inland and coastal water using the Geospatial Regression Equation for European Nutrient (GREEN) losses model	Alberto PISTOCCHI Ocean and Water Unit D.2, European Commission's Joint Research Centre
		Demonstration of sensitivity analysis approaches to study the impact of climate, biotic and abiotic pressures on water model output	Elena BASTIANON Science for Modelling, Monitoring and Evaluation Unit S.3, European Commission's Joint Research Centre
10:50:00	11:00:00	Opportunities to apply counterfactual methodsfor estimating the environmental and climate impacts of adapted farming practices linking administrative data on land parcel use and soil quality survey data	Zelda BRUTTI Science for Modelling, Monitoring and Evaluation Unit S.3, European Commission's Joint Research Centre
11:00:00	11:15:00	Concluding statement and discussion (all participants)	Eric GALL Deputy Director, IFOAM Organics Europe
11:15:00	11:35:00	Break	
11:35:00	11:45:00	Introducing topics in World Cafe	
11:45:00	13:15:00	World cafe on options & solutions	3 rounds, 33'
13:15:00	14:20:00	Lunch	
14:20:00	15:05:00	Sub-groups self programming	
15:05:00	15:25:00	Reviewers synthesis	
15:55:00	16:05:00	Conclusion	

Scope and position

For hydro-social systems, most modeling and model-based policy support processes follow a classical protocol where models are built and ran "in silico", by scientists or experts who compute results to be communicated through scientific papers or policy	*Pour les socio-hydrosystèmes, la plupart des processus de modélisation et d'appui aux politiques basés sur des modèles suivent un protocole classique où les modèles sont construits et exécutés "in silico", par des scientifiques ou des experts qui calculent les résultats à communiquer par le biais d'articles*

briefs. Whereas some are commonly used for daily operations or tactical management (weather and hydrology forecast, water allocation, energy market dynamic), their transformative impact on structures and functionings in the long term is more questionable. The interaction patterns between the scientists, the policy makers and all other "land & water" stakeholders, including end users, when they build and use models and their outcomes, is the core issue here: who steers this design and use? With which rationale? What are the expectations from the various groups? Which alternatives exist for choosing the scope, for the modeling process itself, for allocating the roles, for integrating the results in the policies and actions? Which formalisms are the most suitable? However, for policy makers and other public stakeholders, their relation with modeling and models, how they can participate in their construct, use and evaluation, is a non-issue. Between Science, Policy and Society, we must reassess and share some new modeling pathways for the urgently required transitions.

Questions :

- Typology of case studies, needs and processes ?
- Typology of modeling processes, models and uses?
- How can we reconsider the design and use of modeling processes in public policy support to foster rapid transitions in hydro-social systems ?
    - approach by scientists ?
    - needs' & constraints' elicitation by public stakeholders and policy

scientifiques ou de notes aux politiques. Si certains modèles sont couramment utilisés pour les opérations quotidiennes ou la gestion tactique (prévisions météorologiques et hydrologiques, répartition de l'eau, dynamique du marché de l'énergie), leur impact transformateur sur les structures et les fonctionnements à long terme est plus discutable. Les modèles d'interaction entre les scientifiques, les décideurs politiques et toutes les autres parties prenantes du secteur "terre et eau", y compris les utilisateurs finaux, lorsqu'ils construisent et utilisent des modèles et leurs résultats, constituent la question centrale ici : qui pilote cette conception et cette utilisation ? Avec quelle logique ? Quelles sont les attentes des différents groupes ? Quelles sont les alternatives pour le choix du champ d'application, pour le processus de modélisation lui-même, pour la répartition des rôles, pour l'intégration des résultats dans les politiques et les actions ? Quels sont les formalismes les plus appropriés ? Cependant, pour les décideurs politiques et les autres acteurs publics, leur relation avec la modélisation et les modèles, la manière dont ils peuvent participer à leur construction, à leur utilisation et à leur évaluation, n'est pas un problème. Entre la science, la politique et la société, nous devons réévaluer et partager de nouvelles voies de modélisation pour les transitions urgentes à entreprendre.

Questions abordées:

- Typologie des études de cas, des besoins et des processus ?
- Typologie des processus de modélisation, des modèles et des usages ?
- Comment reconsidérer la conception et l'utilisation des processus de modélisation dans l'appui aux politiques publiques pour favoriser les transitions rapides dans les socio-hydrosystèmes ?
    - approche par les scientifiques ?
    - l'identification des besoins et des

makers ?

- Forms of participation for the various stakeholders?
- Status of modeling as a constructive process vs. models as boundary objects in such domain?
- How can interdisciplinarity contribute to this improvement ?
- How can we evaluate the processes and their impact ?
- What is really useful and what is not impactful ?
- Which research agenda ?
- Which adaptation in the public sector?

keywords : modeling, public policy support, hydro-social systems, adaptation, transition, participatory processes, evaluation, training

contraintes par les acteurs publics et les décideurs politiques ?

- Formes de participation des différents acteurs ?
- Statut de la modélisation en tant que processus constructif par rapport aux modèles en tant qu'"objets frontières" dans ce domaine ?
- Comment l'interdisciplinarité peut-elle contribuer à cette amélioration ?
- Comment pouvons-nous évaluer les processus et leur impact ?
- Qu'est-ce qui est vraiment utile et qu'est-ce qui n'a pas d'impact ?
- Quel programme de recherche ?
- Quelle adaptation dans le secteur public ?

Mots clés : modélisation, appui aux politiques publiques, socio-hydrosystèmes, adaptation, transition, processus participatifs, évaluation, formation

Detailed content

Alexey Voinov, Department of Water Management, Faculty of Engineering Technology (FET), Univ. Twente, NL

Participatory Modeling Yesterday, Today and Tomorrow: the Evolution of Modeling and Participation.

Over the last 50 years participatory modeling (PM) has been evolving steadily with various incarnations promoted by different groups, studies, foci and case studies. In essence, the main goals remained the same, but the implementation was changing largely driven by changes in modeling techniques. These days we also see quite dramatic shifts in how humans interact and how decisions are made. We may expect that this will also affect the ways we do PM.

Case Study Dialogue Process

This interactive session aims at discussing modeling processes and modeling expectations around 8 case studies (CS, see below) proposed by the participants. They will be addressed in 2 sessions of 35 mins, splitted in 4 CS groups, where, after a short 5' introduction by the CS holder, the participants will have to answer the following questions :

1. *Which modeling processeS should be implemented here ?*
2. *With and for whom ? Participants of the modeling process ?*
3. *Which benefit is expected from this modeling process ? For whom ?*
4. *Open challenges ? Expected breakthrough ?*

Amy Wardrop, Australian National University, AU

PhD Candidate, School of Cybernetics & Institute for Water Futures, ANU, Canberra ACT 2600

Australia - waterfutures.anu.edu.au | @ANUWaterFutures -e: amy.wardrop@anu.edu.au

Apprehending cybernetic water system dynamics and futures?: A review of games and immersive environments for education and foresighting

To support the hydrology and water resources community, this paper reviewed some of the less-common approaches in expert water communities; games and immersive storytelling/making experiences, that may engage actors typically missing from current decision processes, including marginalised communities, youth and future generations. Based on a number of interrelated cybernetic principles: perspective plurality, navigating productive discomfort, visible feedback/connections, and synergy for effective collective action; examples of these methods and the findings of their utility are provided for water education and foresighting, as well as what emerging technologies are being deployed, or could be, to improve future efficacy.

https://search.informit.org/doi/abs/10.3316/informit.T202405150001710162669670 6

Anne Johannet, & Salma Sadkou, Noémie Fréalle, Guillaume Artigue, Séverin Pistre

HydroSciences Montpellier, LSR (Laboratoire des Sciences des Risques), IMT Mines Alès, Université de Montpellier

AI for forecasting variables useful for crisis management

Bruno Bonté & Amine Saidani,

UMR G-EAU, INRAE, FR

Feedback on the use of participatory modeling tools from the CoOPLAGE suite for groundwater use in the Badriane oasis (Timimoun, Algeria)

After a presentation of the methodological backgroud and the participatory modelling process carried out between Badriane, Timimoun and Algiers, we will present the results obtained in terms of facilitating debate between stakeholders from different backgrounds. The 10-minutes presentation will be followed by a short film retracing the process and showing the workshops and stakeholders' reactions (French with English subtitles). This will be followed by a short discussion with the audience.
https://drive.google.com/file/d/1HOxUWINSxRJfAWnvw_cCyo1P28_Pu019/view?usp=drive_link

Manon Dardonville

Research Scientist, PhD, Laboratoire Agronomie et Environnement- UMR 1132 – Université de Lorraine – INRAE

Integrated assessment and modeling of agricultural systems and landscapes: toward the generic agent-based simulation platform MAELIA

Reflexivity session

By groups of 3, reflect on the previous talks and sessions, and raise :

- one question
- one comment

to be shared.

Pr. Eduardo Sávio P. R. Martins

President of FUNCEME, Institute for Research in Meteorology, Water Resources and Environment. Professor @ Federal University of Ceará - Marine Sciences Institute, Environmental Sciences Undergraduate Program - Civil Engineering, Graduate Program in Water Resources, Environmental

Sanitation and Geotechnics - Fortaleza, BRAZIL - e-mail: eduardo.martins@ufc.br

Innovations and Limitations in Modeling for Public Policies in Water Governance and Resilience

In this presentation, we will explore how FUNCEME has implemented and refined hydrological and climate modeling to strengthen public policies aimed at water governance and resilience in Brazil's semi-arid region. We will discuss the advances and innovations in drought management and water governance that enable a deeper understanding of water dynamics. Nevertheless, we will also highlight the persistent challenges — from scale limitations and technical constraints to institutional and resource barriers — that hinder the full incorporation of these technologies into public policies. Finally, we will address strategies to overcome these obstacles, emphasizing how a more integrated collaboration between science, policy, and society can transform water management and accelerate adaptation to climate change.

Sonia Siauve & Emilie Darne (visio)

Office International de l'Eau, France & EPAGE Loire Lignon, France

LIFE Eau & Climat : model design and use experience, a feedback

Pascal Dumoulin

Head of Water Resources Dpt - SMAVD-EPTB Durance - France

C3PO, a digital model for collective decision making on the future of water sharing in the Durance catchment

Pr. Dr. Nelson Odume

Director, Institute for Water Research, Rhodes university, South-Africa - n.odume@ru.ac.za

Water quality in a contested catchment

Our case studies demonstrate the contestation that could arise when water quality management instruments and processes are contested. Regulators and water resource users may contest applicable regulatory instruments. How do we model in ways that foster confidence and credibility in the regulatory environment for water quality management? This case study examines the contests of water quality management in a highly developed South African catchment, and then demonstrates the processes we followed that brought the different stakeholders and actors together to move towards a common, collective understanding of the complexity of water quality management. We draw important lessons regarding trust, institutional capacity and technical capability.

Pearl Winchester

Freshwater public/private project management officer - New Caledonia and Pacific Islands

Modeling for participatory planning: toward a national water policy in New Caledonia

Laurence Gauthier

Directrice Cellule BIM & Jumeau Numérique - Responsable Projets Innovation - Direction Transformation, Offres et Projets - Consulting - SAFEGE SAS - France

Digital Twins: for which use cases ?

This presentation will introduce Digital Twins for water applications, feedback on their deployment for water stakeholders (with constraints and accelerators), and describe the design of use cases (from the operator and the public authorities' perspectives).

E. Hassenforder // Taher Adjemi

G-EAU unit, CIRAD, France // DG ACTA, Government of Tunisia

Modeling in support of territorial planning in Tunisia: politician-researcher perspectives

Dr. María Máñez Costa

Head System Dynamics Modeling - Dept Transfer and Capacity Building - GERICS - Hereon.de - Germany

Contested Knowledge for Participatory Modeling. When and where to infuse knowledge in the process

A fundamental aspect of participatory modelling is the decision-making process concerning the introduction of diverse forms of knowledge. This encompasses the determination of the optimal timing for integrating different types of data, projections, and insights from stakeholders. Additionally, the identification of the most suitable stage in the modelling process for incorporating this information is crucial. Potential integration points include initial scenario planning, model calibration, and the interpretation of results. The strategic introduction of knowledge at opportune moments can circumvent conflicts, facilitate mutual understanding, and engender a sense of ownership among participants, particularly in intricate, multi-stakeholder contexts where disparate interests and expertise can readily collide. Furthermore, this approach facilitates a collaborative process that builds trust, enabling stakeholders to co-create models that are not only scientifically robust but also practically and socially relevant.

By skilfully navigating these factors, we show how participatory modeling can potentially transform knowledge that may be contested into a collaborative asset, thereby enhancing the model and improving its utility in real-world decision-making contexts.

Reflexivity session → needs' assessment

By groups of 3 or 4, reflect on the previous talks and sessions, and specify some emerging NEEDS → "**WE SHOULD RESPOND TO OR DEVELOP** :

- new modeling' needs for public policy support
- new modeling approaches, formalisms or processes
- new relationships between modelers, public bodies, NGOs, expert groups, citizens"

European Commission - Joint Research Centre - special session

Chair : Christine MULLER - Head of Competence Centre on Modelling CC-MOD - EC JRC S.3 Science for Modelling, Monitoring, and Evaluation - ISPRA - EC

Full JRC session program :
https://fr.unesco-montpellier.org/document/lien/672e25d0cf587_JRC%20@%20UNESCO%20ICIREWARD.pdf

World cafe on options and solutions

During 3 sessions of 30', you can explore some solutions or demos proposed by the participants :

- eCoOPILOT by SCIC Ananke (Lucie Noyons) → online co-modelling to design an integrated strategy combining multiple actions
- Material Flow Analysis & Open Sankey by STEEP (Peter Sturm, Mathilde Boissier) → building models of territorial metabolism
- ENERKEY by INRIA STEEP & INRAE G-EAU (Marine Valette) → a game dealing with the Energy - Water- Biodiversity - Landscape - Economy nexus
- Fuzzy Cognitive Mapping by GERICS-HEREON (Chiara Bernardini)

- INIWAG by INRAE G-EAU (Géraldine Abrami) → a modeling apparatus for rapid “design by playing” of water related models and games
- + open tables

Case study summary

CS1. Rachel Teen

Waterways Centre for Freshwater Science & Management, University of Canterbury, New Zealand

Transitioning two cities to become more water sensitive

Location : *Melbourne, Australia and Christchurch, New Zealand*
Stakes : *Lack of water expertise at executive levels, no formal connection to research institutes, low knowledge of strategic practices,*
Actors : *Scientists, Public administrations, NGOs, Experts and consultants, Private business stakeholders*
Question : *How can we convince all urban water strategists to transition to an Urban Water Systems, rather than siloed, approach to managing urban water?*

CS2. Léa Duran

Atos, France

Germ of life

Location : *Différents sites pilotes dans 6 pays méditerranéens*
Stakes : *Permettre la gestion du risque sécheresse et des stratégies d'adaptation*
Actors : *Scientists, Public administrations, Private business stakeholders*
Question : *Défis de la définition des besoins et des modèles selon la temporalité du projet*

CS3. Pr. Eduardo Sávio P. R. Martins

President of FUNCEME, Institute for Research in Meteorology, Water Resources and Environment. Professor @ Federal University of Ceará - Marine Sciences Institute, Environmental Sciences Undergraduate Program - Civil Engineering, Graduate Program in Water Resources, Environmental Sanitation and Geotechnics - Fortaleza, BRAZIL - e-mail: eduardo.martins@ufc.br

Polycentric governance and scale challenges in water management

This case study on water management in Ceará’s Banabuiú basin highlights the complexity and challenges of implementing polycentric governance in systems where multiple administrative scales and sectors intersect. Water management, particularly in contexts of scarcity like Northeast Brazil, involves federal, state, municipal, and community actors with distinct priorities, roles, and resources. Polycentric governance may offer a framework that brings diverse stakeholders into collaboration, but misalignments between governance levels often create barriers to equitable resource distribution. In Ceará, for example, prioritizing urban water needs for Fortaleza has generated tension with rural communities and small-scale farmers, revealing a need for more participatory decision-making processes. Group discussions could focus on exploring mechanisms to bridge these gaps, such as enhancing coordination across government levels, fostering local input in policy processes, and identifying practices that allow adaptive management. Ultimately, addressing these

cross-scale governance challenges could improve the resilience and fairness of water allocation strategies in multi-scalar governance environments.

CS4. David Dorchies

INRAE, France

Talanoa-Water European project: inform and catalyze the adoption of robust transformational adaptation strategies to water scarcity under climate change

Location : *Aude River Basin (France).*
Stakes : *Co-construct adaptation strategies and trajectories in the face of water scarcity and climate change, and evaluate them using modeling tools and stakeholder participation.*
Actors : *Scientists, Elected persons, Public administrations, NGOs, Experts and consultants, Citizens, Private business stakeholders.*
Question : *Exchange with participants on the methodology deployed in this project (strength, weakness) for example on the involvement on the main stream farming lobbies.*

CS5. Maria Mañez

GERICS, Climate Service Center Germany, Germany

Water-Health-Nexus

Location : *Girona province (Spain)*
Stakes : *tourism-water-health issues*
Actors : *Scientists, Elected persons, Public administrations, NGOs, Experts and consultants, Private business stakeholders*
Question : *Disparities in the policy framework*

CS6. Simon Peter Muzafu

Helmholtz-Zentrum Hereon (GERICS), Germany

Evaluating Community Governance of Nature-Based Solutions for Urban Stormwater Management in Kampala: A Participatory Modeling Approach

Location : *Kampala Uganda*
Stakes : *This case study investigates community-level governance of localized Nature-Based Solutions (NbS) for urban stormwater management in Kampala, highlighting its vital role in enhancing flood resilience. It examines the challenges these governance frameworks face in achieving effectiveness, social engagement, and ownership within existing institutional structures. By employing a participatory modeling approach, the study seeks to identify key leverage points that can promote more inclusive and effective community governance outcomes.*
Actors : *Elected persons, Public administrations, NGOs, Experts and consultants, Citizens, Private business stakeholders*
Question : *What potential leverage points can be identified to enhance community governance of localized Nature-Based Solutions (NbS) for urban stormwater management in Kampala?*

CS7. Nina Cazin

Sciences Po Paris, France

Le rôle des modèles dans la gouvernance de l'eau du Mekong au Laos

Location : *Laos*
Stakes : *Comprendre comment les réseaux de prise de décisions vis-à-vis de la gouvernance de l'eau sont profondément liés à la modélisation des hydrosystèmes.*
Actors : *Scientists, Elected persons, Public administrations, Experts and consultants, Private business stakeholders*
Question : *Quel est le poids des modèles dans la gouvernance des socio-hydrosystèmes dans un contexte politique autoritaire?*

CS8. Marine Valette - Peter Sturm - Nils Ferrand - Mathilde Boissier - Emmanuel Krieger - Pierre Leroy - Wajma El Khaouda

INRIA STEEP Grenoble, France & INRAE g-EAU Montpellier, France

Multi-stakeholders dialogue for Energy-Water-Bidoversity-Regional Development Nexus

Location : *Briançon mountain area, France*
Stakes : *Support a new process of multi-level-stakeholders dialogue in Briançon region about the challenges of Energy related to water, biodiversity, landscape and local development (mountain / ski touristice area). A special methodological focus is put on the use of Material Flow Analysis models.*
Actors : *Elected bodies, administrations, energy developers, NGOs, citizens, scientists*
Question : *Which modeling processes to be designed and implemented to support this dialogue ?*

Short talks

Chiara Bernardini

GERICS, Climate Service Center Germany, Germany

Climate Neutrality Governance assessment and monitoring tool: a participatory design process

Attention has been paid to design a Climate Neutrality Governance assessment and monitoring tool in such a way that it can be easily applied and re-applied by local administrations independently. The aim was actually to expand its function: it will not only be used by researchers as a control-tool to monitor the advancements towards the achievement of climate neutrality in cities, but rather stakeholders will be provided with a tool for the self-assessment and monitoring of their progress in this direction. With this in mind, the construction of the tool included organizing KPIs participatory design workshops with 12 CLIMABOROUGH project partner cities' representatives. Key informants included: Local government political representatives; Local government technical representatives; Consultants working with local government on specific climate-related issues; Governmental agencies and NGOs; Academics, researchers; Private sector representatives; and others.

Ornella Leni Tchanque Kanda

Geolab, Université de Limoges, France

1ére édition du Colloque Interdisciplinaire sur les Savoirs Ancestraux de l'entité Eau (CISAEE) : « Pourquoi et comment sauvegarder les savoirs anciens autour de l'eau ? Regards croisés Afrique – Europe »

Ces dernières années, les universitaires, les praticiens, les gestionnaires de l'eau et le public ont manifesté un intérêt croissant pour les savoirs et techniques traditionnelles de l'eau et de la gestion de l'eau. Cet intérêt se manifeste dans des domaines tels que la publication de livres
et d'articles scientifiques, la restauration, la protection et la conservation de sites aquatiques patrimoniaux, et la mise en œuvre de projets tels que le Réseau mondial des musées de l'eau, ce dernier parrainé par l'UNESCO.
Le colloque que nous organisons vise à faire le point sur ce phénomène, à expliquer son succès croissant et à se demander comment il peut contribuer à répondre aux problèmes et défis actuels et émergents liés à l'eau.
Sous forme d'un dialogue scientifique, il réunira des chercheurs et des praticiens de France et de pays d'Afrique avec pour objectif de présenter un large éventail de perspectives sur ces questions et de développer des suggestions basées sur ces échanges.

Rachel Teen

Waterways Centre for Freshwater Science & Management, University of Canterbury, New Zealand

Transitioning urban environments to become more water sensitive

My talk synthesises the cross-case comparison findings of my PhD thesis. I compare the difference between water management strategists facilitating their city to become water sensitive and another still strategising in the silos of stormwater, wastewater, and drinking water.

Bruno Bonté

GEAU, INRAE, France

Retour d'experience sur l'utilisation de CreaWAG dans la région de Timimoun en Algérie

Plusieurs outils de la suite Cooplage ont été utilisés en Algérie dans le cadre du projet européen eGroundwater. Un modèle de type Jeu de Rôle a été créé par un collectif d'usagers et de personnels de différentes administrations Algériennes. L'exposé présentera succinctement les résultats et apports des méthodes utilisées.

Léa Duran

Atos, France

Retour d'expérience de mise en place de modèles hydrologiques divers en ESN

Exemples du processus de co-définition, d'exploration, de développement et de mise en production de modèles hydrologiques en entreprise de services du numérique.
Cas d'étude : prédiction du risque de débordement et détection d'anomalies dans des réseaux unitaires en Ecosse; prédiction du niveau de nappes phréatiques en Occitanie; prédiction d'indices pour la gestion du risque sécheresse en Méditerranée.
Méthodes de travail pour la définition des besoins avec les acteurs publics et le déroulement des projets (R&D)

Peter Sturm

STEEP, INRIA Grenoble Alpes, France

Material Flow Analysis and Systemic Risk Modeling

I will briefly present activities of the STEEP research group (https://steep.inria.fr/) related to the "modeling for change" topic of the workshop. A first topic is the analysis of material and energy flows of territorial supply chains and its usage in decision aid. A second topic concerns the modeling of systemic risks.

Nicolas Salerno
CNRS

Les modèles comme outils d'enquête

Si la contribution des modèles à la résolution de problèmes sociaux peut sembler évidente dans le contexte de la recherche-action, où ceux ci sont construits sur mesure en adéquation avec les parties prenantes. La situation semble moins évidente lorsque les modèles sont élaborés en laboratoire, détachés d'une situation spécifique et formulés en des termes génériques. Cet exposé reviendra sur les principaux enjeux épistémologiques liés à l'usage de ces modèles pour la décision et esquissera des solutions inspirées de la philosophie pragmatiste.

Posters

Chiara Bernardini
GERICS, Climate Service Center Germany, Germany

Climate Neutrality Governance assessment and monitoring tool: a participatory design process

Tackling climate change and adapting to current and future impacts is fundamentally a governance challenge. Assessing governance structures is of primary importance for maintaining cities' capability to react to natural hazards, detecting the weaknesses that might need to be addressed and evaluating local governments' performance over time. It can be argued that the fitness of governance is a necessary but not sufficient condition for the fulfilment of climate goals and, more specifically, for the achievement of climate neutrality. The Capital Approach, as theorised by Sen (1983) and subsequently revised by numerous scholars over the years, represents a valuable lens through which to assess the governance performance of cities in dealing with natural hazards. It offers a nuanced understanding of the complex reality on the ground. We adapted and adjusted the capitals on the basis of the specific scope of the research activities carried out within the Horizon CLIMABOROUGH project and proposed this final configuration:
1) Urban environment capital;
2) Social capital;
3) Institutional capital;
4) Policy capital;
5) Financial capital;
6) Information capital.

Attention has been paid to designing this instrument in such a way that it can be easily applied and re-applied by local administrations independently. With this in mind, the construction of the tool included organizing KPIs participatory design workshops with the 12 CLIMABOROUGH partner cities' representatives. Next step will be participatory modeling problems affecting complex governance systems. We will develop participatory dynamic governance systems models for climate neutrality management in cities. Key stakeholders to be involved in the process are: Local government political representatives; Local government technical representatives; External consultants; Governmental agencies and NGOs representatives; Academics and researchers; Private sector representatives; and others.

Dagnija Grabuza
Latvia University of Life Sciences and Technologies, Latvia

Enhancing Total Phosphorus Removal in Subsurface Flow Constructed Wetlands

Constructed wetlands are a highly effective, sustainable method for wastewater treatment, particularly suited to removing phosphorus - a leading contributor to eutrophication that promotes excessive growth in rivers and lakes. In constructed wetlands, phosphorus removal largely occurs in the filter section. For example, the horizontal flow constructed wetlands at a farm Mezaciruli, located in Zalenieki Parish, Latvia, achieves an average phosphorus retention efficiency of 72%. However, seasonal variations significantly affect performance, with efficiency rates peaking at 94% in summer, but dropping below 50% in non-vegetative periods. In light of the recently updated European Union Urban Wastewater Treatment Directive, which mandates stricter nitrogen and phosphorus limits, enhancing the phosphorus removal capacity of existing systems is essential. One promising approach to improve retention is to increase the filter material's sorption capacity by incorporating a sand - Polonite mixture. Laboratory trials with eight sand - Polonite mixtures have demonstrated phosphorus removal efficiencies exceeding 90%, suggesting this mixture could enhance and stabilize year - round removal rates. Further research is needed to optimize the mixture's hydraulic properties and to identify cost - effective methods for large - scale implementation. This research underscores the potential of sand - Polonite mixtures in constructed wetlands, offering a pathway to increased phosphorus retention, enhanced sustainability, and compliance with evolving wastewater treatment standards.

David Dorchies
INRAE, France

Combining modelling and participation to build transformational water management & agricultural adaptation scenarios in water stressed areas

In the Mediterranean area, climate change increases significantly the water needs by crops while water resources are getting scarce because of reduced and distributional shifts of rain patterns. The need for methods to identify and assess robust adaptation strategies are urgent. Combining a multistakeholder dialogue and agro-hydro-economic modelling we aim at addressing this question. Based on an experiment conducted in one of the most overexploited water basins in France, the Aude catchment, we propose an approach to co-construct strategies for climate change adaptation of the farming sector and water management with a multi-stakeholder dialogue and modelling. Local scenarios derived from Socio-economic pathways (SSPs) are co-constructed as narratives that detail context, local economy, agricultural development and, water management and governance. The quantification – partly done by stakeholders and partly enabled by agronomic modelling - enables to state that the difference in the effect of land use changes (socio-economic scenarios) are much higher than the ones associated to alternative climate scenarios. This work is still in progress, but already shows a very good and active level of participation of key stakeholders.

Marine Valette - Mathilde Boissier - Nils Ferrand
INRIA STEEP Grenoble, France & INRAE G-EAU Montpellier, France

EnerKey, a gaming apparatus to test adaptiveness of stakeholders' groups to cope with the Energy-Water-Biodiversity-Economy nexus

EnerKey is a serious game designed to support dialogue on the Energy-Water-Biodiversity-Economy nexus in French mountain area. We'll introduce its design and use process, after 2 years of preliminary surveys. We'll show as well how it can be used to test the capacity of stakeholders' groups to cope with changing conditions, and develop adaptation strategies.

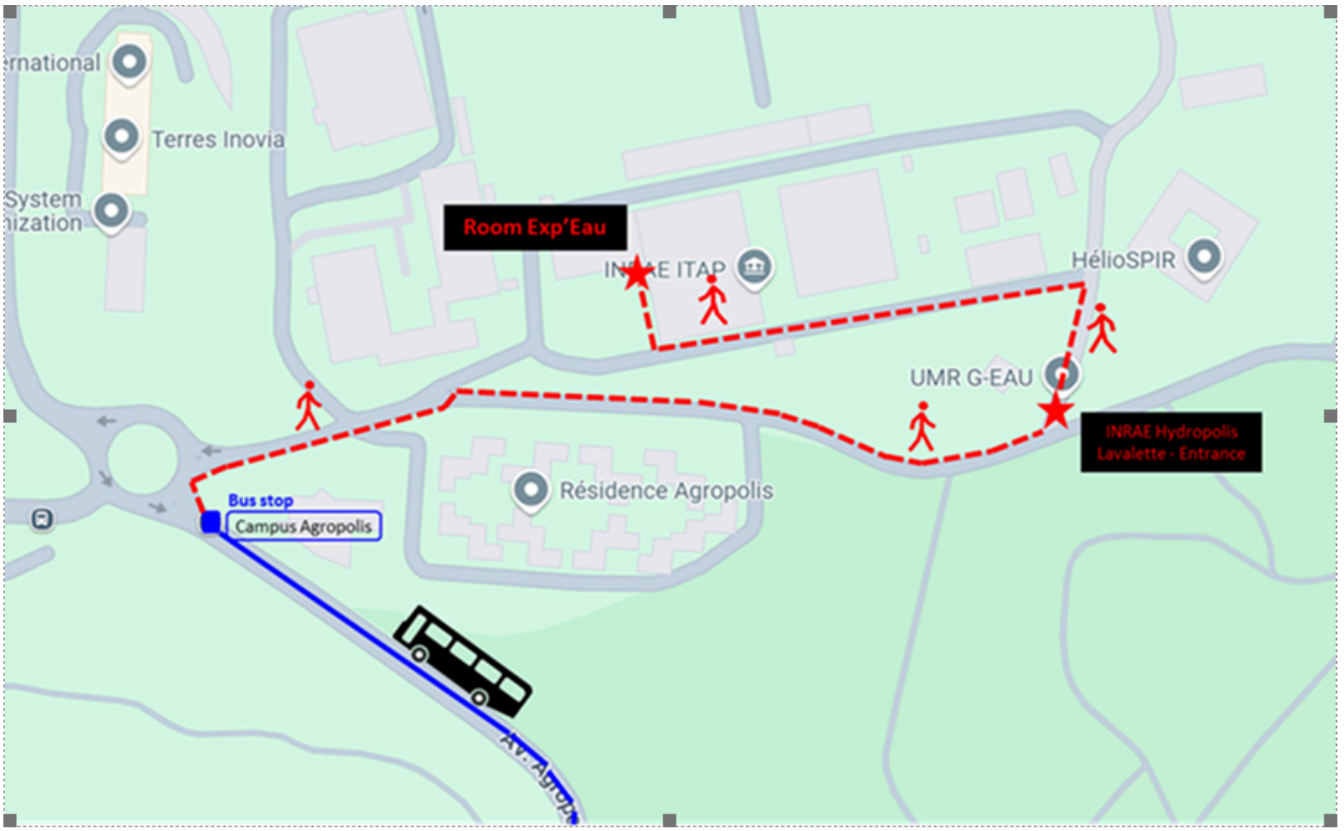
Practical information

Workshop location

INRAE - Hydropolis Lavalette

361 Rue Jean François Breton

34090 Montpellier



You are expected in the room Exp'Eau on day 1er at 9.00am.

Access from public transportation

Take Tram Line 1 towards Mosson

Get off at the "St Eloi" stop

Take the "La Navette" bus towards "Agropolis Lavalette".

Get off at the "Campus Agropolis" stop

Turn right into rue Jean François Breton, the entrance to the INRAE Lavalette Campus is 300 meters on the left.

If you come by car, you can park inside. Ask for the gate opening for the UNESCO workshop.

Transport from Montpellier

Transport in Montpellier is now free for residents of the Metropole.

There are no longer any validation machines on trams or buses, but you still need to have a ticket.

Single tickets can be bought at certain tram stations or from relay shops (note that they are time-stamped with the day and time of purchase and therefore valid immediately for a maximum of 1.5 hours).

The simplest solution is to install the M'Ticket application to buy your tickets.

Simply validate your ticket via the app as you board the bus or tram.

I encourage you to find out more at https://www.tam-voyages.com before you arrive.

Some extracts:

I'm not a resident of the metropolitan area and I travel occasionally on the TaM network; how can I buy my ticket?

There are several ways to buy your ticket and travel legally. For immediate departure:

- *A QR code deployed at each stop, tramway station and bus stop allows you to buy a time-stamped ticket in 3 clicks, using a smartphone,*
- *at one of the 64 ticket machines located in the main tramway stations,*
- *at one of the 100 retailers - TaM relays*

To plan your next trip, you can always use the M'Ticket app to prepare it, and the 10-trip ticket is still available, with activation required at the time of travel.

I don't have a mobile phone to buy a ticket, what should I do?

Paper tickets (time-stamped) can be bought from ticket machines at the main tramway stations on the network or from a relay shop.

how do i know if my paper 1-trip ticket is valid?

Paper tickets issued by an automatic ticket dispenser or by one of TaM's relay shops are time-stamped and valid as soon as they are purchased, with no validation required. They are valid for 1.5 hours, so if you choose to buy them from a relay shop, you can travel to the nearest station with complete peace of mind.