Albeit river basins are complex environmental systems facing an uncertain future, their response to global change remains poorly understood - rendering future water resources management all the more challenging. Their intrinsic property of changing environmental states calls for a better understanding of eco-hydrological processes controlling global hydrological and biogeochemical cycles, vegetation dynamics, pollutant removal, or ecosystem resilience. Progress is largely thwarted by prevailing knowledge and technological gaps - calling for the exploration of new avenues to frame and test hypotheses, and develop innovative environmental monitoring systems, modelling and management tools.

Research challenges

The mission of the Catchment and Eco-hydrology group is to integrate research, technology and education for ensuring sustainable water availability and quality. The research team does this by fostering interdisciplinary research on water threats in a context of global change with national/international private, public and academic partners. Researchers focus on pressing questions in water resources research and management, related to:

- How eco-hydro-systems collect, store, mix and release water, solutes and matter - in the past, at present and in the future;
- Innovative environmental monitoring tools - operating at unprecedented spatial and temporal scales;
- Better monitoring, forecasting and predicting our water futures, as expressed through floods, drinking water availability and quality, water for agriculture, or ecosystem services.

innovative activities

The research group combines theoretical analysis with targeted experiments and innovative monitoring protocols in the field to test and improve our understanding and prediction skills related to water resources. For example, by testing new tracers, they intend to overcome limitations in classical environmental tracing protocols and shed new light on pressing questions related to water, solutes and matter sources, flow paths and transit times. With global change increasingly triggering extreme events, there is a pressing need for the design, crafting and testing of new field deployable, air- or space-borne sensors - delivering data at unprecedented spatial and temporal resolution. As a corollary, new data storage, handling, analysis and assimilation techniques will have to be developed. With structures such as long-term environmental observatories (e.g. the Atlatse River basin as a Critical Zone Observatory, operated by UST’s Observatory for Climate and Environment) or living labs being key in global change impact research, they equally serve as ideal open air laboratories for testing and nuggetizing innovative environmental monitoring systems, gain new process understanding and develop novel environmental management strategies.

Application areas

The research group intends to gear their energies and skills towards the exploration of innovative environmental monitoring systems, ultimately leading to a holistic understanding of eco-hydrosystem functioning. The subsequent improvement of forecasting tools will support a new generation of quantitative and qualitative water management strategies. Application areas are (examples):

- Mechanistic understanding of fundamental river basin functions of water, solutes and matter storage, mixing and release (e.g. use of stable isotopes of O and H & Tritium for water age dating, transit time modelling, soil-plant-atmosphere interactions);
- Field deployable devices for monitoring eco-hydrological processes at unprecedented temporal resolution (e.g. in situ water sampling, in-stream monitoring of physicochemical parameters);
- Development of eco-hydrological processes at unprecedented spatial and temporal resolution (e.g. use of stable isotopes of O and H & Tritium for water age dating, transit time modelling, soil-plant-atmosphere interactions);
- Training of experts with interdisciplinary skills for tackling increasingly complex questions in environmental systems and resources management (e.g. PhD candidates, Post-docs).

Main assets

- Doctoral Education unit in hydrological sciences [FNR PRIDE – HYDRO-C5]
- Ecological interfaces as critical hotspots for transformation of ecosystem exchange fluxes [PFF ITN – Interfaces]
- Catchments As Organised Systems [PFF and FNR-CORE STORE-AGE]
- Exploring catchment functions of drainage, mixing and release across space and time (FNR-CON-SHARE)
- Water and Vegetation in a Changing Environment [FNR-ATTRACT-WAVE]

Selected publications


"Diat fluctuations of viscosity-driven diopan tracers affect streamflow DOC concentrations", Schwab M.P., Klaus j., Pfister L., Weller M., Biogeochemistry 15: 2177-2188.


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