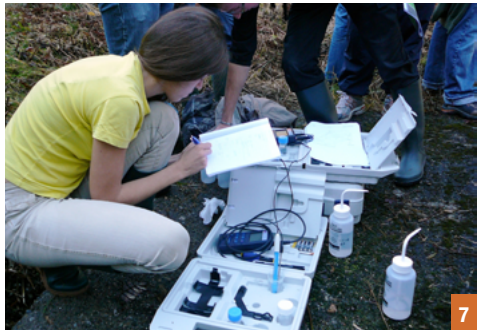
Finally, LHyGeS relies upon the Hydro-Geochemical Observatory of the Environment (OHGE-EOST) as an instrumented site suited to research in hydrology, water chemistry, liquid-solid interface interactions, solid transport, and isotopic signatures of weathering. The observatory also offers the possibility for LHyGeS researchers to face their hydrological and hydro-geochemical models against the numerous collected data.

+ EDUCATION

LHyGeS is an important operator in the orientation and promotion of sciences applied to the Environment at EOST. Therefore, It is the main pedagogical and technical support for the Master «Engineering and Geosciences for the Environment» (ISIE) and for the «Hydro-Geophysics-Geology-Geochemistry» specialty (HydroG3) of the School of Engineers in Geophysics. Finally, the PhD students of the doctoral school of Earth and Environmental Sciences (ED413) can develop their research activity within the LHyGeS teams.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Photos:

1. Gauging station of a mid-mountain small stream (Strengbach catchment area - Haut-Rhin, France) © S. Cotel.
2. Valserine, karstic loss at Bellegarde - Ain, France © F. Delay.
3. Weathering and biogeochemical cycles: exchanges, transformation, availability and transfers of elements and contaminants in the Critical Zone (Strengbach catchment soil profile - Haut-Rhin, France) © B. Wild.
4. Characterizing and modeling the evolution of water-mineral-organisms interfaces © B. Wild.
5. Integrated hydrological modeling of a mountain watershed (steep slope), fine discretization of topography and hydrographic network © S. Weill.
6. Laboratory column - glass beads, carbonate prisms - for dual flow simulation in diffuse fractures and host rock © F. Lehmann.
7. Master ISIE, field training © D. Lemarchand.

LHyGeS

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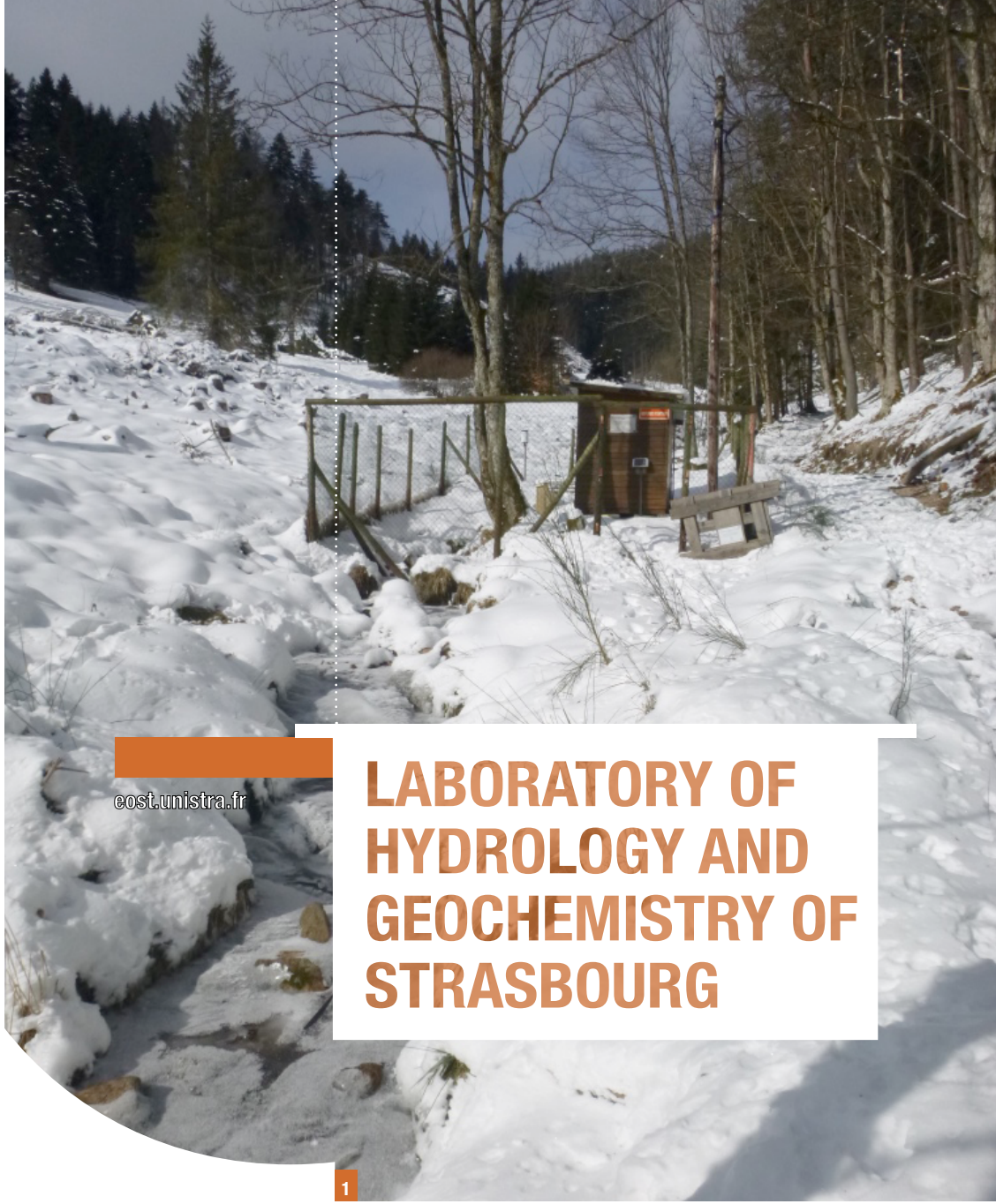
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LABORATORY OF HYDROLOGY AND GEOCHEMISTRY OF STRASBOURG

Ecole et Observatoire des Sciences de la Terre

ENGEES
ÉCOLE NATIONALE DU GÉNIE DE L'EAU ET DE L'ENVIRONNEMENT DE STRASBOURG

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2

LABORATORY OF HYDROLOGY AND GEOCHEMISTRY OF STRASBOURG

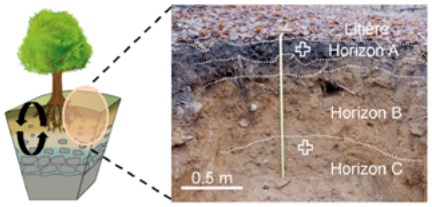
LHyGeS is a research and training center studying alteration, weathering, and transfer processes in continental hydrosystems, and one of the few French laboratories with a substantial staff (75 fellows) committed with Hydrology and Geochemistry.

LHyGeS is a research facility (UMR 7517) jointly appointed by the CNRS, the University of Strasbourg, and the National School of Water and Environmental Engineering of Strasbourg (Engees). It is a partner of the School and Observatory of Earth Sciences (EOST), one of the two Observatories in Strasbourg that are affiliated to the National Institute of Sciences of the Universe (CNRS-INSU).

+ RESEARCH TEAMS

Isotope and Experimental Biogeochemistry

The group works on mechanisms and forecasts relative to transfer processes and matter transformations in the Critical Zone. The latter refers to the outermost thin layer of the planet Earth housing physical and chemical interactions between air, water, organisms, and rocks. This interface between bedrock, landscape, and atmosphere, is essential for cycles of water, nutrients, and contaminants. It is also critical because it hosts most of human activities. The team develops biogeochemical and isotopic approaches and applies them at the lab and over natural sites at the scale of water catchment systems.



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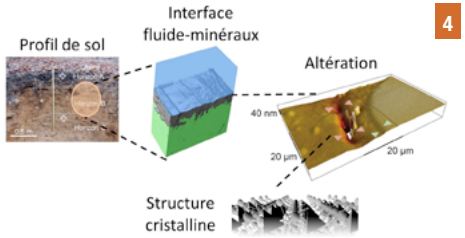
Study of natural sites

The team is involved in a set of studies especially relying upon isotopic approaches to determine:

- **The history of formation and evolution of alteration profiles (U-Th-Ra),**
- **Exchanges and transfers between soil and vegetation (Li, B, Ca, Sr, Cu, Zn ...),**
- **The transformation of micro-pollutants monitored via compound-specific isotope analysis (CSIA).**

Mechanisms and rates of mineral alteration, but also signatures of transformation mechanisms at the interfaces between water, soil, and organisms can thus be identified.

These studies compare results stemming from laboratory experiments with observations from dedicated experimental catchments, such as the Strengbach OHGE (forestry) and Rouffach (vineyard).



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Experimental studies

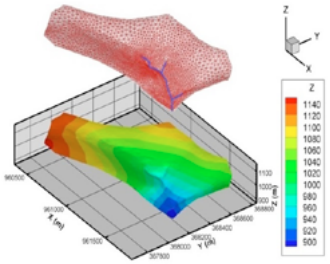
The contributions comprise various topics such as:

- **describing mechanisms and formulating kinetic laws of water-mineral / soil-organism interactions,**
- **developing tracers of these interactions and transformation processes,**
- **setting up experimental approaches in the lab and in the field, for simplified or close to natural complexity systems. As an example, new insights become available on the relationship between reaction processes at the mineral scale and dissolution rates evidenced at the macroscopic scale.**

Transfers in continental hydrosystems

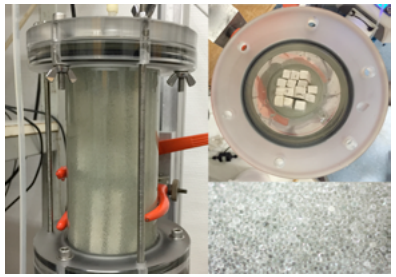
The group analyzes fluid circulations, fluid mixing conditions, and fluxes of dissolved and particle elements from natural or anthropogenic origin in hydrosystems. The research combines laboratory and field experiments with numerical modeling attempts that include advanced computational techniques, inverse problems and uncertainty analysis. The main concern associated with these studies remains that of mechanistic approaches with a physics adapted to spatial and temporal scales characterizing complex items. As targeted topics, one can mention for instance: tracers of matter and energy fluxes, interface systems such as groundwater-river, water-sediment... and the vulnerability of environmental systems.

5



Modeling

Most modeling works are based on advanced numerical techniques, but that still keep the model suited to various comparisons with data. This may involve a reduction in the physics of the model, inverse approaches seeking optimal model parameters, carefully conducted model sensitivity analysis, but also understanding the mechanisms and processes actually «captured» by available data.



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Experiments

Various experimental devices are used in the lab: column, 2-D tanks for hydrology, 2-D tanks for reactive transport ... They are associated with innovative measurement protocols (image processing, in situ sensors ...) and help to discuss on scale effects, especially when compared with studies on «Sceres» (artificial hydrosystem encompassing saturated and vadose zones of the subsurface in a controlled area of 900m3) and with experiments on instrumented watersheds.

+ COMMON MEANS

Research teams in LHyGeS benefit from the technical support of a geochemical analysis center dedicated to water chemistry and isotope measurements. The laboratory also makes good notes of experimental gear and protocols for the purpose of traceability and user's assistance. Some parts of the numerical codes are also transversal to the teams, hosted within a common digital resource, including documentation, various applications, and benchmarking exercises.