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Towards operational hydrology for a thorough spatio-temporal exploration of the Critical Zone

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Over the last century, the Critical Zone faced remarkable climate and land use changes increasing the pressures on the Hydrosphere and giving rise to numerous environmental consequences in terms of water quantity and quality. From now on, the Critical Zone must face the challenge to supply 9 billion people with quality food and safe drinking water in a context of global warming. For the Hydrosphere, this challenge could be addressed with a better understanding of the dynamics and resilience of aquatic environments (rivers, lakes, groundwaters, oceans). In view of the spatial and temporal variety and variability of flow dynamics and biogeochemical reactions occurring in the Hydrosphere a new investigation method is needed. This study approaches the concept of "operational hydrology" aiming to enhance either the spatio-temporal distribution and the quality of environmental data for a thorough exploration of the Hydrosphere.
To illustrate our approach, we present natural and anthropogenic dissolved gas data (He, Ne, Ar, Kr, Xe, N2, O_2, CO_2, CH4, N2O, H2, BTEX, and some VOCs) measured in situ with a CF-MIMS (Chatton et al, 2016) installed in a mobile laboratory arranged in an all-terrain truck (CRITEX-Lab). This ongoing work focuses on groundwater and the field investigation of residence time distributions, recharge processes (origins), water flow paths and mixing, biogeochemical reactivity and contamination (sources).
The rationale behind "operational hydrology" could be applied to the field measurement at high-frequency of many other environmental parameters (temperature, cations, anions, isotopes, micro-organisms) not only for the investigation of groundwaters but also rivers, lakes and oceans.

Eliot Chatton, Thierry Labasque, Je´roˆme de La Bernardie, Nicolas Guihe´neuf, Olivier Bour and Luc Aquilina; Field Continuous Measurement of Dissolved Gases with a CF-MIMS: Applications to the Physics and Biogeochemistry of Groundwater Flow; Environmental Science & Technology, in press, 2016.