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Impact of groundwater table level variations on petroleum hydrocarbon pollutants (LNAPL) remobilization processes in the climate change context: an experimental approach.

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Light-Non-Aqueous-Phase-Liquids (LNAPL, e.g. diesel fuel) are common soil and groundwater contamination sources. After they infiltrate the soil, part of the LNAPL accumulates above the top of the water table as a pure phase able to generate a dissolved LNAPL plume and gas emissions. Seasonal groundwater table level variations can generate a vertical dispersion of these contaminants at the capillary fringe, favoring their release into the atmosphere and groundwater. The predicted increase of the intensity of groundwater level variations (extreme events, increasing use of water resources) in the climate change context (IPCC, 2020), could, therefore, affects LNAPLs remobilization processes and their environmental impacts. To better understand these effects, two lysimeters ($2m^3$) filled with sand contaminated by diesel fuel were equipped by geophysical (electrical resistivity and permittivity), *in-situ* sensors (pH, Eh, temperature, tensiometers), and geochemical device for water and gas analysis (Figure1). This device assesses and compares the nature and the amount of LNAPLs released into the atmosphere and water from the contaminated soil during two groundwater level fluctuations scenarios: one corresponding to the 'actual' rainfall pattern based on regional climate records; the other based on the most extreme IPCC scenario. The first months of monitoring reveal a decrease in the floating LNAPL thickness in monitoring wells as the groundwater table fluctuates, suggesting a spreading of the pollutants through the fluctuation zones. This phenomenon is accompanied by an increase in the gaseous surface emissions, especially for the most extreme scenario. This indicates a more important LNAPL remobilization towards the gas phase under the climate change conditions. The gas composition differs between the scenarios after two months. Water samples analyses (GC-MS, DOC) and geophysical data processing should soon lead to a better understanding of the effect of the intensity of groundwater table fluctuations on LNAPLs mobilization processes in the climate change context.

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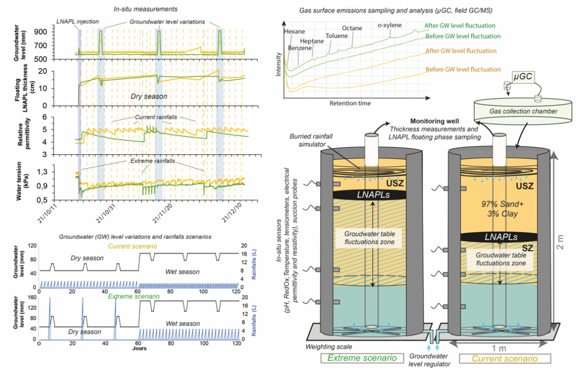

Figure1: Climatic scenarios and experimental devices installed at the GISFI station (Homécourt, France).