

PILOT SITE DESCRIPTION – Ploemeur-Guidel-CZ Laboratory

The [Ploemeur-Guidel critical zone observatory](#) is part of H+ and OZCAR networks. The observatory has been running since 2002 and has contributed to about 75 publications in peer reviewed journals, which use the unique datasets available on this site. Brittany is set in an oceanic climate and crystalline geological context. As such, it has limited subsurface water storage capacity, which is compensated by a regular rain regime. While climate change scenarios predict that rainfall total amount could increase, the length of dry periods should extend, rising questions on water availability during summer periods, generating more pressure on groundwater systems and affecting biogeochemical cycles.

Therefore, the Ploemeur-Guidel CZ observatory (Brittany, France) is focusing on surface-depth relationships and is set around natural groundwater resurgences. It is built on 3 sub-sites: (1) an experimental site to test new instruments and methods (2) a highly anthropized site, Ploemeur (3) a site in natural state (Guidel). In Ploemeur, groundwater has been used for water supply since 1991, providing more than 1 million m³ of high-quality drinking water per year (for 20 000 inhabitants) at a sustainable rate. Such high productivity is explained by the specific fractured network, draining deep geological layers (~400 m) beyond the topographic catchment. Extracted water quality is very good, with limited nitrate concentration, in a region that has been strongly affected by widespread pollution. The Guidel site is in a similar subsurface setting, but in a natural context. Deep iron-rich groundwater is upflowing, feeding a classified coastal wetland. In order to account for population growth, a new pumping station is planned upstream the coastal wetland, raising critical questions on the fate of the ecosystem, with the risk of sea-water intrusion in inland water bodies.

The Ploemeur-Guidel CZ observatory hence combines both monitoring and experimental objectives: (1) Develop innovative methods for imaging subsurface structure and flow in highly heterogeneous environments; (2) Investigate the vulnerability of water resources to climatic and anthropogenic pressures; (3) Study the environment's biogeochemical reactivity, and water quality evolution; (4) Acquire the data necessary for testing and validating modeling methods and hypothesis. The observatory has a very dense equipment for climatic, hydrological, hydrochemical and geophysical monitoring, to study both rapid to long-term surface-depth exchanges: a flux tower, a network of sensors for unsaturated zone monitoring, a network of ~50 shallow (<10m) and deep boreholes (>80m) wells equipped with pressure and temperature sensors and regularly sampled for chemical analysis, a network of high precision deformation sensors to monitor ground deformation in response to subsurface pressure changes. The facility includes a building, with access to internet on a wide part of the field.



Guidel sub-site within the Ploemeur-Guidel Observatory: A patchwork of villages, small agricultural plots and “natural” (i.e. non-managed) structures. The Natura2000 ecosystem encompasses the lake and associated wetlands. The 2 inserted photo shows groundwater resurgences, (1) either natural (left), orange (iron-rich) water is mixed with surface water or (2) artificial in an artesian well, which is planned to be pumped to respond to increasing water needs.