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Investigations based on biaxial tiltmeter array and uniaxial hydrostatic levelling system at the Mont Terri rock laboratory

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In order to enable investigations and further comprehensive understanding of dynamical processes, it is clear one has to identify all relevant parameters and aim to record them all under best conditions concerning e.g. resolution, coverage in space, and in many cases on a multitude of scales in time. Obviously, it is also difficult to satisfy all these constrains in full. Especially scientific long-term observations often suffer the lack of necessary lasting commitment; secure funding, continual high quality maintenance, protected environment, or sufficient planning stability. Fortunately, the Swiss Mont Terri rock laboratory, with its history of now 25 years of forefront scientific expertise, a long-standing fruitful cooperation formed by the partners of the consortium and in consequence thereof state-of-the-art results obtained through 100 completed individual experiments and 45 additional experiments actually ongoing, ensures the conditions listed above.

Based on this favorable prospect, a now growing tiltmeter array is established at the underground laboratory. The instruments are embedded in several multidisciplinary experiments, dedicated to numerous, different scientific questions. Starting in April 2019, the first two platform tiltmeters became operational. Less than two years later, ten biaxial instruments are quasi-continuously monitoring deformation at various locations within the galleries and niches at Mont Terri. The envisioned, increasing spatial coverage of the network will facilitate geodetic observations of the underground rock laboratory as a whole and of its subregions as well.

Already in September 2012, a 50 m long hydrostatic levelling system (HLS) was installed along a gallery in the underground laboratory to detect displacements across an active geological fault zone. The combination of both, i.e. the uniaxial, integral deformations data provided by HLS together with the array of biaxial, point measurements acquired by the tiltmeters offers a unique concerted opportunity to achieve detailed deformation data in a large underground rock laboratory and to survey the associated dynamical processes occurring on timeframes covering seconds to decades.