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Stability of coastal slopes in the Basque region

The vulnerability of an unsaturated slope to rainfall infiltration depends on a number of factors such as the initial depth of the water table, the rainfall intensity, the water retention characteristics of the soil and the associated unsaturated permeability. It also depends on the geological variability of the ground and, in particular, on the spatial arrangement of different material regions with distinct hydro-mechanical characteristics, including the presence of permeable pathways or weaker regions. In general, the stability of an unsaturated soil slope relies on the presence of a cohesive component of strength, which is generated by capillary bonds inside soil pores partly filled by tensile water and partly filled by atmospheric air. This capillary cohesion is not, however, a permanent feature of the material and can suddenly vanish if the degree of saturation of the pores increases due to rainfall infiltration, thus leading to catastrophic failures. The geotechnical group at UPPA proposes to undertake an investigation of the stability of coastal cliffs in the Basque region by means of a combination of experimental and computational activities. The envisaged experimental research activity includes a program of triaxial tests on soil samples from the designated site to determine the unsaturated failure envelope of the material by assessing the evolution of shear strength at different levels of stress confinement and capillary pressure. In-situ experimental campaigns are also currently in progress to measure the environmental and soil characteristics that are most important for predicting failure. A coupled hydro-mechanical model of the slope will be then developed by simulating the geological characteristics and soil properties measured at the designated site. The input data to the model will consist of locally recorded environmental parameters such as rainfall intensity, evapotranspiration and fluctuations of the water table. The output data from the model will be instead the fields of stresses, pore water pressures and displacements, to be be compared against in-situ measurements to validate the accuracy of the simulations.

Fig. 1: EZPONDA Investigation Site: Bidart beach, Basque Country (France).

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8) **A. Cuccurullo** (2019). Earth stabilisation by plant-derived urease enzyme for building applications. Doctoral dissertation, Durham University (United Kingdom) and Université de Pau et des Pays de l'Adour (France).

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