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MONITORING OF WATER AND THERMIC TRANSFERS IN THE VADOSE ZONE OF A GEOLOGICAL CARBONATE FORMATION

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This paper aims at the monitoring of water and thermic transfers in vadose zone of a sedimentary carbonate formation during three hydrological cycles (August 2001 – November 2004). The application of the Time Domain Reflectometry (TDR) and Self-Potential (SP) methods to determine the water content of porous rock has been widely investigated. More than 285 studied point measurements of rock water content observed during three hydrological cycles and distributed among an abandoned underground quarry in Gironde, France, show a permanently undersaturated limestone (between 35% and 50 %).

We also investigated the unsaturated zone in a borehole until the water table. 12 TDR and SP electrodes investigate the unsaturated zone. For the understanding of the streaming potential and electric behaviour from the SP method of a vadose zone we performed an experimental device which allows us to quantify the measurements of electrokinetic coupling coefficient at various saturation conditions.

Experimental results show three periods of maximum water content corresponding to three occurring effective precipitations. The dephasing and the amplitude attenuation of the hydraulic and thermic waves with the depth can be modelled and explained by the physical properties of the porous medium in an unsaturated zone.