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Moisture evaluation of wood material using GPR with WARR method - COST Action TU1208

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This work deals with the study of the sensitivity of GPR electromagnetic waves to moisture variation in wood material in relation with the direction of fibers and polarization of Electromagnetic field. The relations between relative permittivity and moisture content and the amplitude attenuation with distance was a target study using the direct waves in Wide Angle Radar Reflection (WARR) configuration. Comparison of results measured with reflected waves and direct waves was of main importance since they have different behavior in relation with moisture variation, due to different path of propagation. This research activity has been carried out during one Short-Term Scientific Missions (STSM) funded by the COST (European Cooperation in Science and Technology) Action TU1208 "Civil Engineering Applications of Ground Penetrating Radar" in November-December 2015.
In context of durability evaluation of construction materials, several studies have been carried out by the I2M team, University of Bordeaux, using direct and reflected waves for the evaluation of water content on concrete and wood materials [1-3]. As related to the wood material there is one study carried out using the reflected waves on wood for different humidity and different wood samples, in all the direction of polarization using GPR technique ground coupled antenna at 1.5 GHz [3]. This work continued with different moisture content in order to study the behavior of direct waves as function of moisture. Results taken from those measurements are compared with them from Fixed Offset (reflected method) with one antenna (1.5GHz or 2.6GHz), realized from the previous studies from the I2M and already published [1-3].
The results taken from this work from the reflected waves, show that the effect of wood anisotropy is significant on the variation of relative permittivity with moisture content on wood sample and that is in good agreement with the previous results [3-6]. As related to the direct waves, a small change in the dielectric constants exists between transversal and parallel directions. The dielectric constant shows values that coincide with the case of radial polarization of the EM field. This can be explained from the propagation path of direct waves. Since the EM field of direct waves, propagates in the upper part of the sample, the effect of polarization is almost the same in both directions as it is the case of radial polarization when the reflected method was used.
During future STSMs we foresee to do further experimental work with the direct wave method (WARR) on different wood samples, in order to confirm the effect of wood anisotropy and moisture content on GPR direct wave propagation.

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