

## STUDY OF MAIZE PLANTS EFFECTS IN THE RETRIEVAL OF SOIL MOISTURE USING THE INTERFERENCE PATTERN GNSS-R TECHNIQUE

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The use of Global Navigation Satellite Signals Reflections (GNSS-R) techniques to retrieve geophysical parameters from surfaces has been increased in the recent years. These techniques have resulted in suitable tools to obtain information about the sea state of oceans, which is very useful to improve the ocean salinity retrieval [1-3], and also, information about the soil moisture [4-6] of lands.

The present work focuses on the use of the Interference Pattern Technique (IPT) [7-9], a particular type of GNSS-R technique, to study vegetation-covered soils. The IPT consists mainly of the measurement of the interference pattern between the GPS direct and reflected signals, after they impinge over the ensemble soil surface and vegetation layer. The measured interference signal provides information on the soil moisture of the surface and also, on the vegetation height. A previous study [10], showed that this kind of retrievals can be performed over wheat and barley fields, where plants reach 60 cm height and their dominant structure is vertical. This work presents the results for maize-covered fields whose height reaches up to 250 cm and their structure is mostly vertical, but also due to the long leaves, they have a significant horizontal component, they are density packed, and the vegetation water content is higher.

The paper is divided in three main parts. First the theoretical aspects of the IPT measurements over a maize scenario are presented. To develop these theoretical points it is necessary to use an electromagnetic model capable to describe the interactions of the electromagnetic signals and the ensemble soil surface + maize. A software package developed at the Universitat Politècnica de Catalunya [11, 12] is used to model the scattering of the GPS signals. The vegetation is modeled using L-systems [13] (Fig. 1) and trunk, leaves and fruits have their particular scattering models.

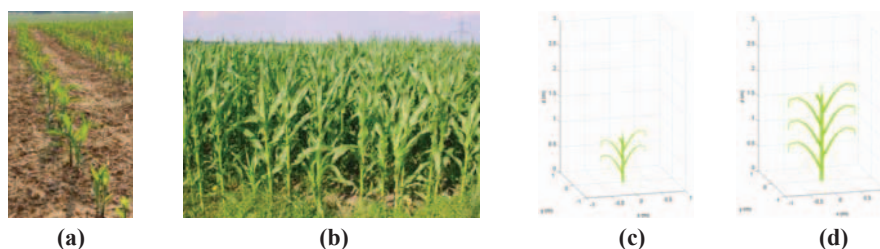


Figure 1. Maize plant structure. (a) and (b), photographs of maize plants in two different growth stages, and, (c) and (d), software package [11, 12] simulated plants for these two growth stages.

A full set of simulations has been performed considering different maize plant heights, soil surface roughness, and soil moisture values, producing a wide range of reflectivities. The IP technique is then analyzed theoretically to find ways to perform the soil moisture retrieval under the presence of maize.

The second part of the paper presents the experimental measurements carried out to prove the theoretical model developed. The SMIGOL Reflectometer [9, 10] will be deployed in a field campaign over a maize field from March to October 2010, in Lleida, Spain, covering different growth stages of the maize, from no vegetation up to 230 - 250 cm vegetation height, including the dry up process of the maize.

The third part of the paper will present the conclusions obtained by comparing these measurements to the theoretical results, in terms of soil moisture retrieval in the presence of maize plants, taking into account the different parameters that influence the measurements, as soil surface roughness and vegetation height.

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