COMPONENT CONTRIBUTION ANALYSIS IN RADAR SIGNATURES OF WHEAT CROPS THROUGH A POLARIMETRIC RADIATIVE TRANSFER MODEL

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Physical models allow the interpretation of radar observations in terms of parameters describing vegetated land surfaces. A first order Radiative Transfer Model has been developed for the simulation of polarimetric radar observation for different scenarios. As various backscattering mechanisms are considered in this study (Direct Canopies, Canopies Ground, Direct Ground, Ground Canopies Ground, Trunks Ground scattering effects), the contribution of each of these components can be analysed. The complete description of electromagnetic scattering processes implies the complete enough knowledge of the observed scenes.

This paper presents results of the electromagnetic polarimetric scattering modelling of wheat canopies based on vegetated field data. The aim of the study is to highlight the relative contributions of the bio-physical components in wheat crops on radar signatures. Field data have been collected during the 2003 growing season for wheat crops. These data very exhaustively describe the geometric and dielectric properties of soil and plant components.

In a first stage the model was validated, in a second one an extensive sensitivity analysis has been performed. A further comparison between model simulations and experimental data has shown that our model matches reasonably well the measured backscattering data. The most important mechanisms involved in the radar echo were analysed and for these mechanisms the contribution of the different components (leave, soil, trunk) were identified. This analysis has been performed for configurations available for sensors currently in orbit (C-band SAR).

The reported study is now being extended in order to introduce a vertical phase dependence in the observed targets to calculate other quantities as for instance the interferometric coherence. A possible application of this is, for example, the development of new algorithms for classification, based on the phase centre height.