**SAR images simulation of vegetated areas involving hydrocarbons presence**

J.P. Monvoisin*(1) (Jean-Pascal.Monvoisin@onera.fr),
P. Borderies (1) (Pierre.Borderies@onera.fr),
(1) Université Fédérale de Toulouse - ONERA Toulouse, 2 avenue Edouard Belin,
31055 Toulouse Cedex 4, France, www.onera.fr/en
D. Dubucq(2) (dominique.dubucq@total.com),
C. Taillandier(2) (cedric.taillandier@total.com)
(2) TOTAL, Centre scientifique et technique, avenue Larribau 64000 Pau, France

Forest observation with RADAR signals is particularly relevant due to their properties of penetration under canopy. As an example, European Space Agency (ESA) will launch synthetic aperture radar (SAR) operating at P-Band in order to determine the distribution of above-ground biomass in forests. The techniques involved include study of radiometry, POLINSAR and tomography. Such penetration properties might be also useful to interrogate the properties of the ground under foliage and in this frame the impact of the presence of hydrocarbon is of particular interest and it is the theme of this paper.

For such applications it is valuable to model the interaction of electromagnetic waves with forests to interpret the existing airborne or space data and to generate predictive ones. Simulating fully polarimetric and interferometric SAR images require the computation of the electromagnetic field in amplitude and phase for each pixel. From this complex field the backscattering coefficients $\sigma_{0pq}$ and polarimetric coherences $\gamma_{pq}$ are derived in each zone of the image, p,q for H or V polarisation.

Previous simulators based on a coherent and discrete formulation have been developed to simulate complex scenarios of forest above a flat ground (e.g. [L. Villard and P. Borderies “Backscattering Border Effects of Forests at P band”, PIERS Online, Vol. 3, No. 5, 731-735, 2007). The present simulator ( J.P. Monvoisin “Electromagnetic diffraction of vegetated surfaces with topography. Application to tropical forests and to the presence of hydrocarbon ”, PHD Thesis).accounts for topography and heterogeneity through the use of particular elements for ground and canopy descriptions.

The presence of hydrocarbons is accounted for through its influence on the soil permittivity. For this purpose, permittivity measurement on mixtures involving usual components of soil and HC have been done either outdoor or in laboratory. The impact of these permittivity changes is evaluated by incorporating these experimental values in the ground part description of the simulation code. In the presentation we will present radiometric and tomographic simulations for tropical forests at P and L bands and for short vegetation at higher frequencies.