Single baseline PolInSAR in tropical context: Assessment of the estimation of the vegetation parameters

Pascale Dubois-Fernandez, Aurelien Arnaubec, Xavier Dupuis

The TropiSAR campaign was conducted in French Guiana in the summer 2009 in the framework of the Phase A studies pertaining to the BIOMASS mission, one of the three for Earth Explorer candidates with the SETHI radar operated by ONERA.
The inversion techniques, proposed for BIOMASS include radiometric inversion to access biomass level and polarimetric interferometric (PolInSAR) approach to evaluate the vegetation height.
In this paper we concentrate on the PolInSAR inversion addressing two main issues. The first one concerns the temporal stability of the polarimetric response. This is a crucial aspect as the interferometric processing requires two acquisitions which will happen in two successive cycles for BIOMASS. Several studies have shown that at C and L band over forests the interferometric coherences are strongly affected by the temporal baseline. The consequence being that at these frequencies, only a single pass system could be used with a zero temporal baseline. At P band, this study needs to be conducted over tropical forest and the TropiSAR dataset is used to that purpose.
The second aspect is to assess the precision of the estimation on the vegetation parameters from single baseline PolInSAR data in this tropical context. The estimation quality is assessed by comparing the output of the inversion to lidar data. The influence of the acquisition geometry on the estimation precision is discussed both for the undercanopy terrain height and the vegetation height.
Several studied have suggested that the interferometric height measured with the HH polarisation channel is close to the ground and can be used in some cases to provide a meaningful terrain elevation model. This will be discussed in the presentation and measured with different interferometric configurations.
Based on the PolInSAR inverstion, we can separate the ground and volume backscatter contributions. These contributions have a polarimetric signature which allows us to explore further the wave interaction with the forest. The analysis will be presented and will point how topography influences the ground response.
Finally, the last point to be addressed in this paper is the effect of resolution. BIOMASS has a low resolution resulting from the limited frequency allocation of 6MHz at 335MHz. The TropiSAR bandwidth is 150MHz; the resulting resolution being 25 time finer that the BIOMASS resolution. We will discuss haw this loss of resolution can affect the inversion results.