Assessment of Boreal Forest Cover Properties from Interferometric TanDEM-X Data

Caner Demirpolat[(1)], Jaan Praks[(1)], Oleg Antropov[(2)], Martti Hallikainen[(1)]

[(1)] Aalto University, P.O. Box 13000 FI-007 AALTO Finland, e-mail: caner.demirpolat@aalto.fi

[(2)] VTT Technical Research Centre of Finland, P.O. Box 1000, 02044 VTT, Finland, e-mail: oleg.antropov@vtt.fi

Recently launched TanDEM-X mission offers new interesting possibilities for interferometric analysis of terrain and evaluation of vertical structure of forest canopy. Location of interferometric Scattering Phase Center (SPC) inside the forest canopy (and canopy penetration depth) can be effectively used to characterize and monitor boreal forests with Synthetic Aperture Radar interferometry (InSAR). Seasonal, monthly or even shorter term variations in these InSAR-derived parameters can provide distinctive information specific to the different tree structure and species that can be useful for their discrimination.

In this study, 5 sets of dual-polarimetric (HH/VV) TanDEM-X coregistered single-look slant-range complex products were processed. The imagery was acquired primarily during autumn 2011 over Kirkkonummi region near Helsinki, Finland. For each interferometric pair, the Canopy Height Models (CHM) were derived from the interferometric coherence phase. As the reference and auxiliary data CHM and Digital Terrain Model (DTM) measured by LIDAR were used. Using the land cover CLC2006 data, temporal variations in average SPC heights and penetration depths were mapped with respect to coniferous, deciduous and mixed forest classes. For all classes, the SPC heights relative to the treetop were found to be decreasing from early September until late October. As expected, mean penetration depths were found to be increasing in this time interval. The biggest temporal variations were observed for deciduous forest, while mixed forest and coniferous forest were found to be less affected. HH-pol signals were found to have higher penetration depths and lower relative SPC heights than VV-pol signals for all acquisitions. Also, temporal variations in parameters of interest were higher for HH-pol data. Some of the aforementioned dependencies are shown in Figures 1 and 2.

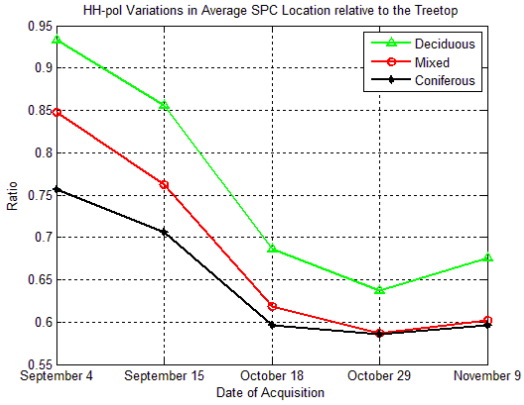

Fig 1. HH-pol variation of average SPC location

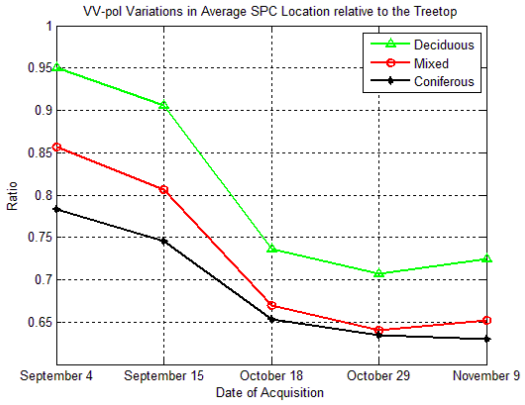

Fig 2. VV-pol variation of average SPC location