Assessment of the quality of digital surface and canopy height models over forests derived from TanDEM-X interferometry

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DSMs (Digital surface models) can be derived from TanDEM-X interferometric data. Due to the short wavelength of X-Band the signal is backscattered at the top of the trees and is not penetrating the canopy. In most regions of Europe high quality DTMs (Digital terrain models) and DSMs based on LiDAR are available. Since the terrain is (relative) stable and the vegetation height varies over time this offers the opportunity to use TanDEM-X interferometric DSMs to determine the actual vegetation height. Tree height is an important parameter for forestry. For wood volume and biomass calculation it is the most important factor besides the BHD (breast height diameter). Provided the age of a forest stand is known or can be estimated it can also be used to assess the quality of a site. And it offers a unique and fast assessment option for storm damages in forests. Storm damages can be detected by using the difference of the vegetation height before and after the event, or simply the difference between two DSMs (thus for this kind of application a DTM is not a requirement and utilising a pre-storm TanDEM-X interferometric DSM is possible as well). The test site of this study is located close to the city of Karlsruhe, covering about 4 by 2 kilometers and covers both flat and mointainous terrain. . Main tree species are pine, oak and beech. In December 2011 a TanDEM-X stripmap mode image was acquired. For processing, different methods were chosen. For the generation of the interferogram different number of looks were applied, the interferogram was then filtered using Goldstein, Adaptive and Boxcar filtering methods and afterwards the phase unwrapping was done using region growing and minimum cost flow algorithms. At the end twelve different DSMs were obtained using different combinations of the processing steps. The resulting DSMs were then compared to a DSM generated with LiDAR data, which was collected in summer 2009. The achieved accuracy was analyzed differentiating age and main tree species of different stands as well as the terrain situation. This study is carried out within the framework of the EU FP7-Project EUFODOS (European Forest Downstream Services - Improved Information on Forest Structure and Damages).