Canopy height model from very high resolution Pléiades stereo images over mountain regions: influence of topography, acquisition and processing strategy

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A detailed, accurate and up to-date information about forest canopy is essential for the forestry community to make the planning and management of forest activities more efficient. Inventory components such as canopy height, stand density, and gaps between trees, can be measured in situ or via remote sensing. This work focuses on the evaluation of the use of Very High Resolution Pleaides Images (VHRPIs) to calculate the forest canopy height model (CHM) over mountain regions. The analyses took place in two study areas located in Alpine regions of Salzburg (Austria) and Ticino (Switzerland). These areas were chosen in order to test the applicability of VHRPI according to different topographic characteristics like slope, aspect and elevation. Moreover acquisition settings such as Stereo and Tri-stereo images, incidence angles and the georeferencing accuracy were analysed. In order to produce photogrammetric point clouds and Digital Surface Models (DSMs), two commercial software packages (i.e. Socet-GXP and Inpho) and a research-based software developed at TU Wien (OrientAL) were tested and the results compared. On the basis of these Pléiades DSMs, CHMs were computed for both test sites by subtracting digital terrain models derived from available high resolution airborne Light Detection and Ranging (LiDAR) data. The LiDAR data was also used as a reference for estimating the accuracy of the Pléiades DSMs. Results show that the accuracy of the Pléiades DSMs is highly dependent on the data processing and data acquisition, that it ranges between 0.5 m to 2 m, and that it depends on the land cover. However, VHRPIs show a great potential for CHM generation for large areas and provide a sufficient alternative in areas where up to-date LiDAR data are not available. The work is part of the PleiAlps project (project number 859774) funded by the Austrian Research Promotion Agency (FFG).