COMPARISON OF A PHOTOGRAMMETRIC CANOPY HEIGHT MODEL (CHM) WITH A LIDAR DERIVED CHM IN VESTFOLD COUNTY

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Introduction and material

Digital aerial images over Vestfold county were acquired by TerraTec in summer 2007 with a Vexcel UltraCamX sensor. The flying height above-ground was approximately 2800-3000 m which resulted in images of approximately 1880x2880 m size. The images were acquired in north-south oriented flight strips with a 20% side and 60% within-strip overlap. Panchromatic image data were acquired in 20 cm ground sampling distance (GSD). Near infrared, red, green and blue image bands were acquired in 60 cm GSD but were pansharpened to a 20 cm pixel size by the data vendor. The original radiometric resolution of the images (12 bit) was resampled to 8 bit for archival storage. The plane location and orientation during image acquisition were logged using a GPS and an inertial navigation system (INS). To increase the accuracy of the external orientation, an aerial triangulation was performed based on 34 ground control points using the software Match-AT.

BLOM ASA was commissioned to generate a photogrammetric canopy height model (CHM) from the digital aerial images. Using the image matching software SocetSet version 5.5.0 with the default NGATE strategy parameter setting, a photogrammetric point cloud of matched pixel locations with 1 m spacing was calculated from the red, green and blue bands of overlapping images. A digital surface model (DSM) with 20 cm pixel size was calculated from the photogrammetric point cloud using bilinear interpolation. Except for the municipality of Lardal where an airborne laser scanning (ALS) digital terrain model (DTM) with one meter resolution was available, the standard Norwegian DTM with a resolution of 10 m was available in the study area. The DTM was resampled to match the DSM resolution using bilinear interpolation and was subtracted from the DSM to yield a CHM.

ALS data with a density of approximately 10 points per m^2 were acquired for the municipality Lardal between 21 and 25 May 2009 using an Optech Gemini sensor from a fixed-wing aircraft. The ALS point cloud which included elevation and height (delta-z) data was provided by the data vendor (BLOM ASA). One tile of approximately 500x500 m was randomly selected for comparison with the photogrammetric CHM (Figure 1). The data contained first, single and last return data. A CHM with 20 cm pixel size was derived from the ALS height data using the software tool FUSION. FUSION basically uses the largest return height as the pixel value.

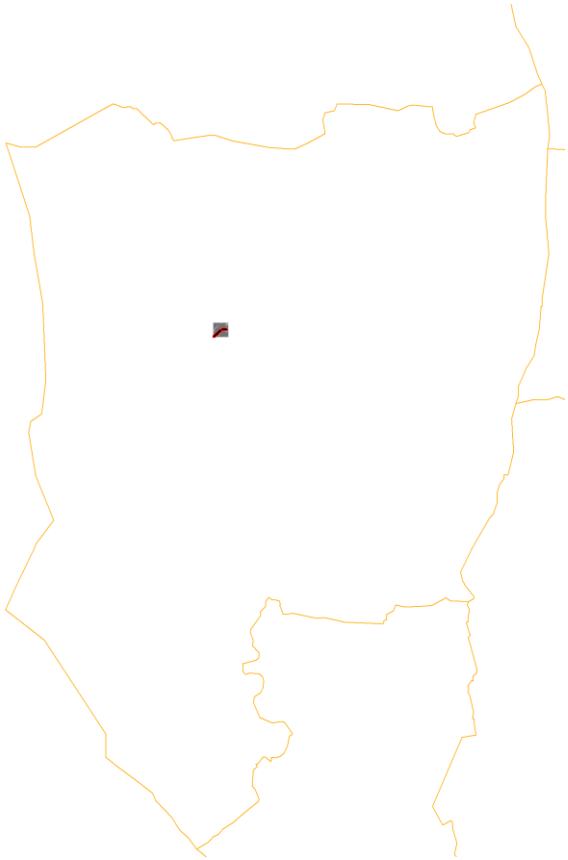

Figure 1: Outline of the municipality of Lardal and location of the randomly selected sub-area where the photogrammetric and ALS CHMs were compared.

Results

The photogrammetric CHM (photo CHM) has less details (small gaps and single trees are often missing) and is smoother than the ALS CHM (see Figures 2-6). In tendency, the photo CHM is higher than the ALS CHM. Shadows in the images have obviously resulted in problems for the matching algorithm. Matched points were therefore missing in shadow-areas at forest borders. Due to the interpolation, the photo CHM is therefore much larger than the ALS CHM in these areas. More results can be found in the presentation at the end of the proceedings.

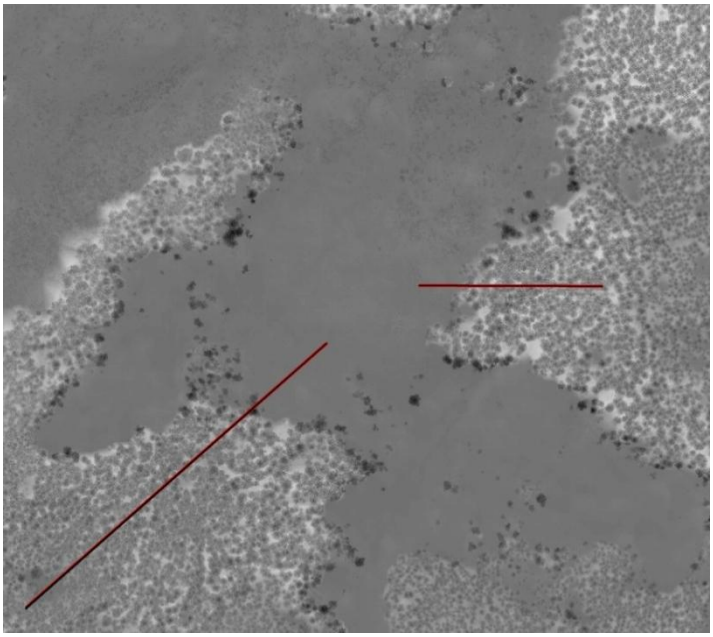

Figure 2: Photo CHM minus ALS CHM.
Black = ALS>photo (-24 m), white = photo>ALS (30 m).

Figure 3: True ortho-photograph.

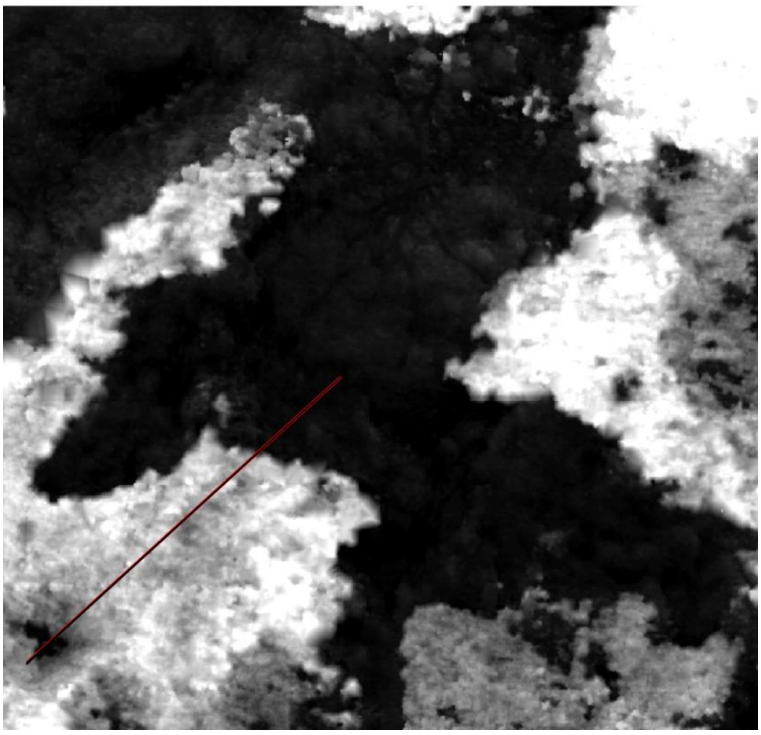

Figure 4: Photogrammetric CHM.

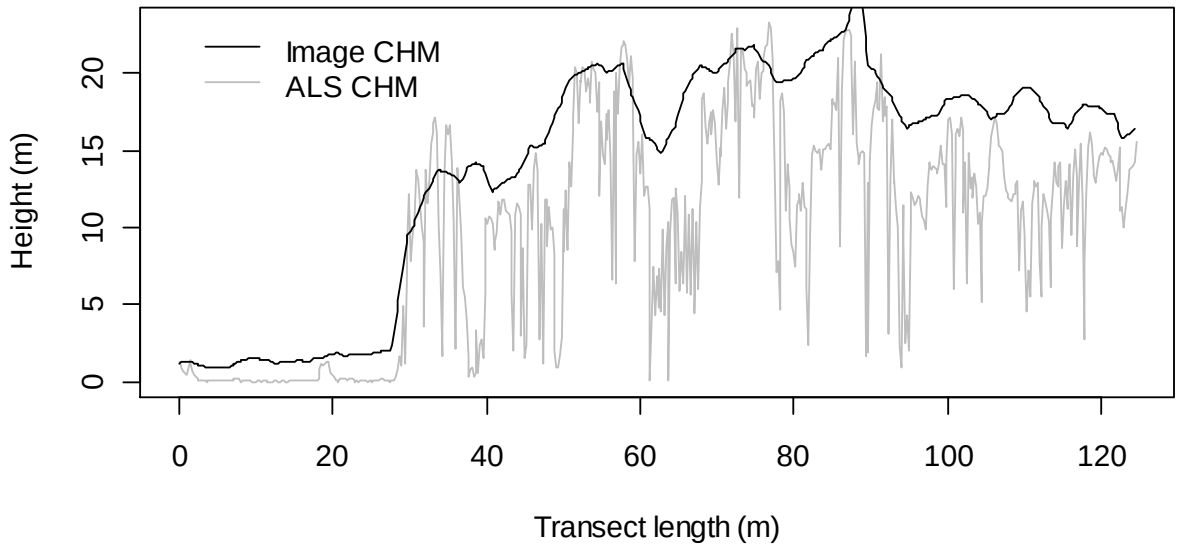

Figure 5: Transect 1.

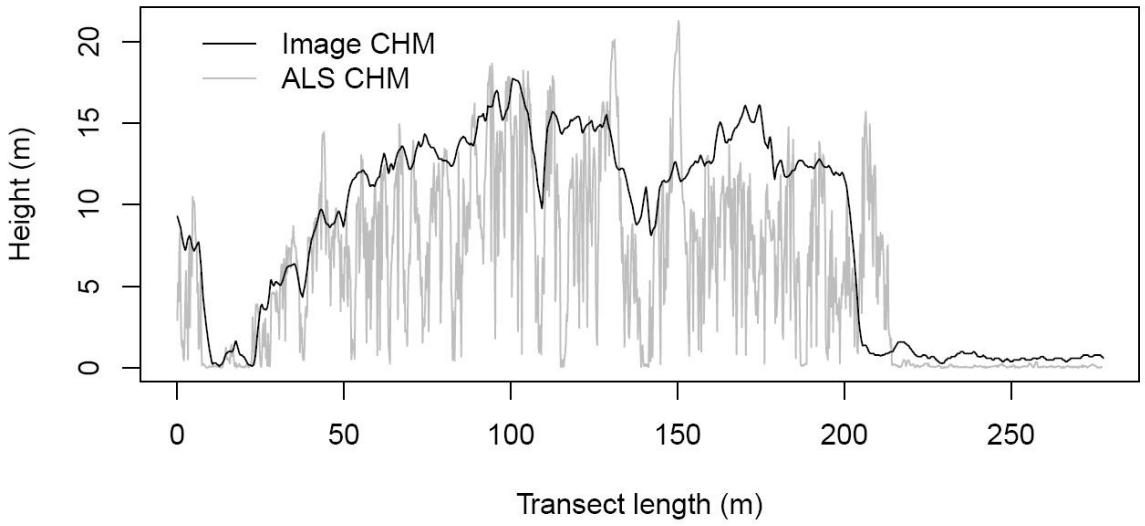

Figure 6: Transect 2.