Vegetation Height Maps from Digital Elevation Models – the Next Innovation in Producing Orienteering Maps

Thomas Gloor, OCAD Inc.

It is impossible to imagine producing orienteering maps without the digital elevation models (DEM). With DEM one can not only calculate contour lines but with this new feature, also derive vegetation boundaries. OCAD AG has developed two new DEM analytical features exactly for that purpose. These were used for the first time when producing the WOC 2012 orienteering maps in Switzerland.

The Digital Terrain Model (DTM)

By now, calculating contour lines from DEM belongs to almost every orienteering map project. This is the most significant innovation in the production of orienteering maps besides the introduction of digital cartography with OCAD, approximately 15 years ago. Beforehand, contour lines were measured either with a compass and pace counting, or analysed with the help of 3D stereo aerial photos. The first method was very time consuming and not very accurate. The second method was quite efficient and accurate in open areas; however, in thick woods, the results were sketchy and vague. With the use of airborne laser measuring tools from an airplane, this gap could be closed.

The millions of emitted airborne laser impulses could penetrate even very thick woods and are reflected from the ground. These laser impulses, known also as reflected dots, are saved in the digital terrain model (DTM) out of which contour lines for any equidistance are calculated. However, this is not the only information that can be extrapolated!

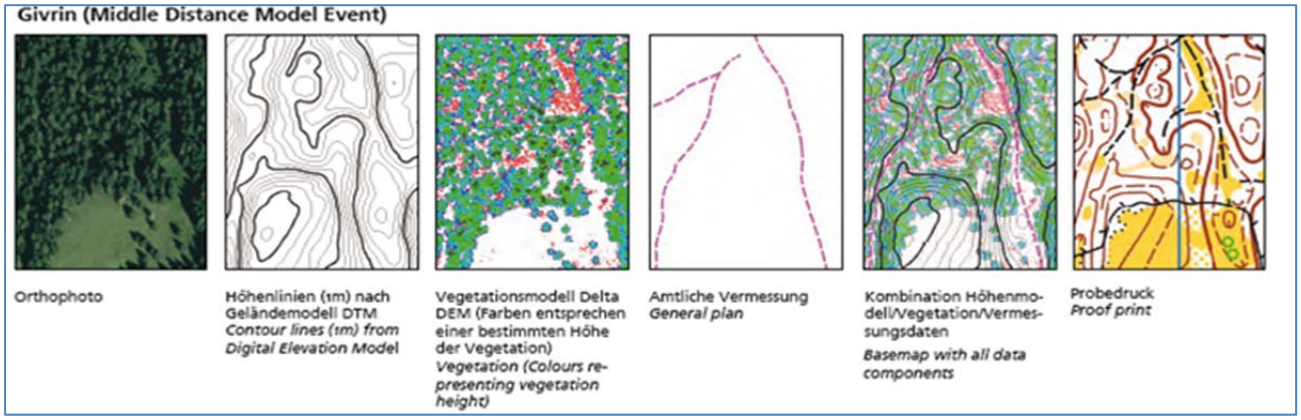
The hill shading is another helpful tool with which one recognises the courses of trails and roadways. DTM with higher resolution even allows recognising gullies, dry ditches or even small depressions. The slope gradient map is very valuable mostly for recognising cliffs. This is due to the fact that slope gradients over a certain steepness (e.g. >45 degrees) show up in black colour. DTM offers an abundance of features for the surveyor who can already analyse a lot of information at home.

The Digital Surface Model (DSM)

The laser impulses emitted million-fold from the airplane, impinge also upon the canopy of the forest. These laser impulses, also known as primary reflective dots, are stored in the digital surface model (DSM) program. By subtracting the differences between the DSM and DTM a vegetation height map is created. Meadows, clearings and clear cuts generate an almost zero elevation difference, reforested areas between half and two metres, and forests would show over 10 metres. On this basis of classifications the surveyor can determine vegetation boundaries. He/she would already be able to vectorise these results at home on the computer which results in another increase in efficiency in the production of orienteering maps.

Both functions “DEM calculating differences” and “vegetation height classifications” were introduced early on in the developing phase of OCAD 11 in order to supply the map surveyors for the WOC maps in Lausanne with early test results by the end of 2010. Both WOC map surveyors, Urs Steiner and Beat Imhof, could therefore extensively test the above mentioned features.

“*The vegetation contour map was not only helpful to map different vegetation zones but also to pinpoint the current position at all times on the map. This further reduced the measuring of clearings, clear cuts or spruce thickets with compass and pace counting*,” agree both surveyors. “*The combination of the vegetation height map and the contour line image with an equidistance of one metre is the ideal basis to survey orienteering maps*”.



Hubert Klauser, the OCAD software developer of that feature has incurred similar experiences with his own mapping projects. “*Based upon the experiences of the two WOC-mappers, we have further developed that feature. In the first prototype the classification for the vegetation height was limited to three classes. In the actual version of OCAD more classes can be added and coloured individually*” says Hubert Klauser, “*this way, the vegetation structure of different types of woods can be better evaluated*.”

Classification of thicket levels?

Airborne laser scanning has revolutionised the production of orienteering maps. Used correctly, it reduces the surveying effort in the terrain significantly. However, there’s no technical help in the near future for the classification of thickets (or levels of runnability) and it still needs to be done by the surveyor in the terrain. The cartography of vegetation remains for the moment the most extensive and difficult part in the production of orienteering maps and thus causes discussions about the correct interpretation of thickets among surveyors and competitors.

The development of the laser scanning technology steadily progresses, especially the Terrestrial Laser Scanning. It could very well be that in a few years the mapper will roam through the woods with a terrestrial laser scanner on the head and consequently solve the last challenge in the production of orienteering maps: the cartography of consistent thicket classification.