# Automatic detection of storm damages in forests using airborne stereoscopic images

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Risks of storms causing damages in forests are increasing due to the climate change. Fast and reliable detection of fallen trees, assessment of their amount and their efficient collection are of great importance for the economical and environmental reasons.

In Finland, the Ministry of Agriculture and Forestry defined a strategy for the fast detection of storm damages. Airborne photogrammetry was selected as the basic remote sensing method, and the image collection flights should be carried out immediately after the storm.

Visual storm damage detection and delineation from images can be a slow and error prone process. It is expected that the methods based on comparisons of digital surface models (DSMs) collected before and after storm could be efficient for automating the storm damage detection. This is a potential approach with airborne images as well, because the novel dense matching methods have provided promising results in DSM generation (Honkavaara et al., 2012).

One of the challenges in the process is the great variability of the input data. Characteristic to the storm damage detection process is that storms can occur at any season, which also influences the properties of the input data. Also low solar altitudes at autumn-winter periods can be challenging, because the low amount of light and shadows can deteriorate quality of image matching. Furthermore, the camera properties can cause variability on the data. (Honkavaara et al., 2012)

The objectives of this investigation were to develop an automated method for storm damage detection and to investigate its performance in detection of storm damages in wintry images collected using a high performance photogrammetric mapping camera.

Serious winter storms took place in Finland in 26.12.2011 and 27.12.2011. Photogrammetric imagery were collected in less than two weeks time after the storms. Data were collected over an area of 1620 $km^2$ from a flying altitude of 5400 m, which provided a ground sample distance of 0. 3 m. The national laser scanning data was used to create the before-storm DSM. After-storm DSM was computed using automatic image matching provided by the Socet Set NGATE software.

The DSM extraction by image matching was successful in wintry imagery. Visual inspection of the storm damage detection results indicated that the automatic method correctly found changed areas.

In the future we will carry out further studies on the performance of the method, including influences of atmospheric conditions, season, sensor and image matching algorithm.

Literature

[1] Honkavaara, E., Markelin, L., Rosnell, T., Nurminen, K, 2012.. Influence of solar elevation in radiometric and geometric performance of multispectral photogrammetry. ISPRS Journal of Photogrammetry and Remote Sensing. 67, 13-26. http://www.sciencedirect.com/science/article/pii/S0924271611001110