On the importance of the reference image for snow detection from multi-temporal synthetic aperture radar

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The EnviSnow processing line is a quasi-operational snow cover area detection system based on the Nagler & Rott (NR) algorithm (2000) using wide-swath Envisat advanced synthetic aperture radar (ASAR): wet snow is mapped by detecting the backscatter decrease in comparison with a dry-snow or snow-free reference images using a threshold of –3dB. Due to the lack of multiple reference images for the same satellite track, the single-image reference scenes has therefore been characterized by the same speckle-noise as a usual ASAR image. After four years in orbit, Envisat provides several images for each individual satellite frame in order to construct averaged reference images, following the NR suggestion. The new reference scenes are built by using a weighted average function using a confidence level image for each individual ASAR image. During the snow season, the confidence level is dependant on surface temperature, obtained by triangularization from the neighbouring meteorological stations and a digital elevation model (DEM), to make sure that only dry snow backscatter is used as reference. The confidence level increases with decreasing temperature. Above 0˚C temperatures have 0% and surface temperatures below –10˚C have 100% confidence level. For summer images, the influence of high soil moisture is reduced and eliminated by thresholding pixels with backscatters lower than –16dB and by using linear functions to increase the confidence level with increasing backscatter. Pixels with backscatter above –10dB have 100% confidence level. Results from the EnviSnow snow cover area processing for southern Norway using the single-image as well as the multiple-image based weighted-averaged reference images will be presented and compared with optical images.