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Detection of Forest Calamities from Multi-temporal and Multi-polarized SAR Imagery

A. Schmitt [a,] *, A. Wendleder [a], U. Heiden [a]

[a] German Aerospace Center (DLR), German Remote Sensing Data Center (DFD), Oberpfaffenhofen
82234 Weßling, Germany – Andreas.Schmitt@dlr.de

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ABSTRACT:

Forests have a strong impact on regional ecological and economic systems. They are essential for the environment by reducing carbon, regulating climate, protecting soils and mitigating hazards. However, the exploitation of forest biomass is an important branch of the local economy. A sustainable management with a long-term monitoring and protection of forested areas is relevant. Harvesting, for instance, has to be regulated and surveyed which is not an easy task regarding large tropical or boreal forests. With respect to smaller temperate forests the removal of dead wood after a storm event (e.g.) is necessary to prevent the dissemination of diseases and pest infestation. In both cases, the prompt identification of areas with a change in biomass is highly appreciated.
Remote Sensing techniques are perfectly suited to deliver large-area information. SAR sensors especially are capable to acquire data all day and night at almost any kind of weather. Nowadays, even space-borne SAR sensors achieve image resolutions of a few meters or beneath so that the identification of single trees becomes feasible. Additionally, the image geometry and location is highly accurate ranging around a few decimetres in general. The typical slant range projection of SAR images unfortunately complicates image registration and ortho-rectification. Furthermore, the radiometry of SAR images showing additive as well as multiplicative noise components inhibits the direct pixel-wise interpretation of SAR images.
In this project we use a state-of-the-art SAR image pre-processing technique to combine pre-event and post-even images to so-called differential Kennaugh elements over a test site in the Austrian Alps where a controlled harvesting took place in September 2014. As minor changes are automatically suppressed, only two types of changes remain: small-scale changes induced by wind, and larger “harvested” patches. Hence, this approach enables the automated localization of unauthorized harvesting and of forest calamities by natural disasters at the same time.

* Corresponding author.