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FUSION OF RADARSAT-2 AND TANDEM-X SATELLITE DATA TO SUPPORT THE ASSESSMENT OF ABOVEGROUND BIOMASS (AGB) IN TEMPERATE FORESTS

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ABSTRACT:
This study aims at investigating the synergistic potential of the Radarsat-2 and TanDEM-X satellite missions to support the assessment of aboveground biomass (AGB) in temperate forests. For this purpose, a two-stage analysis approach is proposed. In the first stage, Radarsat-2 and TanDEM-X data are jointly used to derive three key parameters related to AGB: (1) forest type, (2) forest density (horizontal) and (3) forest height. In the second stage, the derived parameters are used in combination with the input data to ultimately model AGB. With regard to the Radarsat-2 mission, the analyses are based on its new fine quad-pol and ultra-fine beam modes. As an example, signatures of polarimetric decompositions are examined for forest type mapping using images acquired in fine quad-pol mode, while high spatial resolution (HSR) backscatter intensities, interferometric coherence and texture information derived from scenes recorded in ultra-fine mode are employed for horizontal forest density assessment. To extract forest heights, digital surface models (DSMs) generated from TanDEM-X data pairs are employed. AGB is modelled using two different approaches. While the first approach is based on statistical modelling, the second approach is based on a knowledge-driven concept. The former method feeds pre-selected predictors (image features) that have been extracted from the SAR data into a statistical regression scheme. As part of the knowledge-driven approach, the forest type maps are used to stratify the input data. AGB is then assessed by the use of the remaining key parameters (forest density and height) within simple (linear regression) and/or more complex statistical models that are to be built for each forest type. Focus is put on two temperate forests in Thuringia and Karlsruhe, Germany. For these study areas, a comprehensive set of additional multi-sensor remote sensing imagery as well as consistent forest inventory data and other ground truth information are available. In this way, a rigorous validation of the study results as well as a comprehensive testing of methodological robustness is enabled.

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